Do Monetary Policy Announcements Shift Household Expectations?

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REPORTS

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Federal Reserve Bank of New York Staff Reports, no. 897
September 2019; revised January 2020
JEL classification: E30, E40, E50, E70

Abstract

We use a decade of daily survey data from Gallup to study how monetary policy influences households' beliefs about economic conditions. We first document that public confidence in the state of the economy reacts instantaneously to certain types of macroeconomic news. 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. Specifically, we find that a surprise increase in the target rate robustly leads to an immediate decline in household confidence, at odds with previous findings that suggest consumers are largely inattentive to economic developments. Monetary policy news about forward guidance and asset purchases does not have similarly clear and robust immediate effects on household beliefs. We document heterogeneity across demographics in the responsiveness of macroeconomic beliefs to aggregate news, and we relate our findings to existing evidence on informational rigidities.

Key words: 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 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 effective 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 questions in Gallup's U.S. Daily Survey Poll about national economic conditions posed daily to approximately 500 respondents between January 2008 and December 2017. The answers are combined in daily diffusion indices that after aggregation are very highly correlated with well-known monthly consumer confidence indices from Michigan and Conference Board surveys. We also confirm our findings using an alternative daily survey dataset produced by Rasmussen.

Crucially, 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 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 subsequent macroeconomic data releases or to changes in agents' own economic situation that may be influenced by the economic consequences of the monetary

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[1]See Blinder et al. (2008) for an overview of the evidence, as well as more recently: 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).

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. In other words, the exclusion restriction required for event study analysis is more plausibly justified in our 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: 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 may be less well understood by the general public and therefore affect perceptions of economic conditions differently. Our baseline methodology follows Lewis (2019a) and separately identifies the impact on household confidence of news about each of the three policy instruments. We also confirm our findings using other available high frequency measures of monetary policy news, such as those of Swanson (2017), Nakamura and Steinsson (2018), and Jarocinski and Karadi (2018).

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. Specifically, in our sample households on average interpret an upward target rate surprise as negative for the US 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. For perspective, the daily index decreased by 12.6 Michigan-equivalent points following the announcement of the Lehman bankruptcy, one of the largest single-day confidence drops in our sample. We also analyze the heterogeneity of the belief responses to monetary policy news across different age, income and education groups. We find that the reactions to the funds rate surprises are broad-based, but nevertheless somewhat stronger among more highly educated and younger respondents. We relate this to separate new evidence of relatively higher rates of information updating for these groups. Overall, our results indicate 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.

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 in stimulating aggregate spending in

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

the aftermath of the Global Financial Crisis, 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 better substitutes for target rate changes in future experiences with the effective lower bound. Nevertheless, our results suggest that further improvements in communication to the wider public may be warranted to increase the effectiveness of these alternative policy instruments.

The existing evidence on the influence of monetary policy announcements on household perceptions of aggregate economic conditions is very limited. Existing survey evidence generally points to low public informedness about monetary policy, which leads Binder (2017b) to express doubts that central bank communications are transmitted effectively to the general public. Poor economic and financial literacy could imply low demand for monetary policy information as cognitive costs outweigh perceived economic benefits for most.[3] In addition, intense competition for audience attention may result in limited media coverage of central bank news. Binder (2017c) documents, for example, that the Chair of the Federal Reserve features much less prominently in press coverage of economy-related news than the President. Based on data from the Michigan survey, Coibion et al. (2018) also find little change in the fraction of respondents that say that have heard an economic news story about monetary policy after selected major policy announcements.[4]

Some recent experimental evidence, on the other hand, clearly demonstrates that individuals' beliefs do change once they are provided with information about monetary policy. Coibion, Gorodnichenko, and Weber (2019) randomly provide Nielsen survey respondents with either a news summary of the recent FOMC meeting outcome, the official FOMC statement, or simply with information about the inflation target, and find that these treatments all have meaningful effects on reported inflation expectations. Haldane and McMahon (2018) find evidence that presenting survey respondents with more accessible versions of the Bank of England's Monetary Policy Summary leads to smaller differences with the Bank's forecasts.

To the best of our knowledge, the only previous study of the causal effect of actual FOMC announcements on the wider public's perceptions of aggregate economic conditions is Lamla and Vinogradov (2019). These authors study data from online surveys with a first wave sent out two days before each of 12 FOMC meetings between 2015 and 2018, and a second wave sent out one day after those same meetings. The authors compare survey answers before and after the conclusion of the meetings and attribute any differences to the arrival of news about monetary policy. Interestingly, they find a clear and significant jump in the fraction of respondents that report having heard news about monetary policy after a meeting. However, Lamla

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

[4]Specifically, following the 50bps cut in August 2007, the launch of QE1 or QE2, and the announcement of the 2% inflation target.

and Vinogradov ([2019](#)) do not find any detectable effect on the respondents' perceptions of the levels of economic activity or inflation. Our paper overcomes several important limitations of the Lamla and Vinogradov ([2019](#)) study that can easily explain the difference in findings. The most critical one is that we estimate the effects of surprises in the policy stance. One would only expect changes in perceptions of economic conditions in response to new information about monetary policy, and not simply because an FOMC meeting has taken place. Naturally, the direction of the surprise should also matter for the impact on household expectations. Our sample includes 80 FOMC meetings, which allows us to distinguish between news about monetary policy along multiple dimensions. Finally, the Gallup survey takes place every day, which means we can trace the effects for weeks after the arrival of policy news.

Our paper also connects to the broader empirical literature on the formation of expectations, which tends to find that informational rigidity are important. Carroll ([2003](#)), for instance, finds that consumers only very occasionally pay attention to macroeconomic 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 this evidence, 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 evidence for relative inattentiveness to macroeconomic information, 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 even 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 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 about 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 the Gallup data, discusses its relation to alternative measures, and provides evidence that economic confidence reacts instantaneously to certain forms of macroeconomic news. Section 3 presents our baseline estimates of the responses to different types of monetary policy news, and presents an extensive set of robustness checks. Section 4 discusses the relationship with existing evidence on informational rigidities. 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.[5] Founded in 1935, Gallup is one of the world's premier polling and analytics companies. In 2008 it began interviewing roughly 1,000 different Americans every day by telephone on political, economic, and well-being topics in their U.S. Daily Poll.[6] From 2008 to the end of 2017, about half of the respondents were asked two questions about the state of the national economy.[7] 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?*

Both the 'current state' and 'direction' questions explicitly refer to economic conditions at the national level, and not to respondents' own economic situation.[8] While the meaning of 'economic conditions' is admittedly subject to interpretation, we conjecture that most respondents proxy macroeconomic conditions with simple heuristics, such as the unemployment rate or the growth rate of output. We will document below that new information about GDP or the labor market indeed leads to detectable changes in the survey answers.

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[5]The Gallup data have been used in a number of empirical studies, e.g. Kahneman and Deaton (2010), Aghion et al. (2016) and Makridis (2019).

[6]The webpages 'How Does the Gallup U.S. Daily Work?' and 'Understanding Gallup's Economic Measures' provide additional information.

[7]The sample size is about 1,000 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 Dec 31, 2017.

[8]Other questions in Gallup's U.S.Daily Poll 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.

(a) Economic Confidence Index

(b) Current State of Economic Conditions

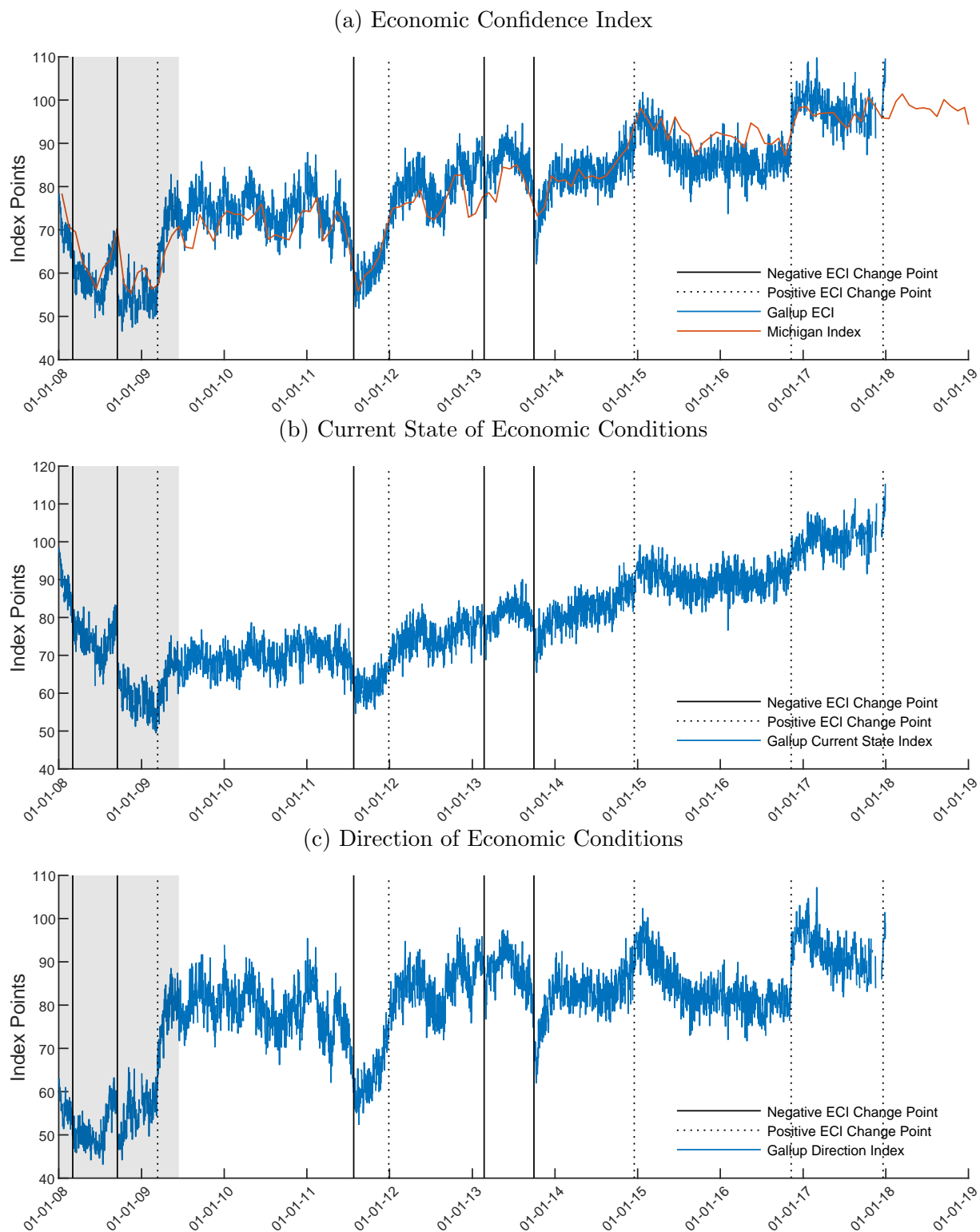(c) Direction of Economic Conditions

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

Notes: Data from Gallup and University of Michigan. The daily Gallup indices cover Jan 2, 2008 through Dec 30, 2017. Panel (b) is based on the fraction of respondents rating current economic conditions (('Excellent' + 'Good') – 'Poor'). Panel (c) is based on the fraction saying the economy is ('Getting better' – 'Getting worse'). Panel (a) is based on the average of both. Each panel shows daily indices that are rescaled to have the same mean and variance as the Michigan Sentiment Index over the sample period. Vertical lines mark the five largest negative and five largest positive change points in the Economic Confidence Index detected by the change point algorithm of Killick, Fearnhead, and Eckley (2012). Shaded areas are NBER recessions.

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Gallup combines the answers to the two questions above in an Economic Confidence Index (ECI). This index is computed by adding the percentage of respondents rating current economic conditions (('Excellent' + 'Good') – 'Poor') to the percentage saying the economy is ('Getting better' – 'Getting worse') and then dividing that sum by 2. The aggregation uses weighting adjustments to make the index representative of the US population. We use the same methodology to construct the ECI series from the underlying microdata. The available microdata allow us to broaden the sample coverage somewhat beyond the aggregate series that are published by Gallup.[9] Figure 1a plots the resulting daily ECI from January 2, 2008 to December 30, 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. 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.[10] 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 very high (0.935).

Another popular monthly 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.[11] 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.[12] The correlation between the month-aggregated Gallup ECI and the Conference Board index is 0.864. The strong relation between the Gallup ECI and the two monthly measures of consumer sentiment indicates that they summarize very similar information.

The Gallup ECI has the important advantage of being available at the daily frequency. There do exist other high frequency alternatives to the Michigan and Conference Board mea-

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[9] Appendix B shows the aggregate series published by Gallup and replicates all results with these aggregate series when this is possible. There are no meaningful implications for any of our results, and the differences in the estimates are quantitative and mostly very minor. Earlier working paper versions of this paper were based on the aggregate Gallup series.

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

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

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

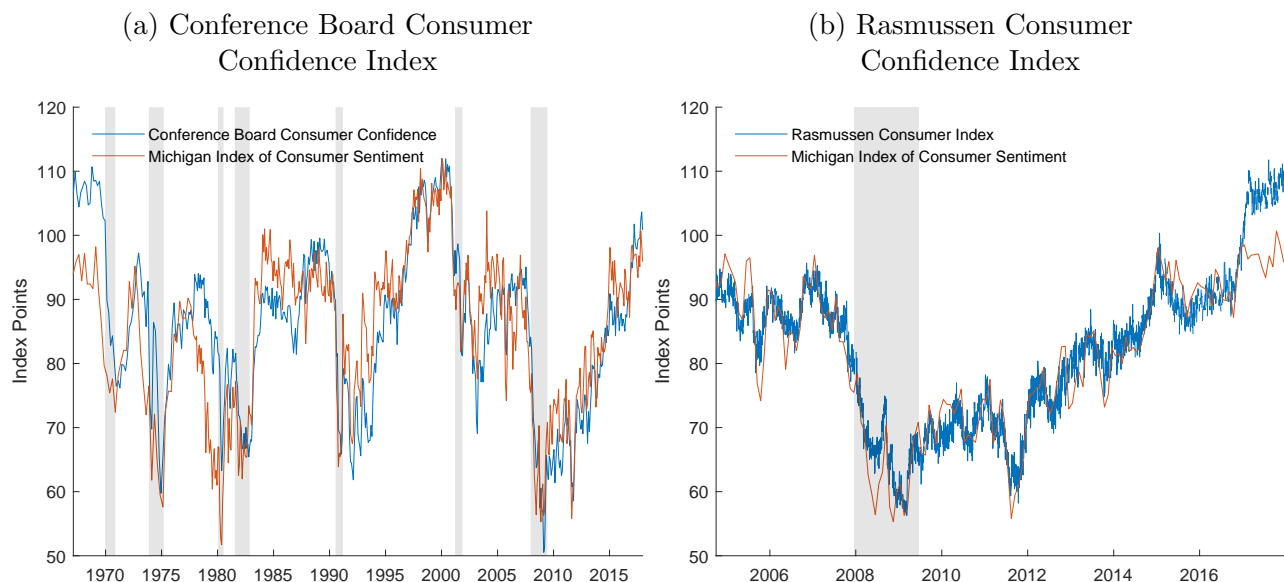| (a) Conference Board Consumer | (b) Rasmussen Consumer |
| Confidence Index | Confidence Index |

Figure 2: Alternative Measures of Economic Confidence

Notes: Source: Gallup, Rasmussen, University of Michigan, Conference Board. All indicators are rescaled to have the same mean and variance as the Michigan Sentiment Index over the sample period shown. Shaded areas are NBER recessions.

sures of consumer sentiment. Figure 2b shows a daily measure constructed by Rasmussen from its daily national surveys of American consumers.[13] 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 correlations between the month-aggregated Rasmussen index and the Michigan and Conference Board indices are 0.969 and 0.940 respectively. As a robustness check, we verify our main results using this alternative daily confidence measure.[14]

Before turning to our main research question – the impact of monetary policy news on household beliefs – the rest of this section first provides evidence that consumer confidence is responsive to certain types of aggregate news at the moment of its arrival. This evidence is important to establish that the daily Gallup ECI is in fact informative for our main hypothesis about monetary policy news. In addition, the daily frequency of the Gallup ECI permits some new insights into the aggregate drivers of consumer confidence that are interesting in their own right. Specifically, we discuss the reactions of consumer confidence to major news events and to surprises in various macroeconomic data releases.

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

[14]In addition, Langer Research produces a weekly index that 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 as a four-week rolling average. As it is therefore less suitable for our high frequency analysis, we do not use the Bloomberg Consumer Comfort Index.

2.1 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 persistence from transitory sampling noise – we apply the optimal change point detection algorithm of Killick, Fearnhead, and Eckley (2012) to the Gallup ECI in Figure 1a.[15]

The vertical lines in Figure 1 mark the five largest negative and five largest 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 shifts reported in column 2 of Table 1 is the magnitude of the daily change in the Gallup ECI (on the same scale as the Michigan Consumer Sentiment 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 Gallup ECI, most change points identified are remarkably 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 day after.[16]

Panel a. 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 Lehman bankruptcy filing in the fall of 2008, the eve of the 2013 government shutdown, the 2011 debt ceiling stalemate in Congress and the prospect of a possible US default, and congressional gridlock surrounding the 2013 fiscal cliff. The fifth identified date, March 3 in 2007, occurs earlier in the financial crisis shortly before the collapse of Bear Stearns, but it is less obviously related to any specific major news event headlining the Wall Street Journal.

Several of the positive confidence shifts in panel b. of Table 1 also coincide closely with major news events, such as the 2016 Presidential election or the signing of the 2017 Tax Cuts and Jobs Act (TCJA). The remaining dates with large positive confidence shifts are more ambiguous. The December 17, 2014, shift coincides exactly with a key FOMC meeting with an announcement 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.

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[15]The algorithm searches for changes in mean between adjacent blocks of observations that exceed a certain threshold. We implicitly restrict the block length by allowing at most 100 change points over the sample period.

[16]The Gallup telephone interviews are typically in the evening, such that any pertinent news may not appear in newspaper headlines until the next day.

Day	ΔECI	Main Event(s)	WSJ.com Headlines
a. Major Negative Confidence Shifters			
16-Sep-2008	-12.46	**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
30-Sep-2013	-11.55	**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.
03-Mar-2008	-7.87		Americans Start to Curb Their Thirst For Gasoline, McCain's Economy Platform: Big Tax Cuts, With Caveats *Next day*: Mortgage Fallout Exposes Holes in New Bank-Risk Rules, Clinton Aims to Push Beyond Ohio And Texas
27-Jul-2011	-7.38	**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	-7.27	**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
b. Major Positive Confidence Shifters			
09-Nov-2016	10.00	**Presidential Election**	Clinton Concedes After Trump's Stunning Win; Trump Team Planning First Months in Office; Dow Jumps 257 points
13-Mar-2009	8.59		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
20-Dec-2017	8.56	**TCJA Tax Cuts**	Sweeping Tax Bill Heads to Trump for Signature; North Korea Suspected in Theft at Bitcoin Exchange *Next day*: GOP Tax Vote Seals Victory for Trump; Tables Turned: Saudi Arabia Hunts for Oil Assets in the U.S.
17-Dec-2014	8.09	**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
29-Dec-2011	7.55		Egyptian Forces Storm NGO Offices; Italy's Borrowing Costs Slip, But Still Near 7% *Next day*: Huge Protests Grip Syria; Spain Expects Wider Deficit

Notes: Listed are the five largest positive and negative daily changes in the Gallup ECI 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 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 Global Financial Crisis, 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 expected 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 surprise to financial markets, see Swanson (2017), for example. The changes in monetary policy announced at the March 2009 meeting are therefore probably not the cause of the major change in household confidence identified the Friday before. The fifth largest positive confidence shift, on Dec 29 2011, is not clearly associated with any single major news event.

The change point analysis shows that some aggregate news events generate notable and immediate changes in aggregate household sentiment. 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 with evidence that consumers update expectations much more frequently during periods of high media coverage (Doms and Morin 2004; Larsen, Thorsrud, and Zhulanova 2019).[17] Many of the events in Table 1 also coincide with large changes in asset prices that likely attract additional attention. Of course, the change point evidence 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. For example, Table 1 lists several political events – such as the 2013 government shutdown – that saw comparatively little reaction in financial markets. That such events are nevertheless associated with large shifts in consumer confidence is consistent with existing evidence from political science showing that politics can be an important causal influence on monthly consumer confidence indicators, see for instance De Boef and Kellstedt (2004). It is also worth noting that several of the main confidence events between 2008 and 2018 are clearly in the sphere of fiscal policy, while there is at most one large confidence shift that can be more or less directly related to monetary policy news (forward guidance on December 17, 2014).

2.2 Confidence Changes Following Surprises in Macroeconomic Releases

Next, we investigate whether the Gallup ECI shows any reaction to new statistical information about macroeconomic conditions. To measure news about economic data, we use surprises in major macroeconomic releases by government statistical agencies and several private organizations. A surprise is measured as the difference between the actual data point released and the 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 Gallup ECI following macroeco-

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[17]Our analysis also lends support for interpreting sentiment measures constructed from text analysis of news media as potentially useful indicators of household sentiment, see Shapiro, Sudhof, and Wilson (2019).

nomic surprises is through Jordà (2005) local projections of the form

$$(1) \qquad y_{t+h} - \bar{y}_{t-1} \quad = \quad c_h + \beta_h s_t + u_{t,h}$$

where y_t denotes the Gallup ECI on day t, $\bar{y}_t$ 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 $\bar{y}_{t-1}$ rather than the value on the previous day y_{t-1} to reduce the influence of the daily noise in the ECI series.[18] 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 Gallup ECI values relative to the average values over the last three days before the day of release.

Local projections as in (1) impose few restrictions on the dynamics of y_t, but the resulting estimates can look highly irregular. This is the case when using daily Gallup ECI as the outcome variable, as the series displays 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 (2019). Specifically, we estimate

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

where h ranges from zero to up to twenty days. Unlike (1), Equation (2) imposes restrictions on the shape of the response 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 ($h > 0$). Unlike the fully nonparametric projections in (1), the smooth projections in (2) estimate the responses at all horizons simultaneously.

