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The economic impact of Russia's invasion of Ukraine on European countries – a SVAR approach

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Abstract

We quantify the economic impact of Russia's invasion of Ukraine on Germany, the United Kingdom, France, Italy and Switzerland using data on historical geopolitical events. Applying a structural VAR approach based on sign and narrative sign restrictions, we find that the war has exerted a notable drag on real activity and has pushed inflation up considerably. For example, a counterfactual exercise suggests that in Germany, GDP would have been 0.7 percent higher and the CPI 0.4 percent lower in 2022Q4 if Russia had neither attacked nor threatened Ukraine. The negative consequences of the war are likely to be far greater in the medium-to-long term, especially with regard to the real economy.

Keywords: Geopolitical risk, structural VAR, narrative sign restriction, war in Ukraine, Russia, Europe
JEL Codes: C1, E32, H56

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1 Introduction

Russia's war on Ukraine has wrought profound human suffering, with countless lives lost and many displaced from their homes. In light of this human catastrophe, economic consequences are certainly secondary. Nevertheless, they appear to have been substantial. The onset of the war saw a surge in energy prices, financial market turmoil and a sharp contraction of Russia's and Ukraine's economies. Especially early in the conflict, policy-makers and investors were deeply worried that the war would exert a considerable drag on global economic activity, fueling inflation and, thus, leading the economy into a stagflationary environment that policy-makers are struggling to combat. A major concern was and still is the impact of rising energy prices (Burkhardt, 2022, Rütti, 2022). As shown in Figure 1, oil and gas prices spiked when Russia started the war on the 24th of February. While oil prices have normalized since, the price of gas and especially of gas futures is still high.

In this paper, we want to quantify the impact of Russia's invasion of Ukraine on the economies of several European countries (France, Germany, Italy, Switzerland and the United Kingdom). To this end, we study historical geopolitical conflicts that are, at least from an economic perspective, similar to Russia's war on Ukraine. We label geopolitical conflicts to be similar to the war in Ukraine when they are associated with fears of disruption or actual disruptions of energy supply.

Our analysis relies on a structural VAR approach. We estimate a separate VAR for each country considered. In each VAR, we include the recently constructed geopolitical risk (GPR) index of Caldara and Iacoviello (2022) to capture the extent and severity of geopolitical conflicts. The index is based on a textual analysis of newspaper articles that mention the threat, realization and escalation of geopolitical conflicts. Geopolitical conflicts are defined as wars, terrorist attacks or any tensions among states that affect the peaceful course of international relations. In our baseline specification, we include data on energy prices as an indicator for fears about or actual disruptions in energy supply. To identify exogenous conflict shocks originating

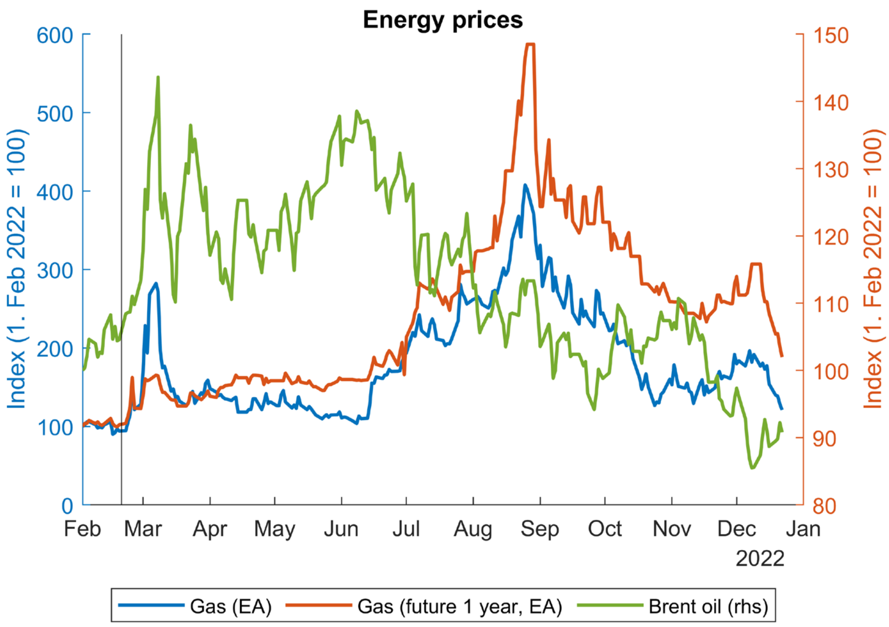

Figure 1: Energy prices

from geopolitical conflicts that are associated with energy disruptions, we combine narrative sign identification restrictions in the spirit of Kilian and Murphy (2014), Antolín-Díaz and Rubio-Ramírez (2018) with conventional sign restrictions in the spirit of Uhlig (2005). We impose that the conflict shocks have been positive at the onset of the Yom Kippur War in 1973, the Middle East Conflicts in the 1980s, the Gulf War in the 1990s, the Iraq War, and the war in Ukraine. The additional, conventional sign restrictions are similar to a combination of a geopolitical conflict shock and an oil shock. We impose that a conflict shock raises the GPR index, lowers GDP growth and raises CPI inflation.

We find that Russia's invasion of Ukraine has exerted a sizeable yet smaller drag on the economy of European countries than thattypically found in the literature. The war has reduced domestic and external demand by having weighed on consumer sentiment and foreign GDP and having caused an appreciation of the domestic currency. It also has led to a rise in domestic inflation, which has exerted a further dampening effect on real economic activity. Our counterfactual exercises suggest that if Russia had not attacked Ukraine, GDP would have been between 0.1 and 0.8 percent higher and the CPI between 0.2 and 0.4 percent lower in 2022Q4. Our results suggest that the negative consequences will be much more pronounced in the medium-to-long term, especially with regard to the real economy.

We are not the first to study the economic impact of Russia's invasion of Ukraine on the economy of European countries. There already exists a fast growing literature on the subject (see, *e.g.*, Bachmann et al., 2022, Baqaee et al., 2022, Krebs, 2022, Lan et al., 2022). Most contributions in this literature focus on the impact of a sudden stop in energy imports from Russia. For instance, Bachmann et al. (2022), Baqaee et al. (2022) emphasize the amplifying supply-side effects from production linkages. Using production network models, Bachmann et al. (2022) find that a sudden stop in energy imports could lead to a decline in German GDP between 0.5 and 3% in the short run. Baqaee et al. (2022) estimates a decline in French national income by approximately 0.15 to 0.2% if Russia stopped supplying energy to Europe. For some other EU countries, they estimate an adverse impact on national income of up to 5%. Krebs (2022) uses a similar approach but argues that the amplification effect from production linkages should be much higher. Based on similar assumptions on the reduction in gas supply, he finds that German GDP would decline between 3 and 8% in the short run. Lan et al. (2022) and Bundesbank (2022) take a broader perspective and not only focus on the impact of energy disruptions in isolation but also consider other factors such as increased uncertainty and fiscal policy. Their results point to a decline in German GDP between 1 and 3% in 2022.

All these studies have in common, that they largely abstract from the experience with past geopolitical conflicts, which is our focus. There exists a literature that studies the economic impact of past geopolitical conflicts (see, *e.g.*, Blomberg et al., 2004, Berkman et al., 2011, Caldara and Iacoviello, 2022, Caldara et al., 2022). However, most of the contributions in this field do not consider the war in Ukraine. An exception is Caldara et al.

(2022). Using the newspaper-based GPR index constructed in Caldara and Iacoviello (2022), Caldara et al. (2022) conduct a structural VAR analysis to assess the influence of the war in Ukraine on worldwide economic activity. They find that the war will reduce the level of global GDP by 1.5% and raise global inflation by 1.3 percentage points in 2022.

