



73 Report by Gökhan Ider, Alexander Kriwoluzky, Frederik Kurcz, and Ben Schumann

And Yet They Move: Energy Prices Fall When Key Interest Rates Increase, Despite Countervailing Effects

- Study investigates whether the European Central Bank (ECB) can do something against rising energy prices
- Results show that the ECB is not powerless: energy prices decline as a result of a key interest rate hike
- Three monetary policy transmission channels with partially countervailing effects play a role

LEGAL AND EDITORIAL DETAILS



DIW Berlin — Deutsches Institut für Wirtschaftsforschung e.V.

Mohrenstraße 58, 10117 Berlin

www.diw.de

Phone: +49 30 897 89-0 Fax: -200

Volume 13 February 24, 2023

Publishers

Prof. Dr. Tomaso Duso; Sabine Fiedler; Prof. Marcel Fratzscher, Ph.D.;
Prof. Dr. Peter Haan; Prof. Dr. Claudia Kemfert; Prof. Dr. Alexander S. Kritikos;
Prof. Dr. Alexander Kriwoluzky; Prof. Dr. Lukas Menkhoff; Prof. Karsten
Neuhoff, Ph.D.; Prof. Dr. Carsten Schröder; Prof. Dr. Katharina Wrohlich

Editors-in-chief

Prof. Dr. Pio Baake; Claudia Cohnen-Beck; Sebastian Kollmann;
Kristina van Deuverden

Reviewer

Prof. Dr. Franziska Holz

Editorial staff

Rebecca Buhner; Dr. Hella Engerer; Ulrike Fokken; Petra Jasper; Kevin Kunze;
Sandra Tubik

Layout

Roman Wilhelm, Stefanie Reeg, Eva Kretschmer, DIW Berlin

Cover design

© imageBROKER / Steffen Diemer

Composition

Satz-Rechen-Zentrum Hartmann + Heenemann GmbH & Co. KG, Berlin

ISSN 2568-7697

Reprint and further distribution—including excerpts—with complete
reference and consignment of a specimen copy to DIW Berlin's
Customer Service (kundenservice@diw.de) only.

Subscribe to our DIW and/or Weekly Report Newsletter at

www.diw.de/newsletter_en

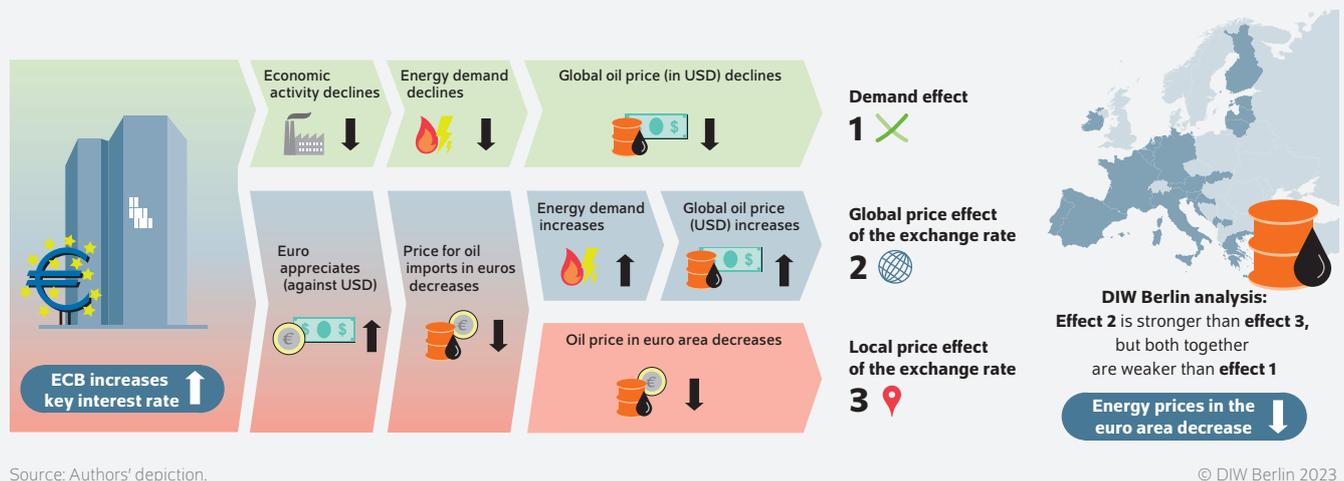
AT A GLANCE

And Yet They Move: Energy Prices Fall When Key Interest Rates Increase, Despite Countervailing Effects

By Gökhan Ider, Alexander Kriwoluzky, Frederik Kurcz, and Ben Schumann

- Energy prices have risen sharply due to the coronavirus pandemic and the war in Ukraine
- Using a time series model for the euro area, study investigates if the European Central Bank (ECB) can generally do something against rising energy prices
- Estimation of the empirical model for 1999 to 2020 shows that the ECB is not powerless: key interest rate hikes decrease euro-area energy prices
- Three monetary policy transmission channels are found with partially countervailing effects; both oil price and euro/US dollar exchange rate both play a large role
- ECB's interest rate hikes since 2022 were the right move and also reduced inflation expectations

European Central Bank can lower energy prices with a key interest rate hike despite countervailing effects



FROM THE AUTHORS

“We are seeing the first successes of the ECB’s interest rate policy, as inflation rates have fallen slightly in recent months. The ECB is also succeeding in keeping inflation expectations in check. There were always more upward deviations, but now expectations are returning toward the two-percent target.”

