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Abstract

We study the impact of the Fed's monetary policy announcements on households' expectations by comparing responses to the Survey of Consumer Expectations before and after Federal Open Market Committee (FOMC) meetings, over the period 2013-2019. We find that Fed decisions affect expectations of interest rates on savings accounts, particularly for respondents with high financial and numerical literacy. The effect is particularly strong in the first few days after the announcement of the decision and decays in the days that follow. The impact of monetary policy announcements on inflation expectations is muted, even in response to some of the most relevant meetings of the FOMC that took place during that period. Expectations of personal financial conditions are barely affected. Our results stand in contrast to experimental studies that find strong effects of monetary policy and other macroeconomic news on expectations of households receiving a specific treatment, suggesting that the news naturally reaching the general population may provide weaker signals.

JEL Classification: E30, E40, E50, E70

Keywords: household expectations, monetary policy announcements, communication

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1 Introduction

The effects of monetary policy depend critically on the public getting the message about what policy will do months or years in the future.

Janet Yellen, April 04, 2013 (Yellen 2013)

Central banks have taken measures to become more transparent and improve their communication with the public over the past decades (Dincer, Eichengreen, et al. 2014). More specifically, their communication strategies have been refined with the aim of reaching all economic agents – most notably households – rather than just a few highly attentive financial market participants (Binder 2017). Recent changes in major central banks' monetary policy frameworks have further emphasised the role played by the management of expectations. The shift to average inflation targeting at the Federal Reserve System and the emphasis on enhanced forward guidance at the European Central Bank signal confidence in the ability of monetary policy to affect agents' inflation expectations.

While the responsiveness of financial markets participants to monetary policy has been extensively documented (see, e.g. Gürkaynak et al. (2005), Bernanke & Kuttner (2005), Gagnon et al. (2011), D'Amico & Farka (2011), Andrade & Ferroni (2021), Swanson (2021)), the evidence on households' reaction is more scant, not least due to data limitations.

In this paper, we contribute to filling this gap by analysing the response of US households' expectations to monetary policy decisions of the Federal Open Market Committee (FOMC henceforth). We use a sample of roughly 35,000 responses to the NY Fed Survey of Consumer Expectations between June 2013 and March 2019 to identify causal effects of monetary policy announcements. We do so by comparing responses given in the days right before FOMC meetings to those given right after. This identification strategy relies on the fact that respondents are assigned randomly to the day of the month on which they are invited to answer the survey.

Our guiding principle in the analysis of the effects of monetary policy announcements on expectations is consistency with some basic economic relationships. Do respondents anticipate a negative relation between interest rates and output or unemployment, as predicted by a standard Euler equation? Do potential expected changes in aggregate demand and labor market conditions then feed through into respondents' inflation expectations, as predicted by the Phillips curve?

To characterise monetary policy announcements, we use several measures with a different degree of complexity. In principle, the multidimensional nature of monetary policy since the Great Financial Crisis suggests that a single quantitative measure of monetary policy surprises might not be sufficient to adequately characterise the decisions taken in a FOMC meeting. Yet less sophisticated households may lack the capacity (and willingness) to decipher fine details of monetary policy announcements and may only be able to digest simpler information. We therefore consider different measures of monetary policy actions in growing order of complexity and sophistication. First, we consider a crude dummy variable that takes unit value if there is a change in the policy instrument. Second, we look at changes in a shadow policy rate, taken as a summary measure of conventional and unconventional monetary policy. Finally, we consider monetary policy shocks extracted using high-frequency identification techniques (see Swanson (2021)) that portray more comprehensively the various facets of unconventional monetary policy: a Federal Fund Rate factor, a Large Scale Asset Purchase factor and a Forward Guidance factor.

We first test whether and to what extent households change their expectations about the aggregate economy and their personal financial situation, following the communication of FOMC's actions. Second, we study expectations about household consumption and personal job prospects. Expectations are policy-relevant insofar as they translate into consumption, labor and spending decisions. While we cannot observe such decisions, expectations about personal unemployment and spending plans can give us an indication of whether households *plan* to react to a monetary policy change.

The degree to which monetary policy affects both macroeconomic and personal financial expectations might differ across respondents. There is an extensive literature on personal characteristics that determine the understanding of, interest in, and reaction to news about the economy (see, e.g. Bruine de Bruin et al. (2010)). Financial literacy stands out as one of the most important determinants. We therefore test whether there are subgroups of the population that thanks to their economic and financial literacy, have an easier time deciphering monetary policy news and their impact on personal finances.

Our results point to a robust reaction of expectations about the interest rate on saving accounts to FOMC decisions in the sample as a whole, the impact being larger the smaller the time window

around the FOMC announcements. Respondents with higher financial literacy or exposure to financial decisions tend to respond more strongly. On the contrary, we find no effects of monetary policy announcements on inflation expectations or on expectations of personal financial conditions. We also document that households react particularly strongly in the first few days following the announcement of the decision, while the effect dissipates within two to three weeks of the FOMC meeting. The results are also illustrated using one of the most salient episodes of monetary policy making that occurred during the sample period – the "Taper Tantrum" between June and December 2013.

This paper relates to an experimental literature that documents the responsiveness of household economic expectations to specific types of central bank communication (Coibion et al. (2019) and Coibion et al. (2020)). An important difference is that in this literature central banks' communication is forced upon the respondents – that is, households are given content to read before answering the questions, rather than having to fetch the information themselves, as in the real world. While these experiments provide very important contributions by isolating the mechanisms through which news about the macroeconomy affect household expectations, the strong impact found in experimental studies may be amplified by the clear-cut and easy-to-interpret information provision in those experiments.

Our methodology can assess whether the signal provided by real world monetary policy announcements is sufficiently strong to reach possibly inattentive households. Our contribution belongs to a different strand of literature that evaluates announcement effects using an event study approach (Lewis et al. (2019), Lamla & Vinogradov (2019), Claus & Nguyen (2020))). We add to this literature along three main dimensions. First, our long sample covering 47 FOMC meetings includes the period when policy rates were close to the zero lower bound and the Fed implemented unconventional policy measures. Second, we use a wide range of elicited expectations, on the macroeconomy as well as on personal finances, to understand whether household expectations adhere to simple yet meaningful economic relationships. Third, we exploit household characteristics to test whether numerical and financial literacy facilitate the transmission of monetary policy through expectations.

In the next section we present the related literature based on event studies in more detail. Section 3 presents the survey data and discusses how we measure monetary policy decisions. Section

4 lays out our identification and estimation strategy. Our baseline results are presented in section 5. In section 6 we investigate whether exposure to financial decision making and financial and numerical literacy help households grasp the effects of monetary policy. Section 7 concludes.

2 Related Literature

Several recent papers study announcement effects of monetary policy decisions relying on event studies.

The closest paper to ours is Lamla & Vinogradov (2019) which surveys a random sample of the US population two days before and after 12 FOMC meetings between 2015 and 2018, applying a very similar methodology as we do. They find that announcements have no effects on respondents' inflation nor on interest rate expectations. One main difference relative to our approach is that they only have limited variation in treatment intensities across FOMC meetings. In 7 out of the 12 meetings they consider, interest rates had been increased, while during the remaining 5 meetings no changes occurred. Another key difference is that monetary policy changes are only measured using the federal funds rate. The effects of forward guidance or large scale asset purchases therefore cannot be measured. By opting for high frequency identified financial market shocks as treatment variable, we can differentiate between conventional and unconventional measures and document which one is more apt to affect household expectations. Our analysis also benefits from a larger sample of FOMC meetings. We cover 47 FOMC meetings which capture interest rate reductions as well as changes in unconventional monetary policies. The richer data and methodology have material implications for the results. We find that household interest rate expectations do react to FOMC announcements, despite the remaining expectations being largely insensitive. Moreover, we show that households with higher numerical and financial literacy revise interest rate expectations more strongly.

Claus & Nguyen (2020) take a different approach to identify monetary policy shocks on economic expectations of Australian consumers. They find that consumers react to monetary policy both in their macroeconomic expectations as well as their personal financial decisions. Inflation expectations seem to be well anchored and do not react instantaneously to monetary policy shocks. Despite tackling a very similar research question, their identification strategy differs quite substantially from

ours. The authors identify unobserved news shocks driven by monetary policy changes in a latent factor model through co-movements in the second moments of elicited expectations on the day in which a monetary policy announcement occurred. We see our contribution as complementary to their work due to the differences in the identification strategy. The authors choose to identify shocks to respondents' information sets through heteroskedasticity in the expectations of the respondents themselves. They point out that this may be superior to measures obtained from financial markets as the expectation formation mechanisms may differ between consumers and financial markets. If that is the case, shocks identified on financial markets may simply be uncorrelated to reactions of consumer expectations. However, we argue that the "off the shelf" monetary policy measures we apply prove to be an adequate gauge of treatment intensity. Our FOMC-meeting specific analysis in section 5.3, which is agnostic concerning the expectation formation of consumers and does not make use of measures obtained from financial markets, confirms our baseline results.

Lewis et al. (2019) use daily Gallup consumer surveys in the United States to assess the impact of monetary policy news on households' consumer sentiment. The consumer sentiment variable is an aggregate measure of responses to two questions about household view of economic conditions at the time of the response, over an undefined future horizon. The authors then estimate the impact of monetary policy shocks on this time series using local projections. They find that an upward shock to the federal funds rate has significantly negative effects on consumer confidence in the days after FOMC meetings. They find no evidence for effects of Forward Guidance or Asset Purchases and do not test other, more naive, measures such as mere policy changes.

Bottone & Rosolia (2019) use Italian firm managers' survey responses around ECB Governing Council meetings to estimate the impact of monetary policy decisions on these managers' inflation expectations and their expectations about their own firms' prices. The dual focus – macroeconomic variables as well as firm-specific variables – is analogous to ours, yet on a different set of respondents. Monetary policy changes are measured using high-frequency financial market variables. They find significantly negative effects of those shocks on managers' inflation expectations while no effects are detected for the managers' own firms' price expectations.

