Are US Monetary Surprises Surprising? Evidence from Global Markets*

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Abstract

We show that FOMC announcement surprises are predicted by preceding ECB monetary policy announcement surprises. Specifically, a 1 p.p. ECB monetary policy surprise predicts a subsequent 0.25 p.p. FOMC surprise. We find little evidence that this predictability is due to the Fed using the ECB to update forecasts on the US economy or to the ECB releasing new information pertinent to near-term US macroeconomic conditions. Instead, we propose that the Fed responds to non-US economic conditions more strongly than investors expect. We find that the component of FOMC surprises predicted by ECB surprises has significant effects on the US economy. Our results suggest that the Fed's response to non-US news is an important facet of monetary policy.

Keywords: Fed surprises, ECB surprises, monetary policy identification, international finance

JEL Codes: E43, E52, E58, F30

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1 Introduction

A major empirical challenge to quantifying monetary policy transmission is the identification of monetary policy shocks. Researchers have primarily treated movements in future policy rate indicators during a small window around central bank announcements as exogenous monetary surprises. A key assumption to this approach is that the change in policy rates observed during this small window reflects only updates to beliefs about monetary policy provided by the central bank announcement. All ex ante information and ex ante expectations about monetary policy should already be reflected in the price before the announcement. Hence, monetary surprises should not be predictable by information prior to the announcement.

We show a surprising fact about Federal Open Market Committee (FOMC) surprises: these surprises are predictable by the monetary surprise of the most recent European Central Bank (ECB) monetary announcement. We do not, however, find evidence of the reverse: preceding US monetary shocks do not significantly predict ECB monetary shocks. This predictability is largely driven by the press conference portion of the ECB announcement, suggesting that information released during the press conference is more relevant to the Fed's decision making.

Previous hypotheses on FOMC surprises predictability do not explain this result. We first consider whether our results can be explained by investors underestimating the Fed response to US macroeconomic news, as in Bauer and Swanson (2022). They find that ex-ante US economic news predicts FOMC surprises, suggesting consistent misspecification of the Fed's response function. We find that ECB monetary surprises predict FOMC surprises even after controlling for US macroeconomic news. Moreover, we do not find that ECB monetary surprises predict changes to US macroeconomic expectations. We also investigate whether the ECB's predictive ability is due to the Fed updating its forecasts on US macroeconomic conditions, consistent with an information effect. ECB surprises predict neither revisions to US macro expectations nor revisions to the Fed's internal Tealbook macro expectations. These findings suggest that the Fed may

be responding to the ECB monetary surprise, but not through updates to US near-term macroeconomic forecasts.

Instead, we propose a new channel: the Fed responds to non-US economic conditions more strongly than investors expect. Both domestic and global variables impact the Fed's and the ECB's policy decisions. While investors pay attention to global markets and anticipate the ECB's reaction to them, partly because of press conference that the ECB holds after each policy decision, investors underestimate the weight that the Fed puts on global variables. A piece of evidence supporting this hypothesis is that there is no predictability of Fed shocks by ECB surprises during the European debt crisis from 2010 to 2015. A potential reason can be that US investors paid close attention to European markets during the crisis and effectively priced the information in Fed Fund futures.

Since high-frequency monetary shocks play a large role in quantifying monetary policy transmission, we consider the role of ECB predictability in three recent papers on monetary policy transmission. We replicate each paper's results using the component of Fed surprises predicted by the preceding ECB announcement.

First, we find that a large portion of the monetary transmission to equity returns found by Bernanke and Kuttner (2005) can be attributed to the part of Fed Funds surprises explained by ECB surprises. Next, we revisit Gertler and Karadi (2015)'s results. ECB-predicted Fed monetary policy shocks impact the one-year rate, but this effect is magnitudes lower when using the ECB-predicted component of monetary policy. Similarly, ECB-predicted surprises do not affect CPI. However, these shocks have significant effects on industrial production and excess bond premium. Finally, we revisit Nakamura and Steinsson (2018b). While ECB-predicted monetary policy surprises impact the 3-, 6-, and 12-month Treasury yields, these surprises have little to no impact on medium- and long-term bond yields.

We contribute to several strands of the literature. First, we contribute to the literature on monetary policy transmission. Monetary policy shocks have been used in many papers to show that monetary policy has an impact on real economy (Kuttner

(2001); Gurkaynak et al. (2005); Gertler and Karadi (2015); Gorodnichenko and Weber (2016); Drechsler et al. (2017); Nakamura and Steinsson (2018b); Indarte (2021)). Moreover, these shocks have been used to identify the impact of monetary policy on global and foreign markets (Cetorelli and Goldberg (2012); Schnabl (2012); Hale et al. (2020); Sarkisyan and Viratyosin (2022)). We show that the component of FOMC surprises predicted by ECB shocks drives key results in several of these papers. This indicates that the Fed's response to non-US news released by the ECB is a key driver of the effects of US monetary policy.

We also contribute to the literature on central bank information and investor reaction. Several papers study how central banks cooperate and pass information to investors (Hanson and Stein (2015); Campbell et al. (2017); Miranda-Agrippino (2017); Nakamura and Steinsson (2018b); Cieslak and Schrimpf (2019). Other papers look into the interaction of stock returns and monetary policy shocks to understand how information is passed through stocks (Rigobon and Sack (2003, 2004); Cieslak et al. (2019)). We show that although US and EU investors have similar information sets, their reactions are different – US investors underestimate the extent to which Fed incorporates global markets in its policy decisions.

Finally, we contribute to the literature on predictability and methodology of construction of monetary policy shocks. Economists have proposed numerous variations of monetary shocks to identify the impact of monetary policy on the economy (Bernanke and Mihov (1998); Kuttner (2001); Romer and Romer (2004); Bernanke and Kuttner (2005); Nakamura and Steinsson (2018b)). Most papers use high-frequency changes to FF futures around FOMC meetings as a measure of monetary shock (Bernanke and Kuttner (2005); Gorodnichenko and Weber (2016); Paul (2020); Indarte (2021)). The reason is that the change period is extremely short and all information available to investors was already priced – shocks are exogenous (Stock and Watson (2018)). However, several papers find that monetary surprises are predictable by stock returns or macro announcements (Ramey (2016); Cieslak (2018); Miranda-Agrippino and Ricco

(2021); Bauer and Swanson (2021, 2022)). We add to the literature by suggesting that monetary surprises are predicted by ECB surprises and the predictability is strong even after controlling for variables that are claimed to impact FOMC surprises.

