ECONOMIC IMPACTS OF ENERGY PRICE SHOCKS IN THE EU DRIVEN BY CRISES

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Abstract

This paper illustrates the impact of the rising prices of the main natural resources used in the production process, oil, and natural gas, on the eurozone economy using a Vector Autoregressive (VAR) model. It also assesses the dependence of the eurozone economy on fossil fuels from Russia and the need to adopt green, renewable energy. The study compares the shocks administered pre/post the outbreak of the Covid-19 pandemic and the outbreak of the war in Ukraine. Finally, based on the futures trajectory of the Brent oil price, a conditional forecast for macroeconomic variables in the euro area is assessed.

Keywords: *Energy, Macroeconomics, VAR, Crises, Matlab.*

Clasificare JEL : *E31, E37, F47*

1. Introduction

The eurozone heavily depends on Russia for natural gas and oil supplies. Russia is one of the world's largest natural gas and oil producers and exports a significant share of these resources to Europe, including the eurozone. According to the International Monetary Fund, in 2020, about 40% of the euro area's oil and gas imports came from Russia (Flanagan et al., 2022). This dependence has grown in recent decades as Europe's own gas and oil reserves have declined, making it increasingly dependent on imports. This dependence on Russian resources has important economic and geopolitical implications for the euro area. On the one hand, it provides a reliable source of energy for the region's economies, essential for industry, transport, and heating in the winter months. On the other hand, it also exposes the euro area to potential supply disruptions and price volatility in the event of political tensions or conflicts between Russia and Europe. Rising oil prices pose a significant problem for central banks due to their adverse impact on economic growth and inflationary pressures. The euro area is deeply affected for two primary reasons: firstly, the region relies heavily on oil imports, covering 98% of its consumption, and secondly, the euro's weak performance against the dollar exacerbates the situation (Bobasu et al., 2022).

This combination is a double whammy: historically, when oil prices rise, the dollar often depreciates, but now the decline of the euro has amplified the impact of surging fuel costs. This is a cause for concern, especially as the eurozone's economy has already shown signs of slowing down following last year's robust growth. The recent surge in oil prices could add further complications to the economic situation. Surveys indicate that the rising oil prices are already having a negative effect on the costs incurred by companies in the region.

The economic consequences of higher oil-related costs largely depend on their underlying causes. Rising prices driven by increased demand, reflecting economic prosperity, are one scenario, while price hikes due to supply constraints can pose a threat to growth. Recent increases in oil prices have been influenced by both factors.

Economic theory (Jia et al., 2021; Wang et al., 2022; Mirza et al., 2023) suggests that a sustained rise in oil prices can reduce productivity and hinder economic growth, potentially leading to higher inflation. However, empirical studies based on oil shocks from the 1970s demonstrate that economies can adapt over time (Mwange & Meyiwa, 2022; Haqeem & Zulkifli, 2022). For instance, they might reduce their reliance on fossil fuels as they implement more flexible labour markets and improved monetary policies. Additionally, economies have managed to reduce their primary energy intensity compared to the past, which contributes to the reduced impact of such energy shocks. In recent years, the Eurozone has sought to reduce its dependence on Russian energy by diversifying its supply sources, increasing energy efficiency, and investing in renewable energy sources. However, given the scale of the region's energy needs and Russia's significant role as a supplier, this remains a significant challenge.

The objective of the paper is to propose a strategy to identify shocks in the context of increased volatility of hydrocarbon prices. The results of our study show that the impact of oil and natural gas prices strongly influences monetary and capital market variables.

The paper will be structured as follows: Section 2 describes the literature review in the field. Section 3 provides information on the data used, and by implication, on the transformations that occurred. Also, in the same section, the model estimation methodology is presented. Section 4 presents the econometric results on both the impact of an oil price shock on euro area macroeconomic variables and their forecasting conditional on the oil price path. Finally, conclusions are drawn in Section 5.

2. Literature review

Since the Ukraine conflict outbreak, energy resource prices have been a significant predictor of macroeconomic factors in the euro area. Several studies have closely investigated the effects of energy price uncertainty and oil price shocks on macroeconomic indicators (Borzuei et al., 2022; Sokhanvar & Lee, 2023).

