European Parliament

The aggravated monetary policy dilemma

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Abstract

Amidst an already heightened inflation environment, the repercussions of the war in Ukraine resemble a macroeconomic supply-side shock which puts monetary policy in a challenging situation. The ECB faces a difficult trade-off and needs to find the right balance between dampening inflation and sustaining economic growth. Our empirical estimates suggest that the ECB is presently not overly loose relative to its historical monetary policy record and that current inflation cannot be easily tamed by monetary policy alone.

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LIST OF ABBREVIATIONS

APP	Asset purchase programme
ECB	European Central Bank
EONIA	Euro OverNight Index Average
EP	European Parliament
EU	European Union
GDP	Gross domestic product
HICP	Harmonised index of consumer prices
LNG	Liquefied natural gas
OPEC	Organization of the Petroleum Exporting Countries
PEPP	Pandemic emergency purchase programme
QE	Quantitative easing
SPF	ECB Survey of Professional Forecasters
TLTRO	Targeted longer-term refinancing operations
US	United States
VAR	Vector autoregression

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EXECUTIVE SUMMARY

- **After a decade of largely staying below target and remaining low during the pandemic-induced downturn**, inflation has undergone a significant surge throughout 2022. The war in Ukraine has a number of channels through which it affects and will further affect the euro area economy and, hence, decisions regarding monetary policy.

- **First and foremost, possible further EU sanctions or the halt of Russian gas and oil exports would have the most significant impact for the European** economy by inflicting the double negative effect of pushing economic growth down and inflation up. Existing evidence suggests that the biggest GDP losses would result from a sudden gas supply stop for the EU, however these losses should not be catastrophic.

- **Further channels will dampen the economic outlook, including uncertainty** induced by the war and further supply chain disruptions, including food supply disruptions and food price increases, which would inevitably have direct effects on price pressures.

- **Financial stability risks have increased since the onset of the war, however they remain broadly limited.** In case of ensuing market fragmentation, the ECB can use its asset purchase programmes and its amended flexibility to reduce the risk of impairment of its monetary transmission mechanism.

- **To assess the role of monetary policy in the current macroeconomic environment, we estimate a small vector-autoregressive model**, which passes various plausibility checks, e.g., concerning the size of the monetary policy rule coefficients, the chronology of monetary policy shocks and the conflicting effects of aggregate supply shocks for monetary policy.

- **By means of a structural scenario forecast, we find that the ECB was significantly restricted from below in setting interest rates during the pandemic-induced crisis.** We also show that the disinflationary effect of constrained monetary policy persisted far beyond its duration and until today, although by now interest rates are already below the level implied by our model.

- **Neither monetary policy nor the estimated (size of) aggregate demand and supply shocks can explain the price surge since 2021.** It is, hence, almost exclusively due to non-cyclical factors. The most obvious candidate is the unusually swift rebound in economic activity that took place amid severe structural distortions that shutdowns and social distancing brought along for world trade and global supply chains.

- **We conclude that headline inflation is currently a poor guide for monetary policy and cannot by easily tamed by the ECB** unless it is willing to orchestrate a significant economic downturn.

- **For its upcoming decisions, the ECB will have to follow closely developments in terms of inflation expectations, wage pressures and a possible broadening of inflation to assess its optimal policy response.** For the time being, the approach of gradualism, flexibility and optionality remains proper in terms of making data-driven decisions for the further policy path and reacting to pressures on financial markets by adjusting asset purchase programmes accordingly.

1. INTRODUCTION

The euro area economy has been undergoing a significant surge of inflation throughout 2022. After a decade of inflation largely staying below the target of the European Central Bank (ECB) of close, but below 2% in the medium run, inflation in the euro area retained very low levels also during the pandemic-induced economic downturn. In accordance with standard economic theory, inflation was expected to increase during the economic recovery from the pandemic. However, both headline inflation (price of all goods and services) and core inflation (excluding food and energy) have been considerably above the 2% target of the ECB since the beginning of 2022 (Figure 1).

The war in Ukraine is a tragic development, which presents further challenges for euro area policymakers amidst an already difficult macroeconomic environment. Its immediate outcomes have been an increase in energy prices, expectations about further supply chain problems, especially regarding the delivery of food, and an increasing uncertainty, which affects firms and households. Its further repercussions will essentially depend on the future geopolitical developments and the decisions taken on the implementation of further EU sanctions and possible oil or gas supply stops from Russia to further EU Member States[1]. These could be key drivers of the dynamics of economic output and inflation in the coming months. However, the overall outcome will also depend on the decisions taken by monetary and fiscal policy makers. In this paper, we therefore discuss the current economic environment, possible and realised repercussions of the war in Ukraine and the implications this will have for the implementation of monetary policy by the ECB.

This policy paper pursues as follows: Section 2 describes the current economic environment and the nature of the already existing factors contributing to inflation before the war in Ukraine, as their relevance and duration are important for further monetary policy actions. Further in this section, we outline the nature of the current shock stemming from the war in Ukraine and the repercussions it already had for growth, inflation, monetary policy and financial stability. The section concludes with a summary of the ongoing debates on the effects of the possible energy supply sanctions on behalf of the EU. Section 3 presents a macroeconometric framework to evaluate the current stance of the euro area economy and the role of monetary policy. We estimate aggregate demand, aggregate supply and monetary policy shocks and assess their relevance for the evolution of real activity and prices over the last two years. The estimation of a monetary policy rule helps us to understand the causes and consequences of interest rate (non-) policy and to derive conclusions about its current stance and further development. The distinction of aggregate demand and aggregate supply shocks enables us to consider the shift that the euro area economy is undergoing since the outbreak of the Ukraine war. Finally, Section 4 draws conclusions on the way forward for monetary policy based on our previous analysis and results.

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[1]   At the end of April, the Russian Federation has already imposed a gas supply halt on Bulgaria and Poland.

Figure 1: Euro area inflation, monthly, year on year in percent
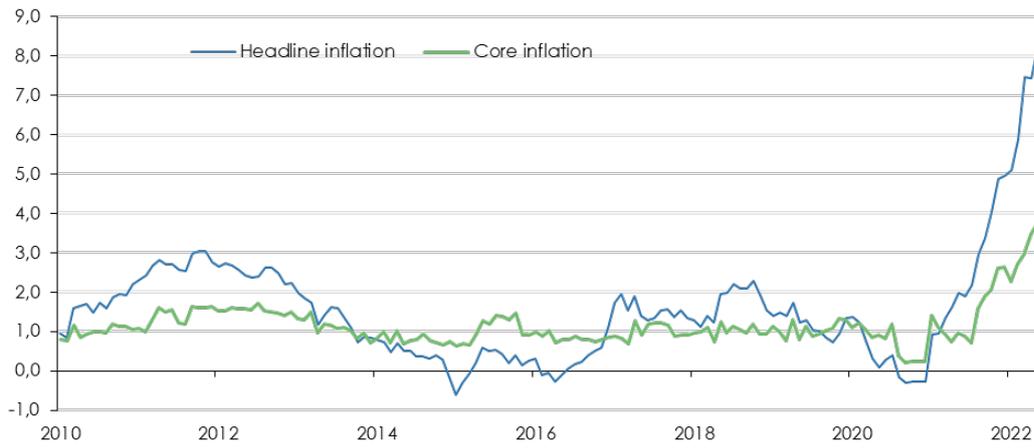
Note: Core Inflation: Overall Index excluding Energy, Food, Alcohol, Tobacco.

2. THE ECONOMIC ENVIRONMENT

2.1. Economic conditions at the onset of the war

Inflationary pressures have been heightened globally and both in the euro area and the United States already before the onset of the war in Ukraine. However, the factors underlying those pressures have partly been different. The economic recovery in the United States (US) has been stronger, driving aggregate demand and the labour market to return to its pre-pandemic position at a fast pace. Aggregate income and consumption have recovered much faster and to higher levels than in the euro area. A particular explanation of this can be attributed to the different composition and design of the pandemic fiscal stimulus (Boone, 2022). The lump-sum nature of the fiscal stimulus in the US has meant that for some low-income households it has led to higher income than before the pandemic and has thus spurred an increase in consumption in comparison to the pre-pandemic levels. The mixture of pandemic-related quantitative easing (QE), expansionary monetary policy and very expansionary fiscal policy therefore pushed the level of demand higher.