The rest of the paper is organized as follows. Section 2 describes our main data sources. Section 3 proposes an empirical strategy and presents evidence that ECB announcement predict subsequent FOMC announcements. Section 4 replicates seminal papers that use monetary surprises to identify the causal impact of monetary policy on real economy, stocks, and bonds. Section 5 discusses traditional explanations of the predictability of monetary shocks, and provides evidence that these explanations do not encompass our findings on FOMC surprise predictability. Section 6 concludes.

2 Data and identification

We collect data on Fed monetary policy surprises and combine it with the data on ECB surprises and macroeconomic releases and forecasts.

2.1 High frequency data

We identify surprises around central bank announcements using intraday trading data on futures. Our source for FOMC surprises is Paul (2020), who measures short-term Federal Funds Rate Surprises as fluctuations of 1-month Fed Fund futures in 1-hour window around FOMC meetings. We also use the measure of Nakamura and Steinsson (2018b) that takes FFR surprises and constructs a proxy for forward guidance surprises. This proxy is the first principle component of movements in the current month and next month Fed Funds Futures rates, as well as changes in Eurodollar futures that expire two, three, and four quarters in the future. The data go back to 1994.

To identify ECB surprises, we turn to Altavilla et al. (2019), who measure movements in Overnight Index Swap rates around ECB announcements. ECB announcements begin with a press release containing direct, to-the-point information on interest rates and

asset purchases. Shortly after the press release, the president of the ECB explains the ECB's policies and economic forecasts in a press conference. Altavilla et al. (2019) record movements in OIS rates around the press release and press conference separately, allowing us to identify the surprise of each announcement. The ECB surprises extend to the formation of the ECB in 1999.

2.2 Macroeconomic data

We use macroeconomic announcement data from Bloomberg's Economic Calendar. The Economic Calendar records the announcement and consensus pre-announcement expectation of official US releases of key macroeconomic variables. The variables we study in this paper include non-farm payrolls, GDP growth, core CPI growth, and unemployment. We augment these announcements with historical data on S&P returns, commodity prices, and treasury yields provided by Bauer and Swanson (2022). Finally, we retrieve the daily VIX from the Federal Reserve Economic Database maintained by the Federal Reserve Bank of St. Louis.

We retrieve the Federal Reserve's internal Tealbook forecasts from the Federal Reserve Bank of Philadelphia. Tealbooks contain the Fed's internal forecasts of macroeconomic variables updated before FOMC meeting. These forecasts are released with a lag of five years, giving us Fed forecasts from the beginning of our sample to 2016.

3 Results

With the data in hand, we show that ECB surprises predict subsequent FOMC surprises. Our main result holds across several subsamples of the data and when we control for lagged monetary surprises. We find that the surprise released during the ECB's press conference is a stronger predictor of Fed surprises than the press release. In our baseline regression, we regress Fed surprises on the previous ECB surprise:

$$\Delta Fed_t = \beta_0 + \beta_1 \Delta ECB_{ME,t-\delta} + \epsilon_t \tag{1}$$

ΔFed_t is the surprise around the FOMC announcement on date t and $\Delta ECB_{ME,t-\delta}$ is the surprise around the previous ECB announcement. We remove cases where there was no ECB announcement between FOMC meetings, so that ΔFed_{t-1} always occurs before $\Delta ECB_{ME,t-\delta}$, which occurs before ΔFed_t. We define ΔFed_t as being either the movement in the Federal Funds Rate future, or as the principle component of the combination of Federal Funds Rate futures and Eurodollar futures identified by Nakamura and Steinsson (2018b). We use movements in the 1-month Overnight Index Swap rate from Altavilla et al. (2019) as our proxy for ECB surprises, $\Delta ECB_{ME,t-1}$.

In addition to measuring the surprise released over the entire ECB announcement, we utilize the ECB's separate press releases and press conferences to distinguish between the ECB's release of information on short-term monetary policy vs forward guidance and its macroeconomic outlook. As discussed in Altavilla et al. (2019), the initial press release contains a short statement outlining the ECB's new policy rate. After 2014, any changes to monthly asset purchases by the ECB were also included in the press release. During the subsequent press conference, the president of the ECB discusses the basis for the previously announced policy decision, including the ECB's economic outlook, and then answers questions from reporters. The press conference is used by investors to infer the ECB's forward guidance.

In our second set of regressions, we disentangle the predictive power of press release surprises and press conference surprises. We predict Fed surprises with ECB surprises identified around press releases $\Delta ECB_{PR,t-\delta}$ and press conferences $\Delta ECB_{PC,t-\delta}$ separately:

$$\Delta Fed_t = \beta_0 + \beta_1 \Delta ECB_{PR,t-\delta} + \beta_2 \Delta ECB_{PC,t-\delta} + \epsilon_t \tag{2}$$

We run regressions 1 and 2 on our 2001-2019 sample. The results are shown in Tables 1

and 2. Table 1 shows regressions predicting short-term FFR surprises, and Table 2 shows regressions predicting the Nakamura and Steinsson (2018b) surprises. The first column of each table shows the results of Regression 1. The second column shows the regression where ECB press releases and press conference predict FOMC surprises separately, as in Regression 2. The final two columns in each table repeat these regressions and add lagged ECB surprises. All standard errors are clustered at the date level.

These regressions indicate that ECB surprises predict subsequent Fed surprises. A surprise of one percentage point from the ECB's monetary event predicts a 0.25 b.p. surprise for the Federal Funds Rate futures. The predictive power of ECB press conference surprises is especially strong. Press conference surprises have coefficients significant at the 5% level when they predict both FFR futures movements and the NS surprise. The ECB's predictive ability suggests that the ECB releases information relevant to the Fed's policy making, but that investors do not take this information into account when updating their forecast of the Fed's policy rate.