Punzi (2019) used a dynamic stochastic general equilibrium (DSGE) model to assess the macroeconomic effects of energy price volatility in an open economy. According to other studies, increases in energy prices caused the economy to slow down since they increased costs for both consumers and businesses (Sims, 1980; Zhao et al., 2022). In contrast, shocks in energy price volatility caused a short-term gain in GDP and a long-term decline. Energy prices were likewise impacted by rising demand or supply uncertainty, with exaggerated variations in comparison to a model that abstracted from energy. Due to market instability, households reduced their spending to make precautionary reserves, which encouraged investment. To lessen households' and businesses' dependency on non-renewable energy and hence lessen the effects of market swings, policymakers should promote investment in energy security and renewable energy (Litterman, 1980; Peersman & Smets, 2001).

Kilian (2009) looked at how stock returns responded to oil price shocks. According to the study, aggregate stock returns responded differently depending on whether supply or demand shocks in the crude oil market caused the price of crude oil to rise. The common knowledge that higher oil prices inevitably resulted in lower re-turns only applied to demand shocks that were peculiar to the oil market, including a rise in crude oil demand for precautionary reasons due to concerns about the future availability of oil supplies. Positive shocks to the global industrial commodity aggregate demand, on the other hand, led to higher actual oil prices as well as higher stock prices. Shocks to the global aggregate demand and shocks to the precautionary demand for oil were more crucial for interpreting changes in stock prices than shocks to the worldwide output of crude oil. Other studies determined which industries are most vulnerable to these shocks and investigated ways to change one's portfolio in response to changes in the oil market (Uhlig, 2005; Lee et al., 2022).

Several studies have investigated the relationship between oil prices and industrial production in the euro area (Cai et al., 2022; Liadze et al., 2023). A study by Baumeister and Kilian (2016) found that oil price shocks have a significant impact on euro-area industrial production, with effects lasting up to two years. The study also found that the impact of oil price shocks on industrial production is asymmetric, with negative shocks having a more substantial impact than positive ones.

However, the relationship between oil prices and industrial production in the euro area can also vary by sector. A study by Nazlioglu et al. (2015) found that the impact of oil prices on industrial production is a specific sector. The study found that oil price shocks have a positive impact on the output of energy-intensive sectors, such as mining and quarrying, but have a negative impact on the output of non-energy-intensive sectors, such as construction.

Another study by Bekiros et al. (2016) found that the impact of oil prices on euro-area industrial production is not constant over time. The study found that the relationship between oil prices and industrial production varies with the business cycle. During economic expansions, oil price shocks have a positive impact on industrial production, while during economic contraction, oil price shocks have a negative impact.

Cologni and Manera (2005) used a structural cointegrated VAR model to investigate the effects of oil price shocks on output and prices as well as how monetary variables respond to outside shocks. Except for Japan and the UK, the study revealed that oil prices had an impact on inflation, which was then transferred to the real economy by rising interest rates. According to impulse response research, changes in oil prices have an immediate, transitory impact on pricing for many nations.

Sakashita and Yoshizaki (2016) investigated the impact of oil prices on production and price levels in five emerging countries compared to the United States using a two-block structural VAR model of the world crude oil market. Their results showed that the effect of oil price shocks on the industrial production index (IPI) and the consumer price index (CPI) in emerging countries also depends on where the changes fundamentally originate.

Drachal (2018) using the Granger causality and Diks-Panchenko nonlinear causality test, found that oil prices have a negative impact on stock prices but only in the long run.

Sultonov (2020) investigated the impact that Western sanctions had on the Russian Federation's economy and the changes that have occurred in the financial market. The results show that the sanctions have a significant positive impact on exchange rate yields in the short term and a negative impact on stock prices in the long term.

Haddad et al. (2021), using a TVP-VAR model, estimated commodity price uncertainty and analysed the relationship between commodity markets and macroeconomic uncertainty. Using a sample of about 40 years they showed that estimated commodity price uncertainties are leading indicators of uncertainty rather than volatility in commodity markets. In addition, time-variable linkage analysis indicates that macroeconomic uncertainty has persistent spillover effects on commodity uncertainty. Energy uncertainty shocks are also found to be the main drivers of connectivity between commodity markets.

Habanabakize (2021) using quarterly data from 2002 to 2020 analysed the responsiveness of household consumption expenditure to oil price, disposable income, and exchange rate volatility. This study claims that regulation and state intervention in the economy have a significant impact on the prices of several goods, including energy, and that public policies can significantly fuel market volatility. The results of the analysis can be considered surprising because there is a long-term relationship between the variables considered.

A study by Ghosh et al. (2021) investigated the impact of oil price shocks on inflation in the euro area during the pandemic. The study found that oil price shocks had a significant positive effect on inflation in the euro area, especially in countries with a higher dependence on oil imports. The authors suggested that this could be due to the pass-through effect of oil prices on transport costs and production costs (Ghosh et al., 2021).