Due to our wide range of survey questions covering both macroeconomic as well as personal financial expectations, we also relate to the literature on economic understanding among the gen-

eral population. Dräger et al. (2016) evaluate the consistency of survey answers to the Michigan Survey of Consumers with economic theory. In their sample, about half of the responses are consistent with the Taylor Rule and roughly one third are consistent with the Phillips Curve. A closely linked study by Andre et al. (2019) experimentally analyzes economic models of the general public. Following a hypothetical change in the Federal Funds Rate, the authors show that a substantial portion of individuals deviates from experts' predictions when forecasting the reaction of inflation to an interest rate shock, while predicting qualitatively similar changes in unemployment. Higher financial literacy increases consistency of responses with those given by experts. Another related experimental study is Roth & Wohlfart (2020). The authors randomly treat respondents in an online experiment with expert opinions on the likelihood of a recession. They find that negative macroeconomic expectations translate into higher personal job loss expectations as well as lower consumption growth expectations.

Overall, experimental studies tend to find strong effects of macroeconomic news on a range of household expectations - both regarding the macroeconomy and personal finances. On the contrary, our observational study based on the impact of FOMC announcements on household expectations suggests that real-world news provide weaker and more difficult to interpret signals relative to experiments in which information is explicitly provided.

The choice of personal characteristics that we condition on is guided by the literature on financial literacy. Lusardi & Mitchell (2014) document stark differences in financial literacy across demographic groups in developed countries and its impact on decision making. Individuals with lower levels of education tend to give more incorrect answers to survey questions eliciting financial literacy. Younger and older respondents perform worse, as well as women. Bruine de Bruin et al. (2010) show that individuals with lower financial literacy tend to have higher and less accurate inflation expectations than those with high financial literacy. In the experimental analysis of individuals' reactions to economic news Andre et al. (2019) find that higher financial literacy is correlated with reactions that are more similar to those of experts. We therefore investigate whether more financially literate respondents according to two complementary measures exhibit different reactions to monetary policy news compared to those with lower financial literacy.

3 Data

3.1 Survey of Consumer Expectations

The Survey of Consumer Expectations (SCE henceforth) is a monthly online survey conducted by the Federal Reserve Bank of New York, eliciting economic expectations among the U.S. population. The questions cover a wide range of macroeconomic as well personal financial expectations. To complete the core survey module respondents usually take 15 minutes. Participation in the survey is capped at 12 months, after which a respondent ceases to be surveyed. Outgoing respondents are being replaced on a rolling basis and new respondents are selected based on a stratified sampling procedure aiming to maintain a representative sample of the population in terms of its demographic and socioeconomic composition. Respondents who fail to respond to three consecutive modules are not invited to complete further survey modules. In total, between 1200 and 1400 respondents are surveyed each month since June 2013. The sample available at the time of our analysis runs until March 2019. Armantier et al. (2017) provide a comprehensive overview of the survey design. In the following, we will give more information about the sample composition and descriptive statistics on the outcome variables of our analysis.

3.2 Expectation Variables

Our analysis studies the reaction of economic expectations of SCE respondents to monetary policy announcements. Table 1 contains information about the outcome variables employed in our analysis. The survey makes use of two different approaches to the measurement of economic expectations. Some variables, namely those on interest rates on savings accounts, aggregate unemployment and stock market expectations, are elicited by asking respondents about the probability they assign to an increase in the respective variable over the 12 months following the survey response. The other macroeconomic and personal financial variables (except unemployment) are elicited in terms of their expected growth rate over a specified time horizon. Expectations about personal unemployment in the 12 months following the survey response are instead elicited by asking for the expected probability of that event. For the exact wording of each question we refer to the second column of Table 1.

Binder (2019) presents evidence that survey responses in the Survey of Consumer Expectations exhibit patterns consistent with panel conditioning. This problem occurs when survey respondents progressively change their behavior because of participation in the survey. Specifically, she finds

that respondents in their early rounds of participation consistently revise their inflation expectations downwards, irrespective of actual inflation dynamics. Despite no evidence of non-random assignment of respondents to specific parts of the month according to the survey description, control and treatment groups exhibit differing average panel tenure levels if the full sample is used. We therefore exclude responses that are given before the seventh round of participation of each respondent. For more details on our approach on this issue we refer to the online appendix.

Table 2 gives descriptive statistics about each of the variables in the previous table, for the subsample of responses given after having participated at least seven times. The maximum number of observations possible per respondent is therefore five.

3.3 Measurement of Monetary Policy Announcements

Our selection of the monetary policy measures that characterise an announcement was guided by two counteracting considerations. First, monetary policy has become more multidimensional since the Great Financial Crisis. One single, quantitative measure like the Fed funds rate might therefore not be sufficient to adequately characterise the decisions taken in an FOMC meeting. Secondly, the capacity and willingness of agents to devote the necessary attention to monetary policy in order to understand its multidimensionality might be limited. This calls for a unified and easy-to-interpret measure. We therefore apply multiple measures that each weigh these two considerations differently.

The most naive measure of monetary policy decisions is a dummy variable that simply indicates whether the Federal Funds Rate (in non-ZLB periods) or the shadow rate (following the methodology of Lombardi & Zhu (2018) during the ZLB-period) increased due to the decisions taken at an FOMC meeting. It takes the value 0 in case of a constant or declining rate, and 1 otherwise. A more refined measure is the change in the shadow rate itself as it allows for varying treatment intensities.

While the change in the shadow rate in principle incorporates different dimensions of monetary policy, it neither disentangles the different dimensions nor does it reveal to what extent a policy change has been anticipated. High-frequency identified financial market surprises can deliver both a multi-dimensional view of monetary policy as well as a quantification of policy changes that were unexpected by financial market participants. The measures reflect the multidimensionality

Table 1: Overview Economic and Financial Expectations

Variable Name	Survey Question	Time Coverage	Answer Range
Interest Rate 12m	What do you think is the percent chance that 12 months from now the average interest rate on saving accounts will be higher than it is now?	2013/03-2019/03	0-100%
Unemployment 12m	What do you think is the percent chance that 12 months from now the unemployment rate in the U.S. will be higher than it is now?	2013/06-2019/03	0-100%
Stock Market 12m	What do you think is the percent chance that 12 months from now, on average, stock prices in the U.S. stock market will be higher than they are now?	2013/06-2019/03	0-100%
Inflation Rate 12m	What do you expect the rate of inflation/deflation to be over the next 12 months?	2013/06-2019/03	$\mathbb{R}$
Inflation Rate 36m	What do you expect the rate of inflation/deflation to be between 24 and 36 months from now?	2013/06-2019/03	$\mathbb{R}$
House Price Inflation 12m	By about what percent do you expect the average home price to increase/decrease over the next 12 months?	2013/06-2019/03	$\mathbb{R}$
House Price Inflation 36m	By about what percent do you expect the average home price to increase/decrease between 24 and 36 months from now?	2013/06-2019/03	$\mathbb{R}$
Lose Job 12m	What do you think is the percent chance that you will lose your main/current job during the next 12 months?	2013/06-2019/03	0-100%
Household Spending 12m	By about what percent do you expect your total household spending to increase/decrease?	2013/06-2019/03	$\mathbb{R}$
Household Income 12m	Over the next 12 months, what do you expect will happen to the total income of all members of your household (including you), from all sources before taxes and deductions?	2013/06-2019/03	$\mathbb{R}$

of monetary policy as they exploit the fact that the same FOMC decision can have different effects at different points along the yield curve. We therefore extend the analysis by considering the three monetary policy factors proposed by Swanson (2021). In a nutshell, the Federal Funds Rate Factor measures surprises at very short maturities, the Forward Guidance Factor at intermediate maturities and the Large Scale Asset Purchases Factor at longer maturities. Using these factors as monetary policy measures allows us to measure the degree to which different policies implemented by the Federal Reserve, e.g. forward guidance or asset purchases, have differential effects on agents' expectations. The three factors are estimated from the first three principal components of the asset price response in a 30-minute window around FOMC meetings. Due to the short time frame around

Table 2: Descriptive Satistics for Economic and Financial Expectations

Variable	Panel	Mean	Median	Sd	Min	Max	Observations
Interest Rate 12m	Overall	33.03	30.00	26.47	0.00	100.00	N = 36755
	Between			22.67	0.00	100.00	n = 7974
	Within			13.69	-41.97	116.37	T = 4.61
Unemployment Rate 12m	Overall	35.27	31.00	22.83	0.00	100.00	N = 36754
	Between			19.38	0.00	100.00	n = 7975
	Within			12.84	-48.07	116.27	T = 4.61
Stock Market 12m	Overall	40.25	45.00	23.47	0.00	100.00	N = 36629
	Between			20.11	0.00	100.00	n = 7958
	Within			12.60	-43.08	123.58	T = 4.60
Inflation Rate 12m	Overall	4.22	3.00	4.21	-5.00	25.00	N = 34750
	Between			4.10	-5.00	25.00	n = 7818
	Within			2.08	-15.78	24.88	T = 4.44
Inflation Rate 36m	Overall	4.25	3.00	4.30	-9.00	25.00	N = 34613
	Between			4.17	-5.00	25.00	n = 7807
	Within			2.18	-14.35	22.45	T = 4.43
House Price Inflation 12m	Overall	5.04	5.00	4.52	-10.00	20.00	N = 34902
	Between			4.17	-10.00	20.00	n = 7870
	Within			2.43	-14.12	22.44	T = 4.43
House Price Inflation 36m	Overall	4.88	4.50	4.56	-10.00	20.00	N = 34556
	Between			4.24	-10.00	20.00	n = 7838
	Within			2.48	-14.29	20.68	T = 4.41
Prob. to lose job	Overall	14.07	6.00	19.54	0.00	100.00	N = 21104
	Between			18.22	0.00	100.00	n = 4939
	Within			9.92	-69.26	97.40	T = 4.27
Spending 12m	Overall	3.63	3.00	6.15	-20.00	25.00	N = 34412
	Between			5.43	-20.00	25.00	n = 7847
	Within			3.80	-23.37	28.63	T = 4.39
Household Income 12m	Overall	3.62	2.00	6.04	-20.00	35.00	N = 33997
	Between			5.55	-20.00	30.00	n = 7788
	Within			3.44	-21.38	33.62	T = 4.37

the announcement of the decision, any change in these asset prices can be interpreted as a reaction to the decision taken at an FOMC meeting.

Jarociński & Karadi (2020) have shown that the same monetary policy surprise can have significantly different effects on the economy depending on the information that the central bank reveals with the decision. They differentiate between two situations: if stock markets rise after a tightening of monetary policy, the central bank has revealed that its information about the outlook of the economy is more positive than previously expected. The authors label this channel the "central bank information shock". In case stock markets fall in response to a policy tightening, as conventional monetary transmission would predict, a traditional monetary policy shock has occurred. In case of a tightening of monetary policy, the information shock is shown to have expansionary effects while the monetary policy shock has contractionary effects on the economy. In a fourth regression for each outcome variable we also include these shocks.

