MONETARY POLICY AND SUPPLY SHOCKS:

THE ROLE OF INFLATION EXPECTATIONS

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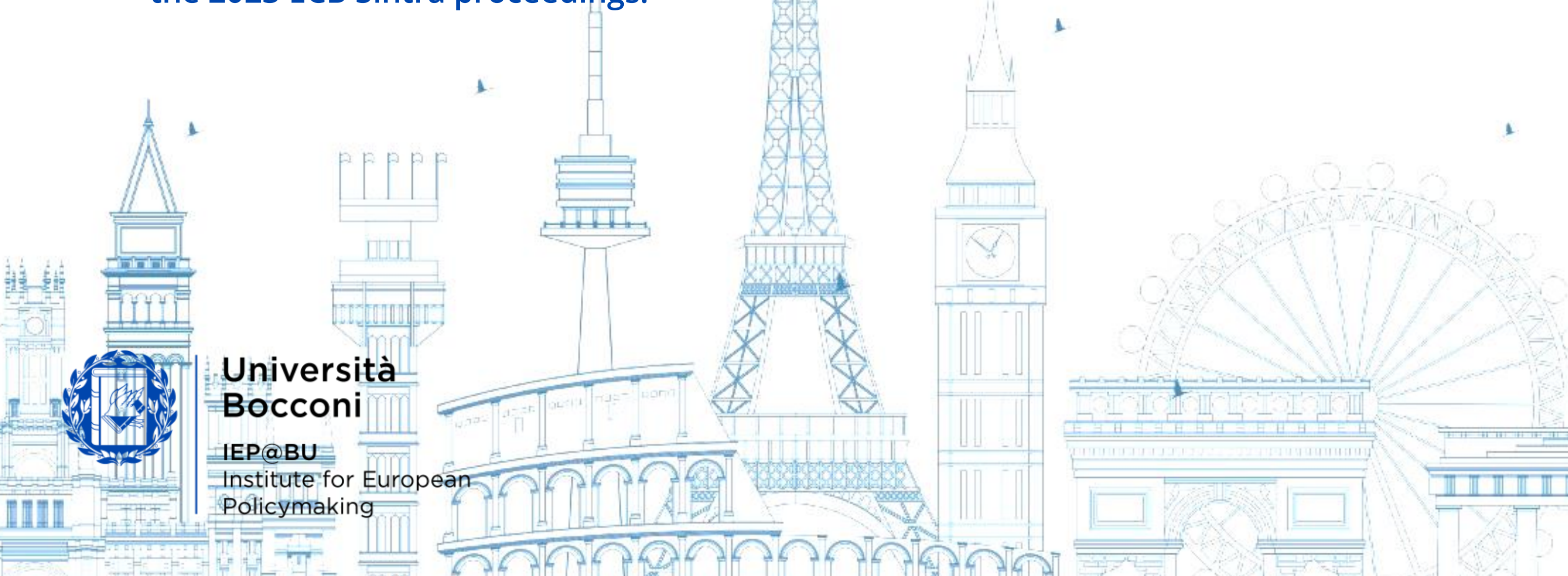

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Introduction

In the discussion on monetary policy in the presence of supply shocks, we focus on the Euro area to understand the recent wave of inflation. Given that the impact of shocks, and the appropriate monetary policy response, depend on two important parameters such as wage rigidity and the degree of financial constraint on households, it is useful to look at the evidence on these parameters.

We show that real wages have been surprisingly flexible downwards and that excess liquid savings have been mostly spent by now. At the same time, the shocks that have contributed to inflation have now reversed with energy prices going back to the pre-war level.

Additionally, we explore the role of inflation expectations, which track the past energy price shocks quite tightly and seem to be scarcely influenced by monetary policy. Thus, most of the inflation cost-push shocks have been temporary in nature, suggesting that inflationary pressures should soon abate.

Finally, we provide a transatlantic perspective to check whether the shocks were similar and could thus account for the similarity in the evolution of inflation.

ANALYZING THE SHOCKS

Real wages and the 2022 energy price shock

The impact of an adverse energy price shock depends on the degree of real wage rigidity. A wage-price spiral would start if workers do not accept a cut in real wages. Chart 1 below thus shows the evolution of real wages in the US and the euro area over a longer period of time, to allow for a comparison of the reaction of real wages between 2022/3 and previous shocks.

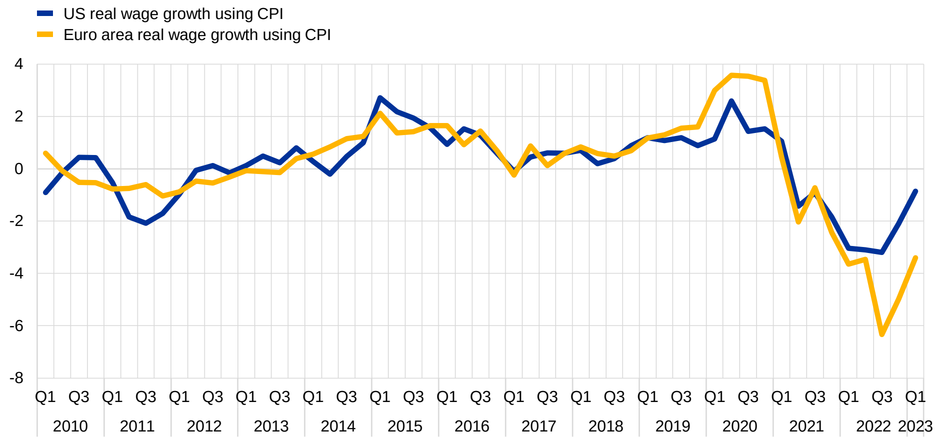
Panel a deflates wages by the CPI; this represents the point of view of workers. Panel b deflates wages with the GDP deflator to provide the perspective of producers.

It is apparent that real wages fell considerably under either measure and that the decline was much larger than at any other time over the previous decade. Chart 1 also shows that real wages fell more in the euro area than in the US, especially by using consumer prices as a deflator, which makes the real loss in purchasing power more biting for households.

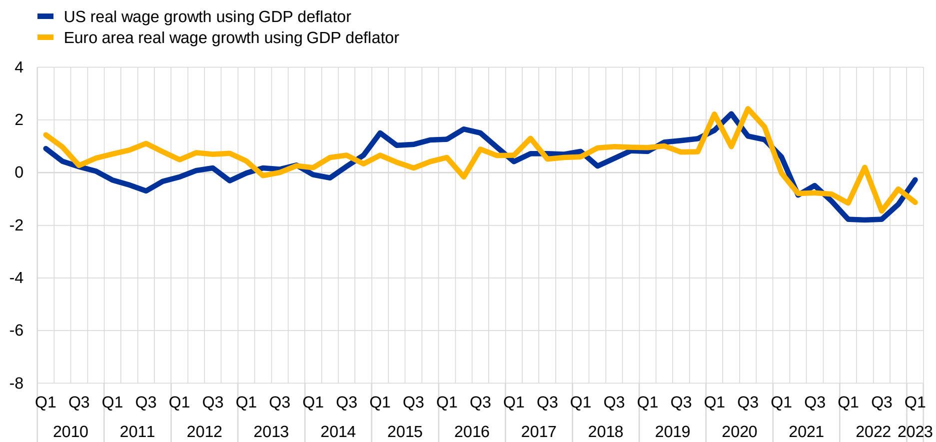
This difference in the evolution of real wages is compatible with the path of the terms of trade presented later on in the paper.