Also, a study by Sheng et al. (2023) investigated the impact of oil price volatility on the euro area economy and the potential role of monetary policy in mitigating the effects of oil price shocks during the pandemic. The study found that monetary policy had limited ability to stabilize the euro area economy during pandemic-induced oil price shocks. The authors suggested that this might be due to the limited ability of monetary policy to address supply-side shocks (Sheng et al., 2023).

Nick and Thoenes (2014) conducted an analysis of natural gas price determinants using a VAR (Vector Autoregressive) model. They identified three major events that significantly influenced natural gas prices: the Russian-Ukrainian natural gas dispute in January 2009, the civil war in Libya in 2011, and the Russian export hold-up in February 2012. Their findings indicate that in the short term, natural gas prices are influenced by factors such as temperature, storage levels, and supply shortages. However, in the long term, the evolution of natural gas prices is closely related to both crude oil and coal prices, considering the economic climate and the substitution relationships between various energy products.

In a study by Zhou and Wang (2022), quantile regression was utilized to capture the nonlinear evolution of systemic risk in European gas and oil markets. The researchers concluded that the conflict in Ukraine notably increased systemic risk in both the European gas and oil markets. However, they observed that the impact on gas prices exhibited greater persistence; during periods of uncertainty, gas prices rose rapidly, but they declined at a slower rate when shocks subsided. Among the contributing factors to this systemic risk, the dollar/ruble exchange rate had the most significant influence, followed by Europe's gas stocks and gas imports from Russia. Notably, the study revealed that the gas market was more vulnerable to risks compared to the oil market.

Balcilar and Ozdemir (2013) examined the causal link between monthly changes in oil futures prices and a subset of changes in the S&P 500 stock index. The causal link between oil and stock markets is modelled using a vector autoregressive model with time-varying parameters to reflect changes in Granger causality over time. They found no Granger causality, but the results of the MS-VAR model show that oil futures prices have strong predictive power for the S&P 500 stock index.

Kum et al. (2012) examines the relationship between natural gas consumption, economic growth and capital using data from G-7 countries and a causality test for the period 1970-2008. They find that in most European countries there are causal relationships between natural gas prices and economic growth.

The overview of this group of specialized literature led the authors to identify a research gap through which the VAR model can be used to measure the impact of energy prices on the euro area using macroeconomic variables.

3. Materials and Methods

This section provides an overview of the SVAR (Structural Vector Autoregressive) model utilized in the empirical analysis, the identification strategies employed and the data specifications used in the study. Additionally, it outlines the methods used for identifying the oil price shock through Bayesian inference.

Since the introduction of the VAR model by Sims (1980), numerous studies have focused on investigating the impact of monetary shocks on the economy, relying on impulse response function analysis (Adra, 2021; Ma et al., 2021, Zhao, 2023). Scholtens and Yurtsever (2012) investigate the impact of industry-level oil price shocks in the euro area from 1983 to 2007 using dynamic VAR models and multivariate regression to investigate how 38 sectors respond to oil price shocks. The results show that the impact of oil price shocks differs substantially across industries. Impulse response functions provide valuable insights into how model variables react when subjected to shocks from other variables. By quantifying the magnitude and amplitude of these macroeconomic shocks on the included variables within the model, researchers better understand their effects on the overall economic system.

To illustrate the impact of the dependence of euro area macroeconomic indicators on oil prices we estimated a VAR model using the BEAR toolbox developed by the European Central Bank. The endogenous variables used in the model consist of the Brent oil price, the industrial production index, the industrial production price index, the harmonized index of consumer prices, the Euro Stoxx 600 stock market index, and the 3-month Euribor interest rate (Table 1). Apart from the Euribor interest rate, all variables were transformed by natural logarithm and multiplied by 100.

Table no. 1 Variable description

Variable	Transformation	Source
Brent oil price	Natural logarithm *100	Energy Information Administration (EIA)
Oil price futures	Natural logarithm *100	Bloomberg
Industrial production index	Natural logarithm *100	Eurostat database
Industrial production price index	Natural logarithm *100	Eurostat database
Harmonized index of consumer prices	Natural logarithm *100	Eurostat database
Euribor interest rate	level	Eurostat database
Euro Stoxx 600	Natural logarithm *100	Investing

This set of indicators has been chosen to capture as accurately as possible the impact of oil and gas prices on monetary policy variables, as well as the impact on European equities, as major companies listed on the main European stock exchanges are dependent on hydrocarbons.