The main difference from our paper is that Caldara et al. (2022) do not distinguish between geopolitical events that are or are not associated with fears of disruption or actual disruptions in energy supply. There are many geopolitical conflicts that are not associated with a noticeable disruption in energy supply, such as the Falkland War of 1982 between the UK and Argentina or the terrorist attack on the US in 2001. Therefore, we believe that this distinction matters. Caldara and Iacoviello (2022) even find that an increase in the GPR index is associated with a decline rather than an increase in oil prices, which stands in contrast to the experience from major geopolitical conflicts such as the Yom Kippur War in the early 1970s, the Middle East conflicts in the 1980s or the Gulf War in the 1990s.[1] When we also consider geopolitical conflicts that are not associated with energy supply disruptions, we underestimate the energy channel of conflicts similar to the war in Ukraine. The energy channel is likely to play a nonnegligible role in macroeconomic fluctuations, as the large oil and macroeconomic literature suggests (see, *e.g.*, Hamilton, 1983, 1996, 2011, Caldara et al., 2019, Känzig, 2021).

In terms of the oil macroeconomy literature, our paper connects with many of its contributions. There is a long-standing tradition in this literature to study the economic impact of oil shocks based on the experience with past geopolitical conflicts. One strand of the literature argues that past geopolitical conflicts involving oil-producing countries led to recessions in other advanced countries through sharp increases in the price of oil. Proponents of this view often emphasize that almost all postwar U.S. recessions were preceded by a sharp increase in the price of oil (see, *e.g.*, Hamilton,

[1]When identifying conflict shocks with a Cholesky scheme as in Caldara and Iacoviello (2022) and Caldara et al. (2022), we also find that oil prices decrease in response to the shock.

1983, 1996, Barsky and Kilian, 2004, Hamilton, 2011). Given that the economic impact works primarily through the oil price channel, we could rely solely on the oil price movements triggered by Russia's invasion of Ukraine to quantify the economic impact. However, another strand of the literature questions the primary importance of the oil price channel. For instance, Kilian and Vigfusson (2017) argue that while most postwar U.S. recessions had been preceded by sharp increases in the price of oil, there have also been many episodes of sharply rising oil prices that have not been accompanied by a noticeable change in economic activity. This observation casts doubt on the primary importance of oil price movements for economic activity. Furthermore, studies based on linear VARs typically find a relatively small role of oil shocks in the observed declines in economic activity that coincided with geopolitical conflicts (see, *e.g.*, Hooker, 1996, Kilian and Vigfusson, 2017, Caldara et al., 2019, Känzig, 2021).

Hence, these contributions in the literature suggest that the oil price channel is not the only relevant channel to be studied when assessing the economic impact of geopolitical conflicts. Our results are in line with this assessment. When we exclude the GPR index in our analysis, our results change significantly, indicating that the oil price movements contain insufficient information to gauge the macroeconomic effects of geopolitical conflicts.

The remainder of the paper is organized as follows. Section 2 describes the data used and explains the identification strategy of our structural VAR analysis. Section 3 discusses the results, including an in-depth analysis of the impact of Russia's war on Ukraine. In Section 4, we discuss the robustness of our results, and Section 5 concludes.

2 Data and empirical approach

In analyzing the economic impact of Russia's invasion of Ukraine on European economies, we focus on Germany, France, Italy, the United Kingdom and Switzerland. The first four countries are the largest economies in Europe, and Switzerland is an interesting case in itself due to its very open economy. We perform a structural VAR analysis for each country separately. However, for better comparability of the results across countries, each of the VAR's contains the same global block. Because we apply our identification scheme only to the global block, the identified conflict shocks are also the same across countries.[2] Below, we describe in detail the data, estimation procedure and identification approach.

2.1 Data

In our main specification, the global block of each VAR includes quarterly data on the following six variables: (1) the log of the global GPR index of Caldara and Iacoviello (2022), (2) US short-term interest rates, (3) the log change in the West Texas Intermediate price of oil, (4) quarter-on-quarter US real GDP growth, (5) quarter-on-quarter US CPI inflation, and (6) standardized US consumer sentiments. For all variables available at a higher frequency, we first compute the quarterly average before applying any further transformations. We include the GPR index to quantify the extent and severity of geopolitical conflicts.[3] Oil price inflation is meant to capture fears of disruption and actual disruptions in oil supply.[4] Real GDP growth and inflation reflect the overall real and nominal global macroeconomic development. We include data on US consumer sentiment to capture the particularly pronounced shocks to consumer and business attitudes as-

[2]Quantitatively, there are minor differences because we impose block exogeneity via tight priors and because the estimation sample is slightly smaller for the UK.

[3]This index is based on a textual analysis of newspaper articles. The textual analysis captures articles that mention geopolitical risk. Caldara and Iacoviello (2022) define geopolitical risk as "the threat, realization, and escalation of adverse events associated with wars, terrorism, and any tensions among states and political actors that affect the peaceful course of international relations". We have the same definition in mind when speaking about geopolitical conflicts. The GPR index is based on the share of articles mentioning adverse geopolitical events relative to the total number of published articles. The historical GPR index, which we use in our analysis, starts in 1900 and is based on approximately 10,000 articles per month.

[4]In the robustness section, we show that replacing oil price inflation by the change in oil production does not change our results qualitatively, although the estimates are somewhat less precise. In our baseline model, we prefer to include oil price inflation because *unrealized* fears about supply disruptions likely played a nonnegligible role in geopolitical conflicts. Such fears affect the oil price while leaving production unchanged.

sociated with geopolitical conflicts. Data on US business sentiment do not have a sufficiently long history for our purposes. Finally, we include short-term interest rates to capture the monetary policy stance. We use the US three-month money market rate. To account for distortions due to interest rate lower bound and unconventional monetary policy, we make use of the Wu-Xia US shadow rates (Wu and Xia, 2016). More specifically, we add the percentage point change in the Wu-Xia shadow rate from 2008Q4–2021Q4 to the 2008Q3 value of the three-month money market rate. Thereafter, we again use the three-month money market rate because the Fed lifted its target rate off from the zero lower bound in March 2022.

Like the global block, the country-specific block of each VAR includes quarterly data on country-specific (1) quarter-on-quarter real GDP growth, (2) quarter-on-quarter CPI inflation, (3) standardized consumer sentiment, and (4) country-specific short-term interest rate.[5] Whenever possible, we use the three-month money market rate as our short-term interest rate. For Germany, France and Italy, the interest rate is the same since the launch of the Euro in 1999Q1. To account for distortions due to the interest rate lower bound and unconventional monetary policy, we take a similar approach as for the US. We add the percentage point change in the EU Wu-Xia shadow rate from 2008Q4–2022Q2 to the 2008Q3 value of the three-month money market rate. From 2022Q3, we again use the three-month money market rate because the ECB increased its policy rate by 75 basis points in September 2022. For the UK, the adjustment based on the Wu-Xia UK shadow rate applies to the period 2008Q4–2021Q4 because the Bank of England raised its official bank rate to 75 basis points in March 2022. For Switzerland, we use a 3-month interbank rate for the 1972Q1–1999Q2 period. To account for interest rate lower bound and unconventional monetary policy distortions in Switzerland, we use the Wu-Xia EU shadow rate for the 2008Q4–2022Q2. We use the EU shadow rate as a proxy because no Swiss-specific estimate is available.

[5] Instead of consumer sentiment, in principle, we could also use an uncertainty measure such as the VIX stock market volatility index. However, the VIX history is not long enough for all countries.

For all countries except the UK, we use a balanced dataset that covers the period 1973Q1–2022Q4. For the UK, we use the 1974Q1–2022Q4 period because UK consumer sentiment data are available only since 1974Q1.

2.2 Reduced form VAR and estimation approach

Our baseline VAR specification consists of two lags and takes the following form:

$$\underbrace{\begin{pmatrix} g_t \\ d_t \end{pmatrix}}_{Y_t} = \underbrace{\begin{pmatrix} \theta_{0,g} \\ \theta_{0,d} \end{pmatrix}}_{\Theta_0} + \underbrace{\begin{pmatrix} \theta_{1,gg} & 0 \\ \theta_{1,dg} & \theta_{1,dd} \end{pmatrix}}_{\Theta_1} \underbrace{\begin{pmatrix} g_{t-1} \\ d_{t-1} \end{pmatrix}}_{Y_{t-1}} + \underbrace{\begin{pmatrix} \theta_{2,gg} & 0 \\ \theta_{2,dg} & \theta_{2,dd} \end{pmatrix}}_{\Theta_2} \underbrace{\begin{pmatrix} g_{t-2} \\ d_{t-2} \end{pmatrix}}_{Y_{t-2}} + \underbrace{\begin{pmatrix} \varepsilon_{g,t} \\ \varepsilon_{d,t} \end{pmatrix}}_{\varepsilon_t}. \tag{1}$$

g_t is a vector of global variables, and d_t denotes the vector of country-specific variables. The θ's denote the set of parameters, and $\varepsilon_{g,t}$ and $\varepsilon_{d,t}$ are residuals. The global variables g_t are block-exogenous within the VAR, *i.e.,* the global variables have an effect on the country-specific variables, but not vice versa.