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 surprises in this monthly jobs report. Both panels show the Gallup ECI conditional on a one standard deviation upward surprise in the official unemployment rate (meaning a higher-than-expected unemployment rate) and in the number of nonfarm payrolls (meaning a higher-than-expected number of additional jobs). Figure 3a provides the local projection estimates from (1), together with 68% and 90% confidence bands based on the equal-weighted cosine long-run variance estimator and optimal bandwidth recommended by Lazarus et al. (2018). For a clear comparison, the broken lines in Figure 3a show the smoothed estimates and its associated Lazarus et al. (2018) 90% bands. Figure 3b shows responses obtained from the smooth projections in (2) with the 68% and 90% Lazarus et al. (2018) bands. Both approaches generally lead to similar conclusions, and for ease of interpretation, we focus on the smoothed estimates in Figure 3b.

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

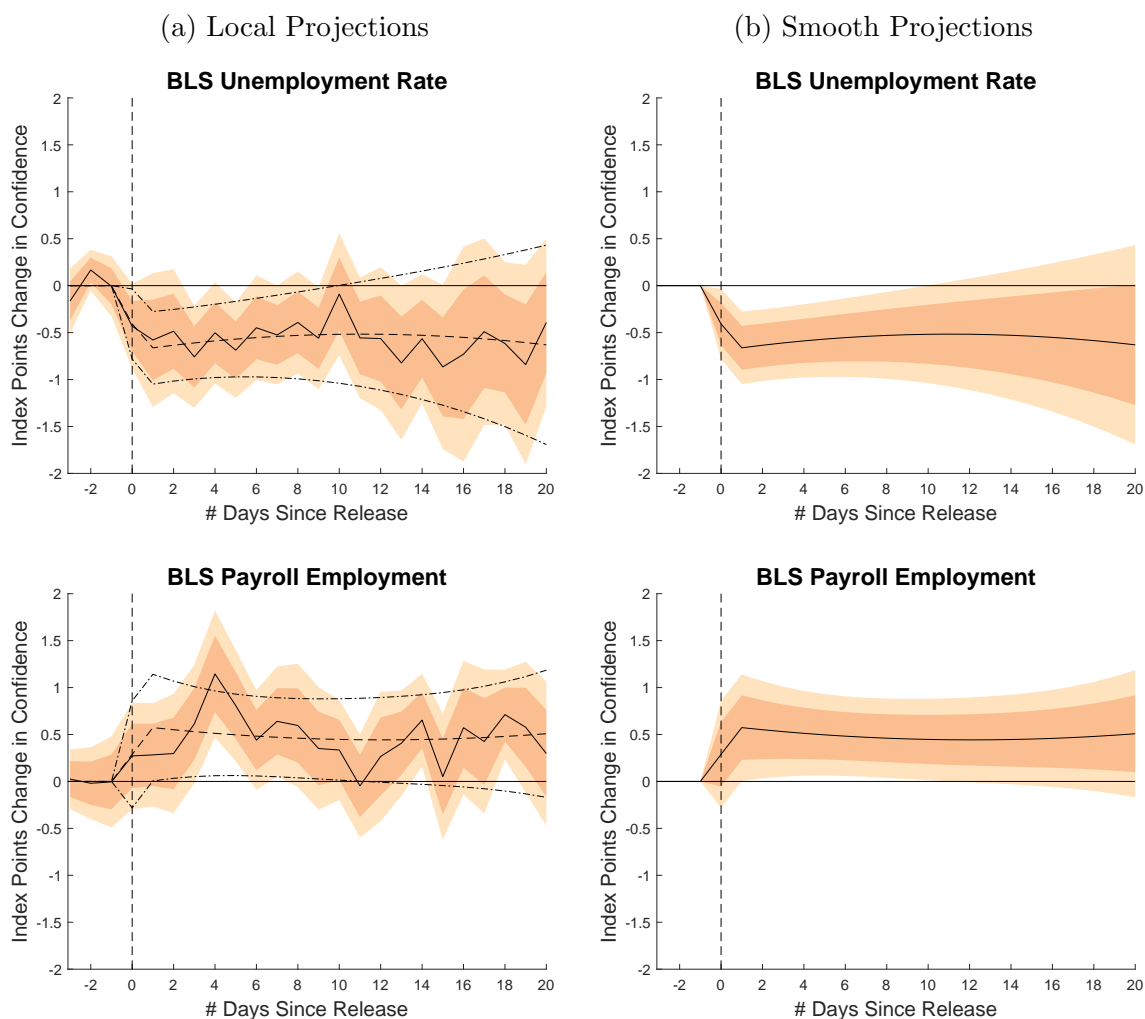(a) Local Projections   (b) Smooth Projections

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

Notes: An upward surprise in the first (second) row means the unemployment rate (the number of jobs added) is higher than the Bloomberg consensus forecast. Estimates based on local projections (1) and smooth projections (2) of the daily Gallup ECI on the data release minus the consensus forecast. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a. In both panels, shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. For the left panels, dashed lines represent point estimates from smooth projections in (2) for comparison, with dot-dash lines corresponding to 90% confidence intervals.

The main finding 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 Gallup ECI by about half a point on the Michigan scale. A one standard deviation upward surprise in the payroll number increases confidence by a similar amount.[19] The estimates of the confidence changes following surprises in the jobs report are statistically significant at conventional levels for the unemployment rate for at least a week, and marginally significant at the 90% level for payroll

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[19]The unemployment rate and the payroll numbers are based on different surveys but are part of the same report, and surprises in both are positively correlated. The confidence effects are therefore not additive.

employment throughout the month.

Other than the jobs report, we find that very few macroeconomic releases generate instantaneous and persistent confidence changes that are statistically significant. Appendix A.1 presents full results for a wide range of data releases.[20] Figure 4 shows a selection of smooth projection estimates that summarize the main findings:

- Apart from the jobs report, surprises in the advance GDP report also seem to have a meaningful confidence impact, see the left figure in 4a. A one standard deviation upward surprise in the first release of previous quarter GDP leads to the largest confidence effects across all releases, persistently raising the ECI by 0.5 to 1 index points on the Michigan scale. Surprises in the ADP National Employment Report – a private estimate of national payrolls released a few days ahead of the BLS jobs report – also seem to have an immediate impact, albeit with effects that are more transitory, the right figure in 4a.

- A number of releases are followed by gradual changes in confidence that become statistically significant after one or more weeks, but without any significant confidence jump immediately following the release. Figure 4b provides two examples: industrial production and housing starts. Positive surprises in these and other releases are signals of an accelerating economy, which is why it is not too surprising that this coincides with rising consumer confidence. The lack of any instantaneous change in consumer confidence, however, suggests there is no immediate informational effect on household beliefs at the time of the data surprise itself.

- For many releases, there is no evidence of any systematic change in consumer confidence over the horizons we consider. Figure 4b provides two examples: the final GDP release and the CPI inflation rate.

While household confidence does not respond noticeably to every single new piece of macroeconomic information, a select few important economic statistics do appear to influence household beliefs about the economy when they become available. These are primarily the advance GDP and job numbers, which arguably also receive the broadest and most regular coverage in the media.

In sum, the daily Gallup ECI shows clear reactions to major news events as well as to surprises in objective statistical information about the state of the economy. This means that the daily Gallup data should also be adequate to assess whether household beliefs respond to news about monetary policy.

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[20]The releases analyzed are 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 Conference Board consumer confidence indices.

(a) Immediate Confidence Response   (b) Delayed Confidence Response   (c) No Significant Confidence Response
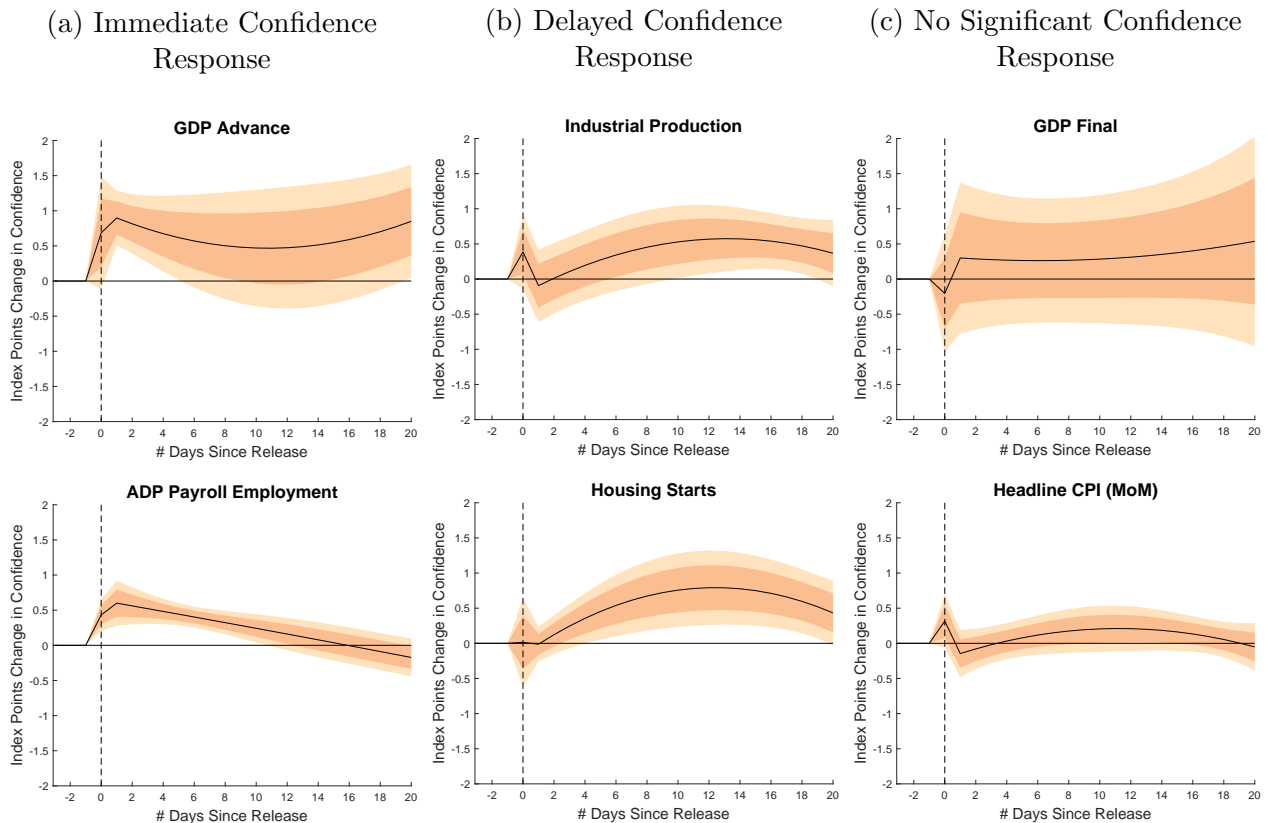
Figure 4: Confidence Changes Following One Standard Deviation Upward Surprises in Selected Macroeconomic Data Releases

Notes: An upward surprise means the statistic released is higher than the Bloomberg consensus forecast. Estimates based on smooth projections (2) of the daily Gallup ECI on the data release minus the consensus forecast. Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.

3   The Response of Economic Confidence to Monetary Policy News

Our main goal is to establish whether monetary policy announcements have immediate effects on individuals' assessments of the economic outlook. By 'immediate' we mean on the day, or within a few days of, the announcement. Any such 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 from (media coverage of) central bank communications or from observing the reaction in asset markets, even without necessarily fully understanding the origins of this reaction. However, confidence effects that occur within just a few days cannot plausibly arise because of any of the macroeconomic effects of the monetary policy announcement itself, for instance through the impact on unemployment or GDP statistics observed subsequently, or through the impact on individuals' own labor market status.

    To measure monetary policy news, we follow a large and well-established empirical literature and assume that unexpected changes in interest rates shortly after FOMC announcements arise predominantly due to information released by the Federal Reserve.[21] While this assumption is

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

relatively uncontroversial, the precise nature of the monetary news being measured using this approach is not always 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 the conventional channels through which a tightening has contractionary effects. On the other hand, agents may alternatively view an unexpected tightening by the FOMC as reflecting information signaling greater economic strength than what is expected publicly, and therefore adjust their beliefs about economic conditions upward. Based on the direction of the reactions in financial markets and in surveys of professional forecasters, there is considerable evidence that monetary policy news is at times interpreted as internal Fed information about the economy.[22] From the short run reaction in the daily Gallup ECI, we are able to assess in what direction the beliefs of the wider public – not just of a small number of professional forecasters – react to monetary policy news.

Applying the high frequency approach during the 2008-2017 period poses challenges beyond the interpretation as policy shocks or Fed information effects. Specifically, it is likely to be important to account for the use of multiple policy instruments by the FOMC in the face of the effective lower bound 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 use the resulting time series as policy shocks. Swanson (2017) shows that monetary policy announcements after the Global Financial Crisis convey information that is consistent with the use of three distinct policy instruments: changes in current policy rates, forward guidance about future policy rates, and asset purchases (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 they may have impacted beliefs about economic conditions differently than the conventional interest rate instrument.

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 requires that both the nature of the surprises as well as their precise transmission to asset prices does not change from one announcement to the next. The validity of each of these assumptions is dubious during the 2008-2017 period, during which the conduct of monetary policy and the state of the financial system both varied greatly. To relax these assumptions, Lewis (2019a) proposes a new methodology that identifies separate decompositions for each monetary policy announcement in time series of intraday interest rate

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Karadi (2015).

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

movements on FOMC meeting days.[23] The identification strategy exploits the presence of time-varying volatility in financial markets, as described in Lewis (2019b). As in Swanson (2017), the key identifying information comes from adjustments in interest rates at different maturities, leading to three separate types of monetary policy shocks: Fed Funds surprises, forward guidance surprises, and asset purchase surprises. The high frequency time series of intraday monetary policy surprises are then aggregated at the daily level using historical decompositions. Lewis (2019a) shows that the resulting daily policy shocks match narrative evidence, and that they capture information missing from other decompositions.

For these reasons, we prefer the measures identified using the announcement-specific decompositions proposed by Lewis (2019a) for our benchmark specifications. Figure 5 depicts these measures over the sample period, which includes 80 regularly scheduled FOMC meetings. The figure also shows the policy shocks constructed by Swanson (2017), and additional measures based on simple changes in yields on the front quarter Eurodollar contract, the 2-year Eurodollar contract, and in the 10-year Treasury rates, each observed within the conventional 30-minute window of the release of FOMC statements. As part of our robustness checks, we verify our results for each of these alternative measures, as well as for several others that have been used in the literature.

To estimate the reaction of consumer sentiment to monetary policy news, we apply the same methodology as in Section 2.2 for estimating the confidence dynamics following surprises in macroeconomic data releases. Specifically, we estimate local projections

$$(3) \qquad y_{t+h} - \bar{y}_{t-1} = c_h + \beta_h^{ff} m_t^{ff} + \beta_h^{fg} m_t^{fg} + \beta_h^{ap} m_t^{ap} + u_{t,h}$$

where y_t is the Gallup ECI on day t, $\bar{y}_t$ is a trailing three-day moving average of y_t, and m_t^{ff}, m_t^{fg} and m_t^{ap} are the monetary policy surprises to the funds rate, forward guidance, and asset purchases instruments, respectively. The identification based on intraday time-varying volatility used to derive the Lewis (2019a) policy surprises does not impose that they are orthogonal at the daily level. We therefore include all three measures simultaneously in (3) to account for the fact that surprises to the multiple dimensions of policy may be correlated. The estimate of the confidence response h days after a surprise to the funds rate is given by β_h^{ff}. Similarly, the estimates for surprises related to forward guidance and asset purchases are β_h^{fg} and β_h^{ap}, respectively.

We again also estimate smoothed versions of the local projections:

$$(4) \quad y_{t+h} - \bar{y}_{t-1} = c + \sum_{i=ff,fg,ap} \left[\mathcal{I}(h=0)\gamma_0^i m_t^i + \mathcal{I}(h>0)\left(\gamma_1^i + \gamma_2^i h + \gamma_3^i h^2\right) m_t^i \right] + u_{t,h}$$

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[23]In other words, the policy surprises are measured based on entirely separate datasets for each FOMC announcement.
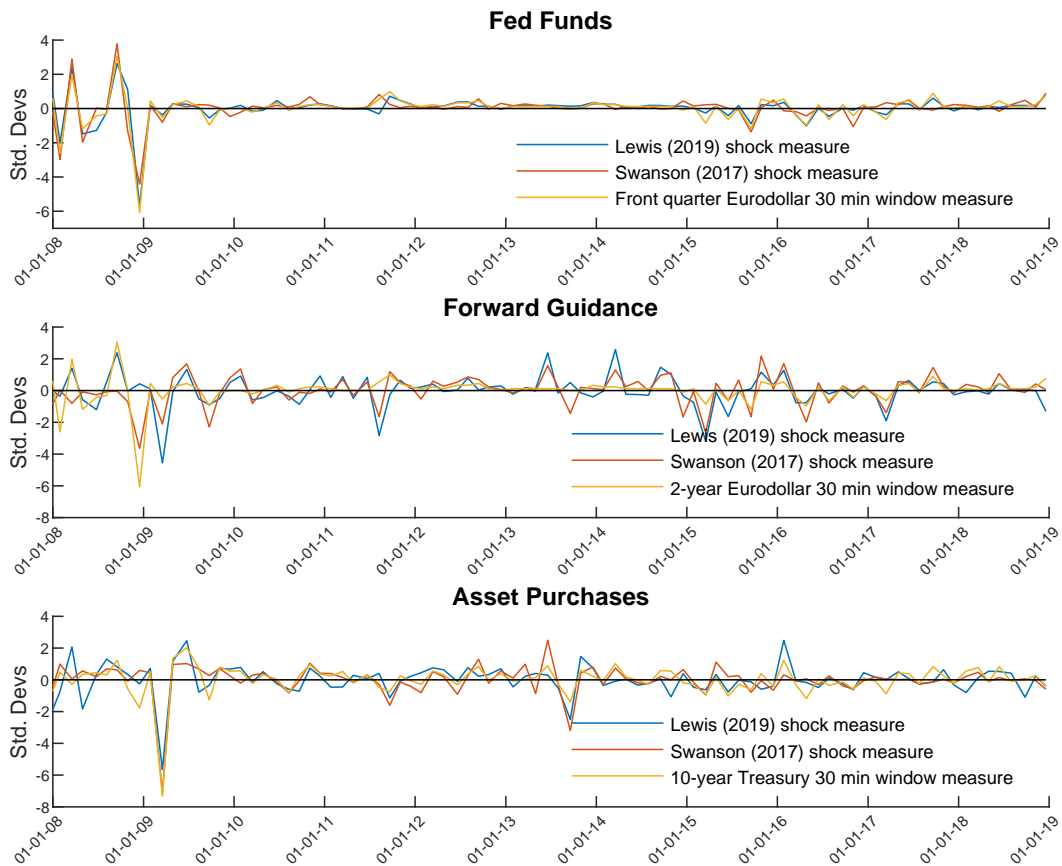
Figure 5: Monetary Policy Shock Measures

Notes: Shock measures are standardized over the sample period shown. See Lewis (2019a) and Swanson (2017) for details on the construction of the shock measures.

For both specifications (3) and (4), 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_t^{ff}, the 2-year Treasury rate for m_t^{fg}, and the 10-year Treasury rate for m_t^{ap}.

The scaling of the responses to 25 basis-point changes in the reference rates follows convention in the literature, but is entirely arbitrary. To be clear, monetary surprises of this size are rare: over our sample period, the standard deviation of the funds rate shock is 8 basis points. The standard deviations of the forward guidance and asset purchases shocks (in terms of changes in the 2-year and 10-year reference rates) are 3 and 4 basis points, respectively. The responses that we report are therefore to very large policy shocks of about three, eight, and six standard deviations for m_t^{ff}, m_t^{fg} and m_t^{ap}, respectively. An advantage of scaling the responses in terms of a fixed change in interest rates is that this facilitates comparison between various measures of monetary policy shocks in the robustness analysis. Finally, we note that the extent of monetary stimulus provided by a 25 basis-point change in the respective reference rates is not comparable across policy instruments.

3.1 Benchmark Estimates of the Aggregate Confidence Response

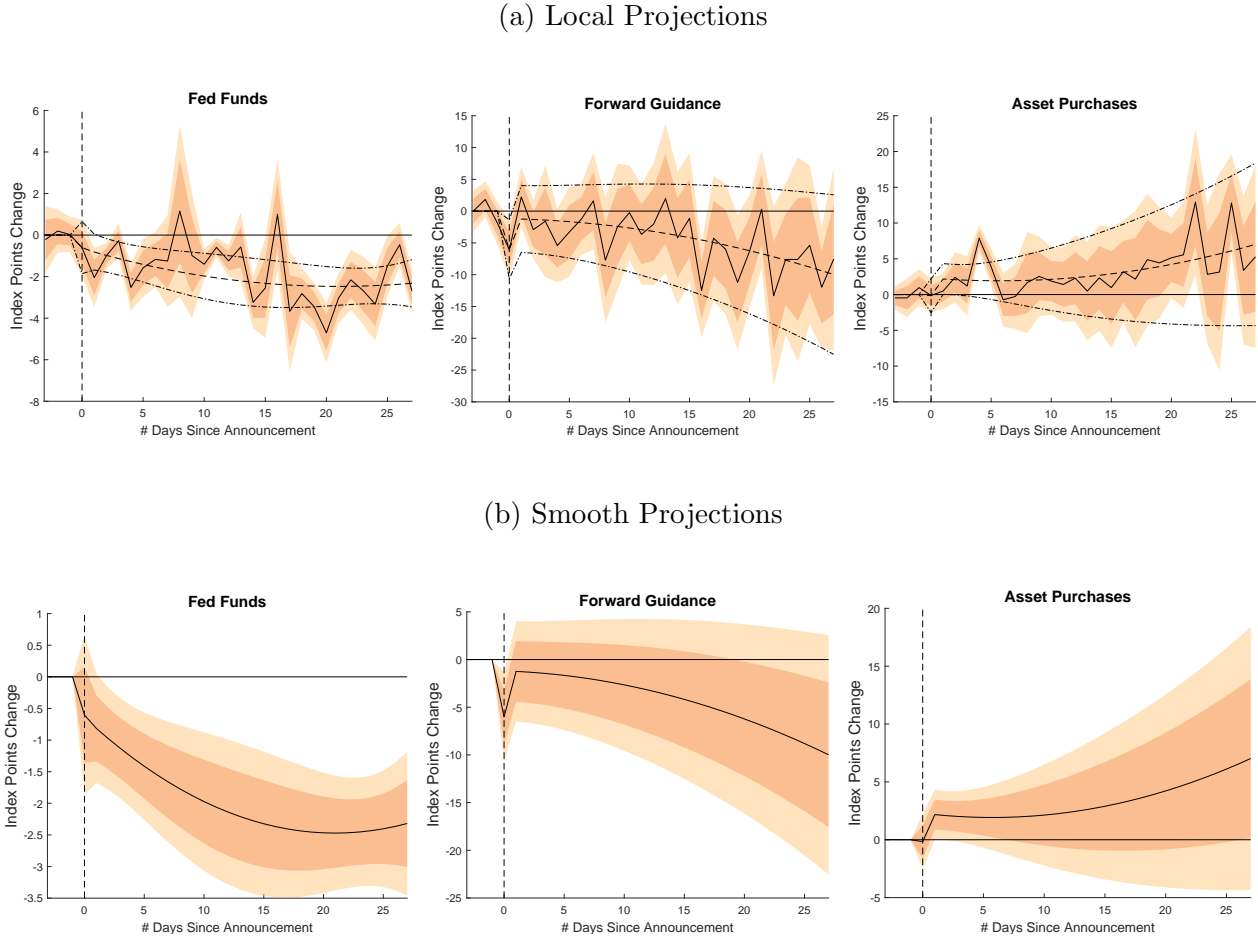### (a) Local Projections

(b) Smooth Projections

Figure 6: Confidence Impact Following News of Tighter Monetary Policy

Notes: Estimates based on local projections (3) and smooth projections (4) of the daily Gallup ECI on the monetary policy surprises constructed in Lewis (2019a). 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 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. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.