— Alexander Kriwoluzky —

MEDIA



Audio Interview with Alexander Kriwoluzky (in German)
www.diw.de/mediathek

And Yet They Move: Energy Prices Fall When Key Interest Rates Increase, Despite Countervailing Effects

By Gökhan Ider, Alexander Kriwoluzky, Frederik Kurcz, and Ben Schumann

ABSTRACT

Energy prices have risen sharply as a result of the coronavirus pandemic as well as the Russian attack on Ukraine in February 2022. The resulting consumer price inflation is forcing the European Central Bank (ECB) to act in accordance with its mandate. However, the ECB expresses doubts that it will be able to have an impact on the price increases. As this Weekly Report based on an analysis of structural relationships in the euro area emphasizes, the ECB is anything but powerless in regard to energy price developments: Following a 2022 Weekly Report that showed that fuel and heating costs generally fall in the wake of an interest rate hike, this Weekly Report identifies three channels of monetary policy through energy prices. In some cases, they have countervailing effects. However, the conclusion is clear: The ECB can actually dampen energy prices by raising the key interest rates.

What can a central bank do against rising inflation? Few questions in economics have been researched as much as this one. The short answer is: It can increase interest rates. A higher key interest rate increases the general interest rate level in the economy. As a result, companies invest less and private households reduce their consumption. The resulting overall decline in demand then has a dampening effect on prices.

Thus, it was surprising when the President of the European Central Bank (ECB), Christine Lagarde, said an interest rate hike would not be able to stop the price increases.¹ The recent increase in the price level in the euro area could be attributed primarily to a rise in energy prices (Figure 1). Following an increase in oil and gas prices in 2021, the Russian attack on Ukraine in 2022 resulted in a further sharp increase. A common narrative in this economic environment is that an interest rate hike could be off target, as it might not affect energy demand. Moreover, the narrative would suggest that a change in demand in the euro area would not necessarily result in a change in energy prices, as important energy prices such as oil are determined on the world market. In addition, although an appreciation of the euro against the US dollar makes oil cheaper in the euro area, the price change is not necessarily passed on to consumers.² This report shows that this narrative is based on false assumptions.

Using a time series model for the euro area, this Weekly Report examines the extent to which a change in interest rates affects energy prices by estimating the structural impact of ECB interest rate changes in the euro area for the period from 1999 to 2020. In addition, this report shows through which channels the interest rate change affects the economy. In the econometric analysis, different channels are identified

¹ At the EU Parliament's Monetary Dialogue on February 7, 2022, ECB President Christine Lagarde said, "Now, if we were to take monetary policy action [...] and rapidly hiking interest rates, would that have an impact on energy prices right away? I don't think so."

² Cf. for example, Carin van der Crujssen, Jakob De Haan, and Maarten Van Rooij, *High inflation erodes trust in the ECB (2023: VoxEU)* (available online; accessed on February 9, 2023). This applies to all other online sources in this report unless stated otherwise.) and Kai Philipp Christoffel, Günter Coenen, and Anders Warne, "The new area-wide model of the euro area: a micro-founded open-economy model for forecasting and policy analysis," *ECB Working Paper* no. 944 (2008).

Box 1

Model and data

This Weekly Report uses an empirical model to show how the ECB's monetary policy decisions affect consumer prices and economic activity in the euro area. A state-of-the-art empirical method, the Bayesian proxy structural vector autoregressive time series model (BP-SVAR),¹ is used to capture the dynamic structure of the euro area economy. The BP-SVAR model is estimated using euro area data from January 1999 to February 2020.²

The baseline model for the euro area economy includes the one-year German government bond yield, the industrial production index, the consumer price index, the energy component of the consumer price index, the Brent crude oil price, a measure for the credit risk premium, and the euro-US dollar exchange rate. The model contains standard variables to capture the necessary macroeconomic relationships in the economy and is expanded to estimate the impact of ECB monetary policy on consumer energy prices via the exchange rate and the oil price. The model uses data at monthly frequency and includes a constant and twelve lags for each variable. While the Bayesian estimation method allows additional information to be included in the estimation procedure, it is not used in this study. Accordingly, the results reflect the information from the underlying time series. The estimated monetary policy effects are presented using impulse response functions that reflect an average dynamic response of variables in the modeled system to an ECB interest rate hike. As the SVAR used is a linear model, the opposite results apply for an interest rate decrease.

