Unconventional Monetary Policy and U.S. Firm Stock Prices: the Information Effect Revisited*

John Rogers† Wenbin Wu‡ Juanyi Xu§ Jingbo Yao¶

Abstract

We provide evidence on the central bank information effect of the U.S. large-scale asset purchases (LSAP). We first present a novel finding that expansionary U.S. LSAP shocks, derived from high-frequency futures price changes around FOMC announcements, have a negative effect on the U.S. stock market during periods of quantitative easing (QE). Consistently, we show that a LSAP easing policy signals a worsening in the Fed's economic outlook, leading to a decrease in equity investors' confidence. Furthermore, we find that the LSAP information effect is bigger for more procyclical firms and is state-dependent, with larger effects occurring during worse economic circumstances. Finally, it is found that the transmission of the LSAP shock's information effect to the stock market works primarily through the risk premium channel, with more significant effects on firms that have greater risk exposure.

JEL Codes: E42, E52, G12, G18.

Keywords: Large-scale asset purchase, equity return, information effect, risk premium.

*We are grateful to Sina T. ATES, Russell Cooper, Rustam Jamilov, Dun Jia, Paymon Khorrami, Alexandre N. Kohlhas, Byoungchan Lee, Yang Lu, Guillermo L.Ordonez, Luigi Paciello, Zhenjiang Qin, Xiaoliang Wang, Dora Xia, Shen Zhao, and participants at the Fudan Brown Bag (2023), PKU-NUS Annual International Conference (2023), AMES, Singapore (2023), WEAI, San Diego (2023), HKUST Workshop (2024), IAAE, Xiamen (2024), AsianFA Annual Conference, Macau (2024), AMES, Vietnam (2024), 8th CCER Summer Institute, Beijing (2024), for helpful comments. We especially thank Eric Swanson and Jonathan Wright for their kind help with data and codes. We also thank Yijing Ren for the excellent research assistance.

†Rogers: Fudan International School of Finance, Fudan Univeristy. Email: johnrogers@fudan.edu.cn

‡Wu: Fudan International School of Finance, Fudan Univeristy. Email: wenbinwu@fudan.edu.cn

§Xu: The Hong Kong University of Science and Technology. Email: jennyxu@ust.hk

¶Yao: The Hong Kong University of Science and Technology. Email: jyaoam@connect.ust.hk

1 Introduction

In response to the financial crisis of 2007–2008, many central banks around the world pushed their monetary policy rates to the lower bounds. Subsequently, a sequence of unconventional monetary policies such as negative interest rates, forward guidance, and large-scale asset purchases (LSAP) were adopted to stabilize the economy and financial system. Sims, Wu & Zhang (2022) argue that asset purchases or quantitative easing (QE) were more effective than forward guidance and negative interest rates. By purchasing predetermined amounts of government bonds or other financial assets, a central bank can further stimulate the economy during the expected prolonged ZLB period. While many researchers agree that LSAPs are effective in reducing interest rates (see Bhattarai & Neely (2022) for a survey), the effect on stock prices remains unclear. LSAPs have been shown to boost the stock market at times, but at other times it has the opposite effect or no effect. Moreover, the transmission channels through which LSAP shocks affect stock prices are debated, as existing discussions of the "floating rate channel" or delayed responses fail to provide an explanation for why an easing LSAP would sometimes depress the equity market or why the effects vary across time.

In this paper, using LSAP shocks derived from high-frequency future price changes around FOMC announcements, we document a novel finding: expansionary LSAP shocks have a negative effect on the U.S. stock returns during the QE periods (July 01, 2009, to May 21, 2013), with the sign reversing in the latter Taper period (May 22, 2013 - Sep 17, 2014). This negative effect is, on the face of it, puzzling from the perspective of conventional thinking on monetary policy transmission to asset prices. While QE refers to a period of expansionary monetary policy and tapering refers to a reduction in the pace of quantitative easing, it is still puzzling why monetary expansion would lead to opposite effects on stock prices in these two periods.

Why do LSAP shocks during the QE period have an effect on asset prices opposite to standard predictions? One answer relates to the "central bank information effect". Nakamura & Steinsson (2018) show that regressions of private-sector macroeconomic forecast revisions on monetary policy surprises often produce coefficients with signs opposite to standard macroeconomic reasoning. They argue that this is driven by the information effect, whereby the Fed's communications provide new information to the public that affects expectations about non-monetary fundamentals.[1] The literature has documented how the information effect can explain the abnormal response of the equity market to forward guidance. However, this has not been extensively studied in the context of LSAPs. Yet in practice, LSAPs have been relied on equally with forward guidance during prolonged periods at the zero lower bound. Consider the FOMC statement of August 9, 2011: "economic conditions - including low rates of resource utilization and a subdued outlook for inflation over the medium run - are likely to warrant exceptionally low levels for the federal funds rate at least through mid-2013." In this environment, the forward guidance provided by the Fed arguably contained less information than large-scale asset purchases, as there was limited room for future policy rate adjustments over the next two years. It is thus natural to think that the Fed information effect may be present more with asset purchases.[2]

With this motivation, we explore the information effect as explaining our baseline finding on equity price responses to LSAP shocks across QE and Taper periods. We draw out both time-series and, more novelly, cross-section implications. First, using the Fed's Greenbook data, we find that Fed LSAPs are larger when its own expectation of future

[1]Similarly, Campbell, Evans, Fisher, Justiniano, Calomiris & Woodford (2012) introduce the notion of "Delphic forward guidance" to refer to situations in which forward guidance by the FOMC conveys information to the private sector about the future evolution of the economy.

[2]Lunsford (2020) suggests that the effects of forward guidance on equity prices were opposite across two adjacent periods (2000-2003 and 2003-2006) and that the revelation of Fed information migrates from policy rate movement to forward guidance due to changes in the content in monetary announcements. We buttress this line of thinking by arguing that Fed private information might also be signaled through LSAPs, in addition to the federal funds rate announcements and forward guidance.

real GDP growth is worse.[3] Although this forecast represents the private information of the Fed, it could be signaled to the market through its policy actions. The information effect then implies that in the QE period, an unexpected easing LSAP shock would make people more pessimistic about future economic growth and lead to a decrease in equity investors' confidence.[4] Consistent with this, we furthermore show that expansionary LSAP shocks lower *market* expectations of future GDP growth during the QE period and that this is robust to accounting for the Bauer & Swanson (2023) critique.

Second, following Cieslak & Schrimpf (2019), we find that in the QE period, FOMC announcements increased the covariance between equity returns and treasury yield changes, which is consistent with the information effect as opposed to a pure monetary policy effect. In contrast, in the Taper period, the covariances are more negative when there is a monetary easing, suggesting the weakening of the information effect and dominance of the pure monetary policy effect.

Third, we show that the information effect is more pronounced during worse macroeconomic conditions, using a variety of measures of the economic state. This is consistent with Altavilla, Brugnolini, Gürkaynak, Motto & Ragusa (2019) and Lunsford (2020). We then estimate that the dominance of the information effect persists for around three weeks and gradually dies off. Moreover, this information effect is not significant (although signs are consistent) in the QE4 period, possibly due to the uncertainty effect.

On the cross-section front, we draw out two implications. First, we hypothesize that if the LSAP shocks send signals about future economic growth in the QE period,

[3]As is well-known, the Greenbook data is made public only five years after it was created. Our working assumption is that the Fed's Greenbook projections of macroeconomic variables serve as a reliable proxy for the Fed's private information.

[4]A potential concern is that the revision in equity price response to LSAP shocks may be influenced by shifts in economic conditions, which could shape the central bank's decision and market expectations simultaneously, as illustrated by the responses-to-news effect (see Bauer & Swanson (2023)). To rule out this channel, we control for the effects of business cycles or news shocks and find that the information effect is robust.

more procyclical firms should be more affected. To test this, we construct a measure of cyclicity and add its interaction term with LSAPs to the baseline regression. During the QE period, we observe that firms with greater pro-cyclicity are more adversely affected by an expansionary LSAP shock. In contrast, during the Taper period, this pattern is insignificant, indicating the weakening of the information effect. Second, if the information effect of LSAPs is significant in the QE period and different firms have different exposures to this effect, investors' preferences should lead to more exposed firms commanding a higher excess stock return. Using standard CAPM reasoning, investors will require a higher return to hold the stocks of firms whose price drops more after bad news about future economic growth as signaled by an easing shock (i.e., firms more exposed to the Fed information effect). To verify this conjecture, we construct firms' individual exposures to the information effect of LSAPs and compute the corresponding excess return using Fama-French risk factors. We show that portfolios with higher exposure to the information effect of LSAPs have larger excess returns.

After establishing the LSAP information effect on stock price responses, we investigate transmission channels. In particular, we show the importance of a risk premium channel as an explanation for our results. In the QE period, an unexpected easing LSAP shock increases market risk perceptions and reduces investors' risk appetite, with firms that have greater risk exposure being more adversely affected. Consistently, if equity prices during the QE period are primarily influenced by the information effect through risk premium, we would expect the effect of LSAPs to weaken when controlling for the variables through which the information effect is transmitted, as well as the central bank's private information. After controlling for these channel variables and private information, we demonstrate that the effect of LSAP shocks is significantly attenuated. Moreover, We also find that the risk-free rate and dividend channels are not the primary drivers of the abnormal reaction during the QE period, as treasury yields decrease and dividend expectations remain relatively stable in response to an expansionary LSAP shock.

Related Literature

Our paper is closely related to several strands of literature. First is the literature on the central bank information effect. Although this has been widely investigated in the context of Fed Funds rate changes (Romer & Romer (2000)) and forward guidance (Campbell, Evans, Fisher, Justiniano, Calomiris & Woodford (2012), Faust, Swanson & Wright (2004), Nakamura & Steinsson (2018), Cieslak & Schrimpf (2019), Lunsford (2020), Bu, Rogers & Wu (2021), Acosta (2022), Bauer & Swanson (2023), and Jarociński (2022) for the ECB), few papers have investigated the information effect of large-scale asset purchases. Furthermore, we highlight the role of the risk premium in the transmission to equity prices. Moreover, papers typically study the information effect exclusively using time series data. A key feature of our paper, however, is in the cross-sectional evidence on which types of firms are more affected by the information effect. Finally, we show that the information effect of LSAPs is state-dependent, which helps to explain the different reactions of the equity market across periods.