Chart 1
Real wage growth in the Euro area and in the USA

a) CPI real wage growth: euro area vs. US
(percent change compared to previous year)



b) GDP deflator real wage growth: euro area vs. US
(percent change compared to previous year)



Sources: own calculations based on Eurostat data.

Financially constrained households

It is not straightforward to determine what share of households are financially constrained. Some studies have focused on accumulated savings during the Covid-19 period and found that households in the euro area still have a considerable amount of excess savings (de Soyres et al., 2023).

We use a narrower indicator, namely bank deposits, because that is the part of savings that would be easiest to use to finance consumption.

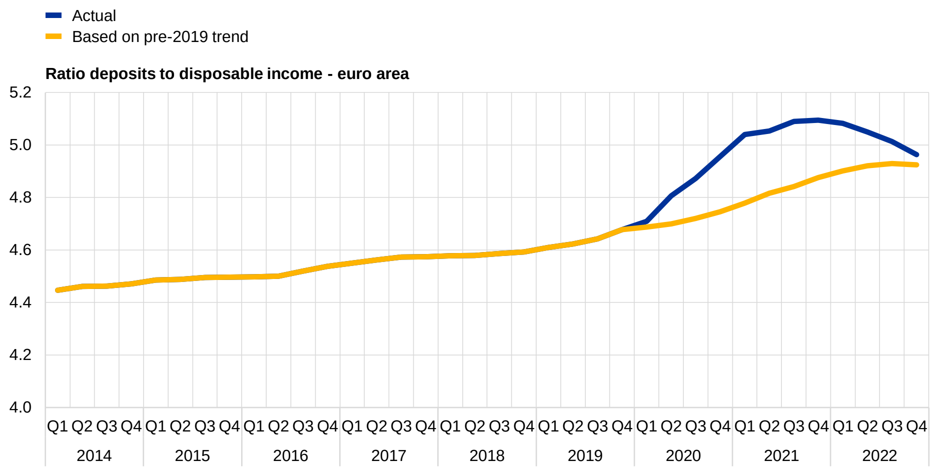
Other forms of savings, like investment in investment funds, bonds, shares might also be relatively easy to liquidate, but the fact that that savings have been put in these securities suggests an intention to keep them set aside for longer, whereas balances in bank accounts are likely kept there to be immediately available.

Chart 2 below shows the ratio of bank deposits to disposable income as well as the line that results from just extrapolating the pre-Covid trend until 2023.

It is apparent that actual balances rise considerably above the trend line. By the end of 2021, the difference is equal to 0.4, or 40% of disposable income. However, most of this large excess liquidity has apparently been reabsorbed. By early 2023 the difference has shrunk to close to zero.

This would indicate that monetary tightening has again become an effective instrument and that one should expect an increasing impact of the higher policy and market rates on demand from now on.

Chart 2
The Euro Area has seen a temporary rise in deposits



Sources: own calculations based on ECB data.

THE NATURE OF THE SHOCKS

In addition to the energy price shock, another shock played an important role in 2022: the delays in the production of many goods due to bottlenecks in the supply of intermediate inputs. We will now briefly analyse two aspects for both the energy price and the supply chain shock, namely whether these shocks were temporary and whether they were exceptional.

The literature usually focus on how monetary policy should react to permanent shocks. This is natural given that most models imply that monetary policy should not react to temporary shocks. Moreover, one could argue that energy prices are a random walk and that one must thus assume that any increase (or fall) is permanent.

In the following sections we document that the 2022 energy price shock(s) turned out to be temporary and that its macroeconomic impact was almost the opposite in the euro area from that in the US. This is intriguing given the similarity in inflation patterns and casts doubt on the hypothesis that inflation was caused by a common energy price shock.

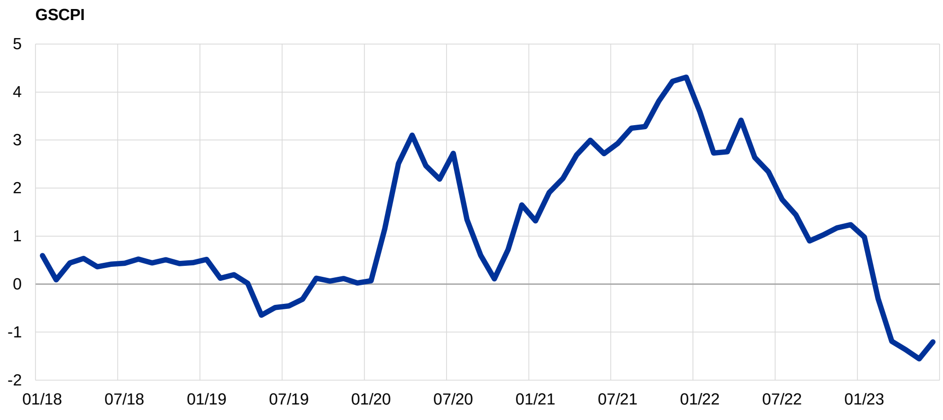
Moreover, we also document that the supply chain shock turned out be temporary and could have been expected, ex ante, to have been temporary.

Supply chain shock

The Federal Reserve of New York has developed a composite indicator of supply chain pressures whose evolution is presented below. The simple, but important, message from Chart 3 is that supply pressures are back to normal. This was thus a temporary shock.

Moreover, one could argue that this should have been expected ex ante: the supply chain difficulties arose from a surge of spending on goods that came with the recovery from the Covid-19 recession after lockdowns had depressed spending artificially.

Chart 3
Global Supply Chain Pressure Index (GSCPI)
(standard deviations from average value)



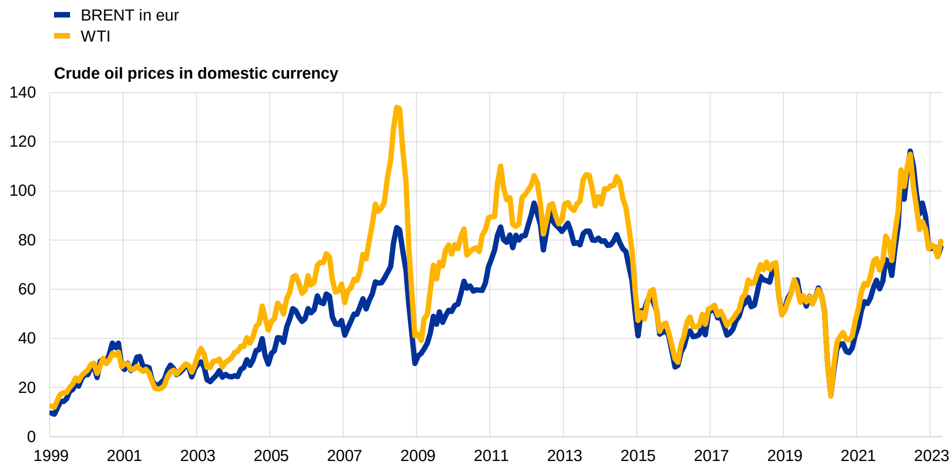
Sources: Federal Reserve Bank of New York

The second aspect, namely whether the shock was exceptional can be answered by considering the scale of the chart, which is in standard deviations. The value reached in 2022 were about 4 standard deviations outside the previous experience, indicating a really exceptional event.

Energy shock: crude oil

The energy price shock of 2022 should be decomposed into two separate elements of a different nature that had a different impact in the euro area and the US, namely the prices of crude oil and natural gas. The difference in their impact arises from the fact that oil prices are the same across the Atlantic, but there are huge differences in the price of natural gas, that should be expected to have an important difference in the dynamics of inflation.

