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Do Monetary Policy Announcements Shift Household Expectations?*

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Abstract

We use daily survey data from Gallup to assess whether households' beliefs about economic conditions are influenced by surprises in monetary policy announcements. We first provide more general evidence that public confidence in the state of the economy reacts to certain types of macroeconomic news very quickly. Next, we show that surprises to the Federal Funds target rate are among the news that have statistically significant and instantaneous effects on economic confidence. In contrast, surprises about forward guidance and asset purchases do not have similar effects on household beliefs, perhaps because they are less well understood. We document heterogeneity in the responsiveness of sentiment across demographics.

JEL Codes: E30, E40, E50, E70

Keywords: Monetary policy shocks, central bank communication, information rigidities, consumer confidence, high frequency identification

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1 Introduction

In the early 1990s, the Federal Reserve began informing the public about its monetary policy decisions immediately after policy meetings. In 2012, the FOMC publicly announced a two percent inflation target as the most consistent with its price stability objective. FOMC members nowadays routinely communicate their views on the economic outlook as well as on appropriate future adjustments to monetary policy. Besides fostering accountability, the rationale for these and other steps towards greater transparency is to facilitate the management of expectations and increase the effectiveness of monetary policy. In theory, effective central bank communication makes policy decisions more predictable, anchors long run inflation expectations more firmly, and creates additional policy options at the zero lower bound in the form of forward guidance about the path of future policy rates (Blinder 2008).

In practice, the benefits of increased transparency depend importantly on whether central bank communications indeed steer the beliefs of economic agents successfully, i.e. in the desired direction and with relatively short delays. There is much evidence that monetary policy announcements influence the expectations of professional forecasters and financial market participants.[1] Much less is known about how strongly central bank communications influence the beliefs of the broader public, i.e. the households and firms that ultimately account for the bulk of economic decisions that monetary policy seeks to influence.

In this paper, we present evidence that monetary policy announcements about the interest rate target have a meaningful and immediate impact on household beliefs about macroeconomic conditions. To measure monetary policy news, we follow the high frequency identification approach and use movements in asset prices on FOMC meeting days. Our baseline measures of household beliefs are based on survey questions about national economic conditions from the U.S. Daily Survey Poll conducted by Gallup between January 2008 and December 2017. The answers are combined in daily diffusion indices that are very similar to existing monthly consumer confidence indices constructed from the Michigan or Conference Board surveys. We also verify our results using an alternative daily dataset produced by Rasmussen.

Importantly, the high frequency of the confidence measures allows us to estimate the impact of monetary policy announcements on agents' economic outlook on the days immediately following the arrival of the monetary policy news. This permits the interpretation of the estimated confidence effects as a reevaluation of beliefs by agents in light of new information about monetary policy, and not as an indirect response to changes in subsequent macroeconomic data releases or in agents' own economic situation that may result from the economic consequences of the monetary policy announcement. In addition, we can be more confident that the expectations effects are due to monetary policy announcements and not to other confounding factors.

[1] See for instance Lucca and Trebbi (2009), Campbell et al. (2012), Del Negro, Giannoni, and Patterson (2015), Altavilla and Giannone (2017), Nakamura and Steinsson (2018), and Cieslak and Schrimpf (2019).

In other words, the exclusion restriction required for event study analysis is more plausibly justified in this daily data than in lower-frequency studies.

Our sample period – January 2008 to December 2017 – includes the use of both conventional and unconventional policy instruments by the Federal Reserve. Based on financial market data on FOMC days, Swanson (2017) shows that monetary policy announcements over this period contain information that is consistent with the use of three distinct policy instruments: changes in current policy rates, forward guidance about future policy rates, and large scale asset purchases (LSAPs). The distinction between policy instruments is potentially important as the unconventional tools deployed by the FOMC in the wake of the Global Financial Crisis (GFC) may be less well understood by the general public and therefore affect perceptions of economic conditions differently. Our baseline methodology follows Lewis (2019) and separately identifies the impact on household economic confidence of monetary policy news about each of these three policy instruments. We also confirm our findings using a range of other available high frequency measures of monetary policy news.

Our first main empirical result is that news about current policy rates has instantaneous, persistent and highly statistically significant effects on aggregate household beliefs about the state of the national economy. A surprise tightening of 25 basis points leads to an immediate deterioration in the daily economic confidence index equivalent to 1 to 2 points of the Michigan Index of Consumer Sentiment. This means that in our sample households interpret a positive target rate surprise on average as negative for the US economy. This finding indicates that the transmission of target rate surprises to the real economy operates at least in part through a direct and immediate effect on household confidence. We also analyze the heterogeneity of the belief responses to monetary policy news across different age, income and education groups. We find evidence that the responsiveness to the funds rate surprises is stronger among more highly educated and younger respondents, and we relate this to evidence of relatively higher rates of information updating for these groups.

Our second main result is that, while there is much evidence that forward guidance and LSAPs affect longer term interest rates by influencing expectations in financial markets, we find no systematic evidence for any immediate statistically significant effects of new information about these policies on household beliefs.[2] This finding suggests that these policies have been less effective than conventional target rate changes to stimulate aggregate spending in the aftermath of the GFC, at least in the short run. It is of course possible that growing public familiarity and a more systematic implementation of forward guidance and LSAPs may make these alternative policy tools more effective substitutes for target rate changes in future experiences with the ZLB. Nevertheless, our results suggest that further improvements in communication to the wider public may be warranted to increase the potency of non-interest rate

[2]For a recent overview of the evidence on the effects of unconventional policies on asset prices, see Eberly, Stock, and Wright (2019).

policies.

Our finding that economic confidence responds instantaneously to conventional monetary policy news offers counter-evidence to a widespread view that central banks have limited influence over expectations held by the general public. An overview study by Binder (2017), for example, expresses doubts that central bank communications are transmitted effectively to households. Survey evidence points to low public informedness about monetary policy. On the one hand, poor economic and financial literacy imply low demand for monetary policy information as cognitive costs outweigh economic benefits.[3] Intense competition for audience attention, on the other hand, results in limited media coverage of central bank news.

More broadly, the available evidence on the formation of expectations suggests that informational rigidities are very important. Carroll (2003), for instance, finds that consumers only very occasionally pay attention to news reports. As a result, consumer expectations track those of professional forecasters with very long delays (one year on average). Coibion and Gorodnichenko (2015) show that the empirical relationships between survey forecast errors and forecast revisions also imply large degrees of informational rigidities. Based on all of the evidence for inattentiveness, Coibion et al. (2018) are skeptical that central bank communication can successfully manipulate household's inflation expectations, at least in a low inflation environment and with existing communication strategies.

Given the broad acceptance in the literature of pervasive inattentiveness to monetary policy, our finding that unexpected target rate changes have immediate measurable effects on consumer confidence is perhaps somewhat surprising. There are, however a number of important differences between our analysis and the existing evidence for inattentiveness. For one, the high frequency aspect of the Gallup data is much better suited than monthly or quarterly survey data to isolate and interpret the drivers of household beliefs, and also avoids problems of time aggregation. It allows us to show, for instance, that daily consumer confidence can react strongly and swiftly to important news events, and responds significantly to some of the major official macroeconomic data releases such as the jobs and GDP reports. These findings add plausibility to our claim that households beliefs about the economy can also shift quickly in response to monetary policy news.

Another key difference with earlier work is that we look at belief measures constructed from categorical answers to questions about the state of the national economy. The existing literature focuses predominantly on quantitative answers to questions about expected inflation rates. Agents may be more attentive to information relevant for broader economic conditions than to information relevant for inflation. Incorporating this information into broad categorical responses may also be simpler and require less effort than translating this information into

[3] or as Blinder (2018) puts it: *"most people are not obsessed about the central bank; ... they would rather watch puppies on YouTube."*

quantitative changes to inflation projections. We verify these conjectures by estimating the degree of 'information stickiness' building on Carroll (2003). We find indeed that daily household confidence tracks information in financial markets much more quickly, with an estimated average time between information updates of less than two weeks. Respondents with a college degree update more frequently than respondents with lower education levels.

The remainder of the paper is organized as follows. Section 2 introduces describes the Gallup data and its relation to alternative measures. Section 3 examines the response of consumer sentiment to macroeconomic news, broadly defined. Section 4 analyzes the response to monetary policy surprises. Section 5 concludes.

2 High Frequency Measures of Economic Confidence

Most of the results in this paper are based on daily survey information collected by Gallup. Founded in 1935, Gallup is one of the world's premier polling and analytics companies. In 2008 it began interviewing roughly 1,000 Americans by telephone on political, economic, and well-being topics in their U.S. Daily Poll.[4] From 2008 to the end of 2017, about half of the respondents were asked two questions about the state of the national economy.[5] The first question asks the respondents' view on the current state of economic conditions:

1. *Rate economic conditions in the country today. (1) Excellent; (2) Good; (3) Only fair; or (4) Poor?*

The second question asks about the direction of economic conditions:

2. *Do you think economic conditions in the country as a whole are getting (1) better or (2) worse?*

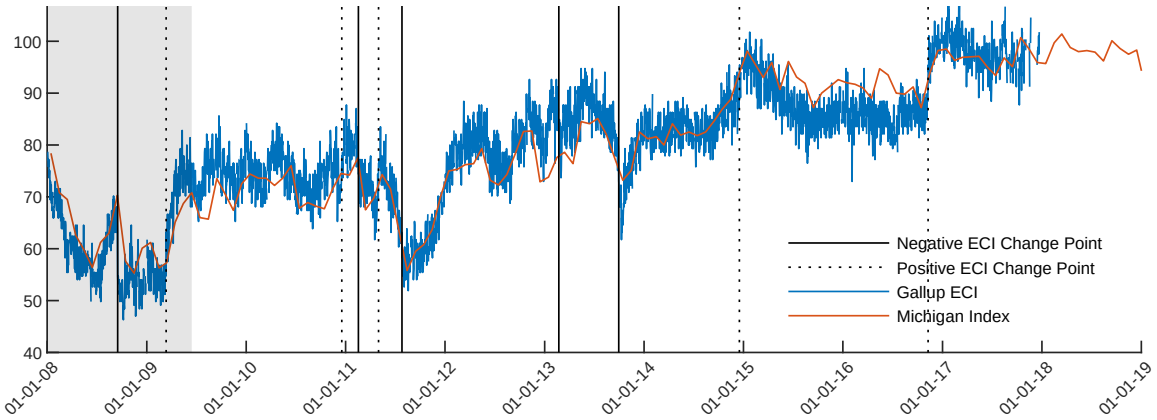
Note that both the "current state" and "direction" questions explicitly refer to *national* economic conditions. While economic conditions is admittedly subject to interpretation, respondents typically proxy for macroeconomic conditions using simple heuristics, such as the unemployment rate or GDP growth rate. Other interview questions ask specifically about respondents' own economic or financial situation. Since our interest is in a measure of macroeconomic beliefs, we only use the questions about the national economic conditions.

Gallup combines the answers to the two questions above in an Economic Confidence Index (ECI). This ECI index is computed by adding the percentage of respondents rating current economic conditions (("Excellent" + "Good") minus "Poor") to the percentage saying the economy is ("Getting better" minus "Getting worse") and then dividing that sum by 2. The aggregation uses weighting adjustments to make the index representative of the US population.

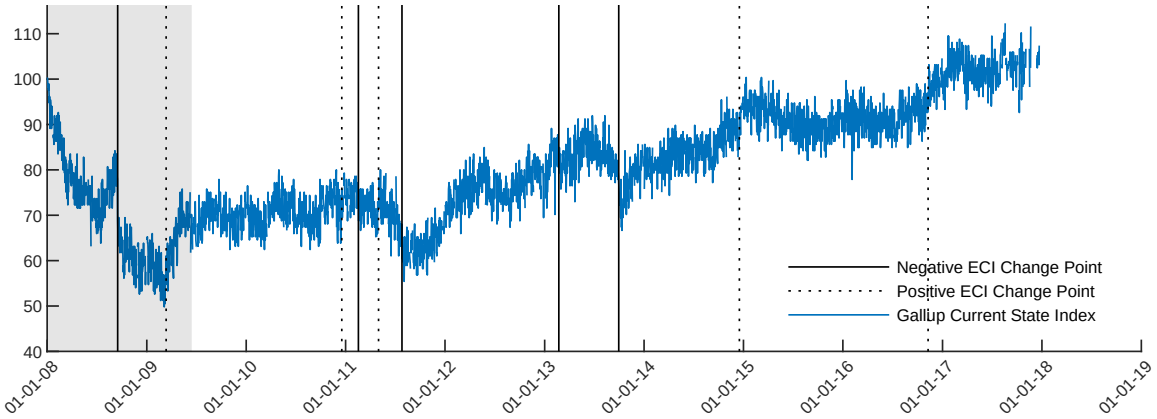
[4]The online publication Understanding Gallup's Economic Measures provides additional information.

[5]The sample size is close to 1,000 between from Jan 2 to Jan 20 in 2008; it is close to 500 between Jan 21, 2008 and July 30 2017; and it varies in a range of around 300 to 700 between July 31 and December 31, 2017.

(a) Economic Confidence Index



(b) Current State of Economic Conditions



(c) Direction of Economic Conditions

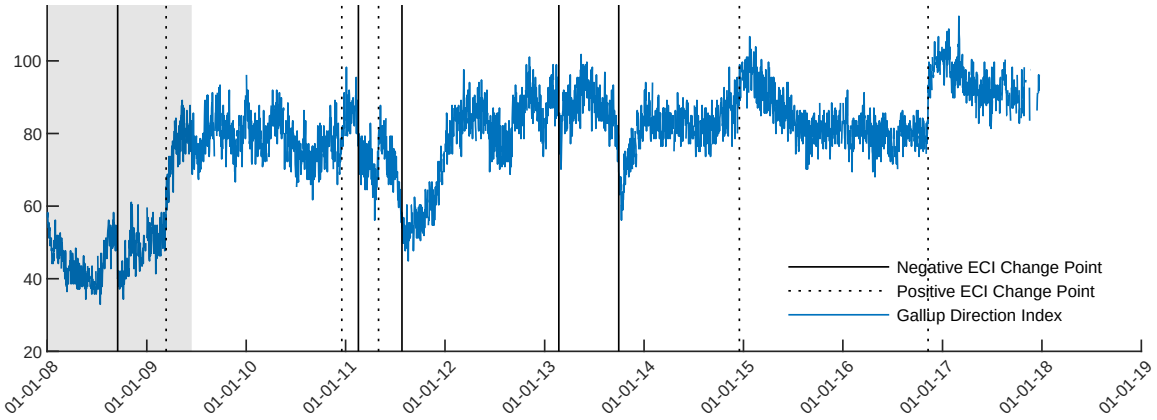


Figure 1: Daily Gallup Confidence Indices and the Michigan Sentiment Index.

Notes: Data from Gallup and University of Michigan. Shaded areas are NBER recessions. The daily Gallup indices cover January 2, 2008 through December 27, 2017 and each rescaled to have the same mean and variance as the Michigan Sentiment Index over this period.

Figure 1a plots the daily ECI index for January 2, 2008 to December 27, 2017. In the empirical analysis, we will also consider the subindices based on 'current state' and 'direction' questions individually. These subindices are shown in Figures 1b and 1c respectively.

The Gallup confidence indices shown in Figure 1 are each rescaled to have the same mean and variance as the Michigan Index of Consumer Sentiment – also depicted in Figure 1a– which is one of the most widely reported measures of consumer confidence in the US. Produced by the University of Michigan, the monthly Index of Consumer Sentiment is similarly based on survey questions about present and expected future economic conditions.[6] The Michigan index is based on five interview questions on both personal and national economic conditions, and asks respondents more explicitly than Gallup about expected future economic conditions (over the next 12 months and the next five years). The sample of respondents is considerably smaller than for the Gallup survey. Each month, around 500 interviews are conducted by telephone.[7] The Gallup ECI, in contrast, is based on approximately 15,000 respondents every month (500 every day). Despite the differences in methodology and sample size, Figure 1a shows that the Gallup ECI and the Michigan Sentiment Index move closely together. The correlation between the month-aggregated ECI and the Michigan index is high: 0.935.

Another popular measure is the Consumer Confidence Index produced by the Conference Board, which is shown from the late 1960s onwards together with the Michigan index in Figure 2a.[8] As the Michigan index, the Conference Board index is a monthly measure of consumer confidence. It is based on very similar survey questions on current and projected business conditions (over the next six months), and has a sample size of approximately 3,000 individuals each month.[9] The correlation between the month-aggregated Gallup ECI index and the Conference Board index is 0.864.

The strong relation between the Gallup ECI and the two monthly measures of consumer sentiment indicates they summarize very similar information about consumer beliefs. While it is available only since 2008, the Gallup ECI has the important advantage of being available at the daily frequency. In addition, the U.S. Daily Poll also gathers a much greater range of information on respondent characteristics. In recent years, the Gallup data have been used in a range of empirical studies, e.g. Kahneman and Deaton (2010), Aghion et al. (2016) and Makridis (2019).