We further test if this predictive power is asymmetric between positive (contractionary) and negative (expnasionary) ECB shocks. We divide our sample into periods where the ECB monetary event surprises were positive or negative in Tables 3 and 4. The first two columns of each table show the baseline regressions predicting FOMC surprises with ECB surprises. The third and fourth columns restrict the sample to ECB surprises that were positive. The last two columns restrict the sample to negative ECB surprises.

ECB press conferences continue to predict Fed surprises within each subsample. The coefficient on the press conference surprise continues to be economically meaningful in all specifications and is statistically significant in in nearly every regression. These subsample-based results indicate that ECB press conferences reveal information pertinent to the Fed across our entire sample.

These regressions indicate that information released during the ECB's announcements is relevant to the Fed's monetary policy decisions, and is not accurately priced by investors before subsequent FOMC announcements. This leaves open the exact mecha-

Table 1: Predicting FOMC Surprises with ECB Surprises

$$\Delta Fed_t = \beta_0 + \beta_1 \Delta ECB_{ME,t-\delta} + \epsilon_t$$
$$\Delta Fed_t = \beta_0 + \beta_1 \Delta ECB_{PR,t-\delta} + \beta_2 \Delta ECB_{PC,t-\delta} + \epsilon_t$$

	Dependent variable:			
	FF surprise			
	(1)	(2)	(3)	(4)
ECB surprise	0.253*		0.254*	
	(0.147)		(0.149)	
ECB PR surprise		0.217		-0.0403
		(0.163)		(0.163)
ECB PC surprise		0.748**		0.553**
		(0.347)		(0.272)
ECB surprise lag			0.0486	
			(0.0688)	
ECB PR surprise lag				0.188
				(0.126)
ECB PC surprise lag				-0.0407
				(0.197)
Observations	151	137	151	128
R^2	0.0376	0.0877	0.0399	0.0697

Note: This table provides results of estimation of equations (1) and (2). The first column shows benchmark result. The second column shows results of regression (2) where the ECB shock is computed separately for the press release and press conference. Columns 3 and 4 include lags. Standard errors are clustered at the time level and displayed in the parentheses. *,** , and *** correspond to 10-, 5-, and 1% significance level, respectively.

Table 2: Predicting Nakamura and Steinsson (2018b) Surprises with ECB Surprises

$$\Delta Fed_t = \beta_0 + \beta_1 \Delta ECB_{ME,t-\delta} + \epsilon_t$$
$$\Delta Fed_t = \beta_0 + \beta_1 \Delta ECB_{PR,t-\delta} + \beta_2 \Delta ECB_{PC,t-\delta} + \epsilon_t$$

	Dependent variable:			
	NS surprise			
	(1)	(2)	(3)	(4)
ECB surprise	0.147		0.147	
	(0.144)		(0.143)	
ECB PR surprise		0.167		-0.107
		(0.170)		(0.133)
ECB PC surprise		0.599***		0.421**
		(0.218)		(0.190)
ECB surprise lag			-0.0590	
			(0.127)	
ECB PR surprise lag				-0.136
				(0.112)
ECB PC surprise lag				-0.353*
				(0.188)
Observations	151	137	151	128
R^2	0.0147	0.0637	0.0186	0.0598

Note: This table provides results of estimation of equations (1) and (**??**) using Nakamura and Steinsson (2018b) shocks. The first column shows benchmark result. The second column shows results of regression (**??**) where the ECB shock is computed separately for the press release and press conference. Columns 3 and 4 include lags. Standard errors are clustered at the time level and displayed in the parentheses. *,** , and *** correspond to 10-, 5-, and 1% significance level, respectively.

Table 3: Predicting FOMC Surprises with ECB Surprises: Expansionary vs Contractionary Surprises

$$\Delta Fed_t = \beta_0 + \beta_1 \Delta ECB_{ME,t-\delta} + \epsilon_t$$
$$\Delta Fed_t = \beta_0 + \beta_1 \Delta ECB_{PR,t-\delta} + \beta_2 \Delta ECB_{PC,t-\delta} + \epsilon_t$$

	Dependent variable:					
	FF surprise					
	(1)	(2)	(3)	(4)	(5)	(6)
ECB surprise	0.253*		0.202		0.373**	
	(0.147)		(0.234)		(0.165)	
ECB PR surprise		0.217		0.128		0.283
		(0.163)		(0.216)		(0.202)
ECB PC surprise		0.748**		1.138***		0.659
		(0.347)		(0.272)		(0.488)
Sample	Full	Full	Contr	Contr	Exp	Exp
Observations	151	137	92	83	88	81
R^2	0.0376	0.0877	0.0138	0.0994	0.0899	0.0906

Note: This table provides results of estimation of equations (1) and (2) separately for contractionary and expansionary shocks. The first two columns show results for the full sample. Columns 3 and 4 present results only for contractionary shocks. Columns 5 and 6 show results only for expansionary shocks. Standard errors are clustered at the time level and displayed in the parentheses. *,** , and *** correspond to 10-, 5-, and 1% significance level, respectively.

Table 4: Predicting Nakamura and Steinsson (2018b) Surprises with ECB Surprises: Expansionary vs Contractionary Surprises

$$\Delta Fed_t = \beta_0 + \beta_1 \Delta ECB_{ME,t-\delta} + \epsilon_t$$
$$\Delta Fed_t = \beta_0 + \beta_1 \Delta ECB_{PR,t-\delta} + \beta_2 \Delta ECB_{PC,t-\delta} + \epsilon_t$$

	Dependent variable:					
	NS surprise					
	(1)	(2)	(3)	(4)	(5)	(6)
ECB surprise	0.147		-0.016		0.390**	
	(0.144)		(0.179)		(0.167)	
ECB PR surprise		0.167		-0.011		0.326
		(0.170)		(0.119)		(0.202)
ECB PC surprise		0.599***		0.657***		0.819***
		(0.218)		(0.198)		(0.408)
Sample	Full	Full	Contr	Contr	Exp	Exp
Observations	151	137	92	83	88	81
R^2	0.0147	0.0637	0.0000	0.0364	0.0933	0.123

Note: This table provides results of estimation of equations (1) and (2) using Nakamura and Steinsson (2018b) shocks separately for contractionary and expansionary shocks. The first two columns show results for the full sample. Columns 3 and 4 present results only for contractionary shocks. Columns 5 and 6 show results only for expansionary shocks. Standard errors are clustered at the time level and displayed in the parentheses. *,** , and *** correspond to 10-, 5-, and 1% significance level, respectively.

nism by which the ECB affects the Fed's decisions, and why investors systematically fail to price this information in Fed policy rates. In Section 5 we find little evidence that the ECB's predictive power can be accounted for by previous explanations of monetary surprise predictability, such as differences between the Fed's information set and that of investors, or incorrect predictions on the Fed's reaction to macroeconomic variables by investors.

