Analysis

# Impact of geopolitical surprises on euro area inflation varies case by case

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Monetary policy decision-making now includes consideration of geopolitics as a factor that can create volatility in inflation rates. However, geopolitical surprises and their consequences are not particularly well understood yet in economics. Our empirical analysis focuses on two events that have substantially increased geopolitical risks: Russia's invasion of Ukraine and the Israel-Hamas conflict. We estimate that Russia's invasion of Ukraine added more than 2 percentage points to euro area inflation and reduced the euro area's gross domestic product (GDP) in 2022 by as much as 1%. By contrast, our analysis indicates that the outbreak of the Israel-Hamas conflict actually reduced euro area inflation. Our findings show that a rise in geopolitical uncertainty has a contractionary effect on euro area output, but the impact on inflation varies on a case-by-case basis.




The geopolitical environment in the euro area has become increasingly less stable in recent years. There had already been signs that instability was increasing, but for Europe the geopolitical situation escalated after Russia's invasion of Ukraine began in February 2022. More recently, further geopolitical risks were created with Hamas's terrorist attack on Israel and Israel's powerful counterattack on the Gaza Strip in October 2023. These geopolitical events, or international crises, have strengthened the narrative that geopolitical risks have increased. At the same time, these events have caused supply and demand disruptions in the global economy and fuelled uncertainty, which ultimately affects households and businesses.

Monetary policy decision-making now includes consideration of geopolitics as a factor that can create volatility in inflation rates. In the words of European Central Bank (ECB) Executive Board member Isabel Schnabel, "Geopolitical shocks are a key risk that we need to watch, and this poses upside risks to the inflation outlook" (interview with Nikkei, 13 May 2024). However, geopolitical shocks and their consequences are not particularly well understood yet in economics. Geopolitical events (or 'geopolitical risks') are often considered to affect the macroeconomy mainly in the form of supply shocks, driving up inflation, as noted by Schnabel in her statement. However, the economic literature suggests that it may not be that simple.

Caldara and Iacoviello (2022), in particular, emphasise the importance of contractionary (i.e. deflationary) demand effects associated with events that increase geopolitical uncertainty. Thus, geopolitical shocks (i.e. surprises) can, at least in theory, manifest themselves equally as inflationary shocks that reduce supply and deflationary shocks that depress demand. This is a key starting point for the study presented in this article.

Below we examine the effects of geopolitical events on the euro area economy using an

econometric model. In addition to the geopolitical risk (GPR) index[1] constructed by Caldara and Iacoviello (2022), we incorporate into our model the euro area Harmonised Index of Consumer Prices (HICP), the euro area Industrial Production index (IP) and oil futures prices[2]. However, in order to gauge not only the effects of geopolitical events on industrial production but also their overall macroeconomic effects, we need data on GDP. We therefore include in our model, as the fifth variable, unobserved monthly real GDP, and we estimate the unobserved values using quarterly observed values as well as correlations between GDP and the model's other variables (incl. the IP index).[3]

We employ an econometric model to identify macroeconomic shocks and to construct counterfactuals. Counterfactuals give a natural response to the question of how the euro area macroeconomy would have performed in the absence of the geopolitical events under review. In the following sections, we will take a closer look at what we mean by macroeconomic shocks and how they relate to geopolitical events.

The contribution of our analysis is twofold. First, we seek to obtain a better understanding of the significance of geopolitical shocks and their transmission mechanisms by focusing particularly on the immediate macroeconomic effects of Russia's invasion of Ukraine and the Israel-Hamas conflict on the euro area. Second, our analysis employs a methodologically innovative model which appears to be particularly well suited to non-normal characteristics (characteristics deviating from normally distributed ones) in our data.

Our results confirm that geopolitical events can be transmitted to the economy as described by economic theory, namely both as demand (deflationary) shocks and supply (inflationary) shocks. In order to better understand the relative importance of the demand and supply channels, the economic consequences of geopolitical events should always be examined on a case-by-case basis.

According to our findings, Russia's invasion of Ukraine in 2022 was transmitted to the euro area macroeconomy primarily as a supply shock that fuelled the accelerating inflation. However, our findings also suggest that positive demand factors unrelated to geopolitics masked most of the substantial negative effects on euro area production resulting from the invasion. The outbreak of the Israel-Hamas war in October 2023 and the increase in geopolitical uncertainty, in turn, were transmitted to the euro area economy as a demand shock. Although its effect on inflation was small, it weakened production surprisingly much.

