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Do all oil price shocks have the same impact? Evidence from the Euro Area

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Abstract

In setting policy, central banks need to understand the impact of oil prices on inflation. During the euro area financial and sovereign debt crisis, oil price shocks drove inflation up, while since mid-2014, large negative oil price shocks have contributed to deflationary pressures in the euro area. This Letter considers whether the impact of oil price shocks is different in periods of uncertainty, such as the financial crisis, and whether positive and negative, large and small oil price shocks affect inflation differently. The findings suggest that there are significant differences in the impact in all of these cases; which should be taken into account by policymakers when they are choosing how to respond to oil price shocks.

1 Introduction

The behaviour of inflation in recent years has highlighted the role of oil price shocks. During the euro area financial and sovereign debt crisis, high oil prices pushed up inflation, even as the economy was weakening. As indicated in Figure 1, from mid-2007, when financial market turbulence began to be felt, until mid-2014, oil prices generally rose with the exception of one sharp decline in the immediate post-Lehman period, when the outlook for the global economy deteriorated sharply (and therefore expected demand for oil declined too). In this respect, despite the fragility of the economy, the ECB raised interest rates in July 2008 and July 2011, to control increases in inflation which were largely attributable to oil prices.[2] Figure 1 also shows how oil prices have fallen extremely sharply in the period since mid-2014. Similar to the positive oil price shocks during the crisis; these negative shocks have also been identified as a cause of the current low inflation (ECB, 2016).

It is unsurprising therefore that policymakers are interested in the role of oil price shocks. Indeed, several questions emerge. Specifically, do oil price shocks impact inflation differently during periods of high uncertainty such as the financial and sovereign debt crisis, compared to more tranquil times? Further, do positive oil price shocks, such as those experienced during the crisis, impact inflation differently compared to the negative ones, such as those experienced more recently? Finally, do large shocks, like those experienced since mid-2014, have a different effect compared to smaller ones? In order to answer these questions, Section 2 discusses some of the reasons why oil price shocks may be expected to impact the economy differently in periods of greater uncertainty. Section 3

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[2] See: https://www.ecb.europa.eu/stats/monetary/rates/html/index.en.html

presents evidence of these differing impacts on the economy. Given the types of shocks that the economy experienced during the financial and sovereign debt crisis and in more recent times, this section also considers the differing impact on HICP of positive and negative and large and small shocks. Section 4 concludes.

2 Why might oil price shocks have different effects during periods of uncertainty?

There are a number of reasons why oil prices might affect the economy more severely during a period of high uncertainty such as the financial and sovereign debt crisis, compared to a more tranquil period. As Bloom (2009) points out, when uncertainty is high, businesses are cautious about hiring and investing since it is expensive to reverse these decisions. As a result, firms postpone them until the business climate becomes more certain, resulting in an inefficient allocation of labour and capital. Turning to oil price shocks, a positive price shock will normally lead to a reduction in output by sectors that are energy intensive, increasing unemployment in the short term. In tranquil times, it would be expected that workers laid off in these sectors would find jobs in other, less energy-intensive sectors. However, if the positive oil price shock were to occur in a period of high uncertainty, firms in other sectors would be much more cautious about hiring and the effect on unemployment would be much larger compared to a similar shock in a more tranquil period. In addition, by definition, large shocks raise the volatility of oil prices. Therefore, it is likely that larger oil price shocks will have a more contractionary impact during stress periods, since they add to the general uncertainty of the economy and its outlook, thereby making businesses even more cautious about hiring and investing.

Finally, oil price shocks may have a greater effect in periods of high uncertainty, because it is likely that monetary policy is less effective at these times. As discussed above, uncertainty causes businesses to postpone decisions until the outlook becomes clearer. As such, they are less responsive to changes in the interest rate.[3] Hence, interest rates must respond more aggressively to shocks when uncertainty is high to control inflationary pressures and boost the economy. Under these circumstances, central banks will find oil price shocks more difficult to counteract in high uncertainty periods compared to low uncertainty periods.

3 Effect of oil price shocks

3.1 Do oil price shocks matter more in periods of uncertainty?

I first consider the impact of an oil price shock on output[4], HICP, interest rates, the stock market and economic sentiment, in periods of high and

[3]For a discussion see Bloom (2009) and Aastveit et al., (2013).