¹ Jonas E. Arias et al., "Inference in Bayesian Proxy-SVARs," *Journal of Econometrics* 225 (2021): 88–106.

² The sampling period does not include the COVID-19 pandemic as of March 2020. A longer sampling period that includes the pandemic does not change the results, cf. Ider et al., "Can the ECB influence consumer energy prices?"

through which monetary policy can influence energy prices in the euro area.³

ECB interest rate changes influence energy prices

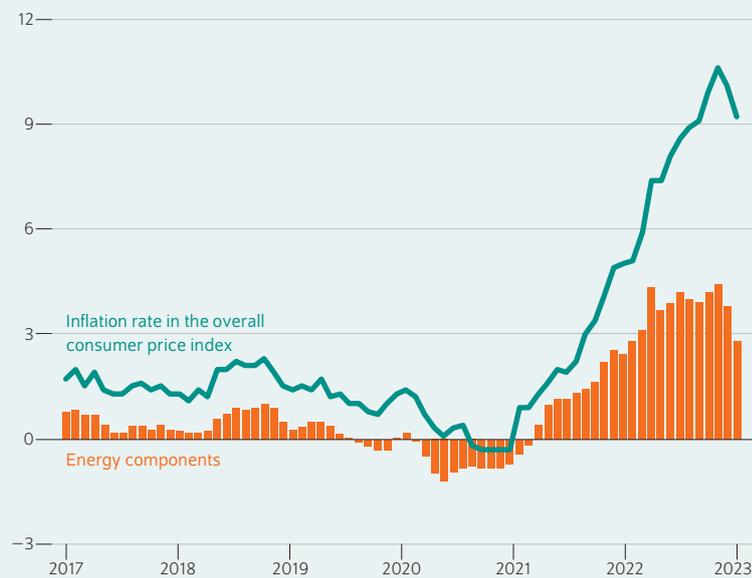
To estimate the effects of ECB monetary policy on the euro area, a structural vector autoregression model (SVAR model) including the following variables is used: the interest rate of the one-year German government bond, industrial

³ For a theoretical foundation of the channels and further results, see Gökhan Ider et al., "Can the ECB influence consumer energy prices?" *DIW Discussion Paper* no. 2033 (2023) (available online).

Figure 1

Inflation in the euro area and impact of energy prices

Change compared to previous year in percent; energy components in percentage points



Source: European Central Bank.

© DIW Berlin 2023

Inflation in the euro area is strongly driven by energy prices.

