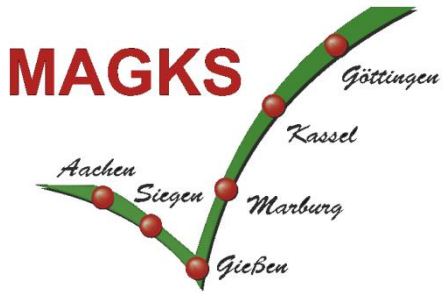

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News Shock Spillovers: How the Euro Area Responds to Expected Fed Policy *

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Abstract

Monetary policy increasingly relies on steering market expectations about future policy. This paper identifies a monetary policy news shock based on a VAR model. A monetary news shock is equivalent to new information about the Fed's future monetary policy becoming available today. One example of a monetary news shock is a forward guidance announcement, where the Fed unveils its prospectively (binding) monetary policy, today. In this paper, we study the spillover effects of news shocks. We estimate the response of the euro area to an expected future policy tightening of the Fed. The U.S. news shock improves sentiment and business cycle expectations in the euro area, which is consistent with the notion of the Fed revealing favorable news by a tightening announcement. We also distinguish the news shock from a conventional U.S. policy surprise and find that they lead to diverging responses in the euro area.

Keywords: News shocks, spillovers, forward guidance, monetary policy, interest rates, expectations, central bank information effects

JEL classification: E43, E58, F42

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1 Introduction

Central banks increasingly aim at steering financial market expectations. Releasing information about the monetary policy stance prevailing in the future, the argument goes, allows market participants to anticipate interest rate changes and thus stabilizes markets. The case for steering market expectations became even stronger when several advanced economies hit the zero lower bound on nominal interest rates.

When changes to the short-term interest rate were no longer feasible, central banks engaged in forward guidance, that is providing guidance on future monetary conditions. A surprise change to forward guidance, e.g. surprisingly lower interest rates in the future are communicated after a meeting of the Federal Open Market Committee (FOMC), is one example of a monetary news shock. In this case, a news shock reflects information becoming available today about a future policy step. In the case of effective forward guidance, the Fed maintains a low level of the federal funds rate in the future even though the economy improves. Hence, the forward guidance announcement issued today pertains to policy actions in the future.

While a surprise change to forward guidance is one obvious example of a news shock, there are others. Think of a central bank announcing a path for future asset purchases. The monetary policy action, i.e. the actual purchases, often happens in the future. Yet, the news themselves enter the market today. Importantly, a news shock needs to be distinguished from a standard monetary policy surprise, which pertains to an unexpected change in the contemporary monetary conditions.

A large body of literature documents that standard policy surprises have cross-border effects. A contemporaneous policy tightening of the Fed spills over to advanced as well as emerging market economies, leading to a depreciation of domestic currencies and a tightening of local real and monetary conditions, as reported in i.a. Iacoviello and Navarro (2019), Dedola et al. (2017), and Georgiadis (2016). The contribution of this paper is to study the effects of U.S. monetary news shocks on expectations in the euro area.

Our identification of the news shock is closely related to Ben Zeev et al. (2020). In particular, we estimate a standard Taylor rule for the Fed, whose residuals reflect unexpected changes in the (shadow) federal funds rate.

These residuals are included in a vector autoregression (VAR) along with other endogenous variables such as interest rates, forecasts, bonds, or other assets. We identify a news shock as the shock which is orthogonal to a contemporaneous, exogenous change in the Taylor rule residual, which at the same time is explaining the largest share of (shadow) federal funds rate changes. This identification follows the work of Barsky and Sims (2011) and Kurmann and Otrok (2013).

In the second step, we extend the analysis and augment the VAR with euro area variables such as asset prices, uncertainty indicators and expectations. Importantly, the additional variables do not interfere with the identification of the news shock. The resulting impulse response functions show how euro area variables adjust to such shocks.

We find that a positive monetary news shock, i.e. an announcement of a future interest rate hike, leads to a contemporaneous increase in long-term interest rates in the U.S. This is consistent with the expectations hypothesis whereupon long rates incorporate information about the expected future short-rate interest path. At the same time, the shock boosts U.S. equity prices and leads to a decrease in uncertainty. In the euro area, sentiment indicators improve after the shock. The reaction of uncertainty is ambiguous. While inflation and unemployment uncertainty tend to fall, growth uncertainty about the future rises.

At first sight, these results appear to contradict the expected effects of an U.S. tightening. However, we rationalize the findings based on the notion that by announcing a future policy tightening, the Fed reveals private information about its assessment of the current state of the economy. In this regard, Cieslak and Schrimpf (2019) report that market participants predominantly react to news concerning economic growth during central bank press conferences and other communication events. If markets are uncertain about the true state of the cycle, such a policy move should be expansionary today, which is in line with what we find. We use the response of stock prices to separate the negative effect of the expected tightening from the positive effect of revealing new information. If the latter dominates, we should observe an increase in stock prices. This argument is similar Lakdawala and Schaffer (2019) and the seminal work of Jarociński and Karadi (2020), who study the role of information shocks originating on FOMC meeting days. We show that the euro area responds consistently: new information about the Fed's assessment of the cyclical

position of the U.S. economy is good news for markets and the private sector in the euro area.

Our contribution adds to three strands of the literature. The first is the literature on anticipated monetary policy shocks and their identification. D'Amico and King (2023) use a combination of sign and zero restrictions in a VAR model, an approach different from Barsky and Sims (2011), to identify an anticipated monetary policy shock. The authors refer to the shock as a "shock to expectations", which has even stronger effects on inflation and real economic activity than a conventionally identified monetary policy surprise. The paper closest to this one is Ben Zeev et al. (2020). We follow their identification of U.S. monetary news shocks. While Ben Zeev et al. (2020) study the domestic (real) effects of news shocks only, this paper extends the analysis and quantifies international news shock spillovers.

The second line on the growing body of literature concerning spillover effects of central bank information. In advanced and emerging markets economies, Fed information shocks increase risk appetite (Pinchetti and Szczepaniak, 2023, Georgiadis and Jarociński, 2023), fuel asset prices (Gai and Tong, 2022, Georgiadis and Jarociński, 2023, Pinchetti and Szczepaniak, 2023), and stimulate economic activity (Gai and Tong, 2022, Georgiadis and Jarociński, 2023, Pinchetti and Szczepaniak, 2023). Regarding spillovers to the euro area, Jarociński (2022) finds similar expansionary effects on stock prices, financing conditions and economic activity within his VAR.[1] Our paper adds a further layer to the spillover effects of Fed information by analyzing how such news affect expectations and economic sentiment in the euro area.

The third line of research relevant for this paper addresses the Fed's possible information advantage reflected in monetary policy decisions. Nakamura and Steinsson (2018) employ a high-frequency identification of monetary policy shocks based on intra-day meeting data to separate the policy surprise from the revelation of new information. They find upward revisions in growth expectations following a policy tightening, which is consistent with superior information available to the Fed about the current

[1] Another paper worth mentioning is Miranda-Agrippino and Nenova (2022). Following Swanson (2021), they extract the three most important factors, *target*-, *path*-, and *QE*-factor, that explain variations in the entire term structure of interest rates. Their results show notable spillover effects from both, contractionary shocks to the *path*-factor as well as to the *QE*-factor, which lead to a slowdown in economic activity as well as an increase in risk aversion. Their results are in contrast to Jarociński (2022), as the authors restrict in such way that they must lead to falling stock prices to falling share prices "in line with economic intuition".

state of the economy, e.g. as famously reported in Romer and Romer (2000). Miranda-Agrippino and Ricco (2021) and Jarociński and Karadi (2020) use structural VAR models to separate the information inherent in policy decisions. As mentioned before, the latter paper uses the response of stock prices to differentiate between a detrimental surprise tightening and a revelation of favorable information. Jarociński (2024) uses the non-Gaussian properties of the reactions of financial market variables to FOMC announcements within a high-frequency window in order to disentangle the variations in the range of effects of the Fed's policy toolkit.

The remainder of this paper is organized as follows. Section 2 introduces the empirical model and outlines the identification of U.S. monetary news shocks. Section 3 extends the analysis to spillover effects on the euro area. Section 4 provides evidence for the favorable nature of news emerging from an anticipated Fed tightening. Section 5 presents results from alternative model specifications before section 6 concludes.

2 Identifying U.S. News Shocks

In this chapter we present the scheme to identify U.S. monetary news shocks. To verify the consequent shocks, we analyze the impulse responses of a group of financial variables that proxy expectations about future Fed policy.

A. *Fed Policy: Expectations, Surprises, and News*

Assume the Fed's policy rule can be described as

$$i_t = E_{t-1}\{i_t\} + \epsilon_t \ . \tag{2.1}$$

That is, the nominal interest rate i_t is a combination of the expected interest rate $E_{t-1}\{i_t\}$ and an unanticipated shock ϵ_t. The aforementioned are formed based on a set of available information at time $t-1$.

Shocks comprise both, surprises and news shocks. Formally,

$$\epsilon_t = \upsilon_t + \eta_{t-j} \ , \tag{2.2}$$

where υ_t denotes the monetary policy surprise at time t and η_{t-j} is the news shock received j periods earlier. Given her mandate and interest rate

smoothing behavior, expectations about future monetary policy of the U.S. Federal Reserve are formed via a Taylor rule that contains past realizations of the interest rate, inflation, and the unemployment rate. Thus, we estimate the expected interest rate in the form of

$$E_{t-1}\{i_t\} = \mu + \rho i_{t-1} + \phi_\pi (\pi_{t-1} - 2) + \phi_y \left(u_{t-1}^{NAIRU} - u_{t-1}\right) \tag{2.3}$$

where we take into account an inflation gap $(\pi_{t-1} - 2)$ — we allege a two percent inflation target by the Fed — and the deviation of the unemployment rate from the NAIRU $\left(u_{t-1}^{NAIRU} - u_{t-1}\right)$.[2] The constant μ captures the real interest rate as well as the inflation target. Unexpected movements in the Fed's policy rate, the monetary policy residual, are then computed as

$$mpr_t = i_t - E_{t-1}\{i_t\} \, . \tag{2.4}$$

Equation (2.4) implies that expectations are formed solely based on the information from the previous period.[3] The monetary policy residual in turn can be partitioned into