The data sample spanned 2005m1-2023m1, but two further sub-samples were created for the model estimation, on the one hand to capture the responses of the variables to an increase in the price of crude oil until the outbreak of the Covid-19 pandemic (2005m1-2019m12), and on the other hand to capture the effect of the pandemic crisis as well as that of supply bottlenecks, specific to 2021, but until the outbreak of the war in Ukraine (2005-2022m1).

Figure 1 shows the direct link between the Brent oil price and the volume of industrial production in the euro area during the two significant crises (the financial crisis and the pandemic crisis). It also shows the robust impact of supply chain bottlenecks on price dynamics following the reopening of the economy and, hence, the recovery in global demand.

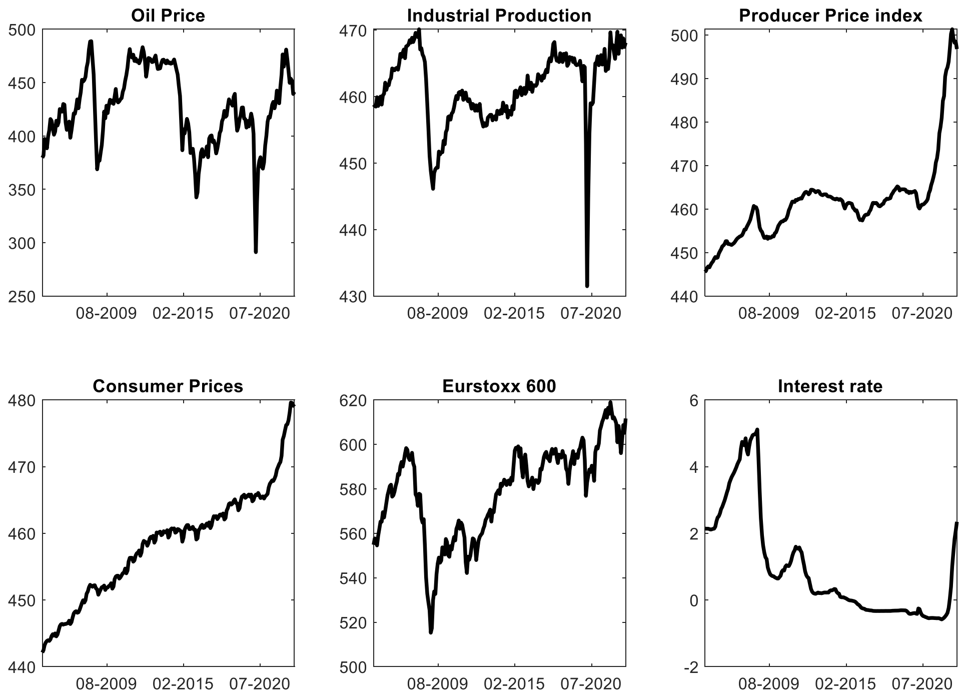

Figure no. 1 Evolution of macroeconomic/financial variables in the euro area

At the same time, for robustness, the impact of the increase in the price of natural gas (TTF Dutch index) on euro area variables was also assessed, as the latter has played an important role in the economy since the war in Ukraine. European countries have realized how important it is to eliminate the dependence on Russian gas fields, as since 2022, the European gas price has shown unprecedented volatility (Figure 2).

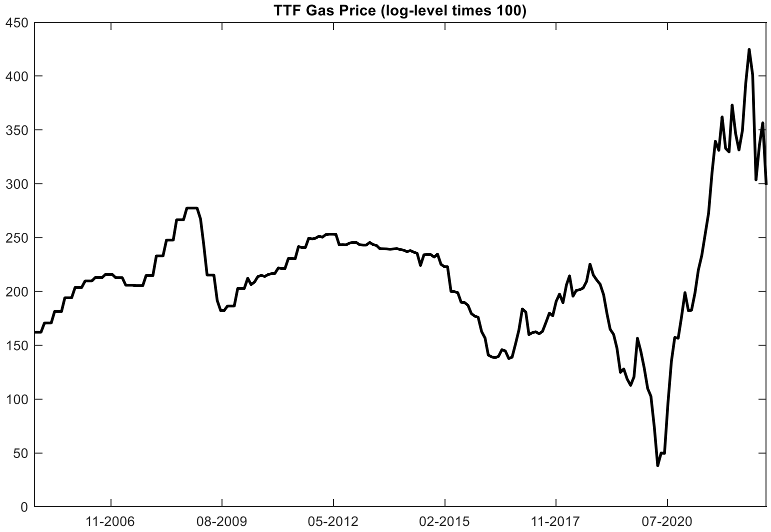

Figure no. 2 European natural gas price evolution (TTF Dutch)