Second, our paper is part of the empirical literature exploring the effects of unconventional monetary policy on asset prices. Although the effects of forward guidance are well studied (Guraynak, Sack & Swanson (2005), Nakamura & Steinsson (2018), Lunsford (2020), Gürkaynak, Karasoy-Can & Lee (2022)), the role of large-scale asset purchases on equity prices is less well understood. The findings have been mixed, although the effect on bond yields is clear and significant.[5] For example, Wright (2012)

[5] Almost all papers document that asset purchases significantly reduce interest rates, especially long-term treasury bond yields, as well as yields on corporate bonds or mortgage bonds. The transmission mechanism is either through the reduction of credit spreads and term premiums or through the signaling of future policy rates. These papers include Gagnon, Raskin, Remache & Sack (2011), Hancock & Passmore (2011), Todorov (2020), etc.

found that the Federal Reserve QE1 announcements which strongly reduced U.S. long yields only mildly increased U.S. equity indices. Swanson (2021) and Jarociński (2024) also find that the U.S. LSAP shocks have a very significant effect in reducing bond yields, especially long-term yields, but the impact on the $S\&P$ 500 equity index is not statistically significant.[6] Overall, the literature concludes that the effects of LSAPs on equity prices are modest, sometimes even insignificant, especially for the US.[7]

Third, some argue that the attenuated reaction in the equity market might imply that unconventional monetary policy is less stimulative than conventional tools. Kiley (2014) states that LSAPs have modest effects on equities because they moved only the medium and long ends of the yield curve but not the short, which meant that they won't reduce floating rate debt payments of firms that have such debt. Namely, the "floating rate channel" doesn't work when short rates are very near zero (see Ippolito, Ozdagli & Perez-Orive (2018)). Another explanation provided by Mamaysky (2018) was that this effect was delayed, due to rational inattention, and thus had limited immediate effects. Nevertheless, these theories can not explain why sometimes an easing LSAP would depress the equity market, nor can they answer why the effects of LSAPs vary across time. With these papers as a backdrop, we document a novel finding that an easing LSAP shock is associated with a drop in equity prices in the recession period, in contrast to the prediction of canonical models. Moreover, we explain the different responses of equity prices to U.S. LSAP shocks across regimes (QE vs. Taper) and emphasize the role of the information effect and risk premium in explaining equity market effects.

Finally, our paper adds to the growing literature on the different effects of uncon-

[6]Using the same method as that in Swanson (2021), Altavilla, Brugnolini, Gürkaynak, Motto & Ragusa (2019) evaluate the effects of an asset purchase shock by the European Central Bank and show that it is effective in decreasing interest rates while the effect on equity prices is mixed: sometimes an expansionary QE shock coincides with a fall in prices while sometimes opposite.

[7]The effects of LSAPs in other countries are also ambiguous. Joyce, Tong & Woods (2011) showed that the first rounds of Bank of England announcements had inconsistent and overall negative effects on equity indices. In contrast, positive effects of QE by the European Central Bank (e.g., Georgiadis & Gräb (2016)) and the Bank of Japan (e.g., Fukuda (2019)) have been shown.

ventional monetary policies across periods. Lunsford (2020) argues that the language change in the FOMC announcement could alter the relative importance of the information effect of forward guidance by comparing two sub-periods: 2000-2003 and 2003-2006. In contrast, we demonstrate that the equity reaction to LSAP shocks is opposite in the QE and Taper periods due to the relative significance of the information effect. Chari, Dilts Stedman & Lundblad (2021) argue that the tapering talk of Bernanke in May 2013 represents a clear shift of the monetary regime when the economy had emerged from the Great Recession and the Fed began to renormalize policy. They show that spillover effects of U.S. unconventional monetary policy on emerging market capital flows and asset prices are more prominent in the Taper period than in the QE period. In this paper, we draw attention to the role of the information effect in explaining differences in the effects of monetary policies on equity prices between the QE and Taper periods, which aligns with the conclusions of Chari, Dilts Stedman & Lundblad (2021).[8] Our finding is also consistent with Cieslak & Schrimpf (2019), who demonstrate that non-monetary news drives a significant part of financial markets' reaction during the financial crisis and early recovery, while monetary news has gained importance since the middle of 2013, which is exactly the cut point of the QE and Taper periods in our paper.

2 Sample Period Selection and Data

2.1 QE and Taper Sample Periods

On 01 December 2008, the Federal Reserve announced a plan to buy $600 billion in mortgage-backed securities, thus marking the beginning of the FOMC's modern experience with quantitative easing. The Federal Reserve began conducting the QE2 and

[8]Our findings provide a possible explanation for their results: a tightening U.S. shock attracts fewer capital flows from emerging markets in the QE period than in the Taper period because this sends a signal of future weakness in the U.S. economy, thus dampening capital inflows.

QE3 programs in November 2010 and September 2012, respectively.[9] On 22 May 2013, Chairman Ben Bernanke gave a speech in which he stated that the central bank was considering slowing down the pace of asset purchasing due to the gradual recovery of the economy. This announcement is widely viewed as ushering in the Taper Tantrum (Chari, Dilts Stedman & Lundblad (2021)). Following this, the Federal Reserve began to gradually unwind its asset purchases. On 29 October 2014, the FOMC announced plans to eventually stop asset purchases. This marked a clear shift in the monetary policy regime, from unconventional toward renormalization, where large-scale asset purchasing would be used less intensively. We analyze the QE4 period separately.[10]

For our regression analysis, we end the QE period on the day before the beginning of the Taper period. Furthermore, following Nakamura & Steinsson (2018), we drop the crisis period (June 2008-June 2009) because of the many financial market anomalies documented during the peak of the crisis. Thus,

QE period: July 01, 2009-May 21, 2013

Taper: May 22, 2013-Oct 29, 2014

2.2 Data and variables

Monetary shocks. We adopt the shocks of Swanson (2021) as our baseline. Using the high frequency (30-minute) information from a vast range of assets including future prices, bond yields, and equity prices, Swanson (2021) extends the method of Guraynak, Sack & Swanson (2005) to extract 3 factors of monetary policy: federal funds rates factor, forward guidance factor, and large scale asset purchase factor.[11] We focus on the

[9] See https://www.newyorkfed.org/markets/programs-archive/large-scale-asset-purchases for details.

[10] As noted by Chari, Dilts Stedman & Lundblad (2021), there is a clear regime shift across these two periods. Combining them could potentially obscure their differences, so we analyze them separately.

[11] The first and second factors are equivalent to the target and path shock of Guraynak, Sack & Swanson (2005), respectively. For more details, refer to Swanson (2021).

LSAP factor while adding the FG and FFR factors as controls. The time series of LSAP, FG, and FFR shocks are displayed in Figure A1, including beyond our sample period. It can be seen that after the Taper period, the magnitude of LSAP shocks decreases sizably. As robustness checks on the baseline results using the Swanson (2021) shocks, we also employ the shocks of Rogers, Scotti & Wright (2018) and Jarociński (2024), which identify LSAP shocks based on different methods.

Stock return. Our main dependent variable is the daily firm-level stock return, obtained from the CRSP database. To minimize the effect of outliers, we winsorize the daily return at 1% on both sides.[12] Apart from the individual firm return, we also investigate the daily responses of the equity index, including the Nasdaq index and the $S\&P$ 500 index. Based on the $S\&P$ 500 future prices, we also explore the intraday (e.g., 30 minutes and 2 hours) effects of monetary policy shocks on the equity market.

Economic forecasts. It is conjectured that the equity responses might be related to the central bank's private information. To capture the private information of the Federal Reserve, we use Greenbook forecasts from the Philadelphia Fed, which are made publicly available 5 years after the forecast release dates.[13] Furthermore, to study the effects of LSAP shocks on market expectations, we use the professional forecasts of future real output growth, unemployment rate, and inflation from the Blue Chip Economic Indicator database, a monthly survey of America's top business economists.

Business cycle and macro news shocks. To distinguish the information channel from the responses to the news effect channel discussed in Bauer & Swanson (2023), we control for the impact of the business cycle and other economic news shocks. To measure the business cycle, we use the Aruoba-Diebold-Scotti (ADS) Business Conditions

[12]Results are robust to winsorizing at 0.5%, 2.5%, or 5%.

[13]This data can be found on the website of the Federal Reserve Bank of Philadelphia (https://www.philadelphiafed.org/surveys-and-data/real-time-data-research/greenbook).

Index[14] and Brave-Butters-Kelley (BBK) Leading Index[15], which summarize all major macroeconomic data releases. The news shocks are the differences between the data release and the consensus expectations prior to the release.[16] We use non-farm payrolls from the employment report, headline CPI and PPI inflation, retail sales, and the "advance" GDP release. These data are obtained from Lakdawala, Moreland & Schaffer (2021).

Risk premium. To investigate the risk premium channel, we use the CBOE Volatility Index (VIX), downloaded from the FRED database. We also use its components, following the Bekaert & Hoerova (2014) decomposition of VIX into conditional variance and variance premium, and following the Bekaert, Engstrom & Xu (2022) decomposition into risk aversion and uncertainty. Furthermore, we use the risk appetite measure of Bauer, Bernanke & Milstein (2023) and the aggregate equity premium constructed by Martin & Wagner (2019). To measure the heterogeneous risk exposure across different firms, we use the individual equity premium constructed by Martin & Wagner (2019) and firms' balance sheet information, including short-term/long-term/total debt ratio, cash ratio, capital investment ratio, and dividend ratio, which are acquired from Compustat.

Other variables. In addition to the responses of equity return, economic forecasts, and risk premium, we also estimate the effects of LSAP shocks on treasury/corporate yield and firms' dividend expectations. The treasury and corporate yield data are from Gürkaynak, Sack & Wright (2007) and FRED database respectively. The components

[14]The Aruoba-Diebold-Scotti business conditions index is designed to track real business conditions at high observation frequency. Its underlying (seasonally adjusted) economic indicators (weekly initial jobless claims; monthly payroll employment, monthly industrial production, monthly real personal income less transfer payments, monthly real manufacturing and trade sales; and quarterly real GDP) blend high-frequency and low-frequency data.

