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# Cash is King – Effects of ECB's Conventional and Unconventional Measures



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# Cash is King - Effects of ECB's Conventional and Unconventional Measures*

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**Abstract**

In this paper we distinguish the responses of conventional and unconventional monetary policy measures on macroeconomic variables, using a high frequency data set which measures the impact of the ECB's monetary policy decisions. For the period 2002:01 to 2019:06 we show that unconventional and conventional monetary policy measures differ considerably with respect to inflation. While conventional measures show the expected response, i.e. an interest rate cut increases inflation and vice versa, unconventional measure appear to have no significant influence. But this holds not for QE, which is found to have similar influence on inflation as conventional interest rate changes.

*Keywords: Unconventional Monetary Policy, High-Frequency Data, ECB*

*JEL-codes: E52, E58, C36*

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# 1 Introduction

The financial crisis starting in 2008/09 changed traditional monetary policy. The effectiveness of the interest rate channel reached its limit with the occurrence of the zero lower bound (ZLB). As a result, central banks broadened their range of instruments. These can be divided into conventional and unconventional measures. On the one hand, conventional actions directly influence short-term interest rates. On the other hand, unconventional measures can be divided into forward guidance and quantitative easing (QE). The former try to manage the expectations of market participants. QE, moreover, directly influences longer term interest rates.

However, it is difficult to distinguish between these conventional and unconventional measures empirically. Altavilla et al. (2019) provide a unique high-frequency data set for the European Central Bank (ECB) which allows to differentiate between these measures. We use those in the following.

While the effect of conventional measures on important macroeconomic variables has been investigated extensively when it comes to empirical studies, the empirical effects of unconventional monetary policy measures are far less investigated. We fill this gap by estimating the influence of the various unconventional measures on e.g. output and inflation in an External Instrument VAR. A comparison of the measures is given, by showing differences in the effectiveness. Using monthly data for the period between 2002:01 and 2019:06 we find indeed significant differences between conventional and unconventional measure but also between forward guidance and QE.

The remainder of the paper proceeds as follows: Section 2 gives a literature review which includes an overview of the different approaches used to distinguish monetary policy measures in the literature. Section 3 describes the data, i.e. the conventional and unconventional measures and the instruments for the VAR, and the methodology used in this study. Section 4 presents our estimation results, showing differences first between conventional and unconventional measures, second between the various forms of unconventional measures and third between market reactions towards unconventional qualitative announcements like forward guidance. We provide two robustness analyses in section 5, by adjusting the sample period and accounting for different market reactions to forward guidance. Section 5 finally concludes and draws some policy conclusions.

## 2 Related Literature

Traditional empirical approaches to identify monetary policy shocks reach their limits because of the common use of a short term interest rate when the ZLB becomes binding and the ECB, like other central banks in industrialized countries, switched its policy to additional unconventional measures. Therefore, other ways have to be found to model these kind of shocks.[1]

The simplest and most straightforward way is to switch to longer-term interest rates as policy variable in order to avoid the problem of variables that are zero. However, this approach is also influenced by the ZLB, i.e. long-term interest rates can approach levels of zero if the zero interest period lasts too long (E. T. Swanson and Williams, 2014). Moreover, when relying on longer-term interest rates, the risk that other factors besides monetary policy (e.g. changing market expectations) bias this variable increases.

A second approach besides classical interest rates are artificial (shadow-)rates which try to include the influence of unconventional measures (Krippner, 2013; WU and XIA, 2016). Recent studies urge caution, as the estimates are very sensitive (Krippner, 2019).

Another method of identification in unconventional times is a combination of sign and zero restrictions (Arias et al., 2018). A large strand of literature combined these

[1] See Rossi (2018) for a detailed overview of these approaches.

method with central bank assets (Boeckx, Dossche, and Peersman, 2017; Burriel and Galesi, 2018; Gambacorta et al., 2014). Whether this combination actually identifies unconventional shocks is currently being discussed in the literature (Boeckx, Dossche, Galesi, et al., 2019; Elbourne and Ji, 2019).

Since Kuttner (2001), there has been a growing literature which make use of high frequency datasets. He has shown that financial variables react to changes in US Federal Reserve policy. Building on these insights, Gürkaynak et al. (2005) identify different monetary shocks, namely an interest rate shock and an information shock. Brand et al. (2010) develop this method further with respect to the ECB, not only by considering the differences before and after the decision, but also by separating the effect of press release and the subsequent press conference. To the best of our knowledge, Gertler and Karadi (2015) are the first to use these monetary high frequency shocks in an External Instrument VAR. The assumption made in these kinds of estimations is that if the time window is small enough, no other shocks distort the results. They find different effects from conventional and high frequency identification in VAR-models. E. Swanson (2017) expanded the previous identification of shocks. He shows that it is possible to extract the effects of large-scale asset purchases (LSAP/QE) for the period from 2009-2015 in the US.