Figure 6 presents our baseline results. Figure 6a displays the estimates based on the local projections in (3), with smooth local projections and associated 90% Lazarus et al. (2018) confidence intervals for comparison. Figure 6b plots the smooth projections with 68% and 90% confidence intervals. The smooth projections again mainly reinforce patterns that are already apparent in the nonparametric results. We will focus mainly on the smooth projection results.[24]

The first main finding is that there is a clear and highly significant negative response of economic confidence to an upward surprise in the Fed Funds target, see the leftmost panels in Figure 6. A 25 basis-point surprise increase in the target rate lowers the ECI by about 1.1

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[24]The baseline specification approximates responses beyond $h = 0$ with a quadratic polynomial. In Appendix A.3, we report results for smoothed projections based on a cubic polynomial. This does not affect any of our findings.

index points on impact, and by up to 2.6 points after three weeks. These responses, which as before are on the same scale as the Michigan Consumer Sentiment Index, are nonnegligible. The immediate ECI impact, for instance, corresponds to around 9% of the one-day confidence drop following the Lehman bankruptcy, reported in Table 1. The confidence decline is more than twice as large after a few weeks. Of course, a 25 basis-point funds rate shock is also a large surprise, amounting to roughly 3 standard deviations of the shock series over our sample period. The direction of the confidence reaction is notable: an upward surprise in the target rate lowers economic confidence. This means that, over our sample period, the broader public interprets upward target surprises as negative for the economic outlook rather than a reflection of positive Fed information about economic conditions. This is consistent with the results in Lewis (2019a), who finds asset price reactions that do not appear to reflect Fed information effects.

The other main finding in Figure 6 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 6. Tightening forward guidance that results in a 25 basis-point 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 2.1 identified a large upward jump in confidence in December 2014 in part on a news headline of a pledge 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 clearly not a systematic 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 panels in both rows of Figure 6. 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 even 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. The responses to the monetary surprises are generally very similar across both subcomponents of the Gallup ECI. This includes the responses to an upward surprise in the Fed Funds target, which show similar significant declines in household sentiment regarding both current and future economic conditions. Although conventional wisdom holds that monetary policy operates with considerable lags, the broader public appears to become more pessimistic

even when asked specifically about the current state of the economy.

Overall, our baseline results constitute evidence that new information about the stance of monetary policy can be transmitted to households more or less directly and relatively quickly. 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. One potential explanation is that it is simply much more difficult to measure news about the unconventional tools as accurately as news about target rates. Another is that information about the future path of interest rates or asset purchases is not transmitted as effectively to the wider public, and/or that it is more easily confused with information about nonmonetary 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. Moreover, changes in the target rate have typically been communicated via a single headline leading each FOMC statement. 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.

3.2 Robustness to the Measurement of Confidence and Monetary News

This section verifies that our benchmark findings are robust to using an alternative daily indicator of household confidence, and to alternative high frequency measures of monetary policy news. We consistently find declines in confidence following surprise increases in the target rate, whereas the responses to shocks to the unconventional instruments vary qualitatively and are not robustly statistically significant. For brevity, we only report smooth projection results in the main text. Appendix A.4 provides all of the local projection estimates for completeness.

Rasmussen Daily Confidence An alternative source of high frequency information on consumer sentiment is Rasmussen's daily confidence index, shown in Figure 2. This index is based on a smaller survey sample and is published as a three-day moving average. Nevertheless, the Rasmussen index should in principle respond in similar fashion to meaningful economic news as the Gallup ECI. Figure 7 reports the estimated smooth projections response of the Rasmussen index – rescaled to the Michigan Sentiment Index – to the different monetary policy surprises. For this exercise, $\bar{y}_{t-1}$ in (3) is replaced with 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 the benchmark estimates in Figure 6b, which are repeated in Figure 7 as broken lines for comparison. Importantly, the Rasmussen index shows a similar highly significant confidence decrease in response to an upward surprise in the Funds target (left panel). Following an unexpected hike of 25 basis points, the index drops by about 1.2 Michigan-equivalent 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. Unlike the ECI response in Figure 6, there is no decline on the day of the announcement. Note, however, that the impact observation is a 3-day trailing moving average, two days of which are pre-announcement.[25]

The middle and right panels in Figure 7 show that the confidence responses to both forward guidance and asset purchase news are also broadly similar to the baseline estimates. The forward guidance surprise does not have the same immediate impact on the Rasmussen index as in the baseline, but confidence similarly declines gradually following the announcement. The response to a surprise announcement about asset purchases again suggests that Fed information effects potentially dominate for LSAP announcements. Interestingly, the response to LSAP news is clearly statistically significant between one and three weeks when we use the Rasmussen index instead of the Gallup ECI. Taken together, the fact that both available high frequency confidence indicators produce broadly similar results is reassuring.
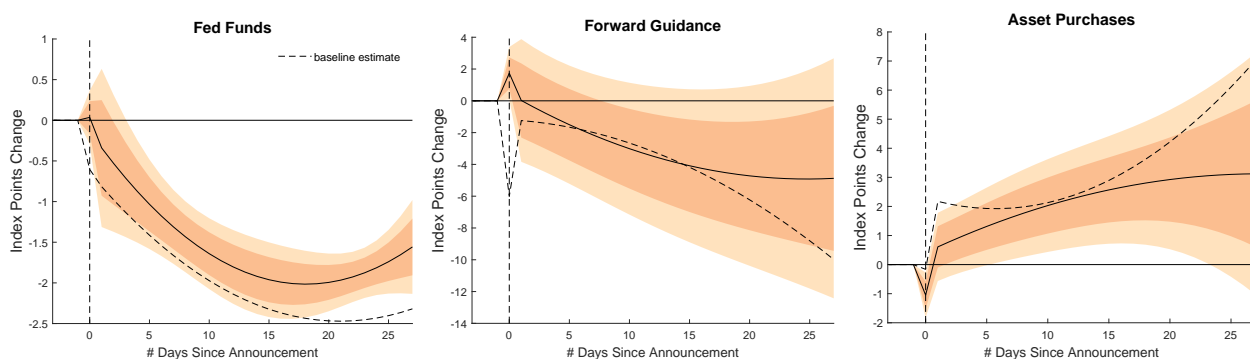
Figure 7: Confidence Impact of Monetary Tightening using the Rasmussen Index

Notes: Estimates based on smooth projections (4) of the daily Rasmussen Confidence Index on the monetary policy surprises constructed in Lewis (2019a). Baseline estimates (broken lines) are the point estimates shown in Figure 6b. 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. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.

Alternative High Frequency Measures of Monetary Policy News   The high frequency literature has produced a range of alternative monetary policy shock measures. These measures differ in terms of the interest rates and futures on which they are based, in terms of sample coverage, and in terms of the dimensionality of the shocks extracted from the data. This section shows that our baseline results do not depend qualitatively on the choice of high frequency measures, and therefore also not on the specific methodology of Lewis (2019a).

Figure 8 first reports the results based on a number of alternative measures that, just as

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[25]Moreover, we also suspect that the collection of all information used the construct the index is completed one day prior to the date provided in the Rasmussen dataset.

the Lewis (2019a) shocks in our baseline, also distinguish between the three different policy tools. Figure 8a shows estimates based on using the shocks constructed by Swanson (2017), which are discussed above and depicted in Figure 5. We also consider two additional sets of shocks that are simpler versions of the Swanson (2017) or Lewis (2019a) shocks: Figure 8b is based on using simple 30-minute window price changes in the front quarter Eurodollar contract, the 2-year Eurodollar contract, and the 10-Year Treasury as a crude approximation for target rate, forward guidance and asset purchase shocks. These measures are also shown in Figure 5. Finally, Figure 8c shows results for the same series as in Figure 8b, but with the changes in longer rates orthogonalized recursively. In each row, the results are based on the smooth projection specification in (4) (local projections results are in Appendix A.4). Broken lines repeat the baseline estimates from Figure 6b for comparison.

Each of the left panels in Figure 8 shows immediate and statistically significant declines in household confidence following an upward surprise in the Funds rate target. The Swanson (2017) measure generates a confidence decline that is substantially larger than in the baseline, whereas the responses for the other measures are similar in magnitude. The middle and right panel of Figure 8 show, on the other hand, that the estimated responses to shocks in the unconventional policy tools differ more substantially from the baseline estimates. As in the baseline, however, none of these responses are statistically significant for any number of consecutive days.

Figure 9 provides results for five additional measures of monetary policy shocks.[26] The top row considers (a) the Fed Funds shock measure (the unexpected change implied by front month Fed Funds futures) and (b) the Policy News shock measure (based on a basket of interest rates) constructed by Nakamura and Steinsson (2018). The bottom row considers, in turn: (c) the Gertler and Karadi (2015) shock series based on the 3-month ahead Fed Funds future contract; (d) the Jarocinski 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; and finally, (e) the simple change in the federal funds target rate. For ease of comparison, we scale all the impulses to correspond to a 25 basis-point upward surprise in the Federal Funds rate. We also only use shocks corresponding to regularly scheduled FOMC meetings for consistency. Note that the sample size varies with the series used, since the Nakamura and Steinsson (2018) measures end in March 2014, the Gertler and Karadi (2015) series ends in June 2012, and the Jarocinski and Karadi (2018) measure ends in December 2016.

Figure 9 shows that, for all measures, an upward Federal Funds surprise generates an immediate decline in household confidence.[27] For each of the Nakamura and Steinsson (2018) shocks as well as for the Jarocinski and Karadi (2018) shock, the effects are similar in magnitude to

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[26]There are other widely used measures, but our analysis requires measures that are available after 2007.

[27]In Appendix A.5, we also estimate the response of the US Gallup ECI to Eurozone shocks using the measure of ECB policy shocks constructed by Jarocinski and Karadi (2018). We find no evidence of any significant effect on consumer confidence in the US of a policy tightening by the ECB.
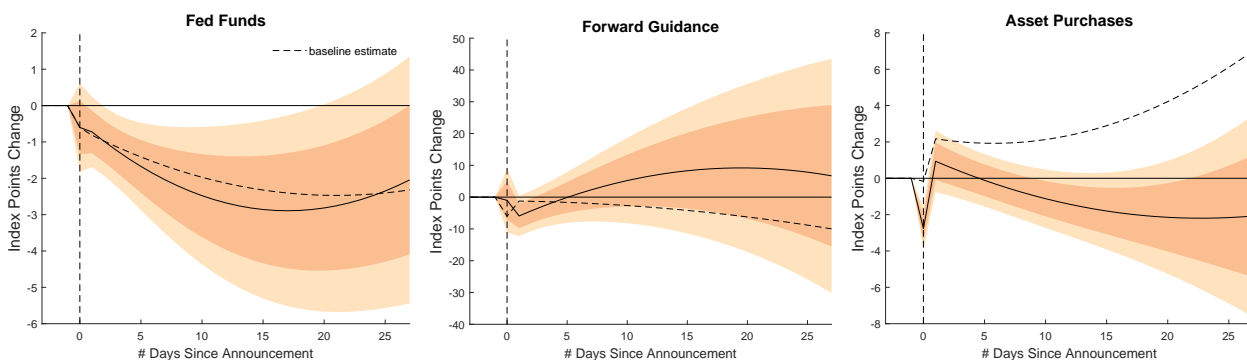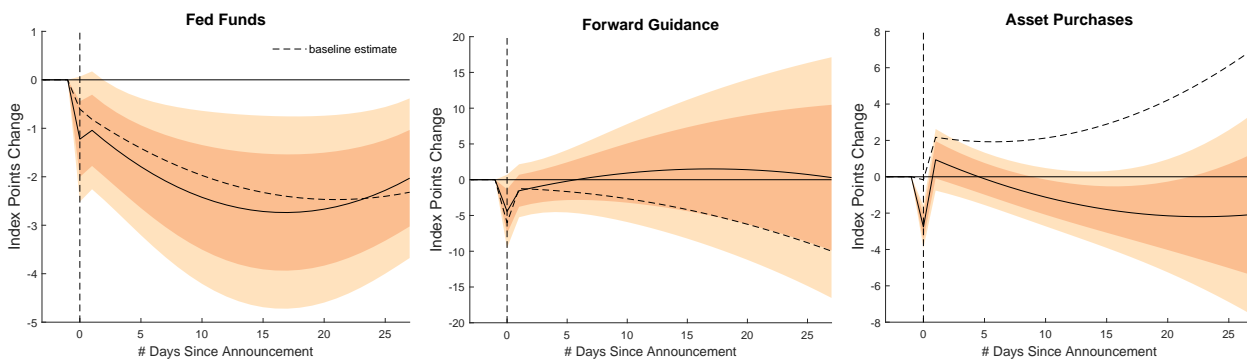
Figure 8: Confidence Impact of Monetary Tightening: Alternative Multidimensional Measures of Monetary Policy Shocks

Notes: Estimates based on smooth projections (4) of the daily Gallup ECI on the monetary policy surprises. The first row uses the measures of Swanson (2017). The second and third row use 30-minute window price changes in the front quarter Eurodollar contract, the 2-year Eurodollar contract, and the 10-Year Treasury. In the third row, the longer rates are first orthogonalized recursively. Baseline estimates (broken lines) are the point estimates shown in Figure 6b. 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. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.

the baseline. The Gertler and Karadi (2015) shock on the other hand yields much larger effects,

(a) Nakamura and Steinsson (2018) Fed Funds shock

(b) Nakamura and Steinsson (2018) Policy News shock

(c) Gertler and Karadi (2015) shock

(d) Jarocinski and Karadi (2018) shock

(e) Raw Changes in FF target
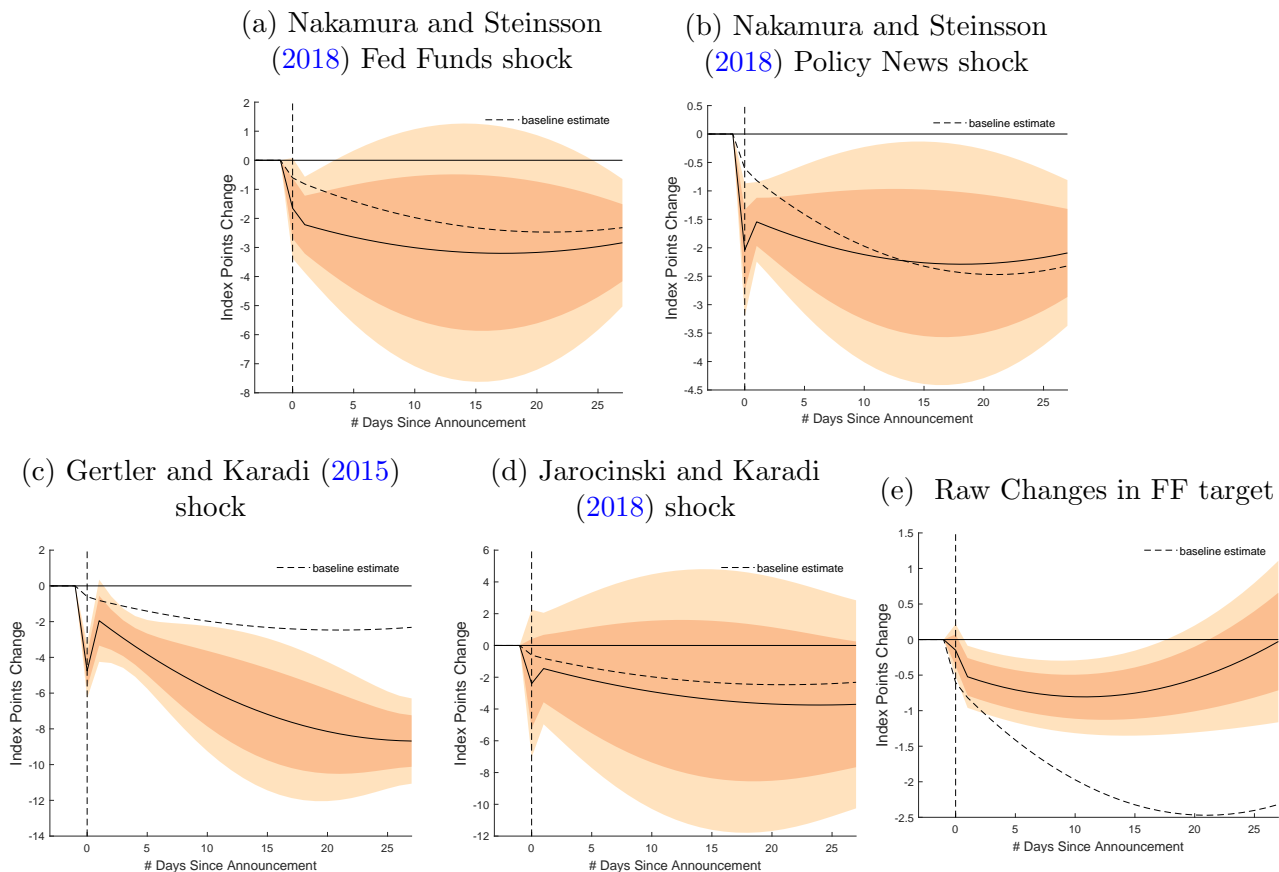
Figure 9: Confidence Impact of Monetary Tightening: Alternative Shock Measures

Notes: Estimates based on smooth projections of the daily Gallup ECI on the monetary policy surprises. The specification is as in (4) but with only the single shock measure on the right hand side. In (d), we include the Jarocinski and Karadi (2018) information effect shock as an additional control. Responses are scaled to a shock corresponding to a 25 basis-point increase in the Federal Funds rate. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a. Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Baseline estimates (broken lines) are the point estimates for the Fed funds shock in the left panel of Figure 6b. Sample periods vary across specification, ending in (a)/(b) March 2014, (c) June 2012, and (d) December 2016.

which is likely due to the much shorter sample period.[28] Using simple changes in the funds target (lower right panel) yields considerably smaller confidence effects. This almost surely is because raw changes in the target are to a large extent anticipated in advance. They should therefore not generate the same short run confidence effects as a 25 basis-point hike that is entirely unanticipated. In the case of the Nakamura and Steinsson (2018) FF shock (upper left panel) and the Jarocinski and Karadi (2018) shock (bottom middle panel), the confidence bands are considerably wider. In the latter case, the confidence response is not statistically different from zero at any horizon. For the most part, however, the estimated confidence declines following a surprise target increase shown in Figure 9 remain statistically significant.

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[28]We also find a larger response to our baseline shocks when we restrict the sample to 2008-2012.

3.3 The Role of the Reaction in Equity Markets

It seems unlikely that the confidence responses to FOMC interest rate decisions (or surprises in jobs numbers and other data releases) arise because of widespread public attention to press statements by the Federal Reserve or the statistical agencies. More plausible is that the public responds to media reporting of these press 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.[29] 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 reaction to monetary policy announcements in determining the impact on household confidence. We focus on reactions in the stock market, as we conjecture that these reactions are an important determinant of media coverage and public attention to economic news.

To assess the role of equity market reactions to monetary policy announcements, we modify our baseline specifications to include interactions with changes in equity prices. In particular, we estimate local projections of the form

$$(5) \qquad y_{t+h} - \bar{y}_{t-1} \;=\; c_h + \beta_h m_t + \alpha_h r_t + \kappa_h m_t r_t + u_{t,h},$$

which, for notational simplicity, is written as if there was just a single policy shock m_t. The variable r_t is the equity price change, which we measure by the daily log return for the S&P 500. The smooth version is given by:

$$(6) \quad \begin{aligned} y_{t+h} - \bar{y}_{t-1} = c &+ \mathcal{I}(h = 0)\left(\gamma_0 m_t + \phi_0 r_t + \psi_0 m_t r_t\right) \\ &+ \mathcal{I}(h > 0)\left[\left(\gamma_1 + \gamma_2 h + \gamma_3 h^2\right) m_t + \left(\psi_1 + \psi_2 h + \psi_3 h^2\right) m_t r_t\right] + u_{t,h}, \end{aligned}$$

Equations (5) and (6) extend our baseline specifications by controlling for change in equity prices r_t as well as the interaction with the monetary policy shocks $m_t r_t$.