## Transmission mechanisms of geopolitical shocks

Geopolitical shocks have often been interpreted as political surprises that serve as catalysts for

supply shocks. Thus, geopolitical shifts give rise to disruptions and chain reactions in the economy, which are expected to reduce the supply of certain commodities, such as raw materials, and to push up their market prices. However, geopolitical shocks can also be understood in a broader sense as shocks which increase uncertainty about future economic growth, raise the household savings rate and postpone firms' investment decisions (see e.g. Bernanke, 1983). Therefore, a shock that increases uncertainty has, by nature, a contractionary effect on demand (i.e. it is deflationary), in contrast to the (inflationary) shock described above with a contractionary effect on supply.

The macroeconomic implications of geopolitical shocks may also be amplified by a characteristic feature of today's economy, namely closely interconnected supply chain networks. This may make the economy more sensitive to geopolitical surprises. When a single link in the chain – an individual company or operating site – is affected by a shock arising from geopolitics, this can be reflected in the entire supply chain. Such supply chain fragilities and their network effects have been described formally by, for example, Acemoglu and Tahbaz-Salehi (2024). Recently, and particularly since the COVID-19 pandemic, companies have increasingly paid attention to their supply chains and also taken steps to increase their resilience to geopolitical shocks.

Recent years have also seen an increase in the number of empirical studies focusing on the macroeconomic consequences of geopolitical shocks. The most important studies include that by Caldara and Iacoviello (2022) referred to above, with its GPR index that we use in the analysis presented in this article. In the study, Caldara and Iacoviello find that geopolitical shocks (as defined by them) induce, above all, a decline in investment, employment, foreign trade and share prices in the United States. This is consistent with the deflationary interpretation outlined above.

Brigone et al. (2024) build on the GPR index of Caldara and Iacoviello and construct their own measure of GPR shocks. The authors find that GPR shocks have non-linear macroeconomic effects, the relative significance of which may depend on the magnitude of the shock. They, too, stress the importance of the deflationary channel of transmission and note that heightened geopolitical risk manifests itself as an uncertainty shock that prompts precautionary savings behaviour and defers investment. Therefore, the deflationary effect of shocks also occurs slowly. However, Brigone et al. (2024) also emphasise that identifying the transmission mechanisms of geopolitical shocks remains challenging due to their diverse nature, which means that different events are also transmitted to the macroeconomy in very different ways. As already mentioned, this is one of the most relevant starting points for the study presented in this article.

As for other literature, Wang et al. (2024) find that geopolitical uncertainty depresses investment especially in firms with greater market power or a higher degree of investment irreversibility, whereas for labour-intensive firms the investment effects are considerably smaller. It is therefore

possible that geopolitical shocks have a very different impact on industrial production than on, for example, the services sector. Consequently, examining the IP index alone is not necessarily enough for understanding the effects of geopolitical shocks on production.

## Model description

Our model builds on a standard structural vector autoregressive model.[4] Hence, each observation in a time series is assumed to consist of a part that can be predicted at each point in time and which depends on past observations, and a part that cannot be predicted, or a surprise, resulting from different shocks. Each shock can, however, affect the surprises relating to each variable, which can complicate to a greater or lesser extent the identification of shocks based on the surprises observed. For example, a positive demand shock will, in principle, increase both prices and production, whereas the impact of a supply shock on production will be in the opposite direction from its impact on prices.

The identification of macroeconomic shocks with vector autoregressive models has traditionally been based on different assumptions regarding their effects on different variables. However, it is often difficult to devise indisputable assumptions, and the use of assumptions that are disputable may call the results of the entire analysis into question. In addition, if we make the assumption that a geopolitical uncertainty shock has a negative effect on production, the results of our model cannot tell us whether the effect is actually negative or not. For this reason, we make use of some of the recent methodological developments in the literature allowing for the identification of shocks only by using the properties of the data, without the need for making additional assumptions about the effects of the shocks.[5]

In an ideal case, however, we would make use of all the available information for the identification of shocks, as only this would ensure that the results of our analysis are also based on all the available information and not just on the sets of information that happen to be technically most easy to use. For this reason, we use, for the identification of shocks, both statistical methods (data properties) and some relatively indisputable assumptions (zero and sign restrictions) concerning the effects of shocks.