A different approach of identifying shocks from high frequency data is made by Andrade and Ferroni (2018). They combine principle component analysis and sign restrictions to distinguish between Delphic and Odyssean forward guidance shocks. We will explain the difference between both in Section 4. With a similar methodology, Jarociński and Karadi (2018) show that information shocks from central banks play an important role in both the US and the Euro area. Thus, Campbell et al. (2012) conclude that a shock can have different effects depending on how it is received by the markets.

Altavilla et al. (2019) combine the high frequency factor analysis also paying to Delphic and Odyssean forward guidance shocks. They provide a high frequency dataset for the Euro area and extract various orthogonal shocks, both for the press release and for the press conference. They give first insights into how the shocks affect individual financial variables.

## 3 Data and Methodology

The following analysis is based on the high frequency dataset developed by Altavilla et al. (2019). We replicate the extraction of four factors identified by Altavilla et al. (2019) and receive the underlying shocks of monetary policy in the Euro area from 2002:01 to 2019:06. More precisely, we use the overnight index rate swap (OIS), to estimate a factor model. By rotating and restricting the principal components we can interpret them as monetary policy surprises. Like Altavilla et al. (2019), we also use the restrictions established by Gürkaynak et al. (2005) and E. Swanson (2017) for the fourth factor. The four factors identified will be termed Conventional,[2] Timing, Forward Guidance and QE.

The Conventional factor is based on market reactions to the ECB press release directly after the ECB governing council meeting and thus contains only interest rate surprises, which is by definition conventional monetary policy.

The other three factors are extracted from the ECB press conference which takes place about 45 minutes after the press release. The timing factor can be interpreted as a short term shock influencing interest rates at the beginning of the yield curve. In contrast, the Forward Guidance factor influences the medium term interest rates with around six months to maturity. Finally, the QE factor loads on the end of the yield curve and can thus be interpreted as long-term influence on market interest rates. The combination of the three press conference factors is moreover summed up to the Unconventional factor. In addition, we construct a Total factor which includes all factors simultaneously. The influence of the Conventional and Unconventional

[2] In fact, Altavilla et al. (2019) call the Conventional shock Target. However, since Target and Conventional shocks model are the same, we will use the latter phrase.

measures in different points of time is shown in Figure 1.

*—Figure 1 about here—*

By construction, QE starts in 2014:10 with the introduction of the Covered Bond Purchase Programme 3 (CBPP3) which later on became part of the Asset Purchase Programme (APP) which was introduced in 2015:01 and started officially in 2015:03.[3]

It is striking that even in the period before the financial crisis, expectation shocks occur in the Timing and Forward Guidance factor. This can be explained with the influence of central bank communication on market expectations. Even before forward guidance was explicitly introduced, ECB press conferences were used to ask about central bank's expectations regarding their future policies. Even though these questions were answered very restrictively, this seems to have had an effect on medium term OIS rates. Compared to the period after 2008, when active forward guidance was applied, however, the shocks were substantially lower in the pre-crisis period.

Since these factors are to be estimated with other macroeconomic variables, the shocks have to be transformed into monthly data. Following Gertler and Karadi (2015) we use monthly average surprises: The shock values of the elapsed 31 days are added up and in the next step the arithmetic mean of all accumulated values in each month is formed. This procedure accounts for the effect of variable meeting dates within a month. Shocks at the beginning of a month get a higher weight, whereas shocks at the end of the month are more relevant for the next period.

In order to investigate the effects of monetary policy on macroeconomic variables, we use an External Instrument VAR, using a two step procedure by James H. Stock

[3]Please note that because of this reason, all models which only contain QE shocks are estimated with data starting 2014:10. The Gertler and Karadi (2015) approach of estimating the different stages for different time spans to increase efficiency is not possible here. The problem is not that high frequency data is not available but that there was no QE before 2014:10.

and Watson (2012) and Mertens and Ravn (2013). The first step is to estimate the reduced form VAR (Equation (1)):

$$Y_t = c + A(L)Y_{t-j} + v_t \tag{1}$$

where $c$ is a constant and $v_t$ is the error term. The endogenous variables $Y_t$ consist of Output (industrial production excluding construction), Prices (harmonized index of consumer prices), Commodities (IMF Primary Commodity Price index), Stock prices (Euro Stoxx 50), Uncertainty (CISS) and 5 year German government bonds (DE5Y).[4] DE5Y is our monetary policy variable because we want to compare conventional/ short-term measures with long-term measures such as QE. Therefore, a five year government bond is a good compromise.[5] We continue to use German government bonds in particular, as the risk component in interest rates should be minimal here and is not distorted by speculation while this is possibly not true for other Euro area countries. Jarociński and Karadi (2018) also use German government bonds because of this reason.