If the daily stock market change r_t and the policy surprise m_t are uncorrelated, then the responses estimated by (5) and (6), when evaluated at $r_t = 0$, should be approximately the same as those estimated in the baseline specifications. Alternatively, this would be the case if r_t and m_t are correlated, but the consumer sentiment response y_t is uncorrelated with the stock market response. Either scenario would indicate that households' confidence responds entirely to information that is not contained in the equity market reaction to monetary policy announcements. Responses that are different from the baseline, but still significant, would mean that there is at least some component of the confidence response that is independent of the stock mar-

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[29]See for instance Carroll (2003), Doms and Morin (2004), Ehrmann, Pfajfar, and Santoro (2017), and Larsen, Thorsrud, and Zhulanova (2019).
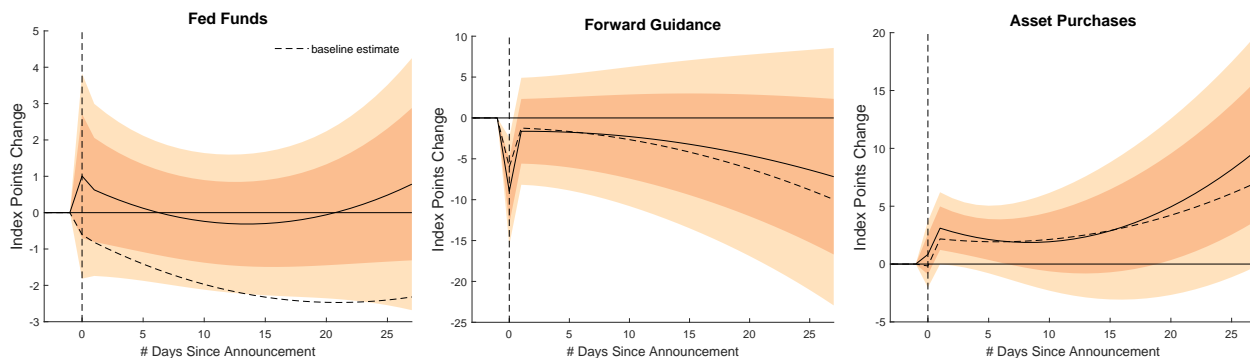
Figure 10: Confidence Impact of Monetary Tightening, Controlling for Equity Price Interactions

Notes: Estimates based on smooth projections (6) of the daily Gallup ECI on the monetary policy surprises constructed in Lewis (2019a). Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Baseline estimates (broken lines) are the point estimates shown in Figure 6b. 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. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.

ket reaction. Finally, a finding of no significant confidence response after controlling for stock price changes indicates that household and stock market reactions reflect the same information.

Figure 10 presents the results for the smooth projections in (6) when we include all three Lewis (2019a) monetary policy surprises as in the benchmark specification.[30] For comparison, the dashed lines repeat the baseline responses of Figure 6b. The middle and right panels show that, for forward guidance and asset purchase surprises, we obtain very similar (statistically insignificant) results as in the baseline. The left panel in Figure 10 shows that this is not the case for an upward surprise in the funds rate target. Once we control for the reaction of equity prices, the decline in consumer sentiment following a rate tightening disappears entirely. The impulse response function shifts up to the zero line, and the estimates become statistically insignificant at all horizons. This result does not necessarily imply that households are only reacting indirectly to reactions in equity markets. Instead, it simply means that there is no evidence that the confidence reaction is to any source of information that is not also reflected in equity prices.

3.4 Asymmetries in Responses to Tighter and Looser Monetary Policy

There is ample theory and evidence to suggest that, in a variety of contexts, economic agents react more strongly to bad news than to good news.[31] There is also substantial evidence for negativity bias in media reporting of economic news.[32] To verify whether the reaction of consumer confidence to monetary policy news depends importantly on the direction of the

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[30]Results for local projections are in Appendix A.6.
[31]See for instance Barberis, Shleifer, and Vishny (1998), Eil and Rao (2011), and Tutino (2013).
[32]See for instance Harrington (1989) or Soroka (2006).

change in the policy stance, we extend our baseline specification to allow the coefficients to depend on the sign of the policy shocks. Specifically, assuming for notational brevity that there is just a single policy shock m_t, the local projection allowing for asymmetries is

$$(7) \qquad y_{t+h} - \bar{y}_{t-1} \quad = \quad c_h + \beta_h^+ m_t^+ + \beta_h^- m_t^- + u_{t,h}$$

where m_t^+ and m_t^- are positive and negative observations of m_t, respectively. The smoothed version is given by

$$
\begin{aligned}
y_{t+h} - \bar{y}_{t-1} \quad = \quad & c + \mathcal{I}(h=0)(\gamma_0^+ m_t^+ + \gamma_0^- m_t^-) + \mathcal{I}(h>0)\left(\gamma_1^+ + \gamma_2^+ h + \gamma_3^+ h^2\right) m_t^+ \\
& + \mathcal{I}(h>0)\left(\gamma_1^- + \gamma_2^- h + \gamma_3^- h^2\right) m_t^- + u_{t,h}
\end{aligned}
$$
(8)

which, for simplicity, is again written for the case of a single policy shock.

Figure 11 shows smooth projection estimates of the confidence response to news of tighter monetary policy and to news of looser monetary policy. The estimates are based on Equation (8) including all three baseline Lewis (2019a) monetary policy shocks simultaneously, separating each into positive and negative shock series.[33] In Figure 11a, the responses are scaled such that they are to shocks that raise the reference rates by 25 basis points (tighter policy), whereas in Figure 11b they are to shocks that lower the reference rates by 25 basis points (looser policy). The broken lines provide the responses implied by the symmetric baseline estimates for comparison.

The results in Figure 11 display evidence of asymmetries in the confidence responses to monetary policy news. The left panels show that household confidence declines after an upward surprise in the funds rate target, and that it rises after a downward surprise. The decline in Figure 11a following a tightening, however, is much larger in size, instantaneous, and highly statistically significant. The rise in confidence in Figure 11b following a loosening of policy is more delayed, much smaller in size, and is never statistically significant. Household beliefs therefore appear to respond very strongly and negatively to news of a higher-than-expected interest rate target, while there is little response to news of lower interest rates. This finding is consistent with stronger responses in asset markets to bad news, e.g. as in Barberis, Shleifer, and Vishny (1998), with negativity bias in media reporting, or both.

There are also signs of asymmetries in the response to forward guidance and asset purchase shocks. Whereas the symmetric estimates of the response to forward guidance news show no significant persistent confidence reaction, the middle panels of Figure 11 suggest that confidence declines to both positive and negative forward guidance shocks. In the case of an announcement that results in a decrease in the 2-year Treasury rate, the decline is immediate and statistically significant in the first week. The drop in confidence dissipates gradually and becomes

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[33]Appendix A.7 provides the asymmetric local projection estimates.

(a) Confidence Impact of Monetary Tightening
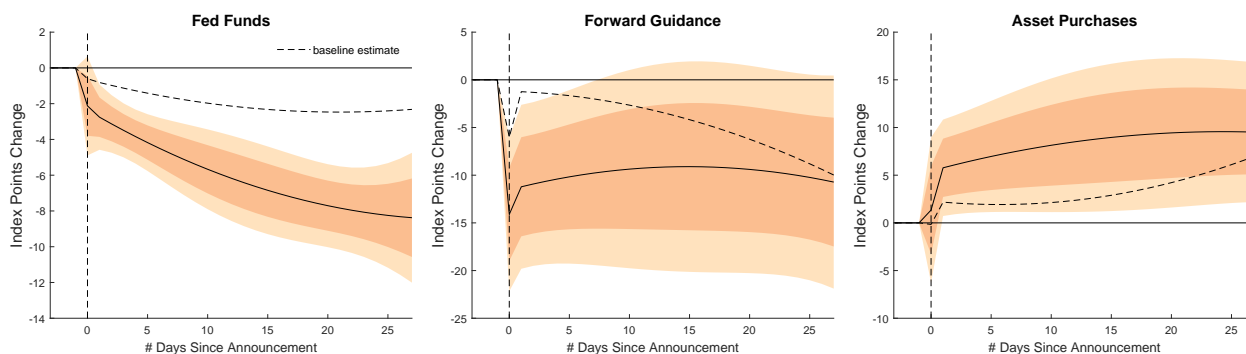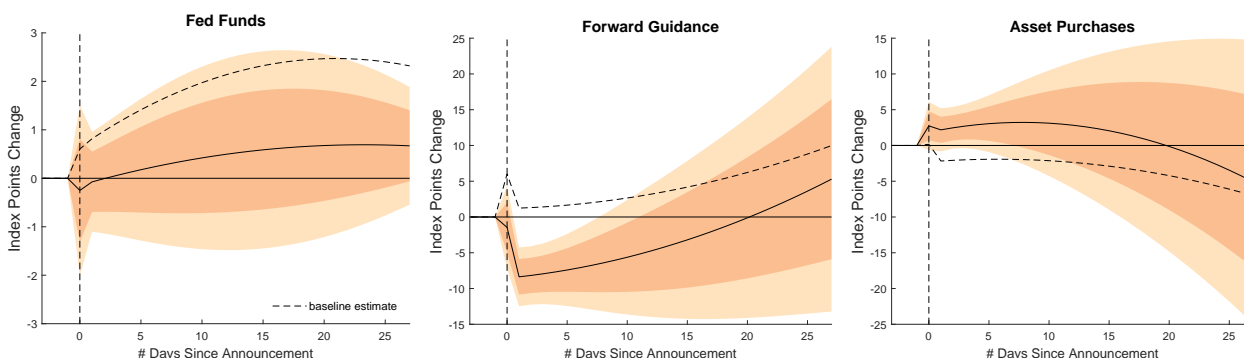

(b) Confidence Impact of Monetary Loosening

Figure 11: Asymmetries in Confidence Impact of Monetary Policy Surprises

Notes: Estimates based on smooth projections of the daily Gallup ECI on the monetary policy surprises constructed by Lewis (2019a). The specification is as in (8) and includes all three baseline Lewis (2019a) monetary policy shocks. 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 (top row) or decrease (bottom row) 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. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.

insignificant in the second week. In the case of an announcement increasing the 2-year rate, the confidence decline is immediate and persistent, but it is also estimated less precisely and its statistical significance is marginal at best. The right panel in Figure 11b shows that confidence rises following an asset purchase announcement that lowers the 10 year Treasury rate, but the response is generally not statistically significant. An asset purchase announcement that increases the 10 year Treasury rate, on the other hand, leads more clearly to an upward shift in household confidence.

The apparent asymmetries in the responses of Figure 11 have two main implications for the interpretation of our baseline results. The first is that the confidence responses to funds rate surprises appear to be, at least in our sample, largely driven by particularly negative reactions to upward surprises. The second implication is that the absence of clear confidence effects of unconventional policy news in the baseline estimates more likely reflects that these effects are highly irregular and variable across the announcements in our sample, rather than that they

are absent altogether.

3.5 Heterogeneity in the Confidence Effects of Monetary Policy

There is plausibly substantial heterogeneity across individuals in both the demand for information about monetary policy and in how that information translates into beliefs about the state of the aggregate economy. Based on additional demographic information in the Gallup survey, in this section we verify whether there are any notable differences depending on respondents' level of education, income, and age. How confidence reactions to monetary surprises vary along each of these dimensions is not necessarily clear ex ante. Older, richer and more educated individuals may be more responsive, for example, because they are more financially literate or more reliant on financial income. On the other hand, younger, poorer and less educated individuals are more exposed to cyclical earnings risk and credit conditions, and may therefore be rationally more attentive to macroeconomic news.

To preserve both the daily frequency as well as minimally adequate sample sizes, we split the sample into two groups for each dimension of heterogeneity. For education, we construct separate daily confidence indices for respondents reporting at least some college experience, and for respondents with at most a high school degree or less. For income, we construct separate indices for individuals reporting annual household income below and above \$60K. For age, we group those aged 18-44 and those aged 45 and older. Just as for the aggregate Gallup ECI, we rescale all six confidence indices to have the same mean and variance as the Michigan index over the 2008-2017 sample period. Finally, we re-estimate the baseline specifications in (3) and (4) for each of the series. Figure 12 presents the smooth projections results.[34]

Figure 12a plots the responses of the confidence indices to monetary policy news by education level. The solid line and orange confidence intervals show the response for survey respondents without college experience, whereas the dot-dash line with green intervals shows the response for respondents with at least some college education. The left panel shows broadly statistically significant confidence declines for both education groups in response to an upward surprise in the target rate. The response for more highly educated survey respondents is considerably more precise and very strongly significant, whereas for less educated respondents the confidence bands are wider and statistical significance is more marginal. Except on the day of the announcement, the point estimates are roughly similar across both groups in the first week following the surprise announcement. However, the more highly educated eventually react more strongly, with a maximum decline in confidence of between 3 and 4 points after several weeks. This drop is about twice as large as the maximum decline in confidence for the less educated (between 1 and 2 points). In addition, the response of less educated individuals is not persistent and reverts back to zero after several weeks. In Appendix A.8, we show that the difference between the confidence responses becomes formally statistically significant after the third week.

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[34]The local projections results for every education, income and age group are provided in Appendix A.8.

The responses to surprise forward guidance and asset purchase announcements (middle and right panels of Figure 12a) are broadly similar across education groups. More educated individuals exhibit an immediate significant decline in confidence following tightening forward guidance on the day of the announcement, but the response reverts back to zero the next day and is never significant afterwards. The confidence impact of forward guidance for the less educated, as well as the responses of both groups to asset purchase news, is never statistically significant. As in the aggregate responses of Figure 6, the pronounced and significant short run confidence effects associated with funds rate surprises are generally absent for the other policy instruments.

Figure 12b plots the responses by income group. The solid line and orange confidence intervals (68% and 90%) show the response for survey respondents with lower incomes (less than $60K in annual income), whereas the dot-dash line with green intervals shows the response for respondents with higher incomes (more than $60K in income). The left panel shows that upward funds rate surprises have broadly similar negative short run confidence effects across income groups. There is a partial reversal of the confidence decline for lower income respondents in the fourth week, but not for higher incomes. The responses to forward guidance and asset purchase surprises (the middle and right panel of Figure 12b) are broadly similar across income groups. One notable difference is that higher income groups show a negative response to tightening forward guidance news throughout the first weeks, with an impact estimate that is statistically significant at the 90% level. The high income group also displays a statistically significant rise in confidence following asset purchase news that leads to higher long term rates. However, none of the differences between the confidence effects across income groups are statistically significant for any of the three policy surprises, see Appendix A.8.

Finally, Figure 12c depicts the confidence response to monetary policy surprises by age group. The solid line and orange confidence intervals show the response for survey respondents younger than 45, whereas the dot-dash line with green intervals shows the response for respondents aged 45 and up. The point estimates show a substantially stronger response to upward surprises in the target rate for younger survey respondents. Confidence for the young drops strongly on impact, and by up to 3 points in the third week. For the older respondents, the decline in confidence is much more gradual, and at most half as large. The estimates of the response of the younger respondents are considerably more precise than for the older respondents, and they are very strongly significant. In contrast, the confidence decline for older respondents is never significant at the 90% level, apart from the very end of the fourth week following the announcement. The responses to the forward guidance and asset purchase surprises (the middle and right panel of Figure 12c) are largely similar for both age groups, except for the fact that the young have a very large negative impact response to forward guidance surprises that is also statistically significant. Appendix A.8 shows that the impact responses to both forward guidance and asset purchase surprises are statistically significantly different between younger and
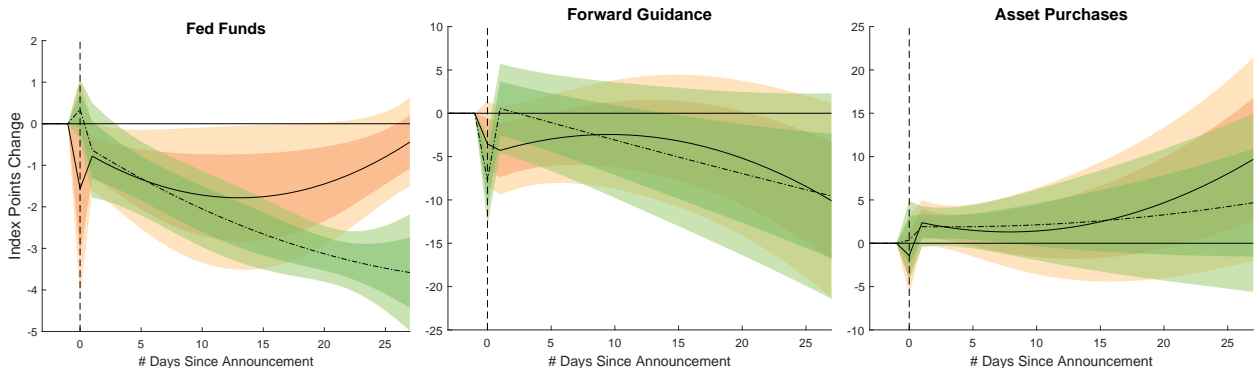
(b) Income Less Than $60K (Orange/Full) – Income Exceeding $60K (Green/Dot-Dash)
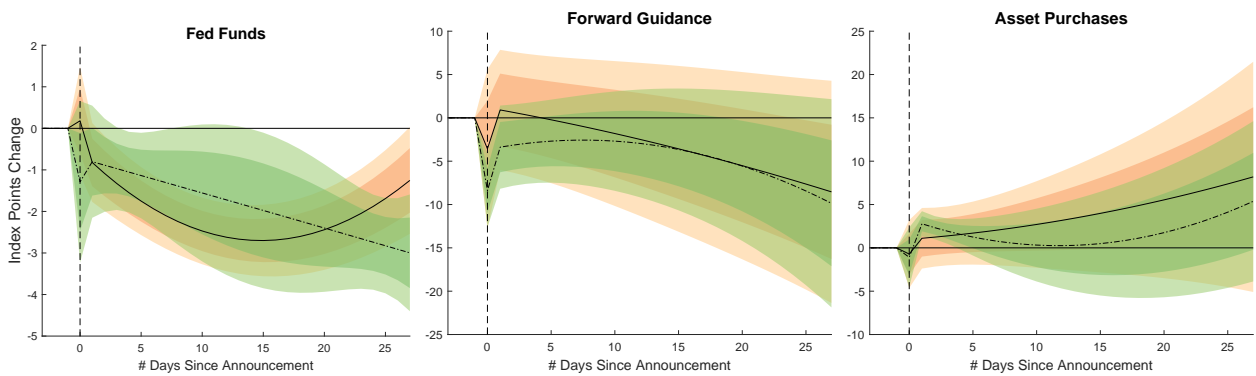
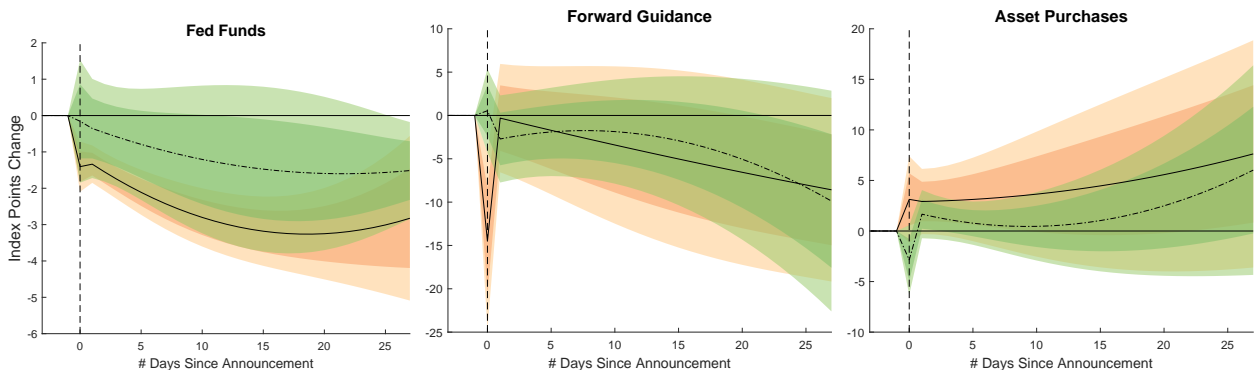(c) Aged 18 to 44 (Orange/Full) – Aged 45 or more (Green/Dot-Dash)

Figure 12: Confidence Impact of Monetary Tightening by Education, Income and Age

Notes: Estimates based on smooth projections (4) of the daily confidence indices by (a) education, (b) income and (c) age group on the monetary policy surprises constructed in Lewis (2019a). 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. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.

older respondents. The difference in the impact response to target rate news for the first few days also lies well outside the 68% confidence bands, although it remains within the 90% bands.

Overall, our conclusions based on the aggregate confidence impact of monetary policy news

remain remarkably intact after disaggregation. Upward surprises in the target rate generate confidence declines across all of our – admittedly somewhat crude – groupings by education, income or age. With the exception of the group of older respondents, all these responses are relatively immediate and statistically significant. Also, there continues to be little evidence for any similarly clear and persistent confidence effects following announcements about the unconventional policy instruments. At the same time, there is some evidence of heterogeneity in the magnitudes of confidence response to monetary surprises. Specifically, better educated and younger individuals show larger and more sharply estimated declines in confidence about the state of the economy following a upward surprise in the funds rate target.

4   Evidence for Informational Rigidities in High Frequency Data

The analysis above shows that public confidence in the state of the aggregate economy – as measured by the Gallup ECI – can be quite responsive to new macroeconomic information. Specifically, our finding that economic confidence responds instantaneously to conventional monetary policy suggests that central banks can influence beliefs held by the general public very quickly. In this section, we relate our findings to the broader empirical literature on informational rigidities. This is important because several seminal studies in this literature have found evidence that the public is broadly inattentive to new macroeconomic information. Carroll (2003), for example, estimates that consumer inflation expectations in the Michigan survey track those of professional forecasters with an average delay of one year. Based on the observed dispersion in inflation expectations in the Michigan survey, Mankiw, Reis, and Wolfers (2004) estimate that households update roughly once a year. More recently, Coibion and Gorodnichenko (2015) estimate rates of information updating on the basis of the correlation between survey forecast errors and forecast revisions. Their estimates imply an average duration between updates of inflation expectations by Michigan survey respondents that is between 5 and 6 months.[35] If the average rate at which households update beliefs about aggregate economic conditions were similarly low - once or twice a year– the Gallup ECI would not display the degree of responsiveness to aggregate news that we document above.