The recovery in the euro area in terms of aggregate demand, aggregate income and consumption has been milder. Figure 2 compares the downturn and recovery of both aggregate output and aggregate consumption in the US and the euro area during the pandemic and during the global financial crisis. The recovery in both constituencies has been stronger than in the aftermath of the global financial crisis, but the euro area lagged in its pandemic recovery to the US. Inflationary pressures in the US have been driven much more by aggregate demand and the mixture of monetary and fiscal policy than in the euro area, where external factors have been more important. While the contribution to inflation from the pandemic stimulus programmes was at first expected to be transitory, by the end of 2021 the evidence has shifted in favour of arguments that inflation will be more persistent than expected. This was driven also by savings of households, accumulated during the earlier stages of the pandemic, which lead to a stronger surge in aggregate demand than expected. The persistence of this aggregate demand strength will in the end depend also on the steps taken by central banks to respond to it.

A further channel which has contributed to the unexpectedly high level of inflation before the war were supply chain disruptions, as well as bottlenecks resulting from pandemic-driven changes of relative supply and demand for certain types of goods. During the pandemic, due to lockdowns or other restrictions, there has been increased pressure on supplies, which have brought supply shortages and rapid price increases, e.g., most notably in used car prices. One indicator to measure such disruptions is the Flexport Ocean Timeliness Indicator[2], which reports the number of days to carry goods on the two biggest trade routes – from Asia to Europe and to North America. Since October 2021 both indices have been showing heightened values close to all-time highs and higher than even in the first pandemic months. This persisted throughout the first months of 2022, however since the beginning of May 2022 a significant decline has been observed, although it has been partly determined by seasonal effects.

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[2] Flexport Ocean Timeliness Indicator, https://www.flexport.com/research/ocean-timeliness-indicator/.

Figure 2: GDP and private consumption trends after the 2008/2009 economic crisis and during the COVID-19 pandemic
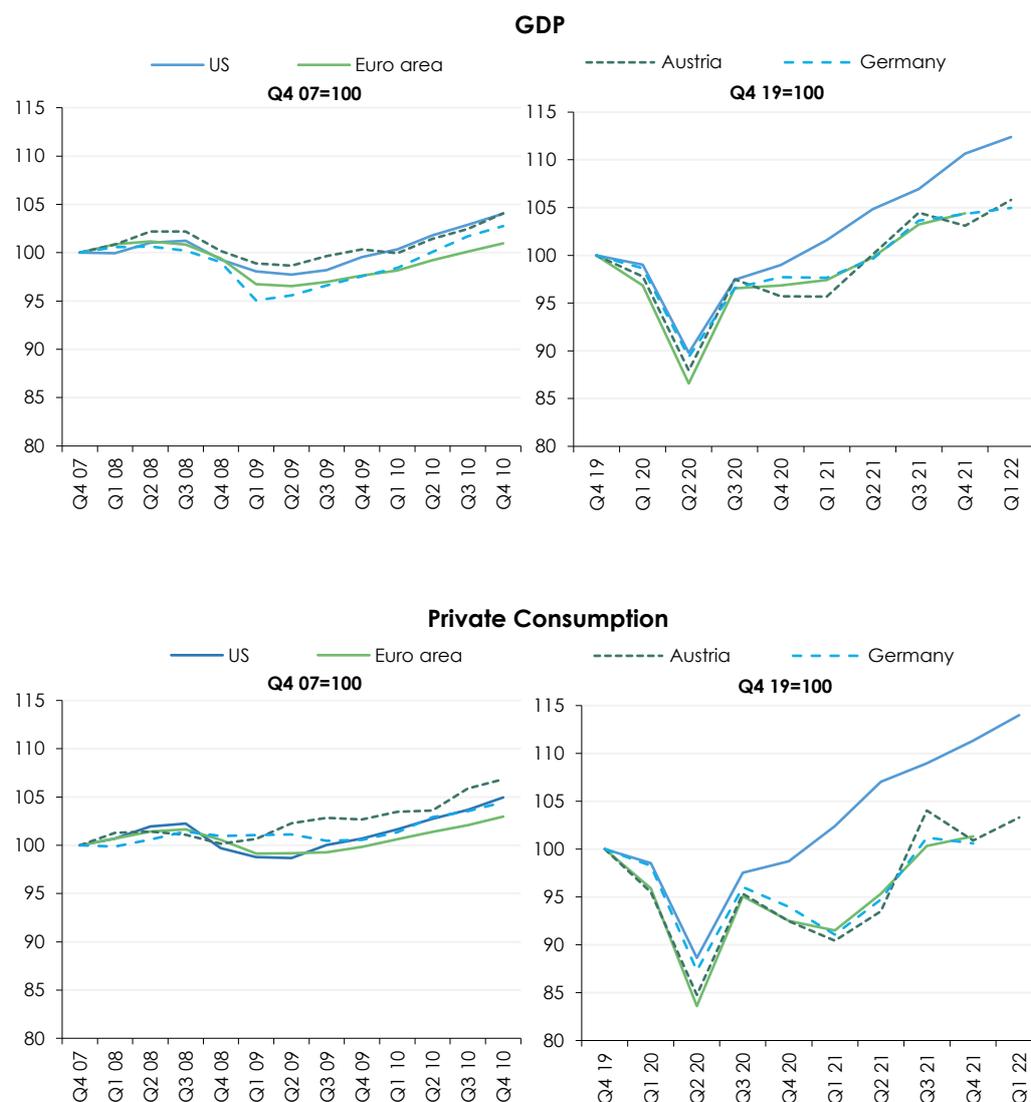
Source: OECD Quarterly National Accounts, Macrobond.

Note: GDP and total private final consumption in current prices and seasonal adjusted.

In addition to disruption on the supply side, specific types of goods – mostly durable goods, have experienced a great surge in demand throughout the pandemic, as consumers, who could not consume services due to different restrictions on socially-related activities, have shifted their preferences toward durable goods. This shift on spending on durable goods has led to significant increase in the price of these goods, which was at first been expected to be temporary. Such a reallocation shock acts similarly to a cost-push shock and creates both increases in prices and unemployment. Fornaro and Romei (2022) show how the increased spending on durable consumption, if financed by trade deficits as in the case of the US, then generates inflationary spillovers vis-à-vis the rest of the world. The increased spending on durable goods can thus also be linked to a phenomenon called "the globalisation of inflation" (Forbes et al., 2021). Since durable goods are tradable, the increased world aggregate demand or aggregate demand in one major economy (e.g. the United States) translated to world aggregate demand for tradable goods increasing. This increases the pricing power of firms producing durable goods, which can then increase their prices overall. This

phenomenon can contribute to inflation significantly increasing even in regions where overall aggregate demand did not recover as strongly as in the United States[3]. Furthermore, a part of the relative shift in demand from services to durable goods might also become more persistent if more people shift to working from home[4].

2.2. Economic implications of the war

Starting from this environment of heightened inflation, the war would have a number of particular channels through which it would affect the euro area economy and therefore might affect decisions regarding monetary policy. First and foremost, the essential result from the war will depend on its effects on trade and mostly on energy imports from Russia. Possible EU sanctions or the halt of Russian gas and oil exports would have the most significant effects for the European economy by inflicting the double negative impact of pushing economic growth to the downside and inflation to the upside. We discuss this central issue in the next section, as it is the most relevant in terms of magnitude, as well as having repercussions for the necessary stance of monetary policy. Secondly, the war results in major uncertainty. This could lead to increases of precautionary savings by households and an investment halt by firms. A similar phenomenon was already observed during the COVID-19-induced pandemic uncertainty (Pekanov and Schiman, 2020). Economic effects can already be seen from the recent downgrade of forecasts on economic output for the euro area for this year (Lane, 2022). Thirdly, there are further additional channels through which the macroeconomic situation in the European Union would change as a result of the war, their overall implications on GDP should however be relatively limited. The war has induced an influx of refugees to Europe, for which the necessary fiscal spending adjustments would be needed. Increased spending on refugees is evaluated to be around 0.35% of EU GDP by Blanchard and Pisani-Ferry (2022). Furthermore, additional military spending increases have been announced by a number of countries. These channels should however have no significant effects for monetary policy or inflation developments.