[4]Here, industrial production (IP) is used as a measure of output since it is available on a monthly frequency, whereas GDP, for instance, is only available quarterly. HICP, the three month interbank rate (IBR), the Euro stoxx 50 (ESTOXX) and the economic sentiment (ES) indicator are the other variables depicted in the figures.

[5]Specifically, the model used in Section 3.1 is a Bayesian TVAR, which includes, in addition to the variables in Figures 2 and 3 the following variables: producer price index (PPI),nominal effective exchange rate (EER), yield spread (yield) and the eur/usd exchange rate (DXR). The series are in monthly frequency. The estimation period is from 2000 to 2015. I use one lag, as indicated by the Bayesian information criterion (BIC). The model is estimated by implementing a Gibbs algorithm. I use a natural conjugate prior with dummy observations (see Banbura et al. 2010; Blake and Mumtaz, 2012). The TVAR coefficients are drawn from the conditional normal distribution, while the covariance matrix of the residuals is drawn from the conditional inverse Wishart distribution. To sample the threshold variable, I consider a random walk Metropolis Hastings algorithm, which is added as an extra step within the Gibbs algorithm.

[6]The relevant literature has used VAR frameworks to model oil prices with domestic variables in the euro area. For instance, Peersman and Van Robays (2009), examine the macroeconomic effects of different types of oil shocks and the oil transmission mechanism in the Euro Area by employing a structural-VAR with seven variables, without any restrictions imposed on the euro area variables. In addition, Rodrguez and Snchez (2004), much closer to the spirit of this Letter, use Cholesky decomposition to assess the impact of the oil price shocks on a group of endogenous variables in the euro area, which includes: real GDP, real effective exchange rate, wages, inflation, and short and long-term interest rates.

[7]The oil price shock is identified through a standard Cholesky decomposition with IP ordered first, followed by oil prices, inflation measures and interest rate. The ordering is as follows: IP, Oil, HICP, PPI, ES, IBR, Yield, EER, ESTOXX, DXR, VSTOXX. Of course, there are different specifications that have been used in the VAR literature (see for instance, Bernanke et al., 1997 for the US). However, the ordering in this Letter is based on a more recent study by Rodrguez and Snchez (2004) in the euro area. In addition, I experimented with a slightly different ordering structure by changing the order of the last four

low uncertainty. I do so using a threshold vector autoregression (TVAR) method.[5][6][7] The threshold in the model identifies when the economy is in a period of high uncertainty, such as the financial and sovereign debt crisis, and when it is in a more tranquil period.[8][9] This allows us to compare the impact of shocks in both periods. Figure 2 presents the impact of an oil price shock in a tranquil period and Figure 3 shows it in a period of high uncertainty.

As is evident from Figure 2, in a tranquil period, a 3 per cent increase in oil leads to an immediate increase of 0.06 per cent in HICP, as would be expected. Interest rates rise gradually to counteract the rise in inflation; after 10 months the increase is approximately 3 basis points. Despite remaining flat initially, output declines since the cost of production is higher. By the end of the forecasting horizon, output has fallen by 0.1 per cent. Finally, financial markets re-evaluate the earnings prospects of firms, and the stock market begins to decline. Similarly, economic sentiment also declines.

Figure 3 shows the impact of the same shock during a period of high uncertainty. Now, although the immediate increase in HICP is slightly lower compared with the tranquil period, the subsequent increase is stronger, reaching approximately 0.07 per cent after 10 months. Interest rates also react more strongly immediately after the shock, increasing by 3 basis points, compared with the negligible initial increase in the tranquil period. Interestingly, economic sentiment and the stock market begin to decline much more quickly in the stressed period compared to the tranquil period. This indicates that sentiment is more fragile when there is uncertainty, as might be expected. As a result, output declines much more quickly when the economy is stressed than when it is tranquil.[10]

Overall then, there is a significant difference between the impact of oil price shocks in uncertain and tranquil periods. However, as noted previously, the euro area economy has experienced a wide variety of oil price shocks over the period since the start of the financial and sovereign debt crisis. Throughout much of the crisis up to mid-2014 oil price shocks were positive. These shocks were relatively small, however, compared to the negative shocks that have been experienced since then. In both instances, movements in inflation have been attributed to these changes in oil prices. It is therefore interesting to consider the impact of different types of oil price shocks on HICP. I turn to this question in the next section.