   To assess the extent of informational rigidities in the daily Gallup ECI data, we adapt the methodology of Carroll (2003) and estimate the degree of 'stickiness' in the Gallup ECI 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 panel dimension for such an approach. We therefore do not test general departures from full information rational expectations 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 a noisy translation

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[35] 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 fundamentals.

To motivate our empirical approach, we consider a general model with both sticky and noisy information. Suppose the vector of relevant economic fundamentals in period t is given by x_t^*, which evolves according to

$$(9) \qquad x_t^* = Ax_{t-1}^* + \eta_t, \quad \eta_t \sim N(0, \Sigma_\eta)$$

where η_t is an i.i.d. vector of shocks. 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,

$$(10) \qquad z_t = Cx_t^* + v_t, \quad v_t \sim N(0, \Sigma_v),$$

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

$$(11) \qquad x_t = Ax_{t-1} + Ku_t,$$

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

$$(12) \qquad u_t = z_t - E[z_t \mid Z_{t-1}] = z_t - Bx_{t-1}, \quad B = CA.$$

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

$$(13) \qquad x_t^b = \lambda Ax_{t-1}^b + (1-\lambda)x_t, \quad 0 \le \lambda \le 1.$$

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

$$(14) \qquad y_t = \phi' x_t^b + \epsilon_t, \quad \epsilon_t \sim N(0, \Sigma_\epsilon),$$

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

$$(15) \qquad y_t = \lambda \phi' Ax_{t-1}^b + (1-\lambda)y_t^{RB} + \epsilon_t,$$

where $y_t^{RB} = \phi' x_t$ is the hypothetical 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 measured well by the average confidence in the economy yesterday, at least after correcting for the measurement error. Implicity, A is assumed to be close to the identity, so the fundamentals, x^*_{t-1}, are highly persistent. This seems a reasonable assumption, in particular given the daily frequency of the data. Second, we extract x_t from the observable information z_t. Provided that the matrix polynomial $I - (A - KB)L$ 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:

$$(16) \qquad x_t \;=\; (I - (A - KB)L)^{-1} K z_t$$

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:

$$(17) \qquad y_t \;=\; \lambda y_{t-1} + M(L)z_t + \epsilon_t - \lambda \epsilon_{t-1}$$

where $M(L) = (1 - \lambda)\phi'(I - (A - KB)L)^{-1}K$. We use the method of Hannan and Rissanen (1982) to estimate λ in (17). 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 (17) 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.

Table 2 presents the estimates of the information stickiness parameter λ implied by the U.S. Gallup survey data. The main finding is that the estimates imply updating rates that are much higher than found by the studies mentioned above. Panel a. in Table 2 shows that the estimate based on the headline Gallup ECI is $\hat{\lambda} = 0.93$. This value implies that the average time between information updates is 1/(1-0.93), or 14 days. For the index based on the question about current economic conditions only, this average duration is 1/(1-0.79), or 5 days. For the index based on question about the direction of economic conditions, it is 1/(1-0.94), or roughly 17 days. These updating rates are consistent with macroeconomic information that is transmitted into households' beliefs far more quickly than once or twice a year.

There are several potential explanations for why we find much lower degrees of informational rigidity than in the studies mentioned above. One explanation is that our estimates are based on confidence indices constructed from categorical answers to questions about the state of the national economy. Carroll (2003), Mankiw, Reis, and Wolfers (2004) and Coibion and Gorodnichenko (2015) focus instead on quantitative answers to questions about expected inflation rates. It is conceivable that agents are rationally more attentive to information relevant for broader economic conditions than to information relevant for inflation, which remained low and relatively stable over our sample period. Another possible explanation is that incorporating information into broad categorical responses requires less effort than translating this information into quantitative changes to inflation projections.

Another possibility is that higher frequency survey data is much better suited to assess rates of information updating than lower frequency surveys. Binder (2017a), for example, shows that the monthly panel data from the New York Fed Survey of Consumer Expectations reveals that consumers adjust expectations much more frequently than suggested by the Michigan survey, in which the same respondent is sampled just twice in a six-month period. To assess the role of time aggregation bias in our setup, panels b. and c. in Table 2 present estimates of the information stickiness parameter λ based on weekly or monthly averages of the Gallup ECI, respectively.[36] The estimate based on the average weekly Gallup ECI is $\hat{\lambda} = 0.82$, implying an average duration of 5.5 weeks or 39 days. The estimate based on the average monthly Gallup ECI is $\hat{\lambda} = 0.29$, implying an average duration of 1.41 months or roughly 43 days. The estimates based on time-aggregated ECI data therefore lead to average times between information updates that are three times longer than implied by the daily estimate.[37]

Panels d. through f. in Table 2 show estimates of the information stickiness parameter λ for different subgroups based on level of education, age and income. To more clearly establish the relationship between these individual characteristics and informational updating rates, we consider finer subgroups than in Section 3.5. Specifically, the estimates in Table 2 are based on separate ECIs for respondents with four different levels of education (high school or less, some college experience, college graduate degree, or college postgraduate degree), four age groups (18 to 29, 30 to 49, 50 to 64, and 64 or more), and three different income groups (annual income less than $36K, between $36K and $90K, and more than $90K). The finer granularity, however, means that the number of observations at the daily frequency is quite low. To ensure adequate sample size, panels d.-f. in Table 2 show estimates based on data at the weekly frequency instead of the daily frequency. These estimates almost surely suffer from similar time

[36]The weekly specification includes 16 lags of the week-aggregated observables z_t. The monthly specification includes three lags of the month-aggregated observables in z_t.

[37]Time aggregation bias arises naturally in our context. Theorem 1 in Engel (2008) implies that a time-aggregated ARMA(1,1) process is itself an ARMA(1,1) with autoregressive coefficient equal to λ^m, where m is the number of periods of aggregation. With suitable conditions on the X variable, the same is true for an ARMAX(1,1). Since $1/(1 - \lambda) < m/(1 - \lambda^m)$ for $0 \leq \lambda < 1$ and $m > 1$, the estimated average time between information updates is biased upwards when $m > 1$, and the bias is increasing in m. Depending on the process for the X variable, additional upward bias is possible. Details are available by request.

aggregation bias as the aggregate weekly estimate in panel b. However, the comparison across the subgroups should remain informative about how updating rates vary with education, age or income.

The estimates by subgroup in panels d.-f. of Table 2 continue to indicate that information updating is uniformly much more frequent than once or twice a year, even without taking into account time aggregation bias. However, there are some meaningful differences across subgroups. Panel d., for example, shows that the estimate of the stickiness parameter λ is decreasing in the level of education. The estimate of λ is 0.83 for respondents with at most a high school degree, but the estimate falls with each successively higher level of education. Respondents with a postgraduate degree have the lowest estimate of λ, equal to 0.66. The evidence, therefore, indicates that more highly educated individuals track general macroeconomic information more closely than less-educated individuals. This is consistent with the estimated responses conditional on monetary news in Section 3.5, which showed some evidence that more highly educated respondents respond more strongly to target rate surprises.

TABLE 2: ESTIMATES OF
INFORMATION STICKINESS λ

	λ	s.e.	# obs
a. All Survey Respondents (Daily):			
Economic Confidence Index (ECI)	0.93	(0.01)	3266
Current Conditions Index	0.79	(0.02)	3267
Future Conditions Index	0.94	(0.01)	3266
b. All Survey Respondents (Weekly):			
Economic Confidence Index (ECI)	0.82	(0.04)	501
Current Conditions Index	0.74	(0.07)	501
Future Conditions Index	0.82	(0.04)	501
c. All Survey Respondents (Monthly):			
Economic Confidence Index (ECI)	0.29	(0.18)	117
Current Conditions Index	0.19	(0.18)	117
Future Conditions Index	0.31	(0.18)	117
d. By Level of Education (Weekly):			
ECI, High school or less	0.83	(0.07)	500
ECI, Some college	0.80	(0.07)	500
ECI, College graduate degree	0.71	(0.08)	500
ECI, College postgraduate degree	0.66	(0.08)	500
e. By Age Group (Weekly):			
ECI, Age 18 to 29	0.59	(0.13)	501
ECI, Age 30 to 49	0.77	(0.07)	501
ECI, Age 50 to 64	0.80	(0.05)	501
ECI, Age 65 and over	0.80	(0.06)	501
f. By Level of Income (Weekly):			
ECI, Low income (less than \$ 36K)	0.73	(0.09)	501
ECI, Mid income (\$ 36K to \$ 90K)	0.78	(0.06)	501
ECI, High income (more than \$ 90K)	0.81	(0.05)	501

Panel e. in Table 2 also reveals meaningful differences in the estimates of the information stickiness parameter λ by age group. Specifically, the estimate of λ for the youngest age group (age 18 to 29) is the lowest, and equals 0.59. The estimate for those between 30 and 49 is substantially higher at 0.77, whereas for each of the age groups above the estimate of λ is 0.80. It appears, therefore, that the young track general macroeconomic information more closely than older individuals. This is again in line with our earlier findings on the responsiveness to monetary news, which showed substantially larger reactions by the younger age group, see Section 3.5. Finally, panel f. in Table 2 shows that the point estimates of λ rise with income, which indicates that lower income individuals update more frequently than individuals with higher income. The differences across income groups, however, are relatively small compared to those across age or education groups. The estimates of the stickiness parameter λ range from 0.73 for those earning less than \$36K, to 0.81 for those earning more than \$90K. We cannot reject with much confidence that the estimates of λ are equal across income groups, in line with the findings for monetary policy shock responses.

5 Conclusion

In this paper, we provide evidence that surprises in Federal Funds rate decisions generate immediate effects on public beliefs about economic conditions. Two key features distinguish our analysis from existing work on the impact of monetary policy on macroeconomic expectations. The first is that we focus on the impact on the beliefs of the general public rather than 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 restrictions implicit in the event study approach.

We find robust and significant instantaneous declines in confidence following upward surprises in the Federal Funds rate. At the daily level, these confidence effects almost surely arise because households revise their economic outlook following new information about monetary policy, and not just because they experience its later economic impact. These results indicate 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. On the other hand, we find little evidence for similar effects in response to monetary policy news related to forward guidance or asset purchases. This suggests that there remain significant communication challenges surrounding the use of these alternative policy instruments.

The high frequency survey data used in this paper reveals that central bank communications – as well as macroeconomic information more broadly – can be transmitted more quickly and effectively to the broader public than suggested by much of the existing evidence on informa-

tional rigidities. Future research can use Gallup or similar high frequency survey data to learn more about the aggregate influences on beliefs about the state of the economy, as well as the nature of the transmission of aggregate news into public beliefs and the role of the media.

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A Appendix (For Online Publication Only)

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 2.2. Figure A.1 depicts the estimates based on local projections obtained from Equation (1) in the main text, whereas dashed lines show the estimates based the smooth local projections in Equation (2).
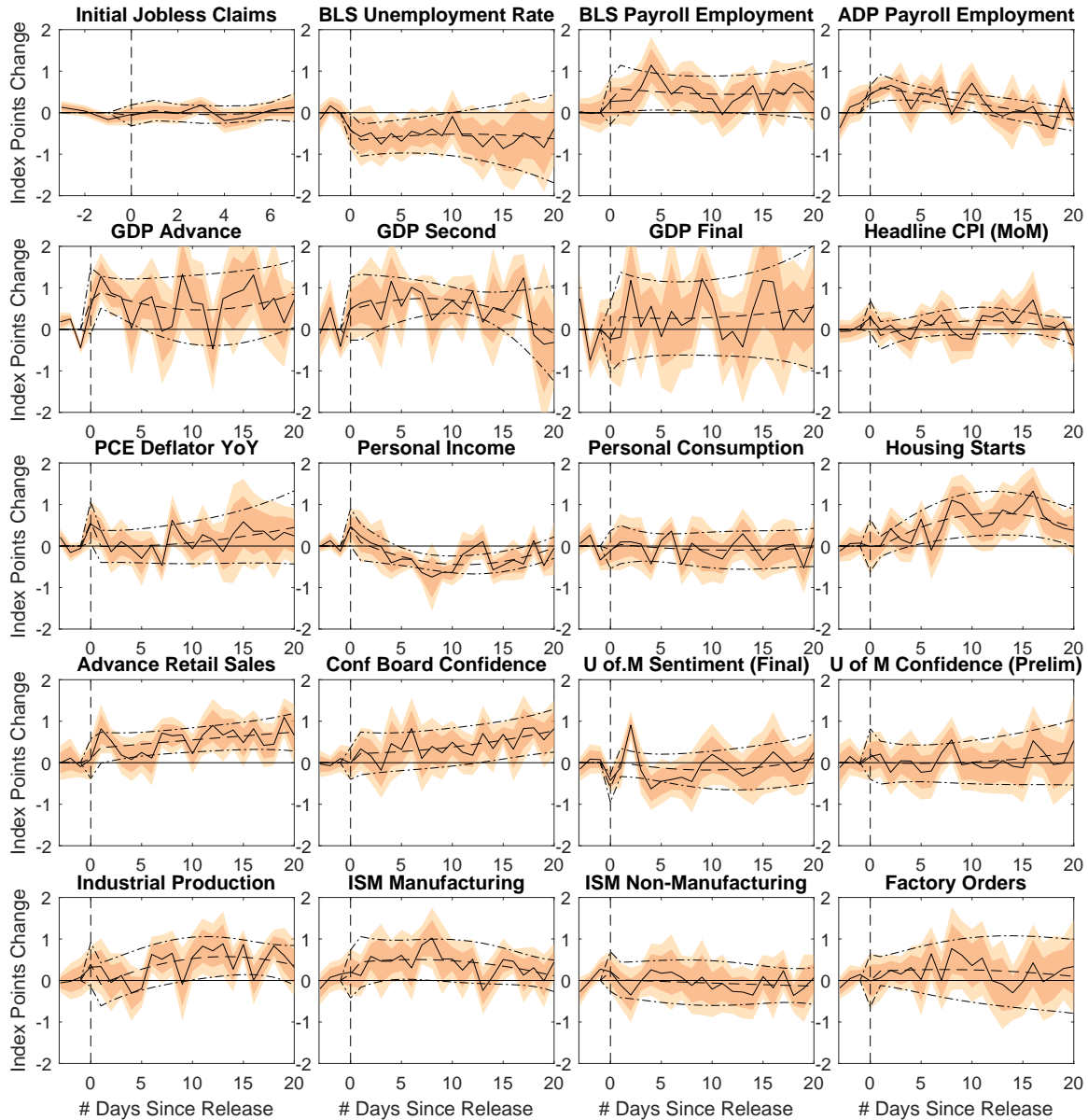
Figure A.1: Confidence Changes Following Surprises in Macroeconomic Releases

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

Table A.I lists the estimated change in confidence relative to the prior 3-day moving average 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

TABLE A.I: CONFIDENCE CHANGES FOLLOWING SURPRISES IN MACRO RELEASES

	# releases	# obs.	Day of Release	Next Day	Next Week
GDP Advance	40	799	0.69	0.90***	0.53
			(0.49)	(0.24)	(0.43)
BLS Unemployment Rate	120	2388	−0.41*	−0.66***	−0.54**
			(0.23)	(0.23)	(0.27)
ADP Payroll Employment	120	2383	0.43***	0.60***	0.36***
			(0.13)	(0.20)	(0.09)
BLS Payroll Employment	120	2388	0.29	0.57*	0.47*
			(0.35)	(0.35)	(0.26)
GDP Second	40	784	0.49	0.54	0.74***
			(0.46)	(0.48)	(0.26)
ISM Manufacturing	120	2358	0.16	0.45	0.50*
			(0.35)	(0.37)	(0.30)
Advance Retail Sales	120	2358	0.10	0.36	0.49***
			(0.29)	(0.23)	(0.17)
GDP Final	32	589	−0.20	0.30	0.26
			(0.50)	(0.65)	(0.54)
Factory Orders	119	2370	−0.01	0.23	0.26
			(0.38)	(0.21)	(0.40)
Conf Board Confidence	120	2364	−0.02	0.22	0.30
			(0.23)	(0.31)	(0.28)
Headline CPI (MoM)	120	2337	0.32	−0.15	0.15
			(0.23)	(0.20)	(0.18)
Personal Income	120	2330	0.45*	0.09	−0.36***
			(0.27)	(0.26)	(0.11)
Industrial Production	120	2352	0.39	−0.09	0.40
			(0.32)	(0.31)	(0.32)
Initial Jobless Claims	522	3421	−0.07	0.05	0.12
			(0.15)	(0.15)	(0.21)
Personal Consumption	120	2330	−0.09	0.04	−0.07
			(0.28)	(0.28)	(0.23)
PCE Deflator YoY	120	2330	0.57*	−0.01	0.03
			(0.30)	(0.24)	(0.27)
Housing Starts	118	2304	0.01	−0.01	0.61**
			(0.38)	(0.15)	(0.28)
U of.M Sentiment (Final)	120	2330	−0.61***	0.01	−0.16
			(0.21)	(0.21)	(0.23)
ISM Non-Manufacturing	120	2402	0.22	0.01	−0.04
			(0.29)	(0.26)	(0.33)
U of M Confidence (Prelim)	120	2364	0.21	0.00	−0.01
			(0.37)	(0.32)	(0.28)

Notes: Estimates based on smooth projections as in (2) of the Gallup ECI on surprises in macroeconomic data releases. Reported in descending order based on the estimated change on the following day. Standard errors based on Lazarus et al. (2018) in parentheses. Asterisks denote 10%, 5% or 1% significance. Sample range is Jan 2, 2008 to Dec 30, 2017.

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 upward surprise (data release minus the Bloomberg consensus forecast). 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 21 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, respectively, and the sample sizes change accordingly. We use a horizon up to 7 days for the weekly claims (to avoid overlapping the subsequent release), and maintain the 21 day window for the GDP reports.

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

Figure A.2 reports the responses of the two subcomponents of the Gallup ECI to the monetary policy surprises. These subcomponents are based on survey questions about the current state of the economy and the direction of economic conditions, respectively, see Section 2. For brevity, the figure reports only results for the smooth projections in Equation (4) in the main text. The figure shows that the responses based on the individual questions are very similar to the response of the overall Gallup ECI reported in Figure 6b of the main text.

(a) Current State of Economic Conditions
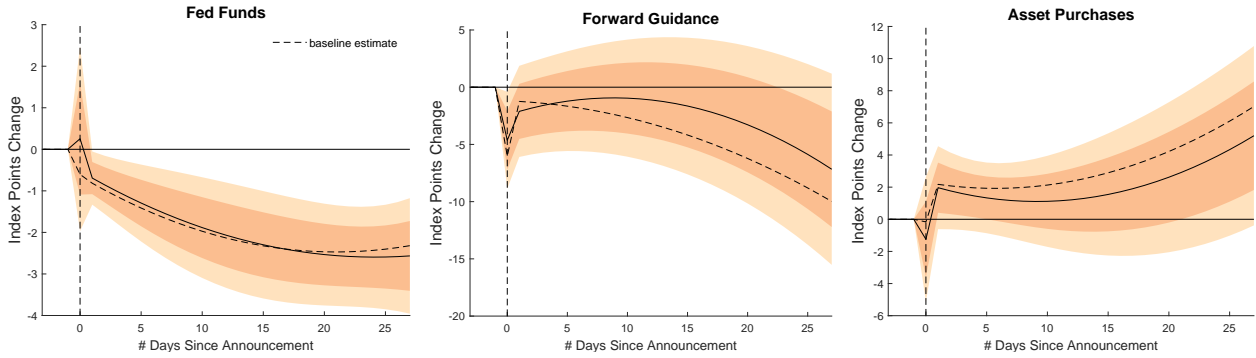
(b) Direction of Economic Conditions
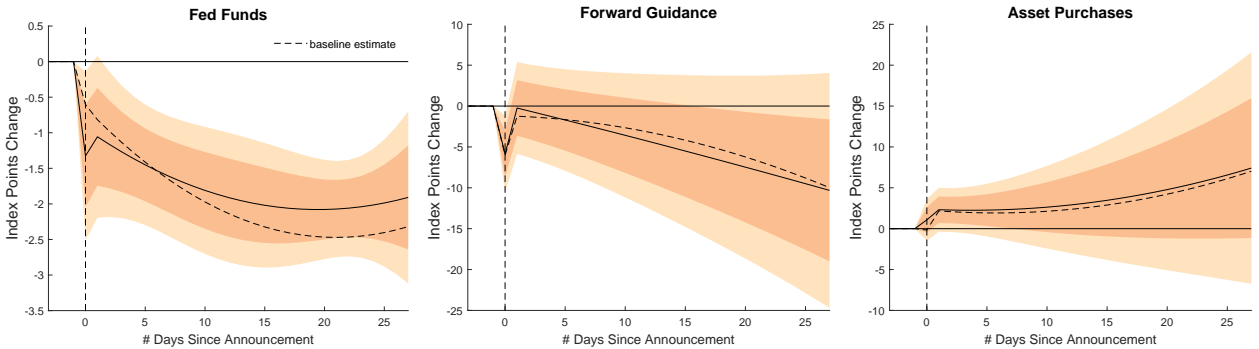
Figure A.2: Confidence Impact of Monetary Tightening: Components of the Gallup ECI index

Notes: Estimates based on smooth projections (4) of the daily Gallup 'Current State' and 'Direction' indices on the monetary policy surprises constructed in Lewis (2019a). 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. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.