We estimate the VAR's using a Bayesian estimation approach. To impose block exogeneity, we use Minnesota priors. We set a very tight prior centered around zero on the parameters related to the block exogenous part. For all other parameters, the prior variance is set to a very high value because, in addition to the block-exogenous structure, we aim to impose as little prior information as possible. The VAR's are then estimated using the BEAR toolbox of Dieppe et al. (2016).

2.3 Identification strategy

To identify shocks from geopolitical conflicts similar to war in Ukraine, we combine sign restrictions in the spirit of Uhlig (2005) with narrative sign restrictions in the spirit of Antolín-Díaz and Rubio-Ramírez (2018).

As narrative sign restrictions, we impose that the conflict shock of interest has been positive in the first few periods of five major geopolitical conflicts that are associated with fears of disruption and actual disruptions in energy supply (see, *e.g.*, Kilian, 2008b, Hamilton, 2009): These are (i) the Yom Kippur War in 1973, (ii) the Middle East Conflicts in the 1980s, (iii) the Gulf War in the 1990s, (iv) the Iraq War in the early 2000s, and (v) the Ukraine War. In imposing the restrictions, we only focus on the first few periods of each conflict. When the rise in the GPR index is concentrated at the beginning of the conflict, as is the case for the Yom Kippur War in 1973 and the Middle East Conflicts in the 1980s, we restrict the shock to be positive at only one quarter. For the Gulf War in the 1990s, the Iraq War and the war in Ukraine, we restrict the shock to be positive for the first two quarters since the rise in GPR continues beyond the beginning of the conflict.

Two limitations related to our set of narrative restrictions are important for our analysis. First, the narrative restriction for the Yom Kippur War has no impact on UK's VAR because UK data starts in 1974Q1. Second, the timing of the narrative restrictions related to the Yom Kippur War restricts our choice of the lag length of the VAR. Because the data start in 1973Q1 (German and Italian consumer sentiment data are not available earlier), *i.e.* only 3 quarters before the first narrative restriction, we cannot use more than 3 lags in our VAR. Thus, we have decided to follow Caldara and Iacoviello (2022) and set the lag length to 2 in our main specification.

The narrative sign restrictions do not impose much structure on their own. Hence, we combine them with sign restriction in the spirit of Uhlig (2005). Table 1 shows the sign restrictions. For better comparability, we impose only sign restrictions on the global block variables, such that the identified shocks are similar across countries. We assume that conflict shocks from geopolitical conflicts similar to the war in Ukraine are a combination of a geopolitical risk shock and an oil supply shock. More specifically, we assume that the conflict shocks of interest (i) raise the GPR index, (ii) decrease US GDP growth, and (iii) increase oil price inflation.[6] The first

[6]The sign restrictions for the response of GDP growth help us to obtain tighter posterior intervals. The median responses, however, are similar if we use only sign restrictions on the response of the GPR index and oil price inflation.

two restrictions are imposed for the first four quarters, including the impact response. The sign restrictions on oil price inflation are only imposed on impact and the following quarter since oil price inflation is quite volatile.

	Global block variables				
Quarters	*GPR*	*dlog(GDP)*	*Infl.*	*Cons. sentiment*	*Oil price infl.*
0	+	-			+
1	+	-			+
2	+	-			
3	+	-			

Table 1: Sign restrictions

There are two seemingly natural alternative identification schemes: (i) identifying geopolitical conflict shocks as in Caldara and Iacoviello (2022) and Caldara et al. (2022) and (ii) identifying purely oil shocks. The reason why we decided against the Cholesky identification scheme used in Caldara and Iacoviello (2022) and Caldara et al. (2022) is that this scheme, put simply, identifies the economic impact of an average geopolitical conflict. However, we want to focus on geopolitical conflicts that are associated with fears of disruption or actual disruptions in energy supply because, in our view, these conflicts are more comparable with the war in Ukraine. This distinction matters. There are many geopolitical conflicts that are not associated with noticeable disruptions in energy supply, such as the Falkland War of 1982 between the UK and Argentina or the terrorist attack on the US in 2001. Caldara and Iacoviello (2022) even find that the average increase in the GPR index is associated with a decline rather than an increase in oil prices, which stands in contrast to the experience from major geopolitical conflicts involving oil-producing countries such as the Yom Kippur War in the early 1970s, the Middle East conflicts in the 1980s or the Gulf War in the 1990s.[7] When we also consider geopolitical conflicts that are not associ-

[7] When identifying conflict shocks with a Cholesky scheme as in Caldara and Iacoviello (2022) and Caldara et al. (2022), we also find that oil prices decrease in response to the shock.

ated with energy supply disruptions, we underestimate the energy channel. The energy channel is most likely an important channel. There is a large literature on the economic effects of oil shocks. Although the relative importance of oil shocks for macroeconomic fluctuations is still debated, there is quite a broad consensus that the role of oil shocks for macroeconomic developments is at the very least not negligible (see, *e.g.*, Hamilton, 1983, 1996, Barsky and Kilian, 2004, Kilian, 2008a, Hamilton, 2011, Caldara et al., 2019, Känzig, 2021).

Several contributions in the oil macroeconomy literature argue that the oil price channel is the primary channel through which geopolitical conflicts involving oil-producing countries have led to recessions in economies that are not directly involved (Hamilton, 1983, 1996, 2011). If this were the case, we could focus only on oil shocks when assessing the economic impact of geopolitical conflicts such as Russia's invasion of Ukraine. However, there are good reasons to believe that channels other than the oil price channel played an important role. For instance, Kilian and Vigfusson (2017) emphasize that although most postwar U.S. recessions were preceded by a spike in oil prices, there have also been many episodes of sharply rising oil prices that have not been accompanied by a noticeable change in economic activity. This observation casts doubt on the primary importance of oil price movements for economic activity. Furthermore, studies based on linear VARs typically find a relatively small role of oil shocks in the observed declines in economic activity that coincided with geopolitical conflicts (see, *e.g.*, Hooker, 1996, Kilian and Vigfusson, 2017, Caldara et al., 2019, Känzig, 2021). Only when assuming a nonlinear impact of oil price changes on the economy are the data consistent with a key role for the oil price channel (Hamilton, 1996, 2003, 2011, Kilian and Vigfusson, 2017). However, the nonlinearities used to show that the oil price channel is of primary importance have been criticized for lacking an empirically founded economic theory (Barsky and Kilian, 2004, Kilian and Vigfusson, 2017). Given the current state of research, we conclude that the oil price movements had been important in transmitting the adverse effect of geopolitical conflicts to other countries, but other channels have most likely been relevant too. Hence, we have decided to take a broader view and focus not only on oil shocks in our assessment of the economic impact of Russia's invasion of Ukraine. Our results provide evidence in favor of this choice. If we exclude the GPR index, our results change significantly. If only the oil price channel were important, excluding the GPR index would not have such an effect.

2.4 Technical implementation

To compute the posterior distribution, we make use of a combination of the BEAR Toolbox (Dieppe et al., 2016), which has readily implemented the Minnesota prior scheme for block-exogenous VAR, with the empirical macro models toolbox of Canova and Ferroni (2021). The latter uses an extended version of the algorithm proposed by Rubio-Ramirez et al. (2010) to implement the sign and narrative sign restrictions.

3 The economic impact of Russia's invasion of Ukraine

We find that Russia's invasion of Ukraine exerts a noticeable drag on the economy of European countries, weighing on economic activity and pushing prices upward. To illustrate this assertion, we analyze the impulse response function to a geopolitical conflict shock and conduct counterfactual exercises that show the hypothetical economic development if Russia had not attacked or threatened Ukraine. Overall, our results are in the lower range of the estimates found in the literature. For the sake of exposition, we focus on Germany. Detailed results for the other countries can be found in Appendix Section 6..