Chart 4
Crude oil prices in the EU and USA



Sources: Trading Economics

The price of crude oil jumped when Russia invaded Ukraine in early 2022 because it was feared that Western sanctions would lead to a restriction in the supply of Russian oil to the market. These fears abated soon, and by early 2023 the standard gauges like Brent or WTI were back to the pre-war level. The short spike is visible at the right-hand end of chart 4 below which shows the prices of crude oil relevant for the US and the euro area, namely Brent in euro and the WTI in US dollars.

The chart shows again the longer-term evolution to provide an indication of whether this shock was exceptional. This does not appear to have been the case since both the level reached at the peak and the speed of the increase can be observed in previous episodes of oil price peaks, e.g. in 2008 and 2011-12. The level reached by June 2023 was not only slightly below the pre-war value, but also very close to the previous multi-year average.
The visual evidence of the chart can be buttressed by a simply calculation. Since 1999, the standard deviation of annual percentage changes in the oil price was around 36(%) for both the WTI and Brent in euro.

The observed maximum increase in the oil price in 2022 was 66% at the peak of the oil in the summer of 2022. This is about 1.8 times larger than the standard deviation and thus cannot qualify as an exceptional event, also because similar price spikes (in percentage terms) occurred in early 2000, 2017 and 2021.

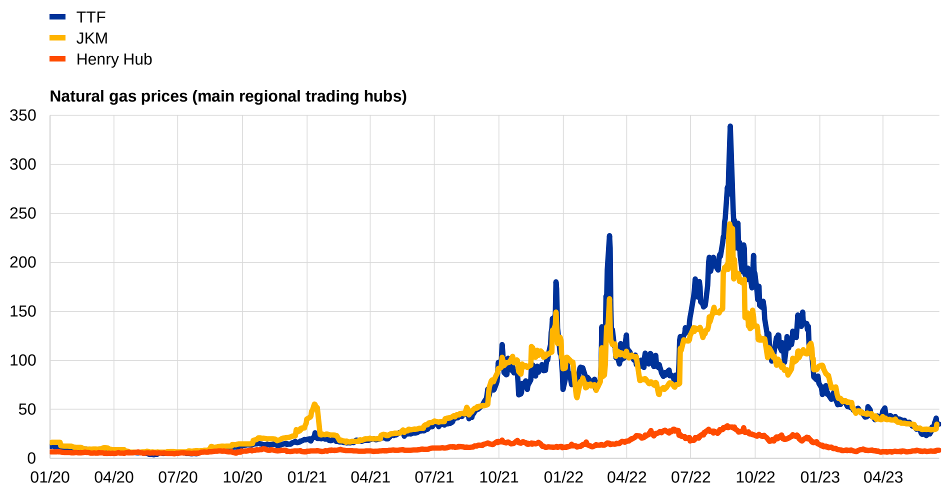
The fact that previous oil price spikes were similar to the one of 2022, but were not associated with a noticeable spike in inflation, makes it difficult to argue that the present level of inflation could be due to an energy price shock. This observation applies even more strongly to the US because of the difference in natural gas prices that we now turn to.

Energy shock: natural gas

The market for natural gas is much less integrated than that of crude oil because transport costs are much higher for natural gas and pipelines create regional markets.

Chart 5 shows that, in recent years, European (TTF) and Asian (JKM) spot prices were linked whereas the US (HH) seems to follow a totally different time path, remaining much lower. However, the chart shows that even in Europe the price of natural gas is back to the pre-war level, but still remains above pre-Covid averages.

Chart 5
Natural gas prices in the main regional hubs
(EUR/MWh)



Sources: Trading Economics

A first aspect to emerge from this pattern of natural gas prices is that for the United States the energy price shock consisted only of a temporary increase in oil prices at the pump whereas in Europe natural gas prices play an additional important role.

The gyrations of the European spot price for natural gas translate only slowly and gradually in the prices paid by consumers because retail prices for gas are regulated and many consumers have long-run fixed price contracts, see Gros and Shamsfakhr (2022).

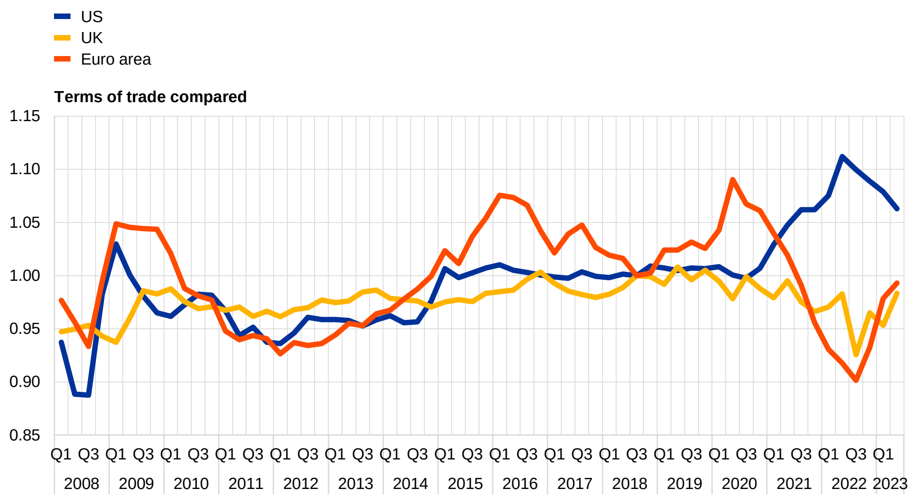
Both the rise and then the fall of natural gas spot prices should thus be expected to have only a delayed impact on headline inflation. However, this does not change the conclusion that, in the medium run perspective which the ECB should adopt, the energy price shock is mostly temporary.

The macroeconomic impact of energy prices: the terms of trade

For a net importer of energy, any increase in energy prices represents a loss of income since the country has to pay more for its imports whereas export receipts might not go up. The loss of income is measured by the terms of trade. Figure 6 below thus shows the terms of trade for the US and euro area. The UK is also included.

The chart below shows that the energy price shock of 2022 led indeed to a major loss in the terms of trade for the Euro area, a loss that was accentuated by the temporary gain experienced in 2020 when oil prices briefly touched record lows. By contrast, the US experienced a substantial terms of trade gain.

Chart 6
US, UK and Euro Area terms of trade as a ratio of export to import unit prices



Sources: Eurostat

The impact of the loss in terms of trade for income in the Euro area can be calculated easily. The fall in the terms of trade of the euro area ('peak to trough') was about 15 percentage points.

This should be multiplied by the weight of trade in goods as a share of GDP, which is about 20%, yielding an income loss of (at its peak) 3% of GDP. The deflationary impact of an adverse energy price shock for an energy-importing country was thus large.
However, about two thirds of the loss of terms of trade of the euro area were recovered by early 2023. This implies that going forward, the normalization of energy prices should provide a positive impulse to demand.

The US, as a net exporter of energy, is in a quite different situation. As the chart shows, it experienced a significant improvement in the terms of trade in 2022, which should have reinforced any existing domestic inflationary pressure.

HOW TO EXPLAIN STICKY INFLATION WITH TEMPORARY SHOCKS

A temporary supply shock should leave the price level unchanged in the long run. This should happen even if, or particularly when, monetary policy does not react to the shocks. With shocks that turn out to be temporary, the price level should first increase and then fall.

In practice, this means that inflation should at first be higher than the canonical 2% target and then dip below that target. But this does not seem to be the case in both the US and the euro area.