There are other high frequency alternatives to the Michigan and Conference Board measures of consumer sentiment. Figure 2b shows a daily measure constructed by Rasmussen from its

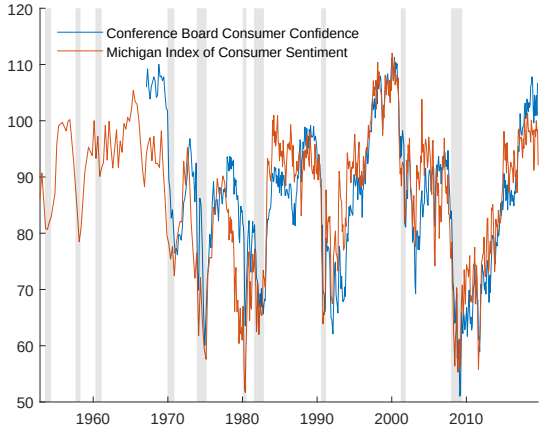
[6]See (Ludvigson 2004) for detailed discussion of the Michigan Index and Conference Board measures of consumer confidence.

[7]See Michigan's Survey Information webpage for additional details.

[8]The correlation between both monthly measures is 0.935. Ludvigson (2004) provides a detailed discussion and comparison between the Michigan Index and Conference Board measures.

[9]See the online Consumer Confidence Survey Technical Note for details.

(a) Conference Board Consumer Confidence Index



(b) Rasmussen Consumer Confidence Index

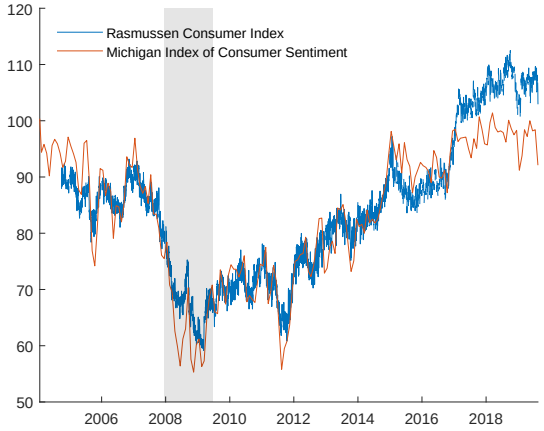


Figure 2: Alternative Measures of Economic Confidence

Notes: Source: Gallup, Rasmussen, University of Michigan, Conference Board. Shaded areas are NBER recessions.

our daily national surveys of American consumers.[10] The index published by Rasmussen is a 3-day moving average and is based on a smaller number of respondents than the Gallup ECI. The correlation between the month-aggregated Rasmussen index and the Michigan and Conference Board indices are 0.969 and 0.940 respectively. We will nevertheless verify our main results using this alternative daily confidence measure. Finally, Langer research also produces a weekly index, which is branded by Bloomberg as the Consumer Comfort index. This measure is based on a much smaller sample (approximately 250 respondents weekly) and is reported in a four-week rolling average. As it is therefore less suitable for our high frequency analysis, we do not use the Bloomberg Comfort Index.

3 Do Daily Confidence Measures Respond to Macroeconomic News?

Before turning to the reaction of households beliefs to monetary policy news, we first provide some broader evidence on the responsiveness of survey-based confidence measures to macroeconomic news. Exploiting the daily frequency of the Gallup measures, we discuss in turn reactions to major news events, to surprises in macroeconomic data releases, and to information in financial markets and other daily economic indicators.

3.1 Confidence Shifts Following Major News Events

One feature of consumer confidence revealed by the daily frequency of the Gallup measures is the presence of occasional large and sudden single day shifts, see Figure 1. To formally identify these sudden shifts in economic confidence – and distinguish genuine belief shifts of some

[10] See the Rasmussen Reports methodology webpage for additional information.

persistence from transitory daily survey noise – we apply the optimal change point detection algorithm of Killick, Fearnhead, and Eckley (2012) to the ECI index. This algorithm searches for changes in mean between adjacent blocks of observations that exceed a certain threshold.[11]

The vertical lines in Figure 1a mark the five largest negative and positive change points detected by the algorithm over the sample period. The days on which these confidence shifts occur are listed in Table 1. The size of the confidence shifts, reported in column 2 of Table 1, is determined simply by the magnitude of the daily change in the index on the day detected as a change point by the algorithm.

While the change point detection method is a purely statistical procedure based on the time series properties of the ECI index, most change points identified are remarkable easy to connect to major economic and political events. To document the news flow around the dates, the last column in Table 1 lists the news headlines from the Wall Street Journal website on the day of the shift as well as on the next day.

The first panel in Table 1 shows that four out of the five largest negative confidence shifts occur clearly at the height of an economic or political crisis. These include the eve of the 2013 government shutdown, the Lehman bankruptcy filing in the fall of 2008, the 2011 debt ceiling stalemate in Congress days and the prospect of a possible US default, and congressional gridlock surrounding the 2013 fiscal cliff. The fifth identified date, February 17 in 2011, is less obviously related to any major news event.

Several of the positive confidence shifts in the second panel Table 3 also coincide closely with important news events, such as the 2016 Presidential Election or the 2010 Obama tax cuts. Interestingly, news of the killing of Osama Bin Laden is associated with a significant positive shift in economic confidence, even though its direct economic implications are not immediately clear. The two remaining dates with large positive confidence shifts are more ambiguous. The December 17, 2014 shift coincides exactly with a key FOMC meeting after which the FOMC announced that "it can be patient in beginning to normalize the stance of monetary policy". This significant piece of forward guidance was widely reported in the media and generated a large response in financial markets. Another positive news headline was the significant thawing of relations with Cuba, which may have contributed to the uptick in confidence.

[11] We implicitly restrict the block length by allowing at most 100 change points over the sample period.

Table 1: Major Identified Confidence Shifters Jan 2008 - Dec 2017

Day	ECI change	Main Event(s)	WSJ.com Headlines
a. Major Negative Confidence Shifters			
30-Sep-2013	-13.83	**Government Shutdown**	Government Heads Toward Shutdown; Uncertainty Poses Threat to Recovery; Health Law Hits Late Snags as Rollout Approaches *Next day*: Government Shuts Down in Stalemate; Senate Rejects House Bill to Delay Part of Health Law; Agencies, start your shutdown.
16-Sep-2008	-12.62	**Lehman Shock**	AIG, Lehman Shock Hits World Markets; Lehman in talks to Sell Assets to Barclays *Next day*: U.S. to take over AIG in $85 Billion Bailout; Lending Among Banks Freezes
27-Jul-2011	-7.42	**Debt Ceiling Crisis**	Boehner Plan on Debt Faces Rebellion, Calls Flood Congress on Deficit Fight *Next day*: Debt Vote Goes Down to Wire, Markets Swoon on Debt Fear; S&P Stays Mum on Rating for U.S.
22-Feb-2013	-7.24	**Fiscal Cliff**	Payroll Tax Whacks Spending; GOP Splits Over Pressure to Slash Defense Budget; Sudden Spending Cuts Likely to Bleed Slowly; Boeing Chief Steers Clear of the Spotlight *Next day*: Long Impasse Looms on Budget Cuts; U.K. Stripped of Triple-A Rating Fed Rejects Bond-Buying Fears; FAA Says 787 Can't Return to Service until Risks Addressed
17-Feb-2011	-6.59		Manager Took Down Friend in Insider Probe; SEC Urged to Revise 'Whistleblower' Plan ; Big Banks Face Fines on Role of Servicers *Next day*: Split Economy Keeps Lid on Prices; Spy Feud Hampers Antiterror Efforts SEC Questions Mutual Funds' Muni Pricing
b. Major Positive Confidence Shifters			
09-Nov-2016	10.03	**Presidential Election**	Clinton Concedes After Trump's Stunning Win; Trump Team Planning First Months in Office; Dow Jumps 257 points
13-Mar-2009	8.41		Madoff Pleads Guilty, Americans See 18% of Wealth Vanish *Next day*: Despite Bailout, AIG Doles Out Bonuses; Bear Stearns: From Fabled to Forgotten; Madoff Lists $826 Million in Assets, Give or Take
17-Dec-2014	8.05	**Fed Forward Guidance/ Cuban Thaw**	U.S Stocks Rise Ahead of Fed Meeting; U.S. Moves to Normalize Cuba Ties as American Is Released; What to Watch for a Fed Meeting *Next day*: U.S. Stocks Jump on Fed Reassurance; Companies Weigh Prospects on Cuba Trade
02-May-2011	7.50	**Bin Laden Killed**	U.S. Kills Bin Laden; Osama Death Strengthens Calls for Afghan Pullout *Next day*: Pakistan Criticizes Raid on Bin Laden; How U.S. Rolled Dice in Raid
18-Dec-2010	7.40	**Obama Tax Cuts**	Obama Signs Tax Deal, Widow to Return $7.2 Billion in Madoff Case Michigan Blue Cross Fights Suit Over Pricing; Budget Brawl Looms In Congress *Next day*: Drill Raises Tensions in Korea; Insider-Trading Case Could Grow

Notes: Listed are the five largest positive and negative daily changes in the Gallup ECI index as detected by the change point detection algorithm of Killick, Fearnhead, and Eckley (2012). The size of the daily ECI change is on the same scale as the Michigan Consumer Sentiment index as in Figure 1a.

The second largest positive confidence shift is detected on Friday March 13, 2009. The main story dominating headlines that day was the announcement that Bernie Madoff pleaded guilty to a massive Ponzi Scheme. Likely much more important, however, is that the week ending on

March 13, 2009 marks the start of the long recovery in equity markets following the large losses in the GFC, with all major indices posting large gains throughout the week. It is worth noting that the March 13 shift in confidence just predates the announcement by the FOMC of a major expansion of its use of unconventional policies. On March 18, the Federal Reserve announced that it would purchase $850B of mortgage-related securities and $300B of longer-term Treasuries (the launch of QE1), and that it expects to keep the federal funds rate between 0 and 25 basis points for "an extended period". The QE1 announcement is generally considered to have been a major surprise to financial markets, see Swanson (2017). The changes in monetary policy announced at the March 2009 meeting are therefore not likely to be responsible for the major change in household confidence identified the Friday before.

The change point analysis offers a first piece of evidence that aggregate news events can generate notable and immediate changes in aggregate household sentiment about the economy. This finding seems consistent with Nimark and Pitschner (2019), who show that major events shift the general news focus and make media coverage more homogeneous, and evidence that consumers update expectations much more frequently during periods of high media coverage (Doms and Morin 2004; Larsen, Thorsrud, and Zhulanova 2019). Some of the events in Table 1 also coincide with large changes in asset prices that likely attract additional attention.

Of course, the above does not imply that all relevant macroeconomic public information is discounted instantaneously in households' beliefs, nor that all drivers of sentiment are also obviously relevant direct influences on the aggregate economy. Consistent with De Boef and Kellstedt (2004), Table 1 lists several political events – such as the 2013 government shutdown – which in contrast caused comparatively little reaction in financial markets. Finally, it is worth noting that several of the main confidence shifting events between 2008 and 2018 are in the sphere of fiscal policy. In contrast, there is just one large confidence shift that can be more or less directly related to monetary policy news (forward guidance on 17 December, 2014).

3.2 Confidence Changes Following Surprises in Macroeconomic Releases

Next, we investigate whether the ECI index shows any reaction to new statistical information about macroeconomic conditions. To measure news about economic data, we use the surprises in major macroeconomic releases by government statistical agencies and several private organizations. Surprises are measured by the difference between the actual data point released and its ex ante expected value as measured by an average of forecasts of economists surveyed by Bloomberg prior to each release.

One straightforward way to uncover the dynamics of the ECI index following macroeconomic surprises is through Jordà (2005) local projections of the form

$$y_{t+h} - y^m_{t-1} = c_h + \beta_h s_t + u_{t,h} \tag{1}$$

where y_t denotes the ECI index on day t, y_t^m is a trailing three-day moving average of y_t, and s_t is the data surprise – the number released in deviation from the ex ante average forecast by economists surveyed by Bloomberg. We measure the confidence dynamics in deviation from a trailing moving average y_{t-1}^m rather the value on the previous day y_{t-1} to reduce the influence of the daily noise in the ECI series.[12] We estimate equation (1) by OLS for horizons h in a range of three days before and up to twenty days after the day of release. The resulting sequence of estimates of β_h trace out the conditional average ECI index values relative to the average values over the last three days before the day of release.

Local projections impose few restrictions on the dynamics of y_t, but the resulting estimates can look highly irregular. This is definitely the case when using daily ECI index as the outcome variable, as the series display considerable noise from one day to the next. For this reason, we also implement a smoothed version of local projections similar to the one proposed in Barnichon and Brownlees (forthcoming). Specifically, we estimate

$$(2) \qquad y_{t+h} - y_{t-1}^m = c + \mathcal{I}(h=0)\gamma_0 s_t + \mathcal{I}(h>0)\left(\gamma_1 s_t + \gamma_2 h s_t + \gamma_3 h^2 s_t\right) + u_{t,h}$$

where h ranges from zero to up to twenty days. Relative to (1), equation (2) imposes restrictions on the shape of the dynamics of y_t. Specifically, (2) leaves the reaction on the day of the release ($h = 0$) unrestricted, but it imposes a quadratic shape from the next day onwards ($h > 1$). Unlike the completely non-parametric projections in (1), the responses at all horizons are simultaneously estimated, and inference must be robust to heteroskedasticity and autocorrelation, while accounting for the fact that the same left-hand-side observations are used across equations for different right-hand-side variables.

One of the most important economic releases in the U.S is the monthly report on the Employment Situation by the Bureau of Labor Statistics (BLS). Figure 3 shows the confidence dynamics associated with the monthly BLS jobs report. Panel 3a shows estimates based on conventional local projections as in (1), whereas Panel 3b shows those obtained from its smoothed version in (2). Both panels show the ECI index conditional on a one standard deviation negative surprise in the official unemployment rate (meaning a higher-than-expected unemployment rate) and in the number of nonfarm payrolls. Panel 3a provides the local projection estimates together with 68% and 90% confidence bands based on the equal-weighted cosines long-run variance estimator and optimal bandwidth recommended by Lazarus et al. (2018). For comparison, the broken lines in Panel 3a show the smoothed estimates and the associated Lazarus et al. (2018) 90% bands. The latter are repeated in Panel 3b, which also shows the 68% bands. Both approaches yield similar findings, and for ease of interpretation we focus on the smoothed estimates in Panel 3b. Note that the pre-announcement response is mechanically zero for the smooth projections given the definition of y_{t-1}^m.

[12] Varying the averaging window does not matter much for the qualitative results.

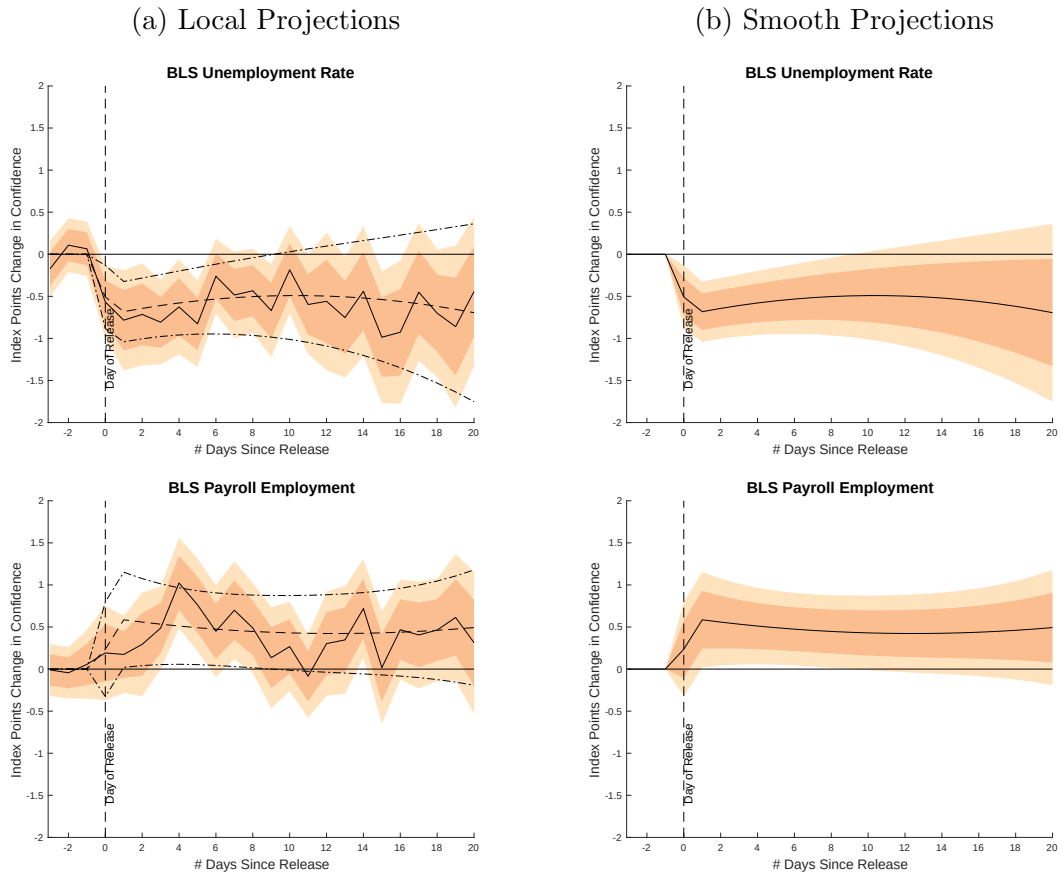


Figure 3: Confidence Dynamics Following One Standard Deviation Surprises in the Jobs Report

Notes: Estimates based on local projections (1) and smooth projections (2) of the daily Gallup ECI index on the data release minus the consensus forecast. In both panels, shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. For the left panel, dashed lines represent point estimates from smooth projections in (2) for comparison, with dot-dash lines corresponding to 90% confidence intervals.

