

A policy bulletin from the German Institute for Economic Research

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DIW BERLIN



109 Report by Gökhan Ider, Alexander Kriwoluzky, and Frederik Kurcz

ECB can lower fuel and heating costs by increasing interest rates but would risk economic recovery

- Fuel prices and heating costs are driving inflation in the euro area
- First study to show that an interest rate increase would decrease energy prices by up to four percent
- This is due to euro appreciation, which reduces prices for dollar-traded oil products

LEGAL AND EDITORIAL DETAILS



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Volume 12 April 6, 2022

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Cover design

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Composition

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

ISSN 2568-7697

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AT A GLANCE

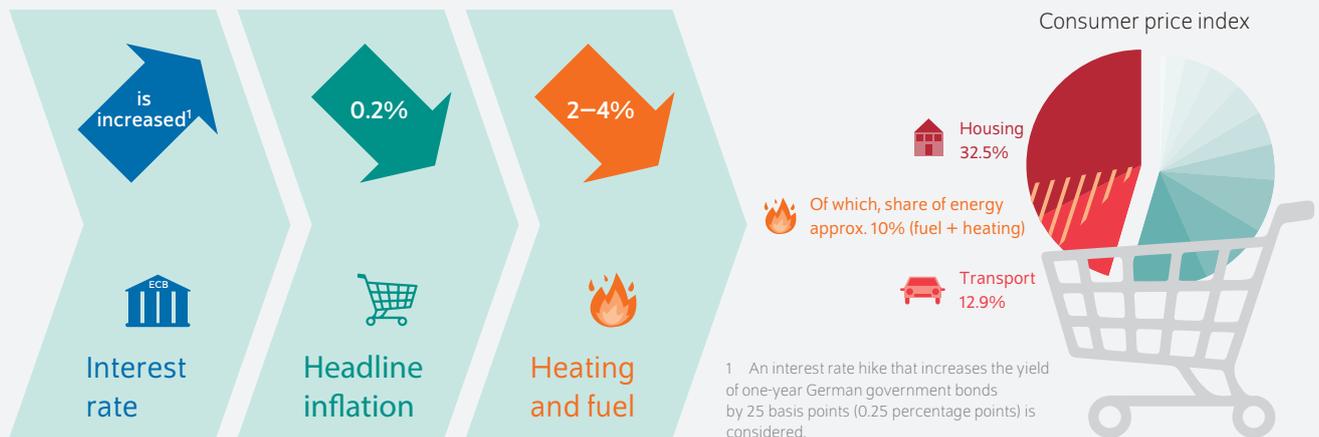
ECB can lower fuel and heating costs by increasing interest rates but would risk economic recovery

By Gökhan Ider, Alexander Kriwoluzky, and Frederik Kurcz

- Increasing fuel prices and heating costs are driving inflation in the euro area; war in Ukraine is exacerbating the price increase
- First study to show whether the ECB could decrease energy prices for consumers with tighter monetary policy
- Time series models for Germany show that an interest rate increase would decrease headline inflation by 0.2 percent and heating and fuel prices by up to four percent
- This is because an interest rate increase would appreciate the euro and decrease prices for dollar-traded oil products
- The ECB has an instrument to curb the drastic price increase, but using it risks the economic recovery

Increasing the interest rate lowers energy prices much more than the overall consumer price index

Shares of German CPI (right) and change in prices in percent (left)



Source: Authors' own calculations.

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FROM THE AUTHORS

“The current combination of high inflation and a faltering economic recovery has put the ECB in a difficult position: If it increases interest rates, it can curb energy prices. However, this would also decrease economic output and increase unemployment.”