Table 3 lists the specific values of all seven monetary policy measures for each FOMC meeting that is part of our analysis. Additionally, it shows the exact observation count for each meeting. In our regressions, all continuous monetary policy measures – the change in the shadow rate, the Swanson factors and the Jarociński & Karadi shocks – are standardised with mean 0 and variance 1, while the table lists the non-standardised values. Standardising enables us to compare the magnitude of the coefficients. A comparison of the effects of the different shocks is useful to better understand the degree to which the multidimensionality of monetary policy is understood and processed by the general population.

4 Estimation Strategy and Identification

We estimate the treatment effect of monetary policy announcements by comparing the expectations of survey respondents right before the FOMC meeting with those given right after. This identification method for announcement effects of monetary policy is borrowed from event studies on financial market responses (see among others e.g. Gürkaynak et al. (2005) and Swanson (2021)) and has recently been applied to household and firm survey data at a lower frequency (see among others e.g. Bottone & Rosolia (2019) and Lamla & Vinogradov (2019)).

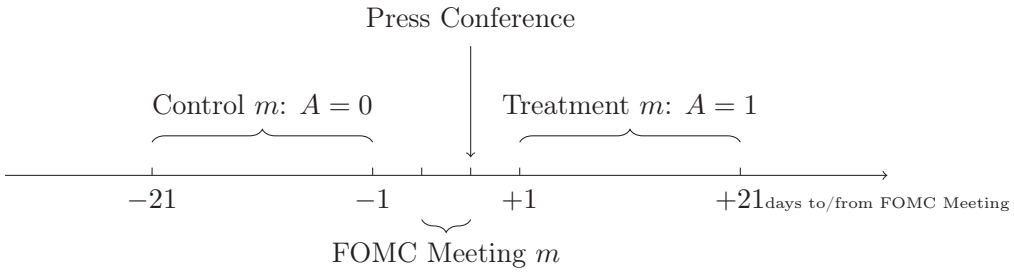
Table 3: Overview FOMC Meetings

FOMC Meeting Day	Tigtening Y/N	Δ Shadow Rate	FFR	FG	LSAP	MP	CBI	Obs. Before	Obs. After
19 Jun 2013	1	0.19	0.16	1.28	1.96	0.01	0.01	154	123
31 Jul 2013	1	0.00	0.09	0.08	-0.23	-0.02	0.04	178	302
18 Sep 2013	0	-0.06	0.08	-1.34	-2.55	-0.06	0.06	314	236
30 Oct 2013	0	-0.34	0.10	0.08	0.33	0.03	-0.01	259	437
18 Dec 2013	1	0.10	0.21	0.02	0.63	-0.04	0.06	311	189
29 Jan 2014	1	0.16	0.22	-0.04	-0.24	0.04	-0.02	183	393
19 Mar 2014	1	0.26	0.06	1.04	0.57	0.03	0.01	315	219
30 Apr 2014	1	0.19	0.15	0.12	0.04	0.01	0.01	341	356
18 Jun 2014	1	0.22	0.09	0.41	-0.16	-0.01	0.03	323	319
30 Jul 2014	1	0.17	0.15	-0.09	-0.23	-0.02	0.03	457	483
17 Sep 2014	1	0.34	0.07	0.75	0.16	-0.00	0.03	423	316
29 Oct 2014	1	0.04	0.09	0.88	-0.01	0.04	-0.00	418	417
17 Dec 2014	1	0.49	0.29	-1.54	0.50	-0.07	0.03	317	334
28 Jan 2015	0	-0.17	0.16	-0.14	-0.14	0.02	-0.01	396	420
18 Mar 2015	1	0.12	0.19	-2.42	-0.77	-0.12	0.06	310	339
29 Apr 2015	0	-0.08	0.20	0.31	0.87	0.00	0.01	404	387
17 Jun 2015	1	0.04	0.09	-0.65	0.14	-0.04	0.01	342	353
29 Jul 2015	1	0.07	0.06	0.48	0.20	-0.01	0.01	370	335
17 Sep 2015	0	-0.12	-0.53	-1.53	-0.64	-0.04	-0.02	323	315
28 Oct 2015	0	-0.02	0.11	1.80	-0.05	0.07	-0.01	390	351
16 Dec 2015	1	0.11	0.31	-0.02	-0.54	0.01	0.02	353	273
27 Jan 2016	1	0.13	0.01	-0.46	-0.06	0.02	-0.03	392	361
16 Mar 2016	0	0.00	-0.11	-1.81	0.04	-0.06	-0.02	333	275
27 Apr 2016	1	0.01	0.10	0.33	-0.25	-0.00	0.03	370	364
15 Jun 2016	1	0.01	0.04	-0.78	0.19	-0.01	-0.02	336	319
27 Jul 2016	1	0.01	0.09	0.16	-0.32	-0.00	0.02	368	326
21 Sep 2016	1	0.01	-0.39	-0.18	-0.47	-0.03	0.01	333	343
02 Nov 2016	1	0.01	0.12	0.18	-0.05	0.00	0.01	340	366
14 Dec 2016	1	0.13	0.03	1.39	0.23	0.04	0.02	327	376
01 Feb 2017	1	0.12	0.13	-0.38	0.13	-0.02	0.01	401	444
15 Mar 2017	1	0.13	0.25	-1.31	0.03	-0.03	-0.00	401	376
03 May 2017	1	0.12	0.19	0.40	-0.00	0.01	0.02	322	364
14 Jun 2017	1	0.13	0.32	0.35	0.01	0.02	0.01	330	355
26 Jul 2017	1	0.11	0.10	-0.21	-0.21	-0.00	0.00	404	339
20 Sep 2017	0	0.00	0.05	1.17	-0.12	0.04	0.02	370	332
01 Nov 2017	1	0.01	0.14	0.14	0.02	0.00	0.01	373	354
13 Dec 2017	1	0.14	0.20	-0.21	-0.17	-0.00	0.01	378	296
31 Jan 2018	1	0.11	0.18	0.25	0.16	0.02	0.01	376	445
21 Mar 2018	1	0.10	0.12	0.11	0.37	-0.02	0.03	380	367
02 May 2018	1	0.19	0.16	-0.19	-0.10	-0.01	0.01	302	383
13 Jun 2018	1	0.12	0.02	0.84	0.10	0.03	0.01	370	349
01 Aug 2018	1	0.09	0.19	-0.05	-0.06	0.01	0.01	332	402
26 Sep 2018	1	0.04	0.31	-0.19	0.04	-0.01	0.02	343	386
08 Nov 2018	1	0.25	0.13	0.27	-0.05	0.01	0.02	330	379
19 Dec 2018	1	0.07	0.50	-0.04	-0.48	0.07	-0.03	323	357
30 Jan 2019	1	0.13	0.13	-0.67	0.08	-0.06	0.04	383	424
20 Mar 2019	1	0.01	0.36	-1.22	-0.18	-0.04	0.02	408	310

Note: Meeting Day indicates day of press conference. Change in shadow rate and shock variables are rounded to two decimal points. FFR: Federal Funds Rate Factor; FG: Forward Guicance Factor; LSAP: Large Scale Asset Purchases Factor (all Swanson (2021)). MP: Monetary Policy Shock; CBI: Central Bank Information Shock (all Jarociński & Karadi (2020)). Obs. Before reports number of responses up to (and including) 21 days before FOMC Meeting. Obs. After reports all responses up to (and including) 21 days after the meeting.

Figure 1 shows the exact timing of our analysis for an exemplary FOMC announcement m. We use a symmetric time window around FOMC meetings. Each cohort is split into control and treatment group based on whether a survey response has been completed before or after a given FOMC meeting, measured by the treatment dummy variable A that takes on the value 0 before the announcement and 1 afterwards. We exclude any responses that have been filed on the days of a meeting as we cannot observe whether the survey module was completed before or after the meeting.

Figure 1: Identification Timeline

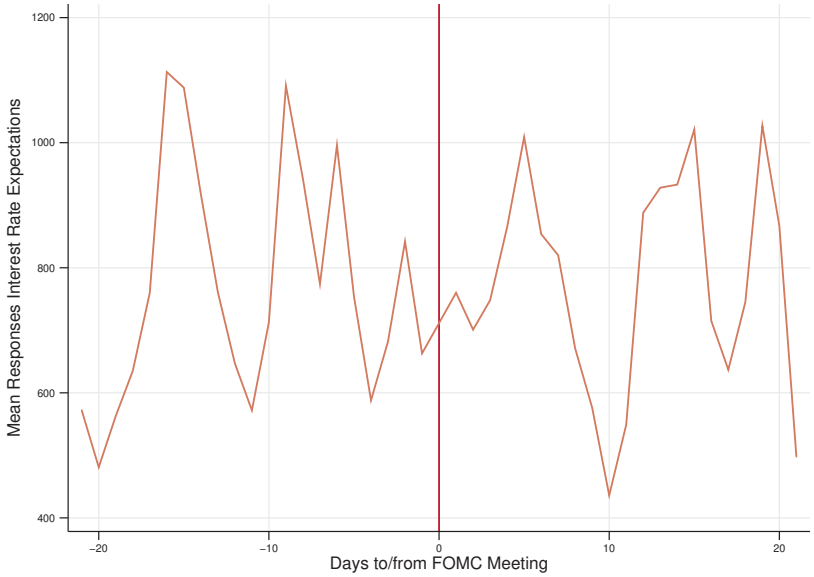


Our identification strategy crucially relies on the fact that respondents are assigned randomly to the day of the month on which they are invited to answer the survey. They are allocated to one of the three batches in which the survey module is sent out in their first month of participation. Afterwards, respondents are assigned with the aim of ensuring equal spacing between each monthly module, thereby implicitly preserving the initial random assignment of respondents to batches.

Figure 2 shows no systematic pattern in the average number of responses to the question on interest rate expectations over the symmetric 42-day window around FOMC meetings. This suggests that respondents receiving the survey module before the FOMC meeting do not show any tendency to postpone their answers to the days after the FOMC decision – a pattern that could possibly bias our results. The number of responses for the other questions follow virtually the same pattern as the one shown in figure 2.