In practice, this means that we assume the first shock of the model to be a (negative) supply shock with an immediate positive impact on prices and a negative impact on industrial production and GDP. The second shock of the model, in turn, is assumed to be a demand shock with an immediate effect in the same direction on prices as well as on industrial production and GDP. We further assume that only a geopolitical uncertainty shock (the fourth shock in the model) has an immediate effect on the GPR index. In addition, we assume that the fifth shock in the model is a

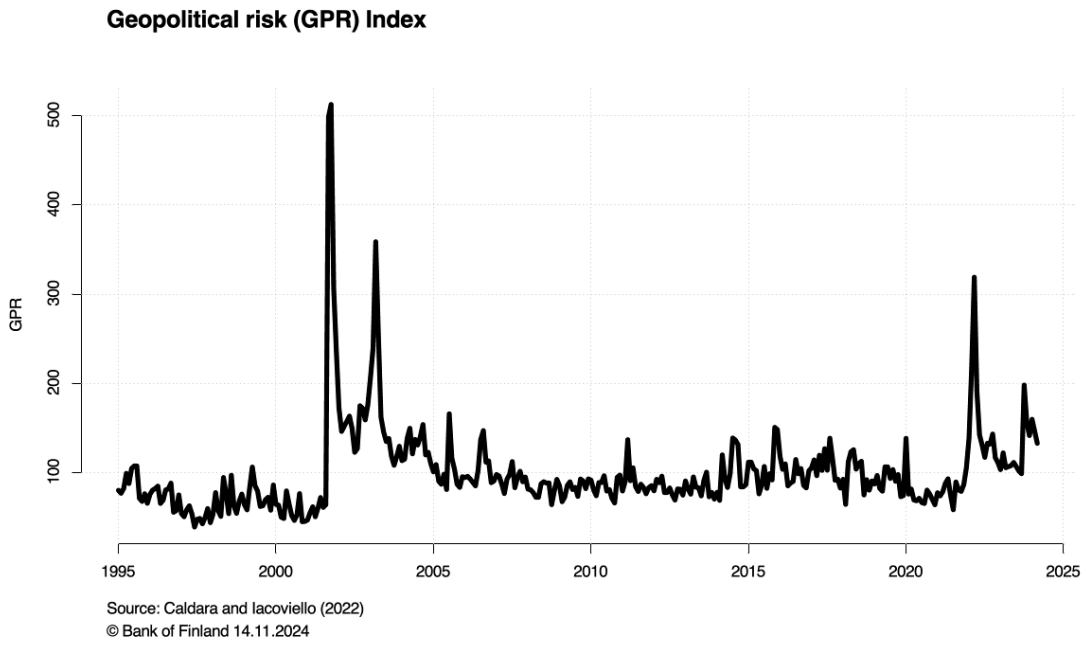
(negative) oil supply shock[6] with an immediate positive impact on oil futures prices.

We make no assumptions regarding the third shock in the model. This means that, unlike the other shocks in the model, we can give no interpretation of this shock before examining the results. However, the results presented later in the article show that this shock mainly influences prices and industrial production. Namely, it has an immediate, significant and long-lasting impact on prices and an effect in the same direction on the volume of industrial production. This would suggest that the shock is associated with demand specifically related to industrial production and would explain some of the latter's excess volatility in comparison with GDP. Thus, this shock can be labelled as an industrial production specific demand shock ('IP demand shock').[7]

## GPR index and transmission of shocks to inflation and rest of the economy

Chart 1 below illustrates the GPR index constructed by Caldara and Iacoviello (2022). We can see that the newspaper-based GPR index has varied significantly over time and that key geopolitical events, such as the 9/11 terrorist attack in 2001, the Iraq War in 2003, Russia's illegal invasion of Ukraine in February 2022, and the attack on Israel by Hamas and subsequent outbreak of the Israel-Hamas conflict in October 2023 are clearly identifiable. Nevertheless these geopolitical events are all different from each other, and so there is reason to assume that their macroeconomic consequences differ not only in magnitude but in other respects too. For example, Russia's invasion of Ukraine is known to have caused significant disruption to supply chains, but there was no such effect associated with the 9/11 events, though this caused a stronger spike in the GPR index. Already at this point we can present an educated hypothesis that there is no single identifiable homogeneous geopolitical shock that would allow us, by studying its effects, to form plausible generalisations about the consequences of geopolitical surprises for prices and production.

Chart 1.