4 Re-evaluation of monetary policy results

As discussed above, monetary policy shocks have been widely used to identify the impact of monetary policy on real variables. Two seminal papers (Gertler and Karadi (2015); Nakamura and Steinsson (2018a)) find that monetary policy impacts bond returns. There is also evidence that contractionary monetary policy negatively impacts stock returns (Bernanke and Kuttner (2005)). All three papers use monetary shocks to identify the impact of the policy on bond and stock returns. In this section, we quantify the importance of the component of FOMC shocks predicted by the ECB for the results in each of these papers.

We start by replicating Bernanke and Kuttner (2005). We identify the effect of monetary policy on equity returns in the 2000-2020 period using the CRSP value-weighted equity index. We run the following regression:

$$Ind_t = \alpha + \beta MS_t + u_{it} \tag{3}$$

where ΔInd_t is the change in the value-weighted equity index around the FOMC announcement on date t and MS_t is the high-frequency monetary shock around that announcement. Table 5 shows the results. First, we replicate Bernanke and Kuttner (2005): a contractionary monetary shock, identified by movements in Fed Funds Rate futures around FOMC announcements, leads to lower equity returns. In column 2, we predict movements in the equity index using ECB-predicted FOMC surprises. The coefficient

Table 5: Replication of Bernanke and Kuttner (2005) Results
$Ind_t = \alpha + \beta MS_t + u_t$

	Dependent variable:	
	Equity Index	
	(1)	(2)
BK shock	-0.063^{**}	
	(0.030)	
KSV shock		-0.060^{*}
		(0.031)
KSV PC shock		
Constant	0.002^{*}	0.002^{**}
	(0.001)	(0.001)
Observations	151	151
R^2	0.047	0.041

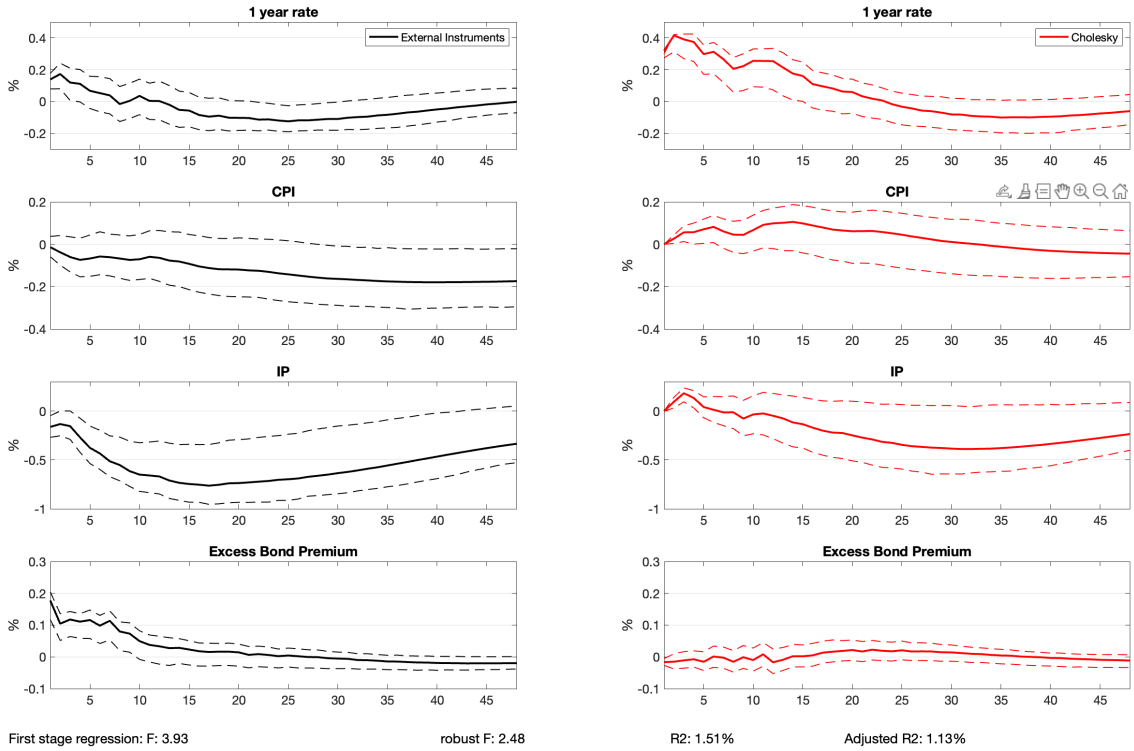
Note: This table provides results of estimation of (3). Column 1 uses classic monetary surprises as a regressor. Column 2 uses the component of FOMC surprises predicted by the previous ECB announcement surprise. Standard errors are robust and displayed in the parentheses. *,** , and *** correspond to 10-, 5-, and 1% significance level, respectively.

in this regression (0.60) is almost identical to the coefficient on overall FOMC surprises (0.63). These similar coefficients suggest that the component of the Fed's policy surprises predicted by the ECB has significant effects on equities in the US.

Next, we replicate Gertler and Karadi (2015), who provide evidence that monetary policy impacts the one-year rate, CPI, industrial production, and excess bond premium (see Figure 1 in Gertler and Karadi (2015)). We rerun their VAR using both instrumental variables and a Cholesky decomposition for identification. We replace one of the benchmark instruments – FF surprises – with our measure of shocks. We use the codes kindly provided by the authors and add our variables to their dataset.