3.1 The conflict shock series

To assure that the impulse response analysis has a solid foundation, Figure 2 shows the identified conflict shock series. This series is similar for all countries because the identification scheme applies only to the global part of the VAR, which is block-exogenous with respect to the country-specific part. As imposed, the conflict shock series displays significant spikes at the onset of the Yom Kippur War, the Middle East Conflicts, the Gulf War, the Iraq War and the Ukraine War.

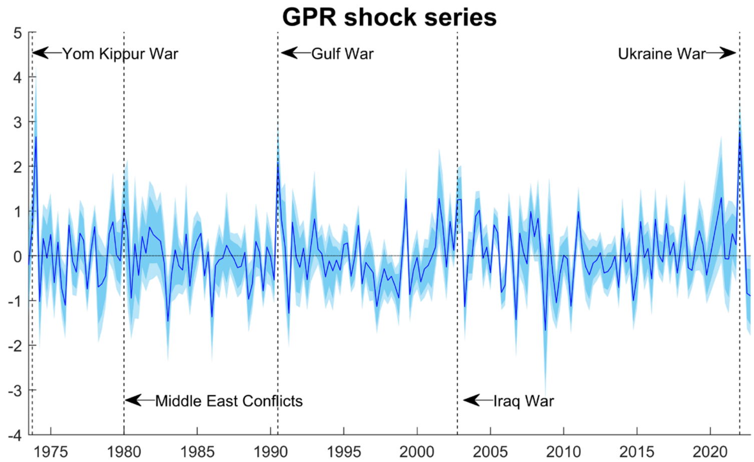

Figure 2: Conflict shock series

3.2 Impulse response

Figure 3 shows the impulse response function of a geopolitical conflict shock. The blue line corresponds to the posterior median impulse response of Germany. The red lines show the poster median impulse response of the other countries. The shaded areas in dark and light blue show the interquartile range and 80% highest probability density set for Germany. To approximately reflect the impact of Russia's invasion of Ukraine, we scale the impulse response function. We scale it to imply an increase in the geopolitical risk index of the same as in 2022Q1, when Russia started its invasion of Ukraine.

A geopolitical conflict shock of this size weighs significantly on Germany's domestic and foreign demand. The posterior median US GDP declines by 1.8% on impact and is approximately 5% lower than that without the conflict shock after 2 years. The sharp rise in oil prices and inflation in general and the deterioration in consumer sentiment contribute to the significant decline in US GDP. Median posterior oil prices increase by more than 50% on impact and stay elevated at this level. The posterior median US CPI inflation rises by 3.5 percentage points annualized on impact. Although the rise in inflation is rather temporary and inflation is only 0.4 percentage points higher one year after the conflict shock hit the economy, consumer prices remain elevated and do not return to their previous level. The response of the US short-term interest rate is not significant. Intuitively, this result makes sense because the Fed faces a trade-off between price and real economic stabilization, and therefore, no strong monetary policy response is to be expected. The results for Germany are similar. After 2 years, posterior median German GDP is 3.2% lower than without the conflict shock. The long-run effect is even larger. The negative effect on German GDP is driven in part by lower foreign demand, but higher German CPI inflation and the deterioration in German consumer sentiments are also weighing on domestic demand. Poster median German CPI inflation increases by 2 percentage points on impact. While the rise is less strong than in the US, it proves to be more persistent. After 1 year, German CPI inflation is still 0.6 percentage points higher than without the conflict shock. The rise in German CPI inflation is also due to higher imported inflation from abroad, although the response of the exchange rate is insignificant. Consumer sentiment drops by 1 standard deviation. For the US, the response of the short-term interest rate is not significant.

In general, the results from the other countries' VARs are on the same order of magnitude. The impulse responses of the global block for France, Italy and Switzerland display a tiny difference from that of Germany. This difference is due to our implementation of block-exogeneity via tight priors, which delivers numerically some smaller differences. The responses of the global block for UK's VAR show a stronger difference because UK's dataset is not long enough to include the Yom Kippur War. Hence, the comparison with the results of the UK should be treated cautiously. The largest differences in the country-specific block concern inflation. The rise in posterior median inflation in Italy and the UK is much more persistent than that in Germany. With regard to GDP, the UK's impulse response is considerably more negative, while the GDP of France and Italy seems to be slightly less affected by a conflict shock. For the UK, this is likely due to the omission of the Yom Kippur War, which leads to an approximately twice as large response of posterior median US GDP as that of the other countries. The weaker GDP response of France and Italy may be due to the lower openness of their economies. The export-to-GDP ratio of these two countries is markedly lower than that of Germany and Switzerland, suggesting that their economies are less impacted by a global downturn. The short-term interest rate response is also somewhat different across countries. However, when considering the country-specific credible intervals, the response is insignificant in all countries.

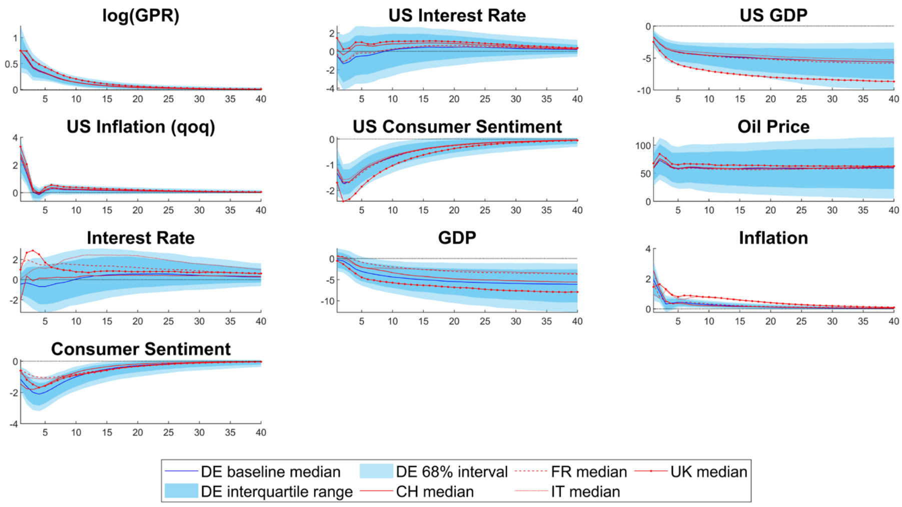

Figure 3: Impulse responses to a geopolitical conflict shock

3.3 Counterfactual: What if Russia did not attack Ukraine?

To assess the economic impact of Russia's war on Ukraine, we construct a counterfactual of the economic development in which Russia did not attack or threaten Ukraine. To construct such a counterfactual, we estimate our VAR's, identify the conflict shocks, set them to zero for 2022Q1–2022Q2, and simulate our VAR's forward using the counterfactual conflict shock series. Without Russia's war on Ukraine, inflation in 2022 would have been noticeably lower in the countries considered. In contrast, the impact on real economic activity has not yet been significant. Our analysis suggests that the real economic effects will build up over time and that the war will have a significant negative impact in the years ahead. Figure 4 shows the results of the counterfactual exercise from Germany's VAR. The black lines show the realized paths, and the blue lines show the posterior median counterfactual paths of the variables. The blue shaded areas show the posterior interquartile and 68% credible intervals. Without Russia's war on Ukraine, the US economy would have been stronger. The posterior median counterfactual US GDP is 1.3% higher by 2022Q4 than realized. This negative effect is, at last in part, due to lower oil prices and inflation and more optimistic consumer sentiment. Posterior median counterfactual oil prices are approximately 20% and the US CPI level 0.4% lower by 2022Q4. The impact on German real activity is somewhat smaller, at least within the short term. The posterior median counterfactual GDP is 0.7% higher than that realized by 2022Q4. However, as shown in the previous subsection, it takes time until the negative effects of a conflict on real economic activity fully unfold. The negative impact of a conflict shock two years after impact is approximately twice as large as that one year after impact. Hence, with new data, the difference between actual and counterfactual GDP should become significant. Higher German GDP would not only be the result of higher foreign demand but would also stem from lower German CPI inflation and better consumer sentiment. The posterior median counterfactual German CPI is 0.4% lower than its realized value by 2024Q4. As is the case for GDP, the difference between counterfactual and actual CPI should increase over time, although to a lesser extent.[8]