However, our model does help to identify geopolitical uncertainty shocks that we can interpret as representing *one* key transmission channel through which geopolitical surprises affect macroeconomic variables. Chart 2 illustrates the estimated effects of a geopolitical uncertainty shock on euro area prices, GDP[8], the GPR index and the price of oil in the 36 months following the shock. The shaded areas in the chart indicate the uncertainty in estimating the effects. The dark, narrower band indicates the effect at a 50% probability, and the wider, lighter area at a 90% probability.[9]

As Chart 2 shows, a geopolitical uncertainty shock that increases the GPR index by some 100 points (e.g. the Hamas attack on Israel and the subsequent outbreak of the Israel-Hamas conflict; see Chart 1) reduces real GDP in the euro area by approximately 0.2%, but GDP returns to the pre-shock level within three years. On the other hand, geopolitical uncertainty shocks do not appear to have a significant effect on inflation (HICP), even though the contractionary demand effect of the shock seems to reduce the price of oil within three years by as much as 5 dollars per barrel.

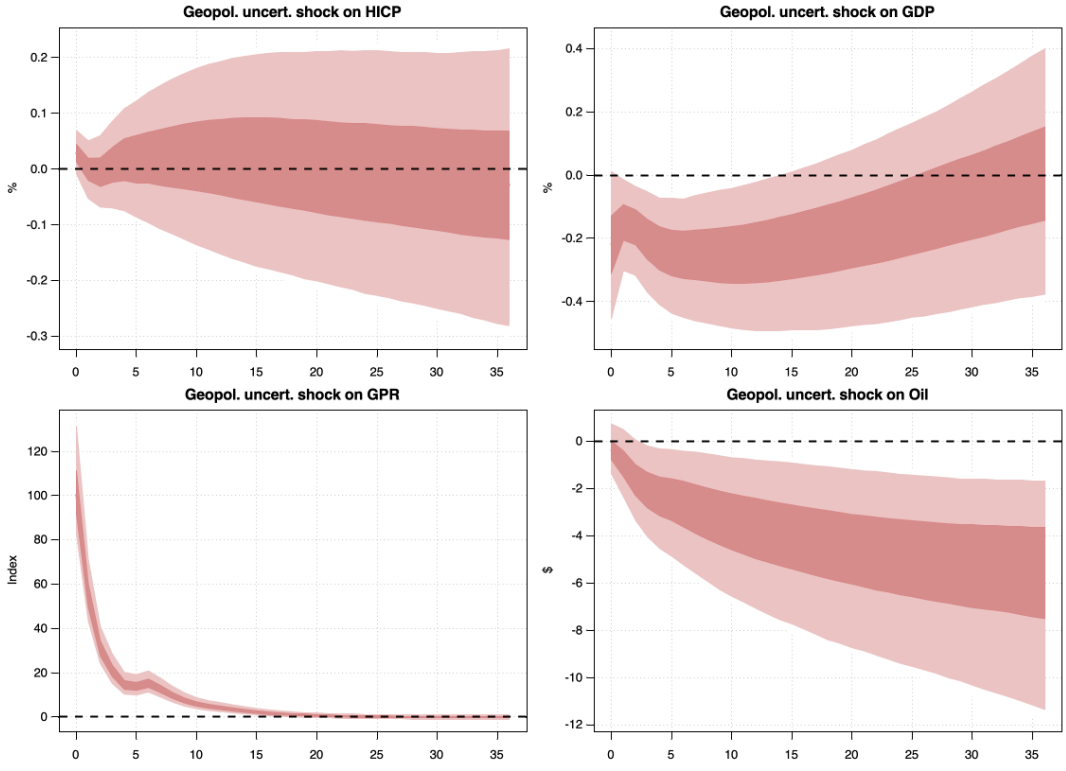
In any case, it is important to remember that the effects of a geopolitical uncertainty shock as described above represent only one potential economic transmission channel for geopolitical events, and therefore impulse responses to such a shock cannot be used alone for forming reliable estimates of the macroeconomic effects of a geopolitical event. To form plausible estimates of such effects, we have to examine all the potential transmission channels for geopolitical events.

We do this by simulating with our econometric model alternative scenarios (counterfactuals) in which all the shocks that can be plausibly associated with the geopolitical surprise are set at zero, and by comparing these to actual inflation and GDP (Charts 3 and 5).