Supply chain disruptions accounted also for one category of factors which were expected to be transitory and to be pandemic-related. The recent hard lockdowns in China however will contribute to further downstream disruptions this year which are yet to materialise. The war in Ukraine will also contribute to new supply chain disruptions in terms of specific raw materials, and in terms of specific food supplies. Food prices can be expected to increase due to several disruptions in the supply of some food categories from the Ukraine and the Russian Federation. This could have a significant effect on headline inflation in the euro area for some time. Ukraine and the Russian Federation account for around 30% of global wheat exports, so the war in Ukraine has increased wheat prices to record levels. This channel would also mean inflation can become more persistent, however increasing wheat and food prices overall will have the biggest negative effects for emerging markets and low-income countries (Agarwal and Kimbal, 2022).

Besides the specific effects it has on energy supplies and energy prices, the halt of trade relations with the Russian federation should not lead to very large macroeconomic losses. Overall exports of goods to the Russian Federation from the European Union amounted to EUR 89 billion in 2021. If half of them stop being exported this would lead to 0.3% of GDP decrease in aggregate demand for EU goods. While some sectors and companies can suffer significantly from this, this shock would not be of major macroeconomic concern (Blanchard and Pisani-Ferry, 2022).

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[3] For more on the globalisation of inflation, see Schnabel (2022).

[4] See Smith (2022) interview with Emi Nakamura, "to the extent that people shift to a lot more work from home (and less people are working at all) this could make some of the changes in demand patterns quite persistent."

Finally, in terms of financial stability, at the onset of the Russian invasion of the Ukraine there were concerns about the implications for the financial sector in the EU. The links between individual banks and their Russian subsidiaries was one argument for concern. During the global financial crisis, we have seen how risk exposures and network effects can accumulate to an overall systemic crisis. The worsening of macroeconomic conditions – growth and inflation, would be the major implication for financial stability in the euro area of the war in Ukraine. This could increase market volatility, as well as duration, credit and liquidity risk (ECB Financial Stability Review, 2022). For highly indebted entities, such as euro area sovereigns, household and corporates this would lead to higher interest rate payments and can lead to risks to debt sustainability. The major risk would be for vulnerable borrowers – for corporates the increasing rise of input prices may lead to lower margins, for households house prices might especially face a correction risk. Banks would also face weaker profits given the worsened macroeconomic environment. However, their buffers should suffice as a first line of defence against risks. These risks however are a standard consequence of a worsening macroeconomic environment. They should not lead to a major episode of financial fragility. National macroprudential policies should be carefully adjusted to account for the new macroeconomic situation, as well as national country-specific conditions. So far, since the onset of the war, there have been no major repercussions on the EU financial system, even after considerable number of the subsidiaries of Russian banks have been liquidated. European banks are also better equipped than in 2008 to withstand any further risks. A default by the Russian federation is not excluded, however its repercussions should also not be catastrophic. Capital requirements are sufficient at the time and do not imply an amplification of financial fragility similar to the aftermath of the global financial crisis. A further question regards the exposure of individual banking groups to their subsidiaries in the Russian Federation, which goes beyond the scope of this text.

The main expectations incoming from the war in Ukraine therefore are for the major effects to be similar to a supply side shock with the accompanying downward pressure on economic activity and upward pressure on inflation. Such a situation puts the central bank in a difficult situation to choose whether to accommodate the economy or to take aggressive measures in tightening policy rates to limit heightened inflation with the inevitable effects on aggregate demand and the labour market. The exact characteristics of the current discussions regarding energy supply sanctions and their implications are discussed in the next subsection. In Section 3, we will then analyse how the ECB has reacted to aggregate demand and aggregate supply shocks in the past and what this means for the current situation.

Table 1: Main factors contributing to inflation in the euro area and assessment of their relevance and duration of effects on output and inflation

Factor	Effect from war
Heightened aggregate demand	Will be affected downwards due to uncertainty and the supply-side nature of the shock
Tight labour market	Will be affected negatively due to uncertainty and the supply-side nature of the shock
Supply chain disruptions	Possibly will exacerbate and would matter longer than expected
Energy price increases	Will be further exacerbated and act as a supply-side shock pushing inflation up and output down

Factor	Effect from war
Additional fiscal budgetary measures for immigrants and military spending	Will increase fiscal deficits, but only to a limited extent
Trade disruptions between the euro area and the Russian Federation besides energy supplies	Macroeconomically limited effects
Financial stability concerns	Risks have increased since the onset of the war, but could be limited by macroprudential policies, capital buffers and ECB non-conventional measures if necessary
Inflation expectations	No de-anchoring of expectations so far

Source: Authors' own elaboration.

2.3.   Energy supply sanctions

The most important consequences of the war on the euro area economy would come from any further actions regarding sanctions, tariffs of a full embargo of energy supplies from Russia (Blanchard and Pisani-Ferry, 2022)[5]. Russia is a major supplier of oil, gas and coal for the European Union, which primarily relies on imports for all three energy sources. The European Union also produces energy through renewables, through nuclear energy or imports electricity directly, but all of these have much lower shares in the energy mix. The discussions regarding further sanctions, after the packages announced so far by the European Union, have revolved around an embargo on oil and gas imports. It is important to note however that these two energy sources have very different characteristics in terms of their substitutability and therefore of their demand and supply elasticities.

The oil market is a global market, where the price is being set globally and is determined significantly by decisions taken by the Organization of the Petroleum Exporting Countries (OPEC). Before the war in Ukraine, the price of Russian oil was very close to the world price of oil. Russia therefore is a price-taker in this market. The market for oil is global also because of its physical characteristics that permit transportation. Due to these factors, both the European Union should easily be able to find some substitutes for oil deliveries in the case of an oil embargo, and the Russian Federation will most probably find additional buyers for its oil outside of the European Union. The war has already had an upward effect on the price of oil; however, the real price of oil is below its all-time highs (Figure 3). Since the Russian Federation cannot control the global price for oil, it can only make quantity adjustments and try to offset some of its revenue losses by selling to other countries.

The gas market is, however, regional. Even though world prices are related because liquefied natural gas (LNG) has made it possible to ship between them, the prices can still differ. There are also constraints on LNG shipments both in terms of boats and terminals available, although the latter constraint can be overcome in a matter of months. There can also be internal disputes, but if we assume that European countries can overcome them, the European market can be treated as one. For the European market, then essential in terms of the outcome would be the pace of imposition of a possible gas embargo or tariffs. In the short run, regarding gas sanctions, the Russian federation should be seen

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[5]   On 3. June 2022, the EU adopted officially the sixth package of sanctions against Russia. Importantly it includes the complete import ban on all Russian seaborne crude oil and petroleum products (90% of all current oil imports from Russia) after a certain transition period and with a number of exemptions. The direct repercussions of this sixth package are not analysed here as the official technical details of implementation were announced after the cut-off date of this briefing paper. For exact details, see: https://ec.europa.eu/commission/presscorner/detail/en/IP_22_2802

as a monopolist and the supply delivery alternatives would probably come with increasing costs (Blanchard and Pisani-Ferry, 2022). Gas prices have already increased significantly both in 2021 and in 2022 as a result of the war.