The key result in Figure 3 is that a disappointing jobs report is associated with an immediate and persistent reduction in household confidence as measured by the daily Gallup ECI. A one standard deviation miss in the unemployment rate lowers the ECI index by about half a point. A positive surprise in the payroll number increases confidence by a very similar amount.[13] The confidence changes following surprises in the jobs report are statistically significant at conventional levels for the unemployment rate for nearly two weeks and marginally significant for payroll employment throughout the month.

Appendix A.1 presents the results for a number of other major official statistical releases: the monthly BLS report on CPI inflation, the Bureau of Economic Analysis' reports on GDP, personal income, consumption and PCE inflation, Census Bureau releases on retail sales, housing starts and factory orders, the industrial production numbers released by the Federal Reserve, and several private releases: the ISM indices, the ADP payroll report, and the Michigan and

[13]Both the unemployment rate and the payrolls number are part of the same report, and surprises in each are obviously highly correlated. The confidence effects are therefore not additive.

Conference Board consumer confidence indices. A few other macroeconomic releases generate immediate and persistent confidence changes that are statistically significant. Besides the BLS jobs report, surprises in the advance GDP report seem to have a meaningful confidence impact, see the left panel in Figure 4a. A one standard-deviation positive surprise in advance GDP leads to the largest estimated change in confidence of all releases, persistently raising the ECI index by between 0.5 and 1 index point. Surprises in the ADP National Employment Report – a private estimate of national payrolls released a few days ahead of the BLS jobs report– also appear to have an immediate impact, albeit with effects that are more transitory, see the right panel in Figure 4a.

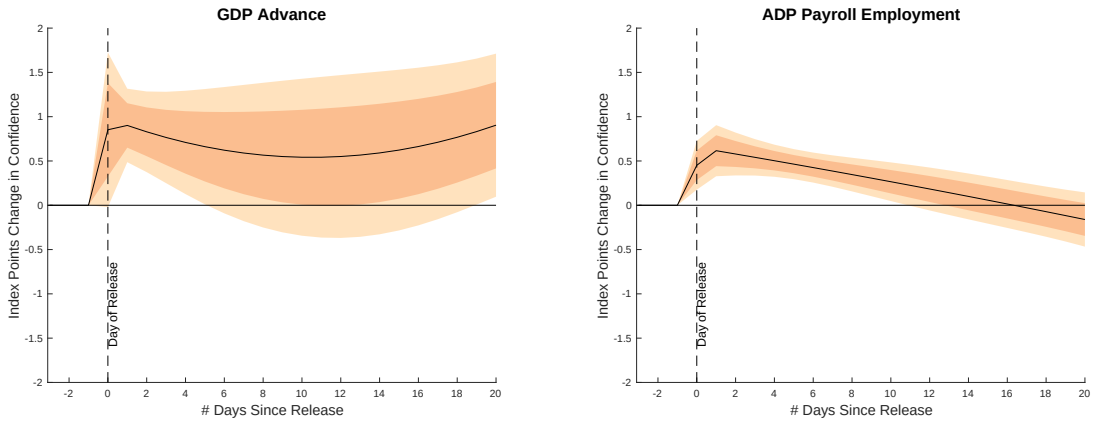
A number of releases are followed by gradual changes in confidence that become statistically significant after a few days or weeks, but without any significant jump in confidence on the same or subsequent day of the release. Figure 4c provides two examples: industrial production and housing starts. Positive surprises in these and other releases are of course signals of an accelerating economy, which also manifests itself as a rise in consumer confidence. The lack of any instantaneous change in consumer confidence, however, suggest there is no immediate informational effect on household beliefs at the time of the data surprise. Finally, for many releases there is no evidence of any systematic change in consumer confidence over the horizons we consider. Figure 4c provides two examples: the final GDP release and the CPI inflation rate.

While household confidence clearly does not respond to every single new piece of macroeconomic information, the evidence above shows that a select few important economic statistics influence household beliefs about the economy. These are primarily the advance GDP growth and the jobs numbers, which arguably also receive the broadest and most regular coverage in the media. The significant high frequency relationship between changes in confidence indicators and certain data surprises shows the potential for a relatively fast adjustment in beliefs to new macroeconomic information.

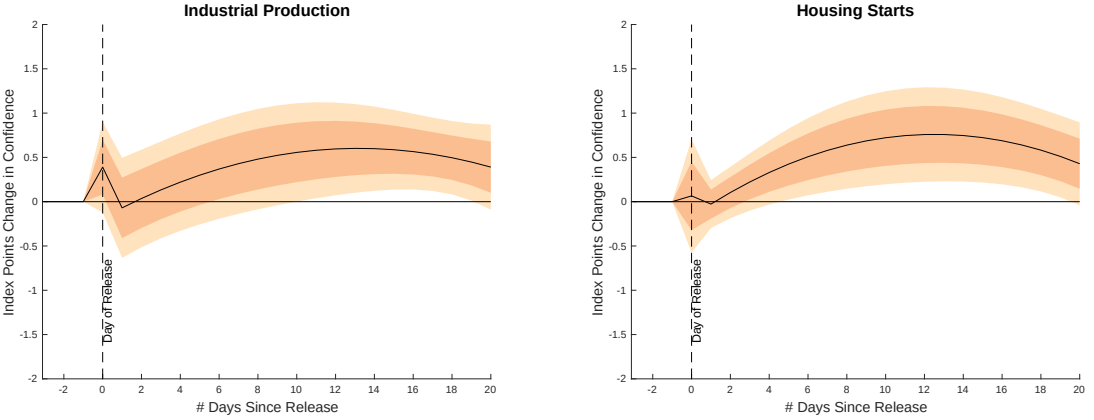
3.3 Information Stickiness in Daily Confidence Data

Another way to assess the responsiveness of household confidence to aggregate news is to see how closely the daily ECI index tracks information in financial variables and other daily economic indicators. To do this, we adapt the methodology of Carroll (2003) and estimate the degree of 'stickiness' in the ECI index relative to other fast-moving high frequency economic data. The approach is related but distinct from Coibion and Gorodnichenko (2015), who develop measures of informational rigidities based on regression of forecast errors on forecast revisions. Unfortunately, the Gallup survey data does not have the required information for such an approach. We therefore do not test departures from full information rational expectations as generally as Coibion and Gorodnichenko (2015). Instead, what we measure is the stickiness of daily household beliefs relative to information available in daily economic and financial indicators, which itself may still be noisy translation of economic fundamentals.

(a) Immediate Confidence Response



(b) Delayed Confidence Response



(c) No Significant Confidence Response

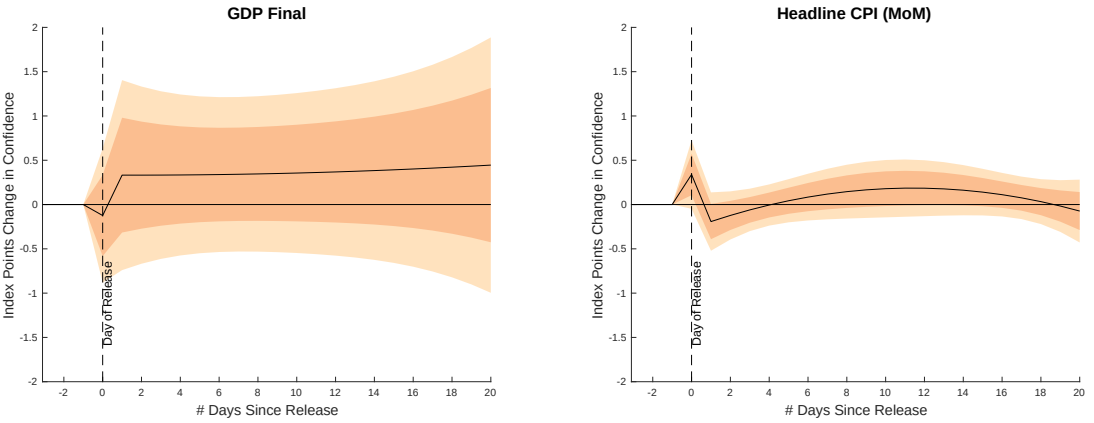


Figure 4: Confidence Changes Following One Standard Deviation Surprises in Selected Macroeconomic Data Releases

Notes: Estimates based on smooth projections (2) of the daily Gallup ECI index on the data release minus the consensus forecast. Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals.

To motivate our empirical approach, suppose the vector of relevant economic fundamentals x_t^* evolves according to

$$x_t^* = Ax_{t-1}^* + \eta_t \quad , \quad \eta_t \sim N(0, \Sigma_\eta). \tag{3}$$

The true fundamentals x_t^* are not (necessarily) directly observed by financial market participants or any other agent in the economy. Instead, all observable data in period t is measured by a vector z_t

$$z_t = Cx_t^* + v_t \quad , \quad v_t \sim N(0, \Sigma_v), \tag{4}$$

where v_t is a vector of noise. Define the rational (noisy) belief $x_t = E[x_t^* \mid Z_t]$ where $E[\cdot]$ denotes the mathematical expectation and Z_t is the history of observables $z_t, z_{t-1}, ...$ This rational belief x_t evolves according to

$$x_t = Ax_{t-1} + Ku_t, \tag{5}$$

where K is the Kalman gain and u_t is the one step ahead forecast error of z_t given history Z_{t-1}:

$$u_t = z_t - E\left[z_t \mid Z_{t-1}\right] = z_t - Bx_{t-1} \quad , \quad B = CA. \tag{6}$$

Actual household beliefs about economic fundamentals, denoted by x_t^b, are not necessarily rational. Following Mankiw and Reis (2002), suppose only a fraction λ of households update to the rational belief every period while a fraction $1-\lambda$ acquire no new information and simple project their beliefs forward by Ax_{t-1}^b. This results in

$$x_t^b = \lambda Ax_{t-1}^b + (1-\lambda)x_t \quad , \quad 0 \leq \lambda \leq 1. \tag{7}$$

where x_t^b are the average household beliefs. Suppose that the confidence index y_t depends on beliefs x_t^b through

$$y_t = \phi' x_t^b + \epsilon_t \quad , \quad \epsilon_t \sim N(0, \Sigma_\epsilon), \tag{8}$$

where ϵ_t is an i.i.d. measurement/sampling error. This implies that

$$y_t = \lambda \phi' Ax_{t-1}^b + (1-\lambda)y_t^{RB} + \epsilon_t \tag{9}$$

where $y_t^{RB} = \phi' x_t$ is the confidence index for agents with updated rational economic beliefs. Neither $\phi' Ax_{t-1}^b$ nor y_t^{RB} is observed directly, so we need additional assumptions to measure both objects and estimate λ. First, we assume that $\phi' Ax_{t-1}^b \approx \phi' x_{t-1}^b = y_{t-1} - \epsilon_{t-1}$. This assumption means that average confidence in the economy among agents that do not receive an information update today is very close to average confidence in the economy yesterday.

This seems reasonable given the daily frequency of the data. Second, we extract x_t from the observable information z_t. Provided that $(I-(A-KB)L)$ is invertible in the past, i.e. that $(I-(A-KB)L)^{-1}$ only has positive powers in the lag operator L, the following is true:

$$x_t = (I-(A-KB)L)^{-1}Kz_t. \tag{10}$$

This expression states that all information in x_t is spanned by the current and lagged values of the observables. Our assumptions lead to the following ARMAX(1,1) model for y_t:

$$y_t = \lambda y_{t-1} + M(L)z_t + \epsilon_t - \lambda\epsilon_{t-1} \quad , \quad M(L) = (1-\lambda)\phi'(I-(A-KB)L)^{-1}K \tag{11}$$

We use the method of Hannan and Rissanen (1982) to estimate λ. The vector of observables z_t includes a large vector of mostly financial market variables (and their lagged variables) as controls. Specifically, z_t contains daily observations on the following: Treasury rates with maturities of 3 months, 1 year, 2 years, and 10 years; futures implied Federal Funds rates at the next FOMC meeting and in 12 months, the S&P500 index, BAA and AAA-rated corporate bond yields, the CBOE VIX index, the trade-weighted dollar exchange rate, WTI crude oil prices, the US Gulf Coast Conventional Gasoline Regular Spot Price, the CRB Spot Commodity Price Index, the Aruoba, Diebold, and Scotti (2009) daily index of economic activity, and the Baker, Bloom, and Davis (2016) daily economic policy uncertainty index. To determine the number of lags of z_t, we follow the AIC criterion for a daily VAR in z_t for all trading days between January 1, 2008 to December 31, 2017, which results in a lag length of 16 days. We estimate (11) using all available observations of y_t including weekends and holidays. We use the latest available observations to replace missing observations in z_t on weekends and holidays.

Existing estimates of the degree of information stickiness based on lower frequency data typically typical find that agents update beliefs very infrequently. Based on data from the Michigan survey, for example, Carroll (2003) estimates that the average duration between updates of household inflation expectations to those of professional forecasters is one year. The estimates in Coibion and Gorodnichenko (2015) imply an average duration between updates of inflation expectations by Michigan survey respondents between 5 and 6 months.[14]

Table 2 presents our estimates of the information stickiness parameter λ based on the higher frequency different Gallup survey measures. The estimates imply updating rates that are much higher than in Carroll (2003) or Coibion and Gorodnichenko (2015). Panel (a) in Table 2 shows that the estimate based on the headline ECI index is $\hat{\lambda} = 0.92$. This value implies that the average time between information updates regarding economic conditions is 1/(1-0.92), or 12.5 days. For the index based on the question about current economic conditions only, this average duration is 1/(1-0.8), or 5 days. For the index based on question about the direction

[14] Coibion and Gorodnichenko (2015) find even slower rates of information updating for professional forecasters, and that the updating rates for these forecasters vary importantly across macroeconomic variables.

of economic conditions, it is 1/(1-0.93), or roughly 14 days.

The updating rates reported in Table 2 provide further evidence that macroeconomic information is transmitted into households beliefs relatively quickly, particularly when compared to the evidence reported in Carroll (2003) or Coibion and Gorodnichenko (2015). Besides the data frequency and sample, an important difference with earlier estimates of information stickiness, however, is that we look at confidence indices constructed from categorical answers to questions about the state of the national economy. Carroll (2003) and Coibion and Gorodnichenko (2015) focus instead mostly on quantitative answers to questions about expected inflation rates. It is conceivable that agents are more attentive to information relevant for broader economic conditions than to information relevant for inflation. In addition, incorporating information into broad categorical responses may also require less effort than translating this information into quantitative changes to inflation projections.

Table 2: Estimates of Information Stickiness λ

	λ	s.e.	# periods
a. All Survey Respondents (Daily):			
Economic Confidence Index (ECI)	0.92	(0.01)	3262
Current Conditions Index	0.80	(0.02)	3240
Future Conditions Index	0.93	(0.01)	3262
b. ECI by Level of Education (Weekly):			
High school or less	0.85	(0.07)	494
Some college	0.77	(0.07)	495
College graduate degree	0.74	(0.09)	492
College postgraduate degree	0.67	(0.08)	490
c. ECI by Level of Income (Weekly):			
Low income (less than $36K)	0.73	(0.08)	492
Mid income ($36K to $90K)	0.80	(0.06)	496
High income (more than $90K)	0.73	(0.08)	491
c. ECI by Age Group (Weekly):			
Age 18 to 29	0.69	(0.21)	359
Age 30 to 49	0.75	(0.07)	492
Age 50 to 64	0.87	(0.06)	494
Age 65 and over	0.86	(0.07)	497

Notes: Listed are estimates of λ in (11) based on Hannan and Rissanen (1982)'s method. Standard errors in parentheses. Maximum sample range is 2-Jan-2008 to 27-Dec-2017.