Careful definition of the counterfactual is of paramount importance , if plausible estimates are to be formed. In some cases, geopolitical conflicts may last many years and have complex and indirect macroeconomic effects, some of which may be reflected in the economy only after a lag of several years and all of which cannot possibly be captured by our model. We therefore focus next on the direct macroeconomic effects of the above-mentioned geopolitical *surprises* (Russia's invasion of Ukraine and the outbreak of the Israel-Hamas conflict) and turn our attention only to the shocks that can be associated with those *surprises*, and to their transmission to the euro area economy.

Chart 2.

**Dynamic effects of a geopolitical uncertainty shock on model variables can be illustrated using impulse response functions**




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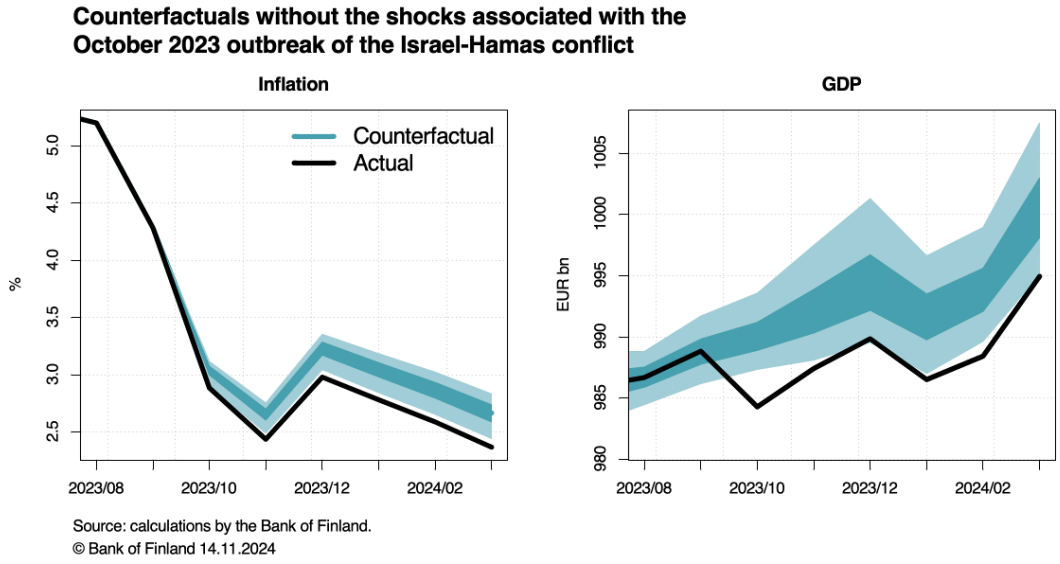
The impulse response functions show how a geopolitical uncertainty shock that induces an approximately 100-point rise in the GPR index affects the model variables over time. The x-axis shows the time since the shock (months) and the y-axis shows the change caused by the shock. The coloured areas indicate the estimation uncertainty (50 % and 90 % bands).

## Outbreak of the Israel-Hamas conflict

We first examine the outbreak of the Israel-Hamas conflict as a geopolitical surprise and look at the effects of the conflict on the euro area economy. The outbreak of the conflict in October 2023 is reflected in the context of our model as a strong geopolitical uncertainty shock and as a shock that amplified the negative demand effects on the euro area's industrial production and other components of demand. The outbreak of the Israel-Hamas conflict can thus be interpreted as having reduced euro area demand by more than if it were simply a shock that lifted the GPR index by the same magnitude.

We construct the counterfactuals presented in Chart 3 by setting the geopolitical uncertainty shock related to the outbreak of the Israeli-Hamas conflict and the simultaneous negative demand shocks at zero, i.e. by removing the shocks in question. As the event does not seem to have had significant effects on supply in the euro area, its total impact on euro area inflation as a result of the contraction in demand was slightly deflationary (Chart 3, left side). The outbreak of the conflict seems to have decreased the HICP of the euro area by some 0.2%[10], which is explained mainly by negative demand factors specific to industrial production (Chart 4, left side). Interestingly, our model shows that the other components of aggregate demand would be reflected in euro area inflation only with a considerable lag. This may be explained by the fact that manufacturing companies may be able to adjust their prices more rapidly than companies in the services sector.[11]

Chart 3.