[15]The Brave-Butters-Kelley Indexes (BBKI) are a research project of the Federal Reserve Bank of Chicago. The BBK Coincident and Leading Indexes and Monthly GDP Growth for the U.S. are constructed from a collapsed dynamic factor analysis of a panel of 500 monthly measures of real economic activity and quarterly real GDP growth.

[16]The consensus expectations are available from the widely used survey by Action Economics, the successor to Money Market Services.

of treasury yields are taken from Kim & Wright (2005). The dividend expectation data is constructed by Gao & Martin (2021), which is a sentiment indicator based on option prices, valuation ratios, and interest rates. We also conduct a covariance analysis using data from Cieslak & Schrimpf (2019). Finally, we test the state-dependent effects of LSAP shocks using three variables to measure economic conditions; (i) the sentiment index proposed by Gardner, Scotti & Vega (2022); (ii) the monthly unemployment rate from the FRED database; and (iii) the daily VIX index.

Summary statistics of some main variables are listed in Table 1. Our baseline sample comprises 30 and 12 FOMC announcements in the QE and Taper periods, respectively.[17] The distribution of individual equity return in the QE and Taper periods is displayed in Figure A2.

3 Baseline specification and empirical results

We follow Nakamura & Steinsson (2018) and Lunsford (2020) and directly regress asset price changes on monetary policy shocks around FOMC announcements. The baseline specification is as follows:

$$y_{it} = \alpha + \beta_1 LSAP_t + \beta_2 FG_t + \beta_3 FFR_t + i.year + i.firm + \epsilon_{it} \tag{1}$$

where the dependent variable is the daily equity returns of individual firms, the three explanatory variables are the large-scale asset purchase shock (LSAP), forward guidance shock (FG), and the federal funds rate shock (FFR), which were constructed by Swanson (2021). Since both a positive FG shock and FFR shock represent a monetary tightening,

[17]In the QE period, we dropped the conference on Aug 9, 2011, because on the former day, the US experienced the biggest equity crash after the crisis and the US sovereign debt rating fell from AAA to AA+. Including this observation will contaminate the impact of monetary shocks on the equity market.

Table 1: Summary statistics

Variable	Obs	Mean	Std. dev.	Min	Max	Obs	Mean	Std. dev.	Min	Max
	QE (2009/07/01-2013/05/21)					Taper (2013/05/22-2014/09/17)				
LSAP	30	0.05	0.51	-1.29	1.01	12	0.02	1.02	-2.55	1.96
FG	30	0.02	0.59	-2.09	1.10	12	0.27	0.69	-1.34	1.28
FFR	30	0.15	0.09	-0.12	0.40	12	0.12	0.05	0.06	0.22
$\Delta Bond_{2Y}$	30	0.00	0.03	-0.04	0.06	12	0.01	0.04	-0.06	0.11
$\Delta Bond_{5Y}$	30	0.00	0.05	-0.10	0.17	12	0.02	0.10	-0.20	0.18
$\Delta Bond_{10Y}$	30	0.01	0.07	-0.11	0.20	12	0.01	0.09	-0.17	0.14
ΔGDP^f_{4Q}	30	-0.04	0.18	-0.43	0.47	12	-0.02	0.05	-0.08	0.07
$\Delta GDP^f_{CB,4Q}$	30	-0.09	0.33	-0.90	0.40	12	-0.10	0.23	-0.40	0.20
ΔVIX	30	-1.51	6.35	-11.95	15.10	12	-1.18	7.01	-14.87	9.81
$\Delta stock\ return$	193545	0.00	2.67	-10.87	13.04	80087	-0.02	2.21	-10.87	13.04

Notes: this table provides the summary statistics of some main variables. $LSAP$, FG, and FFR denote the large-scale asset purchase shock, forward guidance shock, and the federal fund rate shock, respectively. $\Delta Bond_{*Y}$ represents the daily change of $*-$year treasury yield around FOMC meetings. ΔGDP^f_{4Q} is the market's forecast revision of the growth of real GDP around the FOMC dates. $\Delta GDP^f_{CB,4Q}$ is the central bank's forecast revision of the growth of real GDP right before each announcement. ΔVIX is the percent change of the VIX index around the FOMC decisions. In the QE period, we dropped the conference on Aug 9, 2011, one day after the biggest equity crash since the financial crisis when the US sovereign debt rating fell from AAA to AA+. For more definitions of the variables, please refer to the text.

we multiplied Swanson's LSAP factor by -1 to facilitate comparison in our analysis. Consequently, a positive LSAP shock also indicates a monetary tightening, while a negative shock represents monetary easing. t is an index of FOMC conferences and i represents a firm. Both year and firm fixed effects are included. ϵ_{it} is the error term.[18] As discussed by Gürkaynak & Wright (2013), using the event study methodology based on high-frequency data could circumvent endogeneity issues related to omitted variable bias and reverse causality. To make the regression more concise and avoid the problem originating from bad controls, here we don't control any other low-frequency information.[19]

We display estimates of the baseline regression in Table 2. Each column reports the results over different sub-periods:

QE: 7/1/2009-5/21/2013

Taper: 5/22/2013-10/29/2014

Full sample: 1994/2/4-2019/6/19[20]

Pre-crisis: 1994/2/4-2008/9/14

ZLB: 2009/1/1-2015/11/30

QE4: 2020/4/29-2021/9/22[21]

---

[18] As discussed in Guraynak, Sack & Swanson (2005), Swanson (2021), Nakamura & Steinsson (2018), and Lunsford (2020), we assume that the following assumptions hold: (1) during a very short time window around FOMC announcements, monetary policy surprises are the main driver of asset prices; (2) The shocks are relatively exogenous to other factors that affect the prices in the same time window. This is plausible because monetary policy is made before the announcement and will not respond to asset prices in such a narrow window; (3) There is no arbitrage and the market is relatively efficient and responds quickly.

[19] Controlling for some low-frequency information does not alter our main results. We will discuss this issue later in the appendix.

[20] The span covered by Swanson (2021). The definitions of Pre-crisis and ZLB are also similar to Swanson (2021).

[21] On 15 March 2020, the Fed announced that it would increase its holdings of treasury securities by at least \$ 500 billion and its holdings of agency mortgage-backed securities by at least \$ 200 billion. But on this day, the FOMC statement was released at 5 pm when the market had closed. Therefore, we choose the next meeting on April 29, 2020, as the starting point of QE4. On 3 Nov 2021, Federal Reserve Chair Jerome Powell indicated that the FOMC would start to reduce the pace of asset purchases. So,

In column (1), we drop the meeting on 9 Aug 2011, one day after the biggest equity crash since the financial crisis when the US sovereign debt rating fell from AAA to AA+. In columns (3) and (5), we follow Nakamura & Steinsson (2018) to exclude the peak of the crisis period: 2008/6/1-2009/6/30, during which many anomalies of financial markets were documented in the literature.

Table 2: The effect of monetary policy shocks on stock returns

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	stock return		stock return			
Period	QE	Taper	All sample	Pre-Crisis	ZLB	QE4
LSAP	1.275***	-0.174	-0.023		0.226	4.988
	(0.233)	(0.630)	(0.179)		(0.324)	(4.054)
FG	-0.272	-0.420	-0.215***	-0.134*	-0.500	-5.199
	(0.240)	(0.868)	(0.072)	(0.069)	(0.313)	(6.478)
FFR	-3.284***	-1.207	-0.243*	-0.248*	1.137	-15.282***
	(1.182)	(7.549)	(0.141)	(0.136)	(1.427)	(3.451)
Year effect	Yes	Yes	Yes	Yes	Yes	Yes
Firm effect	Yes	Yes	Yes	Yes	Yes	Yes
N	193411	79939	1377643	851028	335459	95351
R^2	0.094	0.120	0.032	0.035	0.058	0.191

Notes: each column reports the results of the baseline regression over each period. In column (1), we dropped the conference on Aug 9, 2011, one day after the biggest equity crash since the financial crisis when the US sovereign debt rating fell from AAA to AA+. The periods in column (3)-(6) are 1994/2/4-2019/6/19; 1994/2/4-2008/9/14; 2009/1/1-2015/11/30; 2020/4/29-2021/9/22, respectively. In columns (3) and (5), we follow Nakamura & Steinsson (2018) and exclude the crisis period: 2008/6/1-2009/6/30, when many anomalies were documented in the literature. Both year and firm fixed effects are included and the standard errors are clustered on both the firm and conference level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

we chose the previous meeting on 22 Sep 2022, as the end point of QE4.

The estimates indicate that the responses of stock returns to the LSAP shock in the QE period are positive and significant–meaning that an unexpected monetary policy *easing* via asset purchases induces a *drop* in equity prices. This finding is inconsistent with the prediction of the standard textbook model where monetary easing should be good news for the equity market. By comparison, the response in the Taper period is opposite and consistent with the canonical model, although the coefficient is insignificant.[22] As shown in Table A2 and Table A3, this is robust to using different fixed effects and standard errors, and winsorizing equity return at different levels. The estimated relationship between LSAP shocks and stock returns is displayed in the scatter plot in Figure 1. The relationship is not driven by outliers.

Note that estimates of the effect of LSAP shocks for the "full" sample, displayed in column (3), indicate that the effect is insignificant both statistically and economically, while the effects of FG and FFR shocks are large. This is consistent with large-scale asset purchases being used intensively only in a short period. In the pre-crisis period, there were no large-scale asset purchases and the LSAP shocks are zero. The effects of FG and FFR in the QE and Taper periods are quite similar to those in the whole sample. Restricting the sample to the Zero-Lower-Bound period, we find that the effects of all shocks are insignificant, consistent with the literature.