In our baseline analysis we run four separate regressions of each expectation variable from Table 1 on the treatment indicator interacted with i) a dummy variable indicating whether monetary policy was tightened at an FOMC meeting, ii) the change in the shadow rate according to Lombardi & Zhu (2018) between two FOMC meetings, iii) the three factors characterizing the surprise component of an FOMC decision according to Swanson (2021), and iv) the two factors disentangling surprises ac-

Figure 2: Average number of responses per day relative to FOMC meeting



cording to the information conveyed by the central bank, as proposed by Jarociński & Karadi (2020).

More precisely, we estimate the following baseline regression specification:

$$Y_{im} = \theta_m + \beta \times A_{im} \times \mathbf{s'_m} + \alpha_i + \epsilon_{im} \tag{1}$$

where Y_{im} is the expectation response elicited from respondent i before or after FOMC meeting m, θ_m is a cohort-specific constant, β is a $1 \times k$ row vector, A_{im} is a dummy variable taking on the value 1 if a response of individual i was elicited *after* FOMC meeting m and $\mathbf{s'_t}$ is a $k \times 1$ column vector containing a constant and $k-1$ monetary policy measures.[1] Individual fixed effects are denoted by α_i and ϵ_{im} is an idiosyncratic error term. Individual fixed effects control for time-invariant factors that might impact the level of expectations. Cohort-fixed effects are meant to control for all information that is common for those that answer before and after the FOMC meeting. Controlling for the common information is crucial for the assumption that the only relevant information treatment is provided by the monetary policy news generated by a given FOMC meeting. Standard errors are clustered at the respondent-level.

[1] For the first two measures of monetary policy – that is the dummy and the change in the shadow rate – $k = 2$, so that the vector $\mathbf{s'_t}$ comprises a constant and the dummy variable or the change in the shadow rate. For the Swanson-Factors, $k = 4$, so that the vector includes a constant and the three factors. For the Jarociński & Karadi-Shocks, $k = 3$, so that the vector includes a constant and the two shocks.

For the heterogeneity results in section 6 we interact the term $\beta \times A_{im} \times \mathbf{s'_m}$ with the levels of the factor variable measuring household characteristics that may determine the reaction to monetary policy news. We thus obtain a separate treatment effect for the base category and the remaining levels.[2]

Identification of causal announcement effects relies on the assumption that the only difference between the information sets of those in the control group and those in the treatment group is the content of the FOMC meeting. Our results are robust to a shortening of the time frame within which responses are included. The choice for 21 days before and after an FOMC meeting was made in order to maximize the number of observations per meeting.

5 Baseline Results

5.1 Macroeconomic Expectations

Table 4 reports the regression results for the following three outcome variables: expectations on interest rates on savings accounts for 12 months ahead, unemployment expectations for 12 months ahead and stock market expectations for 12 months ahead. For all three variables the respondent is asked to fill in the estimated probability that the variable will be higher 12 months after the survey response. It is therefore impossible to draw quantitative conclusions about the marginal effect of a monetary policy change on the expected *level* of the variable in the future. However, as the continuous monetary policy measures are normalised, we can compare the magnitudes of the coefficients and draw conclusions about the relative impact of the different measures.

Columns 1 to 3 in Table 4 report the effects of the post-FOMC meeting dummy depending on the direction of the monetary policy change. The treatment dummy is interacted with a dummy variable that takes the value 1 if the shadow rate increased between two FOMC-meetings. Therefore, the effect of the post-FOMC dummy alone can be interpreted as the treatment effect in case the shadow rate has remained unchanged or decreased. The results show that in case monetary policy is not tightened, the estimated probability of rising interest rates on savings over the 12 months following the survey response decreases significantly. On average it falls by about 1.2 percentage points, the coefficient is significant at the 5%-level. In case of a tightening of monetary policy, the size of the

[2] Numerical literacy and the role in financial decision making are only elicited once for each respondent, the variables are therefore time-invariant at the respondent level. Both heterogeneity variables are factor variables.

Post-FOMC coefficient increases to around 0.4. A joint test for significance of the sum of two coefficients yields an F-statistic of about 3, with a p-value below 0.1. As columns 2 and 3 show, we do not observe any significant effect on the expectations about rising unemployment or stock market prices.

Next, we move on to a more refined measure of monetary policy – quantitative changes in the shadow rate proposed by Lombardi & Zhu (2018). The pattern we observe for the tightening dummy variable holds for quantitative changes in the shadow rate as well. A one standard deviation increase of the shadow rate leads to an increase of the average probability that the interest rate on savings will rise in the 12 months following the response of about 0.5 percentage points. Coefficients of the shadow rate interacted with the treatment dummy in both the unemployment and stock market expectations regressions are close to zero and insignificant.

By using high-frequency identified financial market surprises of monetary policy decisions we try to disentangle the effect of different dimensions of monetary policy on expectations of the general public. The identification procedure of Swanson (2021) tries to capture differential effects of monetary policy decisions along the yield curve, the Federal Funds Rate Factor (FFR Factor) capturing the short end, the Forward Guidance Factor (FG Factor) the medium term and the Large Scale Asset Purchases Factor (LSAP Factor) the long end. Overall, the results from the previous two measures are confirmed: only interest rate expectations are robustly affected.

For an FFR Factor that is one standard deviation above its mean, expectations of higher interest rates significantly increase by about 0.6 percentage points on average (see Column 7, Table 4). At the mean interest rate expectation in the underlying sample, the effect corresponds to a 1.7% increase in the probability of rising interest rates. To put the magnitude of the underlying monetary policy shock into perspective, an example of an FFR Factor roughly one standard deviation above its mean is the FOMC announcement on December 14$^{\text{th}}$, 2014. The language used regarding the timing of monetary policy normalization changed between two press statements. The October statement read that the Federal Funds Rate Target could be raised a "considerable time following the end of the asset purchase programme" (Federal Reserve 2014b). The December statement indicated that "the Committee judges that it can be patient in beginning to normalize the stance of monetary policy" (Federal Reserve 2014a). This was perceived by financial markets as an indication that policy normalization could come sooner than previously expected. As the expected probability

of rising rates within a year at that time was at 28% among the respondents on average, the effect measured by the regression in Table 4 implies an almost 2% increase in the expected probability on average.

The LSAP Factor also explains some of the variation in the interest rate expectations after FOMC meetings – in a similar magnitude as the FFR Factor. Excluding the Taper Tantrum episode, that we discuss separately in subsection 5.3, this effect becomes insignificant. Variation in the FG Factor is not a powerful determinant of variations in interest rate expectations. Regarding unemployment, the effect of the LSAP Factor is marginally significant and negative. A standard deviation surprise tightening of LSAPs leads to a decrease of expectations of rising unemployment of about 0.4 percentage points. However, as for interest rate expectations, this effect is entirely driven by the Taper Tantrum episode, which is discussed in detail later. Stock market expectations are not significantly affected by the Swanson (2021) shocks, neither including nor excluding the Taper Tantrum.

The last set of results in Table 4 concerns the effects of high-frequency identified shocks proposed by Jarociński & Karadi (2020). Consistent with the previous set of results, interest rate expectations react similarly as to the FFR and LSAP Factors. Expectations about unemployment do not react. Contrary to the Swanson (2021) shocks, expectations about rising stock market prices react positively to both the monetary policy shock as well as the information shock. Conditional on being treated by the FOMC decision, the probability of higher stock market prices 12 months after the survey response rises by 0.361 percentage points for a one standard deviation monetary policy shock above its mean. The reaction to a central bank information shock is higher, at 0.486 percentage points for a one standard deviation increase.

Next, we turn to the results for the variable measuring expectations about attainment of the Fed's price stability mandate presented in Table 5. Expected inflation is elicited in a different format than interest rate, unemployment and stock market expectations. Respondents are asked to report their expected inflation rate over the 12 months following the response and for the period between 24 and 36 months following the response. One year ahead expected inflation does not react to either an easing or a tightening of monetary policy, as column 1 in Table 5 shows. The expected inflation rate 3 years ahead does not react either. The coefficients are very similar for both variables and

close to zero. The same is the case for the the announcement effects of the change in the shadow rate. Neither one year nor three year ahead inflation expectations are significantly affected by a change in the shadow rate. The effects of high frequency identified shocks confirm this pattern. The coefficients for all three Swanson (2021) Factors are insignificant and close to zero. The shocks proposed by Jarociński & Karadi (2020) are also largely consistent with the previous null-results. The information shock tends to reduce inflation expectations both over 12 and 36 months and to a similar magnitude. Both effects are insignificant. The monetary policy shock has a marginally significant negative effect on 36-month ahead inflation expectations. The corresponding coefficient on 12-month ahead expectations is also negative but insignificant.

The last set of results on macroeconomic expectations concerns house prices. Respondents are asked to predict the growth of house prices nationally over the 12 months following the survey and over the period between 24 and 36 months following the survey. Table 6 reports the results. House price expectations do not react significantly to the dummy indicator and the change in the shadow rate. They are affected by the Swanson (2021)-shocks. A one standard deviation increase in the FFR Factor decreases expected house price growth over the 12 months following the survey by about 0.07 percentage points, the coefficient is somewhat closer to zero for 36-month ahead expectations. At the mean house price growth expectation (about 5.1%), the effect on 12 months ahead expectations corresponds to an expected 1% decline of the house price growth rate in response to a one standard deviation tightening of the FFR Factor. The LSAP Factor exerts a significant and counter intuitive effect on the 12 month ahead house price growth expectations. They increase by about 0.1 percentage points when the LSAP Factor is one standard deviation above its mean. The LSAP coefficient on house price expectations between 24 and 36 months ahead turns insignificant. However, these effects remain unconfirmed by any other measure of monetary policy as none of the two variables respond significantly to the Jarociński & Karadi (2020)-Shocks.

The effects on interest rate expectations are stronger than the results obtained by Lamla & Vinogradov (2019). The authors find no effect on interest rate and inflation expectations after 12 FOMC meetings between 2015 and 2018. However, when limiting our sample to those 12 meetings, the treatment effect according to all measures we apply is below that of the complete sample. The coefficient of the FFR Factor falls to 0.439 but the joint treatment effect of a standard deviation FFR increase above its mean remains significant. Regarding inflation expectations our results are

consistent with Lamla & Vinogradov (2019) irrespective of the sub sample as our and their analysis find no effects that are significantly different from zero. Our first key result therefore is:

Result 1: *Only expectations about the interest rate on savings accounts are robustly affected by the various measures of monetary policy changes. For any measure of policy tightening/easing the expected probability of rising interest rates increases/falls. No other macroeconomic expectations move in response to FOMC announcements across different monetary policy measures.*

Overall, this set of results suggests limited consistency of respondents' expectations with the basic relationships suggested by mainstream macroeconomic models. Households expect FOMC decisions to affect future nominal interest rates but do not expect interest rates to further transmit to inflation, employment and output.