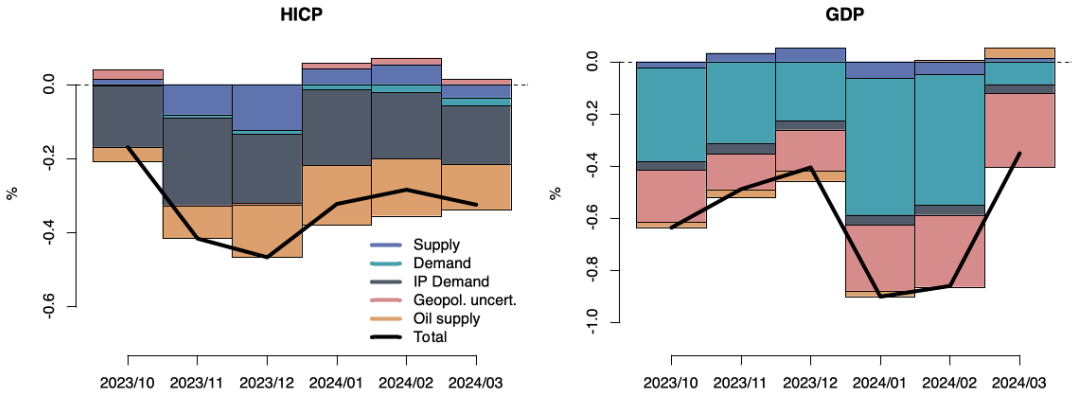


In contrast, the outbreak of the Israel-Hamas conflict seems to have had a relatively large adverse impact on euro area production. We estimate that the increase in uncertainty and the negative effect on demand slashed the euro area's GDP temporarily by as much as 0.6%, or within six months cumulatively by as much as EUR 30 billion (see Chart 4, right side). Overall, the outbreak of the Israel-Hamas conflict can thus be interpreted as a geopolitical surprise that substantially increased economic uncertainty in the euro area and that may have postponed the investment and employment decisions of companies and households (see literature on the macroeconomic effects of uncertainty, e.g. Bernanke, 1983 and Ambrocio, 2022).

The outbreak of the Israel-Hamas conflict seems to have been a geopolitical surprise that worked in the euro area like a deflationary shock, in that it decreased production and lowered prices, which is at odds with the narrative that emphasises the upside inflationary pressures of geopolitical risks. For example, a rise in oil prices, which is often associated with geopolitical risks, did not take place. Instead, the price of oil fell considerably in the months following the outbreak of the Israel-Hamas conflict, which is in line with the interpretation of the shock as being deflationary. Many other factors, too, may have affected the fluctuation in oil prices, such as the increase in oil production in the United States particularly in 2023 and OPEC's decisions on output ceilings. Our model outcomes imply that the supply of oil increased[12] towards the end of 2023 and this also had a small disinflationary effect in the euro area (light brown columns in Chart 4).

Chart 4.

**Shock contributions to deviations of HICP and GDP from their projected paths following October 2023 outbreak of the Israel-Hamas conflict**

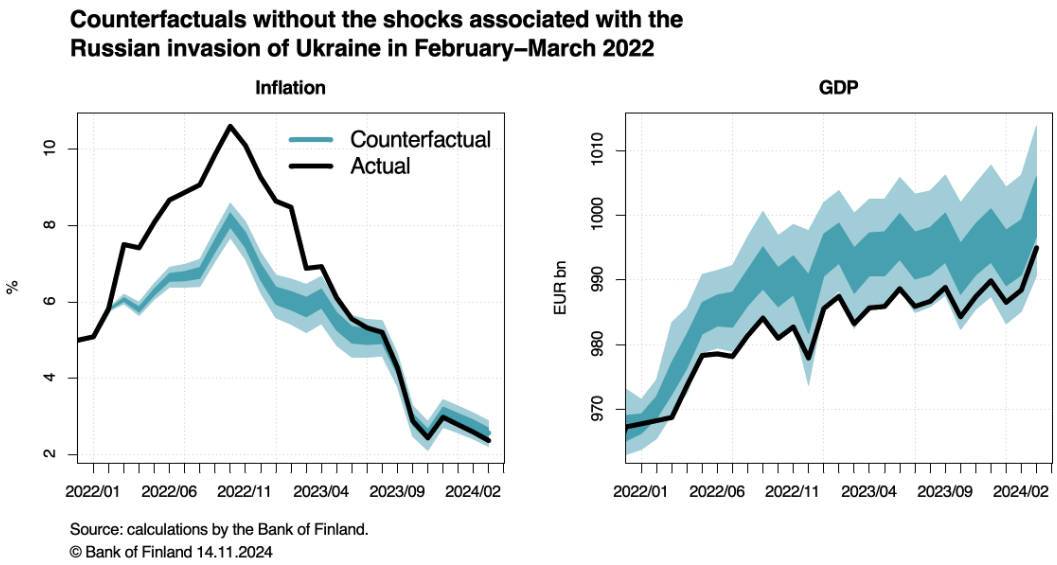



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## Russia's invasion of Ukraine