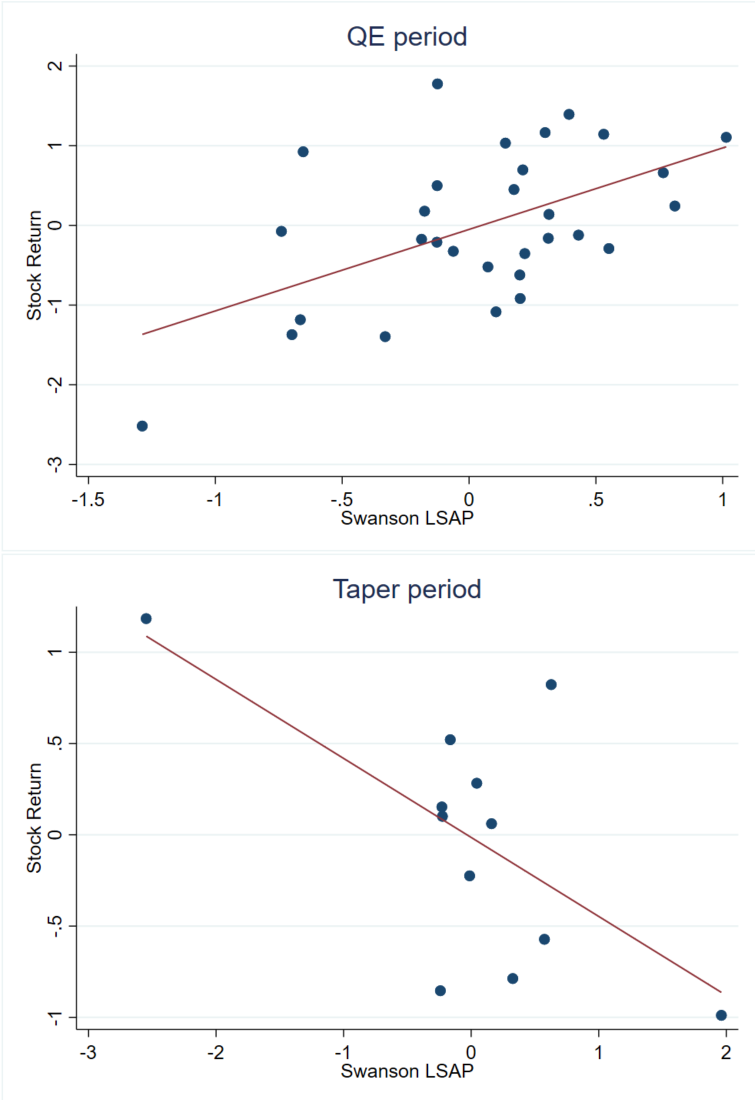
This suggests that in mixing the QE and Taper periods together, differences across regimes might be hidden. This rationalizes our investigation of the effects of LSAP shocks separately across regimes. As for QE4, although the direction of effects is similar to the earlier QE periods, the estimates are insignificant.[23] This period is quite special due to COVID-19. Thus, we mainly focus on the effects of LSAPs in the earlier QE and Taper periods when the shock is relatively large compared to other periods, allowing us

[22]We also show that the difference of the LSAP effect across these two periods is significant. There are no significant differences for the other two shocks. Results are displayed in Table A1.

[23]We extend the shocks of Swanson (2021) to 2022 for the purpose of studying QE4.

to more clearly identify its effects.

Figure 1: LSAP shocks and stock returns in the QE and Taper periods



This figure displays the scatter plot of LSAP shocks and the average daily stock returns of individual firms around the FOMC announcements in the QE (upper) and Taper period (bottom). Each point represents an FOMC meeting.

Robustness

We conduct many robustness checks. First, we employ the Swanson (2021) shock, the most widely used LSAP shock, as well as the shocks of Rogers, Scotti & Wright

(2018) and Jarociński (2024). We find that the results are robust: an unexpected asset purchase shock leads to a drop in stock prices in the QE period while this effect is the opposite or much weaker in the Taper period. The results are displayed in Table A4.[24]

Second, we investigate the daily responses of the equity index (Nasdaq index and $S\&P$ 500 index) and find that the effects are similar to those using individual stock returns. See Table A5 and Figure A3 for more details. Furthermore, the intraday responses of the equity index are also consistent with the daily reaction. We construct the 30-minute and 2-hour return of the $S\&P$ 500 future prices. We find that although the coefficients of LSAP shocks are insignificant, the direction is similar to the daily effects (see Table A6 and Figure A4).[25]

Third, to check whether the overall return is driven by upper or lower tail observations, we run the same regression over different subsamples: for absolute returns smaller than 2%, 5%, 10%, 15%, 20%, respectively. It turns out that the pattern is robust. See Table A7 for more details. Furthermore, note that in the baseline regression, we drop the FOMC meeting of Aug 9, 2011, because, on the former day, the US experienced the biggest equity crash after the crisis and the US sovereign debt rating fell from AAA to AA+. So, including this meeting will confound the effect of monetary shocks. Nevertheless, the results are quite similar if we include this conference, as displayed in Table A8. The scatter plot including this conference is shown in Figure A5. Moreover, we show that dropping other conferences will not alter our results through a leaving-one-conference-out analysis. See Figure A6 for details.

[24]The FG and FFR shock of RSW are the path and target shock of Acosta (2022). The RSW LSAP shock is the residual of regressing the 10-year treasury yield change in the 30 minutes around the FOMC announcement on the path and target shock. We call this RSW shock because Rogers, Scotti & Wright (2018) use a similar method to identify LSAP shocks. Apart from the LSAP, FG, and FFR shocks, Jarociński (2024) additionally estimates an information shock (Delphic forward guidance). His approach exploits an ignored feature: the high-frequency reactions of financial variables, such as interest rates and stock prices, to FOMC announcements, are usually very small, but sometimes very large, i.e. they have very fat tails or excess kurtosis.

[25]One reason for the insignificance is that it may take time for the market to digest the Fed information.

Fourth, our main findings are also robust to controlling for more low-frequency firm-specific information. We select three variables used in the literature (Gürkaynak, Karasoy-Can & Lee (2022)): size, profitability, and asset maturity. These variables are insignificant and our main results are unchanged (Table A9). In addition, to avoid the confounding effects of business cycles and other macroeconomic news on the equity market, we include measures of business cycles and past macroeconomic news shocks into the baseline regression and find that the effects are quite similar. These news shocks include GDP growth shock, retail shock, employment shock, CPI shock, and PPI shock. They are the differences between the real data and the consensus expectations prior to the release. Past news shocks refer to the cumulative sum of shocks within a period (e.g. one month) before the announcement. For more information about these variables, please see Section 2.2. The results in the QE and Taper are displayed in Table A10 and Table A11, respectively.

Finally, we consider but dismiss an alternative explanation for the different reactions of the stock market to LSAP shocks in the QE and Taper periods, that being the possibility that the economic structures differ in these two times.[26] We check whether macro news shocks have different effects on daily equity returns in the QE and Taper periods. The summary statistics of macro news shock are shown in Table A12. The moments of shocks in different periods are not quite distinct, which indicates that the economic structures don't vary too much at least in terms of macro news shocks. We also observe from Table A13 that the macro news shocks have no significantly different effects across the QE and Taper periods. This evidence supports our argument that the different responses of equity return to LSAP shocks in the QE and Taper periods are not due to a changed economic structure across periods but to the nature of LSAP

[26]It is hard to directly gauge the economic structures due to data limitations and other measurement issues. Nevertheless, this hypothesis would predict that other shocks will have different influences across the two periods as the shifts in economic structures will be reflected in the transmission of all the shocks.

transmission.

4 Information effect of LSAPs

We now turn to the question *why* are equity return responses in the QE period anomalous from the perspective of the canonical model? We conclude that LSAP shocks likely contain the central bank's private information. For example, an unexpected easing may suggest that the Fed is more pessimistic about future fundamentals, making shareholders more bearish in spite of the expansionary policies. We organize the section first by analyzing the time series implications and then cross-section implications.

4.1 Information effect of LSAPs: time series implications

To begin, we demonstrate that the Fed tends to buy more assets when it forecasts a worse economic outlook. If the LSAPs signal private information of the central bank, it should be that the FOMC's decision to conduct these purchases is affected by its private information. To test this conjecture, similar to Nakamura & Steinsson (2018) and Gürkaynak, Karasoy-Can & Lee (2022), we use Fed Greenbook forecast revisions of current or future real GDP growth, inflation, and the unemployment rate to measure the private information of the central bank. This data is publicly available only five years after the meeting, thus making it a good proxy for the central bank's private information set. We then demonstrate that an unexpected asset purchase induces a decline in *market* expectations of future GDP growth.

The results of regressing LSAP shocks on the Fed's forecast revisions right before the announcements are displayed in Table 3. In columns (1)-(8), the forecast horizon is 0 to 7 quarters ahead. We find that the Fed implements a larger asset purchase when it is

Table 3: The effect of Central Bank's private information on LSAP shocks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Forecast horizon	0Q	1Q	2Q	3Q	4Q	5Q	6Q	7Q
	LSAP							
ΔGDP^f_{CB}	0.090	0.575*	1.056**	1.006*	0.510	0.879**	1.033**	0.816***
	(0.104)	(0.301)	(0.395)	(0.557)	(0.413)	(0.334)	(0.468)	(0.179)
$\Delta Inflation^f_{CB}$	-0.188	-0.416	-0.425	0.412	0.167	-0.408	-0.218	-1.798
	(0.211)	(0.249)	(0.399)	(0.662)	(1.315)	(0.789)	(0.412)	(1.107)
$\Delta Unemployment^f_{CB}$	0.739	0.047	1.262*	0.762	0.148	0.197	0.329	-0.139
	(0.497)	(0.609)	(0.718)	(0.813)	(0.503)	(0.565)	(0.529)	(0.571)
N	42	42	42	42	42	40	29	9
R^2	0.044	0.192	0.207	0.162	0.044	0.110	0.191	0.609

Notes: In this table, we regress *LSAP* shock on the Central bank's private information. ΔGDP^f_{CB}, $\Delta Inflation^f_{CB}$, $\Delta Unemployment^f_{CB}$ denote the Central Bank's forecast revision on real GDP growth, inflation, unemployment rate right before each announcement, respectively. This information is obtained from the Green Book. From Columns (1) to (8), the forecast horizon is 0 to 7 quarters, respectively. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

more pessimistic about future growth than it was last period. In contrast, the effects of inflation and unemployment expectations are insignificant, indicating that these are not the main considerations for possibly implementing LSAPs.[27] Additionally, we find that LSAP shocks mainly respond to the Fed's own forecast instead of the previous market forecast by regressing the LSAP shocks on both information sets simultaneously (see Table B3). By contrast, testing the responses of FG and FFR shocks to these central bank forecast revisions shows insignificant results (see Table B4). This suggests that the Fed's information effect in this period is mainly due to the LSAP shocks. This is consistent with our baseline finding that the effects of FG and FFR shocks are consistent with the canonical models.