The staff forecast of the ECB of June 2023 implies that the cumulative increase in the price level from 2022 until end-2024 will be about 16%, 10 percentage points higher than that implied by an average inflation rate of 2%.

One could of course argue that there are major asymmetries that imply that prices do not behave the same when energy prices go up than when they go down. However, it is not clear what these asymmetries could look like in practice in this instance.

Real wage rigidity has so far not been a problem, as documented above. And while there might be a need for some prices to fall when energy prices go down (even under a 2% inflation target), there is no sign that the downwards rigidity of nominal wages plays any role at present, or will do so any time soon.

One potential asymmetry that is seldom considered is that of monetary policy. The 2022 energy price shocks were preceded in 2020 by a short-lived fall in energy prices which put downward pressure on consumer prices. Central banks might have overreacted to this deflationary shock when they engaged in additional bond purchases on a large scale.

The delayed effects on inflation of these measures then came not only in 2021 when energy prices had recovered to the pre-Covid level, but also in 2022 when energy prices increased even further. In 2021-22, central banks might have been slower and less determined to react on the upside than they were on the downside in 2020.[1]

[1] As a contribution to the Sintra Forum of 2022, Di Giovanni et al. (2022), found that supply shocks explain 40-50% of inflation in Eurozone; with rapid impact on the way up. The question one must ask is whether this should also be the case on the way down.

Shifts in expectations

Given the importance of the energy price shock for Euro area inflation, as documented above, and given the important role of inflation expectations for monetary policy emphasized in economic theory, we test the interconnection between these variables for the euro area in a simple structural vector autoregression (SVAR).

We use quarterly data from the European Central Bank's consumer expectations survey, our own calculation of real GDP using Eurostat's nominal GDP and the GDP deflator, the OECD's energy CPI and core CPI inflation, the ECB's policy rate, and the Wu-Xia estimate for the ECB's shadow rate.

This latter variable, the shadow rate, is a measure of the central bank policy rate that is adjusted to take into account also unconventional monetary policy. It is particularly useful to assign value to monetary policy when the economy is at the zero lower bound.

The baseline ordering of the variables in the VAR we perform is the following: energy CPI, consumers' expectations, ECB shadow rate, core CPI, and finally real GDP. We use a Cholesky decomposition to estimate the structural shocks, thus our assumption is that energy prices are exogenously identified and not influenced by other shocks within the model. Then: expectations are only influenced contemporaneously by the energy price shock but not other variables; the ECB shadow rate responds contemporaneously to energy price shocks and expectations but not other variables; and so on. In the appendix, we provide a clearer mathematical representation of this structure.

Since we use quarterly data and our sample size is not too large, we set the number of lags to 4, thus corresponding to one year prior. However, in the Appendix we provide additional estimations also using 6 and 8 lags.

With a similar procedure, we also compare this estimation to an alternative one where, instead of consumers' expectations reacting to energy CPI, we include the one-year inflation expectations of professional forecasters and have them react to the Brent oil price change instead of the energy CPI price change.

Using these approaches, we test for different scenarios and present here the main results. In the Appendix, we show alternative scenarios using different variables, different time frames, or different orderings of the variables.

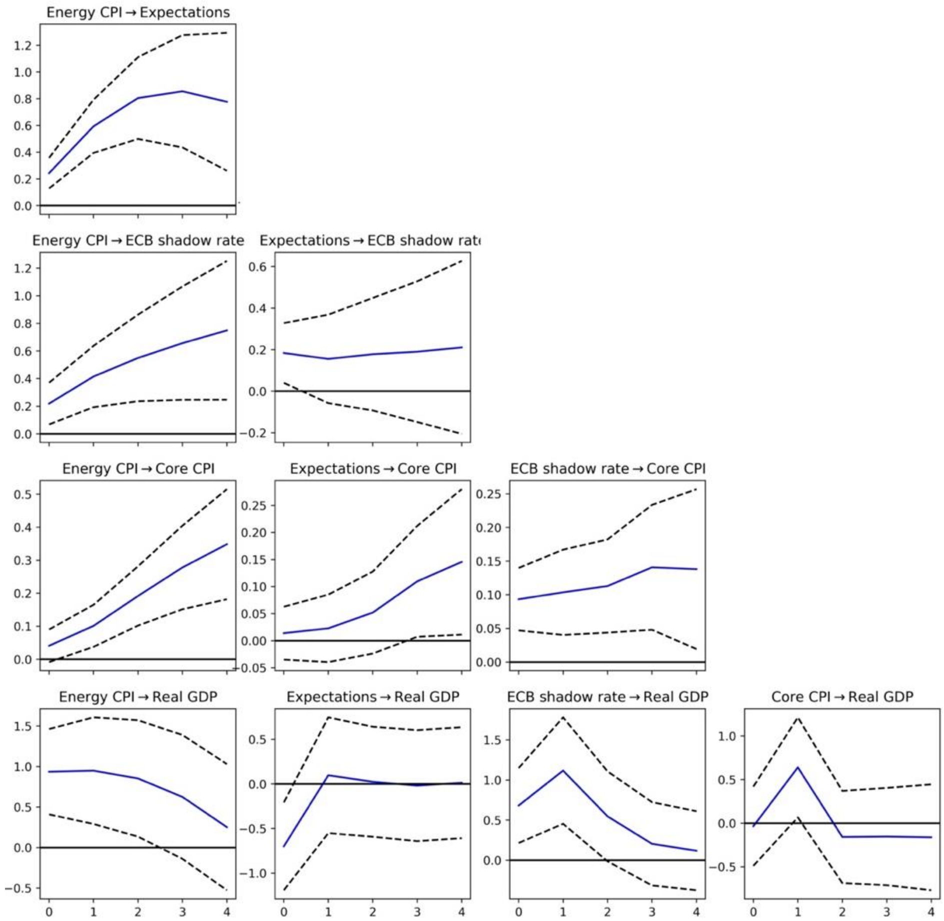
Consumers' expectations: full sample 2004-2023

The first and baseline estimation that we perform focuses on the expectations of consumers on the prices for the following 12 months, and we use the full sample available for the ECB's

Consumer Expectations Survey from 2004 until the first quarter of 2023. The resulting impulse response functions, corresponding to one standard deviation shocks for each variable, are shown below.

Chart 7

IRF's using consumers expectations, full sample 2004-2023
(standard deviation responses following a one-standard deviation shock)



Sources: own estimation using Eurostat, ECB, and OECD data.

As one can easily see, a one-standard-deviation rise in the energy CPI raises expectations quite strongly, peaking after 3 quarters with almost one full standard deviation rise in expectations. The energy CPI shock also leads to a response by the ECB and a smaller one in magnitude by core inflation.

Expectations influence rather little the ECB shadow rate, only in the very short term, and have a small delayed effect on core inflation; interestingly, as in Tanreyro et al., a rise in expectations is associated with a reduction in real GDP, thus suggesting that indeed households might associate higher inflation with a negative effect on their income. Finally, the ECB's response seems to have less of an effect on core inflation than it does on real GDP, which declines approximately one year after monetary tightening.