Table 4: Baseline Regression Results: Macroeconomic Expectations

	(1) Interest 12m	(2) Unempl. 12m	(3) Stocks 12m	(4) Interest 12m	(5) Unempl. 12m	(6) Stocks 12m	(7) Interest 12m	(8) Unempl. 12m	(9) Stocks 12m	(10) Interest 12m	(11) Unempl. 12m	(12) Stocks 12m
Post-FOMC	-1.191**	0.454	0.0500	0.0803	0.0330	-0.103	0.115	0.00679	-0.108	0.0836	0.0324	-0.109
	(0.463)	(0.415)	(0.422)	(0.188)	(0.180)	(0.172)	(0.188)	(0.181)	(0.172)	(0.188)	(0.180)	(0.172)
Post-FOMC × Tightening	1.547***	-0.508	-0.187									
	(0.502)	(0.455)	(0.461)									
Post-FOMC × Δ Shadow Rate				0.472**	-0.000798	-0.0552						
				(0.195)	(0.184)	(0.176)						
Post-FOMC × Federal Funds Rate Factor							0.558***	-0.143	0.202			
							(0.187)	(0.174)	(0.172)			
Post-FOMC × Forward Guidance Factor							0.215	0.195	0.251			
							(0.210)	(0.192)	(0.191)			
Post-FOMC × LSAP Factor							0.506**	-0.412*	0.0303			
							(0.239)	(0.228)	(0.236)			
Post-FOMC × Monetary Policy Shock										0.440**	0.0371	0.361*
										(0.222)	(0.203)	(0.201)
Post-FOMC × Information Shock										0.482**	0.0827	0.486**
										(0.226)	(0.212)	(0.207)
Constant	33.15***	35.12***	40.36***	33.16***	35.12***	40.36***	33.15***	35.12***	40.36***	33.15***	35.12***	40.36***
	(0.0942)	(0.0903)	(0.0862)	(0.0943)	(0.0903)	(0.0863)	(0.0943)	(0.0903)	(0.0862)	(0.0943)	(0.0903)	(0.0863)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FOMC Meeting FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	31662	31661	31525	31662	31661	31525	31662	31661	31525	31662	31661	31525
Respondents	6910	6910	6880	6910	6910	6880	6910	6910	6880	6910	6910	6880
R^2	0.740	0.683	0.717	0.740	0.683	0.717	0.740	0.683	0.717	0.740	0.683	0.717

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Regression Results: Baseline Macroeconomic Expectations

	(1) Inflation 12m	(2) Inflation 36m	(3) Inflation 12m	(4) Inflation 36m	(5) Inflation 12m	(6) Inflation 36m	(7) Inflation 12m	(8) Inflation 36m
Post-FOMC	-0.0857	-0.0701	-0.0376	-0.0625**	-0.0360	-0.0621**	-0.0373	-0.0617**
	(0.0680)	(0.0745)	(0.0294)	(0.0308)	(0.0295)	(0.0308)	(0.0294)	(0.0308)
Post-FOMC × Tightening	0.0579	0.00887						
	(0.0756)	(0.0814)						
Post-FOMC × Δ Shadow Rate			-0.00633	-0.0113				
			(0.0310)	(0.0338)				
Post-FOMC × Federal Funds Rate Factor					0.00105	-0.0102		
					(0.0303)	(0.0305)		
Post-FOMC × Forward Guidance Factor					-0.0333	-0.0471		
					(0.0319)	(0.0343)		
Post-FOMC × LSAP Factor					0.00990	-0.0261		
					(0.0382)	(0.0428)		
Post-FOMC × Monetary Policy Shock							-0.0279	-0.0594
							(0.0339)	(0.0362)
Post-FOMC × Information Shock							-0.0455	-0.0590
							(0.0340)	(0.0371)
Constant	4.223***	4.268***	4.223***	4.268***	4.223***	4.268***	4.223***	4.268***
	(0.0148)	(0.0155)	(0.0148)	(0.0155)	(0.0148)	(0.0155)	(0.0148)	(0.0155)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FOMC Meeting FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	29831	29652	29831	29652	29831	29652	29831	29652
Respondents	6677	6649	6677	6649	6677	6649	6677	6649
R^2	0.752	0.740	0.752	0.740	0.752	0.740	0.752	0.740

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Baseline Regression Results: Macroeconomic Expectations

	(1) House Prices 12m	(2) House Prices 36m	(3) House Prices 12m	(4) House Prices 36m	(5) House Prices 12m	(6) House Prices 36m	(7) House Prices 12m	(8) House Prices 36m
Post-FOMC	-0.118	0.0109	-0.114***	-0.0882**	-0.109***	-0.0856**	-0.112***	-0.0865**
	(0.0818)	(0.0869)	(0.0344)	(0.0357)	(0.0345)	(0.0358)	(0.0344)	(0.0357)
Post-FOMC × Tightening	0.00535	-0.119						
	(0.0905)	(0.0947)						
Post-FOMC × Δ Shadow Rate			0.0273	0.0213				
			(0.0357)	(0.0375)				
Post-FOMC × Federal Funds Rate Factor					-0.0698**	-0.0596*		
					(0.0353)	(0.0351)		
Post-FOMC × Forward Guidance Factor					-0.0450	-0.0280		
					(0.0379)	(0.0378)		
Post-FOMC × LSAP Factor					0.121**	0.0625		
					(0.0469)	(0.0470)		
Post-FOMC × Monetary Policy Shock							-0.0592	-0.0455
							(0.0403)	(0.0401)
Post-FOMC × Information Shock							-0.0181	0.00542
							(0.0405)	(0.0417)
Constant	5.111***	4.938***	5.112***	4.937***	5.111***	4.937***	5.112***	4.938***
	(0.0173)	(0.0180)	(0.0173)	(0.0180)	(0.0173)	(0.0180)	(0.0173)	(0.0180)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FOMC Meeting FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	29987	29616	29987	29616	29987	29616	29987	29616
Respondents	6711	6654	6711	6654	6711	6654	6711	6654
R^2	0.708	0.696	0.708	0.696	0.708	0.696	0.708	0.696

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5.1.1 Robustness to Estimation Window Length

We pointed out before that our baseline sample stretches over 21 days before and after each FOMC meeting. Over the course of six weeks it is possible that other news that are relevant for the future course of economic variables are released. We therefore provide further evidence on the robustness to the length of control and treatment periods of the results on interest rate expectations that we obtain above.

Table 7 shows the effects of the three factors proposed by Swanson (2021) for different sample lengths. It shows that the effect presented in table 4 has the lowest magnitude of all possible sample lengths. The effect of the FFR factor reaches its peak during a symmetric time window of 5 days around FOMC meetings, with a coefficient of 1.885. For longer sample sizes, the effect shrinks quite smoothly. The table suggests that the announcement effect decays substantially.

However, in each of the columns in table 7, both control and treatment group vary. It is therefore also instructive to decompose the result of the baseline regression into sub-periods of the treatment period of 21 days while keeping the control window constant. Figure 3 shows the evolution of the marginal effect of the FFR factor throughout the treatment window and confirms the observation that the announcement effect may not be long-lived and stems from an immediate reaction in expectations within the first few days after an FOMC meeting.

5.2 Expectations About Personal Finances

We now turn to the effects of monetary policy announcements on the personal financial expectations of SCE respondents. Table 8 shows the results for three variables capturing personal financial expectations of individuals: the probability to lose one's job in the following 12 months, and the expectations about personal spending and overall household income for the following 12 months. We apply the same baseline regression model as for the previous set of results.

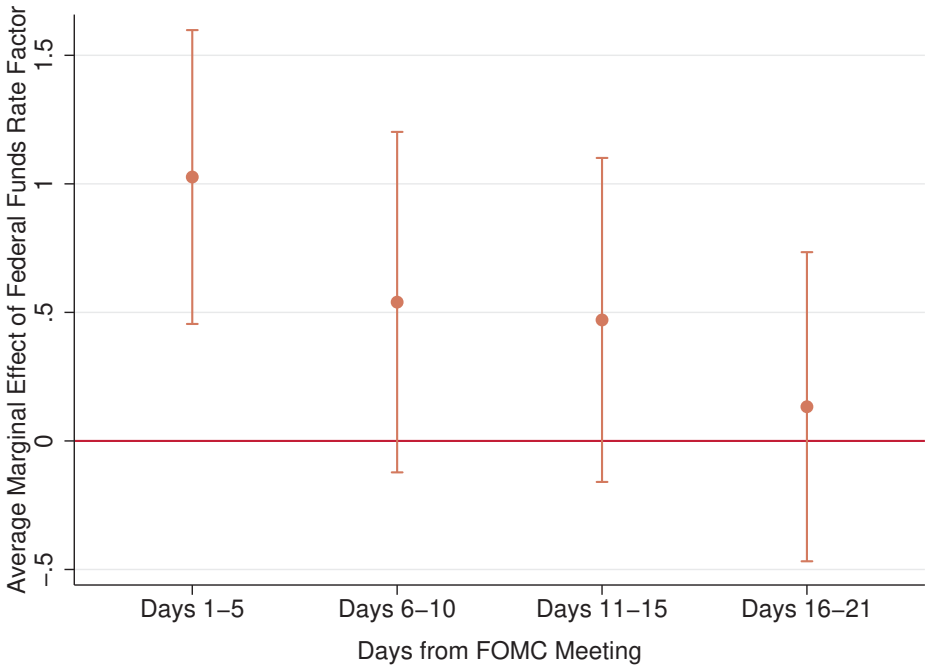
In general, personal financial expectations hardly react to any of the monetary policy measures we consider. We will point out some of the stronger reactions, that are nonetheless insignificant. In case of a tightening, the treatment effect on personal job loss expectations is slightly above zero. For the remaining variables, reactions are small and insignificant throughout. We observe no effects

Table 7: FOMC announcement effects on 12-month ahead interest rate expectations for varying control and treatment window lengths