— Alexander Kriwoluzky —

MEDIA



Audio Interview with A. Kriwoluzky (in German)
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ABSTRACT

Inflation has been growing considerably since the middle of 2021, with rising energy prices driving the increase in particular. Since the end of February 2022, the trend has also been exacerbated by the ongoing Russian invasion of Ukraine. To keep prices stable, the European Central Bank must rein in its accommodative monetary policy. However, would doing so—by enacting an interest rate increase, for example—even decrease the prices of energy traded on the world market? In this Weekly Report, a time series model shows energy prices in Germany would sink by around four percent—even more strongly than the overall consumer price index at 0.2 percent—were the ECB to increase the interest rate. This is primarily due to the fact that such an increase would appreciate the euro, which would make dollar-traded oil imports cheaper. However, at the same time, an interest rate increase would derail industrial production and increase unemployment during an already slow economic recovery.

The war in Ukraine is impacting people in Europe and around the world, as is clearly shown by the mobilization of humanitarian aid, demonstrations, and the actions of western governments. For most Europeans and North Americans, the impact of the war is perhaps most noticeable at the gas station or on their upcoming heating bills. The prices of oil and gas more than doubled in the months leading up to the war, and following the invasion on February 24, 2022, prices shot up again despite unchanged supply.

Energy prices in Germany had already increased in 2021 and were responsible for much of the 3.1 percent increase in inflation that year (Figure 1). Moreover, there were supply chain issues and base effects due to the temporary VAT decrease in the second half of 2020. Due to the high inflation rate, there is growing demand in the euro area, and especially in Germany, for the European Central Bank (ECB) to end its accommodative monetary policy and to increase interest rates promptly.¹ The ECB has long hesitated to tighten its monetary policy because, on the one hand, it assumed that price drivers such as supply chain issues were only temporary. On the other, the risk of impeding the already slow economic recovery by increasing the interest rate too soon was too great for the ECB. At its March 10, 2022, meeting, the Governing Council of the ECB agreed to let the bond purchase program expire and an interest rate increase has become likely to occur in 2022.

However, whether an interest rate increase can decrease energy prices is controversial.² Critics point to the fact that fuel and heating energy demand are not strongly driven by ECB interest rates: Regardless of interest rates, people will heat their homes in the winter and commuters will drive their cars to work. In other words, an interest rate increase by the ECB would not noticeably decrease gas and heating prices, but it would risk stalling the economic recovery.

¹ Gerald Braunberger, "Richtig mit Stagflation umgehen," *FAZ* from March 2, 2022 (in German; available online); accessed on March 23, 2022. This applies to all other online sources in this report; Jens Münchrath, "DIE EZB bekommt ein Glaubwürdigkeitsproblem," *Handelsblatt* from February 2, 2022 (in German; available online).

² Frank Wiebe, "Die EZB hat im Kampf gegen die Inflation drei schlechte Optionen," *Handelsblatt* from March 21, 2022 (in German; available online); Michael Heim, "Inflation, die sich nicht mit Geldpolitik bekämpfen lässt," *Handelszeitung* from January 14, 2022 (in German; available online).

Box 1

Model and dataset

The impact of monetary policy on the economy can be analyzed using empirical and theoretical models. In this paper, an empirical model with minimal restrictions was chosen to demonstrate how the ECB's monetary policy has affected consumer prices and economic fundamentals in Germany. Therefore, a structural vector autoregression (SVAR) time series model is estimated to capture the dynamic structure of the German economy from January 1999 (the founding of the eurozone) to December 2021.¹

The benchmark model for Germany includes the interest rate for one-year government bonds, the industrial production index, the consumer price index (CPI), the unemployment rate, and the nominal effective exchange rate of the euro for Germany. Since the nominal effective exchange rate (NEER) is based on trading partners of each country, the NEER for each country using the euro will be different. Thus, it captures the dynamic interactions of these macroeconomic relationships. The model uses data at monthly frequency and includes a constant and twelve lags for each variable. The confidence bands are constructed using the wild bootstrap method.²

First, using the benchmark model, the reactions of the variables to an interest rate increase are analyzed. Second, the reactions of the different CPI components are analyzed by substituting the analyzed subcomponent for the overall CPI variable in the benchmark specification. As the SVAR used is a linear model, the opposite results apply for an interest rate decrease.