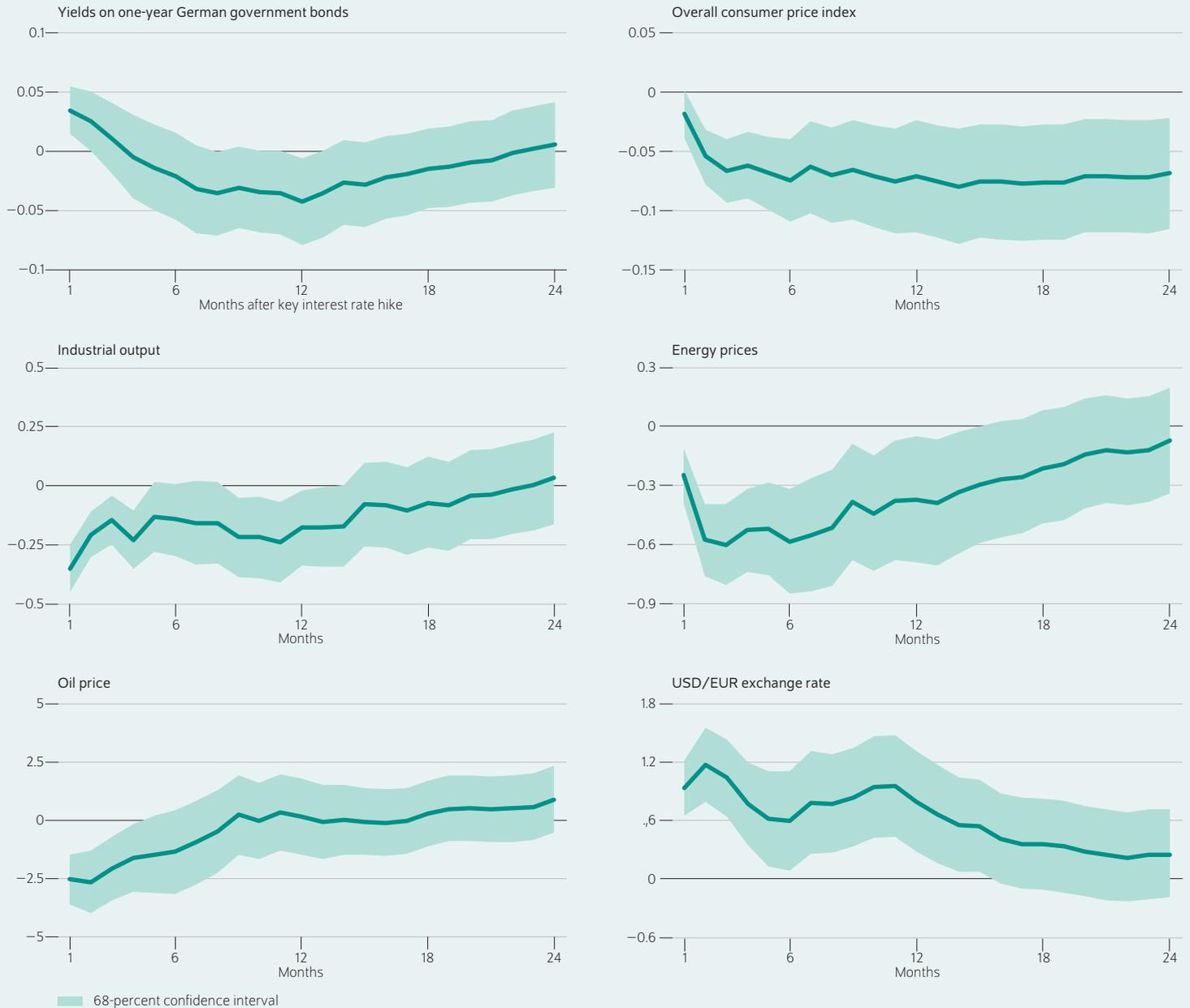
output, consumer prices, energy prices, the euro to US dollar exchange rate, a corporate interest spread, and the Brent crude oil price (Box 1). Exogenous effects of monetary policy can be gauged through measuring interest rates shortly before and shortly after the announcement of ECB policy announcements. This makes it possible to isolate causal effects of monetary policy on the euro area economy, as the ensuing interest rate difference reflects the monetary policy decision that was unexpected and, accordingly, not priced by financial markets (Box 2).

The analysis shows that industrial output and consumer prices decline as a result of an interest rate hike, which is in line with standard monetary theory (Figure 2).⁴ The yield on the German government bond, which is widely regarded as the safe rate, rises by a few basis points after the rate hike (also known as a "shock" in economic terms), leading to a reduction in the consumer price index by slightly less than 0.1 percent. Consumer energy prices, in contrast, decline five times as much. The energy components in the consumer price index are mainly heating energy and electricity prices as well as fuel prices for private transport. The key factor for the sharp decline in energy prices compared to the overall

⁴ Jordi Galí, *Monetary policy, inflation, and the business cycle: an introduction to the new Keynesian framework and its applications* (Princeton University Press: 2015); Frank Smets and Rafael Wouters, "Shocks and frictions in US business cycles: A Bayesian DSGE approach," *American Economic Review* 97, no. 3 (2007): 586–606.

Figure 2

Effects of a key interest rate hike in the euro area
Change in percent, for government bonds in percentage points



Note: The credible interval is an uncertainty band that should be interpreted similarly to a confidence interval.

Source: Authors' calculations.

© DIW Berlin 2023

Energy prices react much more strongly to a change in interest rates than inflation as a whole. The price of oil falls significantly in the short term.

index is the reaction of the exchange rate and the oil price, as oil is the most important driver of energy prices.⁵ As an interest rate increase makes investing in euros more attractive for investors, the euro appreciates against the US dollar.

⁵ Oil is the most important energy commodity in the basket of goods and services on which the consumer price index is based, accounting for 45 percent (in 2019).

A key new result of this study is the influence of the ECB's monetary policy on the global oil price, which drops significantly. This implies that the euro area is a strong player in the global energy and oil markets that should not be underestimated. Thus, it is of central importance to consider the decline in demand that the ECB is causing through its interest rate hikes for the oil market as well.

Box 2

Identification of exogenous monetary policy shocks

The effects of monetary policy on the economy can only be accurately studied by identifying central bank policy changes that are not endogenous reactions to economic fundamentals. These exogenous changes to monetary policy are referred to as monetary policy shocks, which are unexpected and thus not already priced in the financial markets. Monetary policy announcements by the ECB offer the possibility of isolating unexpected changes in monetary policy and can therefore be used to measure the impact of monetary policy on the economy.¹

The modern high frequency identification method is used here, which isolates such unexpected changes in monetary policy by measuring changes in interest rate futures in a narrow time window around the announcement of the policy decision. The important assumption here is that the shift in market expectations about monetary policy is captured in the changes in the futures rate. Moreover, futures only change as a result of monetary policy, as there are no other systematic effects in the short time period around the announcement. This has been shown to be a valid and reasonable assumption by seminal papers in the related literature. Typically, the ECB publishes its monetary policy decisions in a press release on the day of the Governing Council's monetary policy meeting, which is later followed by a press conference. The change of the three-month overnight index swap rate (OIS) before the press release and after the press conference is used as a monetary policy surprise.² In addition, the poor man's sign restrictions are used to filter out central bank information effects of a monetary policy surprise.³

This identified unexpected change in policy is used as an instrument in the time series model to capture exogenous changes of monetary policy. In the model, the monetary policy stance is represented by an interest rate, which in this case is the rate for one-year German government bonds.