Akaike information criteria suggest a maximum of $j = 3$ lags which seems realistic compared to other VAR studies for the Euro area (Boeckx, Dossche, and Peersman, 2017; Gambacorta et al., 2014).

In a second step, the VAR residuals of the DE5Y equation ($\hat{v}_{6t}$) are estimated by our instruments $Z$, i.e. the monetary four policy factors extracted by the high frequency data and the two summarized factors explained above. The effect of the policy variable can be isolated and interpreted as the monetary policy shock $u_{6t}$. A good instrument must, according to James H. Stock and Watson (2018), should

[4]Output, Prices, Commodities, and Stock prices are used in logarithms. All four variables are seasonally adjusted.

[5]We also checked other possible candidates which could have similar properties, i.e. Euribor rates, OIS, other Euro area countries bonds and different maturities. The DE5Y performed best in this respect. The results for the other variables are available from the authors upon request.

have the following characteristics in order to obtain consistent estimates:

$$E[u_{\bullet t} Z'] = 0 \qquad \text{(exogeneity w.r.t. other current shocks)} \qquad (2a)$$

$$E[u_{6t} Z'] = \alpha \neq 0 \qquad \text{(relevance)} \qquad (2b)$$

where $u_{\bullet t}$ are all other shocks. Therefore, an instrument is needed which is highly correlated with the monetary policy shock $u_{6t}$ but not correlated with any other shock $u_{\bullet t}$ at the same time.

Condition (2a) should be fulfilled, as a very narrow time window was chosen by Altavilla et al. (2019) around the press release and conference. According to Kuttner (2001) there will probably be no, and certainly no systematically distorting, effects in this period.[6]

Condition (2b) means that the instrument should be correlated with our monetary policy shock and therefore have explanatory power. To test whether our instruments are suitable, we regress the DE5Y residual ($\hat{v}_{6t}$) on our factors separately. Table 1 reports the regression results for each shock as well as the Unconventional and Total shock as described above.

—*Table 1 about here*—

It can be seen that the extracted factors are all highly significant. The p-values of all potential instruments are well below 0.05. The fit of the data as modeled by the R-squared is similar compared with papers using US data and the same methodology Gertler and Karadi (2015). The robust F-statistic is above the value of 10 for all factors except Timing.[7] This is a guideline for making it a strong instrument (James

[6] Furthermore, Altavilla et al. (2019) control for a possible effect in this time window, the publication of US labor market figures. They find no evidence of any impact of these on European financial market variables during this time window.

[7] We tried other variables and also other VAR-specifications for Timing. In the few cases where the F-statistics increases slightly for Timing it drops sharply for the other factors. In order to

H Stock and Yogo, 2001). Therefore, we conclude that our factors are suitable instruments. The standard errors are normally distributed, which means that they are reliable. The combination of individual shocks (Total) is also highly significant and therefore provide a powerful instrument for the ECB's overall monetary policy strategy. It turns out that with the shocks of Altavilla et al. (2019), it is possible to estimate individual facets of monetary policy, e.g. the influence of forward guidance, and additionally also the overall effects.

# 4 Results

To present the results, we use a general to specific approach. Thus, we begin by presenting the influence of the Total factor shock before disentangling it into Conventional and Unconventional shocks in a second step and splitting up the Unconventional shock into the three subcategories (Timing, Forward Guidance and QE). Finally, we check for the different market response towards ECB annoncements using the concept of Odyssean and Delphic shocks.

## 4.1 Total shock

Starting with the Total effect of monetary policy shocks in the Euro area (Figure 2), we find the expected results. An expansive monetary policy shock lowers the DE5Y on impact and lasts for about 9 month. Moreover, it lowers the uncertainty in financial markets but only after about six months and lasting until for about one year. We see a small increase in stocks prices after about 1.5 years and a non-significant reaction towards commodity prices. Inflation increases with a short time lag but is not significant at a 90% confidence level. This insignificant result is

establish comparability, we use it in our analysis. A similar VAR, with DE2Y as monetary policy variable, gives a sufficiently large F-statistic for the Timing factor that the risk of a weak instrument can be excluded and provides very similar impulses responses and confidence intervals. The results are available from the authors upon request.

possibly due to the diverging effects of conventional and unconventional monetary policy measures which we will see later on. In line with theory output is only significantly increased after some time, namely about 15 months after the shock and lasting for the subsequent years.