$$mpr_t = v_t + \eta_{t-j} \, . \tag{2.5}$$

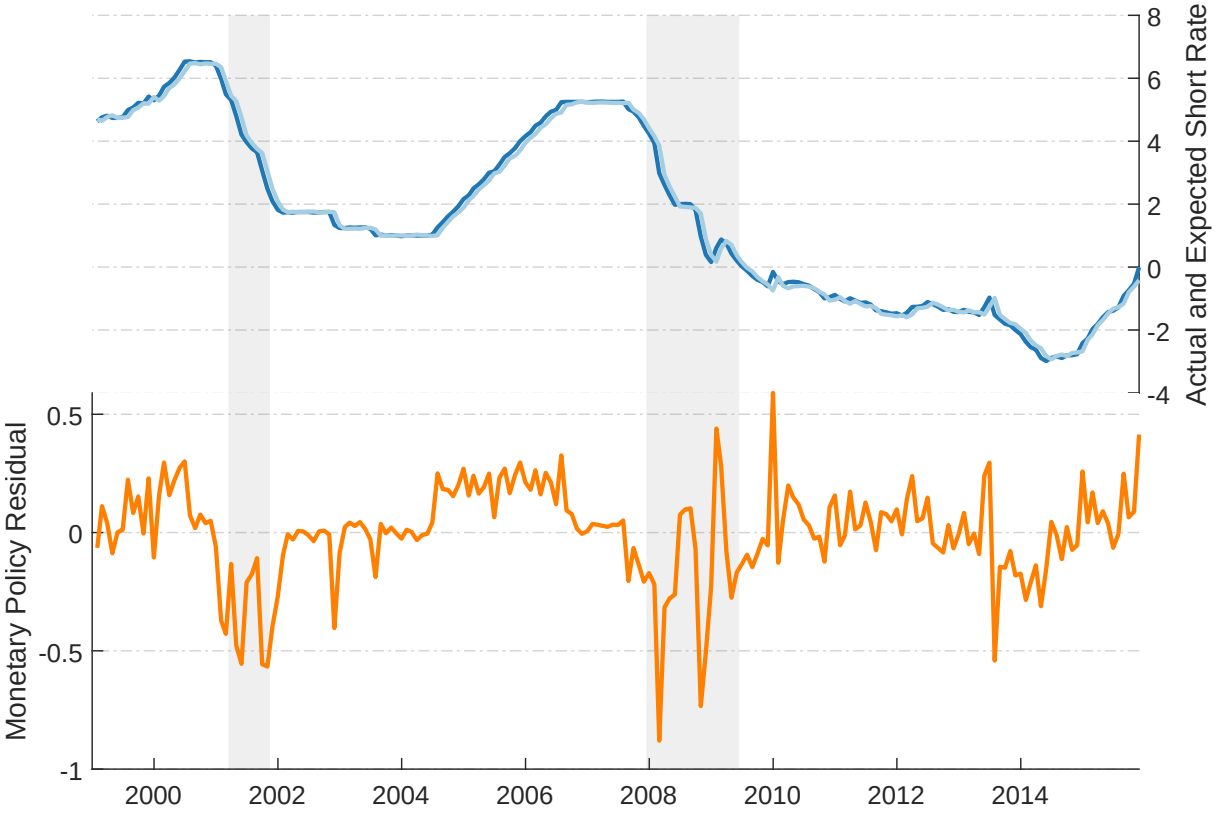
Figure 1 plots the short-term (shadow) interest rate, its expected value, as estimated in equation (2.3), as well as the monetary policy residual *mpr*. One can see that the jutting phases are the Dot-Com bubble burst in the early 2000', the "too-low for too-long" phase between 2004 and 2006, as well as the outburst of the financial crisis and the associated beginning of the Great Recession around 2008.

The exogenous movements of the monetary policy residual build the foundation for the upcoming identification of news shocks. As described by equation (2.5), we assume that these fluctuations are determined by both, contemporaneous surprises as well as news shocks.

[2] We estimate the Taylor rule using OLS with Newey-West HAC standard errors. The NAIRU, the Non-Accelerating Inflation Rate of Unemployment, is a long-term estimation drawn from the Federal Reserve Bank of St. Louis database. This is also our source for inflation and unemployment data.

[3] In the robustness section 5, we use interest rate rules with higher lag orders. As will be seen, our results do not hinge on the initial assumption.

Figure 1: Monetary Policy Residual



Notes: In the upper panel, the bark blue solid line depicts the actual, while the light blue line shows the expected (shadow) short-rate. The resulting monetary policy residual is depicted in the bottom panel. Grey bars mark NBER recession dates.

B. *The VAR Model*

We build on the the total factor productivity (TFP) news shock identification procedure by Barsky and Sims (2011) who combine a VAR model with a set of restrictions in order to identify the TFP news shock. The basic idea is to extract the single shock that explains most of the forecast error variance (FEV) in TFP, yet has no contemporaneous effect on said variable. As we are interested in monetary policy news shocks, we seek to identify the shock that explains most of the movements of the monetary policy residual introduced in the previous section, while leaving the monetary policy residual unaffected on impact. Such a constraint would be consistent with an unexpected forward guidance announcement: the Fed's future policy steps will drive the monetary policy residual in the future, but not at the time of the announcement.

In what follows, we lay the foundation for the subsequent identification of our news shock. The starting point is an unrestricted VAR model that can

be written as

$$\mathbf{y_t} = \mathbf{c} + \mathbf{A_1 y_{t-1}} + \cdots + \mathbf{A_p y_{t-p}} + \mathbf{u_t} \,. \tag{2.6}$$

Let $\mathbf{y_t}$ be an $n \times 1$ vector of observables of length T. The subsequent analysis of the responses of the U.S. financial market to our identified news shock is based on a range of data series, with a particular focus on indicators of market expectations, covering the period between January 1999 and November 2015.

The short-term interest rate, sr_t, our primary indicator of monetary policy, is a composition of the effective federal funds rate and the shadow short-rate provided by Wu and Xia (2016). We use the shadow short-rate in order to incorporate the Fed's unconventional policy measures, such as forward guidance and asset purchases, implemented after 2008.[4]

While we interpret the short-rate as the lower end of the yield curve, we incorporate the two-year $\left(r_t^{2y}\right)$, five-year $\left(r_t^{5y}\right)$, and ten-year $\left(r_t^{10y}\right)$ bond yields taken from Adrian et al. (2013) to map a broader spectrum of the yield curve.

Furthermore, to encompass changes in expectations about the future interest rate path we withdraw the outlook for the t-bill four quarters ahead from the Survey of Professional Forecasters $\left(spf_t^{Tbill}\right)$. Ordering the monetary policy residual first, the vector of endogenous variables, $\mathbf{y_t}$, thus reads

$$\mathbf{y_t'} = \begin{bmatrix} mpr_t & sr_t & spf_t^{Tbill} & r_t^{2y} & r_t^{5y} & r_t^{10y} \end{bmatrix} \tag{2.7}$$

The remainder is standard in the VAR literature. The $n \times n$ matrices $\mathbf{A}_i$ capture the coefficients for lag $i = 1, ..., p$, c is an $n \times 1$ vector of constants and u_t the $n \times 1$ vector of reduced form innovations with variance-covariance matrix $\mathbf{\Sigma}$. The lag order is denoted by p and set to six following the Schwarz information criterion. The reduced-form moving average representation of this specification can be rewritten as

$$\mathbf{y_t} = \mathbf{B(L)u_t} \,, \tag{2.8}$$

[4] We have also carried out our analyses with an *mpr* based on the effective federal funds rate, as shadow short-rates are generated regressors from term structure models and their path thus heavily depends on the underlying assumptions, as shown by Krippner (2020). Our results remain the same. Nevertheless, we will address this issue in greater detail in section 5.

with $\mathbf{B(L)} = \sum_{i=0}^{p} \mathbf{B_i L}^i$ as an $n \times n$ matrix polynomial in the lag operator, $\mathbf{L}$, of moving average coefficients. Assume the existence of a linear mapping between the prediction errors $\mathbf{u_t}$ and the mutually orthogonal shocks $\epsilon_\mathbf{t}$, i.e.

$$\mathbf{u_t} = \mathbf{P}\epsilon_\mathbf{t} \ , \tag{2.9}$$

with variance-covariance matrix $\mathbf{\Sigma} = E\left[\mathbf{u_t u_t'}\right]$. From equation (2.9) we see that the key restriction on the impact matrix $\mathbf{P}$ is that it must satisfy $\mathbf{PP'} = E\left[\mathbf{P}\epsilon_\mathbf{t}\epsilon_\mathbf{t}'\mathbf{P'}\right] = \mathbf{\Sigma}$. However, $\mathbf{P}$ is not unique. Let $\tilde{\mathbf{P}}$ be a valid alternative orthogonalization, e.g. a Cholesky decomposition. Hence, we can rewrite the space of permissible impact matrices as

$$\tilde{\mathbf{P}}\mathbf{Q} = \mathbf{P} \tag{2.10}$$

where $\mathbf{Q}$ is an orthonormal matrix ($\mathbf{Q'} = \mathbf{Q}^{-1}$ and $\mathbf{QQ'} = \mathbf{I_n}$) and therefore $\tilde{\mathbf{P}}\tilde{\mathbf{P}}' = \mathbf{\Sigma}$.

C. *Identification of News Shocks*

From equations (2.8) - (2.10) we can deduce the h-step ahead forecast error as

$$\mathbf{y_{t+h}} - \hat{\mathbf{y}}_\mathbf{t+h} = \sum_{\tau=0}^{h} \mathbf{B}_\tau \tilde{\mathbf{P}}\mathbf{Q}\epsilon_{\mathbf{t+h}-\tau} \ , \tag{2.11}$$

where $\mathbf{B}_\tau$ denotes the matrix of moving average coefficients at horizon τ. The share of the forecast error variance of variable i attributable to a structural shock j at horizon h is then

$$\Omega_{ij}(h) = \frac{\sum_{\tau=0}^{h} \mathbf{B}_{i,\tau}\tilde{\mathbf{P}}\gamma\gamma'\tilde{\mathbf{P}}'\mathbf{B}'_{i,\tau}}{\sum_{\tau=0}^{h} \mathbf{B}_{i,\tau}\mathbf{\Sigma}\mathbf{B}'_{i,\tau}} \ . \tag{2.12}$$

The $n \times 1$ impulse vector $\tilde{\mathbf{P}}\gamma$ corresponds to the j-th column of a possible orthogonalization while $\mathbf{B}_{i,\tau}$ denotes the i-th row of the moving average coefficients matrix at horizon τ. Owing to the fact that the identification of news shocks requires the identification of a shock orthogonal to innovations

in the monetary residual, the optimization problem can be expressed as

$$\gamma^* = \arg\max \sum_{h=0}^{H} \Omega_{1,2}(h) = \frac{\sum_{\tau=0}^{h} \mathbf{B}_{1,\tau} \tilde{\mathbf{P}} \gamma \gamma' \tilde{\mathbf{P}}' \mathbf{B}'_{1,\tau}}{\sum_{\tau=0}^{h} \mathbf{B}_{1,\tau} \mathbf{\Sigma} \mathbf{B}'_{1,\tau}} \tag{2.13}$$

subject to

$$\tilde{\mathbf{P}}(1, j) = 0 \quad \forall j > 1 \tag{2.14}$$

$$\gamma(1, 1) = 0 \tag{2.15}$$

$$\gamma' \gamma = 1 \, . \tag{2.16}$$

The first two restrictions ensure that news shocks have no contemporaneous effect on the policy residual, while the third restriction imposes that γ is a column vector belonging to an orthonormal matrix.[5] Since we use monthly data, we set the truncation horizon to $H = 24$ months. Swanson and Williams (2014) and Hanson and Stein (2015), among others, argue that forward guidance operates within this window.[6]

D. *Estimation and Inference*

Estimation and inference is based on Bayesian techniques. We assume a Minnesota prior for the unknown reduced-form coefficients and a normal-inverted Wishard distribution for the variance-covariance matrix $\mathbf{\Sigma}$. Inference is then based on 2000 draws from the posterior, where we solve for $\gamma*$ each draw.