The general form of the VAR model has the following representation:

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_p y_{t-p} + C x_t + \varepsilon_t,\ \varepsilon_t \sim N(0, \Sigma_t), \qquad t = 1,2, \dots, T \qquad (1)$$

where:

$y_t = (y_{1,t}, y_{2,t}, \dots, y_{n,t})$ is the vector of endogenous variables of size $n \times 1$;

$x_t = (x_{1,t}, x_{2,t}, \dots, x_{n,t})$ is the vector of endogenous variables of size $m \times 1$;

$A_1, A_2, \dots, A_p$ are matrices of size $n \times n$, and p is the number of lags;

$\varepsilon_t = (\varepsilon_{1,t}, \varepsilon_{2,t}, \dots, \varepsilon_{n,t})$ is the vector of model residuals, which follows multivariate normal distribution; errors are identically and independently distributed.

The Model (1) is rephrased as follows:

$$y_t = \bar{X}_t \beta + \varepsilon_t \qquad (1.2)$$

$$\bar{X}_t = I_n \otimes X_t;$$

$$X_t = \begin{pmatrix} y'_0 & y'_{-1} & \cdots & y'_{1-p} & x'_1 \\ y'_1 & y'_0 & \cdots & y'_{2-p} & x'_2 \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ y'_{T-1} & y'_{T-2} & \cdots & y'_{T-p} & x'_T \end{pmatrix};$$

$$\beta = vec(B);$$

$$B = \begin{pmatrix} A'_1 \\ A'_2 \\ \vdots \\ A'_p \\ C' \end{pmatrix}$$

$$\varepsilon_t = vec(\mathcal{E});\ \mathcal{E} = \begin{pmatrix} \varepsilon'_1 \\ \varepsilon'_2 \\ \vdots \\ \varepsilon'_T \end{pmatrix};\ y_t = vec(\mathrm{Y}); \qquad Y = \begin{pmatrix} y'_1 \\ y'_2 \\ \vdots \\ y'_T \end{pmatrix};$$

$$\varepsilon \sim N(0, \bar{\Sigma}), \qquad \bar{\Sigma} = \Sigma \otimes I_T$$

The model expresses each variable as a linear function of its own past values, the past values of the other variables in the model, other exogenous variables, and the error term. The error term captures unanticipated movements of the variables. The use of Bayesian inference is based on treating the parameters in the model as random variables and as signing apriori probabilities to them. The principle underlying Bayesian econometrics involves combining a priori distributions for the parameters to be estimated, based on the literature, with likelihood functions that reflect the information contained in the data.

This combination results in the posterior distribution and the results are more relevant than those obtained from the data series alone. In the literature we find a wide range of apriori distributions, such as Minnesota, Normal - Wishart, independent Normal - Wishart, etc. In this paper the Normal - Wishart distribution has been used, which de-fines the variance-covariance matrix of the unknown residuals and thus it is more flexible in terms of the restrictions set.

As $\varepsilon \sim N(0, \bar{\Sigma})$ and considering the relationship (1.2), the likelihood function is:

$$f(y|\ \beta,\Sigma\ ) = (2\pi)^{-nT/2} |\ \bar{\Sigma}|^{-1/2} \exp[-\tfrac{1}{2}(y - \bar{X}\beta)'\ \bar{\Sigma}^{-1}(y - \bar{X}\beta)]\ (1.3)$$

where:

Σ is unknown and of the form: $\bar{\Sigma} = \Sigma \otimes IT$. Ignoring the parameter-independent terms β and Σ, i.e. the constant terms, relation (1.3) can be approximated and expressed as follows:

$$f(y|\ \beta,\Sigma\ ) \propto |\ \bar{\Sigma}|^{-1/2} \exp[-\tfrac{1}{2}(y - \bar{X}\beta)'\ \bar{\Sigma}^{-1}(y - \bar{X}\beta)] \quad (1.4)$$

The apriori distributions for the two model parameters, β and Σ, were selected so that the obtained apriori distribution was part of the same family of distributions, using conjugate distributions.