*—Figure 2 about here—*

## 4.2 Conventional versus Unconventional shocks

In the next step we distinguish monetary policy shocks into conventional and unconventional policies. Therefore, we calculate two different VAR models (Figure 3). It is noticeable that the reactions of the two shocks to the bond yield are not significantly different from each other and mirror those of the Total shock presented above. Both measures lower uncertainty but the peak effect of Unconventional shocks is a little larger although the differences are not statistically significant throughout. Conventional shocks show an immediate dampening effect on stock prices, whereas Unconventional shocks increase stock prices after about 12 months. The effect on commodity prices is reversed. The Conventional shock leads, in accordance with theory, to increased prices, whereas unconventional shocks even lowers prices. We will come up with a possible explanation for this later. When it comes to inflation the Conventional monetary policy shock appears to have a significantly larger and faster impact than the Unconventional shock. This holds for the first year. Afterwards the influence of both are not statistically significant different anymore. But this is mainly due to the rising confidence intervals over time. The point estimates for Conventional measures are always higher than for Unconventional measures. Moreover, the Unconventional monetary policy shocks appear to be even insignificant throughout the entire period. Thus it has to be concluded at this stage that the increase in prices found for the Total factor is solely driven by the Conventional measures and Unconventional measures had no effect.

*—Figure 3 about here—*

However, the result of Unconventional measures having no effect on inflation must not mean that all sub-measures also do not have an effect. Figure 4 shows the result of splitting up the Unconventional measures into three individual factors (Timing, Forward Guidance and QE).

*—Figure 4 about here—*

The effect of QE is quite different compared to the other measures (Timing and Forward Guidance). A positive QE shock, e.g. the unexpected introduction of bond buying program, lowers uncertainty and increased stock prices almost instantly. The reason may be that QE has already been tested in the US and was there seen as a suitable reaction by the central bank by the markets. Thus, markets have some experience with these kinds of measures. In contrast to the other two unconventional monetary policy measures QE shocks raise also commodity prices. One reason for this could be that companies increase their production and demand more goods. When it comes to the inflation response, the reaction towards QE differs completely from those of the other two Unconventional measures. While the latter are rather similar and found to have no significant impact on inflation, the effectiveness of QE moves at the level of Conventional measures and is significant different from both, zero and the other unconventional shocks at least in the first three months. Finally, a QE shocks tends to increase output on impact more than other conventional or unconventional measures but the differences remains statistically insignificant.

## 4.3 Delphic and Odyssean shocks

The question arises, why Timing and Forward Guidance shocks have no effect on inflation, whereas QE and the Conventional shock show a theory-conform behavior. One reason may be that the former are not properly identified. Campbell et al.

(2012) show that the effect of a Forward Guidance shock may vary depending on how financial markets interpret it. In an Odyssean forward guidance shock, the markets behave as the central bank expects it to be, meaning that if the central bank communicates an expansionary forward guidance, e.g. keeping the interest rate lower for longer, the markets react to it by investing for example in stocks or other assets. In contrast, Delphic forward guidance shocks work the other way around as the central bank commits itself to keep the interest rates lower for longer the markets judge this as a signal that the economic situation is even worse than expected, thus they sell assets. So it can be expected that Odyssean shocks should increase inflation while the reverse is true for Delphic shocks.

It is therefore reasonable to distinguish between these two kinds of Forward Guidance shocks. To do so, we use the "poor man's sign restrictions" which create very similar impulse responses compared to more complex procedures (Jarociński and Karadi, 2018).

*—Table 2 about here—*

For each monetary policy decision we compare the reaction in 5 year German government bonds and Euro Stoxx 50 around the press conference window. If both reactions show the same sign, we label this event as Delphic, otherwise as Odyssean.[8] This gives us 4 new factors: Odyssean Timing factor, Delphic Timing factor, Odyssean Forward Guidance factor and Delphic Forward Guidance factor.

With these four new factors, we re-estimate our External Instruments VAR. The results are shown in Figure 5 and 6.

In fact, the impulse responses for the Timing factors show a different course depending on whether the shock is Delphic or Odyssean. Both, Delphic and Odyssean

[8]We stick to this simple identification scheme based on Jarociński and Karadi (2018) and did not include inflation expectations as Jarociński and Karadi (2018) and Altavilla et al. (2019). This has the advantage that each decision is uniquely assigned to either Odyssean or Delphic shocks. Additionally, we can use the Altavilla et al. (2019) data-set, which, due to the narrow time window around the decision, excludes other effects.

Forward Guidance shocks, lower bond yields. However, if the markets interpret an announcement as Delphic, this influences the markets negatively in various ways: Uncertainty rises, stock prices collapse and commodity prices decrease possibly because of demand side effects. This lowers output and has even a significant negative impact on inflation. An Odyssean Timing shock shows exactly the opposite behavior. Uncertainty is declining and stock prices are rising. Commodity prices also rise, although not significantly. Moreover, output increases for about two years. A price increase results with a short time lag, but is roughly at the level of an Conventional or QE shock.