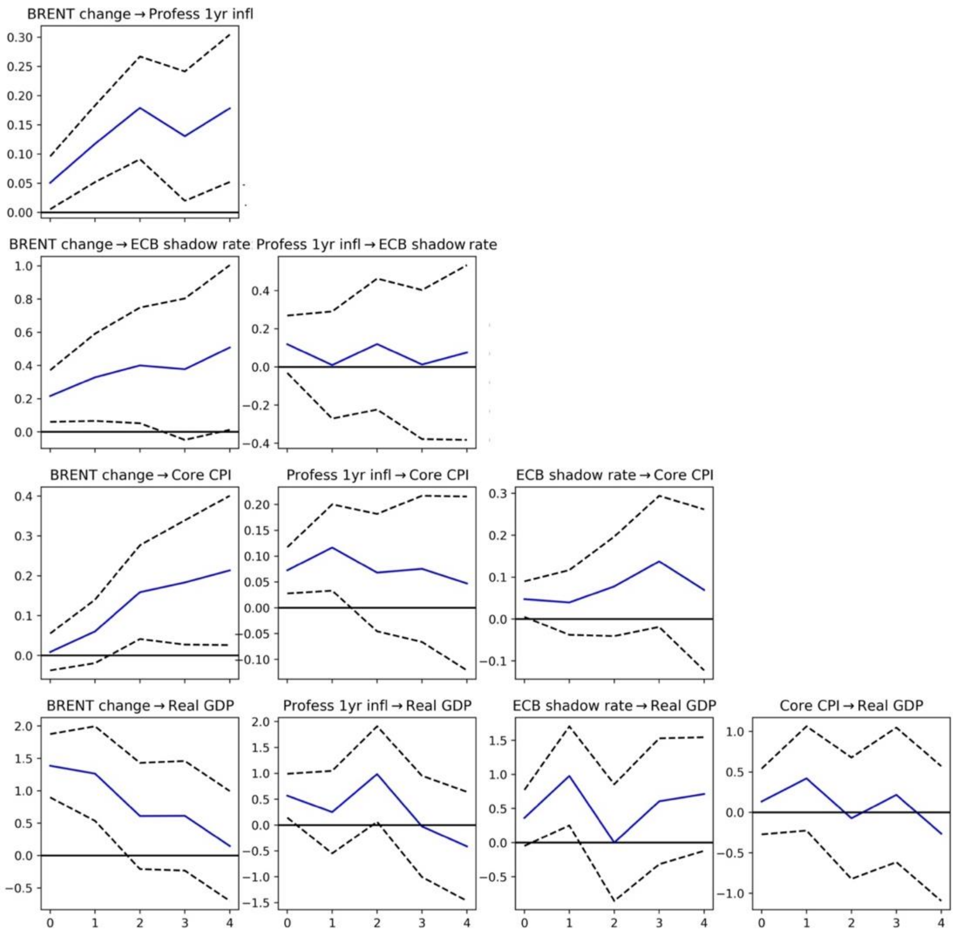
Professional forecasters' expectations: full sample 2004-2023

We run similar estimation using professional forecasters' 1-year expectations instead of consumers' ones, and substituting a measure of energy CPI with changes in the Brent crude oil price, to which professionals might react more strongly. The results are the shown in the Chart below.

Chart 8

IRF's using professional forecasters expectations, full sample 2004-2023

(standard deviation responses following a one-standard deviation shock)



Sources: own estimation using Eurostat, ECB, and OECD data.

As the figure shows, a rise in the price of oil leads to expectations of inflation by professional forecasters, while it has a more noisy (although positive) effect on both the ECB's response and core inflation. Expectations in this case are reflected more rapidly albeit briefly onto core inflation, while their impact on the ECB's response and on GDP is insignificant.

Robustness checks

Since our estimation relies on the assumptions implicit in the ordering of variables in the vector autoregression, in the Appendix we compare our baseline with the results from other estimations where the variables are arranged in a different order.

As impulse response functions are often employed to estimate the effects of monetary policy, we show below the effect of energy shocks in an ordering that prioritizes the monetary response, allowing for a contemporaneous effect of the ECB rate on all variables other than energy prices. Alternatively, we estimate the IRFs for a differently ordered vector, where we now allow monetary policy to react to core inflation while only influencing GDP contemporaneously.

In both cases, the effects aren't very different from those reported in the baseline estimation. Finally, we run different estimations with the following modifications with respect to the baseline: including only the pre-covid periods, using the actual ECB's policy rate rather than the shadow rate, estimating with longer lags (6 and 8 periods, respectively), and including other variables such as gas prices for professional forecasters.

The resulting impulse response functions are shown in the Appendix: with more lags or including only the pre-2020 observations, the error bands become larger as there is less precision in the estimation; however, our main results broadly hold. The same can be said for the use of the policy rate instead of the shadow rate.

CONCLUSION

In this brief analysis, we have shown that real wages in the euro area have been surprisingly flexible downwards in the face of the energy price shock and that excess liquid savings from Covid support measures have been mostly spent by now.

At the same time, most of the shocks that have contributed to inflation – some global such as the supply chain shock or the oil price shock, some idiosyncratic such as the gas price shock and the resulting deterioration in the terms of trade – have now reversed with energy prices going back to the pre-war level. Thus, most of the inflation cost-push shocks have been temporary in nature, suggesting that inflationary pressures should soon abate.

Additionally, we have explored further the role of inflation expectations, both by consumers and by professional forecasters, which seem to track the past energy price shocks quite tightly and are scarcely influenced by monetary policy.

Naturally one cannot expect to see core inflation tracking energy prices instantaneously. Most likely, we can expect to see core inflation following energy prices with a lag and with some added stickiness. The disinflation process will also be affected by the delayed effect of the switch from extraordinary Quantitative Expansion (QE) to Quantitative Tightening (QT) in

2021/2 (Gros, 2023). Since monetary policy works with long and variable lags one would expect the switch to QT to start having a disinflationary impact by end-2023.

The main conclusion is that monetary policy should see through temporary shocks and that in the face of unprecedented shocks old rules of thumb no longer work (Galeone-Gros, 2023). Taking into account the regime shift induced by the unprecedented energy price increases of 2022 remains the main task for the ECB.

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APPENDIX

Appendix A1: estimation of the SVAR

In the SVAR estimation, we call our vector of variables:

$$y_t = [y_{1,t}, y_{2,t}, \dots, y_{n,t}] = [\pi(\text{energy})_t,\ \pi_t^{exp}, \text{ECB shadow } i_t, \pi(\text{core})_t, \text{GDP}_t]$$

We wish to estimate the structural VAR: $B_0 y_t = B_1 y_{t-1} + \dots + B_p y_{t-p} + w_t$
from the reduced form: $y_t = A_1 y_{t-1} + \dots + A_p y_{t-p} + u_t$,

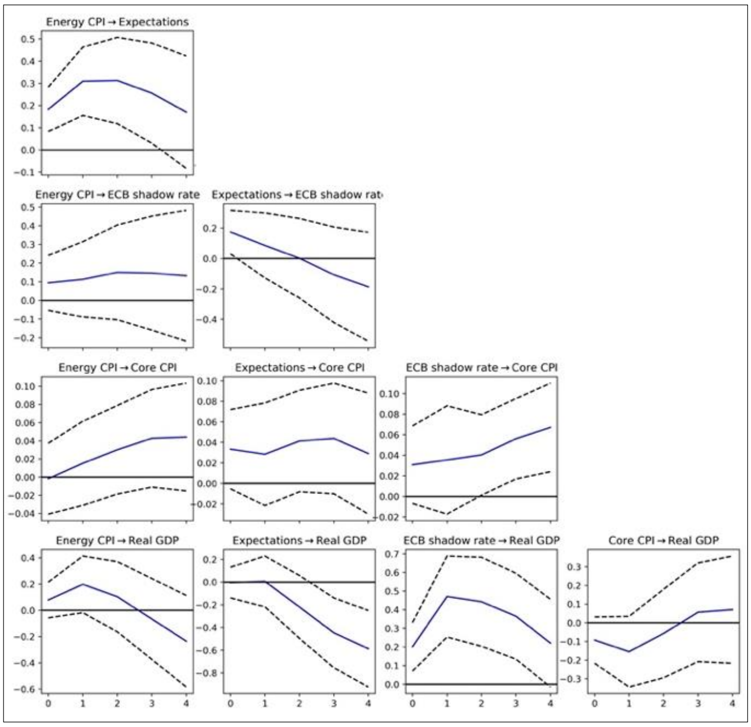
where w_t is the vector of mutually uncorrelated i.i.d. structural shocks, $u_t = {B_0}^{-1} w_t$, and $A_i = {B_0}^{-1} B_i$ for $i = 1, \dots, p$.