E. *Domestic Effects of U.S. News Shocks*

The restrictions we impose in order to identify a monetary news shock, zero contemporaneous impact on the short-rate but maximum explanatory power in the future, allows us to capture all policies which are announced in period t but become effective later. Forward guidance is one candidate for a policy captured by this identification. Under forward guidance, the Fed announces today i.a. to maintain a lower level of the policy rate in the future than it would otherwise do. Hence, to the extent this announcement

[5] Regarding Uhlig (2004), this approach identifies the news shock as the first principal component of the monetary policy residual orthogonalized vis-à-vis its own innovation.

[6] However, robustness checks show that our results do not hinge on this specification. The results can be obtained upon request.

comes as a surprise, it should leave the contemporaneous short-rate unaffected but drive future policy rates.

Nonetheless, forward guidance shocks are not the only candidates that fit this identification scheme. A Fed announcement of asset purchases commencing in the future should not only leave today's short-rate unchanged, but at the same time, drive the future short-rate and other forward-looking variables. Likewise, news shocks are also possible in periods in which monetary policy is not constrained by the effective lower bound on nominal interest rates. Take for example the Fed chair giving a speech hinting at future policy. To the extent this has not been anticipated, the news should drive forward-looking variables instantaneously, yet leave the short-rate unchanged.

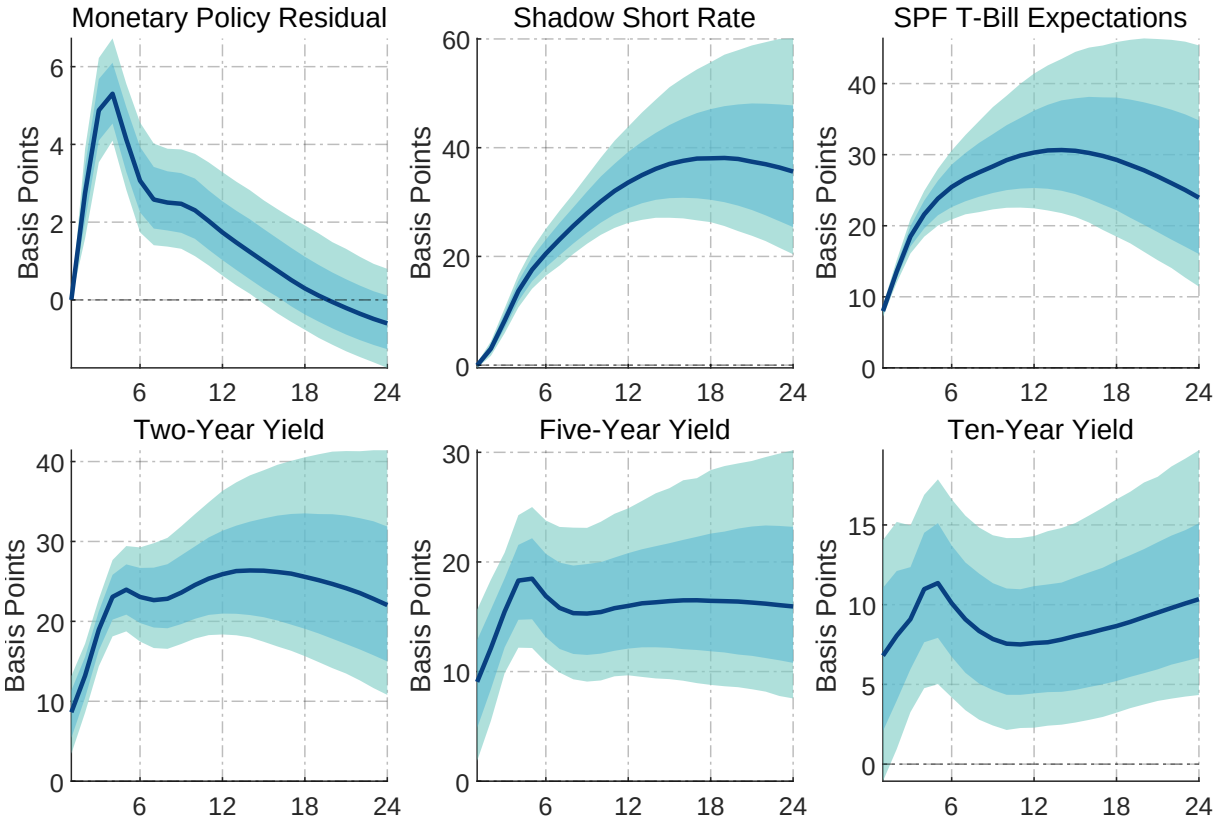
In what follows, we use the terms "news shock" and "forward guidance" interchangeably. However, we should keep in mind that the nature of the policy captured by these shocks goes above and beyond forward guidance in that sense.[7]

Figure 2 shows the median impulse responses to the identified monetary policy news shock along with 68% (dark area) and 90% (light area) posterior credibility intervals. On impact, the news shock does not move the *mpr*. This reflects the constraint imposed on the VAR system. Beyond period t, however, we find that the Fed tightens monetary policy with the *mpr* response peaking four months after the shock. Hence, the identified shock corresponds to a policy tightening announced in t becoming effective a few months later.

We also find that news about the forthcoming monetary policy tightening affect the entire term structure of interest rates. At the short end, the shadow short-rate increases within a two-year window by almost 40 basis points. That is, contractionary monetary policy materializes in increasing interest rates. That is to say - the Fed keeps her word. Market participants expect a notable increase in the T-bill rate four quarters in the future. The peak median response, 30 basis points, is only slightly smaller than the corresponding response of the short-term interest rate. Moreover, yields on two-, five-, and ten-year bonds increase by 25, 18, and 12 basis points, respectively. That is, the effect becomes smaller for longer maturities, which is in line with the findings of Gürkaynak et al. (2005),

[7] Our shocks can therefore be seen as a combination of unexpected disturbances of the *path*- and *QE*-factors, as in e.g. Swanson (2021) and Miranda-Agrippino and Nenova (2022) or as a mix of LSAP and central bank information shocks as in e.g. Georgiadis and Jarociński (2023).

Figure 2: Domestic Responses to U.S. Monetary Policy News Shocks



Notes: Posterior median impulse responses to monetary news shocks (solid line). Dark (light) areas denote 68% (90%) probability masses.

Gertler and Karadi (2015), Swanson (2021), and Jarociński (2024). Hence, news shocks do not only predict short term interest rate movements but also successfully flatten the yield curve.

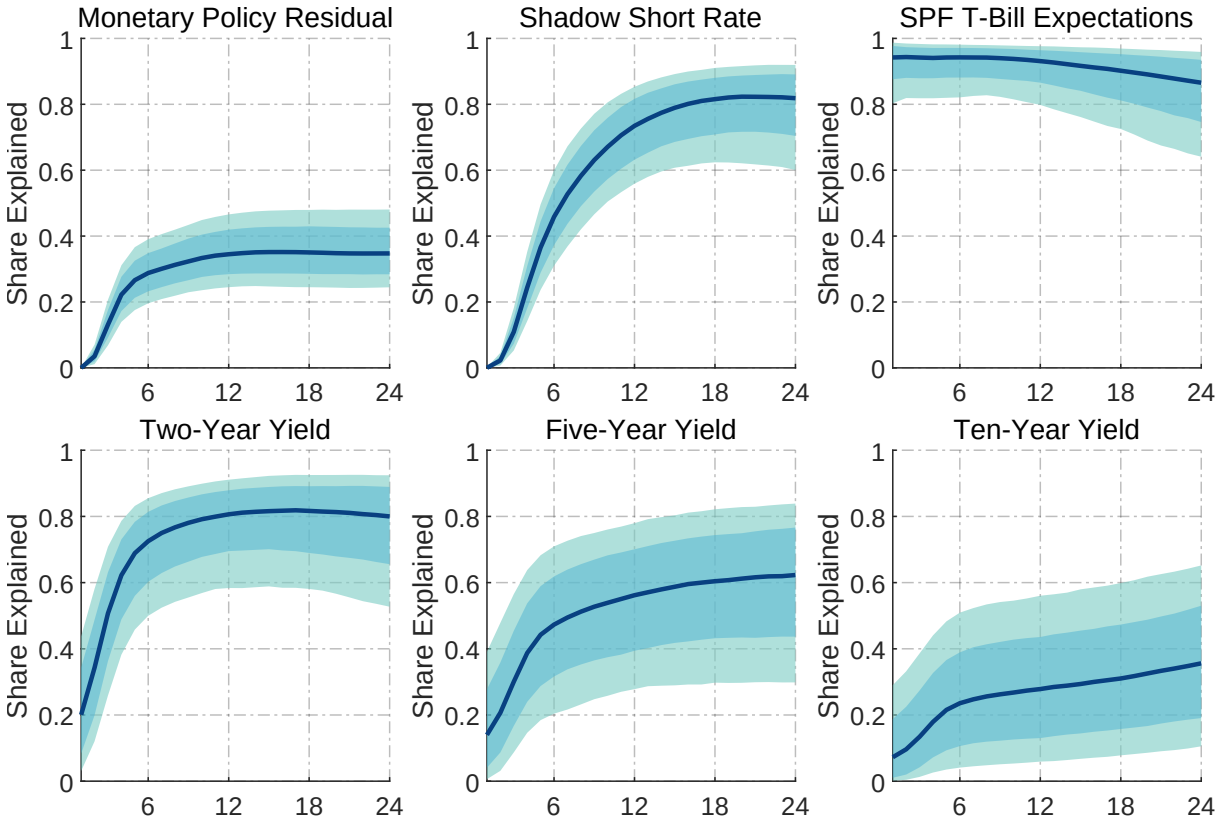
To get further insights into the relevance of our identified news shocks, we depict the share of the forecast error variance explained by said shocks in Figure 3.

Over a 24 months horizon, news shocks explain up to roughly 35% of the variance of the monetary residual.[8] In other words, a notable fraction of the movements in the (unanticipated) interest rate path can be explained by news shocks - that is, anticipated Fed policy. News shocks explain up to 80% of the movement of interest rates at the short end of the yield curve.[9] Furthermore, almost the entire variance of T-bill expectations is explained

[8] Ben Zeev et al. (2020) report very similar contributions of their monetary news shocks.

[9] Ben Zeev et al. (2020) measure a maximum share of 47% in the federal funds rate. Our high value is probably due to the use of a shadow short-rate, which is largely determined by the interest rate structure at the middle and longer end of the yield curve. News shocks (are intended to) shape the yields in the aforementioned spectrum and explain a correspondingly high proportion in the forecast error variance, as also shown in Figure 3. This, in turn, cascades to the (hypothetical) short end of the shadow interest rate.

Figure 3: FEV Explained by U.S. Monetary News Shock



Notes: Fraction of the forecast error variance of each variable, explained by the median monetary policy news shock (solid line) along with posterior 68% (dark) and 90% (light) probability masses.

by news shocks. They therefore decisively shape market expectations. The explanatory power decreases with longer maturities of the underlying securities. Roughly 80% of the variance of two-year bond yields is explained by news shocks within a two-year horizon. Moreover, news shocks explain 60% and between 20% and 40% of the forecast error variance of five- and ten-year bond yields, respectively. Overall, our results suggest that forward guidance is successfully forming expectations concerning future interest rate policy.