¹ A shortened observation period excluding the coronavirus pandemic does not significantly change the results.
² Cf. For more details on the method, cf. Mark Gertler and Peter Karadi, "Monetary Policy Surprises, Credit Costs, and Economic Activity," *American Economic Journal: Macroeconomics* 7, no. 1 (2015): 44–76.

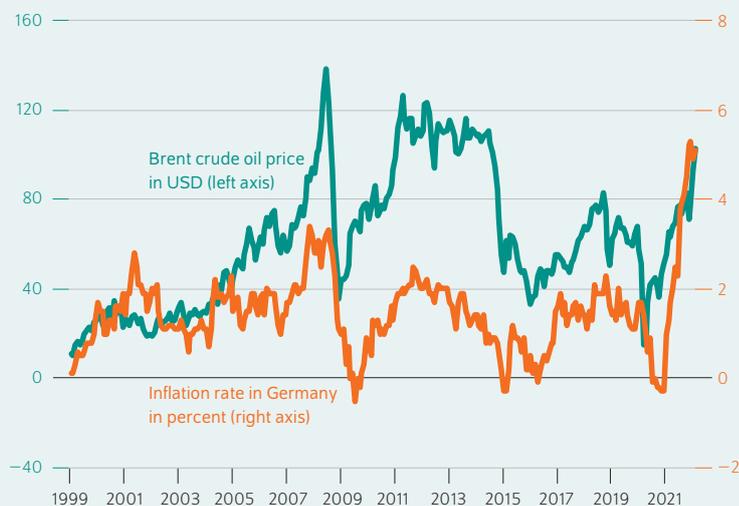
This Weekly Report is the first to investigate the impact of monetary policy decisions on energy prices by evaluating the immediate effect of interest rate changes on fuel and heating costs in the years since the introduction of the euro in 1999. In a second step, the effect on fuel and heating costs as well as effects on other economic variables such as industrial production or unemployment are investigated.

Interest rate increases decrease both inflation and energy prices

To estimate the effects of EU monetary policy on Germany, a time series model is used in which the interest rate of the one-year German government bond, industrial output, unemployment, different price components, and the euro exchange rate are depicted (Box 1).

Figure 1

Development of inflation in Germany and of crude oil prices
 Inflation in percent and Brent crude oil in USD



Sources: Energy Information Administration (EIA); Federal Statistical Office.

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While the crude oil price has been this high several times over the past 20 years, it has never before driven inflation as it is currently.

However, without any further assumptions, this model alone cannot isolate the causal effects of monetary policy on the economy—because, as in real life, monetary policy responds to the state of the economy and the economy responds to monetary policy. Therefore, using the interest rate differential (three-month interest rate futures) just before and after the announcement of a monetary policy decision has become an established tool in the recent literature for measuring exogenous effects of monetary policy.³ Changes to interest rates occur only after monetary policy decisions that financial markets did not anticipate and, accordingly, did not price in (Box 2).

The results of the causal analysis show that an interest rate increase causes the German consumer price index (CPI) to decrease by 0.2 percent—one tenth of the ECB's annual inflation target of around two percent—in the same month (Figure 2). The size of the monetary policy impulse is such that it causes the interest rate on the one-year German government bond to rise by 25 basis points. The CPI's reaction is consistent with standard monetary theories and remains significant for around 30 months after the shock.⁴

³ Cf. Mark Gertler and Peter Karadi, "Monetary Policy Surprises, Credit Costs, and Economic Activity," *American Economic Journal: Macroeconomics* 7, no. 1 (2015): 44–76; Carlo Altavilla et al., "Measuring euro area monetary policy," *Journal of Monetary Economics* 108 (2019): 162–179; Silvia Miranda-Agrippino and Giovanni Ricco, "The Transmission of Monetary Policy Shocks," *American Economic Journal: Macroeconomics* 13, no. 3 (2021): 4–107.

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.