Then we are imposing that the matrix ${B_0}^{-1}$ is lower triangular or, in other words, that the variable y_i reacts contemporaneously only to shocks of y_k for $k < i$ according to the ordering of y_t.

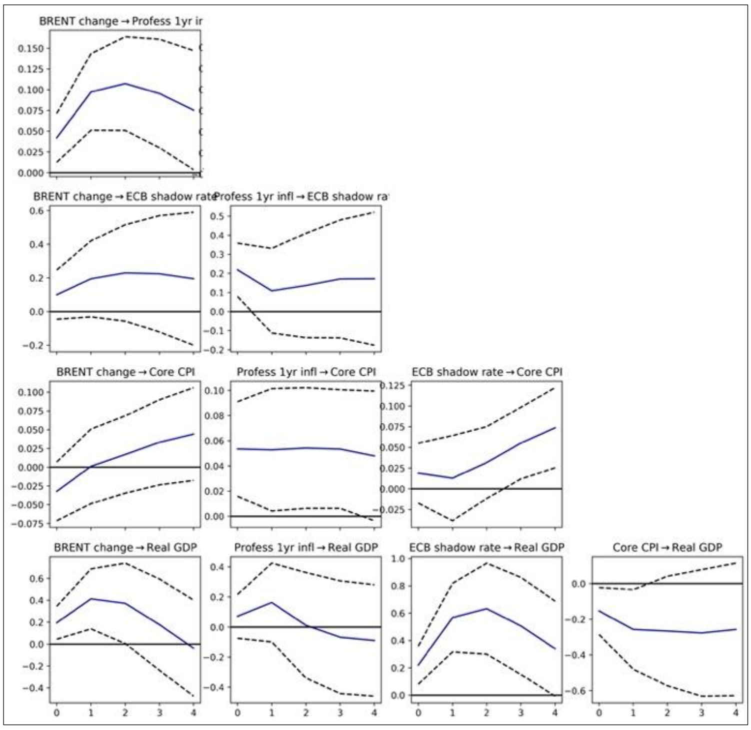
Appendix Chart A1

IRF's using only pre-Covid period, sample 2004-2019

a) Consumers



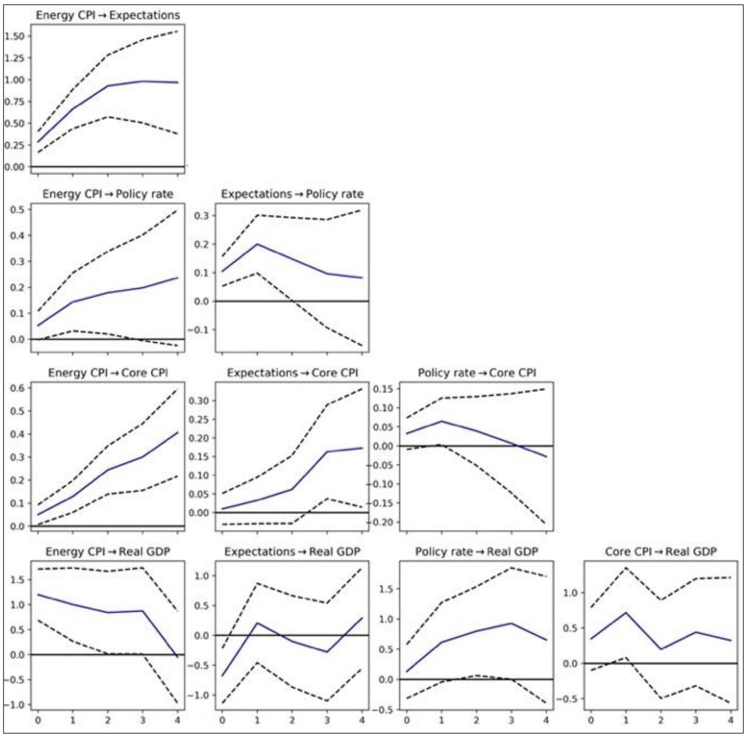
b) Professional forecasters



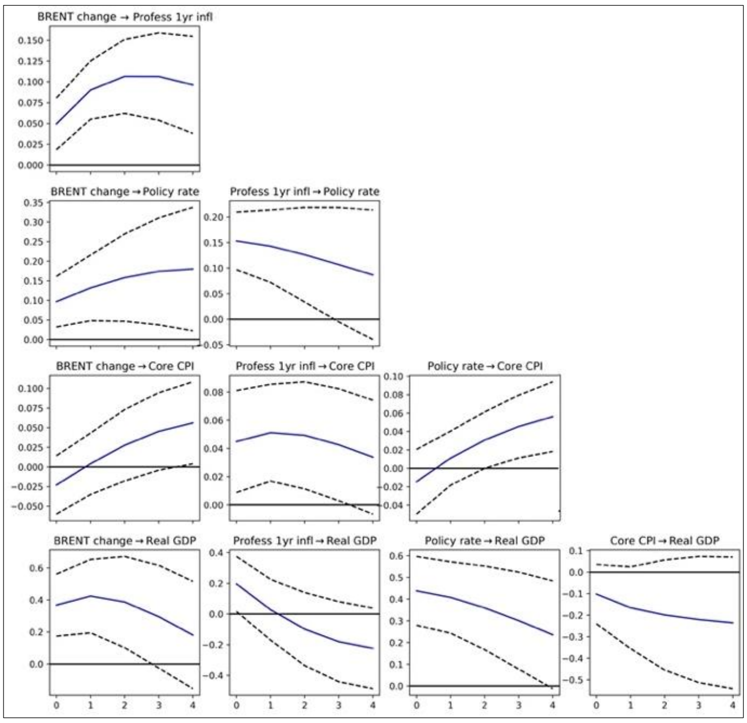
Appendix Chart A2