Finally, to emphasize the role of forward guidance, we compare the influence of both, the monetary news shock identified before and a conventional monetary shock, i.e. a surprise policy tightening effective at time t.[10] In this context, Gürkaynak et al. (2005) provide a much-noticed work of the distinct impact of current shocks and news shocks.[11] For the

[10] The conventional monetary shock is identified based on a recursive Cholesky ordering of the variables. According to this ordering, the monetary policy shock is allowed to have a contemporaneous impact on all other variables, while monetary policy responds with at least a lag of one months to innovations in the other variables.

[11] The authors refer to the current shock as *target factor* and the news shock as *path factor*.

sake of comparability with Gürkaynak et al. (2005) we adjust our analysis twofold: Firstly, in our baseline model we substitute the T-bill outlook with the three-month Eurodollar future to analyze the impact of news shocks on a comparable set of variables.[12] Unlike Gürkaynak et al. (2005), we include the three-month Eurodollar future instead of the one-year Eurodollar future due to data availability. Secondly, as Gürkaynak et al. (2005), we constrain the current shock to lead to the same peak median impulse response of the three-month Eurodollar future, as prompted by the news shock. To be more precise, we adjust the current shock to match the peak median response of the Eurodollar future to a news shock which we in turn cannot manipulate because the impulse vector is the result of an optimization procedure and restricted to have a length of one in order to belong to an orthonormal matrix. Thus, manipulating the news shock vector would violate the imposed restrictions.

Before we turn to the analysis of the impulse responses to both shocks and juxtapose our findings with Gürkaynak et al. (2005), it is worth noting that the size of our shock compared to Gürkaynak et al. (2005) differs. Thus, a quantitative comparison with their point estimates would be misleading.

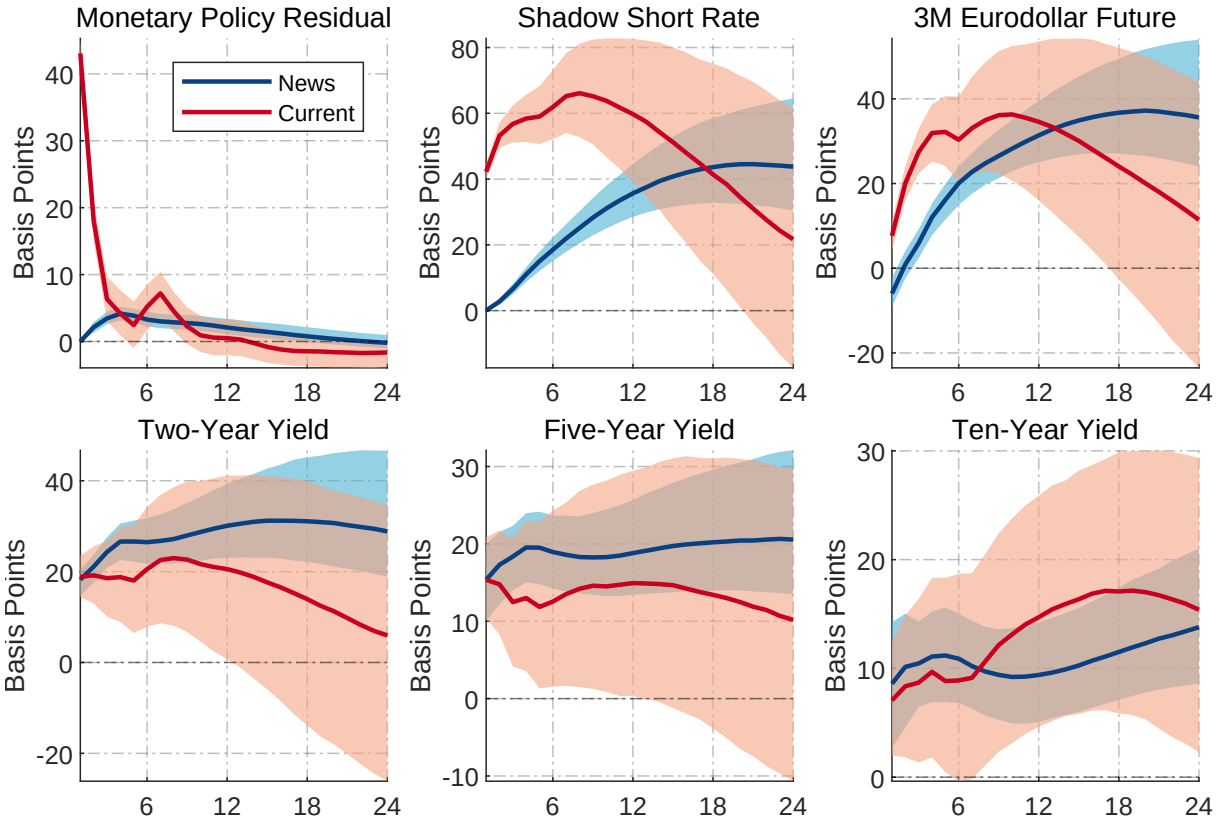
However, we can evaluate our findings qualitatively. Figure 4 reveals the impulse responses to a current monetary policy shock (red) and a monetary policy news shock (blue).

Firstly, by construction, the peak median responses of the three-month Eurodollar future are akin, though the timing of the maximum response differs across shocks. As the current shock becomes effective immediately, the peak response of the three-month future is reached earlier. Not surprisingly, monetary surprises have an immediate (upscaled) 40 basis points impact on the interest rate, while news shocks, by definition, have no direct effect but materialize over time. The short-rate increases by 65 basis points in response to a current shock and by 40 basis points to a news shock.

Returns on two-year government bonds respond on impact basically indistinguishable. While the impact of the news shocks remains quantifiable over the truncation horizon at approximately 30 basis points, the effect of the surprise dissipates over time and is no longer significant after 12 months due to the high degree of uncertainty surrounding it.

[12] Gürkaynak et al. (2005) identify their *path factor* through (unrestricted) principal components analysis given a set of high-frequency data. See also Nakamura and Steinsson (2018).

Figure 4: News Shock vs Conventional Monetary Policy Shock



Notes: Median impulse responses to both, news shock (blue solid) and current monetary policy shock (red solid) along with their respective 68% posterior probability bands. The magnitude of the current shock is adjusted to lead to similar responses of the Eurodollar future as implied by news shocks.

Gürkaynak et al. (2005) find qualitatively similar responses to the two types of shocks at the short end of the yield curve. They estimate highly significant marginal effects on two-year yields of 48 and 41 basis points for the *target factor* and the *path factor*, respectively.

Our impulse responses of the five-year bond yield also resemble the findings of Gürkaynak et al. (2005). On impact, both shocks increase returns by 15 basis points. Over time, news shocks have been observed to have a somewhat greater effect on five-year bonds than monetary surprises. However, given the wide credibility interval of the response to monetary surprises, the results are statistically hardly distinguishable. Again, qualitatively our results do not differ much from the findings of Gürkaynak et al. (2005), who measure a slightly greater marginal effect of the *path factor*. Likewise, the response of the ten-year yield is comparable to the results in the literature.

To sum up, we are able to identify news shocks which lead to plausible responses of U.S. bond yields which are in line with the literature using

alternative approaches.

3 How the Euro Area Responds to Expected Fed Policy

Are market participants in the euro area reshaping their expectations in the light of an expected monetary tightening of the Federal Reserve? To answer this question, we estimate the spillover effects of news shocks within a VAR system similar to the one used in the previous section. The model incorporates both, U.S. and euro area variables. The primary objective of this paper is to examine the impact of U.S. news shocks on expectations in the euro area. To that end, we limit our focus to variables that measure sentiment and uncertainty. As a result, we exclude core economic variables from our analyses.

The U.S. variables consist of the monetary policy residual, the (shadow) short-term interest rate, the expected three-month T-bill rate, and the two-year yield. The rationale for the selection of variables is that forward guidance aims at forging the future interest rate path within a two year window, as stated by Campbell et al. (2012) and Gertler and Karadi (2015), among others. These four core variables are included throughout the subsequent analyses, while we substitute the five- and ten-year yields with survey data on sentiment and expectations about the future economic stance of the euro area. Since the news shock is restricted to be orthogonal to current short-rate changes and to maximize the share of the forecast error variance of the U.S. monetary policy residual, the inclusion of additional euro area variables is innocuous.

To obtain insights into the role of U.S. news shocks for sentiment and expectations in the euro area, we consider aggregate survey responses from both, firms and households. Data on consumer sentiment and the business climate are taken from business and consumer surveys provided by the European Commission. This is also the source of the responses to expectations about prices, unemployment, consumption, and production. The ifo outlook for the eurozone is provided by the CES ifo Group. Finally, the composite index for systemic stress (CISS) stems from the ECB data portal.

To make the responses of the various survey data to an U.S. news shock comparable, we transform them as follows: following the OECD CCI Harmonization Guidelines, we first normalize the survey data to have a

mean of zero and a standard deviation of one. The data is then amplitude adjusted around 100. Finally, we take the natural logarithm and multiply it by 100. As a result, we can interpret the impulse responses as percentage changes following a U.S. news shock.

Figure 5 depicts the impulse responses of the euro area variables to U.S. monetary news shocks. First, regarding the sentiment indicators, U.S. news shocks lead to an improvement in both indicators by a similar magnitude within the truncation horizon. Consumer sentiment as well as business climate increase by about 0.1 percent due to a news shock. Moreover, news shocks contribute up to 30% (42%) to the forecast error variance of the indexes (not shown here). In other words, forward guidance by the Fed has a sizable effect on private sector's sentiment in the euro area.

In addition to an increase in sentiment, the economic outlook also appears to be improving, as indicated by the ifo index, which captures expectations about economic activity six months in the future. The ifo index jumps on impact by about 0.05 percent and reaches a maximum response of 0.1 percent five months after the impact of the shocks. Taken together, the responses of the ifo index and private-sector sentiment suggest that an expected Fed tightening has expansionary effects in the euro area. This is consistent with the notion that a news shock reveals new information about the current and future business cycle. In the case of a positive news shock, the Fed reveals information about its assessment of a continuing boom in the U.S. economy, which spills-over to the euro area. We will discuss the interpretation in detail below.