	(1) 4 Days	(2) 5 Days	(3) 6 Days	(4) 7 Days	(5) 8 Days	(6) 9 Days	(7) 13 Days	(8) 17 Days	(9) 21 Days
Post-FOMC	1.545*	0.777	0.314	0.169	0.379	0.326	0.233	0.238	0.115
	(0.923)	(0.701)	(0.546)	(0.477)	(0.406)	(0.357)	(0.263)	(0.213)	(0.188)
Post-FOMC × Federal Funds Rate Factor	1.198	1.885***	1.528***	1.162***	0.952**	1.033***	0.857***	0.590***	0.558***
	(0.846)	(0.665)	(0.500)	(0.439)	(0.386)	(0.355)	(0.274)	(0.208)	(0.187)
Post-FOMC × Forward Guidance Factor	0.379	0.435	0.745	0.493	0.477	0.375	0.582*	0.399	0.215
	(0.899)	(0.680)	(0.545)	(0.486)	(0.438)	(0.400)	(0.310)	(0.243)	(0.210)
Post-FOMC × LSAP Factor	-0.367	-0.599	-0.352	-0.223	-0.0930	-0.133	-0.0812	0.640**	0.506**
	(1.395)	(1.102)	(0.844)	(0.739)	(0.638)	(0.601)	(0.453)	(0.261)	(0.239)
Constant	33.07***	33.23***	33.02***	32.84***	32.95***	33.14***	33.31***	33.01***	33.15***
	(0.468)	(0.363)	(0.276)	(0.242)	(0.203)	(0.174)	(0.130)	(0.103)	(0.0943)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FOMC Meeting FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2772	4503	6587	8343	10265	12303	18605	26142	31662
Respondents	1330	2104	2934	3571	4224	4819	6019	6664	6910
R^2	0.824	0.824	0.816	0.805	0.801	0.795	0.774	0.754	0.740

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Note: Each column shows the results of estimating the regression in equation 1 on a symmetric window around the FOMC meeting. The respective length of treatment and control window is given in the column title (e.g. column 1 reports results for a symmetric window of 4 days before and after each FOMC meeting, giving a sample length of 8 days in total).

Figure 3: Marginal effect of FFR factor on 12-month ahead interest rate expectations over the course of the treatment window and corresponding 95% confidence interval



of monetary policy announcements on spending plans of households. No measure of monetary policy leads to any significant change in the expectations about the overall household income of the respondent. The clear absence of effects on personal financial expectations stands in contrast to the experimental results obtained by Roth & Wohlfart (2020). Their results suggest that information about recession probabilities significantly impacts respondents' personal job loss and consumption growth expectations. We see this contrast as suggestive evidence that real world news about the macroeconomy are not as clear cut and straightforward to interpret as experimental interventions, where respondents are artificially fed with relevant information. Therefore our second key result is the following:

Result 2: *Personal financial expectations of respondents are unaffected by monetary policy announcements. Specifically, survey participants do not expect to adjust their spending behavior in response to monetary policy changes. (Surprise) easing or tightening of monetary policy also have no effect on expected household income.*

5.3 The "Taper Tantrum" and its Effects on Household Expectations

To better illustrate our findings from above, we look at a particularly relevant - also in terms of its media coverage - episode of monetary policy making in isolation, the so-called "Taper Tantrum" of 2013. The "Taper Tantrum" followed a series of communications made by the Federal Reserve in 2013 attempting to prepare the public and financial markets for a reduction in the pace of asset purchases. During the press conference following the FOMC meeting on June 18$^{\text{th}}$ and 19$^{\text{th}}$ 2013, then Chairman Ben Bernanke announced that conditional on further positive economic data in the months ahead, asset purchases could be reduced later in the year and halted over the course of 2014 (Bernanke 2013). The announcement surprised financial markets and received significant media attention. The Dow Jones Industrial Average fell by around 570 points or 4% between June 18$^{\text{th}}$ and 20$^{\text{th}}$ (Prial 2013). After the meeting on September 18$^{\text{th}}$, Bernanke reassured markets that asset purchases would continue (Park 2013a) before announcing their final scaling down as of January 2014 at the press conference on December 18$^{\text{th}}$ 2013 (Park 2013b).

The large swings on financial markets in response to these various announcements are also reflected in the high-frequency identified surprises presented in Table 3. Both the Forward Guidance Factor and the Long Term Asset Purchases Factor move strongly in response to the meetings of

Table 8: Baseline Regression Results: Personal Financial Expectations

	(1) Lose Job 12m	(2) Spending 12m	(3) Income 12m	(4) Lose Job 12m	(5) Spending 12m	(6) Income 12m	(7) Lose Job 12m	(8) Spending 12m	(9) Income 12m	(10) Lose Job 12m	(11) Spending 12m	(12) Income 12m
Post-FOMC	-0.646	-0.0920	-0.135	-0.114	-0.0249	-0.0513	-0.108	-0.0244	-0.0555	-0.108	-0.0264	-0.0505
	(0.455)	(0.127)	(0.117)	(0.184)	(0.0544)	(0.0491)	(0.182)	(0.0545)	(0.0494)	(0.183)	(0.0544)	(0.0492)
Post-FOMC × Tightening	0.641	0.0810	0.102									
	(0.498)	(0.141)	(0.131)									
Post-FOMC × Δ Shadow Rate				0.00229	-0.00546	0.0296						
				(0.186)	(0.0569)	(0.0518)						
Post-FOMC × Federal Funds Rate Factor							0.126	-0.000534	-0.0312			
							(0.198)	(0.0536)	(0.0480)			
Post-FOMC × Forward Guidance Factor							-0.148	0.0368	0.0121			
							(0.191)	(0.0586)	(0.0533)			
Post-FOMC × LSAP Factor							-0.161	0.0524	-0.102			
							(0.245)	(0.0741)	(0.0649)			
Post-FOMC × Monetary Policy Shock										-0.168	0.0551	-0.00371
										(0.208)	(0.0613)	(0.0561)
Post-FOMC × Information Shock										0.121	-0.0825	0.0408
										(0.214)	(0.0610)	(0.0564)
Constant	13.98***	3.647***	3.637***	13.98***	3.647***	3.637***	13.98***	3.647***	3.638***	13.98***	3.646***	3.638***
	(0.0910)	(0.0273)	(0.0247)	(0.0910)	(0.0273)	(0.0247)	(0.0908)	(0.0273)	(0.0247)	(0.0911)	(0.0273)	(0.0247)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FOMC Meeting FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17929	29452	29108	17929	29452	29108	17929	29452	29108	17929	29452	29108
Respondents	4114	6668	6590	4114	6668	6590	4114	6668	6590	4114	6668	6590
R^2	0.740	0.611	0.667	0.740	0.611	0.667	0.740	0.611	0.667	0.740	0.611	0.667

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

June and September 2013. After establishing the effects of these monetary policy measures and others over the whole sample period, we zoom in on this sub-sample to provide a narrative-based illustration of our findings. Table 9 presents the results of regressions of the main macroeconomic and personal expectations on meeting-specific treatment indicators. The coefficients show the mean difference between expectations of those surveyed before the respective FOMC meeting and those surveyed in the days following the meeting after controlling for respondent and FOMC meeting fixed effects.

The press conference on June 19$^{\text{th}}$ led to substantial reactions among households. We estimate that this announcement significantly increased the expected probability of increasing interest rates over the 12 months following the announcement by 9.6 points. At the average probability respondents attached to rising interest rates *before* the meeting (30.9%) this corresponds to a jump in the expected probability of about 30%. Unemployment expectations were also affected significantly and increased by 7.8 points in response to the announcement. This corresponds to a 25% jump in the probability of increasing unemployment over the 12 months following the announcement. Notably, respondents did not react in their expectations about the stock markets or the inflation rate. Expectations about the respondents' personal probability to lose their job as well as their own spending or income were not affected.

The meeting on September 18$^{\text{th}}$ had less strong effects on interest and unemployment expectations. By announcing a delay of the tapering of asset purchases, respondents' interest rate expectations dropped by 3.8 points. Despite the announcement of an easier monetary policy, expectations of rising unemployment continued to increase. As mentioned in section 5.1, this announcement caused the effect of the LSAP Factor on unemployment expectations we observe in the baseline results. In the context of this episode, the sign of this effect makes sense. The easing of large scale asset purchases as measured by the LSAP Factor consisted of delaying the scaling down of purchases and was perceived to reveal a more pessimistic outlook of the economy by the Fed than previously assumed. The movement of unemployment expectations due to this specific FOMC meeting is therefore consistent with a central bank information channel (Jarociński & Karadi 2020). This interpretation of the communication released after the FOMC meeting also explains the sign of the coefficient of LSAP purchases on unemployment that we observed in the baseline results. After the September meeting expectations about personal spending growth dropped by about 1

Table 9: Treatment Effects of Selected FOMC Meetings in 2013

	(1) Interest 12m	(2) Unempl. 12m	(3) Stocks 12m	(4) Inflation 12m	(5) Inflation 36m	(6) Lose Job 12m	(7) Spending 12m	(8) Income 12m
Post-FOMC × Meeting June 19th 2013	9.624***	7.845**	-0.313	-0.0540	-0.998	-1.837	-1.263	-1.148
	(2.742)	(3.447)	(3.766)	(0.478)	(0.616)	(1.877)	(1.139)	(0.973)
Post-FOMC × Meeting September 18th 2013	-3.828**	2.801*	-1.462	0.0205	0.272	0.236	-1.060**	-0.350
	(1.621)	(1.582)	(1.602)	(0.258)	(0.293)	(1.877)	(0.482)	(0.378)
Post-FOMC × Meeting December 18th 2013	4.812***	2.531	2.573	0.179	-0.0671	1.709	-0.702	0.301
	(1.765)	(1.929)	(1.626)	(0.282)	(0.344)	(1.323)	(0.536)	(0.438)
Constant	31.23***	35.59***	40.53***	4.879***	4.909***	14.53***	4.976***	2.268***
	(0.500)	(0.531)	(0.437)	(0.0734)	(0.0925)	(0.426)	(0.156)	(0.124)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FOMC Meeting FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	884	882	828	826	822	488	828	803
Respondents	345	345	326	327	325	194	324	315
R^2	0.807	0.750	0.748	0.827	0.782	0.816	0.719	0.797

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

percentage point. As the FOMC finally did announce a specific time table for the tapering of their asset purchases at the December meeting, interest rate expectations were sent upwards again, this time increasing by 4.8 percentage points, while no other expectations were significantly affected.