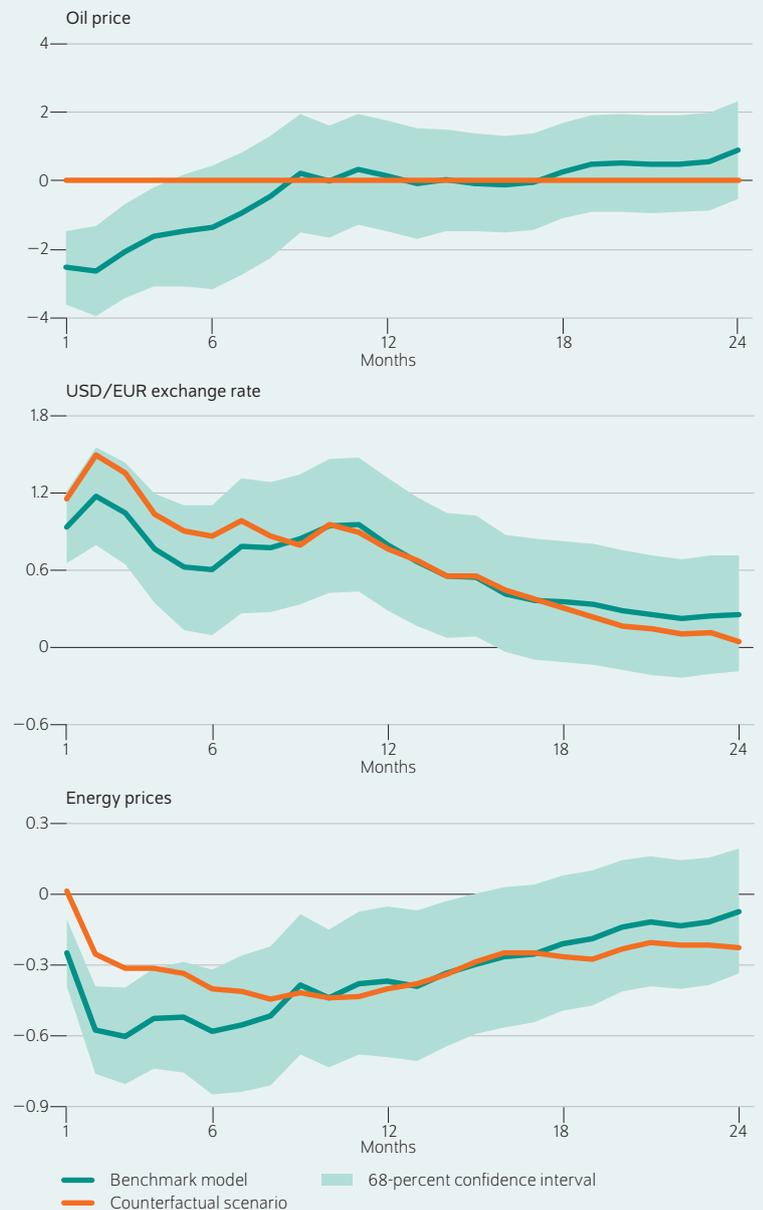
¹ Cf. Mark Gertler and Peter Karadi, "Monetary Policy Surprises, Credit Costs, and Economic Activity," *American Economic Journal: Macroeconomics* 7, no. 1 (2015): 44–76.

² High frequency data were taken from the Euro Area Monetary Database (EA MPD), which are from the following publication: Carlo Altavilla et al., "Measuring euro area monetary policy," *Journal of Monetary Economics* 108 (2019): 162–179.

³ Marek Jarocinski and Peter Karadi, "Deconstructing Monetary Policy Surprises – The Role of Information Shocks," *American Economic Journal: Macroeconomics* 12 (2020): 1–43.

Figure 3

Counterfactual scenario: Key interest rate hike in the euro area without an effect on the oil price
Change in percent



Note: The credible interval is an uncertainty band that should be interpreted similarly to a confidence interval.

Source: Authors' calculations.