The main possible outcomes for energy supplies can therefore be categorised in two types – a price increase, which could be due to the imposition of a tariff, or a full embargo on oil and/or gas, which equals a full stop of supplies and therefore a quantity restriction. The results of a full embargo are discussed in the box below. Blanchard and Pisani-Ferry (2022) use a back of the envelope calculation to estimate how the price increases would affect a standard consumption basket and the harmonised index of consumer prices (HICP). They assume a pass-through from a price increase in commodity prices to the price of energy of final consumers and firms of 0.5 and a pass-through from the rise in commodity prices on food prices also of 0.5. They assume for this year a price increase for commodity prices of 25% and for food price of 10%. Their back-of-the-envelope calculation results in an overall 2% increase in the price of a consumption basket for an increase in the price of commodity prices of 25% and in food prices of 10%. This is, however, the evaluation purely of the direct, first round effects, which are difficult to be limited by any intervention. The initial increase could then spur further, indirect effects if workers are compensated fully for their initial purchasing power loss or if firms index their prices completely to retain their profit margins. Using a similar back-of-the envelope calculation, Blanchard and Pisani-Ferry (2022) also estimate that the losses in terms of aggregate real income for the EU due purely to the assumed increase in oil and gas prices would be of the order of 1% of GDP. These losses come from the fact that the European Union is an importer of these products, which results in loss of aggregate income for the economic region as a whole. Finally, the price increases will also have an unequal distributional effect as in most EU countries, low-income households have higher shares of expenditures on gas, utilities and food then high-income households. In this sense, an OECD analysis also shows that home energy price increases have affected the poorest 20% of households more than high income households in each country of the EU[6]. While monetary policy cannot do anything in terms of these distributional effects, any fiscal measures should take this fact into account.

Figure 3: Real price of oil (indexed)
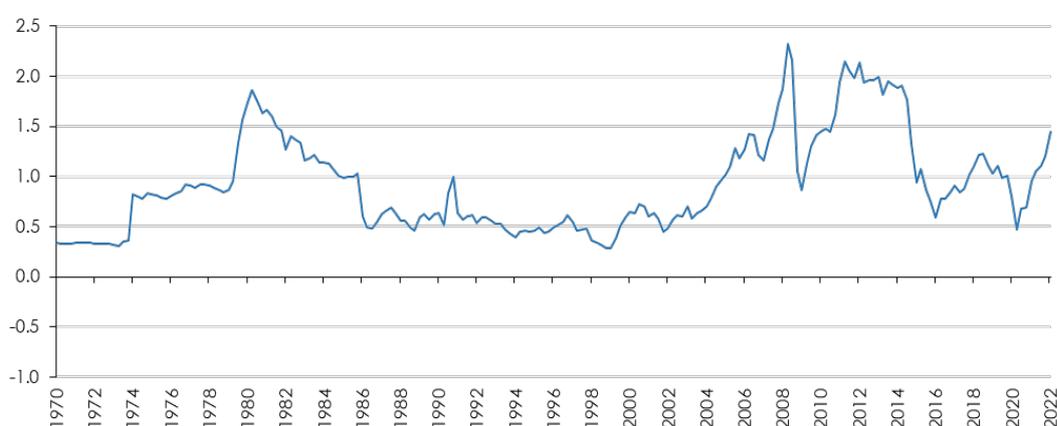
Source: Blanchard and Pisani-Ferry (2022) based on OECD and US Bureau of Labor Statistics, Macrobond.

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[6] For more details, see Blake and Bulman (2022).

Box 1: The macroeconomic costs of a gas embargo

The question on the effects of a sudden stop of oil and gas deliveries on GDP and economic activity has led to numerous detailed discussions. Much of the discussion has centred around Germany, as the biggest economy in the euro area, as well as one of the economies, which is more dependent on Russian gas and oil. For Germany, about up to 55% of its gas imports and 14% of its total energy imports are from Russia.

A widely debated paper which has aimed to estimate such effects is Bachmann et al. (2022) and has led to numerous follow-up discussions regarding its assumptions and results. In its core, the paper uses a state-of-the-art model, developed in Baqaee and Farhi (2022), which raises the question – "How would the German economy cope with such a shortfall of gas deliveries?" The economic effects crucially depend on the feasibility of substitution and reallocation of energy inputs across sectors. To quantify these effects, the model accounts for elasticities of substitution and reallocation between different intermediate inputs.

The main result of the paper is that the cost of a full-scale ban of gas and oil imports from Russia would be in the margin of 0.5% to 3% of GDP for Germany. This is the overall outcome with the assumption of government fiscal measures and a reaction of the European Central Bank to fully limit any indirect, aggregate demand amplification effects. **Bayer et al. (2022) extend this study by modelling indirect, amplification effects through Keynesian channels and obtain a similar estimate of 3%, however without the supply-side heterogeneity modelled in the original study.** This has led to the argument that the two effects may be additive, as argued by the German Council of Economic Experts, which would put the cumulative effects between 3% and 6% (Berger et al., 2022). Furthermore, a crucial assumption regarding all of the results is the short-run substitutability across energy sources and possibly other intermediate production inputs, which determines how much in output losses some sectors and the overall economy will have to undergo in the case of gas shortage and if there is a lack of possibility to substitute it. An IMK study published more pessimistic estimates of the economic impact of a gas import stop that points to a loss of GDP of at least 6% for 2022, which would be a more significant shock than the COVID-19 pandemic (4.6% loss of GDP in 2020) (Feliciano et al., 2022). A study by the Bundesbank estimates the loss to GDP for Germany from a Russian gas ban to be 5.1%, followed by another 1.5% drop in the two years after that (Deutsche Bundesbank, 2022).

A survey of leading European economists by the Center for Macroeconomics at LSE asked about their assessment on the effects of a gas embargo on the economies of Germany and the European Union (Feliciano et al., 2022). **The majority of economists evaluated that the effects for the German economy will be to lose 1 % to 3 % of GDP growth in 2022-2023 if the government responded with fiscal policy measures targeted to compensate losing sectors and households.** If there are no such measures implemented, the losses will be more significant and the majority of respondents put them between 3% and 5%. The majority of economists put the estimation for GDP losses for the European economy also in the magnitude of 1 % to 3 % of GDP, but even without the European Union implementing offsetting measures in terms of fiscal or monetary policy. The overall milder impact on the European economy in comparison to Germany alone is due to the relatively high dependence of Germany on Russian gas, while this dependence is very heterogeneous across EU Member States. In other studies, most economists have also argued that the GDP losses to the Russian economy would be substantially higher than those on the countries imposing those sanctions (Chepeliev et al., 2022, Langot et al., 2022 and Mahlstein et al., 2022). Moreover, there are arguments that favour import tariffs as compared to an embargo, in particular that the ensuing price effects can be re-allocative and, hence, more efficient than pure quantity effects (Baumgartner et al., 2022).

# 3. MACROECONOMIC SHOCKS AND THE ROLE OF MONETARY POLICY

To assess the role of monetary policy in the current macroeconomic environment, we need to estimate its reaction function, i.e., the monetary policy rule. In a univariate framework this is typically done by means of so-called Taylor rules. A recent study that estimates a broad range of cutting-edge Taylor rule specifications for the ECB is the one by Paloviita et al. (2021). The authors not only consider real-time data and real-time forecasts, but also the effect of so-called credibility loss due to missed inflation targets in the past. However, to assess the ECB's response to specific macroeconomic shocks, a multivariate approach capable of identifying these shocks and monetary policy simultaneously is desirable. Our preferred model framework is a vector autoregression (VAR) with identified monetary policy shocks, aggregate demand shocks and aggregate supply shocks. While in doing so we aim for a better understanding of monetary policy in structural terms, this does not come without potential costs compared to the use of univariate Taylor rules. Specifically, the identification of monetary policy in VARs has been criticised for not sufficiently considering the plausibility of the identified shock series (see, e.g., Rudebusch, 1998).