3.2 Does the type of oil price shock matter?

I first consider the impact of positive and negative oil price shocks on HICP as summarized in Figure

variables in the system, i.e. exchange rates and stock market indices. Accordingly, I have put together exchange rates (EER, DXR) and stock market indices (ESTOXX, VSTOXX). The results are quite robust in the different ordering.

[8]The threshold variable is the Vstoxx index; which is a measure of uncertainty in equity markets (specifically, the implied volatility of Eurostoxx 50 option prices). This variable is used to identify uncertainty periods in a number of other studies, including Basu and Bundick (2012) and Bonciani and Van Roye (2015). Nonetheless, although it is the standard measure of uncertainty used in the literature, VStoxx represents only the equity market. For robustness, I also used the CISS index, a measure of broader systemic risk in the euro area developed by Hollo et al. (2012), and find no significant difference in the results.

[9]According to some studies (Peersman and Van Robays 2009; Van Robays, 2012), oil shocks can lower economic activity and cause recessions. Therefore, higher oil price movements might cause increased uncertainty, which means that the results might be subject to an endogeneity bias. This Letter takes into account this issue by modelling the threshold variable with a delay parameter equal to two, which means that oil shocks will not cause a regime shift in the same period that the shock hits. Following Van Robays (2012), when the threshold variable is assumed to have a certain delay in determining the regimes, it prevents potential problems of endogeneity between the identified shocks and the regimes. To further examine the robustness of my results subject to an endogeneity bias, I follow Calza and Sousa (2006) and Van Robays (2012) and I model the threshold variable as a moving average process of order four. In this way, I introduce some persistence in the increase of macroeconomic uncertainty before the shock can trigger a regime switch. The results indicate no significant difference in the impulse responses.

[10]This finding is in line with Van Robays (2012), who finds that economic activity in large major economies, reacts more aggressively to oil shocks when uncertainty is already high.

[11]In this section, the model used is a frequentist TVAR. The primary reason for this is that, unlike the Bayesian model, the frequentist model requires no restriction on the symmetry of the impact of shocks, thus allowing positive and negative shocks (or large and small shocks) to impact the economy differently. In addition, this framework allows for the possibility of regime switches after the shock. Specifically, if the economy lies in a low uncertainty regime, an oil price shock might lead to increased uncertainty and then regime-switching can occurs. However, this approach can only handle a smaller number of variables, and I therefore use only output, inflation, interest rates and the threshold variable. All series are in log levels except for interest rate which are in percentages. I do not consider a VAR in differences since it might be mispecified as there are cointegrated variables. The threshold value of Vstoxx is determined by performing a grid search over the possible values of

4 (note that the negative shock has been inverted for comparison).[11] Hence, this figure allows us to contrast the impact of the positive shocks during the crisis compared to the negative shocks experienced since mid-2014.[12] For the first periods following oil price shocks, there is a negligible difference in the size of the effect on HICP. However, it is clear from the Figure that after that period, the negative shock has a bigger impact on HICP such that, after 20 months the impact of the negative shock is 0.20% compared with the 0.15% in the case of positive shock. Overall, this suggests that the negative shocks experienced since mid-2014, may have had a greater role in driving down inflation, than the positive shocks experienced during the crisis had in keeping it up.

Next, I turn to the impact of large and small shocks. Figure 5 shows the impact of large and small positive shocks. Here a large shock is twice as big as a small shock. Initially, a large shock has almost twice the effect on HICP compared to a small shock; approximately 0.09% compared to 0.045% in the first month. However, over time, the large shock has a slightly bigger impact on HICP, such that after 10 months, it is 0.15% higher following a large shock compared with approximately 0.07% following a small shock. Figure 6 depicts the impact arising from large and small negative oil price shocks. The disproportionally greater impact on HICP of a large shock is even more evident here. Together, these findings imply that if policymakers worry about the impact of oil prices on HICP, they will have to respond more strongly to larger oil price shocks, whether positive or negative.

4 Conclusion

The behaviour of oil prices and inflation since the start of the euro area financial debt crisis has prompted much debate. In particular, the role of oil price shocks in maintaining inflation during the crisis, and in pushing the economy into deflation in more recent times, has been much discussed. This is particularly so among policymakers, who are interested in whether oil price shocks impact the economy differently during periods of high uncertainty compared to more tranquil times; but also whether positive shocks affect inflation differently from negative shocks, and whether large and small shocks impact inflation differently.