© DIW Berlin 2023

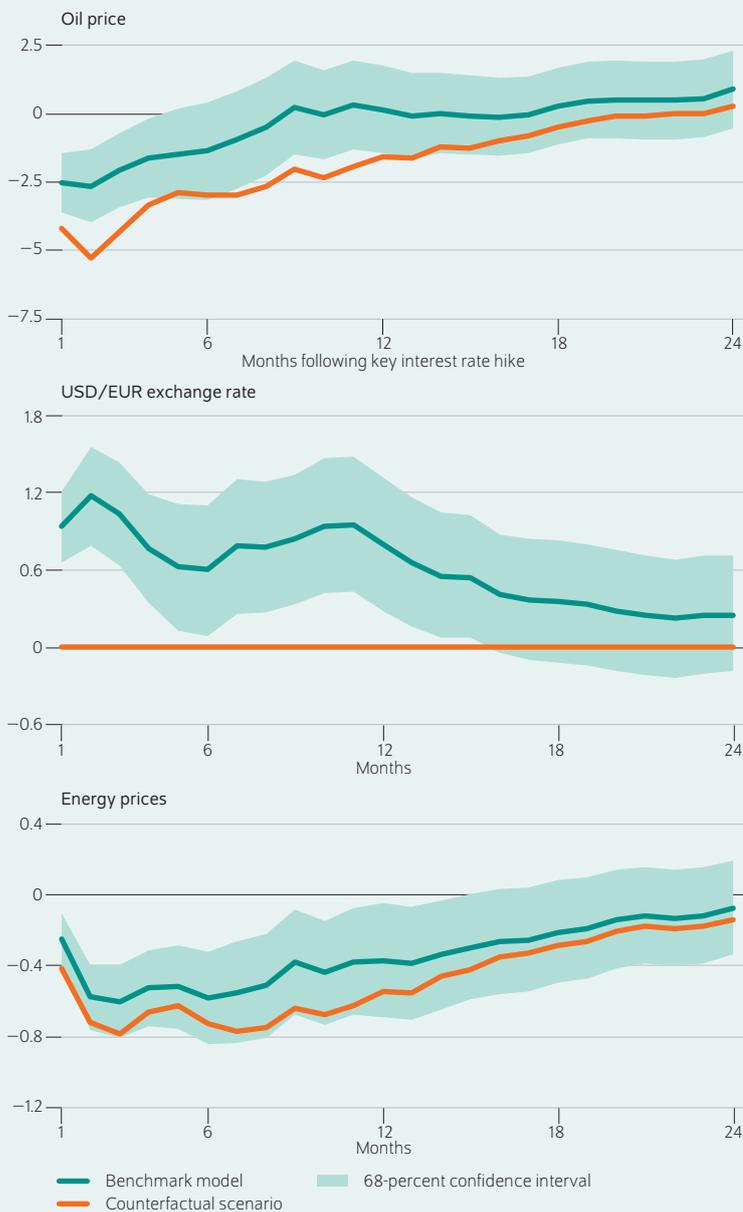
Were the global oil price not influenced by the interest rate change, energy prices in the euro area would experience a less sharp decline.

With its monetary policy, the ECB can influence energy prices, which also react exceptionally strongly to an interest rate hike compared to the response of the overall price index.

Figure 4

Counterfactual scenario: Key interest rate hike in the euro area without euro appreciation (global price effect of the exchange rate)

Change in percent



Note: The credible interval is an uncertainty band that should be interpreted similarly to a confidence interval.

Source: Authors' calculations.

© DIW Berlin 2023

The oil price and energy prices would decline more sharply if the euro did not appreciate. The stronger euro therefore counteracts the price-dampening effect of the interest rate hike.

Monetary policy and energy prices: Three different transmission channels

Monetary policy's effects on the global oil price and the euro to USD exchange rate are essential to understanding why

Box 3

Calculating the counterfactual scenarios

To identify the importance of the individual transmission channels, counterfactual scenarios are calculated in which the ECB interest rate hike does *not* change different variables. These scenarios were calculated with the minimum relative entropy method (MRE method).¹

Generally, every counterfactual scenario can be characterized by two characteristics. The first characteristic of such a scenario is determined by the desired experimental result, which by definition differs from the actual experimental result. For example, in the case of a coin toss showing tails, the desired counterfactual outcome would be heads. The second characteristic of a scenario is described by the possible circumstances that may change in order to get the desired result. In the case of a coin toss, for example, this would be how high the coin is tossed, the wind at the time of the toss, or the weight of the coin. MRE scenarios calculate the necessary minimal change in circumstances for the desired experimental result to be achieved. This makes it possible to calculate the most likely scenario in which the desired counterfactual outcome occurs.