Following Russia's invasion of Ukraine in February 2022, euro area inflation surged, and it would therefore be natural to assume that the invasion was the most significant factor explaining the sharp increase in inflation. Even though our analysis shows that the invasion had a significant inflationary effect, our counterfactual shows that euro area inflation would have risen to approximately 8% even without the invasion, instead of the actual rise to over 10% (Chart 5). The majority of the supply-side factors that pushed up inflation, including the previous year's massive rise in the price of natural gas, stemmed from the shocks that occurred in 2021, which were also affected by Russia's geopolitical actions, but the materialisation of these supply-side factors did not ultimately depend on the 2022 invasion. Our analysis shows that demand-side factors played a considerable role in the acceleration of inflation as well.

Chart 5.



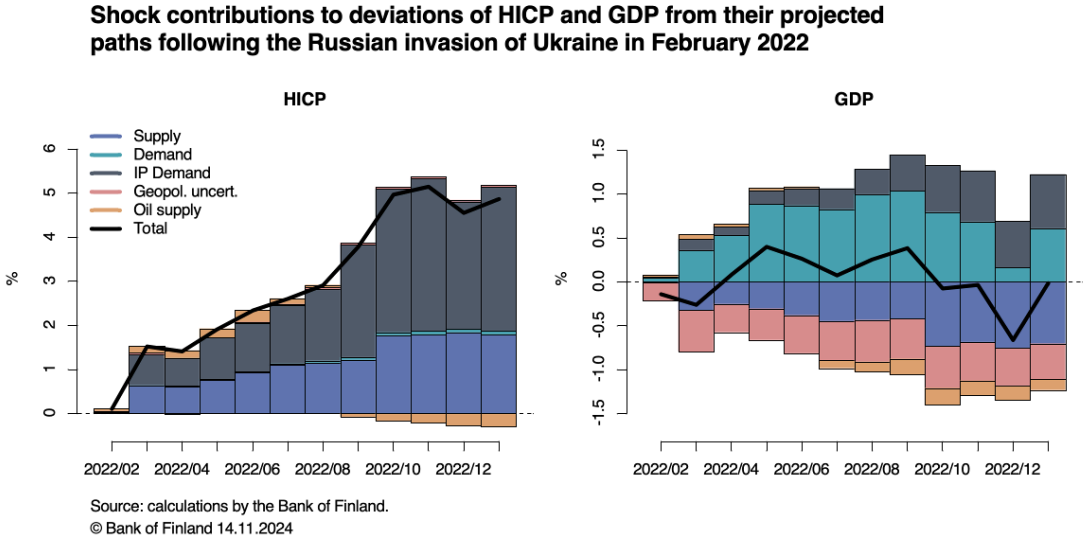

Russia's invasion in 2022 caused a considerable geopolitical uncertainty shock in the euro area in February-March of that year, with contractionary effects on production. The uncertainty shock alone may have decreased euro area GDP by as much as about 0.5% (red columns in Chart 6). The invasion was also evident in March as a considerable negative supply shock that both pushed up prices and reduced production further (dark blue columns in Chart 6).[13] Our counterfactual shown in Chart 5 was constructed mainly by setting these shocks at zero. However, the invasion was also followed in March by a considerable positive inflationary shock that increased the demand for industrial production in the euro area. At least part of this shock can be assumed to be related to the supply chain disruptions caused by the invasion, as these directed some of the demand for industrial goods in the euro area from external to domestic suppliers. Overall, demand

for industrial production was still strong in the euro area in 2022, which according to our analysis may explain as much as 3 percentage points of the surge in inflation (Chart 6).

For the euro area economy, Russia's invasion of Ukraine was therefore a shock that reduced production via demand, due to increased uncertainty, but also reduced supply due to supply chain disruptions. The upward pressure on inflation due to the contraction in supply was nevertheless significantly larger than the downward pressure resulting from the uncertainty, and the invasion therefore had a net inflationary effect on euro area prices. The effect on inflation was thus the opposite of the effect in the case of the Israel-Hamas conflict discussed above. This underlines the heterogeneous nature of geopolitical surprises and the need to examine all the transmission channels simultaneously, instead of only focusing on the geopolitical uncertainty channel.