Evidence in this Letter suggests that there is a considerable difference between the impact of oil price shocks in uncertain and tranquil periods. In particular, the Letter shows that, in response to oil price shocks, output, economic sentiment and stock markets decline much more rapidly when there is uncertainty. In contrast, inflation and interest rates increase more strongly. Considering the type of the shock, the Letter finds that, unsurprisingly, larger oil price shocks have a disproportionally bigger effect on HICP than smaller shocks. Similarly, negative oil price shocks have a bigger effect on HICP compared with positive shocks. Overall, the findings in the Letter suggest that policymakers need to consider not just the economic situation in which an oil price shock is occurring, but also the size and direction of the shock, when choosing a policy response.

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the threshold variable. Consistent with relevant studies (Afonso et al., 2011), and for comparison with the Bayesian VAR used earlier I use only one lag given the low number of observations in the high stress regime.

[12] Figures 4, 5 and 6 show the impact of shocks in high uncertainty periods, as we already know that these are the periods when oil price shocks have the greatest effect.

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Figure 1: Crude oil price in € (2007:01-2015:12)

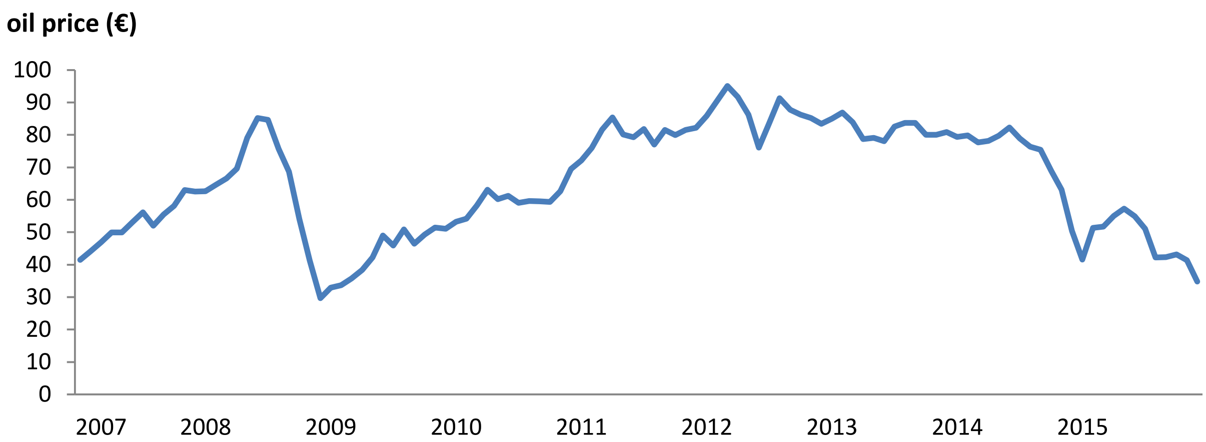
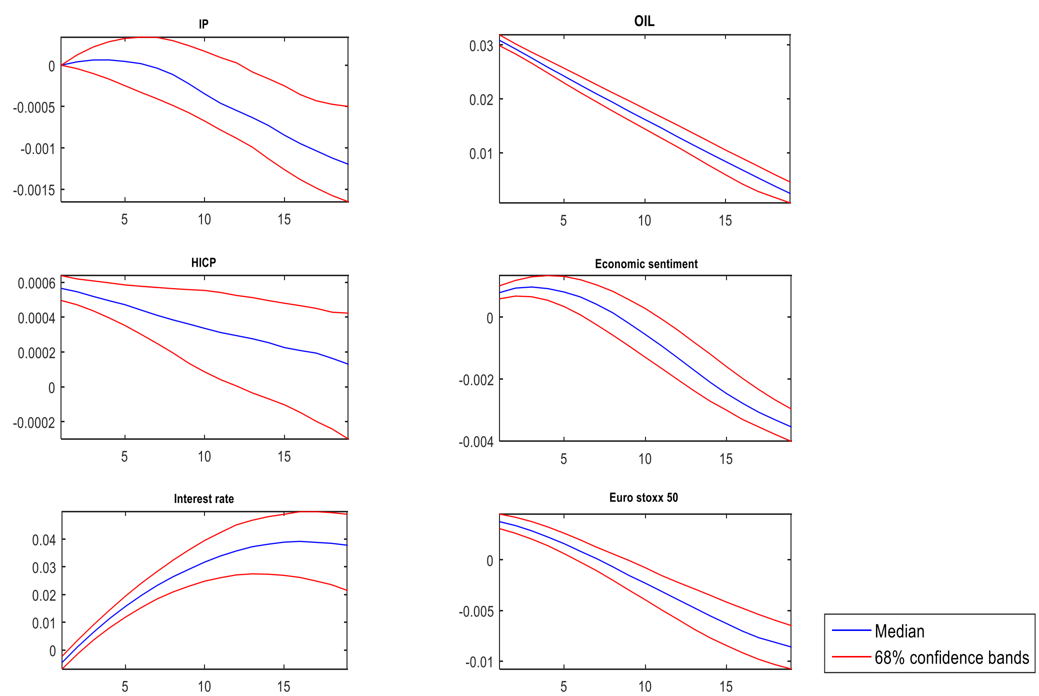
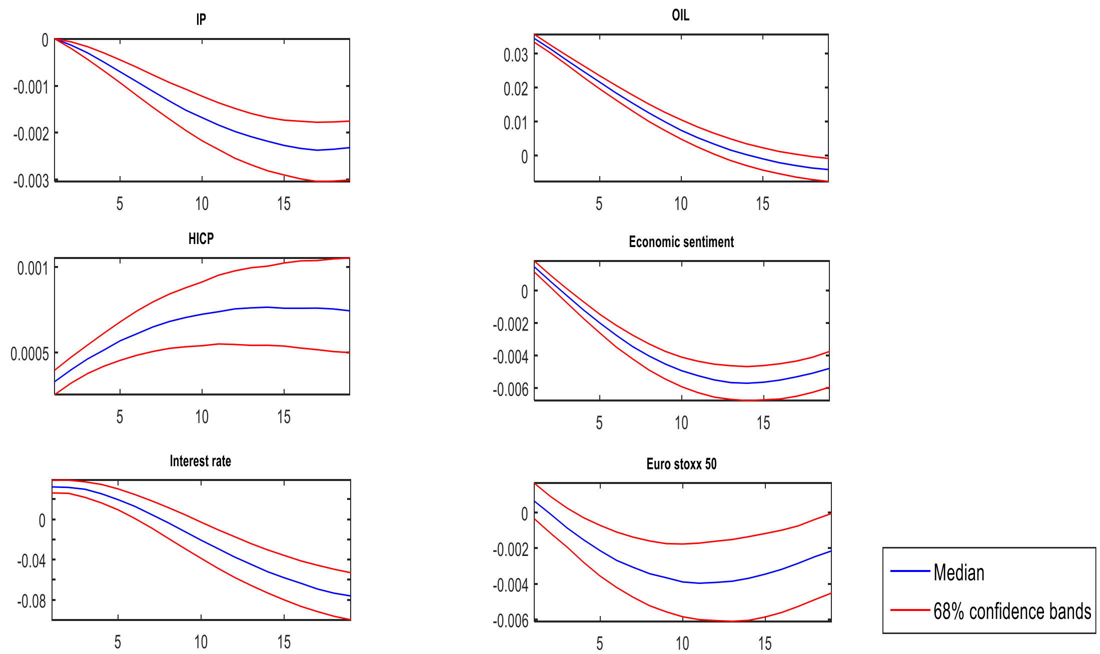


Figure 2: Effect of an oil price shock in a period of low uncertainty



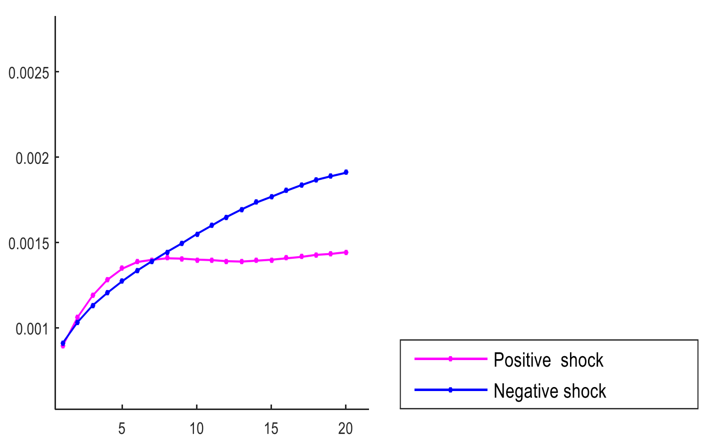
Notes: Selected impulse responses to a positive, 1 standard deviation, oil price increase during normal periods. The responses are estimated by using a Bayesian TVAR framework which includes eleven macro-financial variables. The figure displays the median response (blue line) and the 68% confidence bands (red lines).