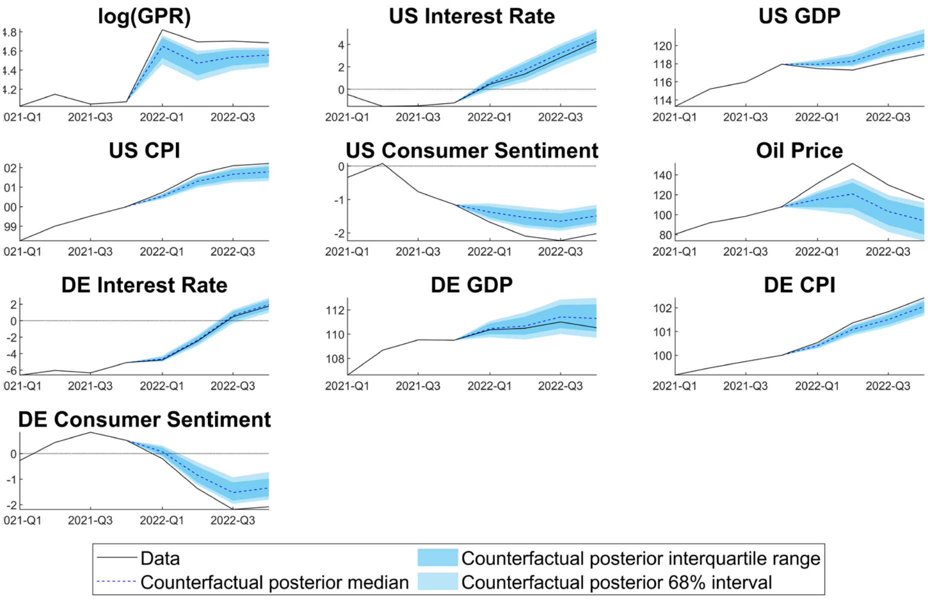

Figure 4: Counterfactual if Russia had not attacked Ukraine

The results for the other countries are similar, as shown in Table 2. The posterior median counterfactual CPI level of all countries is between 0.2% (UK and Italy) to 0.4% (Germany and Switzerland) lower and the GDP level between 0.1% (France) to 0.7% (UK and Germany) higher by 2022Q4. These estimates are in the lower range of the literature on the impact of Russia's invasion of Ukraine.

[8]Note that in our counterfactual exercise, the geopolitical risk index does not remain exactly at the same level as in 2021Q4. The reasons are twofold. First, the geopolitical risk index was below average in 2021Q4. In the absence of shocks, the index converges to its mean of almost 4.4 in logarithms. Second, the geopolitical risk index is also driven by other shocks. For instance, shocks to economic fundamentals may also affect geopolitical risk. This seems reasonable. A well-known strategy of political leaders when facing poor domestic economic development is to distract attention by foreign policy saber rattling.

Countries	*CPI*	*GDP*
DE	-0.36% [-0.6%,-0.15%]	0.7% [-0.26%,1.75%]
FR	-0.28% [-0.53%,-0.07%]	0.08% [-0.4%,0.62%]
IT	-0.17% [-0.4%,-0.01%]	0.33% [-0.43%,1.2%]
UK	-0.16% [-0.35%,0%]	0.7% [-0.09%,1.62%]
CH	-0.41% [-0.63%,-0.21%]	0.33% [-0.55%,1.35%]

Table 2: Median percentage difference to no-war counterfactual by 2022-Q4. Interquartile interval in brackets.

4 Robustness

Our results are robust to a number of alternative specifications. These include (i) using oil production growth instead of oil price inflation, (ii) different assumptions with regard to the sign restrictions, and (iii) different lag length choices of the VAR. With regard to (i), we use the world crude oil production series provided by the US Energy Information Administration. Since data on oil production growth start only in 1973Q2, we drop the first observation of the dataset used in the baseline specification. Regarding (ii), we consider two alternative assumptions. First, we consider how the results change if we drop the sign restriction on GDP. Second, we reduce the number of horizons for which we restrict the sign of the response of the GPR index and GDP to a conflict shock from four to two, *i.e.,* we restrict only the response on impact and the first quarter after the conflict shock has hit the economy. With regard to (iii), we consider a version of our VAR, in which we use 4 instead of 2 lags. Because the dataset for Germany and Italy is not long enough to cover the Yom Kippur War when using more than 3 lags in the VAR, we drop the narrative restrictions of this geopolitical event for all countries when assessing the impact of choosing 4 instead of 2 lags. The results of the alternative specifications for Germany are shown in Figures 5-7. The blue lines show the posterior median impulse responses of the baseline specification, the blue shaded areas show the posterior interquartile and 68% credible intervals, and the other lines show the median impulse responses of the alternative specifications. The results for the other countries can be found in Appendix Section 6.2.

As seen in Figures 5-7, the median impulse responses across all specifications are mostly within the posterior interquartile interval of the baseline model. The only exception worth mentioning is the response of US GDP, which becomes smaller when we do not impose sign restrictions on it. In this sense, the sign restrictions on GDP are informative. However, qualitatively, the picture remains the same as in our baseline specification. The same applies to the robustness checks for the other countries (see Appendix Section 6.2).