Panels (b) through (d) in Table 2 show estimates of the information stickiness parameter λ implied by economic confidence indices by level of education, income and age group. The indices for these subgroups are constructed at the weekly level to ensure adequate sample size,

and the estimates are therefore based on weekly rather than daily data. Panel (b) shows that informational rigidities are decreasing in education level and increasing in age. The point estimates in Panel (c) suggest that rigidities are greater for mid-income groups than for low- or high-income groups. While we cannot reject that the estimates are equal across the age or income groups with much confidence, the estimates by education level are more sharply different.

4 The Response of Economic Confidence to Monetary Policy News

The evidence in the previous section indicates that public confidence in the state of the aggregate economy can be quite responsive to new macroeconomic information. We now turn to our main question, does consumer confidence also respond meaningfully to news about monetary policy? More specifically, our goal is to establish whether monetary policy announcements have immediate effects on individuals' assessments of the economic outlook, i.e. upon the arrival of the news or in the days immediately afterwards. Any instantaneous confidence effects can be, in our view, only interpreted as a direct reaction to news about monetary policy. The public may learn this news directly from (media coverage of) central bank communications or from the reaction in asset markets, even without necessarily fully understanding the origins of this reaction. However, immediate confidence effects cannot arise from any of subsequent macroeconomic effects of the monetary policy announcement itself, for instance through reactions to unemployment or GDP statistics or changes in individuals' own labor market status.

To measure monetary policy news, we follow a large empirical literature and assume that unexpected changes in interest rates shortly after FOMC announcements arise entirely due to information released by the Federal Reserve.[15] While this assumption is relatively uncontroversial, the nature of the monetary news being measured using this approach is not fully clear. On the one hand, news of tighter-than-expected monetary policy can lead agents to become more pessimistic about economic conditions because of all of the conventional channels through which a monetary policy shock has contractionary effects. On the other hand, agents may alternatively view an unexpected tightening by the FOMC as a signal of internal views of greater-than-expected economic strength, and therefore adjust their beliefs about the economic conditions upward. Based on the direction of the reactions in financial markets and in surveys of professional forecasters, there is much evidence that monetary policy news is at least in part interpreted as internal Fed information about the economy.[16] From the short run reaction in the daily ECI index, we are able to assess in what direction the beliefs of the wider public – not just of small number of professional forecasters – react to monetary policy news.

Monetary policy news identified using the high frequency approach during the 2008-2017

[15] See for instance Cook and Hahn (1989), Kuttner (2001), Cochrane and Piazzesi 2002, and Gertler and Karadi (2015)

[16] See for instance Romer and Romer (2000), Campbell et al. (2012), Nakamura and Steinsson (2018), Miranda-Agrippino and Ricco (2015), Jarociski and Karadi (2018), Lunsford (2018) or Cieslak and Schrimpf (2019).

period poses challenges beyond the interpretation as policy shocks or Fed information effects. Specifically, it is necessary to account for the FOMC's use of multiple policy instruments in the face of the ZLB constraint on short term interest rates. Gürkaynak, Sack, and Swanson (2005) and Swanson (2017) extend the high frequency methodology to account for the multiple dimensions of monetary policy by extracting principal components from changes in a range of interest rates and interest rate futures on FOMC meeting dates. They use economic restrictions to isolate a unique rotation of the principal components and label the resulting time series as policy shocks. Swanson (2017) shows that monetary policy announcements in the post GFC sample conveys information that is consistent with the use of three distinct policy instruments: changes in current policy rates, forward guidance about future policy rates, and LSAPs. Distinguishing between the different policy tools is also important for judging the economic confidence effects. The additional tools deployed by the FOMC since 2008 were almost certainly less familiar to the general public and therefore may have impacted beliefs about economic conditions differently.

A ubiquitous assumption in the high-frequency literature is that the decomposition of observed rate movements on FOMC dates into different types of policy surprises is constant throughout the sample. This implies both that the nature of the surprises does not change from one announcement to the next and that the elasticities of the economy are fixed. The validity of both of these assumptions is dubious during the 2008-2017 period, when the nature of monetary policy shocks varied greatly, as did the state of the economy. Lewis (2019) relaxes these assumptions using a new methodology, identifying a separate decomposition for each monetary policy announcement based on daily time series of intraday interest rate movements. This means that a completely separate dataset is available for each announcement. Identification of the structural shocks exploits time-varying volatility in financial markets based on Lewis (2018). The resulting time series of intraday monetary policy surprises are then aggregated using historical decompositions to compute daily measures of monetary policy surprises for each announcement date.

For our baseline estimates, we use the measures based on the announcement-specific identifying decompositions developed in Lewis (2019). These decompositions yield three separate measures for each FOMC announcement date: Fed Funds surprises, forward guidance surprises, and asset purchase surprises. Lewis (2019) shows that the properties of these policy surprises match narrative evidence, and that they capture information missing from series based on conventional decomposition approaches. As part of our robustness checks, we will however also verify the results for a range of other high frequency measures of monetary shocks used in the literature.

4.1 Benchmark Estimates of the Aggregate Confidence Response

To assess the response of consumer sentiment to monetary policy news, we apply the same local projection methodology that we used in Section 3.2 to estimate the confidence dynamics around surprises in macroeconomic data releases. Specifically, we estimate

$$y_{t+h} - y^m_{t-1} = c_h + \beta^{ff}_h m^{ff}_t + \beta^{fg}_h m^{fg}_t + \beta^{ap}_h m^{ap}_t + u_{t,h} \tag{12}$$

where y_t is the ECI index on day t, y^m_t is a trailing three-day moving average of y_t, and m^{ff}_t, m^{fg}_t and m^{ap}_t are the Lewis (2019) monetary policy surprises to the funds rate, forward guidance, and asset purchases instruments, respectively. The identification based on time-varying volatility used to derive the policy surprises does not impose that they are orthogonal. We therefore include all three measures simultaneously in (12) to account for the fact that surprises to the multiple dimensions of policy routinely occur together.

As before, we also estimate smoothed versions of the local projections:

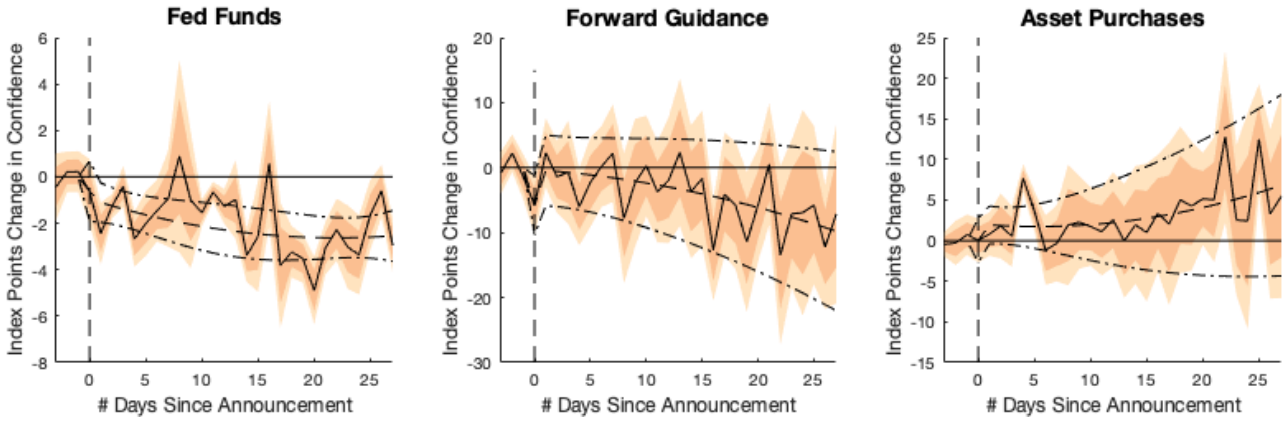
$$y_{t+h} - y^m_{t-1} = c + \sum_{i=ff,fg,ap} \left[\mathcal{I}(h=0)\gamma^i_0 m^i_t + \mathcal{I}(h>0)\left(\gamma^i_1 + \gamma^i_2 h + \gamma^i_3 h^2\right) m^i_t\right] + u_{t,h} \tag{13}$$

For both specifications, we compute responses at daily horizons up to four weeks, and we scale the impulses to correspond to a 25 basis point change in a reference rate, on average, with the reference rates being the Fed Funds rate for m^{ff}_t, the 2-year Treasury rate for m^{fg}_t, and the 10-year Treasury rate for m^{ap}_t.

Figure 5 reports the results. Panel 5a displays local projections, with smooth local projections and associated 90% Lazarus et al. (2018) confidence intervals for reference; Panel 5b plots the smooth projections with 68% and 90% confidence intervals. The smooth projections reinforce patterns already apparent in the non-parametric results.

Our first main finding is a strong and highly significant negative response of economic confidence to a positive surprise in the Fed Funds target, see the left panel in Figure 5. A 25 basis point surprise hike in the target rate lowers the ECI index by about 1.1 index points on impact, and by up to 2.6 points after three weeks. These responses, which are on the same scale as the Michigan Index of Consumer Sentiment, are sizable. The immediate ECI impact, for instance, corresponds to around 9% of the one day confidence drop following the Lehman bankruptcy, see Table 1. Another notable feature of the response to a surprise target rate hike is that it lowers economic confidence. This indicates that, over our sample period, the broader public interprets positive target surprises as contractionary policy shocks rather than as positive Fed information about economic conditions. This is consistent with Lewis (2019), who finds based on the asset price reactions that the policy surprises do not appear to conflate policy news with Fed information effects.

(a) Local Projections



(b) Smooth Projections

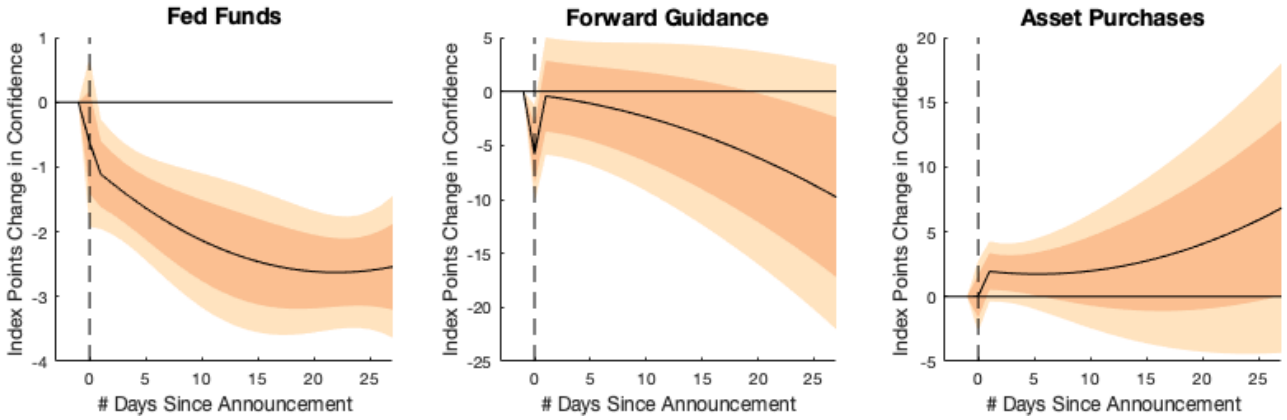


Figure 5: Confidence Impact of Monetary Policy Surprises

Notes: Estimates based on local projections (12) and smooth projections (13) of the daily Gallup ECI index on the monetary policy surprises constructed in Lewis (2019). In both panels, shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. For the upper panel, dashed lines represent point estimates from smooth projections in (13) for comparison, with dot-dash lines corresponding to 90% confidence intervals. Responses are scaled to a shock corresponding to a 25 basis-point increase in the respective reference rate: the effective funds rate in case of a funds rate surprise, the 2 year Treasury rate for forward guidance, and the 10 year Treasury rate for the asset purchases.

The other main result is that surprises in the forward guidance or asset purchase instruments do not have similarly clear and pronounced short run confidence effects, see the middle and right panels in Figure 5. Contractionary forward guidance that results in a 25 basis points surprise increase in the 2 year Treasury yield lowers confidence by about 5.8 points on impact, an estimate that is significant at the 90% level. However, in contrast to the target surprise the confidence effect of forward guidance is almost fully reversed the next day. Economic confidence gradually declines in subsequent days, but remains insignificant for the first three weeks after the announcement. Recall that the change point analysis in Section 3.1 identified a large upward jump in confidence on in December 2014 in part on a news headline of a pledged by

the Federal Reserve to be patient in raising interest rates. The regression evidence on the confidence impact of forward guidance over the entire sample suggests that such confidence effects are not clearly systematically a feature of forward guidance announcements.

Interestingly, a surprise asset purchase announcement that raises the 10 year yield by 25 basis point leads to an improvement in economic confidence, see the right panel of Figure 5. The positive confidence effect of a tightening through asset purchases indicates that Fed information effects around LSAP announcements may dominate the policy-inclination effects over our sample period. However, the response to LSAP surprises is imprecisely estimated and at best only marginally statistically significant at very short horizons.

In Appendix A.2, we repeat the analysis for the indices based on the separate responses to the survey questions about the 'current state' and 'direction' of the national economy, see Section 2. There are some indications of a relatively stronger response of the more forward looking 'directions' component to forward guidance surprises. In general, however, we find that the responses to the monetary surprises are very similar across both subcomponents of the ECI index.

We view the results in Figure 5 as evidence that information about monetary policy can be transmitted to households more directly and quickly than commonly assumed. However, not all monetary policy news is equal in this regard: only news about the target rate instrument results in clear and unambiguous instantaneous effects in survey measures of household confidence. Information about the future path of interest rates or asset purchases may not be transmitted as effectively to the wider public and/or more easily confused with information about non-monetary fundamentals. That the confidence impact of central bank communication depends on the monetary policy instrument is perhaps not too surprising. The Federal Funds target is a long-standing policy tool with which both the media and the wider public is more likely to be familiar. Additionally, changes in the target rate have been typically communicated via a single headline leading each FOMC announcement. Communications about forward guidance and asset purchases have arguably been much more challenging, and their effects on the economy remain relatively poorly understood even among professionals and academics.

Finally, an important implication of our results is that the transmission of target rate surprises may operate at least in part through a direct and immediate effect on household confidence, but also that achieving similar effects with other policy instruments may require further improvements in central bank communication.

4.2 Robustness

In this section, we show that our results on the short run confidence effects of monetary policy are robust to using an alternative daily indicator of household confidence, and to alternative high frequency measures of monetary policy news.

Rasmussen Daily Confidence As discussed in Section 2, Rasmussen's daily confidence index is another source of high frequency information on consumer sentiment, see Figure 2. This index is based on smaller survey sample and published as a three-day moving average, but it should respond similarly to meaningful economic news as the Gallup ECI index. Figure 6 reports the estimated smooth projections response of the Rasmussen index to the different monetary policy surprises. For this exercise, y_{t-1}^m in (12) is replaced with simply y_{t-1}, which is already a three-day moving average.

Even though it is based on an entirely different survey, the responses of the Rasmussen index to the policy surprises are very similar to those of the Gallup ECI index shown in Figure 5. Importantly, the Rasmussen index also shows a highly significant confidence decrease in response to a positive surprise in the Funds target, shown in the left panel. Following an unexpected hike of 25 basis points, the index drops by about 1.2 index points (equivalent to Michigan Sentiment Index points) after a week, and by up to 2.2 index points between two and three weeks. The magnitude of the confidence drop after a target surprise is therefore about the same as for the Gallup ECI index. Unlike for the ECI response in figure 5, there is no significant decline on impact. Note, however, that the 'impact' observation is actually a 3-day trailing moving average, two days of which are pre-announcement.[17]

The middle and right panels in Figure 6 show that the trajectories of the confidence responses to both forward guidance and asset purchase surprises are also broadly similar to those in Figure 5. The forward guidance surprise has no immediate impact on the Rasmussen index, but confidence gradually declines following the announcements. In contrasts to the ECI response, there are some indications that a forward guidance surprise has a statistically significant negative confidence effect around two weeks or so after the announcement. The response to a surprise announcement about asset purchases is qualitatively similar to Figure 5, and again suggests that Fed information effects dominate for LSAP announcements. Interestingly, the Rasmussen response to LSAP news is quite clearly statistically significant between one and three weeks. Overall, it is reassuring that the alternative high frequency confidence indicators produce results that are very much consistent.

Alternative High Frequency Measures of Monetary Policy News The high frequency identification literature has led to a proliferation of alternative measures of monetary policy shocks. These differ in terms of the interest rates and futures they are based on, in sample coverage, and in terms of the dimensionality of the shocks extracted from the high frequency data. Our baseline results are based on the three policy surprises in Lewis (2019), which are constructed from announcement-specific decompositions and identification through time-varying volatility. In this section, we show that our benchmark results are robust to alternative high-frequency measures of monetary policy news, and are therefore not driven by the Lewis (2019)

[17]Moreover, we also suspect the information used the construct the index is collected largely one day prior the date of publication.