Euro area GDP in 2022 has attracted much less attention than inflation, which is undoubtedly because it developed more or less as expected, despite Russia's invasion. Our analysis reveals that the uncertainty and supply shocks related to Russia's invasion reduced real GDP in the euro area by as much as 1% in 2022, but also that demand was more robust than expected and so the effects of the opposing shocks on production more or less offset each other (Chart 6, right side). However, industrial demand, in particular, pushed up inflation even further.

Chart 6.



## Effects of geopolitical surprises on euro area inflation are event-specific

Summarising our results, Russia's invasion of Ukraine was a geopolitical surprise that was transmitted to the euro area economy both as an uncertainty shock and as a supply shock, driving up inflation and reducing production. However, the 2022 inflation surge was the result of a combination of other factors as well. Our rough estimates suggest that approximately one third of the surge in inflation can be explained by the direct effects of the invasion, one third by other supply-side factors and one third by demand-side factors.

The outbreak of the Israel-Hamas conflict, in turn, presents itself as a very different type of geopolitical surprise. In contrast to Russia's invasion of Ukraine, the Israel-Hamas conflict prompted simultaneous macroeconomic shocks that reduced aggregate demand but had very little impact on supply. Our results show that adverse geopolitical surprises weaken total output due to higher uncertainty, but the subsequent effects on inflation vary case by case.

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## Notes

1. The index is constructed by counting the number of hits or words expressing geopolitical disruption in articles of leading international newspapers in 1990–2024. Articles discussing adverse geopolitical events, such as wars, terrorism and tensions in international political bodies, are given positive values in the index. The index is updated regularly on the basis of new articles. ↑
2. Monthly series of short-term (3-month) oil futures prices. ↑
3. In empirical macroeconomics, the effects on production are often analysed using industrial production (output) indices as these yield monthly observations, whereas GDP is typically only reported on a quarterly basis. ↑
4. Our model is a Bayesian structural vector autoregressive model (SVAR) which stands out in the literature from more traditional models in that shocks are not expected to follow a normal distribution. A more flexible distributional assumption is better suited to our data and allows for the model's estimation and the identification of shocks without restrictive assumptions regarding the effects of shocks on the model's different variables. ↑
5. Technically, this is referred to as the statistical identification of the model, which is usually based on the fact that the data is not assumed to follow a normal distribution. To be precise, we assume that the shocks follow a skewed t-distribution, a special case of which is the normal distribution (see e.g. Anttonen, 2023). The results of our model point to significant deviations of the shocks from a normal distribution, meaning that we can make particularly accurate estimates of the effects of the shocks on the different variables in the model. ↑
6. The interpretation of the fifth shock as solely an oil supply shock is not entirely accurate. The shock does comprise changes in oil supply, but it might also comprise changes in global demand affecting oil prices to the extent that they are not reflected in euro area demand. However, whether or not the shock exactly identifies changes in oil supply is not relevant to any of the results presented in this paper, and so for clarity, we use the label 'oil supply' as opposed to the arguably more vague 'mostly supply, but also global demand not reflected in euro area demand'. ↑
7. It should be noted that, despite its label, the IP demand shock that we identify only explains that proportion of industrial production surprises which is independent of other demand surprises (e.g. aggregate demand surprises associated with the demand for services). On the other hand, however, it explains a very significant share of the observed surprises in inflation. ↑

8. The estimated effect on industrial production is slightly greater but otherwise very similar to the effect on GDP. ↑
9. In Charts 3 and 5, we apply the same probabilities. ↑
10. A 0.2% decrease in the HICP corresponds to a 0.2 percentage point decline in inflation. ↑
11. There are indications of this at least for the years 2022 and 2023, when unit profits in manufacturing rose initially more rapidly than in services sector companies (see OECD, 2023). ↑
12. Instead of an increase in oil supply, some of the downward price pressure (light brown in Chart 4) could also be explained by weaker Chinese demand. See footnote 6. ↑
13. Inflationary effects on the euro area that were triggered by the pandemic and exacerbated by Russia's invasion of Ukraine have been analysed extensively in earlier empirical research – see for example Oinonen and Vilmi (2024) or Bernanke and Blanchard (2024). ↑

## Keywords

euro area, geopolitics, inflation