These results confirm that, while households are attentive to monetary policy, the range of expectations that are affected are rather limited. Not even the most publicised monetary policy decisions in our sample trigger substantial reactions in inflation expectations among survey respondents. We do, however, measure effects on unemployment expectations and personal spending growth that the rest of the FOMC meetings during our sample do not trigger. In contrast, the effects on interest rate expectations that we document in section 5.1, are observable throughout the sample. When excluding the year 2013 from our analysis, the effect of the FFR factor remains significant and of similar magnitude as the one presented in Table 4.[3]

6 Financial and Numerical Literacy

Next, we investigate whether more financially literate respondents exhibit different reactions to monetary policy news. First-time respondents of the SCE are asked to answer seven questions eliciting their numerical and financial literacy. These questions measure respondents' understanding of compounding interest, probability, risk and numerical reasoning (for the specific questions, see

[3] For the full set of results when excluding the year 2013, see the online appendix.

Table 10: Role in Financial Decision Making and Numerical/Financial Literacy (percentage of row total in parentheses)

	Numerical & Financial Literacy		
Who takes financial decisions?	Low	High	Total
Only/mostly spouse	304 (34.2%)	586 (65.8%)	890
Shared equally	3,231 (24.4%)	10,027 (75.6%)	13,258
Only/mostly respondent	2,965 (26.0%)	8,453 (74.0%)	11,418
Total	6,500 (25.4%)	19,066 (74.6%)	25,566

the online appendix). The survey's administrators use the answers given to these questions during the initial participation in the SCE and categorise respondents as highly numerically literate if they answer at least four of these questions correctly. We use the same classification. Since the questions do not only elicit numerical but also financial literacy we use this variable as a combined measure of numerical and financial literacy.

As a complementary measure we use respondents' exposure to financial decision making. Respondents are asked who in their household is largely responsible for financial decisions and based on this answer assigned to one of three categories: decisions are taken only or mostly by their partner, they are shared equally or taken only or mostly by themselves. We find this additional measure important since more responsibility in financial matters likely translates into more exposure to financial topics and potentially news about the economy – even for respondents with correct answers to the seven numerical and financial literacy questions. As the results of Binder (2019) suggest, exposure to financial decision making is important for the expectation formation of highly financially literate respondents. Table 10 shows how the two measures relate in our sample and underlines their complementary nature. Even among respondents whose partners handle most or all of financial decisions of the household, 65% score highly in the numerical and financial literacy questions. Nevertheless, respondents with more responsibility in the financial matters of the household tend to answer more numerical and financial literacy questions correctly. Between the respondents that share the responsibility equally with their partner and those that are mostly responsible themselves, we see no substantial difference in numerical and financial literacy scores. These descriptive statistics show that the two measures do not necessarily measure the same characteristic.

For ease of exposition we will present the results of this section graphically.[4] Each figure presents the marginal effect of treatment on the outcome variable for a one standard deviation increase in the monetary policy measure, for each level of the respective factor variable. In the case of the dummy variable indicating a tightening of monetary policy, the figure presents the marginal effect of treatment in case the dummy variable takes the values 0 and 1 separately. Each point estimate is accompanied by the corresponding 95% confidence interval. In the following, we discuss the significance of the marginal effects as well as whether these marginal effects significantly differ across groups. For the latter purpose we report the results of F-tests of equality of marginal effects in the text.

Figure 4 shows these results for the effect of the role in the financial decision making process in the household on interest rate expectations. We plot the effects for the following four monetary policy measures for which we found the strongest effects in section 5.1: the dummy variable indicating a policy tightening, the shadow rate, the FFR Factor and the LSAP Factor.

Panel 4a shows the marginal effects of the tightening dummy across the three groups. The only sub group for which we find significant effects in case of easing/no change and tightening in the expected directions are those that are themselves responsible for financial decision making. The marginal effects for those respondents are also significantly different from each other (F-statistic of about 12, p-value of less than 0.01). Those whose partner is responsible for most or all financial decisions show no significant reaction to easing/no change of monetary policy and a significantly positive reaction in interest rate expectations to a tightening of policy. The point estimate is even larger than that for those carrying the main responsibility for financial decisions.

The respondents' reaction to a change in the shadow rate (Figure 4b) confirms that those with most exposure to financial decision making react the strongest to changes in monetary policy. The marginal effects of the three sub groups are all significantly different from each other at least at the 10% significance level.

For the effects interacted with the FFR Factor this is clearly not the case. All three groups have roughly similar point estimates, while only the marginal effects for the two groups with more exposure to financial decisions are significantly different from zero. Those two groups also exhibit similar

[4] The underlying regression tables can be found in the online appendix.

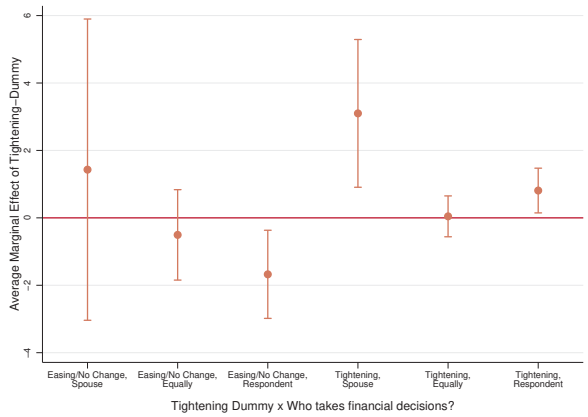
reactions to the LSAP Factor. When excluding the year 2013, the reactions of all three groups to changes in the LSAP factor are closer to zero and insignificant, while the effects of the other three measures remain the same. The breakdown by financial decision making role also does not reveal any previously hidden reactions of any of the three sub groups on other variables considered in our baseline regressions.

The pattern becomes even clearer when considering the effects according to the respondents' level of numerical and financial literacy. Figure 5a confirms the finding from above. Only those with high literacy react significantly in both directions to the dummy variable - lowered expectations in case of easing/no change and increased interest rate expectations in case of a tightening. Unsurprisingly, the effects of a change in the shadow rate are consistent with this result. While the FFR Factor caused similar reactions across the three groups considered above, the breakdown by numerical and financial literacy reveals differential effects. Only the group of highly literate respondents reacts significantly to the policy surprise. However, the difference between the point estimates of the announcement effects for each group is not significantly different from zero (F-statistic of about 1.4, p-value of about 0.2). The reaction to the LSAP Factor is insignificant for both groups and remains so after excluding the year 2013.

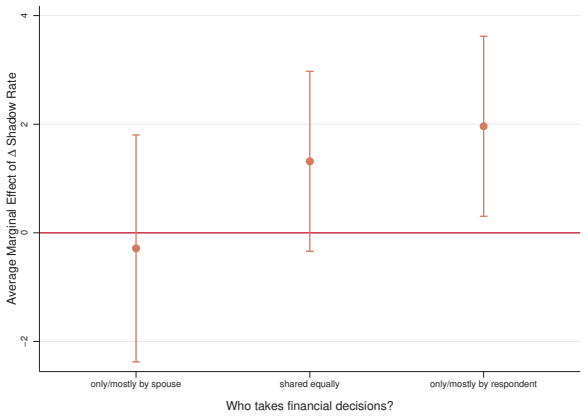
In contrast, we find no robustly measured effects on other expectation variables that are different from zero. Figure 6 shows the announcement effects of the previously analyzed monetary policy measures on inflation expectations by numerical literacy category. Inflation Expectations of respondents react to none of the policy measures, just as in our baseline specifications. This means that the insignificant baseline effects on inflation expectations and personal financial conditions do not mask any substantial heterogeneities in announcement effects determined by numerical and financial literacy. Our third and last key result is therefore:

Result 3: *We find evidence that respondents with higher financial and numerical literacy react more strongly to monetary policy announcements in their interest rate expectations. Even respondents with high numerical and financial literacy or strong exposure to financial decision making show no substantially different reactions to other macroeconomic expectations nor predictions about their personal finances.*

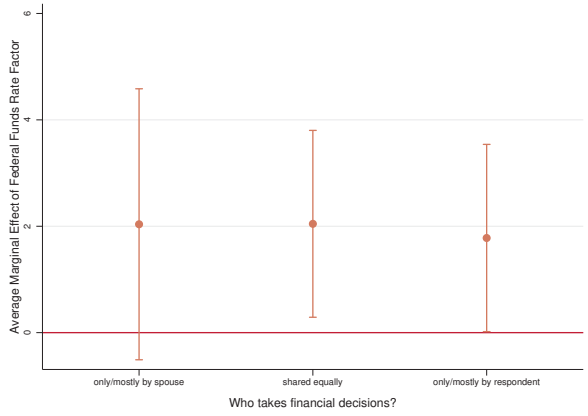
Figure 4: Effect of Role in Financial Decision Making on Interest Rate Expectations



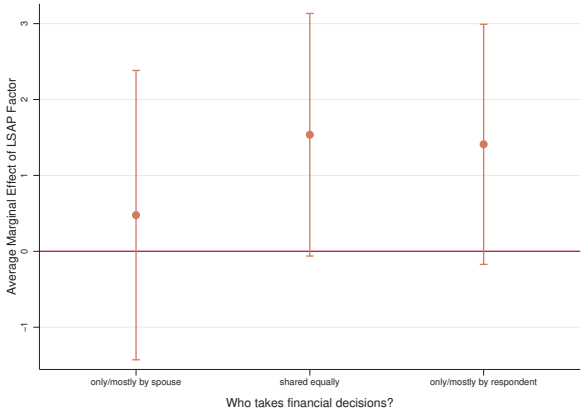
(a) Marginal Effect of Tightening Dummy by Financial Decision Making Category



(b) Marginal Effect of Change in Shadow Rate by Financial Decision Making Category



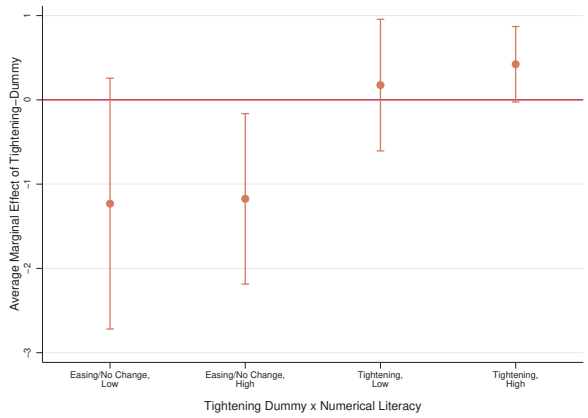
(c) Marginal Effect of FFR Factor by Financial Decision Making Category