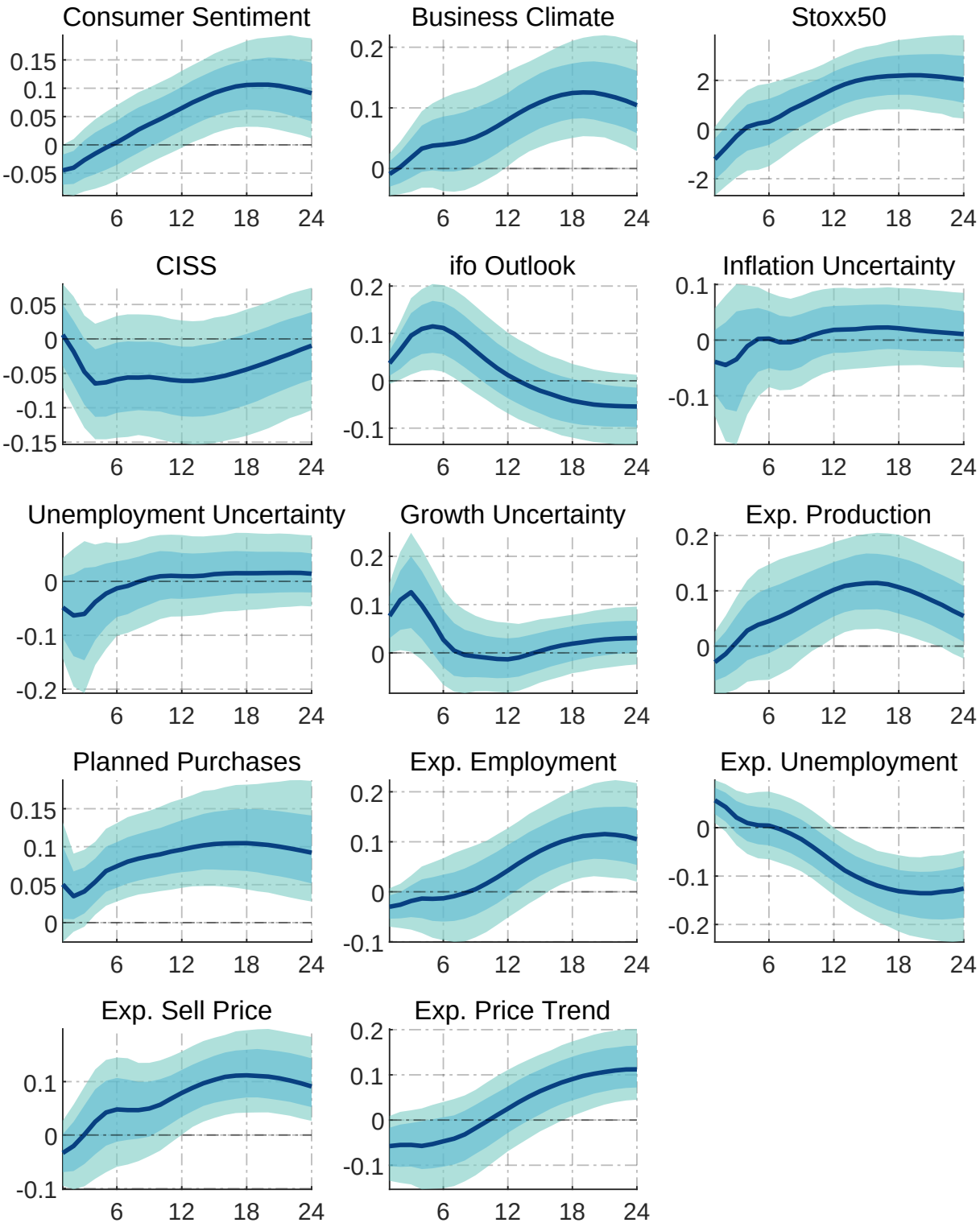
The positive tone is furthermore reflected in the response of the STOXX50, an index which comprises stocks of 50 blue-chips from the euro area. After an initial fall, the STOXX50 increases by up to 2 percent in response to the news shock. This reaction is in line with the findings in Jarociński and Karadi (2020).

The indicator for systemic stress in the euro area (CISS) decreases in a hump-shaped manner by up to 0.05 percent. This is consistent with the argument previously put forth: the economic outlook for the euro area improves and, hence, financial stress in the subsequent months falls.[13]

A prospective Fed tightening, as discussed below, reveals a favorable

[13] See Bachmann et al. (2013) for an analysis of the nexus between uncertainty and economic activity and Jarociński and Karadi (2020) for the accommodative effects of information shocks on financial condition. Bernal et al. (2016) provide an examination of the impact of economic policy uncertainty on risk spillovers within the euro area.

Figure 5: Euro Area Responses to U.S. Monetary Policy News Shock



Notes: Median impulse responses (solid lines) to anticipated U.S monetary tightening. Dark (light) areas depict 68% (90%) probability masses. Responses are in percentage changes.

assessment of the current economic situation. This, in turn, could contribute to a reduction in economic uncertainty. Since the euro area

business cycle expands upon the news originating from the Fed, we should also expect a reduction of macroeconomic uncertainty in the euro area. Indeed, uncertainty concerning inflation and unemployment in the euro area tends to decrease, as shown in Figure 5. However, this effect is not significant. Uncertainty concerning future economic growth, on the other hand, increases by roughly 0.1 percent within the first year after the news shock appears. One potential explanation for this phenomenon is that, despite a general consensus regarding the direction of the future business cycle in the euro area, there is no consensus regarding the extent of economic growth. This lack of consensus translates into increased uncertainty.

Manufacturing firms in the euro area report increasing production expectations for the months ahead following the U.S. news shock. Firms report an increase in expected production by 0.1 percent. On the demand side, consumers report their intention to increase major purchases over the next 12 months by up to 0.1 percent. Both responses are statistically and economically significant.

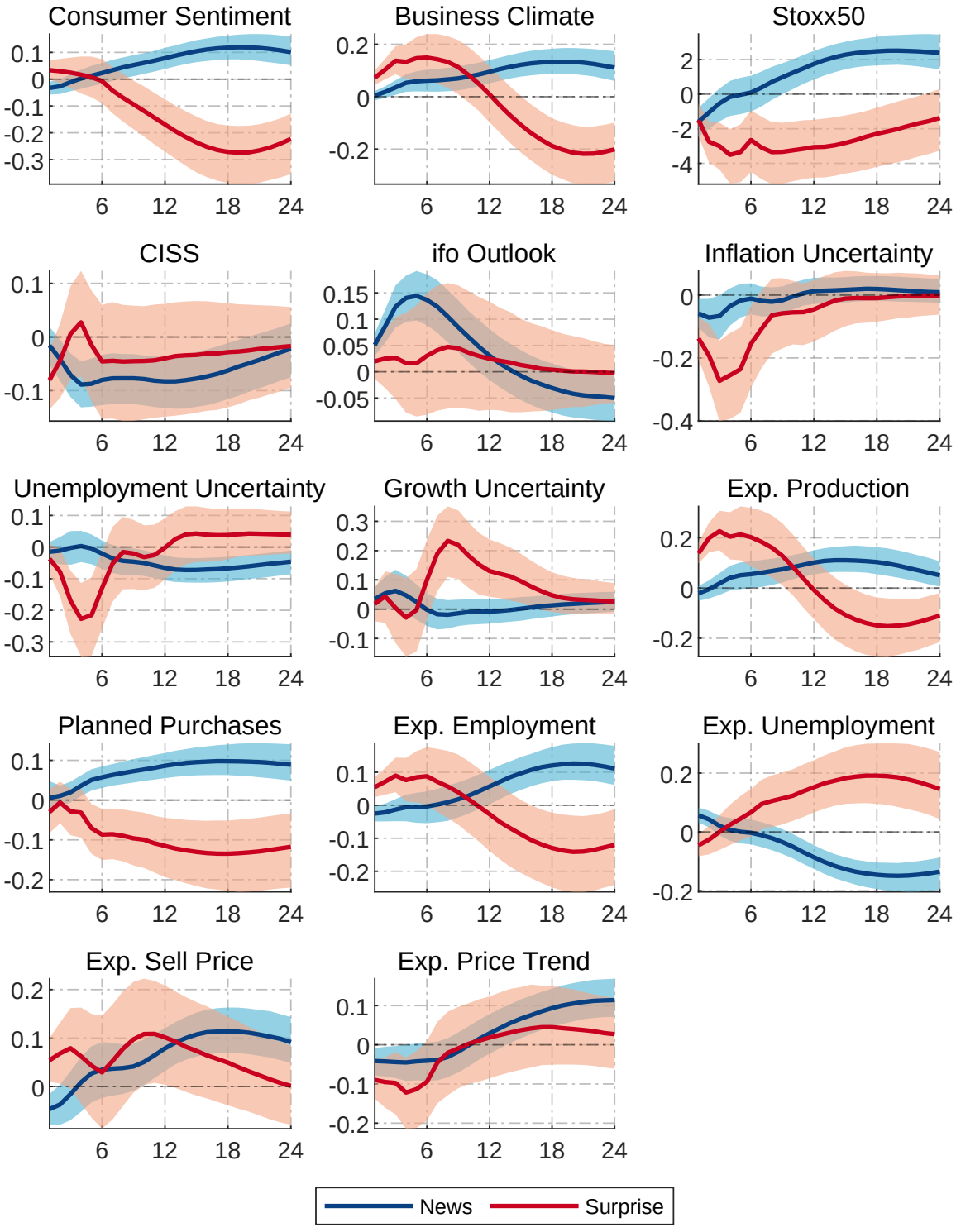
Furthermore, the optimistic tone is mirrored by a positive response concerning the labor market. Producers report an anticipated increase in employment by 0.1 percent, whereas consumers forecast a decrease in unemployment of 0.15 percent.

Figure 5 furthermore shows the responses of expected selling prices for the months ahead as stated by manufacturers and expected price trends over the next 12 months as stated by households. Both groups anticipate overall increasing prices within a 24 month horizon. The peak median responses are akin around 0.1 percent. Again, this is consistent with the good news emanating from the U.S., which have a favorable effect on the euro area economy. The additional demand causes price expectations to increase. Jarociński and Karadi (2020) show for the U.S. and the euro area that shocks that exhibit a concurrent co-movement of interest rates and stock markets lead to a notable increase in prices. Our results indicate that such shocks have considerable spillover effects.

Finally, we want to asses in how far the responses of expectations and sentiment to news shocks differ from their responses to a monetary surprise. Figure 6 plots findings discussed above (blue) and the responses to a U.S. monetary surprise (red) along with their respective posterior 68 percent probability masses.

In the majority of cases, the responses exhibit a notable disparity. We find

Figure 6: News Vs. Surprise in the Euro Area



Notes: Median impulse responses of euro area variables to both, U.S.news shock (blue solid) and current U.S. monetary policy shock (red solid) along with their respective 68% posterior probability bands. Responses are in percentage changes.

that monetary surprises, that is, the contemporaneous implementation of a

more restrictive monetary policy than expected, leads to a sizeable deterioration of consumer sentiment and business climate in the euro area. Both indicators decrease by more than 0.2 percent in response to a monetary policy tightening. Likewise, returns of the STOXX50 decrease immediately by two percent. The reason is that (i) real interest rates and risk premia increase and (ii) expected payoffs decline with the deteriorating outlook. Systematic stress is barely affected.

While inflation and unemployment uncertainty decrease, growth uncertainty increases. One reason could be that as central banks call out their interest rate decisions, they enable market participants to adjust their assessment concerning the state of the business cycle. Such information can decreases uncertainty. By contrast, an interest hike higher than expected could outface market participant's expectations concerning future business cycle movements.

The response of expected production within the next 12 months is puzzling. After a counter-intuitive increase, expected production eventually decreases, as higher interest rates slow down the economy, increase unemployment and thus decrease demand. As a consequence, firms respond with lower production. The decrease in demand becomes evident given the decrease in planned purchases by households. The decrease in supply and demand, and hence economic slowdown, gets further evident given the responses concerning expected employment and unemployment: firms report that they are expecting to employ less, while households report to be more likely unemployed within the next 12 months.

The responses of expected prices complete the overall picture. Within the first six months after the shock hits the economy, firms report decreasing expected selling prices.

It is worth noting that our findings concerning the role of news shocks and monetary surprises on (expectations about) inflation and economic activity are very similar to Jarociński and Karadi (2020) threefold. Firstly, our current monetary shock and their monetary surprise lead to similar responses. Secondly, the effect of our news shock is comparable to their information shock and thus emphasizes the vital role of central bank communication furthermore. Finally, our results indicate an asymmetric response to monetary surprises and news shocks. We find that expectations tend to respond stronger to an actual monetary tightening than to the

accommodating information of news as such.