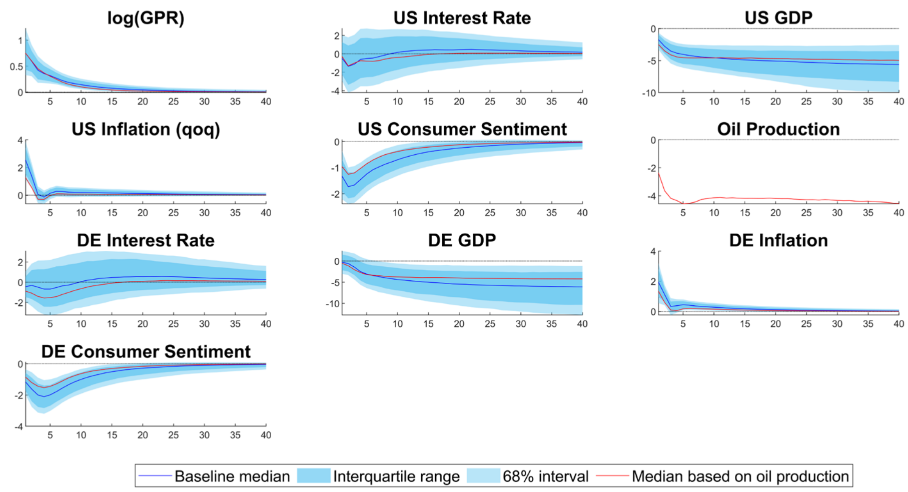

Figure 5: Robustness check: Oil production

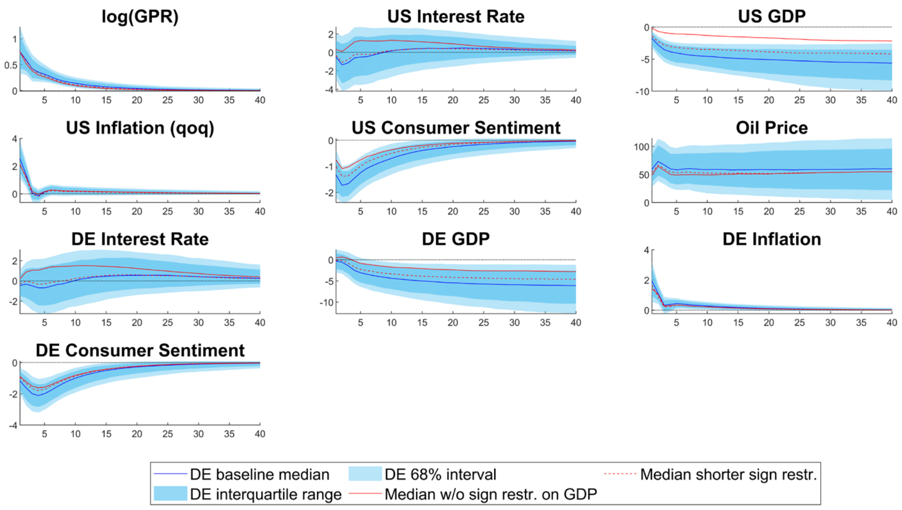

Figure 6: Robustness check: Sign restriction

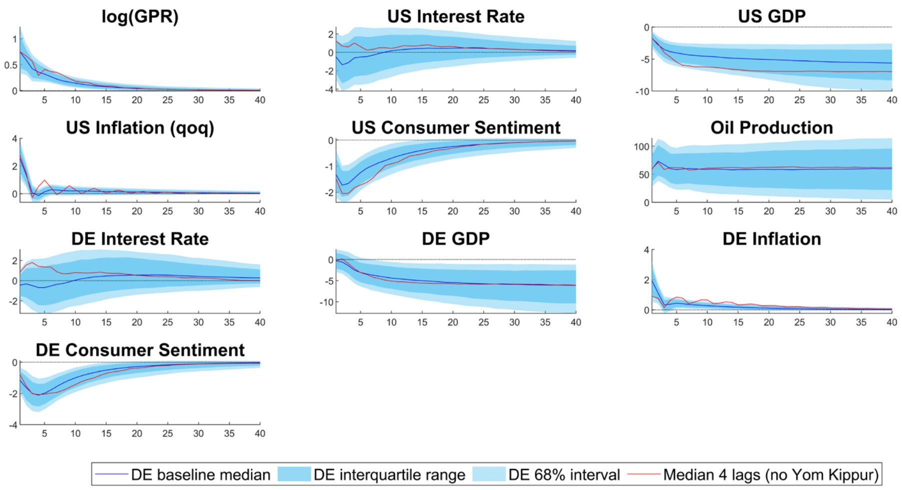

Figure 7: Robustness check: Sign restriction

5 Conclusion

We examine the impact of Russia's invasion of Ukraine on the economies of Germany, France, Italy, the UK, and Switzerland. Our structural VAR analysis suggests that the invasion has noticeably pushed up inflation and weighed on the real economy. The adverse effects are likely to unfold over the coming years and become much stronger, particularly with regard to the impact on real economic activity. Counterfactual exercises suggest that if Russia had not attacked or threatened Ukraine, the real GDP of the countries considered would have been 0.1 to 0.7% higher and consumer prices by 0.2 to 0.4% lower by 2022Q4. In one to two years, this effect is likely to be approximately twice as large. We are not the first to examine the impact of Russia's invasion of Ukraine on the economy of European countries (see, *e.g.*, Bachmann et al., 2022, Baqaee et al., 2022, Krebs, 2022, Lan et al., 2022). Our main contribution to the literature is our focus on past geopolitical conflicts that are similar to Russia's invasion of Ukraine. Most papers in the literature abstract from the experience we have from past geopolitical conflicts. An exception in this regard is Caldara et al. (2022), who also conduct a VAR analysis using information on past geopolitical events. While they treat all past geopolitical conflicts as similarly informative, we are more rigorous and focus only on geopolitical conflicts that are associated with fears or actual disruptions in energy supply – a key feature of the conflict between Russia and Ukraine.

Our study is subject to important limitations, which tend to suggest that our estimates represent a lower bound. First, we likely underestimate the energy channel of the current conflict because we focus on oil. While oil played a major role in past geopolitical conflicts, gas plays a more important role in the conflict between Russia and Ukraine. Indeed, gas prices in Europe have risen much more than global oil prices. Second, we do not explicitly take food prices into account and thus probably underestimate the impact of the war on inflation arising from this channel. Ukraine and Russia are major grain exporters and grain prices, and thus food prices overall, have risen significantly since the outbreak of war. In the past geopolitical conflicts we focus on, food price inflation tends to play a less important role. Third, the current conflict is geographically much closer to the countries we study than the past geopolitical conflicts. Accordingly, these countries have been affected more strongly by refugees, additional military spending, and the like than in the past.