Therefore, for β the multivariate normal distribution was assumed:

$\beta \sim N(\beta 0, \Sigma \otimes \Phi 0)$ where β_0 is a vector (q x 1), Φ_0 is a diagonal matrix (k x k) and Σ is the variance-covariance matrix of the VAR model residuals. After defining the hyperparameters based on the values defined in the literature, the a priori distribution for the parameter β is of the form:

$$\pi(\beta) \propto |\Sigma|^{-k/2} \exp[-\tfrac{1}{2} (\beta-\beta 0)'(\Sigma\otimes\Phi 0)^{-1}(\beta-\beta 0)] \quad (1.5)$$

Applying Bayes' rule, we identify the posterior distribution of the form:

$$\pi(\beta,\Sigma|y) \propto |\Sigma|^{-(k)/2} \exp[-\tfrac{1}{2} ((\beta-\bar{\beta})'(\Sigma\otimes\bar{\Phi})^{-1}(\beta-\bar{\beta})] \times |\Sigma|^{-(\bar{\alpha}+n+1)/2} \exp[-\tfrac{1}{2} tr\{\Sigma^{-1}\ \bar{S}\}] \quad (1.6)$$

where:

$$\Phi=[\Phi_0^{-1}+X'X]^{-1} \quad (1.7)$$

$$\bar{\beta}=vec(\ \bar{B}),\ \bar{B} = \bar{\Phi}\ [\Phi_0^{-1}\ B_0 + X'Y] \quad (1.8)$$

$$\bar{\alpha} = T + \alpha_0 \quad (1.9)$$

$$\bar{S} = Y'Y+S_0+B_0'\ \Phi_0^{-1}\ B_0 - \bar{B}'\ \bar{\Phi}^{-1}\ \bar{B} \quad (1.10)$$

Relation (1.6) is a combination of the multivariate normal distribution and the inverse-Wishart distribution, with the aposteriori distribution taking a similar form to the apriori distribution.

To obtain the marginal distributions:
- we integrate through β to obtain the aposteriori marginal distribution for the parameter Σ:

$$\pi\ (\Sigma|y) \propto |\Sigma|^{-(\bar{\alpha}+n+1)/2} \exp[-\tfrac{1}{2}\mathrm{tr}\{\Sigma^{-1}\ \bar{S}\}] \qquad (1.11)$$

- we integrate through Σ to obtain the aposteriori marginal distribution for the parameter β:

$$\pi\ (B|y) \propto I_n + |\ \bar{S}^{-1}\ (B-\bar{B})'\bar{\Phi})^{-1}\ (B-\bar{B})|^{-[T+\alpha 0-n+1]+n+k-12} \qquad (1.12)$$

A feature of VAR models is the existence of model stability. We check that if the inverse of the characteristic roots of the estimated coefficient matrix has modulus < 1 and lies inside the circle of radius 1, then we infer that the model is stable.

The use of the structural identification scheme involves setting some assumptions. The structural VAR model used for decomposing innovations into orthogonal components is:

$$Y_t = \alpha + A(L)Y_{t-1} + D\varepsilon_t,\ \ \varepsilon_t \sim N(0, \Sigma_t) \qquad (2)$$

where:

Y_t – vector of endogenous variables, α – vector of model constants, $A(L)$ - polynomial matrix in the lag operator L , B - contemporaneous impact matrix of mutually uncorrelated residuals, ε_t – vector of model residuals.

4. Results

In this section, we consider the VAR model described above, using 6 representative variables, to understand the impact of the euro area's dependence on one of the most widely used fossil fuels and how it can influence the trajectory of key economic indicators in turbulent times characterized by high volatility.

Figure 3 shows the impulse response functions (IRFs) to a one-standard deviation shock in the Brent oil price along extensible windows from 2005 to the end of 2019, the beginning of 2022, and the beginning of 2023, respectively. The shock was captured using a Choleski decomposition identification scheme, which is captured over a 36-month window.

The magnitude of the oil price shock is higher once observations from the pandemic are included. In terms of industrial production, the response to the shock of the pandemic outbreak is under-observed by the specification presented because at the time of the financial crisis (2007-2008) the constraint on economic activity resulted in a fall in both the oil price and industrial production and subsequently through the cost effect, the reduction in the Brent oil price caused an increase in the industrial production. However, since the outbreak of the Covid-19 pandemic, including in the context of the energy crisis, the link between production and oil prices has been closely correlated (Figure 3).