However, our findings stand out as we find that U.S. monetary news play a remarkable role in the expectation formation in the euro area.

4 Black Clouds and Silver Linings

So far, our results suggest that a monetary news shock, which raises expected interest rates in the U.S., has expansionary effects in the euro area. A contemporaneous Fed tightening, in contrast, has contractionary effects on expectations in the euro area and leads to a fall in uncertainty. These opposing responses between an expected and current policy tightening are consistent with the notion that news shocks convey favorable information about the business cycle, which spill over to the euro area.

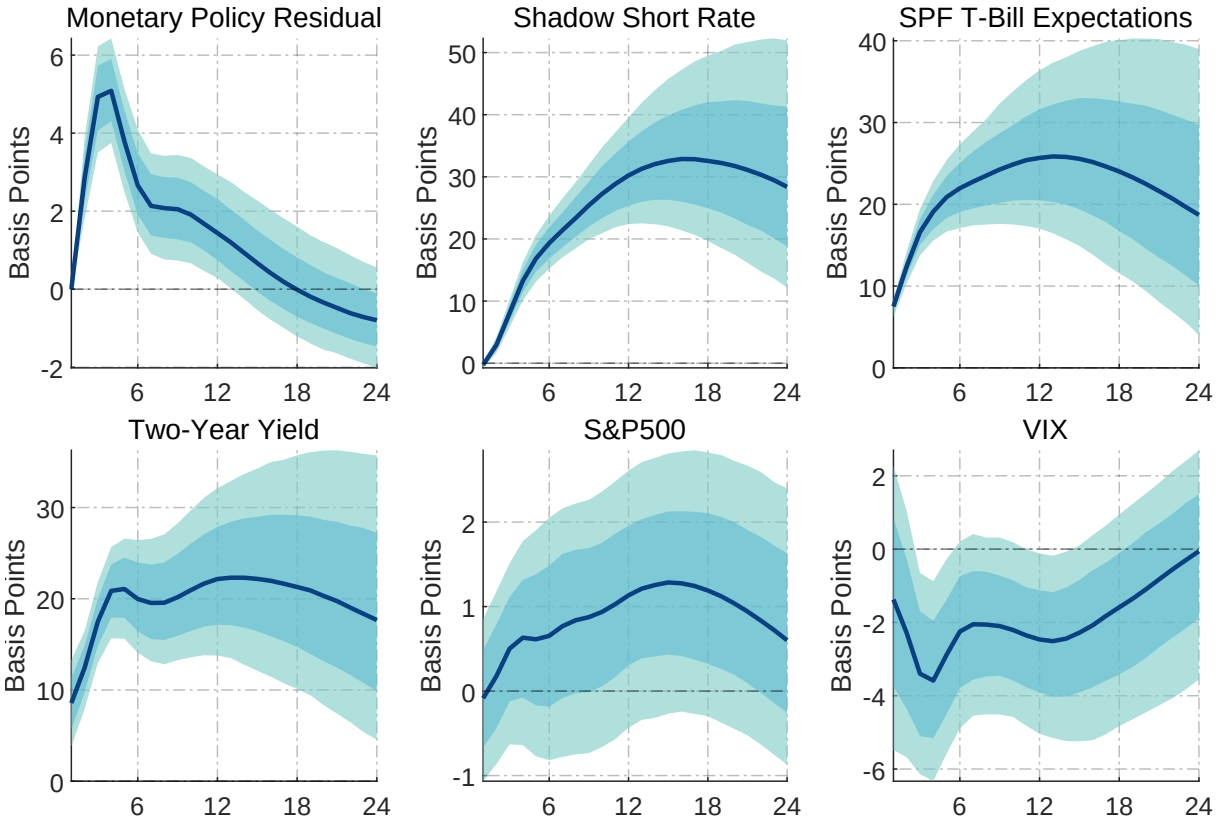
In this section, we provide evidence for this interpretation of our results. For that purpose, we jump back to the model for the U.S. economy and study the effects of news shocks on equity prices and volatility. A negative co-movement of anticipated interest rate hikes and stock returns would indicate that market participants expect the present value of future payoffs to decline because (i) real interest rates and risk premia increase and (ii) the expected payoffs decline with the deteriorating outlook caused by the indicated policy tightening. However, news concerning current and future monetary policy are to some extend based on information that are not open to the public. Thus, a concurrent co-movement between expected interest rate tightenings and stock returns reveals that market participants construe the announced policy action as a measure to counteract the impact of current and future demand conditions on the economy.

Figure 7 shows that our identified news shocks lead to an appreciation of equity prices as reflected by the S&P 500 index.[14] The effect is highly significant at the 68 percent level. That is, expected future corporate earnings increase upon receiving the news about the intentions of the Fed. Hence, the news shock can also be seen as an information shock in the sense of Jarociński and Karadi (2020) or a Delphic shock as in Lakdawala and Schaffer (2019) or Jarociński (2024).

Figure 7 further reveals that monetary news entering the market not only increase stock returns, but also decrease volatility. The VIX index of

[14] We take data of the monthly average of daily S&P500 returns from Yahoo Finance. VIX data stem from FRED St. Louis database.

Figure 7: Monetary News Shocks and the U.S. Stock Market



Notes: Posterior median impulse responses to monetary news shocks (solid line). Dark (light) areas denote 68% (90%) probability masses.

implied volatility falls by almost 2 basis points on impact and reaches its through at nearly 4 basis points five months after the news shock hits the economy.As new information concerning future monetary policy enters the market, whether through FOMC statements or speeches, uncertainty decreases notably. Since elevated levels of uncertainty are typically seen as depressing economic activity, see Bachmann et al. (2013), the fall in the VIX index is again consistent with the favorable information content of the news shock and the responses of sentiment and expectations in the euro area.

Another way to infer the information content of news shocks is to take a closer look at changes in forecasters expectations concerning future macroeconomic outcomes. If the inherent news carry a positive tone, forecasters should revise their outlook concerning i.a. expected prices and output upward. For this task, we compute the revision of CPI and real GDP expectations as the difference in the forecaster's assertion of the respective variables' value four quarters ahead and the respective statement

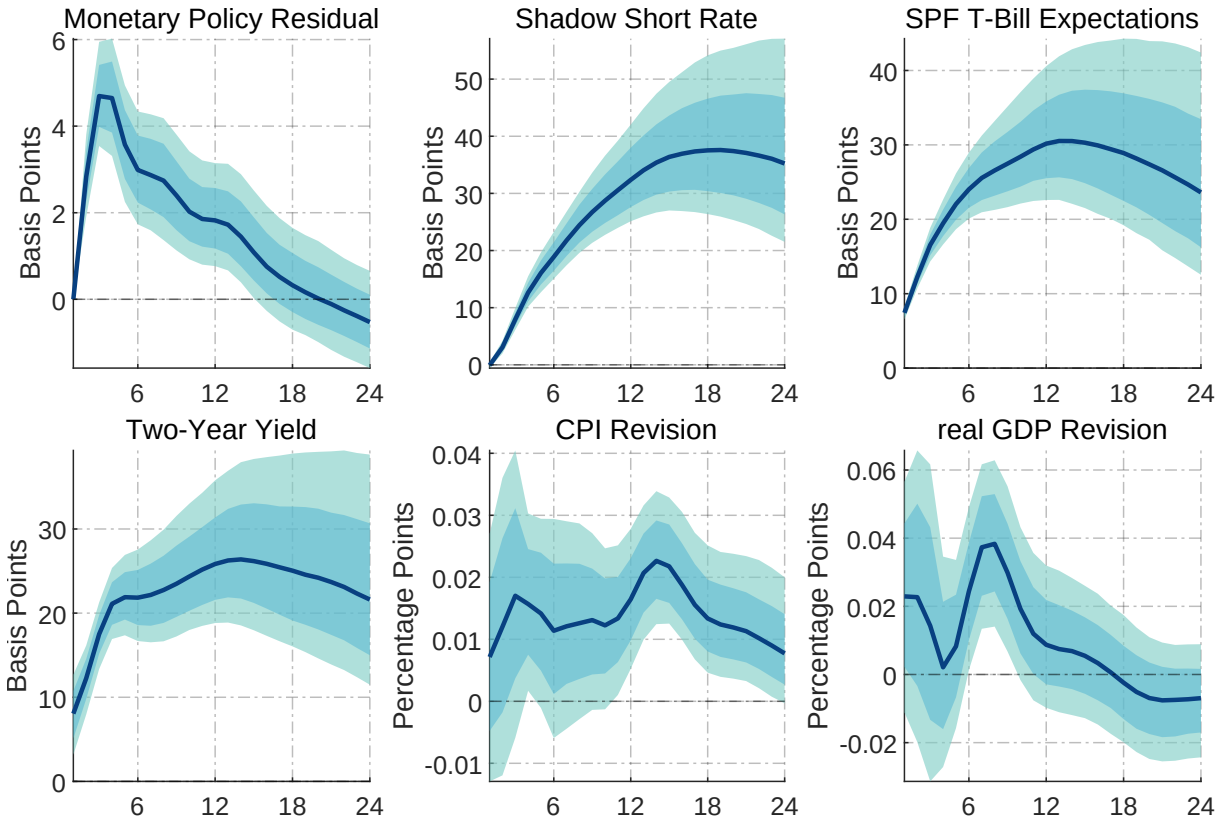
in the previous forecast vintage.[15] Formally, we compute

$$rev_t = E_t x_{t+4} - E_{t-1} x_{t+4} \,, \tag{4.1}$$

where x_{t+4} is either CPI or real GDP.

Figure 8 reveals that there is a movement in the same direction between interest rate expectations and projections of real GDP as well as prices in the presence of news shocks. In this sense, our results confirm the findings of Campbell et al. (2017), whereupon Delphic forward guidance reveals information about macroeconomic fundamentals, and are similar to the effects that the *information shock* by Jarociński and Karadi (2020) to real GDP and inflation generates.

Figure 8: Monetary News Shocks and SPF Expectations



Notes: Posterior median impulse responses to monetary news shocks (solid line). Dark (light) areas denote 68% (90%) probability masses.

Moreover, the positive change in expected real GDP is consistent with the upward revision of prices. Note that this does not imply that forecasters do

[15] Data on CPI and real GDP expectations are taken from the survey of professional forecasters (SPF). Data is available only on a quarterly frequency. To get monthly data, we convert them using the technique of *quadratic-match average*.

not believe that a future interest rate hike is not effective in fighting inflation. Such revisions only state that forecasters initially underestimated the true state of the business cycle and believe that the Fed is capable to assess the state of the economy more correctly and thus adjust their expectations upward.

5 Robustness

Our analysis crucially depends on the monetary policy residual. In our baseline setup, we use the Wu and Xia (2016) shadow rate as a proxy for the monetary stance. The interest rate utilized itself is a point estimate, as shadow short-rates are not observable and are therefore estimated from term structure models. Consequently, some degree of uncertainty surrounds them. Moreover, their path is heavily dependent on the model assumptions, as demonstrated by Deutsche Bundesbank (2017) and Krippner (2020).

In what follows, we therefore estimate alternative monetary policy residuals entirely based on the (observed) federal funds rate. In doing so, we use policy rules closely related to Coibion and Gorodnichenko (2012). Among their variations, the authors incorporate i.a. Tealbook forecasts and a higher lag order of the interest rate.