Figure 1 shows the results. The left panel shows impulse responses (IRFs) from running benchmark VAR with external instruments, and right panel shows VAR results

Figure 1: Replication of Gertler and Karadi (2015) Results



with the Cholesky decomposition. Consistent with Gertler and Karadi (2015), ECB-predicted surprises impact the one-year rate. However, the magnitudes and significance levels are lower in our case. ECB-predicted surprises do not impact CPI. In contrast, ECB-predicted surprises have a strong impact on industrial production, indicating that the component of US monetary policy predicted by the ECB has significant effects on real US variables. Finally, the impact on excess bond premium is stronger with our measure of shocks.

We also replicate credit cost results of Gertler and Karadi (2015). Figure 2 shows the results. All spreads react stronger to monetary policy identified using our measure of shocks than the standard measure. In other words, monetary policy pass-through to the real economy might have been underestimated.

Finally, we revisit Nakamura and Steinsson (2018a). They find a strong impact of monetary policy on bond yields, including long-term yields. We repeat their analysis in Table 1 by regressing movements in bond yields on ECB-predicted FOMC surprises. The bond yield data are kindly provided by the authors.

Figure 2: Replication of Gertler and Karadi (2015) Credit Cost Results

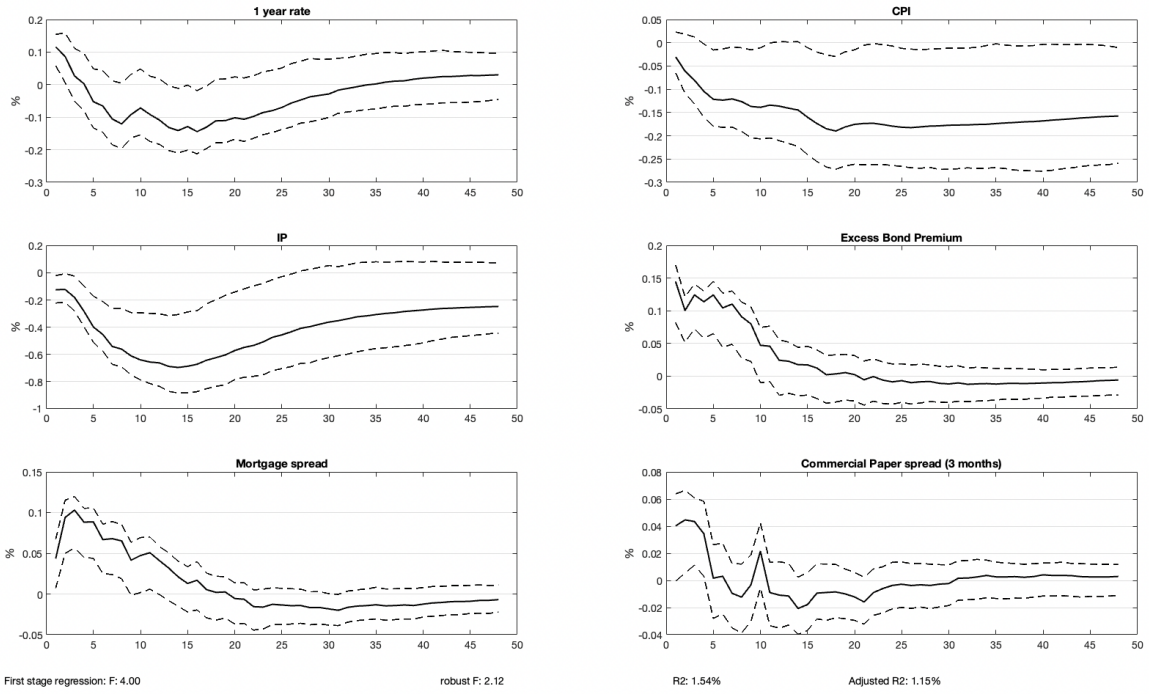


Table 6 shows the results of these regressions. Consistent with Nakamura and Steinsson (2018a), we find that US monetary policy predicted by ECB surprises impacts 3-, 6-, and 12-month Treasury yield, although our estimates are smaller than those of the authors. However, we do not find any significant impact of monetary policy on medium- and long-term yields.

These exercises suggest that the Fed's response to news released by the ECB is a major driver of macroeconomic variables in the United States. ECB-predicted monetary surprises have significant effects on short-term bond yields and industrial production, indicating the importance of this international channel for US monetary policy.

5 Traditional explanations for FOMC surprise predictability

Researchers have shown that surprises around FOMC announcements are predictable by economic forecasts and news. A large literature has studied the implications of the Fed re-

Table 6: Replication of Nakamura and Steinsson (2018a) Results

	Dependent variable:		
	Nominal	Real	Inflation
	(1)	(2)	(3)
3M Treasury yield	0.51***		
	(0.16)		
6M Treasury yield	0.60***		
	(0.10)		
1Y Treasury yield	0.41***		
	(0.16)		
2Y Treasury yield	0.46	0.47**	−0.01
	(0.32)	(0.20)	(0.15)
3Y Treasury yield	0.35	0.37*	−0.03
	(0.34)	(0.20)	(0.18)
5Y Treasury yield	0.10	0.18	−0.09
	(0.16)	(0.12)	(0.09)
10Y Treasury yield	−0.01	0.10	−0.10
	(0.12)	(0.09)	(0.07)

Note: This table provides results of replicating Table 1 of Nakamura and Steinsson (2018a) paper. All regression specifications, time periods, and standard errors (reported in the parentheses) are similar to their paper.

leasing private information on the economy during FOMC announcements. In this literature, movements in futures around FOMC announcements are contaminated by economic news in addition to pure monetary policy surprises. More recently, Bauer and Swanson (2022) have challenged this view by pointing out that public economic news surprises predict both changes in forecasts and FOMC surprises. This evidence points to the Fed not having additional information on the economy, but instead systematic underestimation of the Fed's reaction to economic news by investors.