*—Figure 5 about here—*

When it comes to the Forward Guidance shocks, the reactions differ from the preceding ones (Figure 6). Again, we can observe the clearly different behavior of Odyssean and Delphic shocks in uncertainty and stock prices. However, in contrast to Odyssean Timing shocks, Odyssean Forward Guidance shocks do not lead to an increase in commodity prices. Output does not increase on impact but only after some time. There is now a negative effect on prices. Longer-term expectation management by the central bank does not appear to have the desired effect on inflation.

*—Figure 6 about here—*

We conclude from this result that a more precise distinction of Timing and Forward Guidance shocks is reasonable. It seems that the ECB can influence its primary target inflation more successfully if it influences short-term expectations. A prerequisite for this is, however, that the central bank can consciously send an Odyssean shock. If a central bank can influence whether the its shocks are viewed as Odyssean or Delphic has not been investigated to the best of our knowledge. Here would be a promising starting point for further research.

## 5 Policy conclusion

In this paper, we distinguished the responses of conventional and unconventional monetary policy measures on macroeconomic variables, using a high frequency data set which measures the impact of the ECB's monetary policy decisions. We show that unconventional and conventional monetary policy measures are rather similar when it comes to the influence on uncertainty and output but differ considerably with respect to commodity prices and the ECB's primary target inflation. While conventional measures show the expected response of an increase in inflation following an expansionary monetary policy shock, unconventional measures appear to have no significant influence.

This holds only with respect to Information and Forward Guidance shocks but not for QE which is found to have an equal influence on inflation like conventional interest rate changes. Timing shocks and Forward Guidance are divided into two parts. We show that for the short term Timing shock there is indeed a difference depending on how the markets interpret the signal given by the ECB. Whereas Odyssean shocks are more like QE in this case, i.e. an expansionary shock tends to increase inflation, Delphic shocks show no or even a negative effect on inflation. Even worse, with respect to the medium term Forward Guidance shocks both Odyssean and Delphic shocks tend to decrease inflation if the ECB wants to send an expansionary signal.

What do these results mean for monetary policy? In fact, we would call for central banks as the ECB to conduct conventional monetary policy for as long as possible which is what the ECB did in large parts of the crisis period. Only when the interest rate approaches the ZLB and thus conventional monetary policy is no longer possible, central banks have to switch to other unconventional measures. The most preferable measure among those is QE because the "softer" communication measures as on the one hand forward guidance do not exhibit the desired influence on inflation and thus the main monetary policy target of many central banks. Influencing the short term expectations (Information shock), on the other hand, is unpredictable in terms of its effects on the price level because it is unclear whether the central bank can precisely control the effect of its announcement and thus intentionally trigger an Odyssean shock. Only in this case an expansionary shock would indeed raise inflation. Thus, we would conclude that using communication measures are all in all not able to guide the markets in a way the ECB expects it to be. So we call for quantitative measures as it seems that only those count for the markets.

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# Tables

Table 1: Regression of Residuals on Z

| | Dependent variable: | | | | | |
|---|---|---|---|---|---|---|
| | DE5Y | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Conventional | 0.019*** | | | | | |
| | (0.004) | | | | | |
| Timing | | 0.017*** | | | | |
| | | (0.006) | | | | |
| Forward Guidance | | | 0.012*** | | | |
| | | | (0.003) | | | |
| QE | | | | 0.012*** | | |
| | | | | (0.003) | | |
| Unconventional | | | | | 0.014*** | |
| | | | | | (0.003) | |
| Total | | | | | | 0.0001*** |
| | | | | | | (0.00002) |
| Constant | 0.0002 | 0.0003 | −0.0001 | 0.001 | 0.0004 | 0.001 |
| | (0.010) | (0.010) | (0.010) | (0.008) | (0.009) | (0.009) |
| R-squared | 0.055 | 0.052 | 0.06 | 0.121 | 0.11 | 0.15 |
| robust F-statistic | 21.799 | 7.477 | 15.29 | 19.492 | 28.479 | 42.286 |
| *Note:* | | | | | | *p<0.1; **p<0.05; ***p<0.01 |