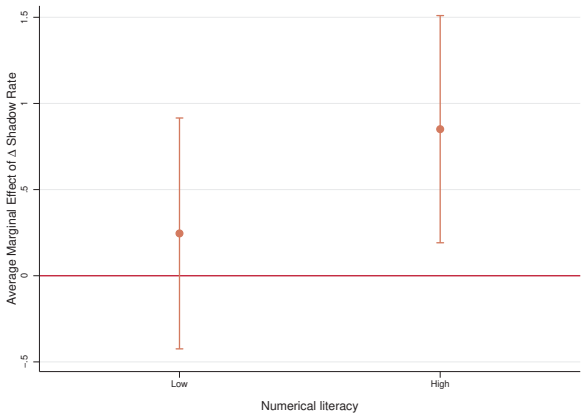
(d) Marginal Effect of LSAP Factor by Financial Decision Making Category

Note: Panel a) shows the marginal effect of both levels of the monetary policy tightening dummy variable by respondent characteristic. Panels b)-d) show the marginal effects of a one standard deviation increase in the monetary policy measure by respondent characteristic. All marginal effects are accompanied by a 95% confidence interval. The underlying regressions control for individual and FOMC meeting fixed effects. Standard errors are clustered at the respondent level.

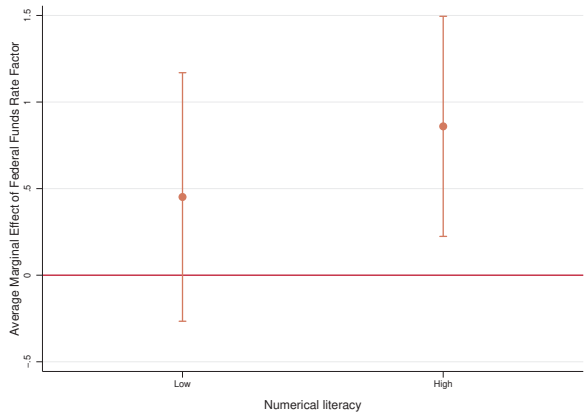
Figure 5: Effect of Numerical Literacy on Interest Rate Expectations



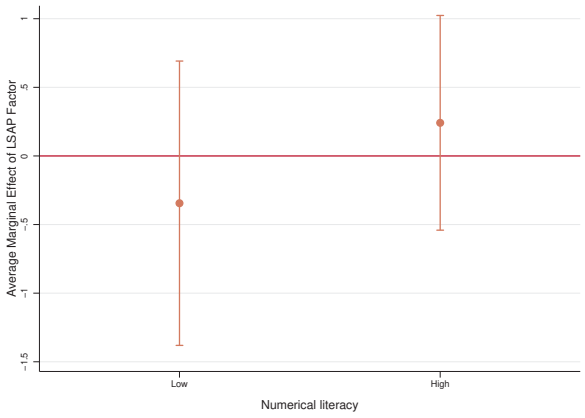
(a) Marginal Effect of Tightening Dummy by Numerical Literacy Category



(b) Marginal Effect of Change in Shadow Rate by Numerical Literacy Category



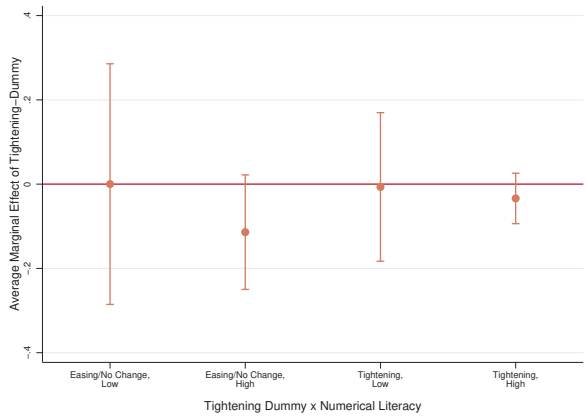
(c) Marginal Effect of FFR Factor by Numerical Literacy Category



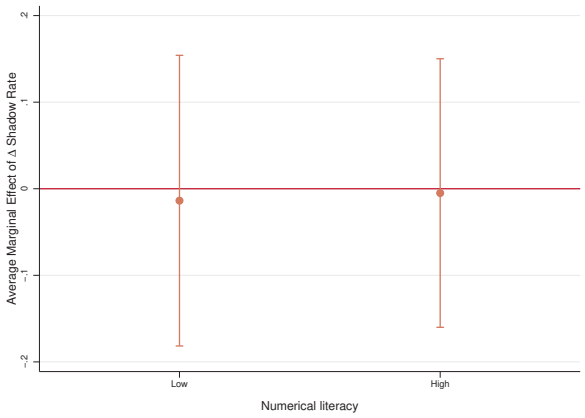
(d) Marginal Effect of LSAP Factor by Numerical Literacy Category

Note: Panel a) shows the marginal effect of both levels of the monetary policy tightening dummy variable by respondent characteristic. Panels b)-d) show the marginal effects of a one standard deviation increase in the monetary policy measure by respondent characteristic. All marginal effects are accompanied by a 95% confidence interval. The underlying regressions control for individual and FOMC meeting fixed effects. Standard errors are clustered at the respondent level.

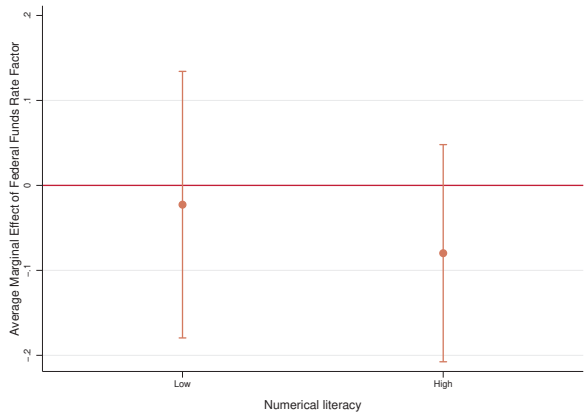
Figure 6: Effect of Numerical Literacy on Inflation Expectations (12 months ahead)



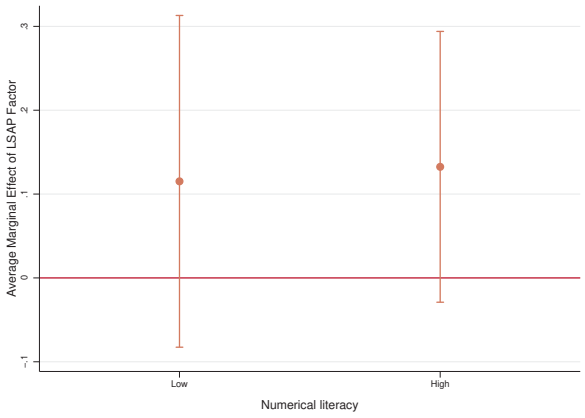
(a) Marginal Effect of Tightening Dummy by Numerical Literacy Category



(b) Marginal Effect of Change in Shadow Rate by Numerical Literacy Category



(c) Marginal Effect of FFR Factor by Numerical Literacy Category



(d) Marginal Effect of LSAP Factor by Numerical Literacy Category

Note: Panel a) shows the marginal effect of both levels of the monetary policy tightening dummy variable by respondent characteristic. Panels b)-d) show the marginal effects of a one standard deviation increase in the monetary policy measure by respondent characteristic. All marginal effects are accompanied by a 95% confidence interval. The underlying regressions control for individual and FOMC meeting fixed effects. Standard errors are clustered at the respondent level.

7 Conclusion

In this paper, we document causal effects of monetary policy announcements on household expectations about the economy in the United States. We compare responses to the Survey of Consumer Expectations given in the days before an FOMC meeting to those given afterwards and find that FOMC decisions robustly affect interest rate expectations of surveyed individuals. These effects are detectable using a diverse range of monetary policy measures. However, no other macroeconomic expectations are affected by FOMC decisions in the population as a whole. Additionally, the effect on interest rate expectations decays over the horizon of three weeks after an FOMC meeting.

The second key result that carries special importance for monetary policy making is the lack of announcement effects on personal financial expectations, such as spending or income expectations. We find that monetary policy, even in cases when interest rate expectations are affected strongly, is perceived to be largely disconnected from the personal financial situation of survey participants. Beyond the baseline results, we explore response heterogeneity based on measures of financial or numerical literacy. Knowledge in these matters could make deciphering of FOMC decisions easier. We find some evidence of the importance of economic knowledge for announcement reactions. More numerically and financially literate respondents react more strongly to FOMC announcements in their interest rate expectations. Overall, however, they do not react on a wider range of expectations.

The experimental literature has identified rather strong effects of monetary policy news on household expectations while the evidence we provide using observational data does not reproduce these results. This could mean that the signals that real-world monetary policy news send are not strong enough to trigger the effects we observe in experimental settings. An alternative interpretation is that the Federal Reserve enjoys a high degree of credibility. The fact that expectations about unemployment and inflation, the two most important target variables of the Federal Reserve, do not react to changes in monetary policy, could be a byproduct of well anchored expectations and a resulting flat Phillips Curve. Under a steep Phillips Curve short-term inflation expectations could react to monetary policy even if they are anchored in the longer term. However, a flat Phillips Curve could mute the short-term effects on anchored expectations, which themselves may have contributed to the flattening of the Phillips Curve.

Our results are consistent with this, as not even the most salient FOMC announcements during

our sample period exerted any effects on respondents' inflation expectations while having moderate effects on unemployment expectations. However, they are not easily reconciled with the strong effects from experimental evidence unless real world conditions, such as central bank credibility or the flatness of Phillips Curves, are part of the information set provided in experimental settings.

The common conclusion from both interpretations is that providing macroeconomic news in experimental settings may send fundamentally different signals than in the real world. Given that we cannot confirm or reject any of the two interpretations, the literature would benefit from more evidence about the effects of *real-world* macroeconomic news on expectations in the population, also in areas other than monetary policy. This would allow comparisons of different communication strategies and transmission mechanisms.

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