A.3 Smooth Projections with Cubic Polynomial

Figure A.3 shows the response of the Gallup ECI to the monetary policy surprises estimated by smooth projections as in Equation (4) of the main text, but allowing for a cubic approximation to the impulse response function instead of a quadratic approximation. The dashed line repeats the baseline estimates based on the quadratic approximation from Figure 6b for comparison. The results based on the cubic specification are not meaningfully different from the baseline.
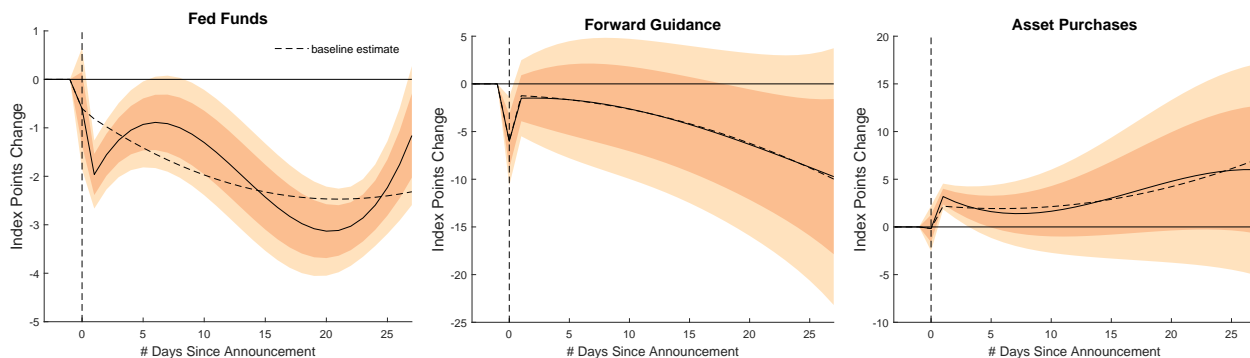
Figure A.3: Confidence Impact of Monetary Tightening: Cubic Smooth Projections

Notes: Estimates based on smooth projections on the monetary policy surprises constructed in Lewis (2019a). The specification is analogous to (4) but based on a cubic instead of a quadratic polynomial approximation. Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Dashed lines represent point estimates from the baseline quadratic smooth projections in (4) for comparison. 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. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.

A.4 Robustness to the Measurement of Confidence and Monetary News: Local Projections

Section 3.2 in the main text presents estimates of the short run confidence impact of monetary policy news using an alternative measure of daily confidence as well as different monetary policy shock measures. The main text only presents the results from smooth projections as in Equation (4). This section provides the results based on local projections as in Equation (3) of the main text. Figure A.4 shows the confidence response to monetary policy surprises based on local projections and using the daily Rasmussen confidence index instead of the Gallup ECI.
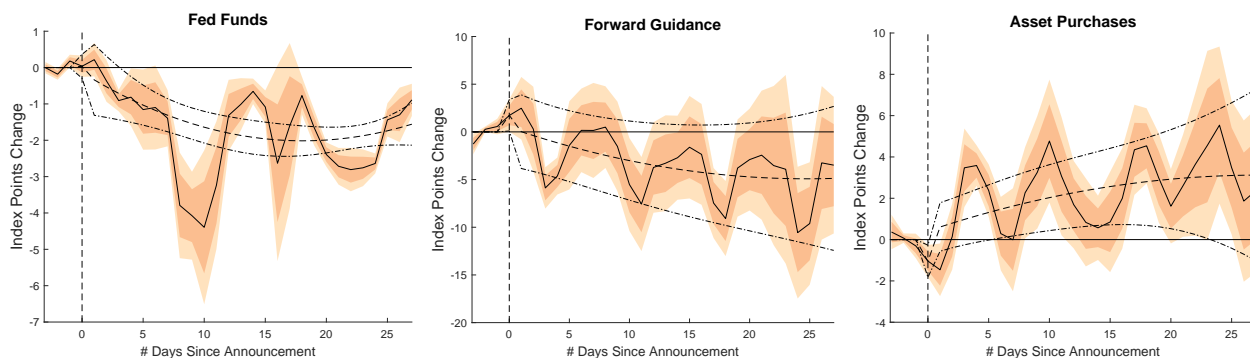
Figure A.4: Confidence Impact of Monetary Tightening using the Rasmussen Index

Notes: Estimates based on local projections (3) of the daily Rasmussen Confidence Index on the monetary policy surprises constructed in Lewis (2019a). Baseline estimates (broken lines) are the point estimates shown in Figure 6b. Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Dashed lines represent point estimates from smooth projections 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. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.

Figure A.5 shows the confidence response to monetary policy surprises using the Gallup ECI but using alternative multidimensional measures of monetary policy shocks.

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Fed Funds

Forward Guidance

Asset Purchases

(b) 30 minute window interest rate changes

Fed Funds

Forward Guidance

Asset Purchases

(c) 30 minute window interest rate changes, orthogonalized

Fed Funds

Forward Guidance

Asset Purchases
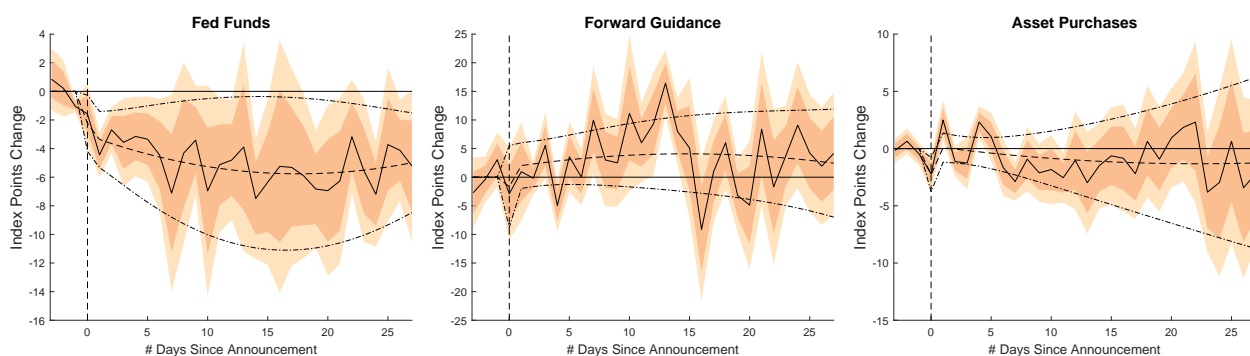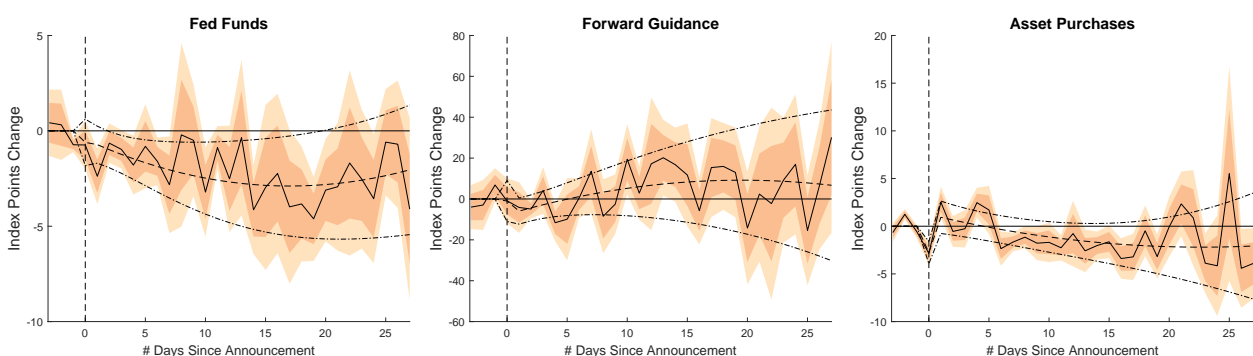
Figure A.5: Confidence Impact of Monetary Tightening: Alternative Multidimensional Measures of Monetary Policy Shocks

Notes: Estimates based on local projections (3) of the daily Gallup ECI on the monetary policy surprises. The first row uses the measures of Swanson (2017). The second and third row use 30-minute window price changes in the front quarter Eurodollar contract, the 2-year Eurodollar contract, and the 10-Year Treasury. In the third row, the longer rates are first orthogonalized recursively. Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Dashed lines represent point estimates from smooth projections 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. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.

Figure A.6 shows the confidence response to monetary policy surprises using the Gallup ECI and a number of additional alternative high-frequency measures of monetary policy shocks.

(a) Nakamura and Steinsson (2018) Fed Funds shock

(b) Nakamura and Steinsson (2018) Policy News shock

(c) Gertler and Karadi (2015) shock

(d) Jarocinski and Karadi (2018) shock

(e) Raw Changes in FF target
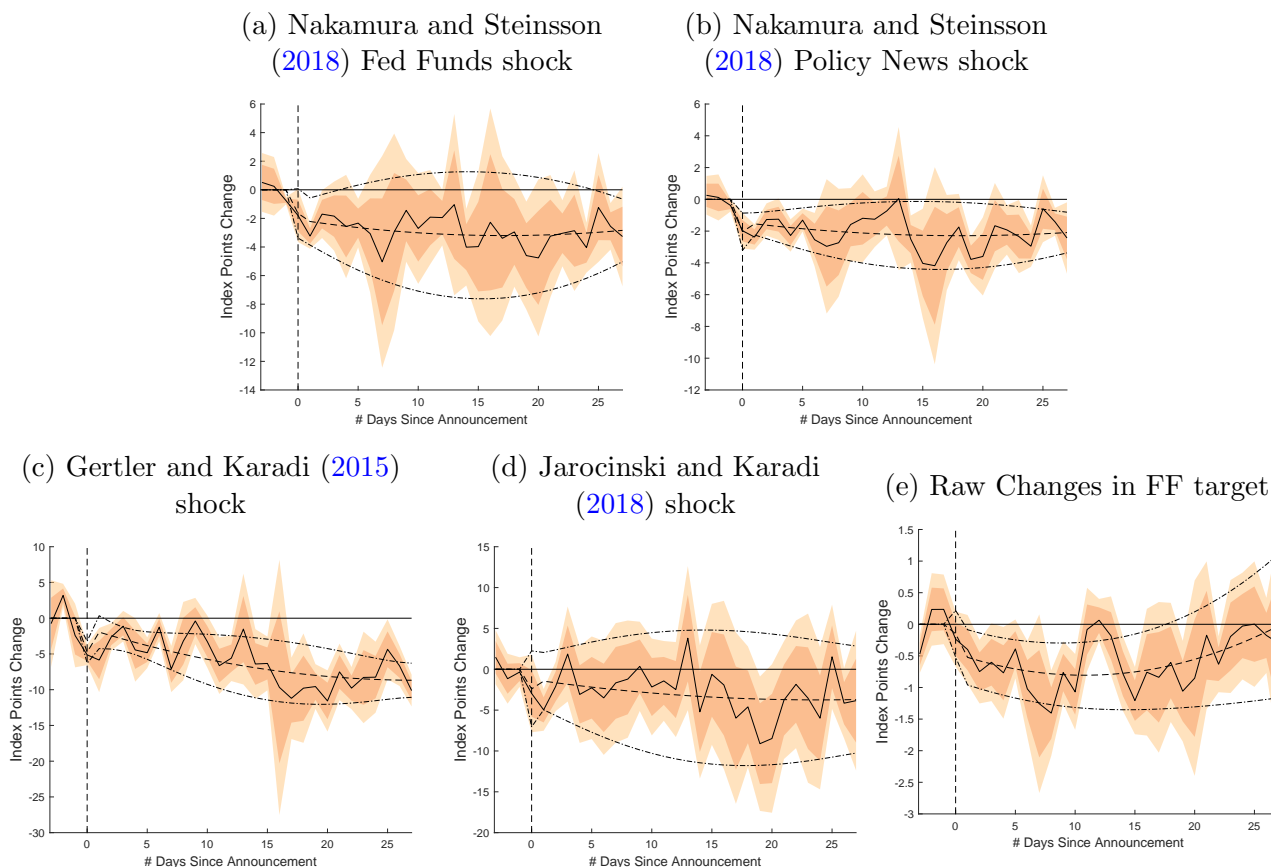
Figure A.6: Confidence Impact of Monetary Tightening: Alternative Shock Measures

Notes: Estimates based on local projections of the daily Gallup ECI on the monetary policy surprises. The specification is as in 3 but including only the single shock measure on the right hand side. For the Jarocinski and Karadi (2018) shock, we also include their information effect shock as an additional control. Responses are scaled to a shock corresponding to a 25 basis-point increase in the Federal Funds rate. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a. Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Dashed lines represent point estimates from smooth projections for comparison, with dot-dash lines corresponding to 90% confidence intervals. Sample periods vary across specification, ending in (a)/(b) March 2014, (c) June 2012, and (d) December 2016.

A.5 U.S. Confidence Impact of Monetary Policy Tightening by the ECB

Figure A.7 shows estimates of the US confidence response to Eurozone monetary policy shocks as constructed by Jarocinski and Karadi (2018). The right panel shows local projection estimates of the response to a 25 basis-point increase in the Jarocinski and Karadi (2018) measure. The right panel shows smooth projection estimates. For comparison, the dashed line in the right panel shows the baseline response to a 25 basis-point upward surprise in the US funds rate target. Neither panels of Figure A.7 show any evidence for statistically significant confidence effects of surprises in the monetary policy stance of the ECB.

A.6 The Role of the Reaction in Equity Markets: Local Projections

This section provides the local projection results complementing Section 3.3 of the main text, which presents results for specifications that include interactions with equity price reactions on FOMC announcement days. Figure A.8 presents the estimates based on Equation (5) in the main text.
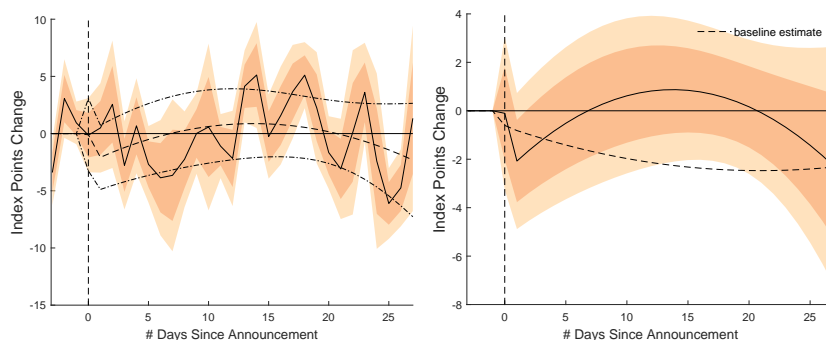
Figure A.7: US Confidence Impact of Monetary Policy Tightening by the ECB

Notes: Estimates based on local projections (3) (right panel) and smooth projections (4) (left panel) of the Gallup ECI for the U.S. on the ECB policy shock measure constructed in Jarocinski and Karadi (2018). Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Responses are to a 25 basis-point increase in the Jarocinski and Karadi (2018) shock measure. Dashed lines in the right panel represent point estimates from smooth projections for comparison, with dot-dash lines corresponding to 90% confidence intervals. The dashed line in the right panel shows the baseline response to a 25 basis-point upward surprise in the U.S. funds rate target, as also shown in Figure 6b. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.
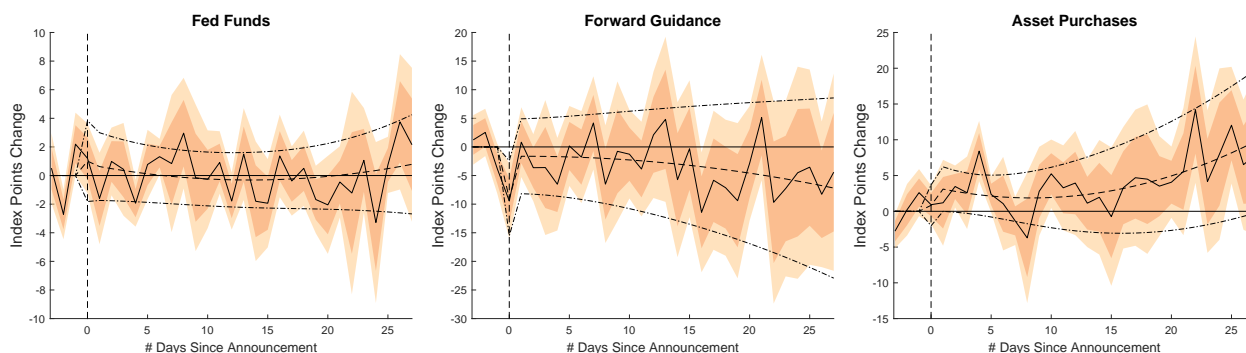
Figure A.8: Confidence Impact of Monetary Tightening, Controlling for Equity Price Interactions

Notes: Estimates based on local projections (5) of the daily Gallup ECI on the monetary policy surprises constructed in Lewis (2019a). Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Dashed lines represent point estimates from smooth projections 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. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.

A.7 Asymmetries in the Response to Tighter and Looser Monetary Policy: Local Projections

This section provides the local projection results complementing Section 3.4 of the main text, which presents results for specifications that allow for asymmetries in the responses according to the sign of the monetary policy shocks. Figure A.9 presents the estimates based on Equation (7) in the main text.

(a) Confidence Impact of Monetary Tightening
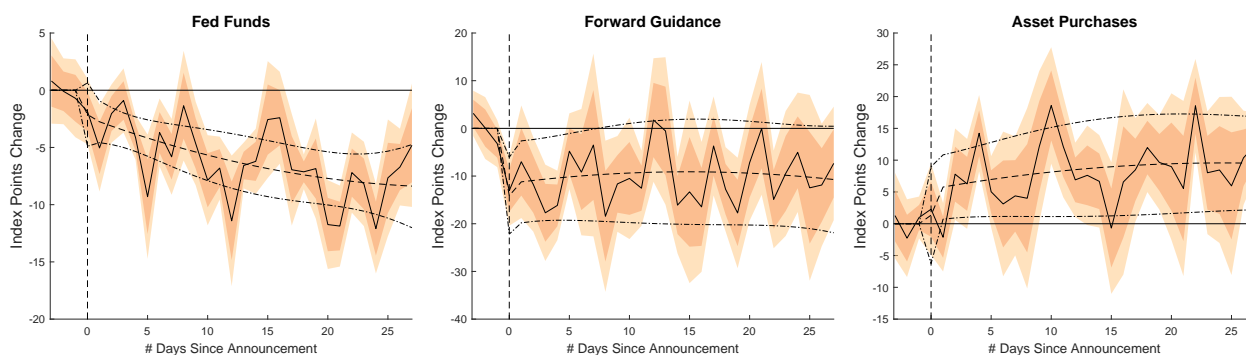
(b) Confidence Impact of Monetary Loosening
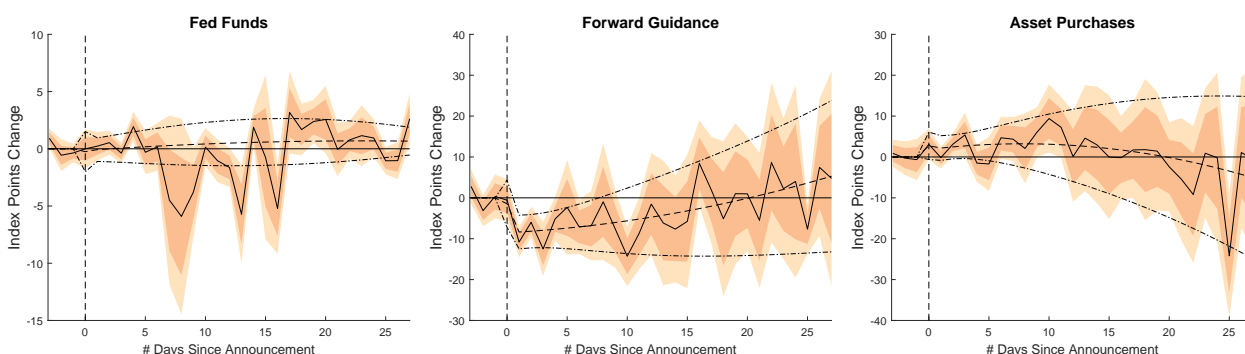
Figure A.9: Asymmetries in Confidence Impact of Monetary Policy Surprises

Notes: Estimates based on local projections of the daily Gallup ECI on the monetary policy surprises constructed by Lewis (2019a). The specification is as in (7) and includes all three baseline Lewis (2019a) monetary policy shocks. Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Dashed lines represent point estimates from smooth projections for comparison, with dot-dash lines corresponding to 90% confidence intervals. Responses are scaled to a shock corresponding to a 25 basis-point increase (top row) or decrease (bottom row) 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. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.

A.8 Confidence Impact by Education, Income and Age

This section provides several results complementing Section 3.5 in the main text. Figures A.10, A.11 and A.12 contain the local projection estimates of the responses of economic confidence to monetary policy surprises by education, income, and age group.

(a) Some College
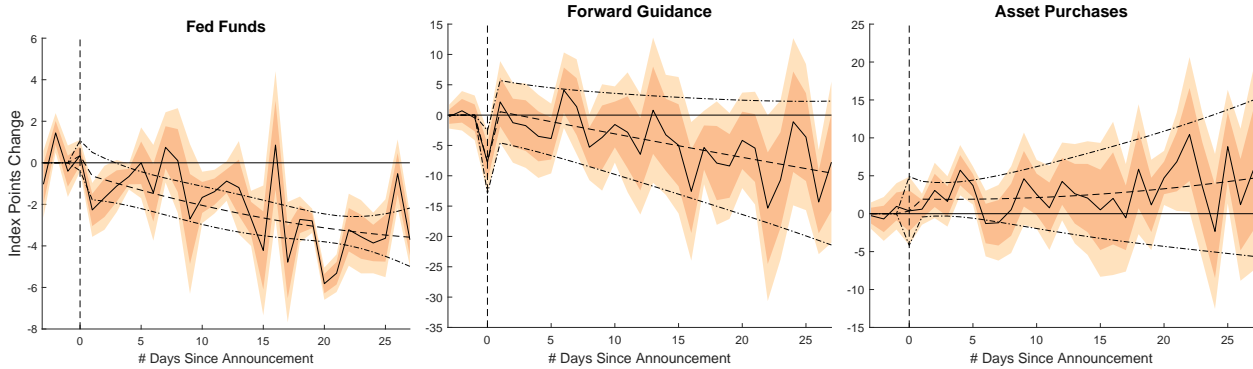
(b) Without College Experience
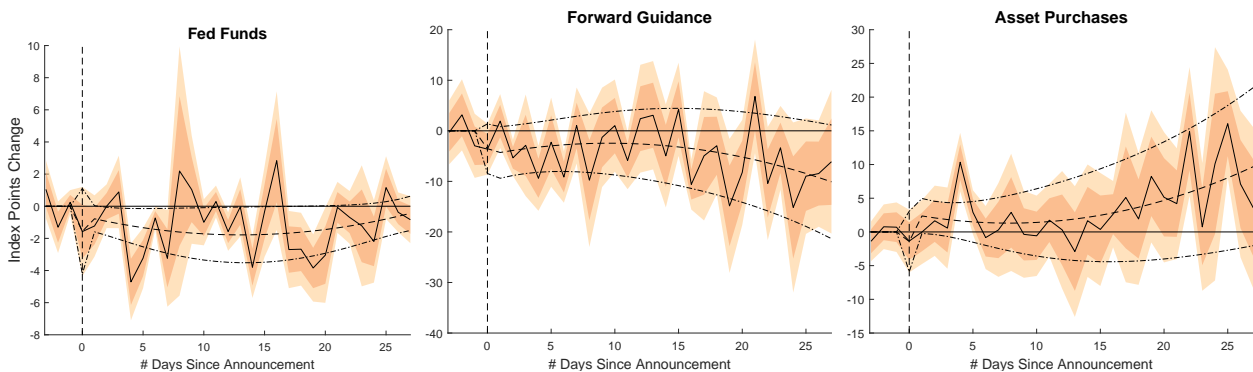
Figure A.10: Confidence Impact of Monetary Tightening by Education

Notes: Estimates based on local projections (3) and smooth projections (4) on the monetary policy surprises constructed in Lewis (2019a). Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Dashed lines represent point estimates from smooth projections in (4) 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. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.