Table 2: Identification of Shocks

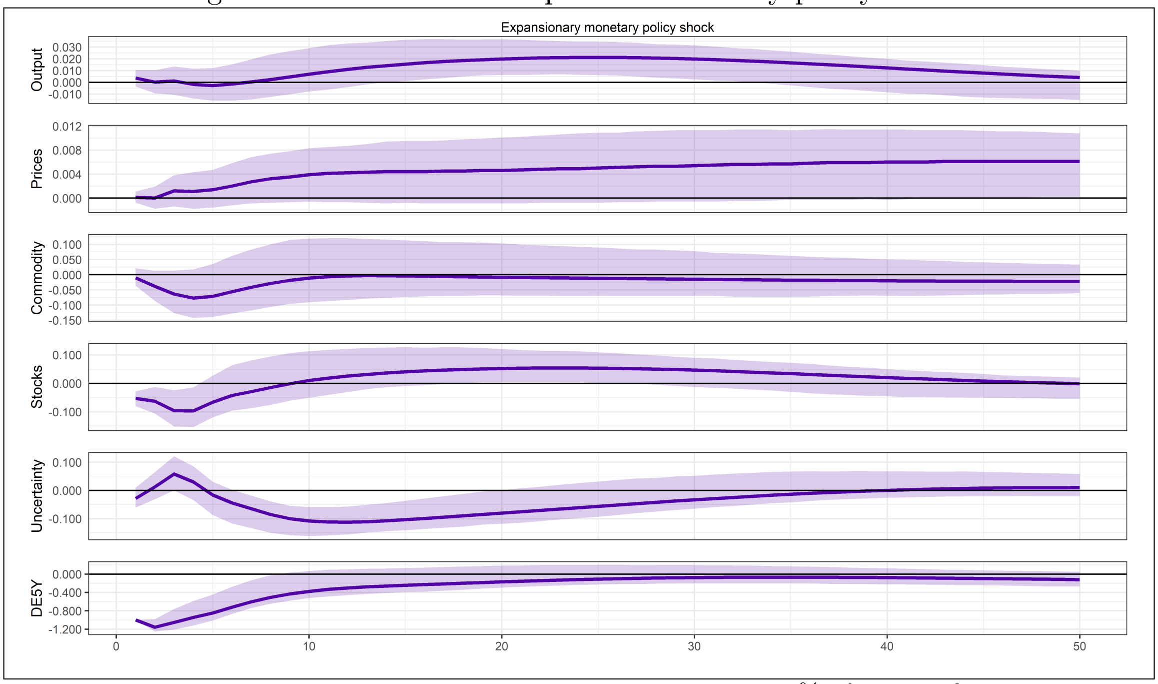
| | Dependent variable: | |
|---|---|---|
| | shock | |
| | Odyssean Shock | Delphic Shock |
| OIS2Y | + | + |
| STXE50 | − | + |

# Figures

Figure 1: Estimated Factors

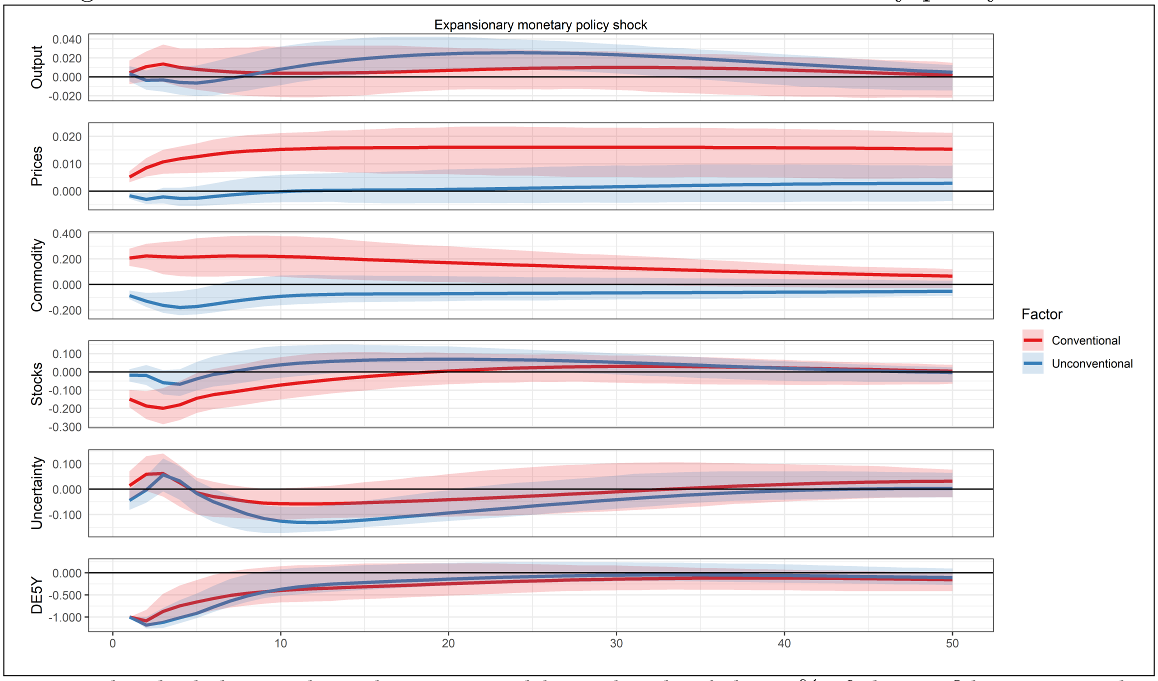

Notes: Sample period: 2002:01- 2019:06, accumulated factors in basis points.