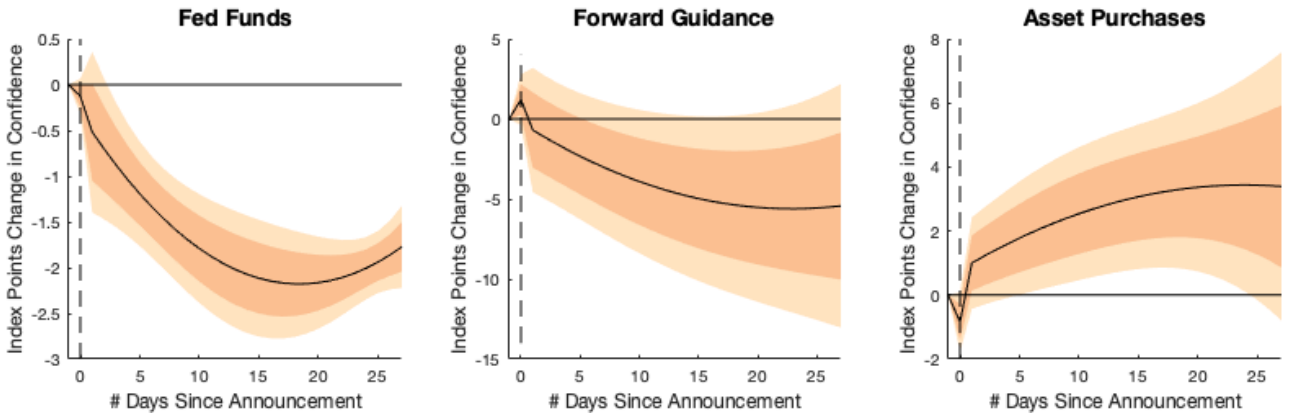


Figure 6: Confidence Impact of Monetary Policy Surprises using the Rasmussen Index

Notes: Estimates based on smooth projections (13) of the daily Rasmussen Confidence Index on the monetary policy surprises constructed in Lewis (2019). Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Responses are scaled to a shock corresponding to a 25 basis-point increase in the respective reference rate: the effective funds rate in case of a funds rate surprise, the 2 year Treasury rate for forward guidance, and the 10 year Treasury rate for the asset purchases.

methodology.

We consider six additional measures of monetary surprises based on several seminal papers in the literature.[18] First, we consider both the Fed Funds shock measure (the unexpected change implied by front month Fed Funds futures) and the Policy News shock measure (based on a basket of interest rates) from Nakamura and Steinsson (2018). We also consider the Gertler and Karadi (2015) shock series based on the 3-month ahead Fed Funds future contract, and the Jarociski and Karadi (2018) series, which is also based on the 3-month Fed Funds future but controls for movements in the S&P 500 to partial out Fed information effects. Finally, we consider two additional high frequency measures of funds rate surprises that are simpler versions of the Lewis 2019 shocks: First, simple 30-minute changes in the front quarter Eurodollar contract (ED1), while controlling for 30-minute changes in the 2-year Eurodollar and 10-Year Treasury as a crude approximation for forward guidance and asset purchase shocks. Second, the same series as the first, but with the longer rates orthogonalized to the front Eurodollar contract. For consistency, we use only shocks corresponding to scheduled FOMC announcements. Note that the sample size varies with the shock series, since the Nakamura and Steinsson (2018) measures end in March 2014, the Gertler and Karadi (2015) shock ends in June 2012, and the Jarociski and Karadi (2018) shock ends in December 2016.

Figure 7 shows the responses of the Gallup ECI index to each of these six additional measures of monetary policy surprises, estimated by the smooth projections in (12). The corresponding local projections estimates are reported in Appendix A.4. For ease of comparison, we scale all the impulses to correspond to a 25 basis point positive surprise in the Federal Funds rate. Each

[18] While there are more series that are well-cited in the literature, many do not contain observations after 2007, and thus are not useful for our analysis.

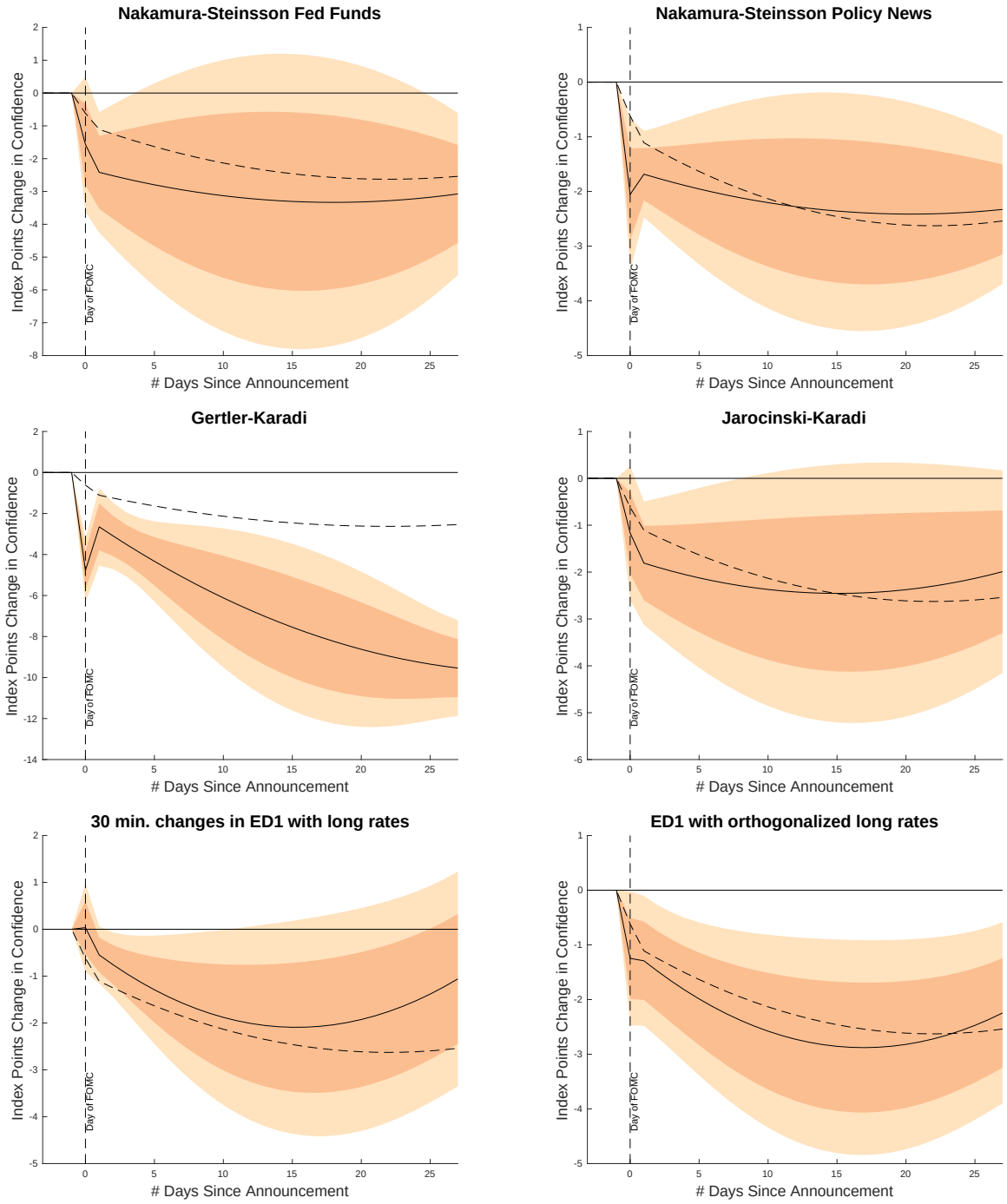


Figure 7: Confidence Impact: Alternative Measures of Monetary Policy Shocks

Notes: Estimates based on smooth projections (13) of the daily Gallup ECI index on the monetary policy surprises. Responses are scaled to a shock corresponding to a 25 basis-point increase in the Federal Funds rate. Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Dashed lines represent the baseline response from the left panel of Figure 5 similarly normalized. Sample periods vary across specification, ending in March 2014 for Nakamura and Steinsson (2018), June 2012 for Gertler and Karadi (2015), and December 2016 for Jarociski and Karadi (2018).

panel also shows our baseline estimated ECI response to a funds rate surprise from Figure 5 as a dashed black line.

The responses in Figure 7 reveal that, independent of the measure used, a positive Federal Funds surprise always has a negative and statistically significant effect on household confidence.

With the exception of the Gertler and Karadi (2015) shocks, the effects are also all of a similar magnitude, with a scaled effect peaking at 2-3 index points around 2-3 weeks after the announcement. For all series, the decrease is significant at least during the first week following an FOMC announcement. The only notably different results occur for the Gertler and Karadi (2015) shocks, which exhibit much larger effects reaching 8 to 10 Michigan-Sentiment-equivalent index points. The much larger responses are likely due to the fact that these shocks only run until June 2012.[19] The overall conclusion is nevertheless that our finding that Federal Funds target surprises have immediate and significant effects on household confidence is robust to the use of alternative shock measures.

4.3 The Equity Market Channel

It is unlikely that the confidence responses to surprises in jobs numbers or FOMC interest rate decisions arise because of widespread public attention to press releases by the Federal Reserve or the statistical agencies. More plausible is that the public responds to media reporting of these releases and/or to the reactions in financial markets. Several studies document evidence for a role of both the volume and tone of media reporting in shaping household expectations.[20] However, it is inevitably very difficult to distinguish sharply between media and financial markets as sources of public information, as events that cause larger financial market reactions are almost automatically also more newsworthy. While making such a sharp distinction is beyond the scope of this paper, in this section we explore the role of the stock market response to macroeconomic news in determining the impact on households confidence. Reactions in the stock market are arguably one of the most important determinants of media coverage and public attention to economic news.

To assess the potential role of an 'equity market channel', we modify the local projections in (1) and smooth projections in (2) to include interactions with equity price changes. In particular, we estimate local projections of the form

$$y_{t+h} - y_{t-1}^{m} = c_h + \beta_h s_t + \alpha_h r_t + \kappa_h s_t r_t + u_{t,h} \tag{14}$$

as well as its smooth version:

$$\begin{aligned} y_{t+h} - y_{t-1}^{m} = c &+ \mathcal{I}(h=0)\left(\gamma_0 s_t + \phi_0 r_t + \psi_0 s_t r_t\right) \\ &+ \mathcal{I}(h>0)\Big(\left(\gamma_1 s_t + \gamma_2 h s_t + \gamma_3 h^2 s_t\right) + \left(\psi_1 s_t r_t + \psi_2 h s_t r_t + \psi_3 h^2 s_t r_t\right)\Big) + u_{t,h}, \end{aligned} \tag{15}$$

where s_t is the macroeconomic surprise and r_t is an equity price change. We use the daily log return for the S&P 500 as our measure of equity price change r_t. The regression in (15)

[19] After estimating and rescaling responses for the 2008-2012 sample, we also find larger response to our baseline shocks.

[20] See for instance Carroll (2003), Doms and Morin (2004), Ehrmann, Pfajfar, and Santoro (2017), and Larsen, Thorsrud, and Zhulanova (2019)

effectively extends our earlier specification by controlling for the equity price response.

If the daily stock market change r_t and the surprise s_t are uncorrelated, then the responses estimated by (15) and evaluated at $r_t = 0$ should be approximately be same as those estimated without controlling for r_t. This would indicate that the households response is to information that is orthogonal to equity price changes. If the responses are changed, but still significant, it means that there is at least some component of the confidence response that is independent of the stock market response. Finally, if there is no significant confidence response after controlling for stock price changes, this does not necessarily mean that households are only reacting indirectly to the equity response, but simply that they respond in a similar fashion as the stock markets.

We estimate the smooth projections augmented with stock price changes in (15) for the macroeconomic data surprises analyzed in Section 3.2. The full results for all statistical releases are reported in Appendix A.4. The main finding is that for almost all of the twenty releases we consider, the confidence response after controlling for equity price movements are virtually unchanged. The job market and advance GDP releases that had significant responses in the baseline specification also remain significant. On this basis, we can reject the hypothesis that consumers are solely responding to the equity price movements following macroeconomic data surprises.

Figure 8 presents the corresponding results for the three monetary policy surprises constructed by Lewis (2019). For comparison, the dashed lines represent the baseline responses reported earlier in section 4.1. For forward guidance and asset purchase surprises, we obtain very similar results as for the macro data surprises: the point estimates barely change after controlling for the equity response. However, the left panel shows that the drop in consumer sentiment following a positive funds rate surprise disappear entirely after controlling for equity prices. Household confidence and equity markets, therefore respond very similarly to funds rate surprises. This is consistent with households responding primarily to the stock market reaction to funds rate surprises, but we cannot rule out that these responses are to equivalent information obtained elsewhere.

4.4 Heterogeneity in the Confidence Effects of Monetary Policy

The Gallup data allows us to explore possible heterogeneity in the confidence response to monetary surprises. In Section 3.3, we showed that estimates of the degree of information stickiness decrease with the level of education. It is therefore conceivable that the transmission of information about monetary policy decisions varies with the level of education or other demographic characteristics.

To assess the role of education, we construct separate daily indices for respondents with at

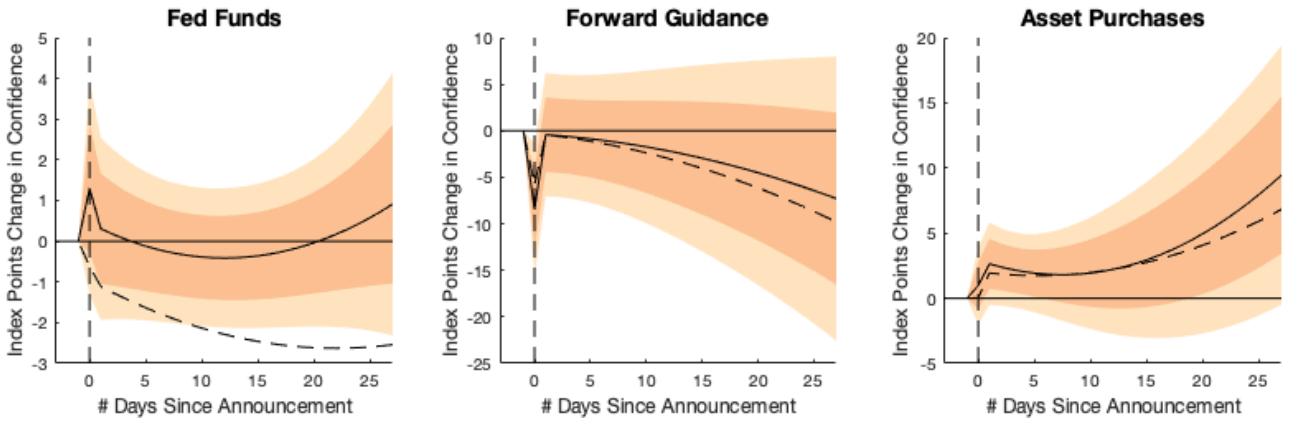


Figure 8: Confidence Impact of Monetary Policy Surprises, Controlling for Equity Prices

Notes: Responses are scaled to a shock corresponding to a 25 basis-point increase in the respective reference rate: the effective funds rate in case of a funds rate surprise, the 2 year Treasury rate for forward guidance, and the 10 year Treasury rate for the asset purchases. Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals.

least some college and for those with a high school degree or less. We also construct separate indices for low and high income individuals, depending on whether household income falls below or above $60K, and for younger and older survey respondents, by grouping those aged 18-45 and those aged 46 and over. For each of these subindices, we re-estimate the projections in (12) and (13).

Figure 9 plots the smooth projection results by education level.[21] The impulse with orange confidence intervals is for survey respondents with at least some college education, whereas the one with green intervals is for the non-college educated. The responses indicate that more highly educated survey respondents react more strongly to a Fed Funds surprise, with a maximum decline in confidence of around 3.3 points, about twice as much as the decline in confidence among the less educated (1.6 points). In Appendix A.6, we show that the difference between the confidence responses becomes formally statistically significant in the third week following the funds rate surprise. The responses to forward guidance and asset purchase surprises are broadly similar among education groups. As in the aggregate results in Figure 5, the pronounced and strongly significant short run confidence effects associated with funds rate surprises are generally absent for the other policy instruments. However, more educated individuals do exhibit a significant decline in confidence following forward guidance on impact and also after 3 weeks or so. The confidence impact of forward guidance for the less educated, in contrast, is never statistically significant. The responses to news about asset purchases are not significant for either education group. The impact response to asset purchase surprises, however, is significantly lower among the more highly educated, see Appendix A.6. While the estimates are inevitably somewhat imprecise, our overall conclusion is that are indications of larger confidence reactions to monetary policy news among the more highly educated. This is consistent with greater levels of attention to monetary policy news, and is consistent with the results of Section 3.3.

[21] The local projections results for every education, income and age group are provided in Appendix A.5.