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6 Appendix

6.1 Counterfactuals

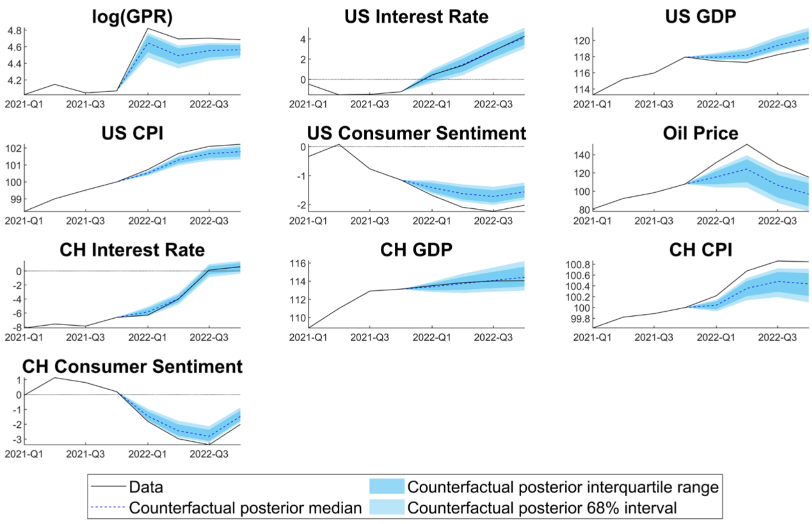


Figure 8: Switzerland: Counterfactual if Russia had not attacked Ukraine

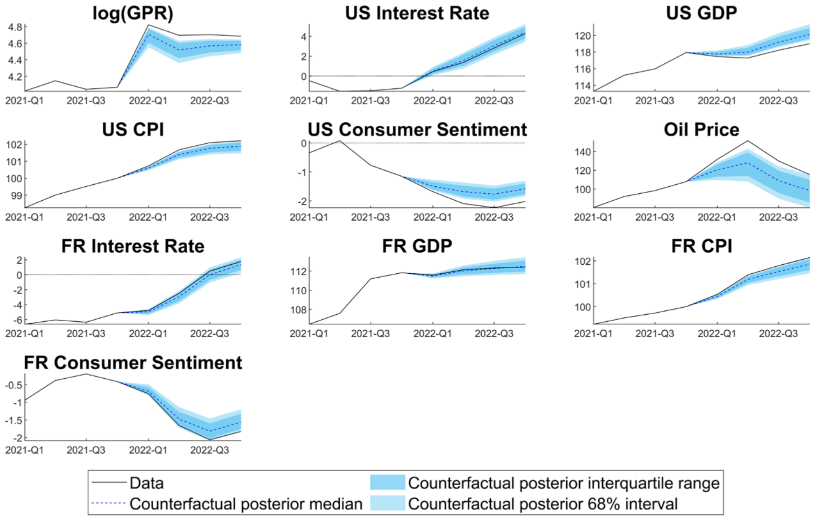


Figure 9: France: Counterfactual if Russia had not attacked Ukraine

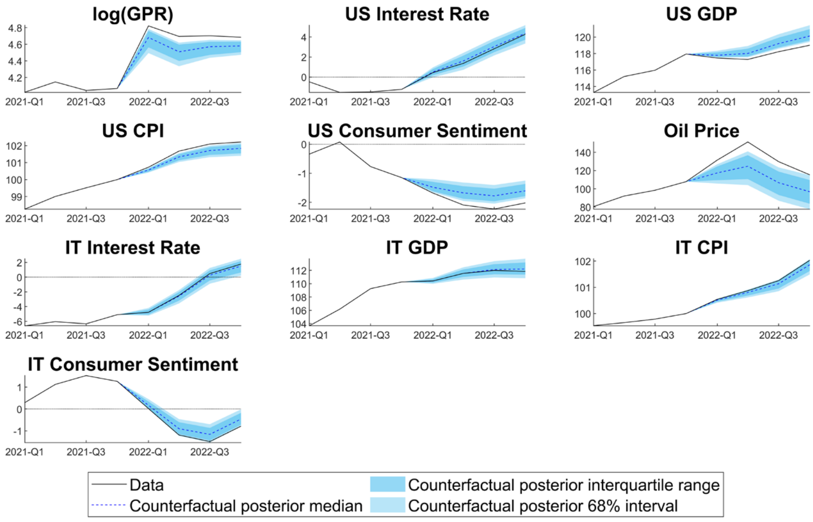


Figure 10: France: Counterfactual if Russia had not attacked Ukraine

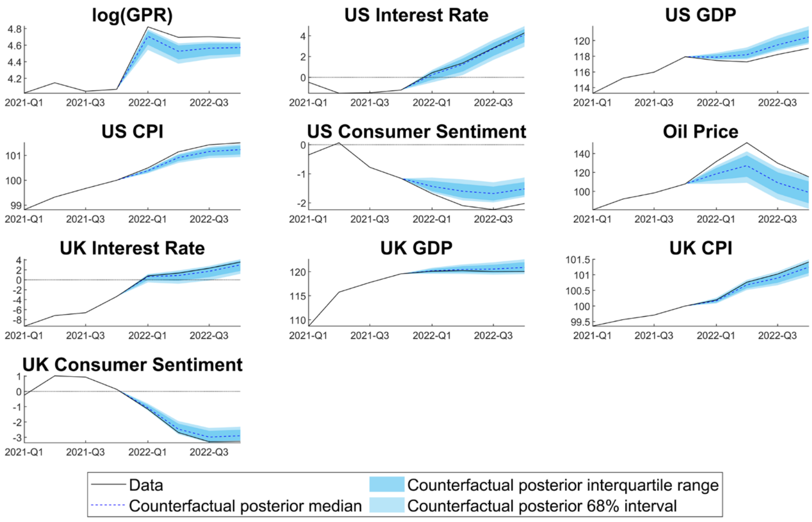


Figure 11: France: Counterfactual if Russia had not attacked Ukraine

6.2 Robustness checks

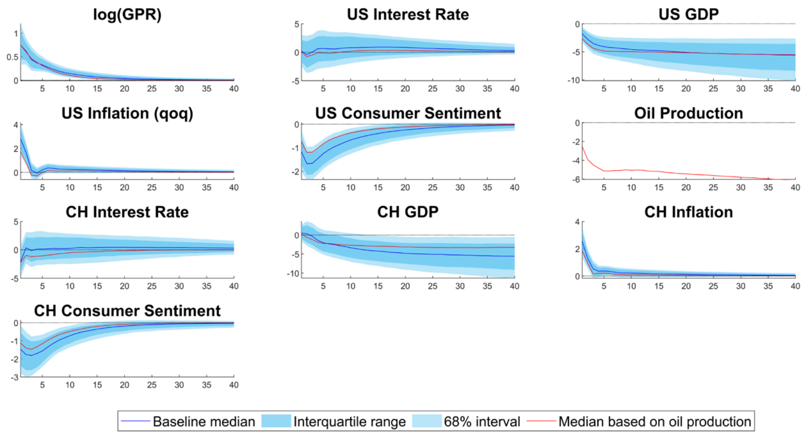


Figure 12: Robustness check: Oil production

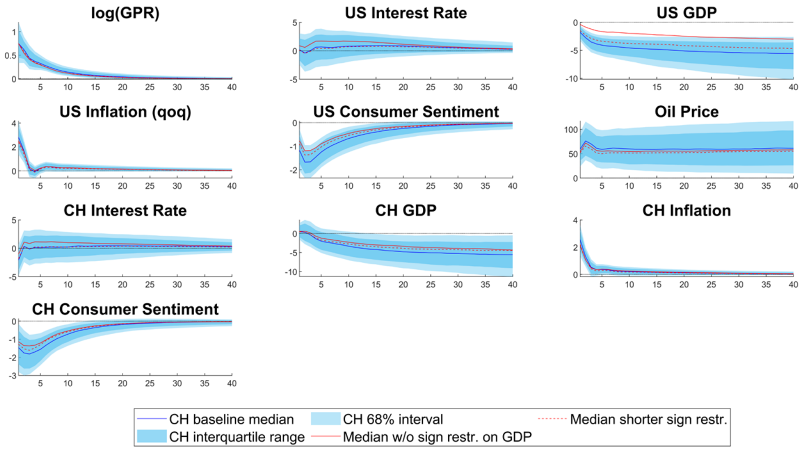
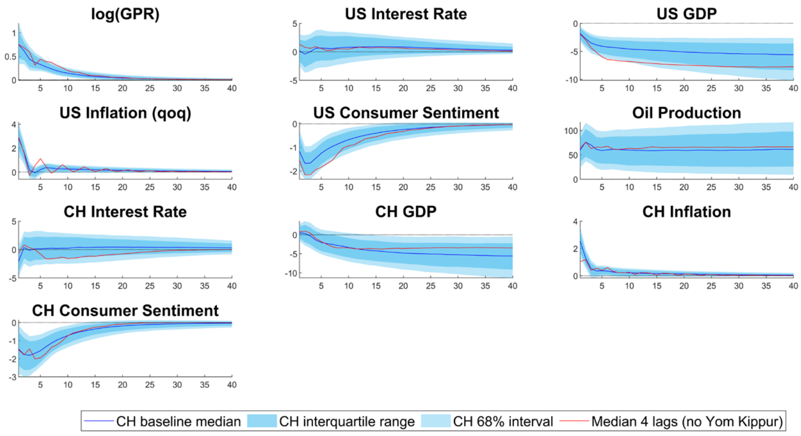


Figure 13: Robustness check: Sign restriction



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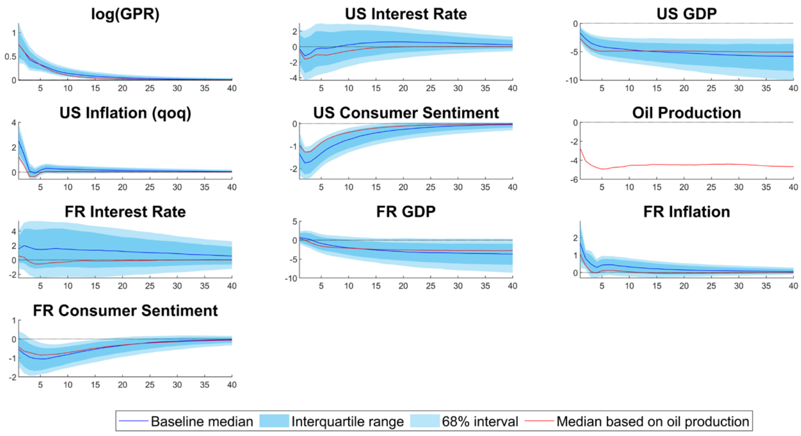


Figure 15: Robustness check: Oil production

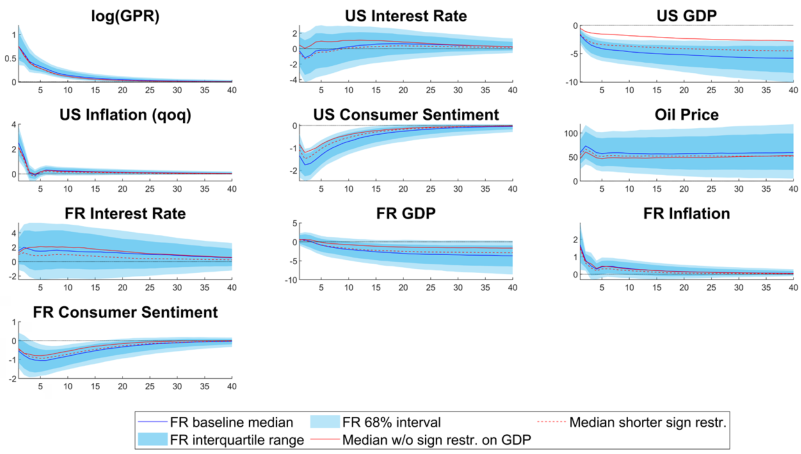
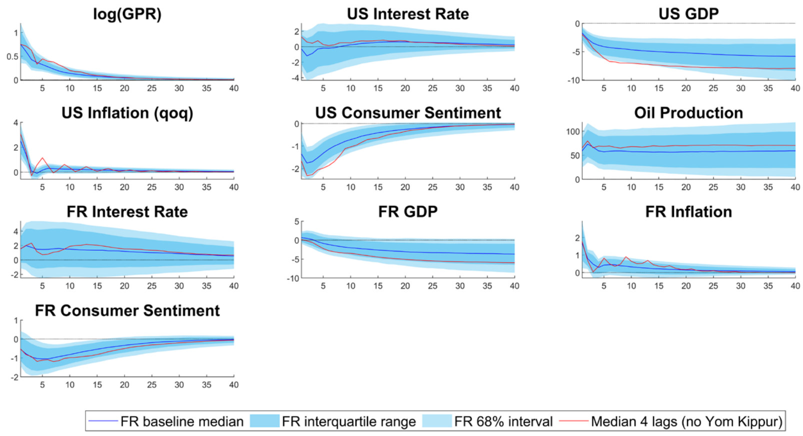