In the illustrated application, the objective is to calculate the impact of a monetary policy shock that does not change some of the endogenous variables. The circumstances that are allowed to change in the implementation of the MRE method chosen here to achieve the desired result are the parameters of the SVAR model. The MRE method thus calculates the minimum change in the parameters needed for the desired result to occur. This ensures that the counterfactual scenario generated is the most likely scenario to achieve the desired result. Intuitively, this means that the dynamics of the other endogenous variables in the SVAR model are as close as possible to the actual observed dynamics from the original estimation.

¹ Max Breitenlechner, Georgios Georgiadis, and Ben Schumann, "What Goes around Comes around: How Large Are Spillovers from US Monetary Policy?" *Journal of Monetary Economics* 131 (2022): 42–160.

energy prices react (so strongly) to interest rate changes. In particular, three transmission channels are discovered. To quantify the significance of the different transmission channels, three counterfactual scenarios (Box 3) in which the effects of the various channels are simulated. The difference between the reaction of the energy prices in the original SVAR model and the reaction in the counterfactual scenario provides an insight into how significant the individual channels are for the impact of the interest rate change on European energy prices.

Decline in demand following an interest rate change also influences energy prices

A clear channel results from the general decline in demand and production in the euro area as a result of an interest rate hike and the resulting lower demand for oil. An analysis based on the assumption that the euro area is a small open economy with no influence on the global oil price, which is traded in USD on the world market, fails to recognize the global importance of the euro area. Thus, the importance of the euro area monetary policy channel for the oil market can be measured by the difference between the original scenario and a counterfactual scenario where the global oil price remains unaffected by the interest rate change. In this scenario, energy prices are shown to decline much less sharply, especially in the first six months after the interest rate decision (Figure 3).⁶

Euro appreciating against the US dollar causes countervailing effects

The benchmark model (Figure 2) has shown that the euro appreciates against the US dollar when the ECB increases the interest rate. This implies two countervailing effects in regard to the oil and energy prices in the euro area. On the one hand, the appreciation of the euro causes imported oil prices in euros to fall. This reduces local energy prices in euros, which is the price that is critical for the ECB due to its importance for consumers and companies in the euro area. This channel is referred to as the *local* price effect of the exchange rate.

On the other hand, the demand for energy goods rises due to the decrease in local energy prices in the euro area. This increases, among other things, oil demand and thus the world market price for oil in USD. Thus, an appreciation of the euro could also cause local energy prices in euros to rise because of the increase in the global oil price. This is the *global* price effect of the exchange rate.

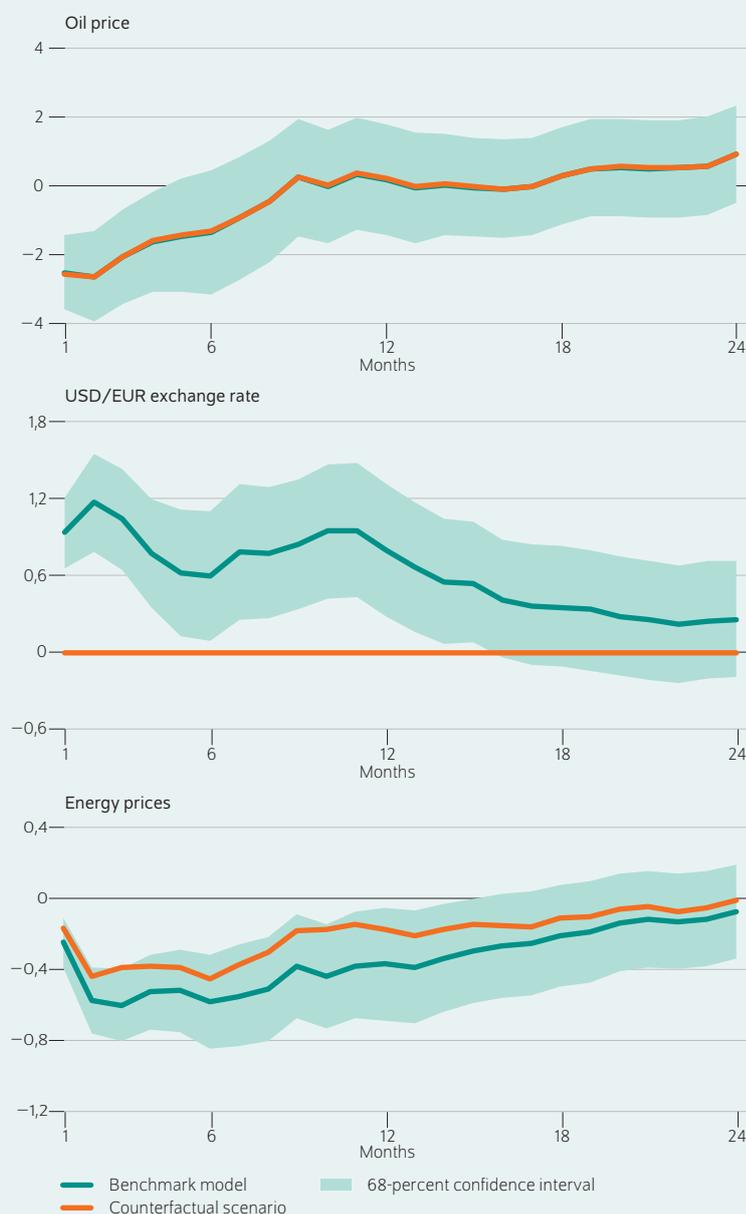
Due to these countervailing effects, it is not clear in advance whether the prices of oil in euros will ultimately fall or rise due to the appreciation of the euro following the interest rate hike. To investigate this and to differentiate between the two effects, two more counterfactual scenarios are calculated (Figure 4 and Figure 5).