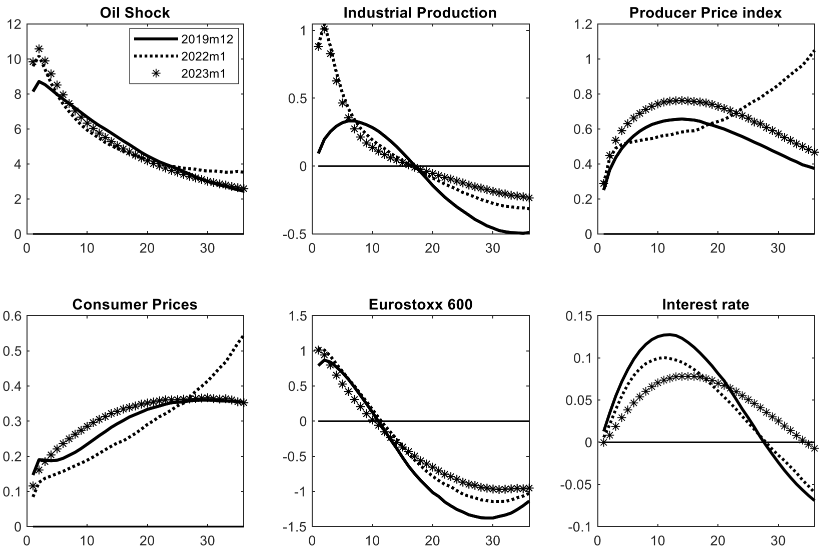

Figure no. 3 Response functions to a positive oil price shock

Regarding the impact on prices, both for consumer and industrial production prices, a fast pace is observed using the sample until January 2022, driven on the one hand by the recovery in demand with the easing of travel restrictions and the advancement of the SARS-COV-2 vaccination program, and on the other hand by the outbreak of supply bottlenecks. Producers have lowered their expectations for future orders due to the mobility and quarantine restrictions adopted by the authorities, and because of the major uncertainty about the virus's spread.

The stock index response to a 10 p.p. increase in oil prices is about 1 p.p. in the short term. In general, the stock market is directly correlated with the commodity market, especially when fluctuations in prices are influenced by the demand side. After 10 periods the response gradually moves into negative territory as the shock persists. The monetary policy response is restrictive for each sample, the central bank increases the interest rate to stabilize the pace of price growth. In fact, a larger magnitude is observed for the latter sample, given the European Central Bank's July 2022 benchmark interest rate hike in response to rising prices. Similarly, we estimated the responses of the variables to a one standard deviation shock to the European natural gas price (Figure 4).

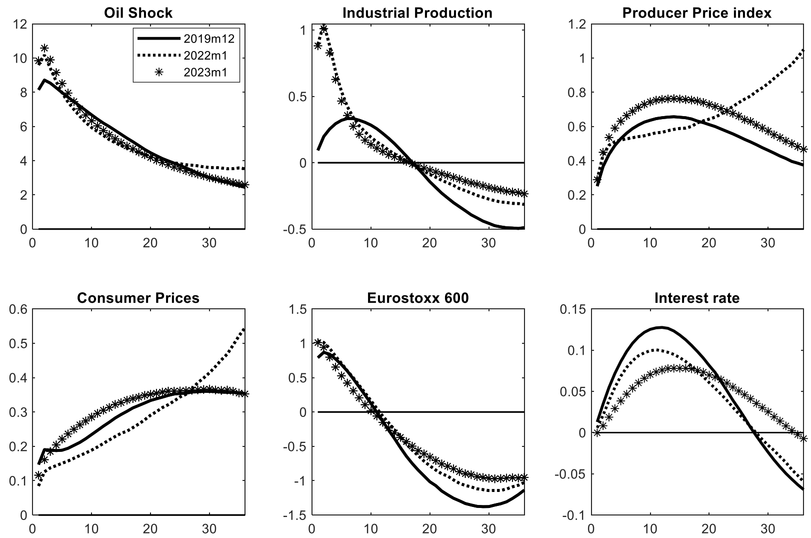

Figure no. 4 Response functions to a positive gas price shock

The magnitude of the shock is higher with the onset of war, but it fades more quickly. As for the response of industrial production, to a positive gas price shock between 8 and 12 p.p., it decreases to 0.4 p.p. via the direct production cost channel, as the economic agent produces more expensively. Note the significantly faster response in output prices, and by implication, inflation after the outbreak of the Covid-19 pandemic, when commodity prices have exacerbated. Moreover, after the outbreak of the war in Ukraine, the price of natural gas reached an all-time high, affecting the pace of price increases through second-round effects (the increase in costs for economic agents is passed on to final prices). The capital market responds negatively, but the magnitude of the shock is only marginal. In contrast, the tightening of monetary policy is only felt in the case of the last specification (2023m1), as the European Central Bank started the monetary policy tightening cycle later than other central banks.