Figure 2: Effect of total expansive monetary policy shock



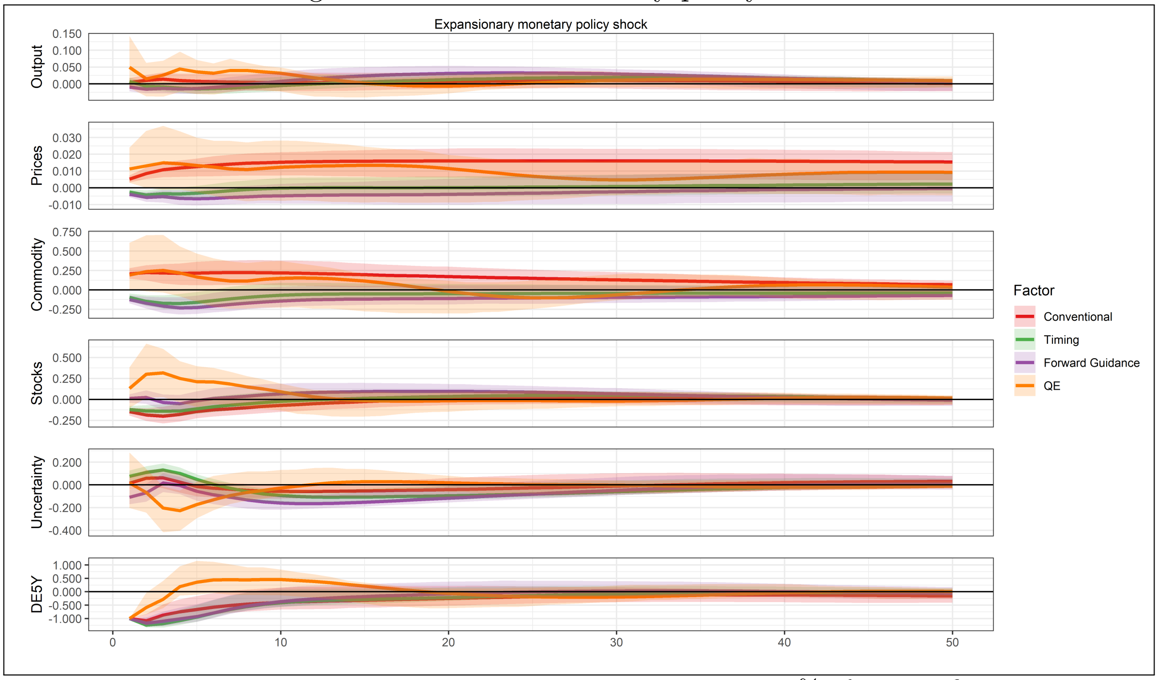

Notes: The shaded area show the upper and lower bands of the 90% of the confidence intervals computed using 1000 bootstrap replications