A second step to verify the existence of the information effect of LSAP shocks is by investigating its effects on *market* expectations of future fundamentals. Following Nakamura & Steinsson (2018) and Bauer & Swanson (2023), we use the Blue Chip forecasts to measure market expectations and estimate:

$$y_t = \alpha + \beta_1 LSAP_t + \beta_2 FG_t + \beta_3 FFR_t + \epsilon_t \tag{2}$$

where the dependent variable is the market's average consensus forecast revision of real U.S. GDP growth over the next 1 to X quarters. Sometimes FOMC meetings are held before the current month's survey (especially when the meetings happen in the first week of a month) and sometimes after. In the former case, the dependent variable should be the forecast in t minus that of $t-1$ while in the latter case, it should be $t+1$ minus t, namely the next month's revision. In the QE period, there are 5 out of 30 meetings that happened in the first week of a month. Because we don't know the exact date on

[27]The sample we use here is the QE and Taper period. Using only the QE period sample yields a consistent result, see Table B1. The effects in the Taper period share the same direction as that in the overall sample but are less significant, suggesting that the information effect in the Taper period may still exist but is relatively weaker (see Table B2).

which firms respond to a survey ("deadlines" are on day 10) and because dropping these meetings would cause a large loss of sample observations, we use the sum of t minus $t-1$ and $t+1$ minus t as our dependent variable. Intuitively, this is the revision from $t-1$ to $t+1$ so that the announcement falls into the time window for certain.[28]

As seen in columns (1)-(4) of Table 4, expansionary LSAP shocks significantly lower the market's expectation of future fundamentals, suggesting that market expectations are affected by the private information of the Fed revealed through asset purchases. However, this effect is not significant in the Taper period (see columns (5)-(8)).[29] We display the scatter plot of LSAP shocks and GDP forecast revisions in Figure B1. It is clear that in the QE period, LSAP shocks are positively correlated with real GDP forecasts, while in the Taper period, this correlation is weaker. This suggests that the information effect is less strong. The results are unlikely due to outlier observations.

We consistently find that an expansionary LSAP shock decreases the CPI-measured inflation rate in the QE period while the effect is opposite in the Taper period. This reinforces the hypothesis that the information effect is strong in the QE period and becomes relatively weaker in the latter Taper period. The effects of LSAP shocks on the unemployment rate forecast are insignificant, perhaps due to noise originating from long time windows. Nevertheless, the signs of coefficients are consistent with the information effect, as an easing LSAP shock tends to increase/decrease the unemployment rate in

[28]Specifically, the dependent variable $\Delta GDP^f_{XQ} = revision^t_{t-1} + revision^{t+1}_t = \left[\sum_{i=1}^{X}(GDP^{iQ}_t - GDP^{iQ}_{t-1})/X\right] + \left[\sum_{j=1}^{X}(GDP^{jQ}_{t+1} - GDP^{jQ}_t)/X\right]$, where $revision^t_{t-1}$ ($revision^{t+1}_t$) is the average forecast revision from month $t-1$ to t (from t to $t+1$) over the next X quarters, GDP^{iQ}_t is the month t forecast of GDP growth rate in next i quarters (relative to the quarter in month t), and GDP^{iQ}_{t-1} is the month $t-1$ forecast of GDP growth rate for the same target. For example, if t is 2013 May, then GDP^{3Q}_t is the forecast for 2014 Q1. Similarly, GDP^{jQ}_{t+1} is the month $t+1$ forecast of GDP growth rate in the next j quarters (relative to the quarter in month $t+1$) and GDP^{jQ}_t is the month t forecast of GDP growth rate for the same target.

[29]Most of the conferences (83%) in the QE period happened after the first week of a month, so using one-month revision ($t+1$ minus t) may be more suitable for these meetings. As a robustness check, we use $t+1$ minus t for all the meetings and find that the information effect is also much weaker in the Taper period (shown in Table B5).

Table 4: The effects of LSAP shocks on the market's real GDP forecast revision

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Period	QE				Taper			
	ΔGDP^f_{3Q}	ΔGDP^f_{4Q}	ΔGDP^f_{5Q}	ΔGDP^f_{6Q}	ΔGDP^f_{3Q}	ΔGDP^f_{4Q}	ΔGDP^f_{5Q}	ΔGDP^f_{6Q}
LSAP	0.198***	0.174***	0.162***	0.165***	0.005	-0.014	-0.015	-0.014
	(0.054)	(0.049)	(0.046)	(0.044)	(0.042)	(0.032)	(0.031)	(0.028)
FG	-0.107**	-0.089**	-0.087**	-0.086**	0.022	0.041	0.041	0.037
	(0.042)	(0.040)	(0.039)	(0.039)	(0.063)	(0.049)	(0.047)	(0.042)
FFR	-0.492**	-0.426**	-0.421**	-0.428**	0.312	0.513	0.539	0.574
	(0.189)	(0.167)	(0.166)	(0.165)	(0.466)	(0.382)	(0.353)	(0.326)
N	30	30	30	30	12	12	12	12
R^2	0.335	0.299	0.289	0.299	0.272	0.321	0.375	0.446

Notes: This table reports the effects of LSAP shocks on the market's real GDP forecast revision in the QE and Taper periods. The dependent variable ΔGDP^f_{XQ} is the market's average consensus forecast revision of the real GDP growth over the next 1 to X quarters. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

the QE/Taper period. These results are displayed in Table B6.[30]

Accounting for the Bauer-Swanson critique

As argued forcefully by Bauer & Swanson (2023), a concern is that revisions are affected by shifts in past economic conditions, which then shape the central bank's policy decision and market expectations simultaneously. Consequently, we control the effects of the movement of the business cycle. We use the Aruoba-Diebold-Scotti (ADS) Business Conditions Index, Brave-Butters-Kelley (BBK) Leading Index, $S\&P500$ index, and past news shocks (see Section 2.2 for more details about these measurements). In panel A of Table 5, we control for the past 15/30/60-day average of the ADS index before the announcement, the BBK index in the last month, and the past 30-day change of the $S\&P$ 500 index. To save space, we only show the coefficients on the LSAP. These are consistent with our baseline results. The coefficients on other variables are also quite similar to the ones without these controls. In panel B, we control for the past 30-day cumulative news shocks, the differences between the data release and the consensus expectations. Following Lakdawala, Moreland & Schaffer (2021), for the employment report, we use non-farm payrolls, for CPI and PPI we use headline inflation, retail sales are the total sales including automobiles, and GDP is the advance GDP release. Results are also robust.[31]

[30] The effects of federal fund rate shocks on the unemployment rate forecast in the Taper period are significantly negative, which means an easing policy rate shock is associated with rising unemployment. This is inconsistent with the responses of equity and other forecast revisions to this shock. It may not be proper to interpret this as evidence of the information effect of FFR shocks, however, as at the zero lower bound, the federal funds rate is quite small, and identification of this shock may not be as accurate as the other two shocks.

[31] Due to the small sample size, we don't control all the variables in one regression as in Bauer & Swanson (2023), but instead control each of these variables one by one like Acosta (2022). This also helps us to identify the relative importance of each variable and avoid the problem of multicollinearity.

Table 5: The market expectation responses with the control of business cycle or news

	(1)	(2)	(3)	(4)	(5)
			Panel A: Control business cycle		
	ADS_{15d}	ADS_{30d}	ADS_{60d}	BBK_{1m}	$\Delta S\&P500_{30d}$
			QE		
LSAP	0.169***	0.173***	0.185***	0.168***	0.175***
	(0.047)	(0.048)	(0.050)	(0.052)	(0.053)
N	30	30	30	30	30
R^2	0.320	0.315	0.323	0.346	0.314
			Taper		
LSAP	-0.012	-0.010	-0.004	-0.055**	-0.051**
	(0.035)	(0.034)	(0.028)	(0.017)	(0.018)
N	12	12	12	12	12
R^2	0.330	0.356	0.468	0.777	0.663
			Panel B: Control past news		
	GDP_{30d}	$Employment_{30d}$	$Retail_{30d}$	CPI_{30d}	PPI_{30d}
			QE		
LSAP	0.164***	0.177***	0.173***	0.178***	0.181***
	(0.053)	(0.053)	(0.049)	(0.044)	(0.051)
N	30	30	30	30	30
R^2	0.302	0.300	0.304	0.305	0.303
			Taper		
LSAP	-0.014	-0.015	-0.043	-0.012	-0.023
	(0.032)	(0.034)	(0.032)	(0.026)	(0.029)
N	12	12	12	12	12
R^2	0.321	0.331	0.467	0.450	0.470

Notes: Compared with columns (2)(6) of Table 4, we additionally control the impacts of the business cycle and macroeconomic news. ADS_{Xd} is the average of ADS index in the past X days before the announcement. BBK_{1m} is the BBK index in the last month. $\Delta S\&P500_{30d}$ is the change of $S\&P500$ index in the past 30 days. Past news S_{Xd} refers to the cumulative sum of news shocks S in the past X days prior to the meeting. Please refer to Section 2.2 for more details about these measurements. Sometimes there are no specific types of news shocks in the past one month (e.g. GDP news is quarterly) and the corresponding coefficients will be automatically eliminated. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Covariance analysis

As suggested by Cieslak & Schrimpf (2019), an economic growth shock and a risk premium shock should cause equity returns and treasury yields to move in the same direction. This would be opposite to the effects of a pure monetary policy shock. If the LSAP shocks in the QE period signal the central bank's private information about future fundamentals, one would expect that in this period, the covariance of the equity return and bond yield change on monetary policy event days should be more positive compared with non-event days. We verify this hypothesis by regressing the covariance on a dummy of monetary events in the QE and Taper periods:

$$y_t = \alpha + \beta_1 QE * ME + \beta_2 Taper * ME + \epsilon_t \tag{3}$$

where y represents the realized covariance of the equity return and yield change in the window from -15 minutes to +90 minutes around FOMC announcements, in basis points squared.[32] ME is a dummy equal to 1 when there is a monetary event (FOMC statements, minutes release, or press conferences). QE and $Taper$ are two dummies which equal 1 if the date belongs to 07/01/2009 – 05/21/2013 and 05/22/2013 – 10/29/2014, respectively. Here we drop the outlier conference on Aug 9, 2011, in the QE period. The regressions are estimated over the sample from Jul 2009 through Dec 2017, controlling for covariances on non-Fed-announcement days.