Next, we conducted a scenario analysis in which the future path of Brent oil prices is given by futures prices. Based on this, we made a conditional forecast (until February 2024) for the remaining macroeconomic variables (Figure 5).

The y-o-y rate of the industrial producer price index can be seen to fall into negative territory, suggesting the dissipation of the cost push shock. At the same time, consumer price inflation also gradually declines to a level of 4% at the projection horizon with a lower threshold of 2% (suggesting possible entry into the central bank's inflation target) and an upper threshold of 6%. Industrial production is relatively stable up to the projected horizon, but the Euro Stoxx 600 has a steep downward trend with a high uncertainty range suggesting a possible contraction in financial markets. In contrast, monetary policy is still tight for 3-6 months, with the tightening cycle coming to an end.

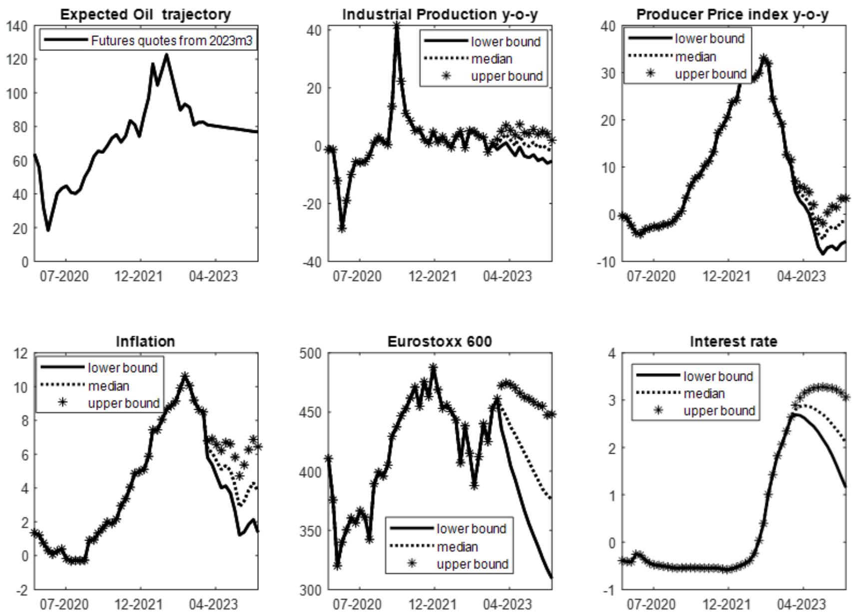

Figure no. 5 The conditional forecast of variables on the trajectory of futures oil quotes

5. Conclusions

The energy market plays an important role on macroeconomic variables in the euro area, and at the same time, the dependence on Russia's natural resources is a challenge in terms of assessing the outlook over a relatively short horizon (one year). In this paper, we have captured the reaction of the euro area economy to a positive shock from both oil and natural gas, both resources being directly influenced by the outbreak of war in Ukraine. However, a possible shift towards green, renewable energy, may bring inflationary pressures, given the technological process and the continuing development of this area. However, in the medium/long term the shift to a green economy reduces the dependence on natural resources, which are manipulated over time by certain events which are caused even on purpose.

The paper emphasizes the significance of geopolitical factors, particularly the substantial sanctions imposed on the Russian Federation, and how they impact various sectors of the economy. The high dependency on energy resources makes productivity vulnerable, leading to potential repercussions on the welfare of the population and public finances of member states.

The study's findings not only capture the effects of the shock but also demonstrate the euro area economy's ability to adapt to such challenges. The swift response of institutions to the inflationary consequences of the war indicates their resourcefulness and capacity to formulate effective public policies.

However, the study does have some limitations, one of which is that certain responses became more volatile once pandemic observations were included. To address this, future research may explore using a VAR model with Stochastic Volatility (SV) and fatter-tailed errors, employing a student's t-distribution for error terms instead of a Gaussian one. This approach could help in smoothing the responses of the Impulse Response Functions (IRFs) and provide a more robust analysis.

Energy is an indispensable resource for everyday activities, whether we are talking about the population or economic operators. Thus, the recent sharp rise in energy prices in Europe is likely to have an impact on consumer price dynamics sooner or later, and the general rise in inflation rates at Community level may signal the start of such adjustments. At the same time, concerns have started to grow about the potential medium- and long-term effects of these shocks, with the risk that economic agents' inflation expectations may be unanchored, and economic activity may recover slower.

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