Box 2

Identification of exogenous shocks

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 decision 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 change in market expectations about monetary policy is captured in the variation in the futures, which is 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 at 1:45 pm on the day of the Governing Council's monetary policy meeting, which is later followed by a press conference at 2:30 pm. The ECB's press release does not contain any

rationale or discussion on the decision.² Therefore, we choose to use the variation in interest rate futures around the press release window to minimize the central bank information component in the isolated unexpected change in policy that can render disentangling the pure monetary policy surprise difficult.

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. It is of crucial importance to find the correct combination of policy instrument and indicator to avoid the issue of weak instruments. In this respect, we experimented with several combinations and found that the one-year rate as the policy indicator and three-month Overnight Index Swap (OIS) futures as the policy instrument is the optimal combination. The relevant F-statistic, which is commonly used in the literature to check for weak instruments,³ is greater than ten for all model specifications used in the analysis, exceeding the weak instrument threshold.

¹ Gertler and Karadi, "Monetary Policy Surprises, Credit Costs, and Economic Activity."

² Carlo Altavilla et al., "Measuring euro area monetary policy," *Journal of Monetary Economics* 108 (2019): 162–179.

³ James Stock, Jonathan Wright, and Motohiro Yogo, "A survey of weak instruments and weak identification in generalized method of moments," *Journal of Business & Economic Statistics* 20, no. 4 (2002): 518–529.

However, how do the consumer prices for fuel and heating energy react? To investigate this question, the responses of the two largest CPI categories, housing and transport, are examined. Housing and transport include the subcategories "heating costs" and "fuels and lubricants," respectively.⁵ Together, these two subcategories comprise around 11 percent of a consumer's typical consumption basket.

Both heating costs and fuel react strongly to an interest rate increase: While the CPI decreases by only 0.2 percent, fuel decreases by over four percent in the month of the interest rate shock. Electricity and heating energy prices fall by up to two percent and decrease significantly for around ten months.

These results suggest that the ECB's monetary policy decisions do impact German energy prices and lower them even more than the overall CPI, indicating that such decisions have a particularly strong impact on precisely these components.

⁵ "Housing" and "heating costs" are abbreviated forms of "housing, water, electricity, gas, and other fuels" and "electricity, gas, and other fuels," respectively. Cf. information on the website of the Federal Statistical Office (available online).

The role of euro appreciation

It is important to understand why heating and fuel prices in particular react to interest rate increases so strongly. To do so, it is observed which other variables, such as the euro exchange rate, are influenced by interest rate increases (Figure 3). As an interest rate increase makes investing in euros more attractive for investors, the euro appreciates against other currencies. Following the increase, the effective euro exchange rate increases markedly by two percent and remains at this high level for around ten months. A two-percent increase in the effective exchange rate means that euro area buyers receive two percent more dollar-traded oil for the same euro amount. For households that pay for gas in euros, this is reflected directly in lower prices.

While the oil price also falls after an interest rate shock, it is only affected for a very short time. However, its temporarily lower price also decreases the prices of energy components in the CPI. While the price of oil reacts only briefly, heating costs decrease over a longer horizon, hence relating it to the euro's sustained appreciation.

The reaction of the price of gas, which is mostly traded in euros, also confirms that the exchange rate is a driving factor. Gas prices also fall, but for a shorter amount of time

Figure 2

Impact of an interest rate increase on consumer prices in Germany

Change in percent, one-year yield in percentage points



Note: An interest rate hike that increases the yield of one-year German government bonds by 25 basis points (0.25 percentage points) is considered.

Source: Authors' own calculations.

Energy prices react much more strongly to a change in the interest rate than the overall consumer price index does.

Figure 3

Impact of an interest rate increase on economic output
Change in industrial production and the euro exchange rate in percent and the unemployment rate in percentage points



Note: An interest rate hike that increases the yield of one-year German government bonds by 25 basis points (0.25 percentage points) is considered.
Source: Authors' own calculations.