The results are displayed in Table 6. Columns (1)-(5) correspond to the covariance of the equity return and 3-month/2-year/5-year/10-year/30-year treasury yield changes, respectively. We find that the covariances become more positive in the QE period, especially for the longer-term bond yields, which is consistent with the information effect.

[32]The data on covariance is only available until Dec 2017. For more details on the construction of the covariances, please refer to Cieslak & Schrimpf (2019).

By comparison, in the Taper period, the covariances are more negative when there is a monetary event, suggesting that monetary shocks regained importance at the prospect of the monetary stimulus being removed. These results are robust to many checks: 1) decompose the monetary event into monetary policy decisions, minutes release, and press conferences; 2) considering the co-occurrence of forward guidance; and 3) different time windows: -15 to +15 min, -15 to 60 min. These results are shown in Table B7, Table B8, and Table B9, respectively.

Table 6: Monetary events and the covariance of stock returns and treasury yields change

	(1)	(2)	(3)	(4)	(5)
	3M	2Y	5Y	10Y	30Y
QE*ME	-0.181	2.321	8.372	13.099	23.769***
	(2.381)	(5.182)	(11.024)	(8.504)	(8.770)
Taper*ME	-2.096	-42.685***	-108.035***	-93.794***	-75.357***
	(1.714)	(16.091)	(38.655)	(33.455)	(23.888)
N	6155	6155	6155	6155	6155
R^2	0.000	0.008	0.018	0.015	0.011

Notes: The dependent variables are the realized covariance of equity return and yield change from -15 min to +90 min. ME is a dummy that is equal to 1 when there is a monetary event (FOMC statement, minutes, or press). QE and $Taper$ are two dummies which equal 1 if the date belongs to 07/01/2009 – 05/21/2013 and 05/22/2013 – 10/29/2014, respectively. Here we have dropped one outlier conference in the QE period. The regressions are estimated over the sample from Jul 2009 through Dec 2017, controlling for covariances on non-Fed-announcement days. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Information effect and economic conditions

We now illustrate that the information effect is more pronounced during worse economic conditions. To investigate this, we include the lagged economic states and their interaction terms with LSAP in the baseline regression. We use three measures to describe the economic state: the first is the condition described in the FOMC announcements, and the other two are the circumstances observed in the real data. The first is the sentiment index developed by Gardner, Scotti & Vega (2022) using a textual method (bigger values correspond to better situations). The latter two are the monthly unemployment rate and the daily level of the VIX index. The results can be observed in Table B10. The dependent variables in columns (1)(2)(3), (4)(5)(6), and (7)(8)(9) are market forecast revision, VIX change, and stock return respectively. It is seen that under worse economic conditions, an easing LSAP shock leads to a bigger drop in the market forecast of real GDP growth, a larger increase in the VIX index, and a larger decline in equity prices.[33] These results help to explain why the information effect is more pronounced in the QE period during which the economic fundamentals are worse than in the Taper period. This finding is also consistent with Altavilla, Brugnolini, Gürkaynak, Motto & Ragusa (2019) and Lunsford (2020) in which they document that the information effects of monetary policy shocks are stronger during the recession period.

Dynamics of the information effect

We turn to examine how persistent the effects of the LSAPs information effect are in the QE period. Using local projections as in Jordà (2005) and Swanson (2021), we estimate:

$$\Delta P_{i,t+h} = \alpha_h + \beta_h LSAP_t + \gamma_h FG_t + \theta_h FFR_t + \sum_{n=1}^{3} \Delta P_{i,t-n} + i.year + i.firm + \epsilon_{i,t}^h \quad (4)$$

where t takes on the dates of FOMC announcements, and $t+h$ denotes the date h business days after an FOMC announcement, i represents a firm, P is the equity price of an individual firm, $\Delta P_{i,t+h} = (P_{i,t+h} - P_{i,t-1})/P_{i,t-1} * 100$, $h = 0/1/2/\ .../30$, $\Delta P_{i,t-n} =$

[33] The sample we used here is the QE and the Taper period. The pattern also holds in the QE period alone, see Table B11 for more details.

$(P_{i,t-n} - P_{i,t-n-1})/P_{i,t-n-1} * 100$, $n = 1/2/3$. Both year and firm fixed effects are included. Standard errors are clustered at both the conference and firm levels. $\beta_h/\gamma_h/\theta_h$ is the response coefficient to $LSAP/FG/FFR$ associated with a specific horizon. We plot the β_h and h in Figure B2. It is seen that the dominance of the LSAP information effect persists for around three weeks and then gradually dies out.

Information effect in the QE4 period

As seen Table 2, the responses of equity prices in the QE4 period are insignificant.[34] To further investigate this, table B12 displays the comparison of the effects between the QE and QE4 periods. We see that the effects of LSAP shocks on all variables are insignificant, although the direction is consistent with those in the QE (1 to 3) period. This is robust to using the RSW shock (see Table B13). This is consistent with Gardner, Scotti & Vega (2022), who find that the FOMC sentiment index and other variables perform less well in explaining the reaction of equity prices to macroeconomic news in the Covid-19 sample and that equity price reaction is even lower than in previous recessions. One possible explanation is that the uncertainty effect dominates the policy intervention under extremely elevated uncertainty, such as in the COVID-19 pandemic.

4.2 Information effect of LSAPs: cross-section implications

We put forth two additional pieces of evidence on the information effect associated with the Fed's LSAP shocks. First, we demonstrate that in the QE period, more procyclical firms are more adversely affected by an expansionary LSAP shock. Second, we show that the information effect is priced in the cross-section of stock return. In the QE period, stocks with higher exposure to LSAP shocks have larger excess returns compared to

[34]The Swanson (2021) shocks end in 2019, we extend them to 2022 using a similar methodology.

lower exposure stocks.

Information effect and procyclicity

If LSAP shocks send signals about future economic growth in the QE period, we may expect that those more procyclical firms should be more affected. To test this, we construct a measure of cyclicity and include its interaction term with LSAP in the baseline regression. More specifically, we regress the revenue-to-asset ratio on nominal GDP growth for each industry (SIC 3-digit classification) and use the coefficient of GDP growth as a proxy for the cyclicity of this industry. A more positive value means more pro-cyclical. To alleviate the endogeneity issue, we estimate the coefficients based on the data from 1994 to 2008, which has no overlap with our main sample. We also winsorize this variable at a 1% level on both sides to avoid the effect of outliers. As seen in Table 7, in the QE period firms that are more pro-cyclical experience a larger decline in the QE period following an easing LSAP shock. By contrast, in the Taper period, this impact is insignificant indicating the information effect is not strong enough compared with the QE period. The results are robust to use 4-digit industry, see Table B14.

Table 7: The procyclical effects of LSAP shocks on stock returns

	(1)	(2)	(3)	(4)
	stock return			
Sample	QE		Taper	
LSAP	1.043***	1.284***	-0.436***	-0.158
	(0.283)	(0.233)	(0.078)	(0.649)
LSAP*cyclicity	1.501***	1.568**	0.220	-0.393
	(0.523)	(0.588)	(0.185)	(1.296)
FG		-0.268		-0.448
		(0.240)		(0.895)
FG*cyclicity		0.126		0.935
		(0.351)		(1.785)
FFR		-3.327***		-1.268
		(1.184)		(7.780)
FFR*cyclicity		-0.520		4.920
		(2.374)		(14.496)
N	177186	177186	73432	73432
R^2	0.087	0.096	0.121	0.122

Notes: *cyclicity* is the coefficient of regressing the ratio of revenue to asset on nominal GDP growth for each industry (the sample is from 1994 to 2008). A higher value means more pro-cyclical. Here, the industry code uses SIC 3-digit classification. We include both year and firm fixed effects. The standard errors are clustered on both the conference and firm levels. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

LSAP information effect premium

We then examine whether the Fed information effect of LSAPs is priced in the cross-section of U.S. firms' equity returns. It may be that different stocks have different sensitivities (exposures) to the information effect of LSAPs in the QE period. Standard risk-return reasoning suggests that investors prefer holding less sensitive stocks to high-sensitive stocks. There should thus be higher excess returns associated with holding more sensitive stocks in the QE period.[35]

To examine this, we first estimate firms' equity exposure to LSAP using:

$$StockReturn_{it} = \alpha_i + \beta_i LSAP + \gamma_i FG + \delta_i FFR + \epsilon_{it},\ i = 1, 2, 3, ... \tag{5}$$

where the dependent variable is the daily equity return of each firm on FOMC days and i denotes the firm. We estimate this regression in the QE period. Firm equity exposure to the Fed information effect of LSAP is measured by β_i. A higher positive value means this firm suffers more from an easing LSAP shock, i.e., is more exposed to the information effect. The distribution of β_i is displayed in Figure B3.[36]

We then group firms into deciles according to their estimated β_i (with one as the lowest) and construct equally weighted portfolios by decile. For each portfolio, we estimate the excess return that is unexplained by common risk factors.[37] We display excess returns by portfolio in the QE period in Figure 2. Portfolios with greater exposure to the information effect have larger excess returns, suggesting that in recession periods (e.g. the QE period) investors require a higher return as compensation for holding these stocks. By comparison, we show in Figure B4 that for the same portfolios, the excess return in the Taper period has a much weaker connection to this exposure. This is