Figure 3: Effect of Conventional and Unconventional monetary policy shock



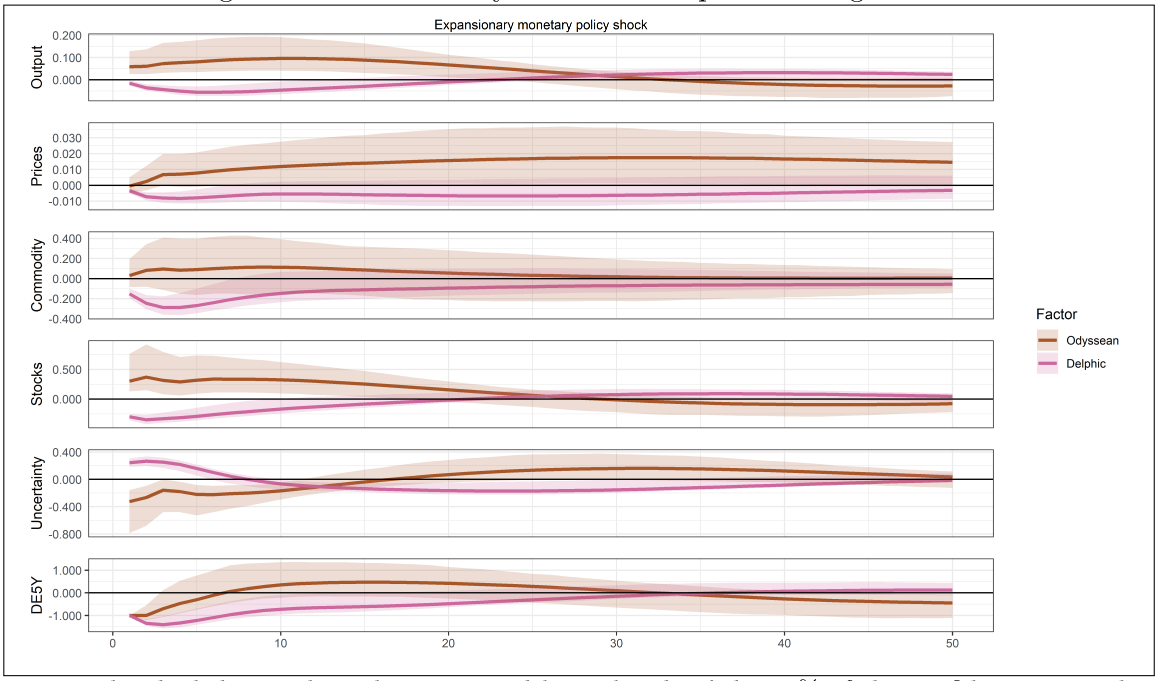

Notes: The shaded area show the upper and lower bands of the 90% of the confidence intervals computed using 1000 bootstrap replications

Figure 4: Effect of monetary policy shocks



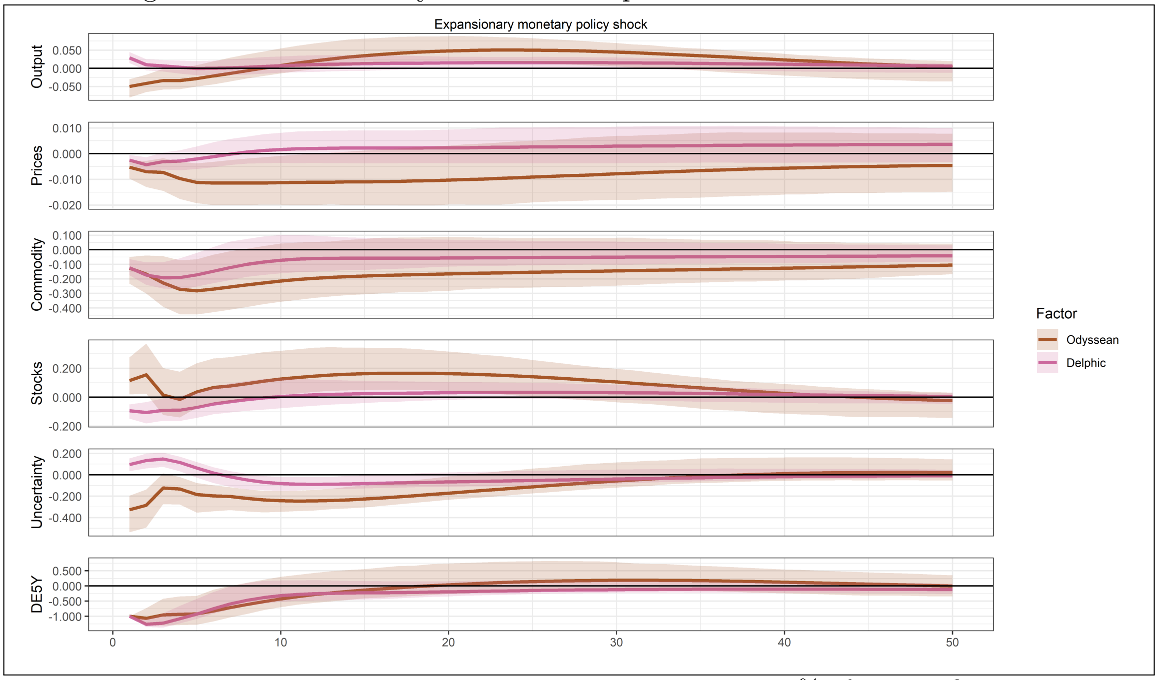

Notes: The shaded area show the upper and lower bands of the 90% of the confidence intervals computed using 1000 bootstrap replications

Figure 5: Effect of Odyssean and Delphic Timing shock




Notes: The shaded area show the upper and lower bands of the 90% of the confidence intervals computed using 1000 bootstrap replications

Figure 6: Effect of Odyssean and Delphic Forward Guidance shock




Notes: The shaded area show the upper and lower bands of the 90% of the confidence intervals computed using 1000 bootstrap replications