Figure 3: Effect of an oil price shock in a period of high uncertainty



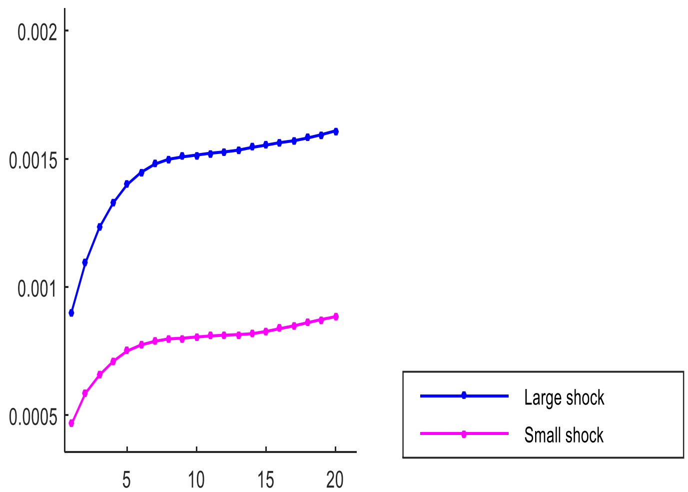
Notes: Selected impulse responses to a positive, 1 standard deviation, oil price increase during stress periods. The responses are estimated by using a Bayesian TVAR framework which includes eleven macro-financial variables. The figure displays the median response (blue line) and the 68% confidence bands (red lines).

Figure 4: Effect of positive and negative shocks on HICP in periods of high uncertainty



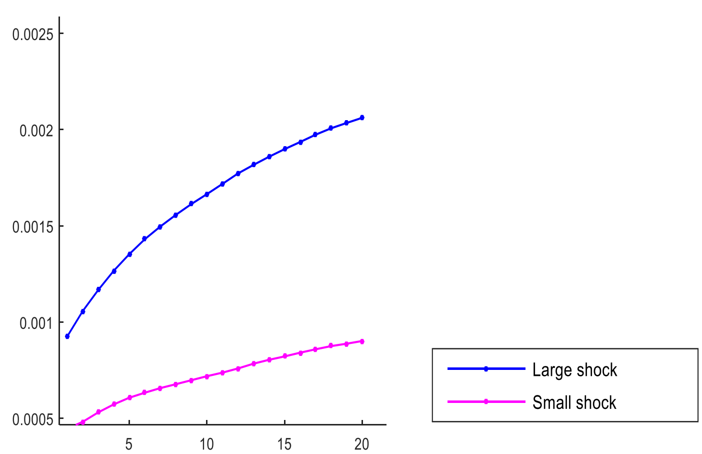
Notes: The figure depicts the median response of HICP to positive (purple line) and negative (blue line) large oil price shocks in the high uncertainty regime. Responses have been estimated by using a frequentist TVAR model. This approach allows positive and negative shocks (or large and small shocks) to impact the economy differently.

Figure 5: Effect of large and small *positive* oil price shocks on HICP in a period of high uncertainty



Notes: The figure depicts the median response of HICP to large (2 standard deviation, blue line) and small (1 standard deviation, purple line) positive oil price shocks in the high uncertainty regime. Responses have been estimated by using a frequentist TVAR. This approach allows positive and negative shocks (or large and small shocks) to impact the economy differently

Figure 6: Effect of large and small *negative* oil price shocks on HICP in a period of high uncertainty



Notes: The figure depicts the median response of HICP to large (2 standard deviation, blue line) and small (1 standard deviation, purple line) negative oil price shocks in the high uncertainty regime. Responses have been estimated by using a frequentist TVAR model. This approach allows positive and negative shocks (or large and small shocks) to impact the economy differently.