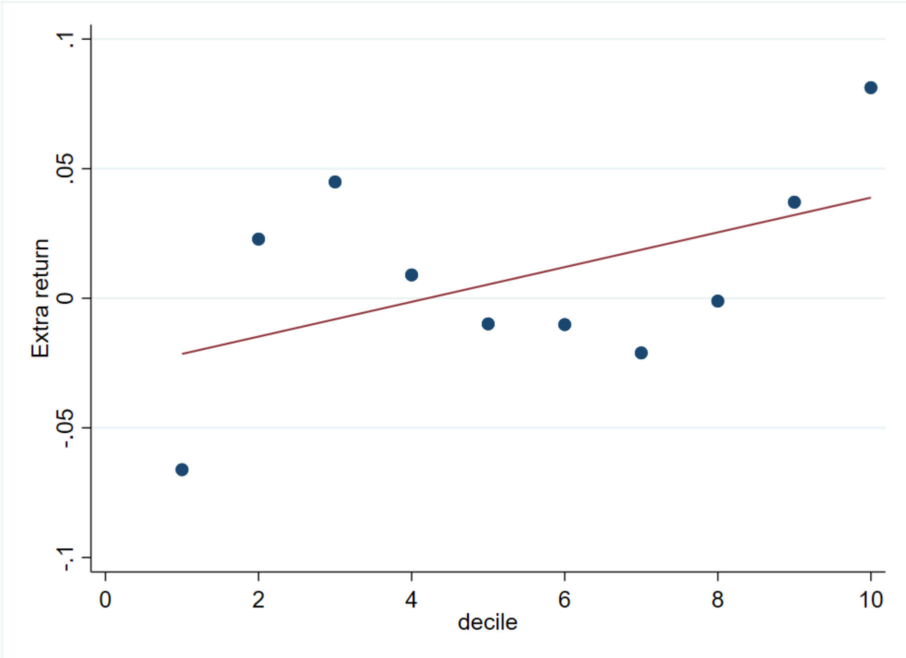
[35] In this period, the overall economy is bad and those firms with greater sensitivity to the Fed information effect (i.e., their prices decrease more when facing bad news about future economic growth signaled by the easing shock) should be less preferred by investors because these stocks have worse performance on bad days.

[36] We see that the average of β_i is positive, which is consistent with our baseline finding that a tightening LSAP shock boosts the overall equity market.

[37] The estimation specification is $StockReturn_{it} - RF_t = \alpha_i + \beta_{1i} Market_t + \beta_{2i} SMB_t + \beta_{3i} HML_t + \beta_{4i} RMW_t + \beta_{5i} CMA_t + \epsilon_{it}, i = 1, 2, 3, ..., 10.$, where $StockReturn_{it}$ is a portfolio's daily equity return on FOMC dates, RF_t is the daily risk-free rate, $Market$ is excess return on the market portfolio, SMB is small minus big (size factor), HML is high minus low (value factor), RMW is most profitable minus the least profitable (profitability factor), and CMA is conservatively minus aggressively (investment factor). The left-hand side represents a portfolio's excess return relative to risk-free rates. All the factors are obtained from Kenneth French's data library. The α_i is the excess return we need.

because investors require a smaller premium for these stocks when the economy improves.

Figure 2: Excess returns and the information effect exposure to LSAP shocks



This figure plots the relationship between portfolio excess return and the information effect exposure to LSAP shocks. The horizontal axis denotes the decile, with the biggest decile denotes the portfolio with the largest exposure. The vertical axis is the corresponding excess return above Fama-French five risk factors.

5 Risk premium channel

In this section, we turn to explore *how* the information effect associated with Fed LSAP shocks is connected to the responses of equity prices. We conclude that it is mainly a risk premium channel: in the QE period, the pessimistic information suggested by an easing LSAP shock increases market risk perception and induces a drop in equity prices. Furthermore, we show that the different responses in equity prices across QE and Taper periods are not due to two other channels through which monetary shocks affect equity prices, namely the risk-free rate channel and the dividend channel.

To begin, we test the effect of LSAP shocks on market risk using a specification analogous to Equation 2, the only difference being that we replace the forecast revision with the change in market risk around the FOMC announcements. To measure market risk, we use several variables. The first is the CBOE Volatility Index (VIX). Second, Bekaert & Hoerova (2014) decompose VIX into conditional variance (CV) and variance premium (VP), and Bekaert, Engstrom & Xu (2022) decompose VIX into risk aversion (RA) and uncertainty (UNC). We use these decomposed components as well to see which component responds to the LSAP shocks. Finally, we also use the risk appetite (lower value means more risk averse) developed by Bauer, Bernanke & Milstein (2023) and the average equity premium ($SVIX$) constructed by Martin & Wagner (2019).

The results displayed in Table 8 indicate that in the QE period, an expansionary LSAP shock drives up the equity market risk premium. By comparison, the effects in the Taper period are insignificant although the direction is consistent. This explains why an easing LSAP leads to a negative response of equity returns in the QE period yet an insignificant response in the Taper period. The change of VIX and LSAP shocks are also depicted in Figure B5, which suggests that the results are not driven by outliers.

In the QE period, if equity prices are mainly affected by the information effect through risk premium, the effects of LSAP shocks should be weaker after controlling for the variables through which the information effect is transmitted and the Fed's private information itself. As seen in Table B15, in the QE period the coefficient on LSAP declines from 1.3 to 1.1/0.7 with the control of market forecast revision and change of VIX, respectively (columns (1)-(3)). This parameter drops to 0.5 if we control for both variables and is even smaller and less significant if we additionally control for the private information itself (columns (4) and (5)). Moreover, the effects of an easing LSAP shock are more pronounced in the Taper period after controlling for variables proxying for the information effect. This indicates that the information effect also exists in the Taper period but is less powerful than the pure policy effect.

Table 8: The effect of LSAP shocks on risk premium

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	ΔVIX	ΔRA	ΔUNC	ΔCV	ΔVP	ΔRAP	$\Delta SVIX$
	Panel A: QE						
LSAP	-6.836***	-0.039**	-0.021**	-0.040	-0.271***	0.849***	-4.768***
	(2.275)	(0.019)	(0.009)	(0.038)	(0.090)	(0.240)	(1.314)
FG	-0.501	0.006	-0.008	0.019	-0.041	0.283	-0.579
	(1.557)	(0.011)	(0.009)	(0.056)	(0.043)	(0.255)	(1.021)
FFR	6.301	0.109	0.114***	0.001	0.276	-2.696*	4.697
	(9.587)	(0.071)	(0.031)	(0.283)	(0.336)	(1.414)	(5.921)
N	30	30	30	30	30	30	30
R^2	0.273	0.308	0.214	0.013	0.255	0.159	0.330
	Panel B: Taper						
LSAP	-6.136	-0.016	-0.029	-0.039	-0.238	0.958	-2.664
	(6.830)	(0.015)	(0.027)	(0.057)	(0.281)	(0.742)	(6.528)
FG	11.044	0.022	-0.008	0.047	0.436	-1.496	4.246
	(9.312)	(0.020)	(0.036)	(0.074)	(0.401)	(1.002)	(9.007)
FFR	42.823	0.093	0.210	1.442*	0.881	-6.434	13.861
	(78.829)	(0.179)	(0.253)	(0.697)	(2.646)	(8.862)	(52.841)
N	12	12	12	12	12	12	9
R^2	0.187	0.171	0.643	0.361	0.222	0.292	0.070

Notes: RA (risk aversion) and UNC (uncertainty) are constructed by Bekaert, Engstrom & Xu (2022). CV (conditional variance) and VP (variance premium) are obtained from Bekaert & Hoerova (2014). RAP (risk appetite) is created by Bauer, Bernanke & Milstein (2023). $SVIX$ is yielded by Martin & Wagner (2019), which is derived from index option prices and is a proxy for equity premium. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Firm heterogeneity

To further illustrate the risk premium channel, we explore how the effects of LSAP shocks on equity returns vary for firms with different equity premiums. To measure the equity premium of individual firms, we use the firm's $SVIX$ index from Martin & Wagner (2019). As seen in Table 9, during the QE period companies with higher equity premiums experienced greater losses following an easing LSAP shock but during the Taper period this pattern was almost reversed (though not statistically significant). The dataset includes only firms from the S&P 500 index from August 1999 to September 2013. In order to extend this analysis to more firms and longer horizons, we also use several variables as proxies of firms' risk exposure, including *Sdebt* (short-term debt over total asset ratio), *Ldebt* (long-term debt over total asset ratio), *Debt* (total debt over total asset ratio), *Cash* (cash and short-term investment over total asset ratio), *Capital Inv* (capital investment over total asset ratio), *Dividend* (dividend over total asset ratio). Although these variables are not perfect measures of firm risk, it is typically firms with higher debt leverage, lower cash flow, higher capital investments, and lower dividend payments that are of higher risk. All of these variables are from Compustat and the sample covers all listed firms rather than only those included in the $S\&P$ 500 index.[38] As seen in Table 10, in the QE period firms with larger risk exposure (higher debt ratio, lower cash ratio, bigger capital investment ratio, lower dividend) are more adversely affected by an unexpected easing LSAP shock. In the Taper period, the coefficients of the interaction term are almost opposite, which means that the stock prices of these firms increase even more in response to an easing LSAP shock.

LSAP shocks could affect equity prices through channels other than the risk premium channel, such as the risk-free rate channel or the dividend channel, but we find that these are not the primary drivers of differences in equity returns between the QE and Taper periods. Using a specification analogous to Equation 2, we estimate the effects of LSAP shocks on treasury yields. The results are illustrated in Table C1. The

[38]We use only industrial firms, including companies reporting manufacturing, retail, construction, and other commercial operations other than financial services. To avoid the impacts of outliers, we winsorize these variables at a 1% level on both sides.

dependent variables are 2/5/10-year treasury yield changes around the FOMC meetings and the data are from Gürkaynak, Sack & Wright (2007). We see that an easing LSAP shock decreases medium/long-term treasury yields in the QE period. This is inconsistent with the response of equity returns in the same period because a reduction in the risk-free rate reduction should lead to an increase in equity prices.