IRF's using actual policy rate instead of the shadow rate

a) Consumers



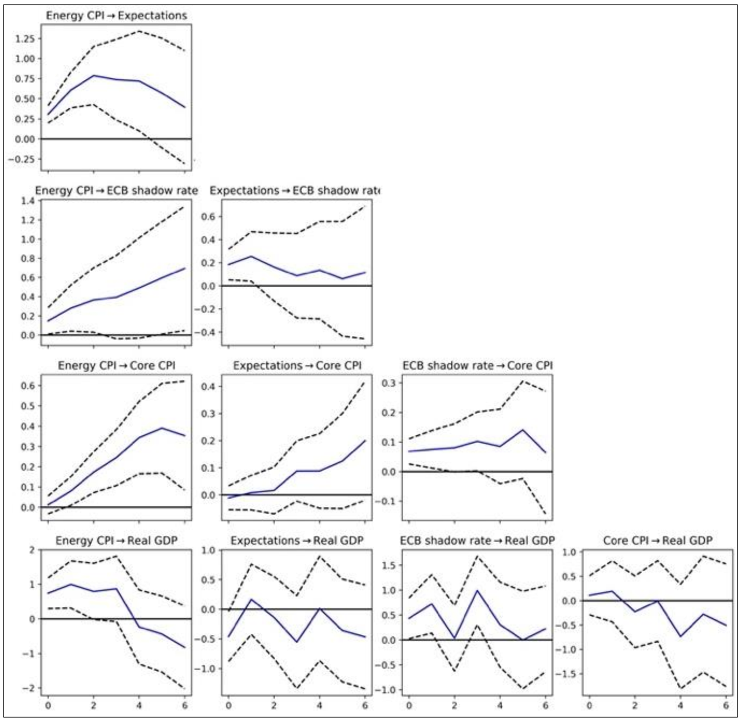
b) Professional forecasters



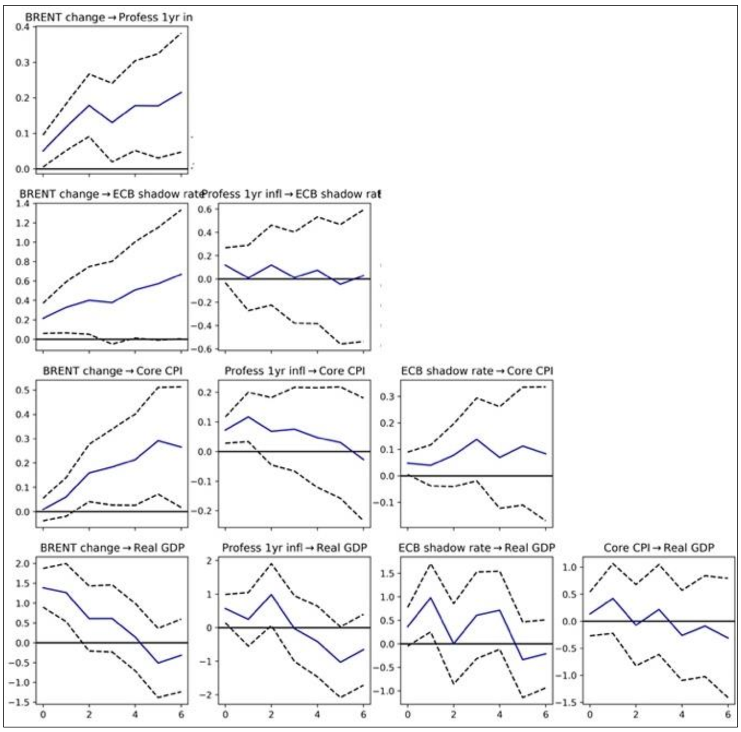
Appendix Chart A3

IRF's calculated using 6 lags

a) Consumers

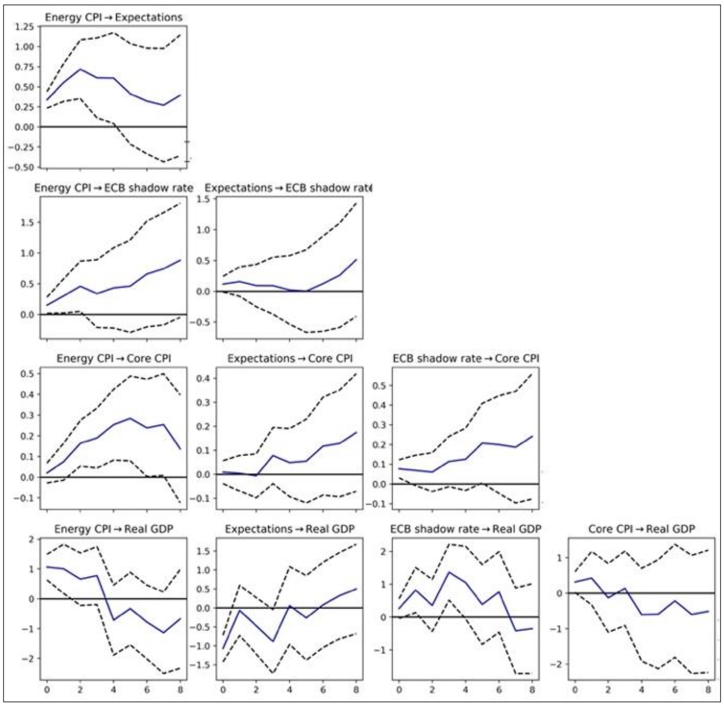


b) Professional forecasters

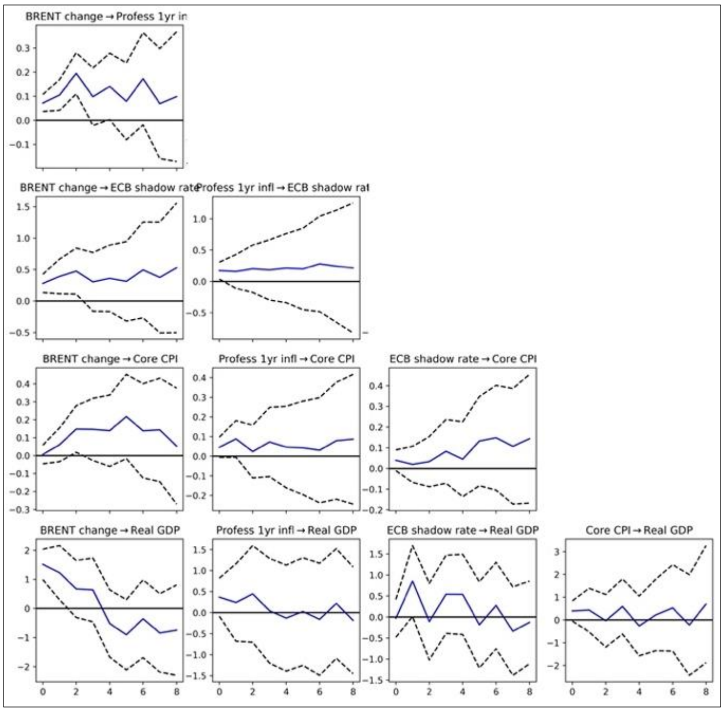


Appendix Chart A4
IRF's calculated using 8 lags

a) Consumers

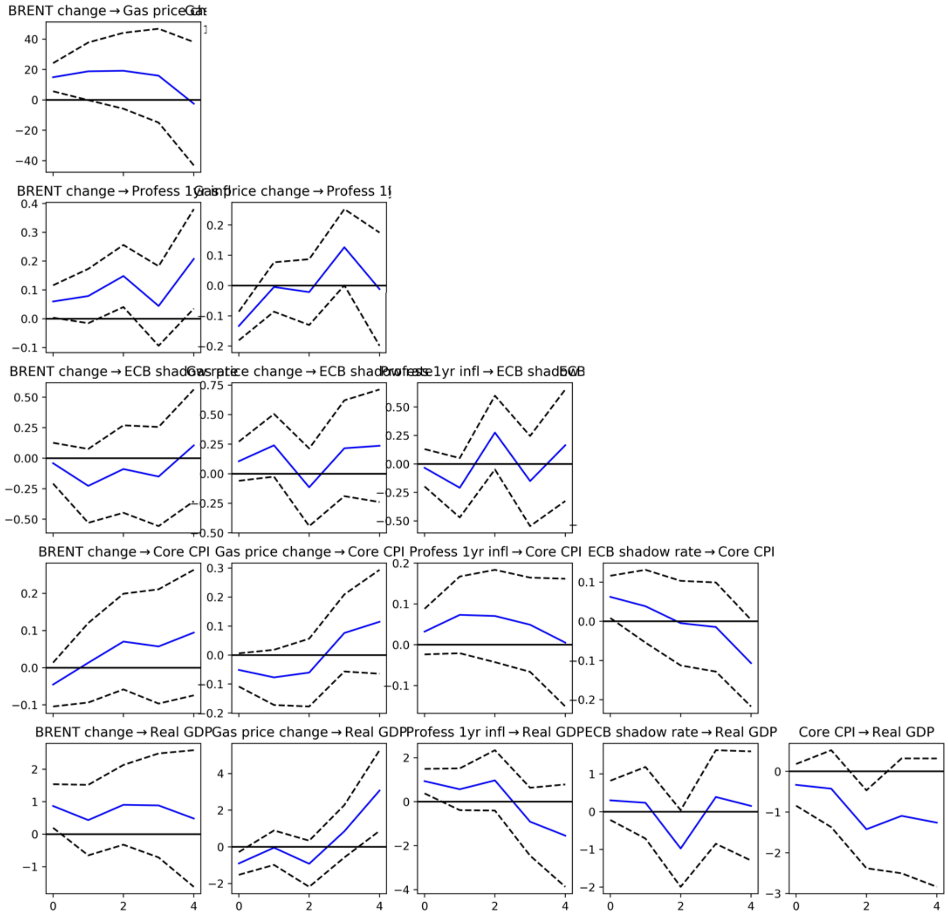