Therefore, we choose an approach that addresses these shortcomings, the one proposed by Badinger and Schiman (2022). We deviate from their baseline specification, which involves six variables, and consider a VAR of three variables: Eonia, industrial production and the harmonised consumer price index. All other elements of the specification are the same: The estimation period ranges from January 1999 to December 2019, the VAR includes a constant and 12 lags and we use a Minnesota prior to prevent overfitting. The reason for reducing the dimension of the VAR from six to three variables is that unlike in the original article, we want to identify three structural shocks that encompass all unexplained fluctuations in the economy. Having more variables than shocks would leave some fluctuations unexplained. We have cross-checked the results with the original six-dimensional specification and find that the smaller model does not miss essential information. Before we proceed, a comment on the estimation period is needed. We cut the sample at the end of 2019 in the baseline model, as the ECB most probably hit a lower bound when the pandemic-related crisis in early 2020 struck, which would raise issues for the identification of monetary policy. However, we will use more recent data up to March 2022 to estimate an extended model where only aggregate demand and aggregate supply shocks are identified.

We proceed as follows: First, we present the average effects (impulse responses) of the three identified macroeconomic shocks. Then we analyse the coefficients of the monetary policy rule, i.e., how the ECB responds systematically to real activity and inflation. Next, we dissect the ECB's interest rate setting behavior conditional on whether it responds to aggregate demand or aggregate supply shocks. Subsequently, we extent the observation period beyond 2020 and estimate how this recent period was shaped by aggregate demand and aggregate supply shocks. Based on this, we estimate how the ECB would have responded if it had not been constrained by a lower bound, how actual monetary policy affected economic outcomes and what this means for monetary policy in the current crisis.

3.1. Impulse responses to macroeconomic shocks

Figure 4: Impulse responses
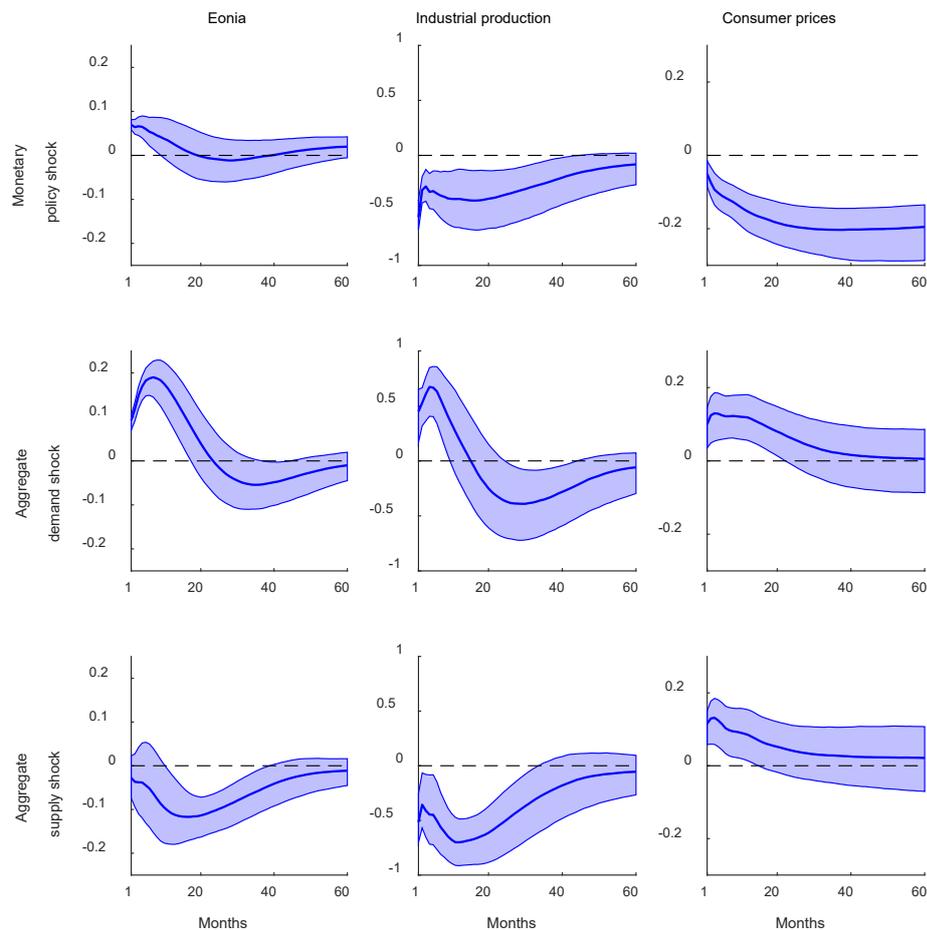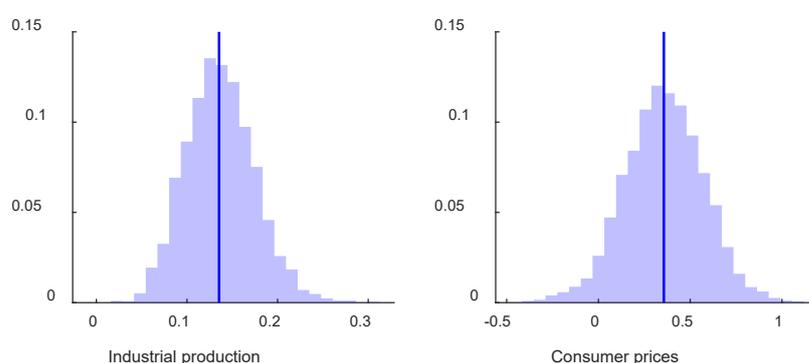

Source: Authors' own elaboration.

Notes: Blue lines are one-standard-deviation median impulse responses; blue shaded areas correspond to 68% credible sets. The impulse responses of Eonia are measured in percentage points, those of industrial production and consumer prices in percent.

Figure 4 shows the impulse responses for the three identified shocks. The monetary policy shock is identified in the same way as in Badinger and Schiman (2022); i.e., we set residual sign restrictions in four months in which the interest rate decision was followed by strong financial market reactions plus a magnitude restriction in a month in which the monetary policy shock was the only material driver of Eonia. Importantly, we do not set any sign restrictions on impulse response, so the presented effects of a restrictive monetary policy shock – an increase in Eonia and a decrease in economic activity and prices – are not assumed but arise as a result from our identification procedure. The other shocks are identified by means of traditional sign restrictions on the impulse responses. An aggregate demand shock moves all three variables in the same direction. An aggregate supply shock moves real activity and prices in different directions, while the response of the interest rate is not restricted. Intriguingly, a large share of draws involves a decrease in Eonia, i.e., a loosening of monetary policy, in response to an adverse supply shock to counteract the (disinflationary) downturn induced by the shock.

3.2. The systematic response of monetary policy

In line with Paloviita et al. (2021), we find that the inflation coefficient in the estimated monetary policy rule is substantially larger than the output coefficient, reflecting the ECB's inflation orientation (Figure 5). However, the high degree of interest rate smoothing implies that these coefficients are lower than in static specifications of the Taylor rule. The median estimates of the coefficients are 0.14 and 0.36 respectively, meaning that the ECB raises interest rates on average by 14 basis points when industrial production increases by one percent and by 36 basis points when consumer prices increase by one percent. These values are well within a range given by the ECB's New Area Wide Model (Coenen et al., 2018): The cumulative output and inflation coefficients in the new version of this model are 0.10 and 0.23, respectively. The coefficients in the updated original version are 0.15 and 0.44. The baseline estimates of Paloviita et al. (2021, Table 1) are somewhat higher: 0.24 and 0.71, respectively. Given that these are more sophisticated specifications – forward-looking elements, real-time data, incorporation of further elements like the output gap and the natural rate of interest – the similarity with the results of our monetary policy rule approximation is reassuring.

Figure 5: Monetary policy rule coefficients

Source: Authors' own elaboration.

Note: Distribution (blue shaded bars) and median (blue lines) of monetary policy rule coefficients.