Figure 16: Robustness check: Sign restriction



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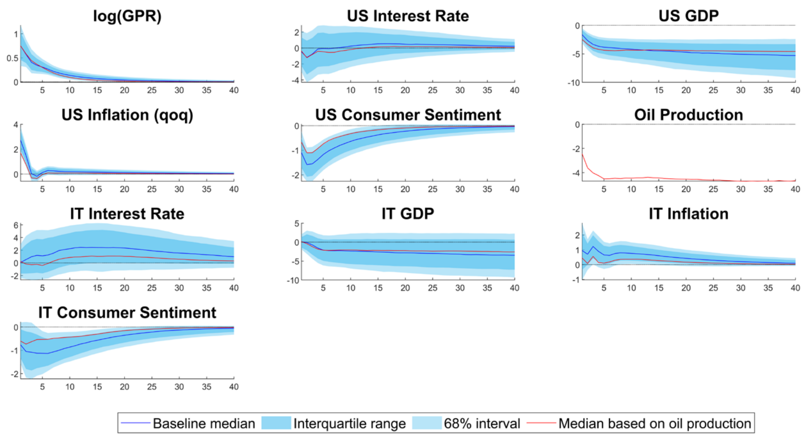


Figure 18: Robustness check: Oil production

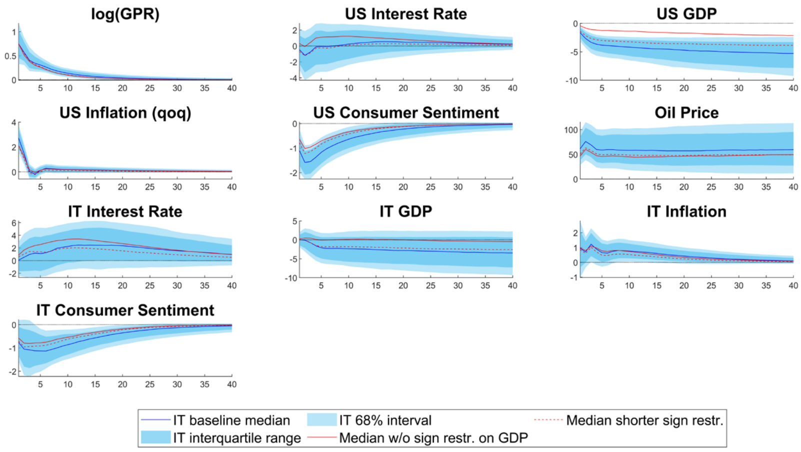
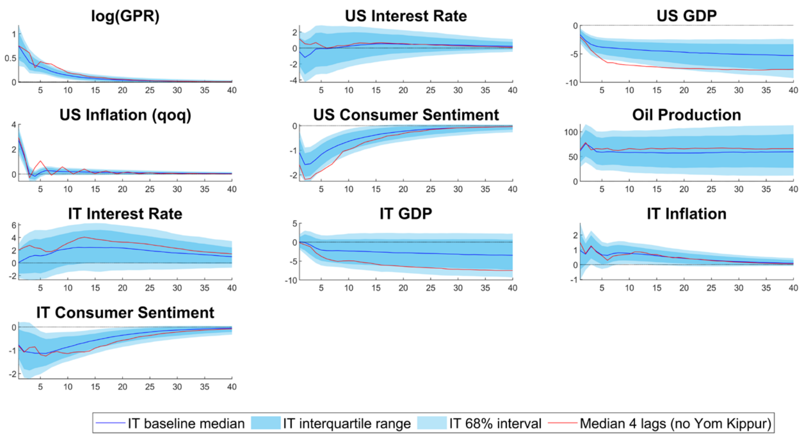


Figure 19: Robustness check: Sign restriction



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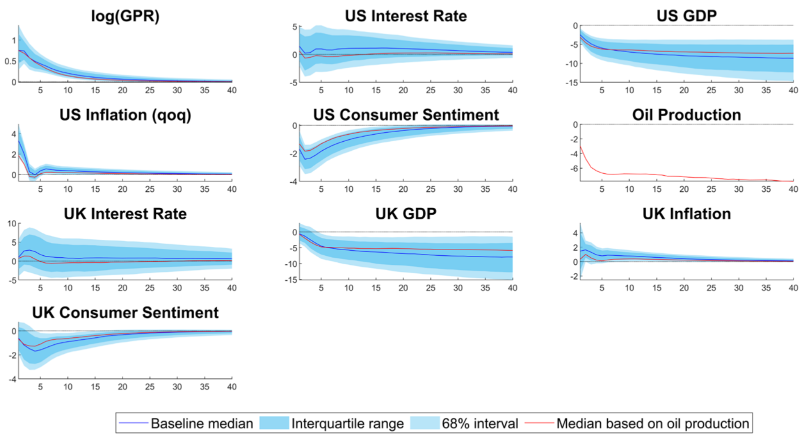
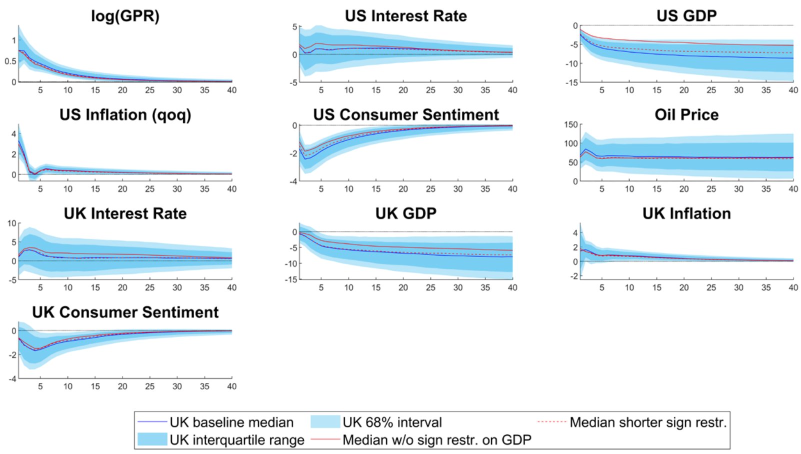


Figure 21: Robustness check: Oil production



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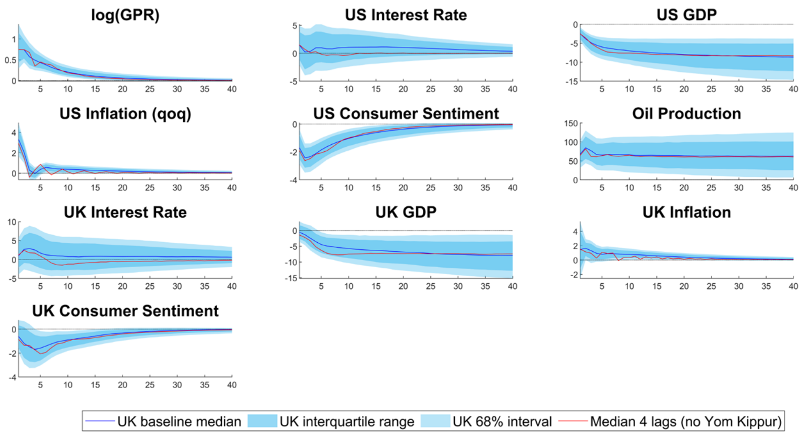

Figure 23: Robustness check: Sign restriction

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