b) Professional forecasters



Appendix Chart A5

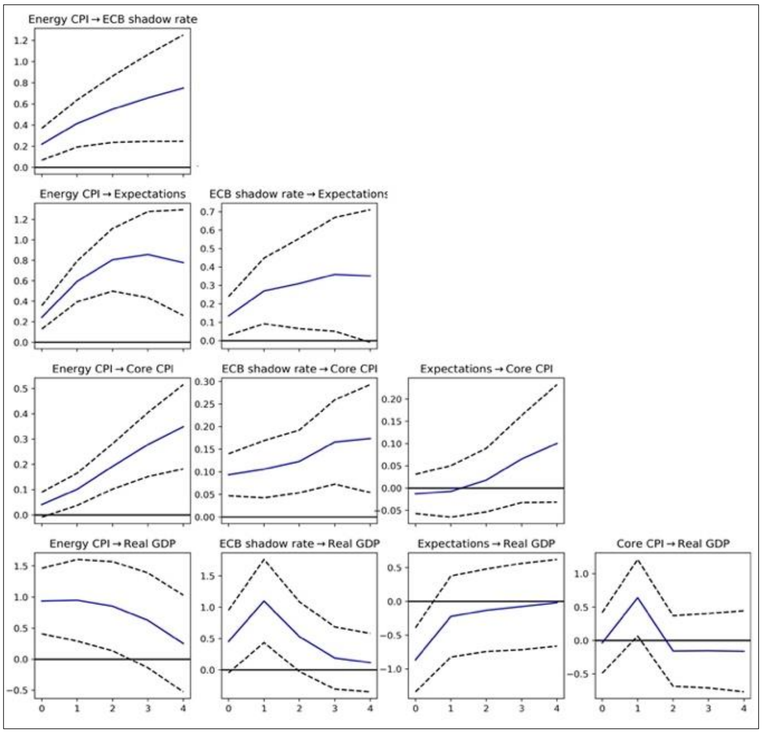
IRF's including gas prices for professional forecasters



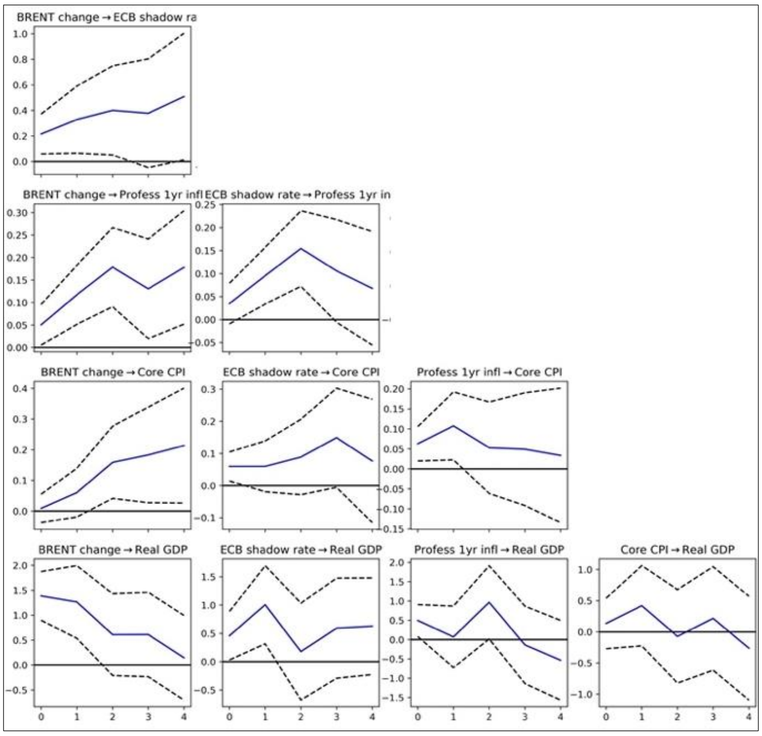
Appendix Chart A6

IRF's following a different vector ordering, full sample 2004-2023

a) Consumers



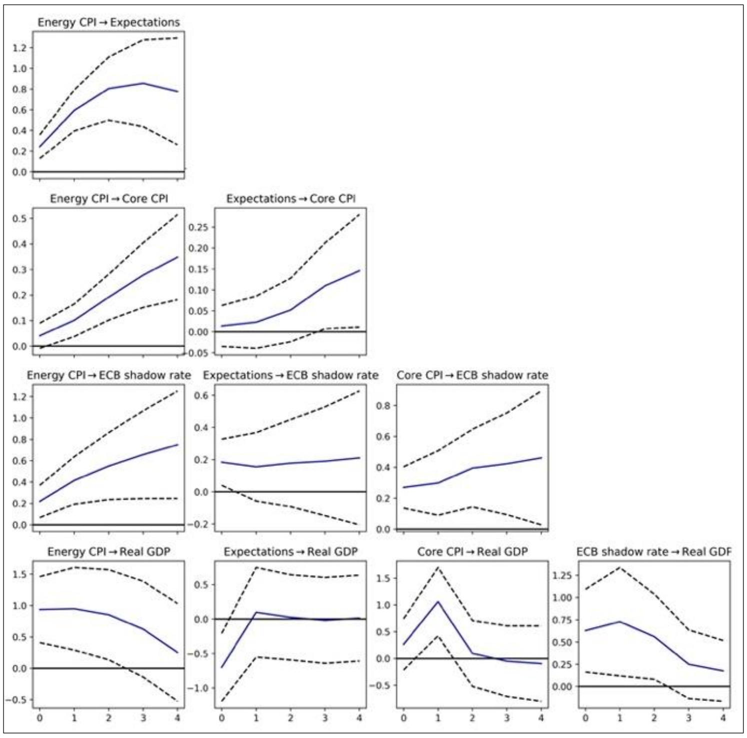
b) Professional forecasters



Appendix Chart A7

IRF's using a different vector ordering, full sample 2004-2023

a) Consumers



b) Professional forecasters