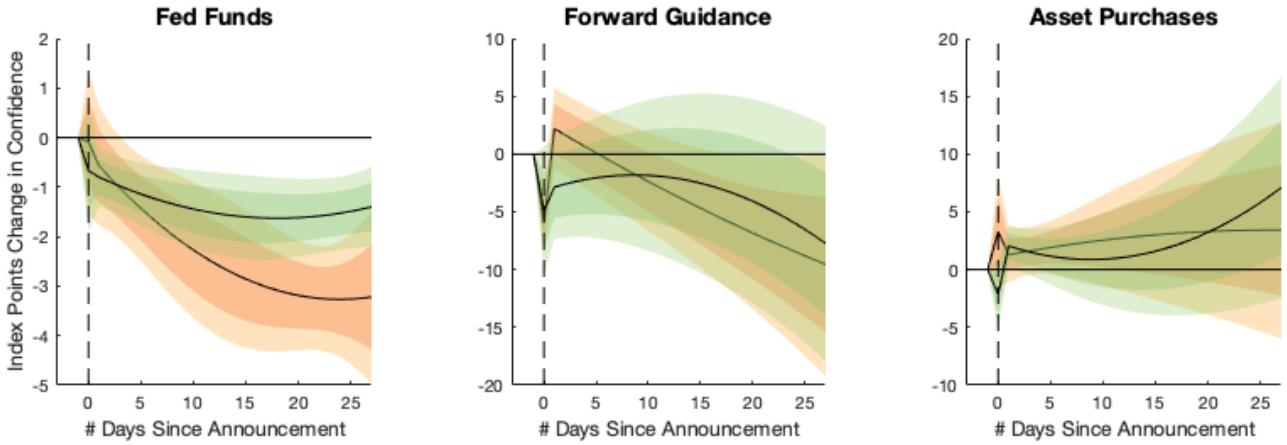


Figure 9: Confidence Impact of Monetary Policy Surprises by Education Level

Notes: Orange shows the response for survey respondents with some college, and green shows the response for those without college experience. Estimates based on smooth projections (13) of the daily confidence indices by education group on the monetary policy surprises constructed in Lewis (2019). Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Responses are scaled to a shock corresponding to a 25 basis-point increase in the respective reference rate: the effective funds rate in case of a funds rate surprise, the 2 year Treasury rate for forward guidance, and the 10 year Treasury rate for the asset purchases.

Figure 10 plots the results by income group. The impulse with orange confidence intervals is for survey respondents with higher incomes, whereas the one with green intervals is for those with lower incomes. The results show that the confidence response of younger survey respondents to funds rate surprises have similar negative short run confidence effects for respondents with higher and lower incomes. There is a partial reversal of the confidence decline for lower income respondents in the fourth week, but not for higher incomes. Note that the response for lower incomes (less than $60K in income) is far more precisely estimated. Overall, however, there are no pronounced differences between the confidence effects across income groups for either of the policy surprises, see Appendix A.6. This is again in line with the findings in Section 3.3, which showed very similar degrees of information stickiness across income groups.

Finally, Figure 11 depicts the results by age group. The impulse with orange confidence intervals is for survey respondents aged 45 or younger, whereas the one with green intervals is for those aged 46 and up. The results show a stronger response for younger survey respondents to funds rate surprises, peaking at 2.7 points, compared to 1.7 among the old. The response of the younger respondents is also far more precisely estimated. The responses to the forward guidance and asset purchase surprises are again very similar, except for the fact that the young have a very large (11.9 point) negative impact response to forward guidance surprises, which is also statistically significant. Appendix A.6 also shows that the impact response the impact response to asset purchases is significantly higher for the young than for the old. Apart from the impact responses to the surprises, there is no statistical evidence that the responses differ meaningfully by age group.

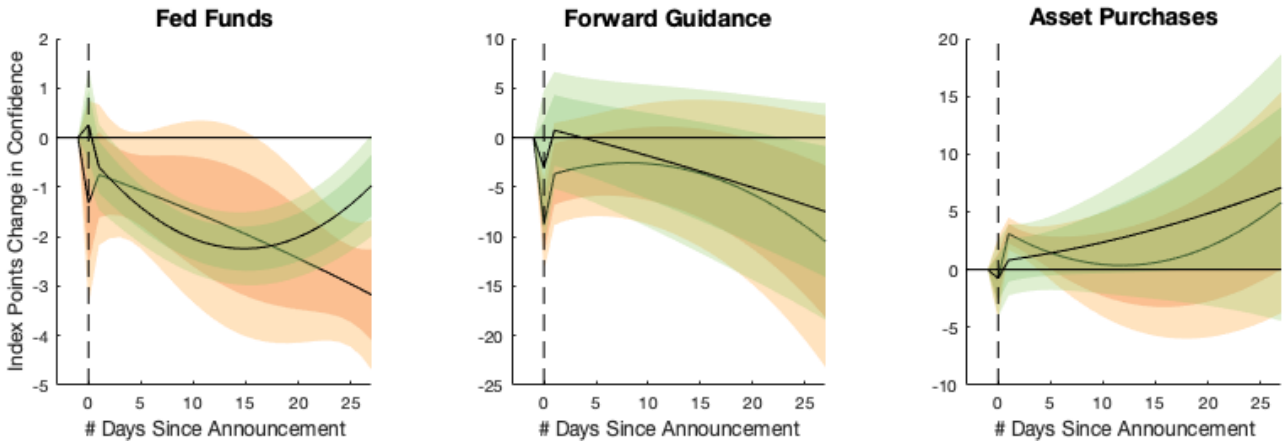


Figure 10: Confidence Impact of Monetary Policy Surprises by Income Level

Notes: Orange shows the response of respondents with household incomes exceeding $60K, and green shows the response for lower incomes. Estimates based on smooth projections (13) of the daily confidence indices by income group on the monetary policy surprises constructed in Lewis (2019). Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Responses are scaled to a shock corresponding to a 25 basis-point increase in the respective reference rate: the effective funds rate in case of a funds rate surprise, the 2 year Treasury rate for forward guidance, and the 10 year Treasury rate for the asset purchases.

In conclusion, there is definitely some evidence of heterogeneity in the confidence response to monetary surprises. Specifically, better educated and also younger individuals appear to show a larger decline in confidence following a upward surprise in the funds rate target. The fact that the results conditional on monetary policy news are broadly in line with the evidence of heterogeneity in information stickiness reported in Section 3.3 suggest that the heterogeneity in the confidence responses is linked to heterogeneity in attentiveness to information about monetary policy decisions.

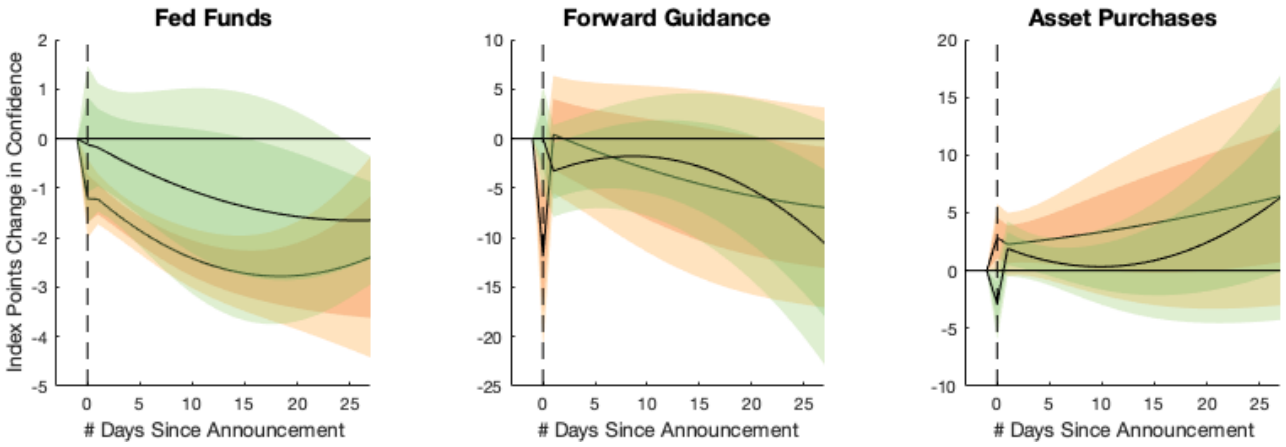


Figure 11: Confidence Impact of Monetary Policy Surprises by Age Group

Notes: Orange shows the response for survey respondents aged 45 or younger, and green shows the response for those aged 45 and up. Estimates based on smooth projections (13) of the daily confidence indices by age group on the monetary policy surprises constructed in Lewis (2019). Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Responses are scaled to a shock corresponding to a 25 basis-point increase in the respective reference rate: the effective funds rate in case of a funds rate surprise, the 2 year Treasury rate for forward guidance, and the 10 year Treasury rate for the asset purchases.

5 Conclusion

In this paper, we provide evidence that surprises in Federal Funds rate decisions generate immediate effects on public confidence in economic conditions. Two key features of our analysis distinguish it from existing work on the impact of monetary policy on expectations. The first is that we focus on the impact on the beliefs of the general public rather than of professional forecasters or financial market participants. The second is that we evaluate confidence reactions at the daily frequency. This means we can more confidently rule out other confounding factors and satisfy the exclusion restriction implicit in the event study approach. Moreover, the significant instantaneous confidence response at the daily level establishes that households change their economic outlook in response to announcements about monetary policy, and not just after experiencing its later economic impact.

Whereas we find that surprises in the funds rate impact public confidence instantaneously, we find little evidence for similar effects in response to monetary policy news related to forward guidance or asset purchases. This finding suggest that there remain significant communication challenges surrounding the use of these alternative policy instruments, and is consistent with a broader recognition that there is still ample scope to improve the communication of Federal Reserve policies, see Orphanides (2019).

Our results imply that information about monetary policy decisions is therefore transmitted more effectively, through media coverage and/or observation of the asset market reaction, to the general public than suggested by existing evidence on informational rigidities. Moreover, we also provide more general evidence that measures of public confidence in the economy respond to certain types of macroeconomic news relatively quickly. A likely important difference between our analysis and the existing literature on informational rigidities is that we focus on categorical survey answers about economic conditions rather than on quantitative inflation expectations. We conjecture that time aggregation may be an additional reason that the higher frequency survey data points to more flexible adjustments in beliefs in response to new information. We plan to pursue this conjecture in future research.

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A Appendix

A.1 Confidence Dynamics Around Macroeconomic Data Surprises

This section provides the full set of estimates of the confidence dynamics surrounding surprises in macroeconomic data releases, discussed in Section 3.2. Figure 12 depicts the estimates based on local projections obtained from (1), whereas dashed lines shows the estimates based the smooth local projections (2).

Table 3 lists the estimated change in confidence relative on (1) the day of the release, (2) the next day and (3) one week after the release. The releases are in descending order based on the estimated ECI change on the next day. Standard errors are in parentheses. The point estimates are based on the smooth projections in (2) and represent the confidence change in index points associated with a one standard deviation positive surprise. Most of the releases are monthly with roughly 120 releases over the 10-year sample. The number of observations roughly equals the number of releases over the sample period times the estimation horizon of 28 days. The sample sizes vary slightly across the releases because of missing observations in the ECI series (holidays etc.) The weekly initial claims and the GDP reports are at a weekly and quarterly frequency, and the sample sizes change accordingly. We use a horizon up to 7 days for the weekly claims, and maintain the 21 day window for the GDP reports.

Table 3: Confidence Changes Following Surprises in Macro Releases

	# releases	# obs.	Day of Release	Next Day	Next Week
GDP Advance	40	799	0.85	0.90***	0.59
			(0.53)	(0.25)	(0.47)
BLS Unemployment Rate	120	2389	−0.51**	−0.68***	−0.52*
			(0.23)	(0.22)	(0.27)
ADP Payroll Employment	120	2384	0.45***	0.62***	0.39***
			(0.17)	(0.18)	(0.11)
BLS Payroll Employment	120	2389	0.24	0.59*	0.46*
			(0.34)	(0.34)	(0.26)
GDP Second	40	784	0.40	0.52	0.75***
			(0.42)	(0.47)	(0.29)
ISM Manufacturing	120	2359	0.16	0.47	0.53*
			(0.37)	(0.37)	(0.30)
Advance Retail Sales	120	2358	0.12	0.39*	0.53***
			(0.29)	(0.23)	(0.18)
GDP Final	32	584	−0.12	0.33	0.34
			(0.46)	(0.65)	(0.53)
Factory Orders	119	2371	0.05	0.33	0.31
			(0.40)	(0.22)	(0.40)
Conf Board Confidence	120	2360	0.07	0.29	0.33
			(0.25)	(0.31)	(0.30)
Headline CPI (MoM)	120	2337	0.34	−0.19	0.12
			(0.24)	(0.20)	(0.17)
Personal Income	120	2325	0.23	0.12	−0.39***
			(0.23)	(0.32)	(0.12)
U of.M Sentiment (Final)	120	2325	−0.62***	−0.08	−0.21
			(0.21)	(0.25)	(0.25)
U of M Confidence (Prelim)	120	2364	0.15	0.08	0.02
			(0.38)	(0.31)	(0.27)
Industrial Production	120	2347	0.39	−0.07	0.43
			(0.31)	(0.34)	(0.34)
PCE Deflator YoY	120	2325	0.59**	0.04	0.09
			(0.30)	(0.23)	(0.26)
Initial Jobless Claims	522	3416	−0.07	0.03	0.09
			(0.16)	(0.14)	(0.21)
Personal Consumption	120	2325	−0.06	0.03	−0.06
			(0.30)	(0.26)	(0.23)
Housing Starts	118	2300	0.07	−0.03	0.58**
			(0.39)	(0.16)	(0.28)
ISM Non-Manufacturing	120	2403	0.12	0.01	−0.00
			(0.31)	(0.24)	(0.34)

Notes: Estimates based on smooth projections as in (2) of the Gallup ECI on surprises in macroeconomic data releases. In descending order based on the estimated change on the next day of the release. Standard errors based on Lazarus et al. (2018) in parenthesis. Asterisks denote 10%, 5% or 1% significance. Sample range is 2-Jan-2008 to 27-Dec-2017.