While the monetary policy rule coefficients indicate how the ECB responds to real output and price developments in general, it is also of interest to examine the response to the identified structural shocks specifically. This can be achieved with a method proposed by Kilian and Lewis (2011) to determine the contribution of a specific variable to the response of another variable (Eonia) to a structural shock (aggregate demand and aggregate supply shocks). While this could be done for any horizon of the impulse response, we find that the response of Eonia to either shock at horizons beyond impact is predominantly autoregressive because of strong interest-rate smoothing. Substantial genuine effects of demand and supply shocks on monetary policy are confined to the month of impact. These effects are shown in Table 2.

While the central bank's response is unambiguous in case of an aggregate demand shock, the effects of aggregate supply shocks are putting monetary policy in a dilemma. On the one hand, an adverse supply shock creates upward pressure on interest rates due to its inflationary effect. On the other hand, downward pressure on interest rates emerges due the shock's dampening effect on real activity and associated disinflation. This is obvious when we look at the counteracting contributions of real output and inflation in Table 2. Note that even if we restricted Eonia to respond positively to an adverse supply shock, this would only reweigh these counteracting contributions in favour of the inflation effect (such that the overall median response of Eonia would be positive). But the fact that the central bank is in a dilemma when it faces a supply shock, remains. Moreover, remember that the

loosening motive dominates the tightening motive even more clearly in the medium term, i.e., some months after impact.

Table 2: Shock-specific monetary policy responses

	Aggregate demand shock	Aggregate supply shock
Eonia response	+9 [+7 , +11]	−3 [−8 , +3]
… due to output	+6 [+2 , +9]	−7 [−10 , −3]
… due to prices	+3 [0 , +6]	+4 [+1 , +7]

Source: Authors' own elaboration.

Note: Median impact response of Eonia to a one-standard-deviation shock in basis points; in brackets: 68% credible sets.

Armed with this knowledge about the interest rate setting behavior of the ECB, we now turn to the recent past. We first analyse to which extent aggregate demand and aggregate supply shocks shaped the period since 2020. We will then use the estimated shock series to derive a structural forecast of output and consumer prices based on the baseline mode, i.e., pre-pandemic estimates. We analyse how Eonia would have evolved and estimate the effects of actual monetary policy and of non-cyclical factors for the development of output and prices since 2020. Based on our findings, we draw conclusions for current and future monetary policy.

3.3.   The economy since 2020

Extending the estimation period beyond 2019 leaves the estimated shock series until 2019 essentially unchanged: The correlation of the series until 2019 in the extended sample and the original series is 81% for aggregate demand shocks and 93% for aggregate supply shocks. That means that the baseline and the extended model identify the same shocks and that they are comparable with each other.

A remarkable result of the extended model is that the occurrence of very large shocks[7] intensified considerably since the outbreak of the pandemic. 57% of all very large demand shocks since 1999 and 83% of all very large supply shocks occurred between March 2020 and March 2022. The largest demand and supply shocks struck in March and April 2020. While the simultaneous occurrence of negative demand and adverse supply shocks at the start of the pandemic kept inflation in check, it slashed real output dramatically. On the other hand (and in contrast to previous crises), economic activity rebounded quickly. The negative aggregate demand effects were compensated already in the first half of 2021. From then on positive demand impulses prevailed.

Even more impressive than the very large negative demand shocks at the start of the pandemic is the simultaneous occurrence of very large adverse supply shocks. While the size of the supply shock in March 2020 was already unprecedented, in April 2020 it more than doubled compared to March. On the one hand this pattern might be partly spurious in the sense that due to forced lockdowns output declined much stronger than prices, which shows up as adverse supply shock. On the other hand, the outbreak of the pandemic and the related large-scale worldwide shutdowns mark the birth of supply chain disruptions, which perfectly fits the notion of marked adverse supply shocks. While, like aggregate demand shocks, a large part of these early supply shocks were compensated soon, further

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[7]   "Very large" means larger than two standard deviations of the shock series.

adverse supply shocks followed. The simultaneous occurrence of large positive demand shocks and large adverse supply shocks since the second half of 2021 was associated with a dramatic surge in consumer price inflation.
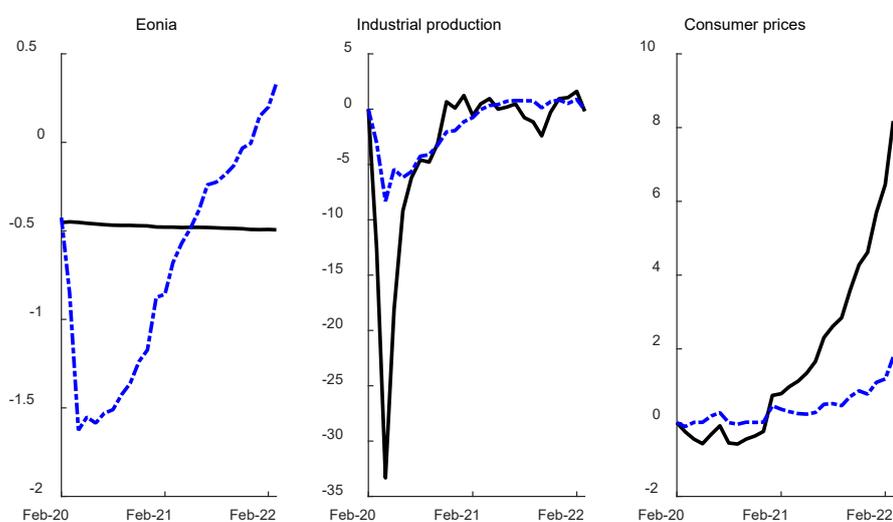
3.4. Structural scenario forecasts

To examine how monetary policy would have been set according to the monetary policy rule that we estimated up until 2019, we perform a structural scenario forecast. That is, we apply the median impulse responses of the original (pre-pandemic) model to the median shocks estimated for the last two years and calculate hypothetic paths of the variables at hand. This helps us to assess, first, to which extent deviations from the estimated monetary policy rule affected economic outcomes and, second, to which extent these outcomes are due to cyclical shocks on the one hand and non-cyclical factors on the other hand. Figure 6 shows the structural scenario forecast based on the median impulse responses from the baseline model and the median aggregate demand and aggregate supply shocks estimated for the last two years (using the extended model). The simulated data (dot-dashed blue lines) is compared with the actually realised paths (solid black lines).

It turns out that the ECB was significantly restricted from below in setting interest rates when the pandemic-induced crisis hit the euro area. According to the estimated policy rule, Eonia (and, hence, the deposit facility rate) should have been at times more than 100 basis points below its actual level. The lower bound forced the ECB to be overly restrictive for a considerable period of time. If it would not have been constrained from below, it would have started to hike rates (from a very low level) already in early 2021 and would have increased the policy rate to 80 basis points above its actual level in March 2022.

Figure 6 also shows the simulated and actual paths of real activity and inflation, both measured in deviation from their pre-crisis, i.e., February 2020, levels. The simulated paths suggest that the output loss in 2020 and the price surge since 2021 would have been much milder than they actually were. In order to assess the role of monetary policy for these hypothetical favourable paths, we simulate monetary policy shocks that bring Eonia back to its realised values over the whole forecast horizon.

Figure 6: Pandemic shocks based on pre-pandemic economy
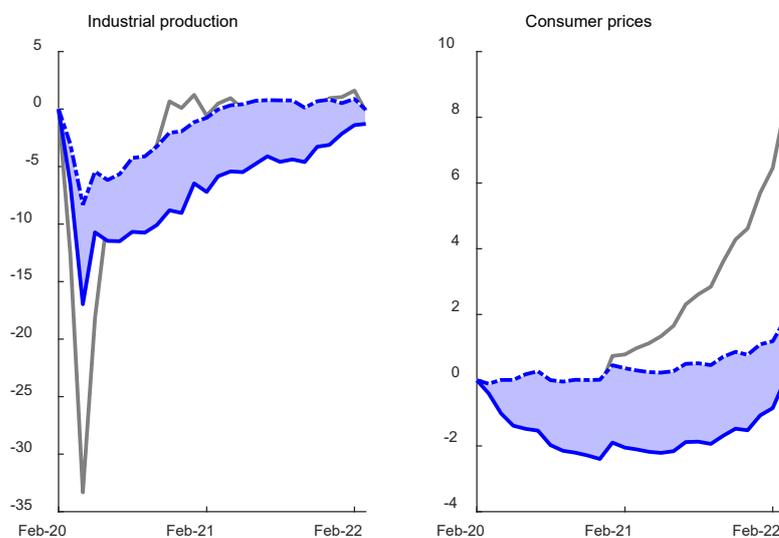

Source: Authors' own elaboration.