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An interest rate increase has a negative impact on industrial production and the unemployment rate. The euro appreciates.

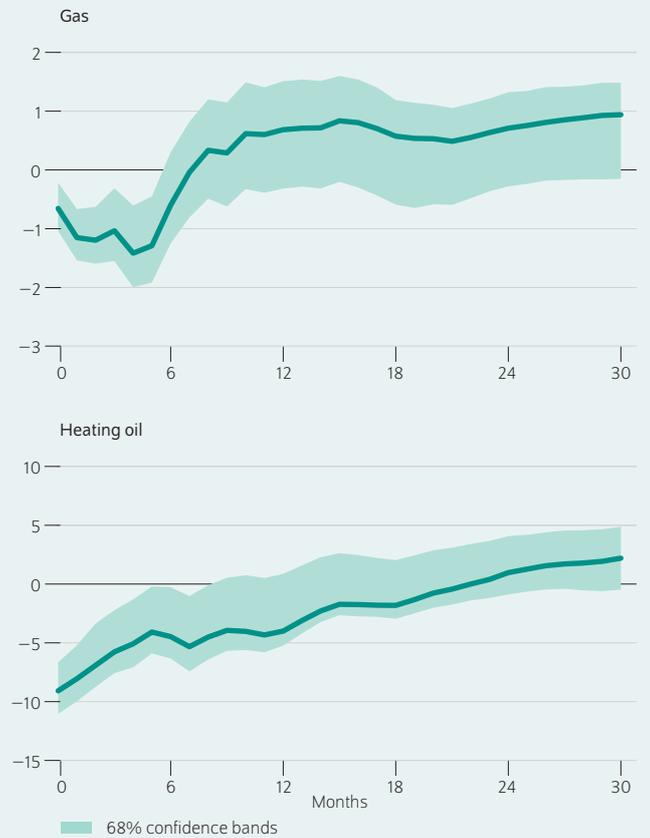
and by far less than the price of heating oil: gas prices in the housing index decrease by only one percent, while heating oil prices drop by nine percent (Figure 4).

Unemployment increases as well

While an interest rate increase decreases prices, it also is a drag on the manufacturing industry and the labor market (Figure 3). Following the shock, worsening financing conditions and decreasing demand increase the unemployment rate by slightly more than 0.1 percentage points. While the

Figure 4

Impact of an interest rate increase on gas and heating oil prices
Change in percent



Note: An interest rate hike that increases the yield of one-year German government bonds by 25 basis points (0.25 percentage points) is considered.
Source: Authors' own calculations.

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Because the euro appreciates as a result of an interest rate increase, dollar-traded heating oil has a much stronger reaction than gas, which is mostly traded in euros.

manufacturing industry recovers quickly and returns to its initial level after around three months, the increase in the unemployment rate remains for a longer period of time.

The ECB has found itself in a difficult position due to the war in Ukraine: It must deal with soaring energy prices and an endangered economic recovery simultaneously. While it can fight rising consumer and energy prices by initiating a restrictive monetary policy, doing so risks slowing the economic recovery.

Conclusion: ECB facing a dilemma

This Weekly Report has shown that tighter monetary policy does indeed have a significant effect on energy prices. While the ECB's interest rate decision does not affect the price on the world market significantly, it does influence the

value of the euro. When the euro appreciates against other currencies, the consumer prices for fuel and heating costs decrease significantly in Germany. Thus, theoretically, the ECB has an effective instrument available for stabilizing prices in the euro area.

However, such an interest rate increase would slow the recovery of an economy that is already struggling due to

the coronavirus pandemic and the war in Ukraine. As past restrictive monetary policy measures show, interest rate increases decrease industrial production in the short term and increase unemployment. Thus, the ECB is facing a dilemma: If it decreases inflation, it will also stall economic recovery. Nevertheless, it is crucial that the ECB fulfills its responsibilities and credibly conveys that it will take the necessary action.

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JEL: E31, E52, Q43

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