A. *Incorporating Tealbook CPI Forecasts*

The Tealbook is prepared by the Research staff at the Board of Governors and contains projections for various variables about how the economy will fare in the future; including inflation expectations. With this information at hand, we estimate

$$i_t = \mu + \rho_1 i_{t-1} + \rho_2 i_{t-2} + \phi_\pi E_t \pi^{tb,cpi}_{t+2,t+1} + \phi_{dy} E_t dy^{tb}_t + \epsilon^{mpr}_t \,, \qquad (5.1)$$

for the period 1999m01 to 2015m11. Here, i_t is the effective federal funds rate with its lagged values i_{t-1} and i_{t-2}. $E_t \pi^{tb,cpi}_{t+2,t+1}$ is the average Tealbook forecast of CPI inflation over $t+1$ and $t+2$, and $E_t dy^{tb}_t$ is the Tealbook now-cast for the contemporaneous growth rate of real output.[16]

[16] The now-cast for the contemporaneous growth rate refers to the current quarter of data collection. As before, we transform the data to a monthly frequency. In contrast to Coibion and Gorodnichenko (2012), we do not incorporate the now-cast of the contemporaneous output gap due to data availability. As the Tealbook is produced *before* each meeting of the Federal Open Market Committee, the data contained therein are thus exogenous to interest rates and can consequently be estimated using OLS without posing an endogeneity

It is worth mentioning that we do not have to transform the data from a quarterly to monthly frequency because FOMC meetings usually take place eight times a year which provides us 8/12 observations a year on a monthly basis. We calculate the missing four observations as the average between the prior and subsequent forecast.[17]

Figure 9 reveals that our results are robust to this alternative specification. All median impulse responses from the baseline model (dashed lines) are located within the posterior credibility bands. The most striking difference is the response of the monetary policy residual. We will also see this noticeable feature in the subsequent robustness exercises. The observation that the effect of news shocks is more pronounced in the baseline model can be attributed to the use of the shadow interest rate. This is estimated or calibrated using term structure models, which makes it particularly responsive to anticipated future interest rates. Furthermore, the response of the alternative MPR is less persistent which is likely due to the additional interest rate lag in the policy rule.

B. *Incorporating Core Personal Consumption Expenditure*

One could argue that core personal consumption expenditures (PCE) inflation is the more appropriate inflation indicator to describe policy decisions by the Fed.[18] To evade potential misspecification, we therefore estimate (5.1) using average Tealbook forecasts for core PCE inflation over $t+1$ and $t+2$ instead of CPI inflation. That is, we estimate

$$i_t = \mu + \rho_1 i_{t-1} + \rho_2 i_{t-2} + \phi_\pi E_t \pi^{tb,pce}_{t+2,t+1} + \phi_{dy} E_t dy^{tb}_t + \epsilon^{mpr}_t \,, \qquad (5.2)$$

where $E_t \pi^{tb,pce}_{t+2,t+1}$ is the average Tealbook forecast of PCE core inflation over $t+1$ and $t+2$. In this exercise, our sample is slightly shorter, as Tealbook core PCE forecasts are available only from January 2000.

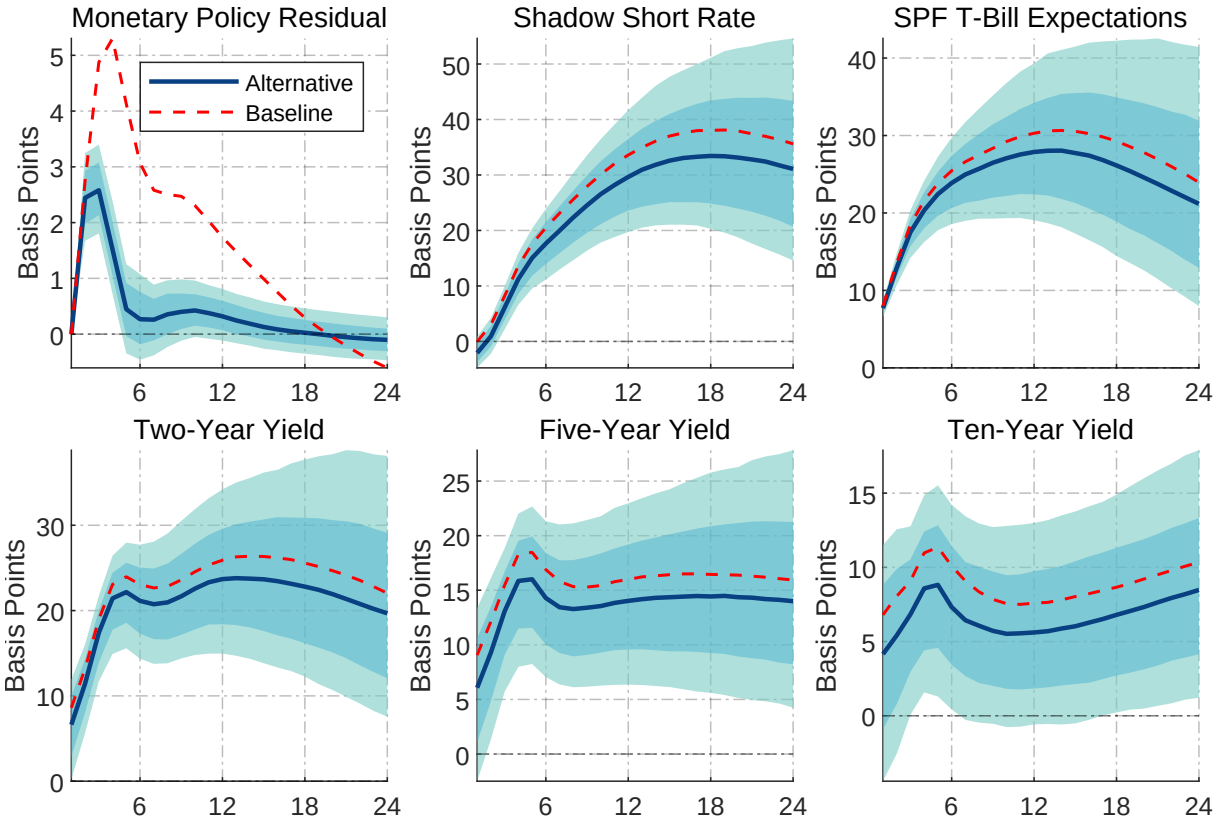
The results are shown in Figure 10. Yet again, our results are robust to this alternative. It is striking that all median responses (solid lines) in this setup are consistently below the respective median response of the baseline model

problem.

[17] For example, the January 1999 ($t = 99,1$) now-cast for dy is $E_{99,1} dy_{99,1} = 2.7$. The respective now-cast for March 1999 ($t = 99,3$) is $E_{99,3} dy_{99,3} = 3.4$. Thus, we calculate the missing now-cast for February 1999 ($t = 99,2$) as $E_{99,2} dy_{99,2} = (E_{99,1} dy_{99,1} + E_{99,3} dy_{99,3})/2$. We do the same for core PCE inflation forecasts.

[18] For example, during the FOMC meeting in December 1999, Chairman Greenspan provided a clear statement as to why to prefer the PCE price index to the CPI.

Figure 9: Interest Rate Rule with Tealbook CPI Forecasts



Notes: Posterior median impulse responses (solid lines) to monetary news shocks as in equation (5.1). Dark (light) areas denote 68% (90%) probability masses. Dashed lines depict median impulse responses from the baseline model.

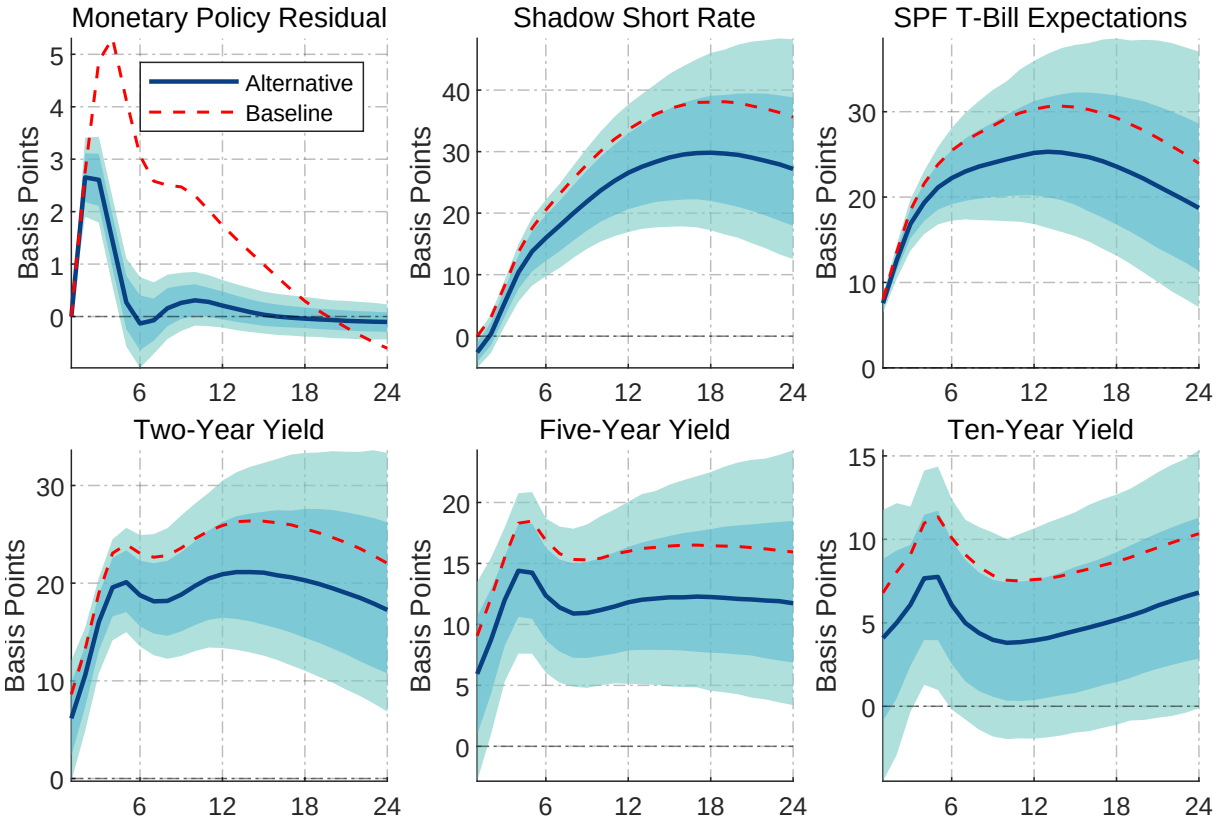
(dashed lines). Nevertheless, they lie well within the probability masses of the alternative specification.