In this section, we examine whether these previous explanations for monetary policy predictability account for our results on ECB announcements predicting FOMC an-

nouncements. Our testable hypotheses about each channel follow:

1. Fed Response to Economic News: Investors accurately predict how ECB surprises predict US economic conditions, but underestimate how strongly the Fed will react to those conditions. This is consistent with the ECB NOT predicting US economic surprises (because investors update their economic forecasts based on the ECB announcements). Furthermore, when we regress FOMC surprises on both ECB surprises and US economic news surprises, the latter should drive out the predictive power of the former. This is because the ECB predicts the Fed only insofar as it moves investor's expectations about the US economy.

2. Information Effect: During ECB announcements, information pertinent to the US economy is revealed. This information is reflected in updates to the Fed's internal forecasts, but investors ignore it and do not trade US futures based on that information. This channel is consistent with the ECB announcement surprises predicting revisions to the Fed's forecasts between meetings. If the information revealed from the ECB announcements are accurate, ECB surprises should also predict surprises around US economic news announcements, since investors fail to incorporate this information in their economic forecasts.

In this section, we show that the ECB's predictive power on FOMC surprises does not work through either of these channels. Our analysis indicates that a new channel, which we term the global monetary shock channel, drives the ECB's predictability of the Fed.

5.1 Fed response to economic news channel

Bauer and Swanson (2022) argue that professional forecasters and the Fed respond to the same set of economic news, but that investors systematically under-predict the Fed's response. To support their hypothesis, they regress Blue Chip forecast revisions on economic news surprises in addition to FOMC surprises, repeating the information effect

regression with economic surprises as control variables. They find that the sign of the FOMC surprises flip: controlling for economic news, Fed tightening makes Blue Chip forecasts more contractionary, consistent with standard economic theory. To explain why economic news predicts FOMC announcements, Bauer and Swanson (2022) propose investor misspecification of the Fed's reaction function to the economy. They argue that the Fed consistently reacts more strongly to economic fundamentals than investors predict, leading to the ability of economic news to predict FOMC surprises.

To test if the ECB's predictive ability over FOMC surprises is due to this channel, we rerun the regression in Equation (1) controlling for the economic news variables in Bauer and Swanson (2022). These variables include the previous surprises on unemployment news, non-farm payrolls news, GDP, and core inflation, as well as the change in core CPI over the previous 6 months, the change in core CPI expectations over the previous 6 months. They also include the change in the log SP 500 index, the change in the yield curve slope, and the change in the Bloomberg commodity price index over the previous 3 months. The regression takes the form

$$\Delta Fed_t = \beta_0 + \beta_1 \Delta ECB_{ME,t-\delta} + \Gamma X_t \epsilon_t \tag{4}$$

$\Delta ECB_{t-\delta}$ are movements in OIS futures around ECB announcements in the ECB meeting before an FOMC meeting. X_t are the Bauer and Swanson (2022) variables. Surprises are defined as the difference between the value of a macroeconomic variable publicly revealed at announcement time t and the survey expectation of that release.

The results from these regressions are shown in Table 7. The first three columns predict FFR surprises, while the last three predict NS surprises. The first column within each group of three runs the baseline regression from Table 3 in Bauer and Swanson (2022).

ECB press conference surprises continue to predict FOMC surprises controlling for the Bauer and Swanson (2022) variables. In fact, the point estimates for the press conference surprises in these regressions are higher than the point estimates in the baseline

regressions shown in Tables 1 and 2, indicating that the ECB reveals information relevant to FOMC surprises that is orthogonal to US economic news announcements. These regressions show that the Fed response to news channel does not explain why FOMC surprises are predicted by the ECB.

5.2 Information effect channel

We now examine whether the information effect is a plausible channel to explain our results. If the ECB reveals information that the Fed uses to update its economic forecast, but investors ignore, ECB surprises can be considered a source of private information for the Fed.

We first test whether ECB surprises predict US economic news surprises. If they do, this would indicate that investors systematically ignore information released by the ECB that is relevant for the US economy. If the ECB surprises do not predict economic news surprises, then either investors incorporate this information in their forecasts, or the ECB does not reveal relevant information.

We regress macroeconomic surprises on ECB surprises:

$$Surprise_{t,v} = \beta_0 + \beta_1 ECB_{ME,t-\delta} + \epsilon_t \tag{5}$$

Where $Surprise_{t,v}$ is the surprise to a macroeconomic variable v revealed at announcement time t, where surprises are defined in the previous section.

As shown in Tables 8 and 9, ECB surprises have little predictive power over US economic news surprises. In none of these regressions is the coefficient on an ECB surprise significant at the 5% level. Based on these results, either investors accurately incorporate revelations from the ECB into their forecasts, or the ECB does not reveal private information relevant to the US economy.

The possibility remains that the Fed uses ECB releases to update its view of the economy, whether or not ECB surprises predict public economic news releases. In this case, the ECB surprises are effectively private information the Fed uses to update its

view of the economy. We directly test whether the Fed updates its forecasts using ECB surprises by regressing Greenbook Forecast changes on ECB surprises that occurred before each meeting and after the previous meeting, as well as economic news releases. The regressions take the form:

$$\Delta GB_{v,t} = \beta_0 + \beta_1 ECB_{t-\delta} + \Gamma X_t + \epsilon_{v,t} \tag{6}$$

where $\Delta GB_{v,t}$ is the update at time t to the Fed's forecast of variable v and X_t are the Bauer and Swanson economic news variables. We run this regression for unemployment, GDP, and CPI forecasts. The results are shown in Tables 10, 11, and 12. We predict the nowcast, 1 quarter ahead forecast, and 2 quarter ahead forecast revisions for each variable. The first three columns of each table predicts these revisions using OIS movements around the entire ECB monetary announcement, and the last three columns predict them using separate press release and press conference movements.

ECB surprises have little predictive power over Greenbook forecast revisions controlling for US economic news. The only time an ECB surprise is significant at the 5% level is for predicting CPI revisions one quarter in the future. However, this significance is anomalous: ECB surprises do not add any predictive power for the unemployment rate or real GDP growth. Given these results, it is unlikely that the Fed uses ECB announcements to update its forecasts for the US economy.