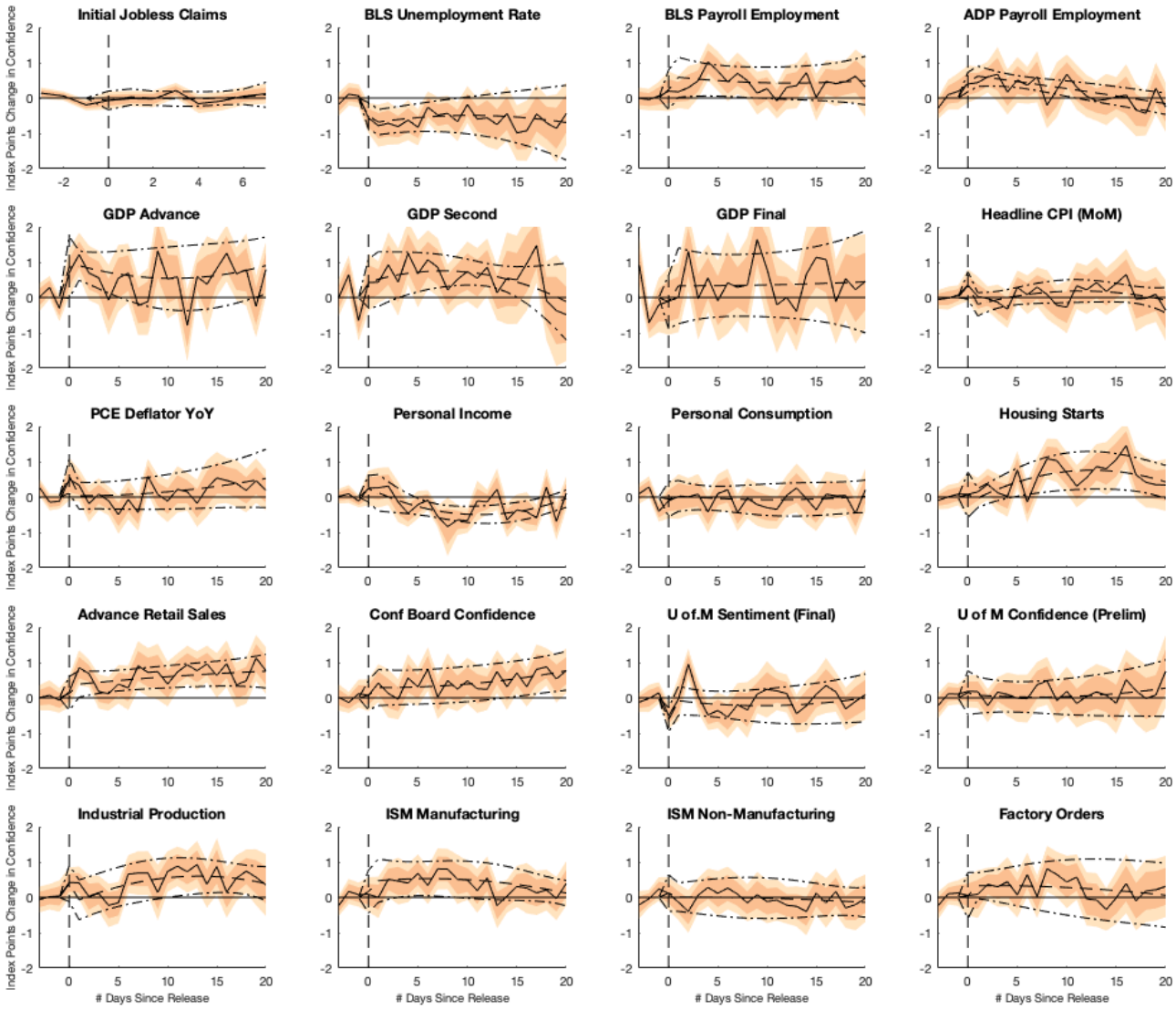


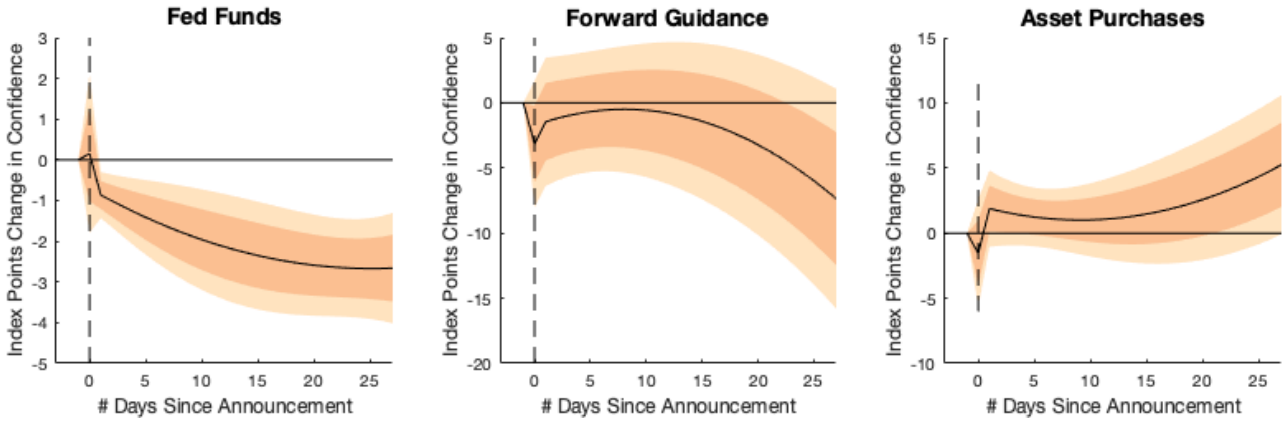
Figure 12: Confidence Changes Following Surprises in Macroeconomic Releases

Notes: Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Full lines are based on local projectiona of the Gallup ECI on surprises in macroeconomic data releases as in 1. Dashed lines represent point estimates from smooth projections (see 2) and dot-dash lines corresponding 90% Lazarus et al. (2018) confidence intervals.

A.2 Response of the Confidence Components to Monetary Policy News

Figure 13 reports the responses of the two subcomponents of the Gallup ECI index to the monetary policy surprises. These subcomponents are based on survey questions about the current state and the direction of economic conditions, respectively, see Section 2. For brevity, the figure reports only results for the smooth projections in (13). The figure shows that the responses based on the individual questions are overall both very similar to the response of the overall ECI index in Figure 5b. One minor distinction is that the impact response to forward guidance shocks is more clearly apparent in the more forward looking 'directions' component, which is consistent with forward guidance providing news about the future as opposed to contemporary conditions.

(a) Current State of Economic Conditions



(b) Direction of Economic Conditions

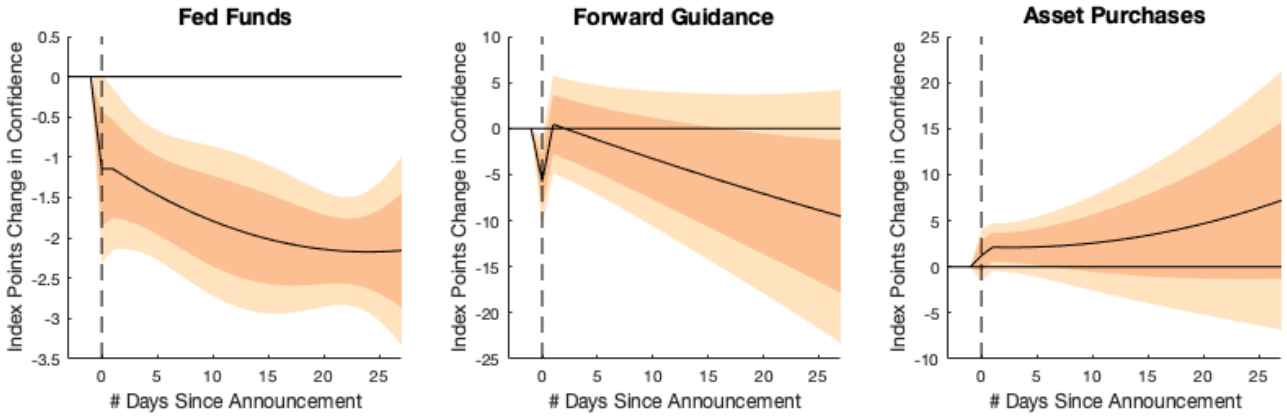


Figure 13: Confidence Component Impact of Monetary Policy Surprises

Notes: Estimates based on smooth projections (13) of the daily Gallup 'Current State' and 'Direction' indices on the monetary policy surprises constructed in Lewis (2019). In both panels, shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Responses are scaled to a shock corresponding to a 25 basis-point increase in the respective reference rate: the effective funds rate in case of a funds rate surprise, the 2 year Treasury rate for forward guidance, and the 10 year Treasury rate for the asset purchases.

A.3 Local Projection Estimates Using Alternative Monetary Policy Shocks

Figure 14 shows the responses of the ECI index to various measures of monetary policy shocks, estimated using local projections as in (12).

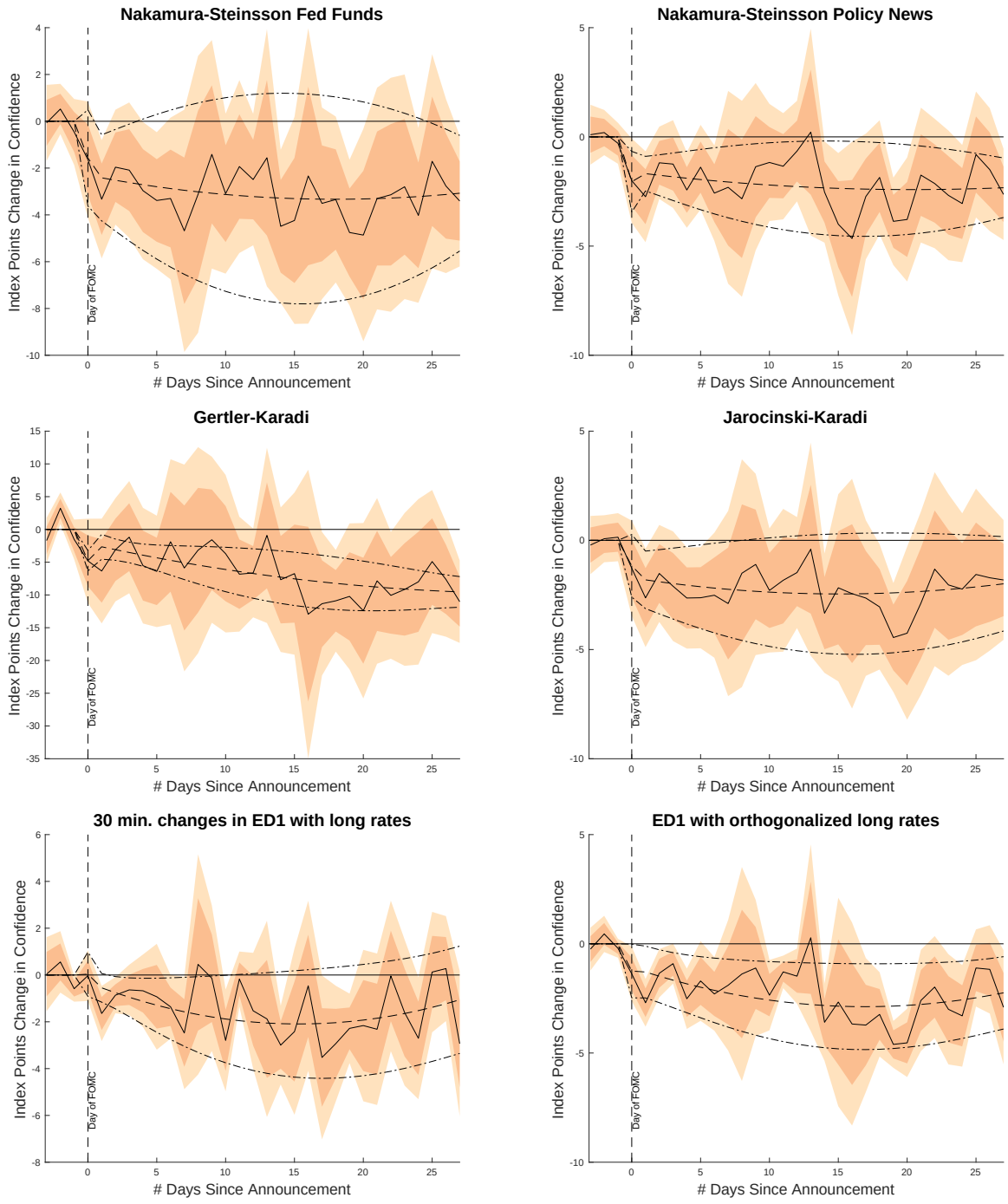


Figure 14: Confidence Impact: Alternative Monetary Policy Shocks

Notes: Estimates based on local projections (12) of the daily Gallup ECI index on the monetary policy surprises. Responses are scaled to a shock corresponding to a 25 basis-point increase in the Fed Funds rate. Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Dashed lines represent point estimates from smooth projections and dot-dash lines corresponding 90% confidence intervals. Sample periods vary across specification, ending in March 2014 for Nakamura and Steinsson (2018), June 2012 for Gertler and Karadi (2015), and December 2016 for Jarociski and Karadi (2018).

A.4 Confidence Responses and the Equity Market Channel

Figure 15 shows the dynamics of the ECI index following surprises in various data releases while controlling for changes in equity prices, estimated using smooth projections as in (15).

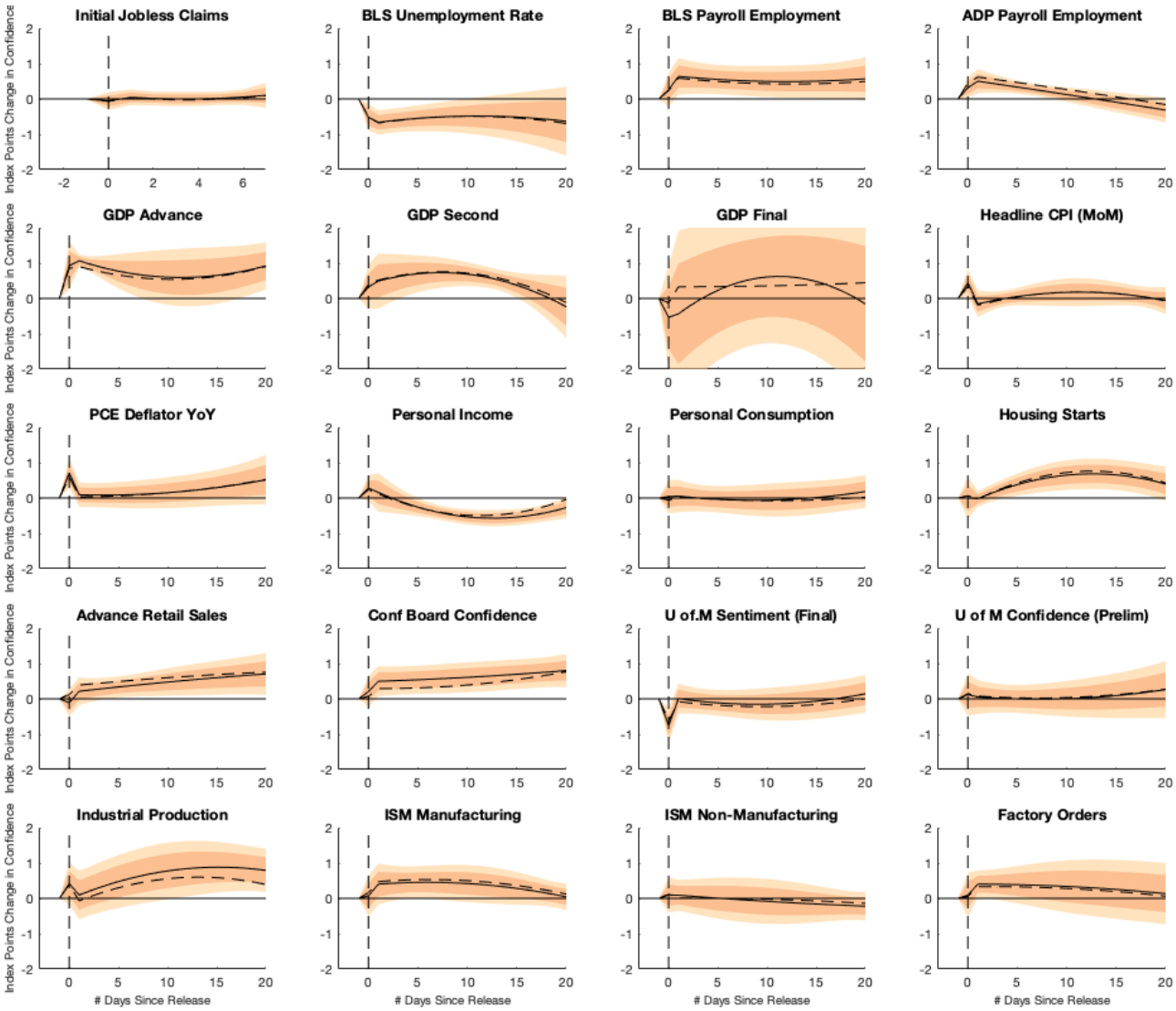


Figure 15: Confidence Changes Following Surprises in Macroeconomic Releases, Controlling for Equity Prices

Notes: Responses are evaluated for zero change in equities on the announcement date. Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals.

A.5 Confidence Impact by Education, Income and Age

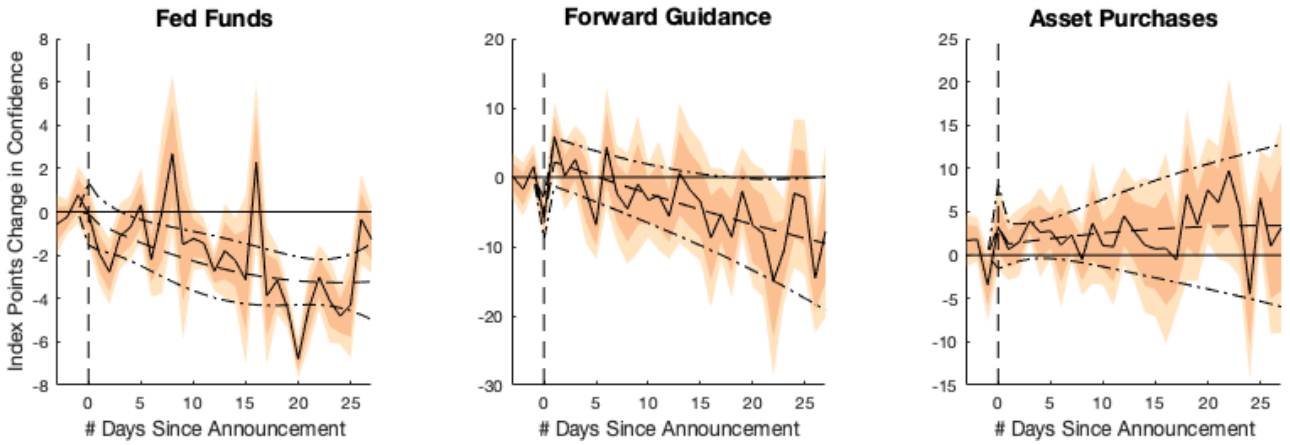


Figure 16: Confidence Impact of MP Surprises: Respondents with Some College Education

Notes: Estimates based on local projections (12) and smooth projections (13) on the monetary policy surprises constructed in Lewis (2019). Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Dashed lines represent point estimates from smooth projections in (13) for comparison, with dot-dash lines corresponding to 90% confidence intervals. Responses are scaled to a shock corresponding to a 25 basis-point increase in the respective reference rate: the effective funds rate in case of a funds rate surprise, the 2 year Treasury rate for forward guidance, and the 10 year Treasury rate for the asset purchases.