C. *Considering Market Expectations*

Especially in the course of the 2007-08 financial crises and the subsequent recession with interest rates at the zero lower bound, central bank communication and expectation formation became increasingly important. At the same time, the Fed faced a trade-off between flexibility in and commitment to its designated monetary policy. To avoid financial stress and uncertainty, the Fed might therefore take market expectations into account. To control for that possibility, we estimate

$$\begin{aligned} i_t = \mu + \rho_1 i_{t-1} + \rho_2 i_{t-2} + \phi_\pi E_t \pi^{tb,cpi}_{t+2,t+1} + \phi_{dy} E_t dy^{tb}_t \\ + \phi^d_\pi \left(E_t \pi^{tb,cpi}_{t+2,t+1} - E_t \pi^{spf,cpi}_{t+2,t+1} \right) + \phi^d_{dy} \left(E_t dy^{tb}_t - E_t dy^{spf}_t \right) + \epsilon^{mpr}_t \ . \end{aligned} \tag{5.3}$$

Figure 10: Interest Rate Rule with core PCE Forecasts

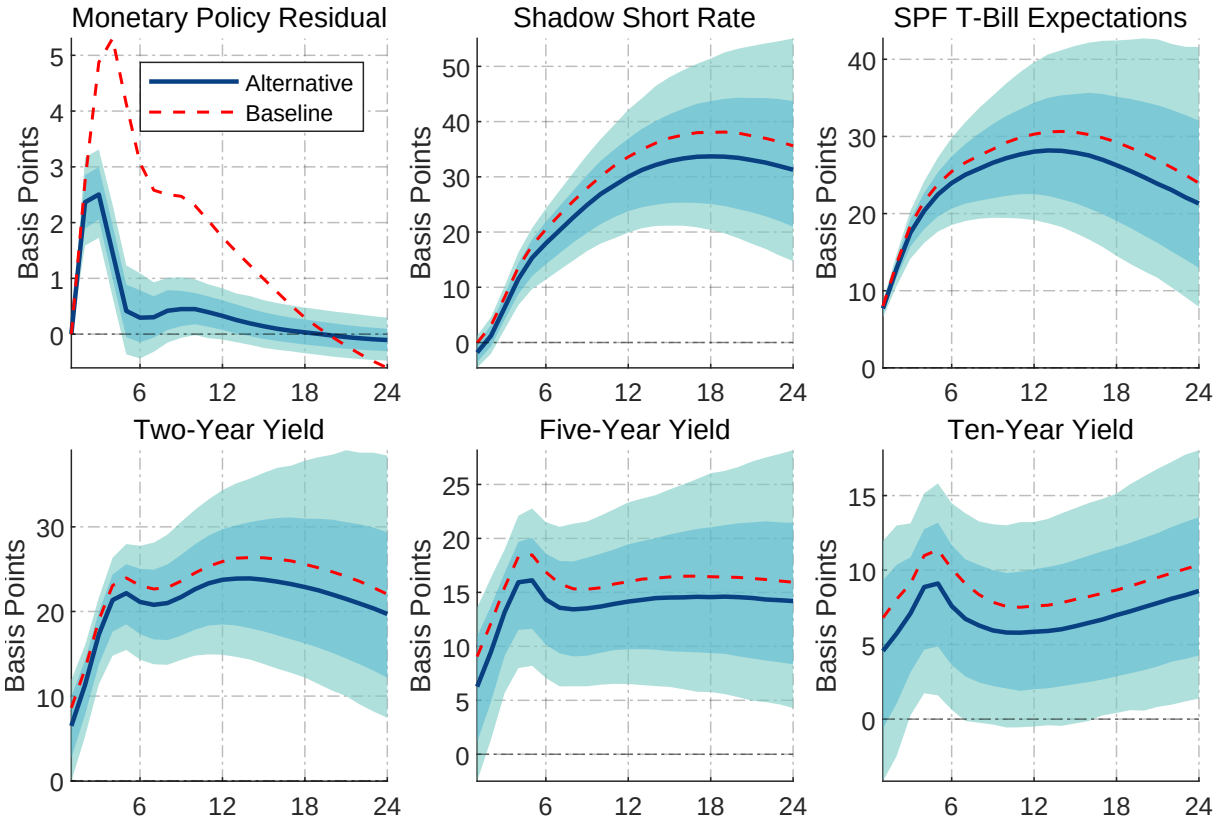


Notes: Posterior median impulse responses (solid lines) to monetary news shocks as in equation (5.2). Dark (light) areas denote 68% (90%) probability masses. Dashed lines depict median impulse responses from the baseline model.

The term $E_t\pi^{tb,cpi}_{t+2,t+1} - E_t\pi^{spf,cpi}_{t+2,t+1}$ captures discord in expectations concerning CPI inflation between the Fed and the market. The divergence in expectations concerning real output growth is captured by $E_t dy^{tb}_t - E_t dy^{spf}_t$. The results are depicted in Figure 11. Once more, our baseline results are robust to this alternative specification.

Lastly, we want to assure that the responses of the euro area are robust to the alternative specification. We therefore take the MPR as in equation (5.3) and look at the impulse responses of our euro area variables, which are depicted in Figure 12. The alternative specification corroborates our previous findings that anticipated of future interest rate hikes by the Federal Reserve induce a positive sentiment within the euro area.

Figure 11: Interest Rate Rule with Expectation Discord



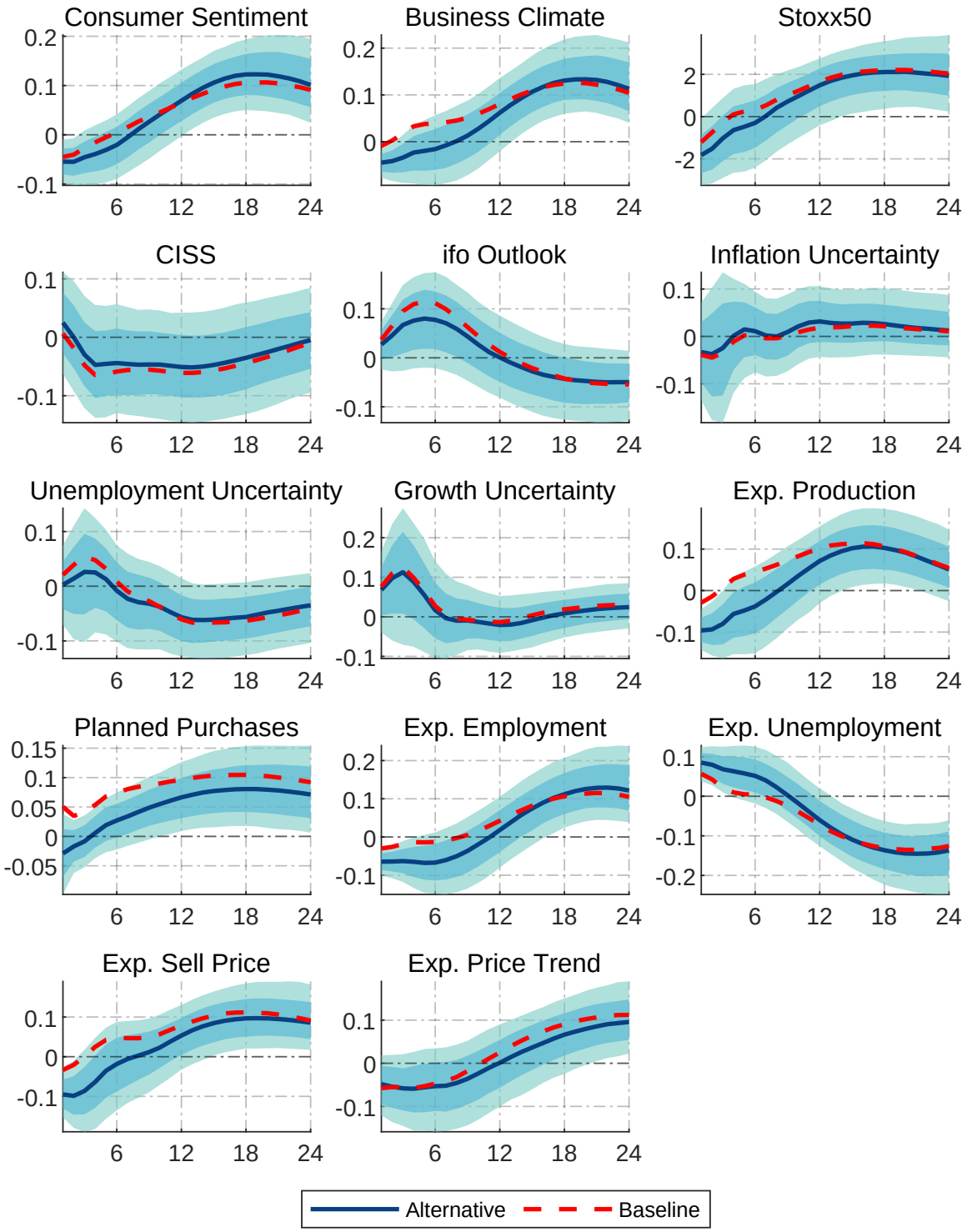
Notes: Posterior median impulse responses (solid lines) to monetary news shocks as in equation (5.3). Dark (light) areas denote 68% (90%) probability masses. Dashed lines depict median impulse responses from the baseline model.

6 Conclusion

This paper quantifies spillovers of U.S. monetary news shocks to the euro area. News shocks originate from anticipated Fed policy actions such as credible forward guidance. We identify news shocks based on a VAR approach and estimate the responses of euro area variables to an anticipated Fed tightening.

Our main results are twofold. First, we find significant spillovers. Variables such as asset prices, expectations, and sentiment indicators in the euro area respond to an anticipated Fed policy. Hence, our analysis underlines the relevance of policy spillovers among advanced economies. Our second finding pertains to the sign of these spillover effects. An expected Fed tightening is shown to be expansionary for the euro area, rather than contractionary. Confidence indicators improve and uncertainty tends to decrease after the anticipated tightening. Likewise, stock prices appreciate in the euro area.

Figure 12: Euro Area Responses to Alternative News Shock



Notes: Posterior median impulse responses (solid lines) to monetary news shocks as in equation (5.3). Dark (light) areas denote 68% (90%) probability masses. Dashed lines depict median impulse responses from the baseline model.

At first, this pattern is difficult to reconcile with economic intuition. However, these findings are in line with the notion that an announcement issued today about a future tightening reveals private information the Fed

might have about the state of the U.S. economy. This favorable news trigger an upward revision of sentiment indicators in the euro area. We underline this interpretation by showing that the news shocks, although raising expected future interest rates, also raise equity prices in the U.S. and lower equity market volatility. Hence, it's the new information about a stronger than expected economic expansion that spills over to the euro area. This logic also implies that an anticipated policy *easing* in the U.S., such as the one implemented at the zero lower bound, had *contractionary* effects on the euro area as the policy step reveals worse than expected fundamentals.

Our results shed new light on the discussion of policy spillovers. Traditionally, the literature studies spillovers with an opposite sign: a policy tightening in the U.S. reduces euro area exports, which has contractionary effects on the economy. Tighter monetary conditions in the U.S., the argument goes, also raise global interest rates and lead to capital outflows back into the U.S. dollar, which is contractionary abroad. Most policy prescriptions to deal with this kind of spillover effects are based on this notion of policy spillovers. For example, small open economies often ease monetary conditions as a result of the Fed tightening in order to reduce the fallout from the contraction in the U.S. economy. Hence, spillovers in this sense lead to a divergence of policy stances between the U.S. and other economies.

The notion of spillovers highlighted in this paper, however, suggests that an *anticipated* U.S. tightening can be expansionary abroad, such that the monetary policy response in the euro area is also a policy tightening. Thus, the spillovers shown here lead to a convergence of policy stances. This, in turn, reduces the scope for international policy coordination.

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