Figure A.13 shows estimates from smooth projections of differences in ECIs between subgroups on monetary policy surprises. Figure A.13a shows the response of the ECI for respondents with some college less the ECI for respondents without college experience. Figure A.13b shows the response of the difference between the ECI for respondents with income exceeding $60K and the ECI for respondents with income less than $60K. Finally, Figure A.13c shows the response of the ECI for respondents aged 45 or more less the ECI for younger respondents.
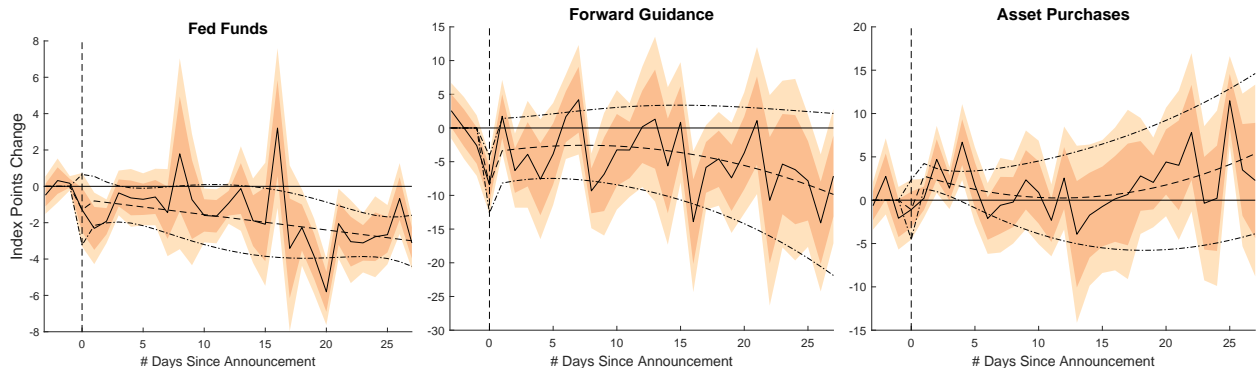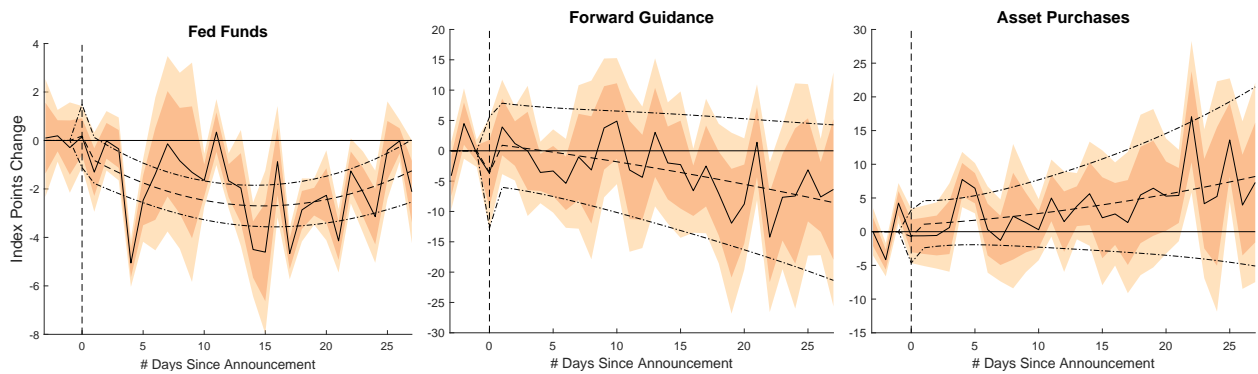
Figure A.11: Confidence Impact of Monetary Tightening by Income

Notes: Estimates based on local projections (3) and smooth projections (4) on the monetary policy surprises constructed in Lewis (2019a). Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Dashed lines represent point estimates from smooth projections in (4) 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. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.

(a) Aged 18 to 44
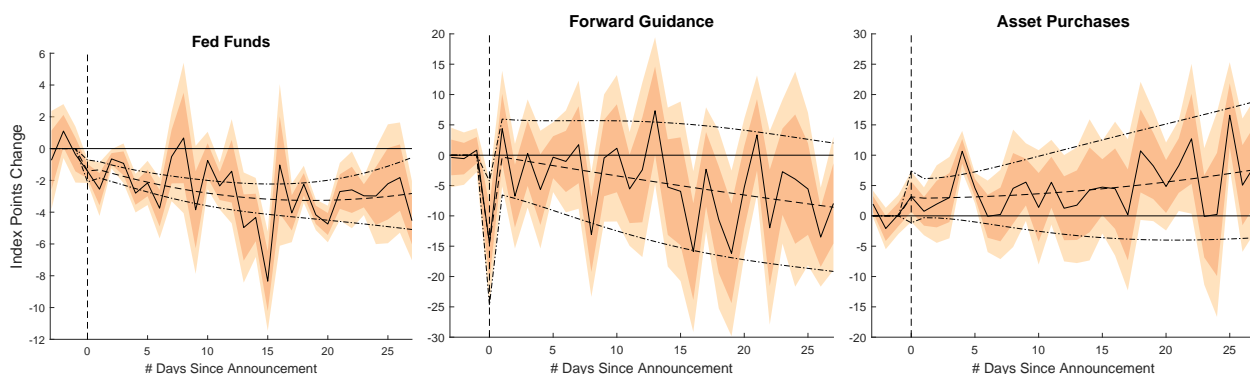
(b) Aged 45 or More
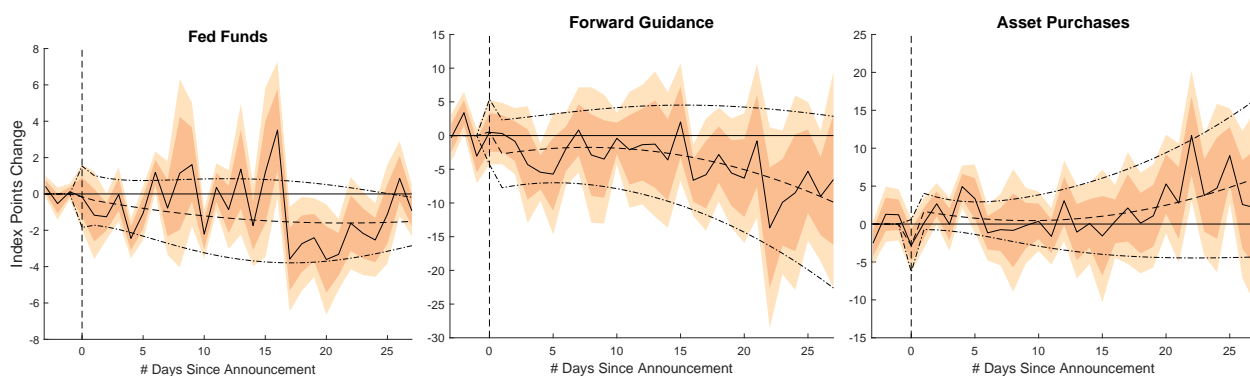
Figure A.12: Confidence Impact of Monetary Tightening by Age

Notes: Estimates based on local projections (3) and smooth projections (4) on the monetary policy surprises constructed in Lewis (2019a). Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Dashed lines represent point estimates from smooth projections in (4) 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. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.

(a) Difference Between: Some College and Without College Experience
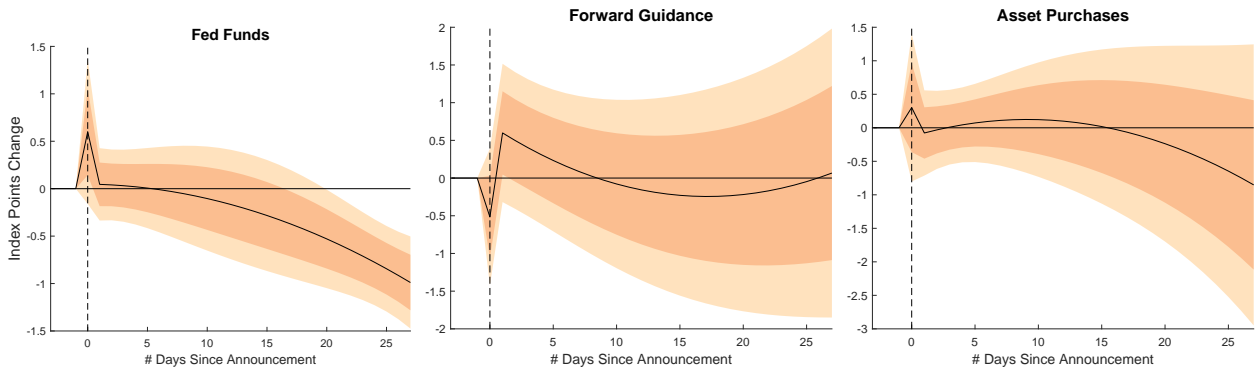
(b) Difference Between: Income Exceeding $60K and Income Less Than $60K
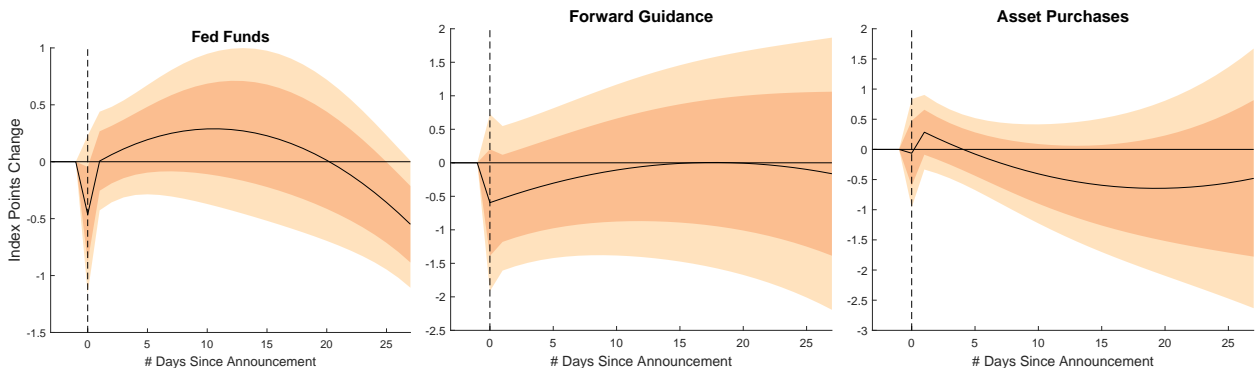
(c) Difference Between: Aged 45 or More and Aged 18 to 44
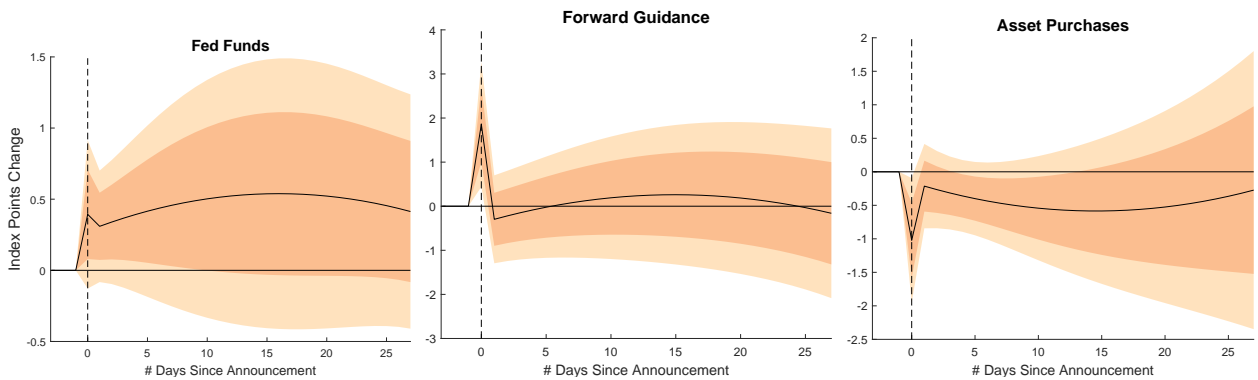
Figure A.13: Differences in the Confidence Impact of a Monetary Tightening

Notes: Estimates based on smooth projections (4) of the difference in the daily confidence indices between the groups listed on the monetary policy surprises constructed in Lewis (2019a). 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. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.

B   Appendix: Results with Aggregate Gallup Analytics Data (For Online Publication Only)

Gallup publishes aggregate series for the Economic Confidence Index and its subcomponents through the Gallup Analytics portal, which with a subscription can be accessed through the following link: https://www.gallup.com/analytics/. In the main paper, we do not use the aggregate series provided by Gallup. Instead, we construct the confidence indices directly from Gallup's underlying microdata using the same formulas and population weights. This allows us to cover a slightly larger sample than what is available for the official indices published by Gallup. For replication purposes, this appendix provides analogs to the results in the main text that can be obtained with the official aggregate series. The aggregate series published by Gallup are shown in Figure B.1 below. In earlier working paper versions of this paper, we reported the results on the basis of the official aggregate series (Dallas Fed Working Paper 1906 September 2019 version, and FRB of New York Staff Report No. 897, September 2019). The vast majority of the results are extremely similar, and vary only numerically from those in the main text.

The only more substantive difference between the official Gallup ECI and our version is that the somewhat broader sample coverage affects the identification of the largest five negative and positive change points. Table B.I lists these change points as selected by the algorithm of Killick, Fearnhead, and Eckley (2012) for the official aggregate ECI series published by Gallup. The majority of the identified change points overlap exactly with those in our version of the ECI series, which are reported in Table 1 of the main text. Four out of the five largest negative confidence shifts are the same. The confidence drop on March 3, 2008 does not appear in Table B.I, which instead lists Feb 17, 2011 as the fifth largest single day drop. We were unable to link this drop to any clearly important news events on that day. Three out of the five largest positive confidence shifts in Table B.I are the same as in Table 1. The official ECI series does not cover the signing of the Tax Cuts and Jobs Act on December 20, 2017, which as a result does not show up in Table B.I. Instead, the signing of the tax deal on December 18, 2010 is identified as being associated with a significant positive shift in economic confidence. Interestingly, news of the killing of Osama Bin Laden coincides with a significant positive shift in economic confidence in Table B.I, even though its direct economic implications are perhaps not immediately clear.

The remainder of the results are extremely similar between the official Gallup ECI and our version. This can be seen in Figures B.2 and B.3, which reproduce Figures 3 and 4 using the official ECI aggregate series. Similarly, Figure B.4 reproduces Figure 6. Figures B.5 and B.6 reproduce Figures 8 and 9. Figures B.7 and B.8 reproduce Figures 10 and 11. Finally, Table B.II reproduces Table 2 in the main text with the series for the subgroups that are available through Gallup Analytics. None of our conclusions in the main text are affected materially by using the ECI series published by Gallup instead of our own version.

(a) Economic Confidence Index

(b) Current State of Economic Conditions

(c) Direction of Economic Conditions
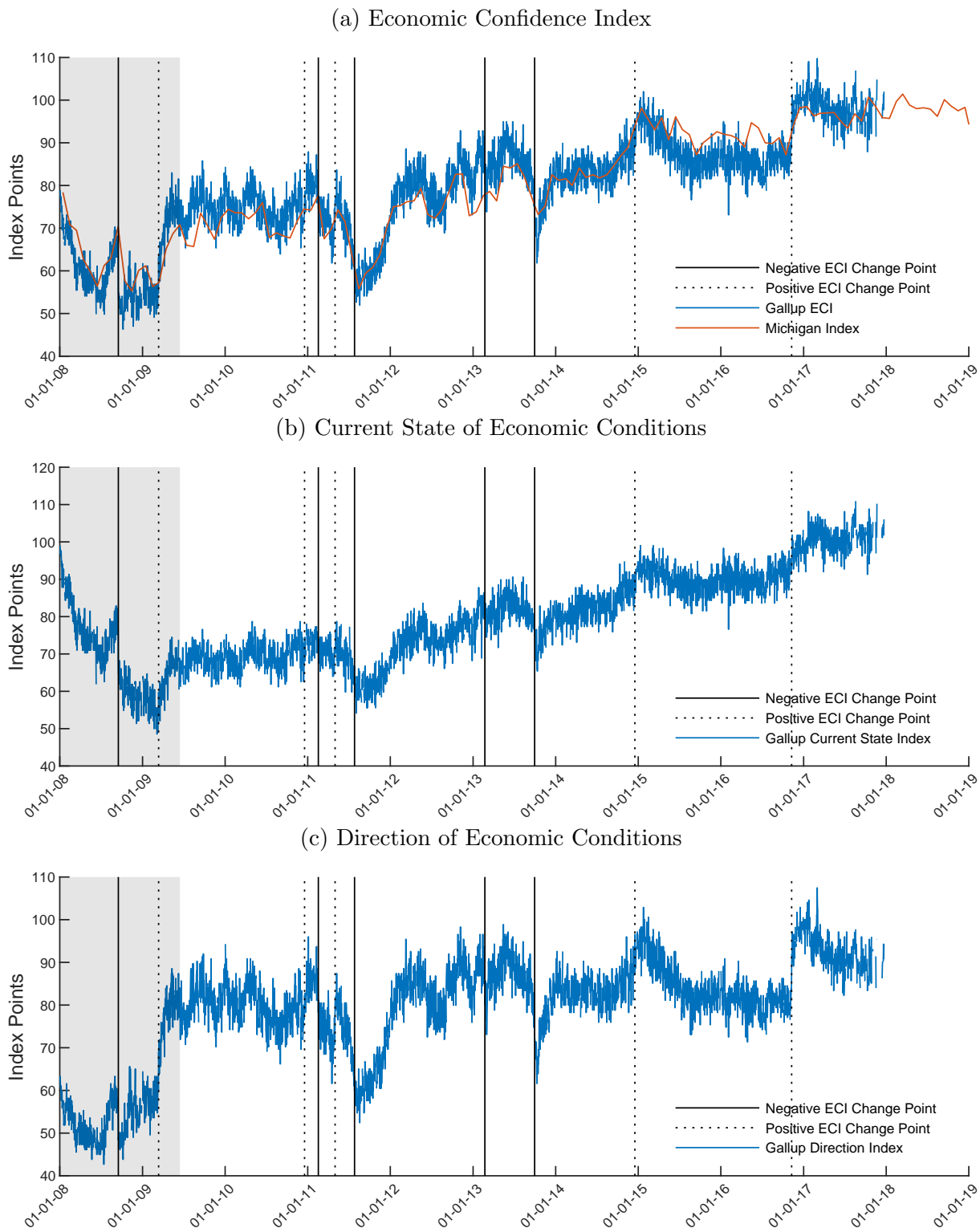
Figure B.1: Daily Gallup Confidence Indices and the Michigan Sentiment Index.

Notes: Data from Gallup and University of Michigan. The daily Gallup indices cover Jan 2, 2008 through Dec 27, 2017. Panel b is based on the fraction of respondents rating current economic conditions (('Excellent' + 'Good') minus 'Poor'). Panel c is based on the fraction saying the economy is ('Getting better' minus 'Getting worse'). Panel a is based on the average of both. Each panel shows daily indices that are rescaled to have the same mean and variance as the Michigan Sentiment Index over the sample period. Vertical lines mark the five largest negative and five largest positive change points in the Economic Confidence Index detected by the change point algorithm of Killick, Fearnhead, and Eckley (2012). Shaded areas are NBER recessions.