Lastly, we test whether the predictive power of the ECB shocks is confounded by the Fed's forecasting updates. Following Miranda-Agrippino (2017), we regress FOMC surprises on changes in the Fed's forecasts for real GDP growth, inflation, and unemployment for the current quarter, subsequent quarter, and 2 quarters in the future. We also include the previous four FOMC surprises. The results in Table 13 indicate that the predictive power of ECB press conference surprises are not accounted for by updates to Greenbook forecasts. This result is inconsistent with the Fed using the ECB surprises to update its view of the economy.

6 Conclusion

In this paper, we take a critical look at the widely-used high-frequency identification of monetary policy surprises. We show that despite the assumed full-information rational expectations, high-frequency identified US monetary shocks are predictable by preceding ECB monetary shocks. Our findings are robust to considering the Fed response under-reaction explanation proposed by Bauer and Swanson (2022). Moreover, we show that ECB monetary surprises neither correspond to changes to US public expectations of US macroeconomic variables, nor do they predict changes to the Federal Reserve's Tealbook internal macroeconomic projections. Furthermore, we find the explanatory power of ECB monetary shocks drives a large portion of the monetary transmission findings to stock returns, bond yields, and real variables. These findings suggest that, despite the outsized role of the Federal Reserve in international monetary policy transmission, the unanticipated Federal Reserve's response to foreign monetary policy, may be an important driver of US monetary policy shocks.

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Table 7: Predicting FOMC Surprises with ECB Surprises and Economic News

	FF surprise			NS surprise		
	(1)	(2)	(3)	(4)	(5)	(6)
Unemployment Surprise	−419.4**	−412.0**	−321.2*	−357.1*	−351.9*	−295.9
	(191.9)	(189.0)	(193.2)	(194.8)	(192.6)	(200.1)
GDP Surprise	−68.41	−52.11	1.727	−59.17	−47.78	−101.1
	(81.40)	(80.11)	(84.66)	(72.72)	(71.80)	(71.77)
BBK Index	0.678	0.959	1.254	1.395	1.591*	1.498
	(1.264)	(1.234)	(1.272)	(0.886)	(0.885)	(0.937)
Core CPI Inflation Surprise	57.19	196.2	210.2	212.9	309.9	-3.186
	(541.5)	(524.7)	(541.0)	(453.4)	(446.3)	(437.6)
ECB Announcement Surprise		0.243*			0.170	
		(0.135)			(0.112)	
Press Release Surprise			0.179			0.0890
			(0.153)			(0.133)
Press Conference Surprise			0.910**			0.855***
			(0.370)			(0.264)
Macro controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	150	150	136	150	150	136
R^2	0.0520	0.0843	0.127	0.135	0.154	0.158

Note: This table provides results of estimation of equation (4). The first three columns predict FFR surprises, while the last three predict Nakamura and Steinsson (2018b) surprises. The first column within each group of three runs the baseline regression from Table 3 in Bauer and Swanson (2022). Standard errors are clustered at the time level and displayed in the parentheses. *,** , and *** correspond to 10-, 5-, and 1% significance level, respectively.

Table 8: Predicting US Economic Surprises with ECB Surprises

$$Surprise_{t,v} = \beta_0 + \beta_1 ECB_{ME,t-\delta} + \epsilon_t$$

	Dependent variable:			
	Unemployment	Nonfarm payroll	GDP	Core CPI
	(1)	(2)	(3)	(4)
ECB surprise	0.0000	-0.0401	-0.0000	-0.0000
	(0.0000)	(2.764)	(0.0000)	(0.0000)
Observations	257	257	258	257
R^2	0.0007	0.0000	0.0000	0.00376

Note: This table provides results of estimation of equation (5). The first column shows results for unemployment surprise. The second column shows the results for nonfarm payroll surprise. The third column presents results for GDP surprise. Column 4 presents results for core CPI surprise. Standard errors are clustered at the time level and displayed in the parentheses. *,** , and *** correspond to 10-, 5-, and 1% significance level, respectively.

Table 9: Predicting US Economic Surprises with Disaggregated ECB Surprises
$Surprise_{t,v} = \beta_0 + \beta_1 \Delta ECB_{PR,t-\delta} + \beta_2 \Delta ECB_{PC,t-\delta} + \epsilon_t$

	Dependent variable:			
	Unemployment	Nonfarm payroll	GDP	Core CPI
	(1)	(2)	(3)	(4)
ECB PR surprise	0.0000	-6.753	-0.0000	-0.0000*
	(0.0000)	(6.553)	(0.000)	(0.0000)
ECB PC surprise	-0.0000	-0.639	-0.0001	-0.0000
	(0.0000)	(9.337)	(0.0003)	(0.0000)
Observations	235	228	221	235
R^2	0.0024	0.0007	0.0039	0.0095

Note: This table provides results of estimation of equation (5) separately for press release and press conference surprises. The first column shows results for unemployment surprise. The second column shows the results for nonfarm payroll surprise. The third column presents results for GDP surprise. Column 4 presents results for core CPI surprise. Standard errors are clustered at the time level and displayed in the parentheses. *,** , and *** correspond to 10-, 5-, and 1% significance level, respectively.

Table 10: Predicting Greenbook Unemployment Revisions with ECB Surprises

	Current	1 qtr ahead	2 qtr ahead	Current	1 qtr ahead	2 qtr ahead
	(1)	(2)	(3)	(4)	(5)	(6)
Unemployment surprise	30.99***	21.93***	13.80	30.64***	21.12***	12.02
	(6.761)	(7.212)	(9.564)	(7.577)	(7.987)	(9.586)
Nonfarm payroll suprise	−0.0000	−0.000	−0.000270**	0.0001	−0.0000	−0.0002
	(0.0002)	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0001)
GDP surprise	−2.133	−2.012	−5.135*	−3.930	−3.066	−6.396**
	(2.468)	(2.451)	(2.753)	(2.591)	(2.551)	(2.848)
CPI surprise	−13.48	−10.03	−23.32*	−12.53	−5.053	−21.57
	(14.74)	(14.37)	(13.99)	(15.96)	(14.59)	(14.13)
ECB surprise	−0.0070*	−0.0033	−0.0008			
	(0.0042)	(0.0036)	(0.0044)			
ECB PR surprise				−0.0069	−0.0014	0.0024
				(0.0047)	(0.0036)	(0.0043)
ECB PC surprise				−0.0009	−0.0079	−0.0019
				(0.0111)	(0.0120)	(0.0121)
Macro controls	Yes	Yes	Yes	Yes	Yes	Yes
Observation	147	147	147	134	134	134
R^2	0.232	0.276	0.288	0.254	0.282	0.301

Note: This table provides results of estimation of equation (6) for unemployment current and 1 and 2 quarter ahead forecast. The first three columns predict include ECB shocks. The last three columns include press release and press conference shocks separately. Standard errors are clustered at the time level and displayed in the parentheses. *,** , and *** correspond to 10-, 5-, and 1% significance level, respectively.