Notes: Dot-dashed blue lines are structural scenario forecasts based on the model estimated up to 2019. Solid black lines are realised data. Industrial production and consumer prices are in %-deviation from its February 2020 levels.

3.4.1. The effects of monetary policy

In this scenario, monetary policy shocks are calibrated to match Eonia's actual path over the forecast period (Figure 7, while in the other scenario monetary policy shocks are set to zero). We know from the impulse response analysis that this implies lower output and dampened inflation for the period in which monetary policy was constrained from below. But two further interesting observations emerge from Figure 7. First, overly tight monetary policy explains only a fraction of the tremendous decline in real activity during the first wave of the pandemic.

Second, the disinflationary effect of previously tight monetary policy persisted far beyond the period of constrained monetary policy and until today (although the estimated monetary policy rule would have implied swift and significant rate hikes since early 2021). That means that by remaining inactive (and, hence, loose) regarding interest rates in recent months, the ECB has only compensated for the dampening effects of its (presumably involuntarily) tight policy stance in the months before. This is in line with evidence that the ECB and other central banks attempt to correct past policy failings (see, e.g., Paloviita et al., 2021). It can also be understood in light of the revised ECB strategy, published in 2021, which binds the ECB more clearly to a symmetric inflation target and, hence, might at times permit higher inflation following a period of below-target inflation.

Figure 7: Actual versus unconstrained monetary policy

Source: Authors' own elaboration.

Notes: Dot-dashed blue lines are structural scenario forecasts with unconstrained monetary policy, solid blue lines are structural scenario forecasts with simulated actual monetary policy. The blue shaded areas are the estimated effects of actual monetary policy. Gray solid lines are realised data. All values are in %-deviation from February 2020 levels.
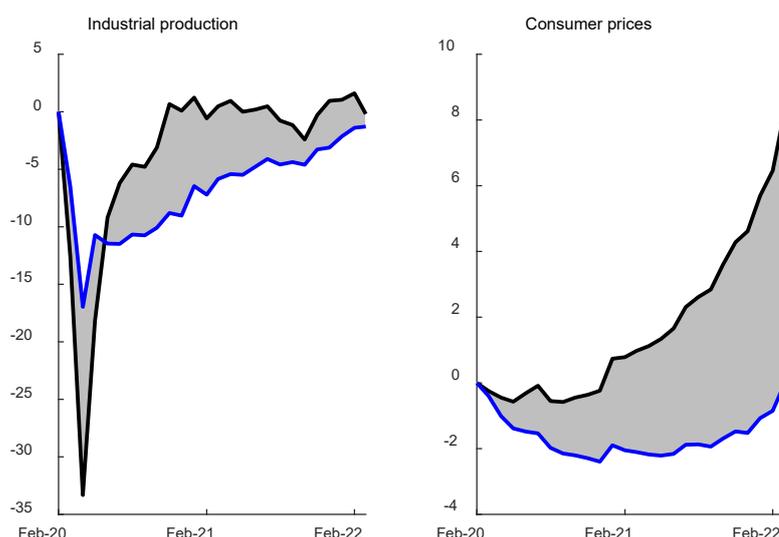
3.4.2. The effects of non-cyclical factors

So, if monetary policy does neither make up for the 2020 output loss nor for the 2021 and 2022 price surge, what does? Our model gives an indirect, yet clear answer to this question. Neither monetary policy nor the estimated (size of) demand and supply shocks can explain these phenomena (see Figure 8). Concerning real activity, not only the huge decline in output but also its rapid rebound remains unexplained. The most obvious candidate cause for this pattern of output is the deliberate and enforced nature of the downturn.

Shutdowns pushed real output far lower than "usual" negative shocks of the estimated size would have. By the same token, they prepared for an equally strong rebound when the social distancing measures were lifted. The pandemic-specific nature of the recession did not have longer lasting effects on the level of output. If anything, output recovered much faster than it would have if the economy had been hit by the same adverse shocks in an "usual" (i.e., non-pandemic) environment.

This might in part also explain the behavior of prices: The rapid surge in inflation is almost exclusively due to non-cyclical factors (Figure 8, right hand-side). It might result from the unusually swift rebound in economic activity taking place amid severe structural distortions that shutdowns and social distancing brought along for world trade and global supply chains, as discussed in Section 2.

Figure 8: Non-cyclical factors

Source: Authors' own elaboration.

Notes: Solid blue lines are structural scenario forecasts with simulated actual monetary policy. Solid black lines are realised data. The grey shaded areas are the estimated effects of non-cyclical (i.e., pandemic-related) factors. All values are in %-deviation from February 2020 levels.

4. CONCLUSIONS

In response to the environment of heightened inflation in recent months, the European Central Bank has taken steps to signalise it will start adjusting its monetary policy and reacting to the ongoing price pressures by using its conventional and non-conventional measures (Lagarde 2022)[8]. PEPP has ended in March 2022. APP will end at the beginning of Q3 2022. Some time after that, the first interest rate hike is expected.

The ECB's inaction so far on interest rates can be understood as offsetting the macroeconomic effects of its (presumably involuntary) tight stance in the first year of the pandemic. As the gap between the price paths given by the estimated policy rule and actual monetary policy (Figure 7, right hand-side) might close soon, the ECB will return to its usual monetary policy rule. This does not imply that interest rates will rise considerably, however, because the euro area is more exposed to adverse supply shocks than to favourable demand-side shocks since the outbreak of the Ukraine war, as summarised in Section 2. Headline inflation is currently a poor guide for monetary policy as it is still partly driven by structural pandemic-related distortions and cannot by easily tamed by the ECB unless it is willing to orchestrate a significant economic downturn. As this would only add further distortions to an already battered world economy, current seemingly runaway inflation should better be tackled at its root by resolving global supply chain distortions.

In the current highly uncertain situation, the ECB has taken the correct approach to favour gradualism and optionality. The interest rate path in the coming months should be driven by the further developments in terms of economic losses from the ongoing geopolitical instability and should be data driven. While at first inflation has been expected to be transitory and induced by external factors, a broadening of inflation has been observed lately. European inflation will continue to be determined by the factors discussed above – and their relative contribution towards overall inflation might change. Optionality also means that the ECB would not exclude even more aggressive measures, including 50 basis points interest rate increases, similar to the ones taken by the US Federal Reserve, if it recognises in the coming months that inflation is accumulating or broadening. This approach of constructive ambiguity could contribute also to partly tightening financing condition due to risk premia rising, which might be a beneficial development since it would lead to a tightening of credit and therefore dampening of inflation in the medium run.

In regard to ensuring price stability in the medium run, policymakers will also have to closely follow how inflationary expectations are evolving as a key component for the assessment on the stance of monetary policy. Inflation expectations anchored at 2% in the medium run is a major condition for the central bank to credibly achieve its target. And vice versa – the central bank is taking risk for its further monetary policy stance if inflation expectations de-anchor. It will need to act more aggressively if that happens and would therefore dampen demand considerably more to bring inflation back to the anchor. Available data from the Survey of Professional Forecasters (SPF) so far does not indicate de-anchoring of inflation expectations in the euro area (Lane, 2022). Inflation expectations have nevertheless been revised upwards and are now near the 2% target or even slightly above, after having fluctuated below it for a considerable period in the past decade (Figure 10). It is unclear whether inflation expectations will stay at this new level or will continue increasing – this will depend on the further steps of the central bank and its credibility. Inflation is also gaining attention in the wider public,

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[8] At the time of writing of this paper, a first interest rate increase by the ECB is expected to take place in July 2022.

as can be easily observed from Google Search data. Figure 11 documents the frequency of Google Search for the word "inflation" in the top 4 European economies.