The first of these scenarios contains an interest rate hike by the ECB that does not cause the euro to appreciate, which provides information on the overall effect of the exchange rate's local and global price effects (Figure 4). The exchange rate's global price effect appears to have a stronger impact than its local price effect. This scenario shows that the global oil price and local energy prices would decline more without

Figure 5

Counterfactual scenario: Key interest rate hike in the euro area without euro appreciation (local price effect of the exchange rate)

Change in percent



Note: The credible interval is an uncertainty band that should be interpreted similarly to a confidence interval.

Source: Authors' calculations.

© DIW Berlin 2023

This scenario shows that the stronger euro in itself certainly lowers energy prices, but the countervailing effect (Figure 4) dominates.

the euro appreciating. Therefore, it can be inferred that the appreciation of the euro leads to a larger increase in the global oil price than its effect on the local price.

However, the final counterfactual scenario shows that the exchange rate's local price effect does actually play a role.

⁶ The counterfactual analyses can also be simulated in a structural scenario analysis, cf. Joan Antolin Diaz, Ivan Petrella, and Juan F. Rubio-Ramierz, "Structural scenario analysis with SVARs," *Journal of Monetary Economics* 117 (2021): 798–815. In Ider et al., "Can the ECB influence consumer energy prices?" it is shown that the results do not change.

This can be seen in a simulation in which, first, the ECB's rate hike does not appreciate the euro against the US dollar and, second, the lack of appreciation does not change the global oil price relative to the benchmark model. The scenario shows that local energy prices decline less when the euro does not appreciate and the oil price response remain the same. This means that the appreciation of the euro definitely has a negative—that is, dampening—effect on energy prices in euros in the euro area. However, the exchange rate's global price effect outweighs the local price effect, which therefore recedes into the background.

Current monetary policy fighting inflation, harboring risks

The analysis in this Weekly Report shows that the ECB can successfully combat inflation with its interest rate hikes. In this context, the interest rate increases implemented in 2022 were the correct course of action at the time. However, the results show that an interest rate hike can also lead to a decline in economic output and to an increase in unemployment. Therefore, the ECB measures come with economic costs. However, in the current inflationary environment, the ECB must pay particular attention to the development of inflation expectations, which are essential for the development of inflation in the medium term. The ECB can rein in inflation with interest rate hikes and thus achieve its inflation target of two percent in the medium term.

Gökhan Ider is a PhD Student in the Macroeconomics Department at DIW Berlin | gider@diw.de

Alexander Kriwoluzky is Head of the Macroeconomics Department at DIW Berlin | akriwoluzky@diw.de

JEL: E31, E52, Q43

Keywords: ECB monetary policy, energy prices, exchange rate channel

Conclusion: ECB interest rate increases since 2022 were the correct course of action

The analysis in this Weekly Report identifies three channels through which monetary policy in the form of an interest rate hike affects energy prices. The most significant channel is the decline in aggregate demand following an interest rate hike in the euro area, as a result of which prices on the world market fall. The monetary union is not a small economy, but rather (still) an important player on the energy market. Moreover, the analysis shows that the appreciation of the euro against the US dollar as a result of the ECB's interest rate hike leads to an increase in the global oil price and the oil price in USD. On the one hand, oil in the euro area is becoming cheaper due to the strong euro, but this also increases demand for oil in USD, which makes it more expensive. This global price effect overcompensates for the decline in the oil price in euros driven by the local price effect. Thus, the appreciation of the euro following an interest rate hike counteracts the demand-induced decline in local and global energy prices. Considering all three transmission channels, it can be seen that an ECB interest rate hike does lower global and local energy prices because the euro area demand for energy decreases.

By beginning to raise interest rates in the euro area successfully from July 2022 following a long period of hesitation, the European Central Bank successfully prevented a further rise in inflation and reduced inflation expectations, which is an important determinant of inflation in the medium term.

Frederik Kurcz is a PhD Student in the Macroeconomics Department at DIW Berlin | fkurcz@diw.de

Ben Schumann is a PhD Student in the Macroeconomics Department at DIW Berlin | bschumann@diw.de