Table 11: Predicting Greenbook RGDP Revisions with ECB Surprises

	Current	1 qtr ahead	2 qtr ahead	Current	1 qtr ahead	2 qtr ahead
	(1)	(2)	(3)	(4)	(5)	(6)
Unemployment surprise	4.860	23.60	5.624	27.21	28.31	18.87
	(68.06)	(33.32)	(30.28)	(73.12)	(31.04)	(20.90)
Nonfarm payroll surprise	0.0014*	0.0001	−0.0001	0.0009	0.0002	0.0003
	(0.0008)	(0.0004)	(0.0004)	(0.0008)	(0.0004)	(0.0004)
GDP surprise	−4.253	16.25**	7.661	−5.274	13.12	2.180
	(14.64)	(8.212)	(8.346)	(17.49)	(10.05)	(7.550)
CPI surprise	82.29	60.12	49.60	72.50	48.28	31.04
	(74.06)	(54.92)	(38.83)	(76.88)	(60.13)	(42.00)
ECB surprise	−0.0051	−0.0032	−0.0027			
	(0.0167)	(0.0117)	(0.0139)			
ECB PR surprise				0.0124	0.0004	−0.0113
				(0.0150)	(0.0138)	(0.0123)
ECB PC surprise				−0.0398	−0.0056	0.0067
				(0.0524)	(0.0229)	(0.0184)
Macro controls	Yes	Yes	Yes	Yes	Yes	Yes
Observation	147	147	147	134	134	134
R^2	0.0813	0.313	0.133	0.0715	0.243	0.166

Note: This table provides results of estimation of equation (6) for real GDP current and 1 and 2 quarter ahead forecast. The first three columns predict include ECB shocks. The last three columns include press release and press conference shocks separately. Standard errors are clustered at the time level and displayed in the parentheses. *,** , and *** correspond to 10-, 5-, and 1% significance level, respectively.

Table 12: Predicting Greenbook CPI Revisions with ECB Surprises

	Current	1 qtr ahead	2 qtr ahead	Current	1 qtr ahead	2 qtr ahead
	(1)	(2)	(3)	(4)	(5)	(6)
Unemployment surprise	7.644	30.26	-4.584	5.931	25.62	9.607
	(49.69)	(59.56)	(26.42)	(55.40)	(63.45)	(27.50)
Nonfarm payroll surprise	−0.0004	−0.0011	0.0008**	−0.0006	−0.0004	0.0007*
	(0.0009)	(0.0007)	(0.0004)	(0.0010)	(0.0008)	(0.0004)
GDP surprise	−24.32	7.560	−6.360	−21.62	−0.851	−11.01*
	(19.92)	(12.32)	(6.275)	(22.77)	(15.61)	(6.359)
CPI surprise	62.23	20.36	−32.94	79.87	6.209	−51.27
	(125.4)	(87.71)	(40.87)	(132.0)	(93.75)	(40.18)
ECB surprise	−0.0383	0.0321**	0.0057			
	(0.0281)	(0.0138)	(0.0085)			
ECB PR surprise				−0.0322	0.0279	−0.0015
				(0.0321)	(0.0177)	(0.0108)
ECB PC surprise				−0.0326	0.0435	0.0265
				(0.0470)	(0.0466)	(0.0225)
Macro controls	Yes	Yes	Yes	Yes	Yes	Yes
Observation	147	147	147	134	134	134
R^2	0.227	0.229	0.0692	0.226	0.228	0.0607

Note: This table provides results of estimation of equation (6) for CPI current and 1 and 2 quarter ahead forecast. The first three columns predict include ECB shocks. The last three columns include press release and press conference shocks separately. Standard errors are clustered at the time level and displayed in the parentheses. *,** , and *** correspond to 10-, 5-, and 1% significance level, respectively.

Table 13: Predicting FOMC Surprises with ECB Surprises and Greenbook Forecasts

	FF surprise			NS surprise		
	(1)	(2)	(3)	(4)	(5)	(6)
GDP forecast	-0.0349	0.0619	-0.374	-0.174	-0.0983	-0.150
	(0.556)	(0.536)	(0.484)	(0.555)	(0.558)	(0.550)
Unemployment forecast	0.523	1.709	-2.696	1.434	2.416	-0.765
	(6.094)	(5.858)	(5.702)	(4.784)	(4.763)	(4.968)
CPI forecast	0.0231	0.145	-0.123	0.747*	0.839**	0.675*
	(0.449)	(0.461)	(0.418)	(0.412)	(0.417)	(0.405)
ECB surprise		0.236			0.205*	
		(0.153)			(0.123)	
ECB PR surprise			0.197			0.224
			(0.162)			(0.164)
ECB PC surprise			0.662*			0.472**
			(0.368)			(0.199)
Future forecasts	Yes	Yes	Yes	Yes	Yes	Yes
Observations	147	147	136	147	147	136
R^2	0.0917	0.121	0.178	0.143	0.168	0.149

Note: This table provides results of estimation of equation (1) including greenbook forecasts and one and two quarters ahead forecasts. The first three columns predict FFR surprises, while the last three predict Nakamura and Steinsson (2018b) surprises. Standard errors are clustered at the time level and displayed in the parentheses. *,** , and *** correspond to 10-, 5-, and 1% significance level, respectively.