In taking their decisions in the coming weeks and months, the Governing Council of the ECB will therefore need to take into account a number of crucial factors to evaluate the further path of interest rates and the unconventional toolkit:

- Data on realised inflation and the differences between traditional headline HICP and core inflation as measurements of inflationary and signal of broadening of inflation. Furthermore, developments regarding demand for goods consumption versus consumption of services should be followed to evaluate whether the phenomenon of reallocation of demand from services to goods was temporary or would become more embedded and persistent.

- Wage developments will have to be followed closely by the central bank to evaluate how the labour market evolves, whether wage pressures are still mild or begin to increase and whether this signals to risks of the development of a wage-price spiral, which requires monetary policy action. The role of European trade unions here will be crucial, as the possibility of wage adjustments to be compensated by one-off energy compensation by government might be central to hinder a wage-price spiral from starting[9].

- Inflation expectations as measured by the SPF.

The central bank would thus need to find the right balancing act between dampening inflation without hampering economic growth and tightening financial conditions too fast in terms of financial stability perspective.

On the other hand, the ECB asset purchase programmes would continue to be available and can be further used again if any risk of market fragmentation starts to materialise in the euro area. In their latest design, they should enable a composition of asset purchases with more flexibility, which could address any evolving fragmentation in the euro area which could hinder the effective transmission of monetary policy. Even though financial stability risks have only mildly increased after the onset of the war, a careful monitoring of such risks would be needed and national macroprudential policies should be used to counteract any risks from materialising or amplifying further.
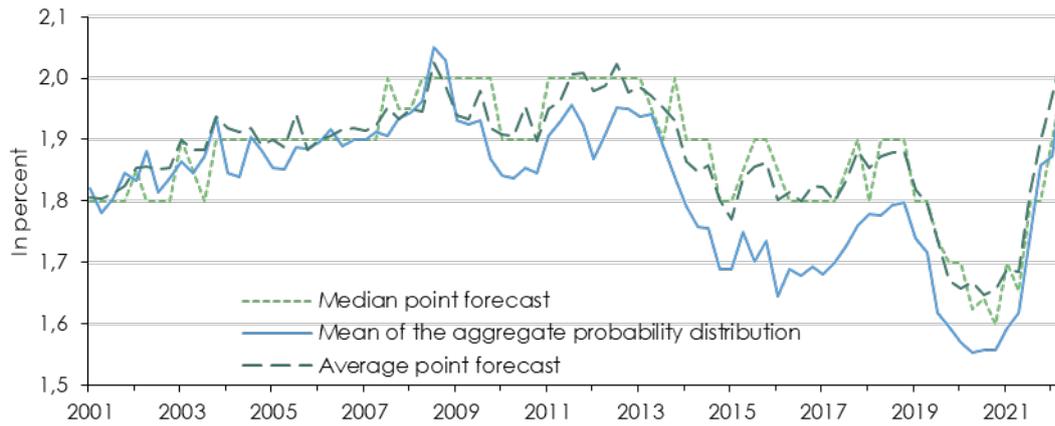
Figure 9: SPF on inflation, euro area
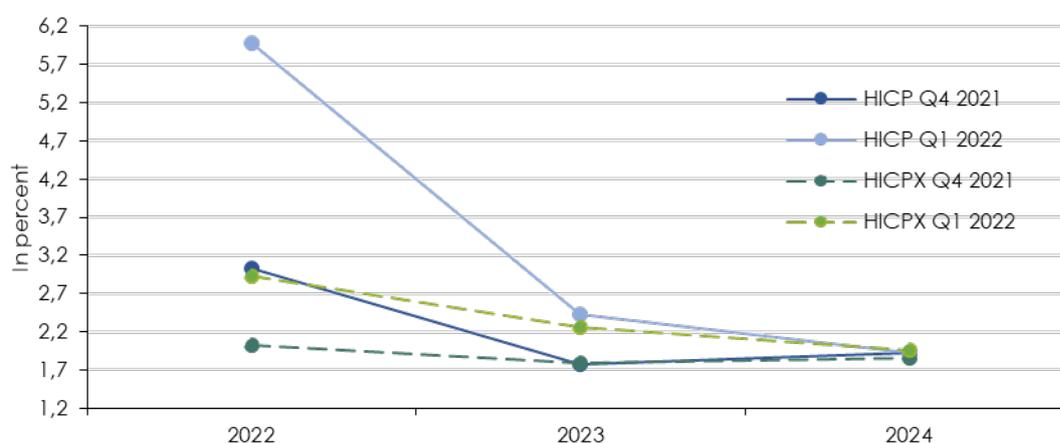
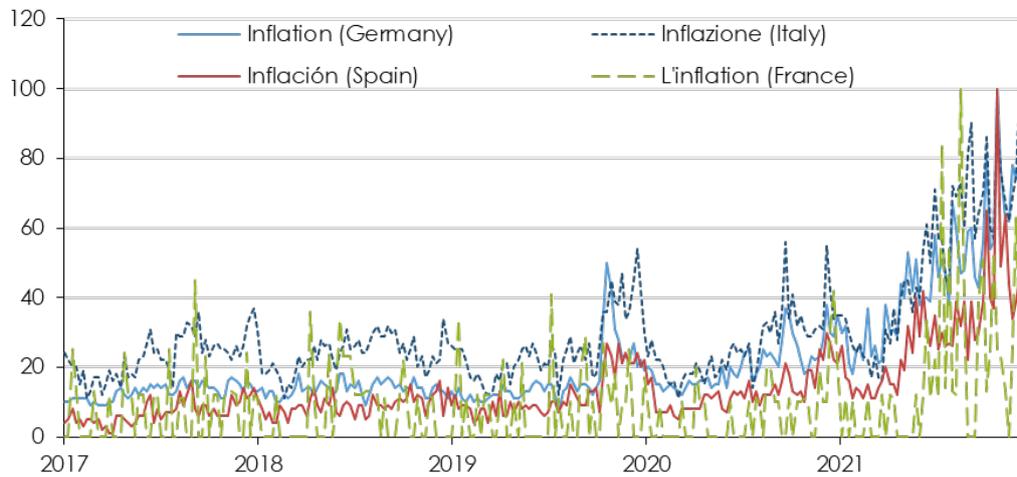Source: ECB Survey of Professional Forecasters (SPF).

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[9] For more on this, see Blanchard-Pisani-Ferry (2022).

Figure 10: Long-term inflation expectations

Source: ECB Survey of Professional Forecasters (SPF).

Figure 11: Google searches for the word "inflation" in Germany, France, Italy and Spain

Source: Google Trends. Country specific search for the word "inflation".

Notes: The values indicate the search interest relative to the highest point in the chart for the selected region in the specified period. The value 100 represents the highest popularity of this search term.

QUESTIONS FOR THE DISCUSSION

- Why did the ECB decide on following the sequencing approach?

- Would it have been possible to start with interest rate increases even before the end of QE and APP and what would have been the consequences?

- Would the APP retain the flexibility in the capital key that was embedded in PEPP?

- Does the ECB have an assessment on whether the reallocation of demand from services to goods that took place during the pandemic is transitory or expected to be more permanent?

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Amidst an already heightened inflation environment, the repercussions of the war in Ukraine resemble a macroeconomic supply-side shock which puts monetary policy in a challenging situation. The ECB faces a difficult trade-off and needs to find the right balance between dampening inflation and sustaining economic growth. Our empirical estimates suggest that the ECB is presently not overly loose relative to its historical monetary policy record and that current inflation cannot be easily tamed by monetary policy alone.

This paper was provided by the Policy Department for Economic, Scientific and Quality of Life Policies at the request of the Committee on Economic and Monetary Affairs (ECON) ahead of the Monetary Dialogue with the ECB President on 20 June 2022.