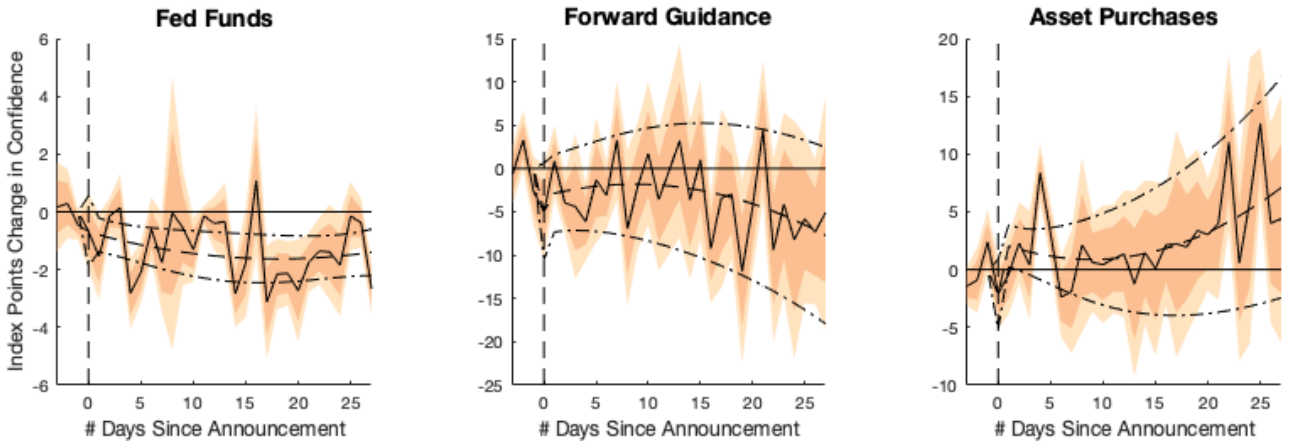


Figure 17: Confidence Impact of MP Surprises: Respondents with No College Experience

Notes: Estimates based on local projections (12) and smooth projections (13) on the monetary policy surprises constructed in Lewis (2019). Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Dashed lines represent point estimates from smooth projections in (13) for comparison, with dot-dash lines corresponding to 90% confidence intervals. Responses are scaled to a shock corresponding to a 25 basis-point increase in the respective reference rate: the effective funds rate in case of a funds rate surprise, the 2 year Treasury rate for forward guidance, and the 10 year Treasury rate for the asset purchases.

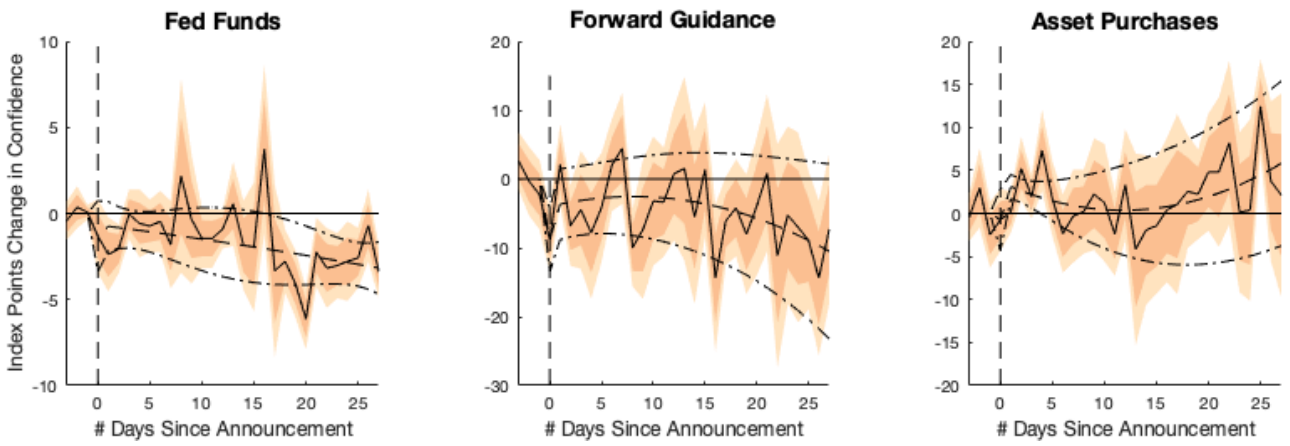


Figure 18: Confidence Impact of MP Surprises: Respondents with High Income (more than $60K)

Notes: Estimates based on local projections (12) and smooth projections (13) on the monetary policy surprises constructed in Lewis (2019). Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Dashed lines represent point estimates from smooth projections in (13) for comparison, with dot-dash lines corresponding to 90% confidence intervals. Responses are scaled to a shock corresponding to a 25 basis-point increase in the respective reference rate: the effective funds rate in case of a funds rate surprise, the 2 year Treasury rate for forward guidance, and the 10 year Treasury rate for the asset purchases.

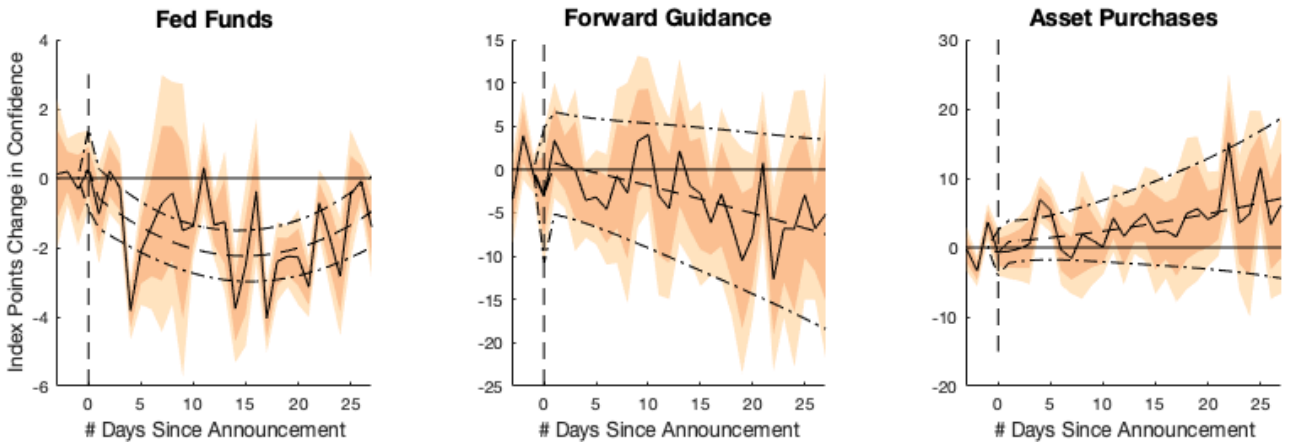


Figure 19: Confidence Impact of MP Surprises: Respondents with Low Income (less than $60K) Respondents

Notes: Estimates based on local projections (12) and smooth projections (13) on the monetary policy surprises constructed in Lewis (2019). Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Dashed lines represent point estimates from smooth projections in (13) for comparison, with dot-dash lines corresponding to 90% confidence intervals. Responses are scaled to a shock corresponding to a 25 basis-point increase in the respective reference rate: the effective funds rate in case of a funds rate surprise, the 2 year Treasury rate for forward guidance, and the 10 year Treasury rate for the asset purchases.

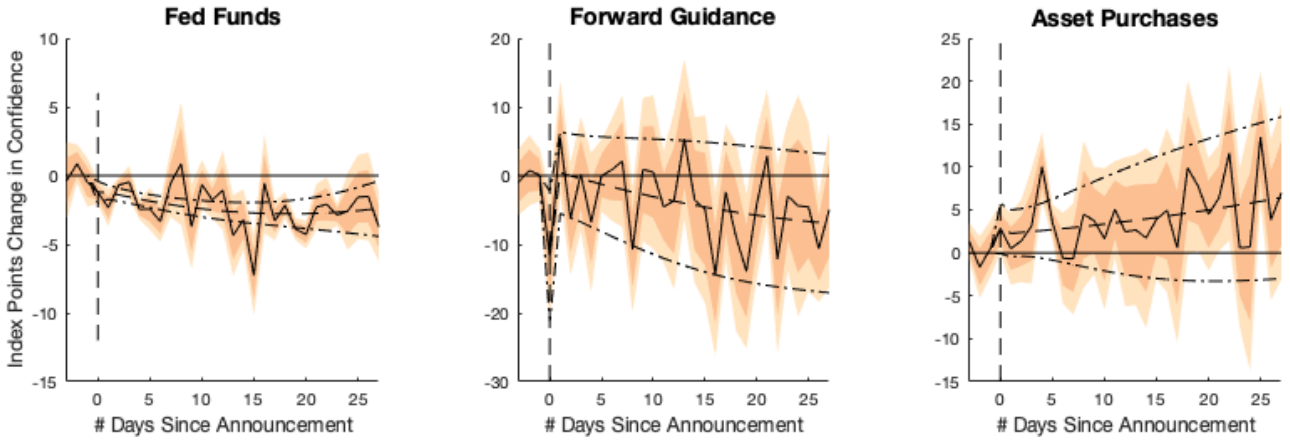


Figure 20: Confidence Impact of MP Surprises: Younger Respondents (18 to 45)

Notes: Estimates based on local projections (12) and smooth projections (13) on the monetary policy surprises constructed in Lewis (2019). Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Dashed lines represent point estimates from smooth projections in (13) for comparison, with dot-dash lines corresponding to 90% confidence intervals. Responses are scaled to a shock corresponding to a 25 basis-point increase in the respective reference rate: the effective funds rate in case of a funds rate surprise, the 2 year Treasury rate for forward guidance, and the 10 year Treasury rate for the asset purchases.

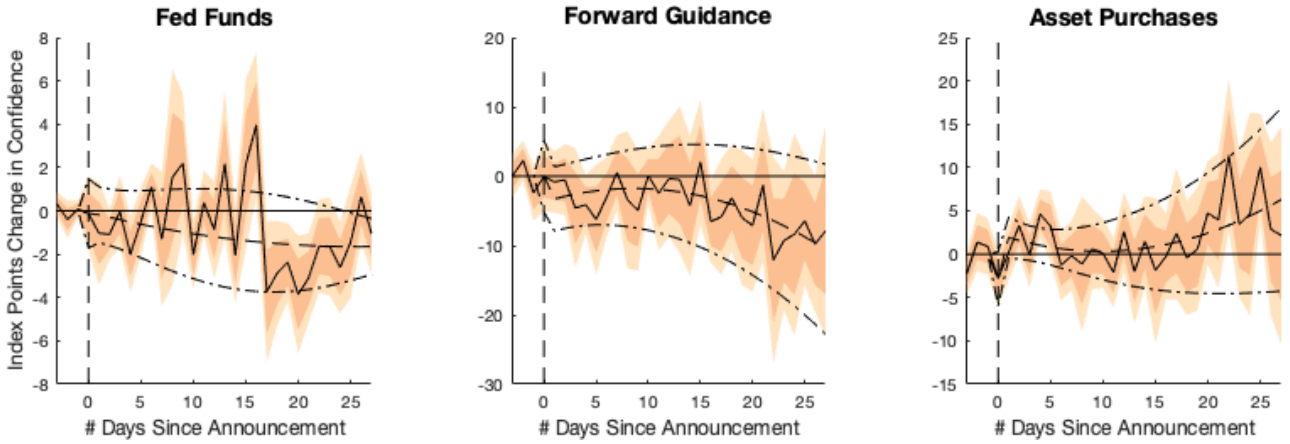


Figure 21: Confidence Impact of MP Surprises: Older Respondents (over 45)

Notes: Estimates based on local projections (12) and smooth projections (13) on the monetary policy surprises constructed in Lewis (2019). Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Dashed lines represent point estimates from smooth projections in (13) for comparison, with dot-dash lines corresponding to 90% confidence intervals. Responses are scaled to a shock corresponding to a 25 basis-point increase in the respective reference rate: the effective funds rate in case of a funds rate surprise, the 2 year Treasury rate for forward guidance, and the 10 year Treasury rate for the asset purchases.

A.6 Differences in the Confidence Responses by Education, Income and Age

Figure 22: Difference in Confidence Impact of MP Surprises Across Education Groups

Notes: Differences in the smooth projection (13) on the monetary policy surprises constructed in Lewis (2019) across education levels. Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Responses are scaled to a shock corresponding to a 25 basis-point increase in the respective reference rate: the effective funds rate in case of a funds rate surprise, the 2 year Treasury rate for forward guidance, and the 10 year Treasury rate for the asset purchases.

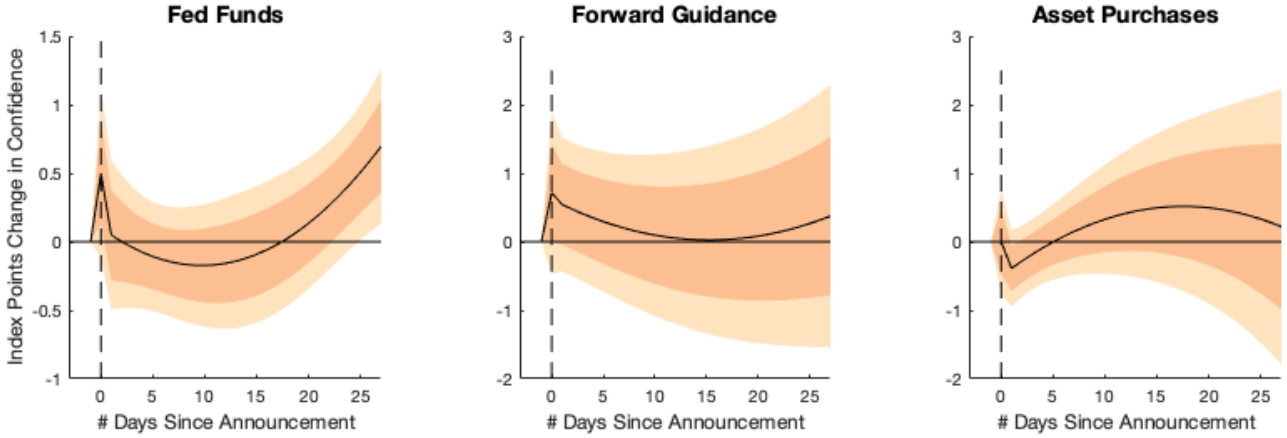


Figure 23: Difference in Confidence Impact of MP Surprises Across Income Groups

Notes: Differences in the smooth projection (13) on the monetary policy surprises constructed in Lewis (2019) across income levels. Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Responses are scaled to a shock corresponding to a 25 basis-point increase in the respective reference rate: the effective funds rate in case of a funds rate surprise, the 2 year Treasury rate for forward guidance, and the 10 year Treasury rate for the asset purchases.

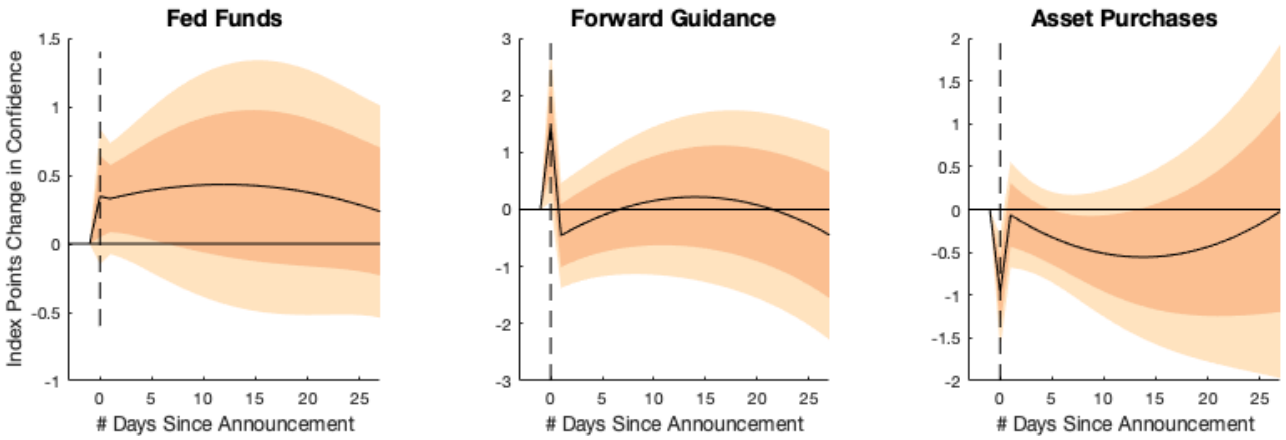


Figure 24: Difference in Confidence Impact of MP Surprises Across Age Groups

Notes: Differences in the smooth projection (13) on the monetary policy surprises constructed in Lewis (2019) across age levels. Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Responses are scaled to a shock corresponding to a 25 basis-point increase in the respective reference rate: the effective funds rate in case of a funds rate surprise, the 2 year Treasury rate for forward guidance, and the 10 year Treasury rate for the asset purchases.