Day	ΔECI	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 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.
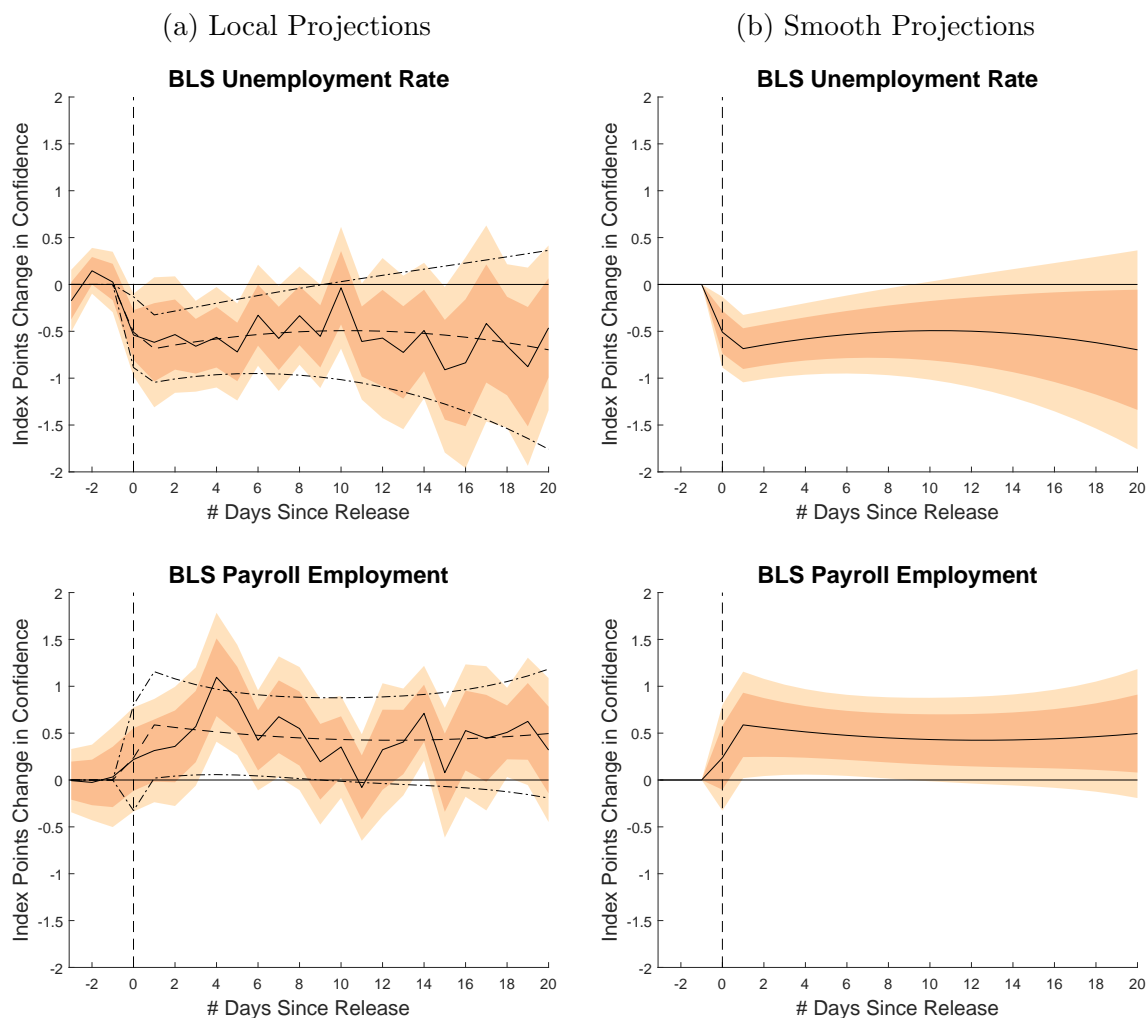
Figure B.2: Confidence Dynamics Following One Standard Deviation Surprises in the Jobs Report

Notes: An upward surprise in the first (second) row means the unemployment rate (the number of jobs added) is higher than the Bloomberg consensus forecast. Estimates based on local projections (1) and smooth projections (2) of the daily Gallup ECI on the data release minus the consensus forecast. Index point changes in confidence are on the same scale as the Mic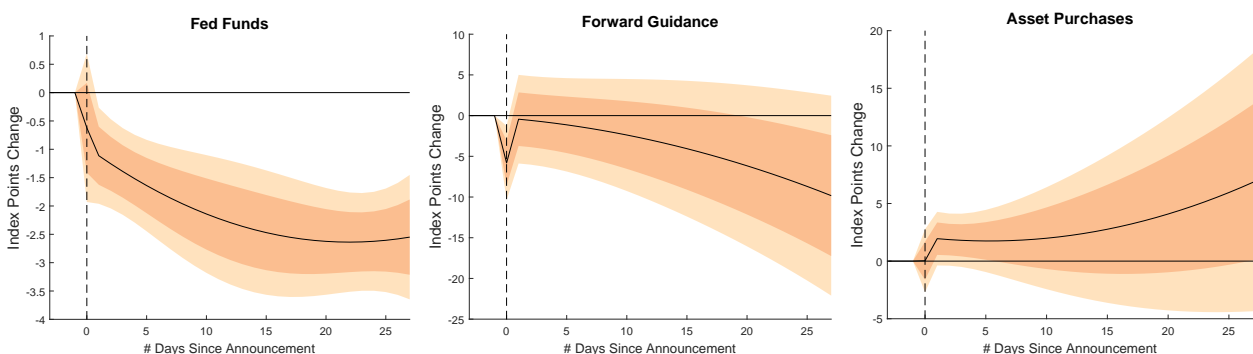higan Consumer Sentiment index, as in Figure 1a. In both panels, shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. For the left panels, dashed lines represent point estimates from smooth projections in (2) for comparison, with dot-dash lines corresponding to 90% confidence intervals.

Figure B.3: Confidence Changes Following One Standard Deviation Upward Surprises in Selected Macroeconomic Data Releases

Notes: An upward surprise means the statistic released is higher than the Bloomberg consensus forecast. Estimates based on smooth projections (2) of the daily Gallup ECI on the data release minus the consensus forecast. Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.

(a) Local Projections
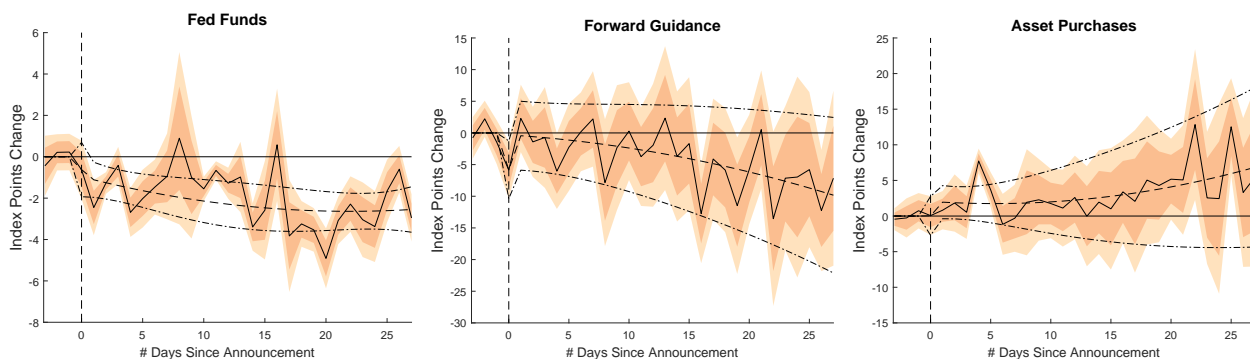
(b) Smooth Projections

Figure B.4: Confidence Impact Following News of Tighter Monetary Policy

Notes: Estimates based on local projections (3) and smooth projections (4) of the daily Gallup ECI on the monetary policy surprises constructed in Lewis (2019a). 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 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. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.

(a) Swanson (2017) monetary policy shock measures
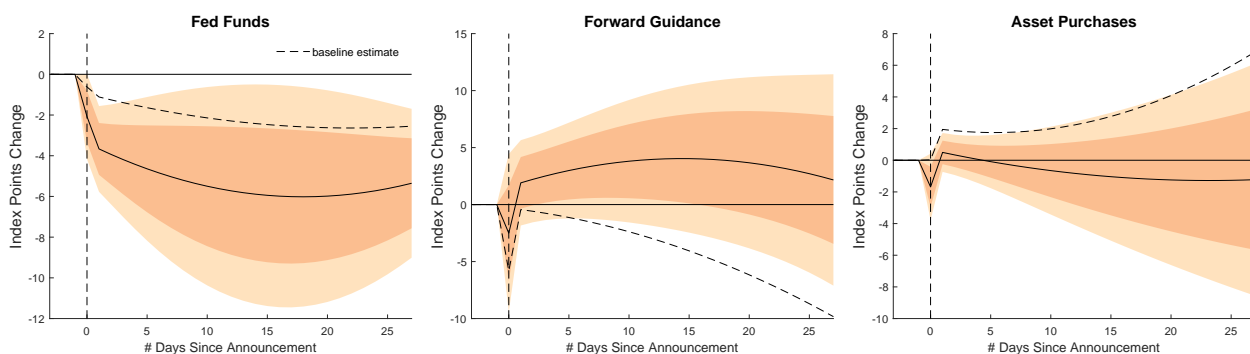
(b) 30-minute window interest rate changes
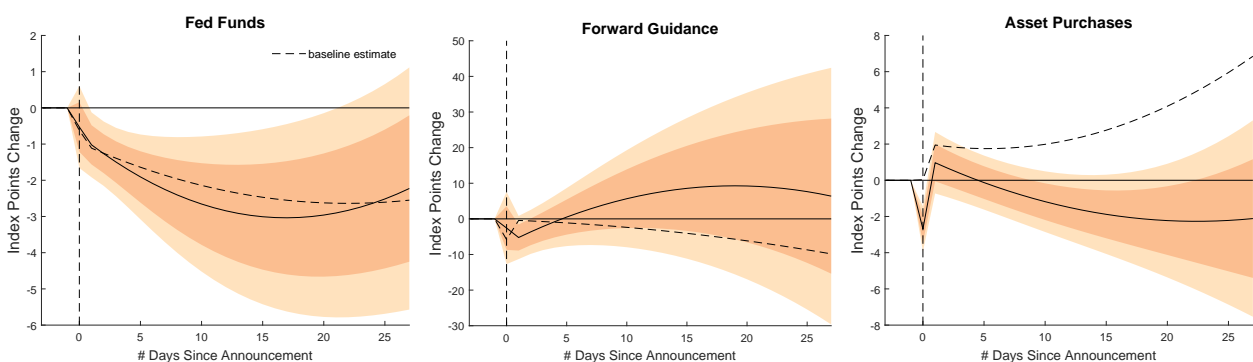
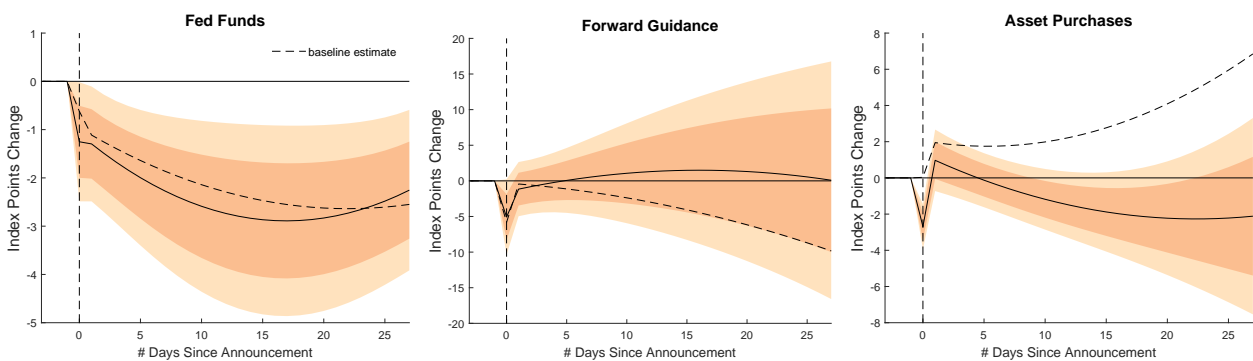(c) 30-minute window interest rate changes, orthogonalized

Figure B.5: Confidence Impact of Monetary Tightening: Alternative Multidimensional Measures of Monetary Policy Shocks

Notes: Estimates based on smooth projections (4) of the daily Gallup ECI on the monetary policy surprises. The first row uses the measures of Swanson (2017). The second and third row use 30-minute window price changes in the front quarter Eurodollar contract, the 2-year Eurodollar contract, and the 10-Year Treasury. In the third row, the longer rates are first orthogonalized recursively. Baseline estimates (broken lines) are the point estimates shown in Figure B.4b. 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. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.

(a) Nakamura and Steinsson (2018) Fed Funds shock

(b) Nakamura and Steinsson (2018) Policy News shock

(c) Gertler and Karadi (2015) shock

(d) Jarocinski and Karadi (2018) shock
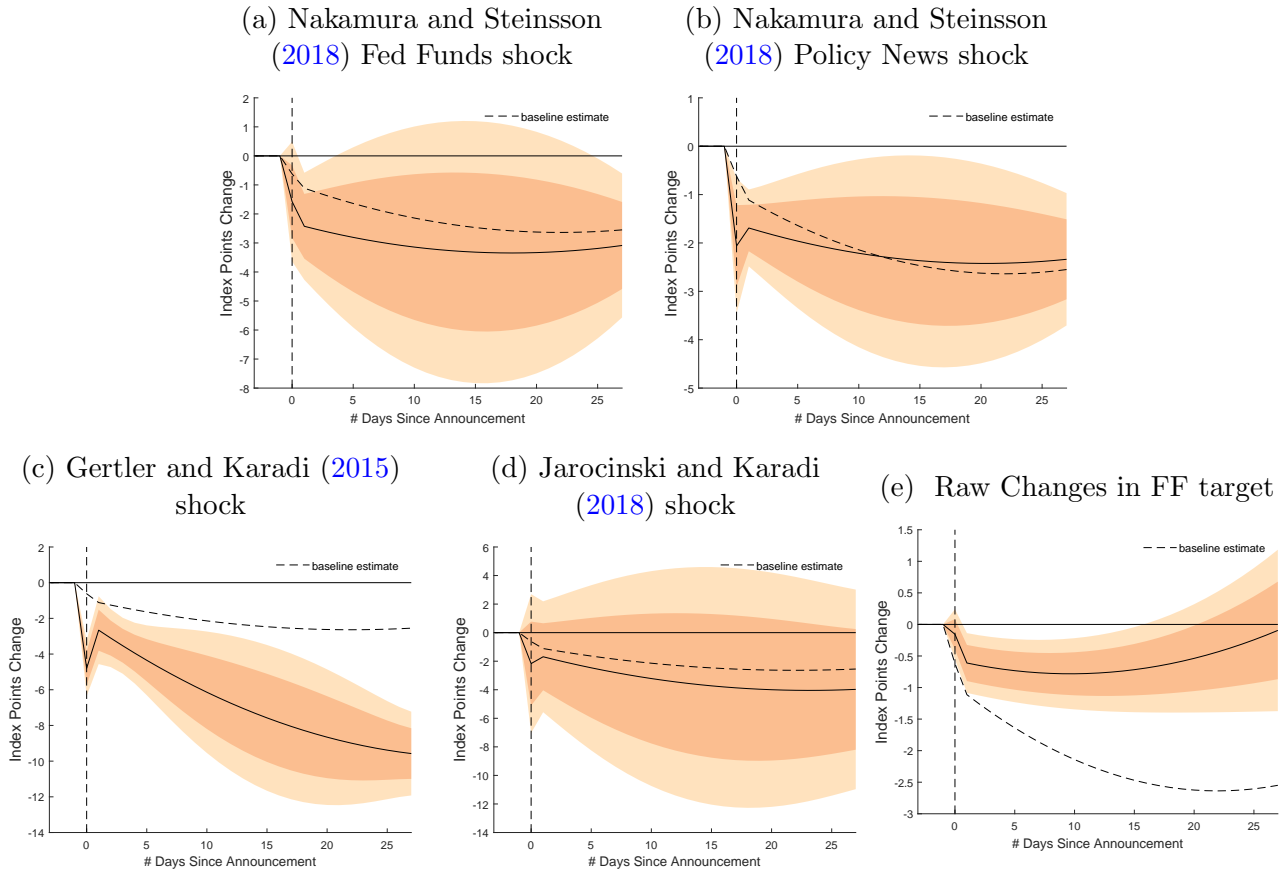
(e) Raw Changes in FF target

Figure B.6: Confidence Impact of Monetary Tightening: Alternative Shock Measures

Notes: Estimates based on smooth projections of the daily Gallup ECI on the monetary policy surprises. The specification is as in (4) but with only the single shock measure on the right hand side. In (d), we include the Jarocinski and Karadi (2018) information effect shock as an additional control. Responses are scaled to a shock corresponding to a 25 basis-point increase in the Federal Funds rate. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a. Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Baseline estimates (broken lines) are the point estimates for the Fed funds shock in the left panel of Figure B.4b. Sample periods vary across specification, ending in (a)/(b) March 2014, (c) June 2012, and (d) December 2016.
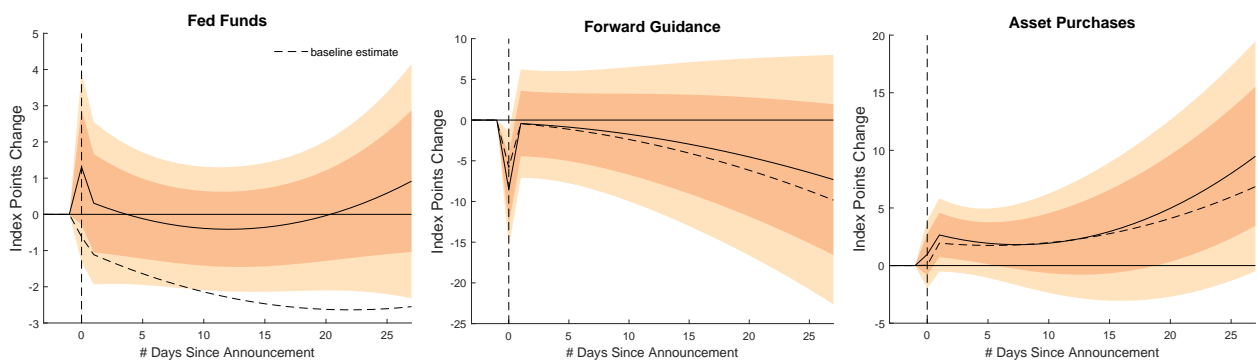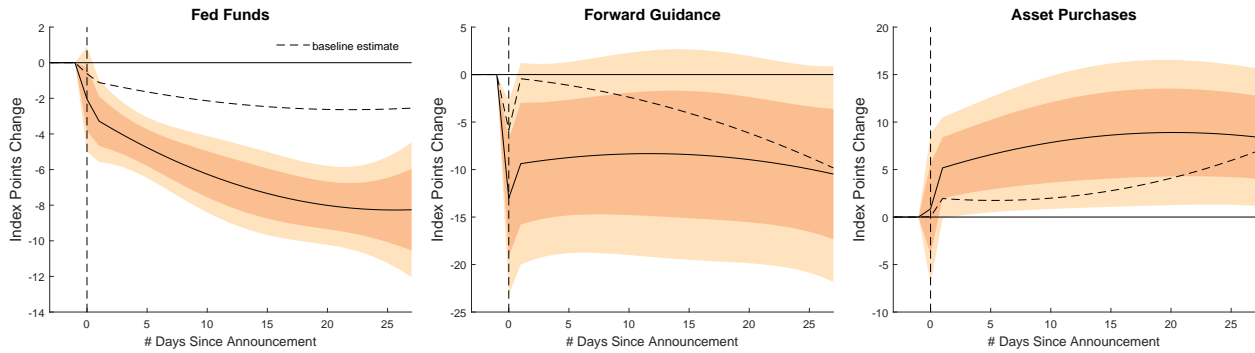
Figure B.7: Confidence Impact of Monetary Tightening, Controlling for Equity Price Interactions

Notes: Estimates based on smooth projections (6) of the daily Gallup ECI on the monetary policy surprises constructed in Lewis (2019a). Shaded areas denote 68% and 90% Lazarus et al. (2018) confidence intervals. Baseline estimates (broken lines) are the point estimates shown in Figure B.4b. 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. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.

(a) Confidence Impact of Monetary Tightening

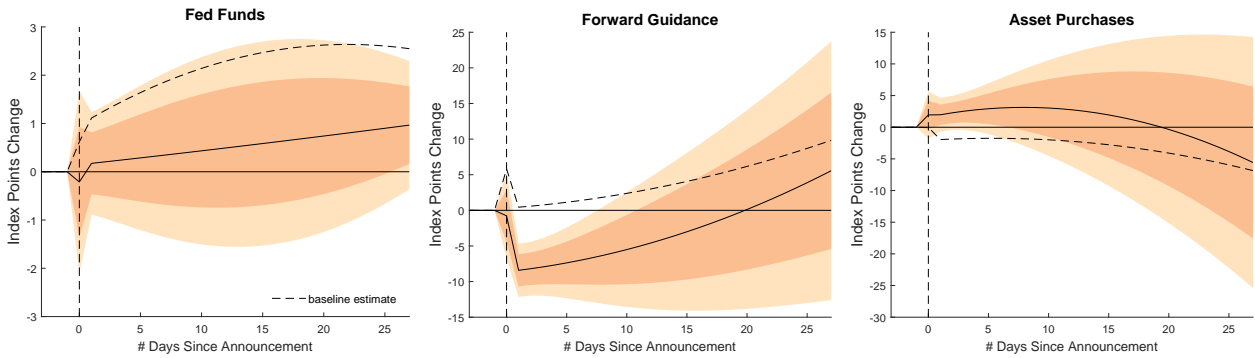(b) Confidence Impact of Monetary Loosening

Figure B.8: Asymmetries in Confidence Impact of Monetary Policy Surprises

Notes: Estimates based on smooth projections of the daily Gallup ECI on the monetary policy surprises constructed by Lewis (2019a). The specification is as in (8) and includes all three baseline Lewis (2019a) monetary policy shocks. 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 (top row) or decrease (bottom row) 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. Index point changes in confidence are on the same scale as the Michigan Consumer Sentiment index, as in Figure 1a.

TABLE B.II: 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. All Survey Respondents (Weekly):			
Economic Confidence Index (ECI)	0.82	(0.05)	501
Current Conditions Index	0.77	(0.07)	501
Future Conditions Index	0.82	(0.04)	501
c. All Survey Respondents (Monthly):			
Economic Confidence Index (ECI)	0.30	(0.18)	117
Current Conditions Index	0.27	(0.19)	117
Future Conditions Index	0.28	(0.18)	117
d. By Level of Education (Weekly):			
ECI, High school or less	0.85	(0.07)	494
ECI, Some college	0.77	(0.07)	495
ECI, College graduate degree	0.74	(0.09)	492
ECI, College postgraduate degree	0.67	(0.08)	490
e. By Level of Income (Weekly):			
ECI, Age 18 to 29	0.69	(0.21)	359
ECI, Age 30 to 49	0.75	(0.07)	492
ECI, Age 50 to 64	0.87	(0.06)	494
ECI, Age 65 and over	0.86	(0.07)	497
f. By Age Group (Weekly):			
ECI, Low income (less than $ 36K)	0.73	(0.08)	492
ECI, Mid income ($ 36K to $ 90K)	0.80	(0.06)	496
ECI, High income (more than $ 90K)	0.73	(0.08)	491

Notes: Listed are estimates of λ obtained by estimating the ARMAX(1,1) process in (17) using Hannan and Rissanen (1982)'s method. Standard errors in parentheses. The maximum sample range is Jan 2, 2008 to Dec, 27 2017.