Table 9: The effects of LSAP on the stock return of firms with different risk premiums

	(1)	(2)	(3)	(4)
	stock return			
Period	QE		Taper	
$LSAP_t$	0.757***		-0.525***	
	(0.056)		(0.063)	
$LSAP_t * SVIX_{it-1}$	5.248***	5.153***	-0.546	-0.505
	(0.622)	(0.647)	(1.094)	(1.108)
$SVIX_{it-1}$	-2.655***	-2.303***	32.509***	23.170*
	(0.478)	(0.640)	(11.178)	(12.217)
Firm FE	Yes	Yes	Yes	Yes
Conference FE	No	Yes	No	Yes
N	12338	12338	1188	1188
R^2	0.145	0.363	0.570	0.576

Notes: This table displays the effects of LSAP on the stock return of firms with different risk premiums. The specification in columns (1) and (3) is $stock\ return_{it} = \alpha + \beta_1 LSAP_t + \beta_2 LSAP_t * SVIX_{it-1} + \beta_3 SVIX_{it-1} + i.firm + \epsilon_{it}$. In columns (2) and (4), we additionally include the conference fixed effects to absorb any time-varying factors. $SVIX_{it-1}$ is the equity premium of a firm in the last month of each announcement, which is obtained from Martin & Wagner (2019). Its time range is from Aug 1999 to Sep 2013 and the sample only covers the *S&P* 500 firms. The standard errors are clustered at the firm level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Moreover, the bond yield responses in the Taper period are quite similar to the QE period (e.g. see columns (3) and (6)), thus the risk-free rate channel is unlikely to

Table 10: Heterogeneous effects of LSAP shocks on stock returns

	(1)	(2)	(3)	(4)	(5)	(6)
	Sdebt	Ldebt	Debt	Cash	Capital Inv	Dividend
			Panel A: QE			
LSAP*X	0.098	0.367***	0.281***	-0.257***	0.480***	-1.324***
	(0.181)	(0.084)	(0.078)	(0.081)	(0.132)	(0.335)
N	128078	127694	127600	128172	108891	127625
R^2	0.190	0.191	0.190	0.190	0.192	0.190
			Panel B: Taper			
LSAP*X	-0.115	-0.259***	-0.238***	0.156**	-0.397***	-0.208
	(0.107)	(0.057)	(0.054)	(0.061)	(0.122)	(0.203)
N	51888	51707	51671	51924	43875	51693
R^2	0.173	0.173	0.173	0.173	0.173	0.173

Notes: The regression equation is $stock\ return_{it} = \alpha + \beta_1 LSAP_t * X_{it-1} + \beta_2 X_{it-1} + i.conference + i.firm + \epsilon_{it}$, where X_{it-1} denotes a firm's one-year lagged balance sheet variable. In columns (1)-(6), the variable we use is *Sdebt* (short-term debt ratio), *Ldebt* (long-term debt ratio), *Debt* (total debt ratio), *Cash* (cash ratio), *Capital Inv* (capital investment ratio), *Dividend* (dividend ratio), respectively. We control for both conference and firm fixed effects. The standard errors are clustered at the firm level. For space-saving, we only display *LSAP*-related coefficients. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The results are robust to use quarterly data, see Table B16 for more details.

be the main reason for the difference in equity return across the two periods.[39] We also decompose the bond yield into term premium and average expected short rate and find that LSAP shocks have effects on both components and the effects in the QE and Taper periods are quite similar (see Table C4).[40] We don't find significant differences in the responses of corporate yields and credit spreads to LSAP shocks across periods either (see Table C5).

Finally, we test the dividend channel. To measure the dividend expectations, we use the variable developed by Gao & Martin (2021), a daily sentiment indicator based on option prices, valuation ratios, and interest rates.[41] The results are displayed in Table C6. The dependent variables of columns (1) and (4) are derived from full sample data, while the dividend expectation in columns (2) and (5) are based on real-time data. Columns (3) and (6) use the real-time data and assume a random walk process. We find that the dividend responses are insignificant in both the QE and Taper periods for all three measures, which suggests that the dividend channel might not be the key force explaining the pattern in the equity market.

6 Conclusion

We document a novel finding that an unexpected easing shock from U.S. large-scale asset purchases leads to a decline in equity prices in the QE period, contrary to the prediction of canonical models. We show that the key to understanding this phenomenon is the

[39]The results are robust to (1) using intraday yield changes, see Table C2; (2) using the daily yield change with other maturities, see Table C3.

[40]This decomposition data comes from Kim & Wright (2005).

[41]This daily measure offers a sharper identification compared with other low-frequency proxies. As explained in Gao & Martin (2021), the indicator can be interpreted as a lower bound on the expected dividend growth that must be perceived by an unconstrained, rational investor with risk aversion equal to at least one who is happy to invest his or her wealth fully in the stock market and whose beliefs are consistent with historical evidence on the relationship between valuation ratios, returns, and dividend growth.

information effect associated with LSAP shocks. Namely, an unexpected asset purchase signals the private information of the Federal Reserve that future fundamentals are worse than previous expectations, thus indicating bad news for the equity market in spite of the easing policy itself. Furthermore, it is found that the information effects are bigger for more procyclical firms and more prominent during worse economic conditions, which explains why its influence is less powerful in the Taper period when the economy begins to recover from the recession. To connect this information effect to stock price responses, we highlight the risk premium channel by showing that an unexpected easing LSAP shock depresses investors' risk appetite and increases the market risk premium. Moreover, firms with higher risk exposure are more adversely affected. By contrast, risk-free rates drop in response to an expansionary LSAP shock and the effects of LSAPs on dividend expectation are insignificant. These suggest that the risk-free rate channel and dividend channel are not the main reasons for the abnormal responses of equity price in the QE period. In the future, it is worth exploring the information effect of LSAP on the real economy rather than only on the financial market, such as its impact on inflation, unemployment, and investment, as in Kim, Laubach & Wei (2023). Another interesting avenue may be incorporating the information effect channel into a model and comparing how this interacts with other channels, such as the risk-free rate channel, balance sheet channel, and signaling channel, etc. Finally, it is important to consider the optimal Large-scale asset purchase policy in the context of private information revelation.

References

Acosta, M. (2022), 'The perceived causes of monetary policy surprises', *Published Manuscript* .

Altavilla, C., Brugnolini, L., Gürkaynak, R. S., Motto, R. & Ragusa, G. (2019), 'Measuring euro area monetary policy', *Journal of Monetary Economics* **108**, 162–179.

Bauer, M. D., Bernanke, B. S. & Milstein, E. (2023), 'Risk appetite and the risk-taking channel of monetary policy', *Journal of Economic Perspectives* **37**(1), 77–100.

Bauer, M. D. & Swanson, E. T. (2023), 'An alternative explanation for the "fed information effect"', *American Economic Review* **113**(3), 664–700.

Bekaert, G., Engstrom, E. C. & Xu, N. R. (2022), 'The time variation in risk appetite and uncertainty', *Management Science* **68**(6), 3975–4004.

Bekaert, G. & Hoerova, M. (2014), 'The vix, the variance premium and stock market volatility', *Journal of econometrics* **183**(2), 181–192.

Bhattarai, S. & Neely, C. J. (2022), 'An analysis of the literature on international unconventional monetary policy', *Journal of Economic Literature* **60**(2), 527–97.

Bu, C., Rogers, J. & Wu, W. (2021), 'A unified measure of fed monetary policy shocks', *Journal of Monetary Economics* **118**, 331–349.

Campbell, J. R., Evans, C. L., Fisher, J. D., Justiniano, A., Calomiris, C. W. & Woodford, M. (2012), 'Macroeconomic effects of federal reserve forward guidance [with comments and discussion]', *Brookings papers on economic activity* pp. 1–80.

Chari, A., Dilts Stedman, K. & Lundblad, C. (2021), 'Taper tantrums: Quantitative easing, its aftermath, and emerging market capital flows', *The Review of Financial Studies* **34**(3), 1445–1508.

Cieslak, A. & Schrimpf, A. (2019), 'Non-monetary news in central bank communication', *Journal of International Economics* **118**, 293–315.

Faust, J., Swanson, E. T. & Wright, J. H. (2004), 'Do federal reserve policy surprises reveal superior information about the economy?', *Contributions in Macroeconomics* **4**(1), 20121011.

Fukuda, S.-i. (2019), 'Spillover effects of japan's quantitative and qualitative easing on east asian economies', *Macroeconomic shocks and unconventional monetary policy: Impacts on emerging markets* pp. 66–98.

Gagnon, J., Raskin, M., Remache, J. & Sack, B. (2011), 'The financial market effects of the federal reserve's large-scale asset purchases', *International Journal of Central Banking* **7**(1), 45–52.

Gao, C. & Martin, I. W. (2021), 'Volatility, valuation ratios, and bubbles: An empirical measure of market sentiment', *The Journal of Finance* **76**(6), 3211–3254.

Gardner, B., Scotti, C. & Vega, C. (2022), 'Words speak as loudly as actions: Central bank communication and the response of equity prices to macroeconomic announcements', *Journal of Econometrics* **231**(2), 387–409.

Georgiadis, G. & Gräb, J. (2016), 'Global financial market impact of the announcement of the ecb's asset purchase programme', *Journal of Financial Stability* **26**, 257–265.

Guraynak, R., Sack, B. & Swanson, E. (2005), 'Do actions speak louder than words? the response of asset prices to monetary policy action and statements', *International Journal of Central Banking* **1**, 55–93.

Gürkaynak, R., Karasoy-Can, H. G. & Lee, S. S. (2022), 'Stock market's assessment of monetary policy transmission: The cash flow effect', *The Journal of Finance* **77**(4), 2375–2421.

Gürkaynak, R. S., Sack, B. & Wright, J. H. (2007), 'The us treasury yield curve: 1961 to the present', *Journal of monetary Economics* **54**(8), 2291–2304.

Gürkaynak, R. S. & Wright, J. H. (2013), 'Identification and inference using event studies', *The Manchester School* **81**, 48–65.

Hancock, D. & Passmore, W. (2011), 'Did the federal reserve's mbs purchase program lower mortgage rates?', *Journal of Monetary Economics* **58**(5), 498–514.

Ippolito, F., Ozdagli, A. K. & Perez-Orive, A. (2018), 'The transmission of monetary policy through bank lending: The floating rate channel', *Journal of Monetary Economics* **95**, 49–71.

Jarociński, M. (2022), 'Central bank information effects and transatlantic spillovers', *Journal of International Economics* **139**, 103683.

Jarociński, M. (2024), 'Estimating the fed's unconventional policy shocks', *Journal of Monetary Economics* .

Jordà, Ò. (2005), 'Estimation and inference of impulse responses by local projections', *American economic review* **95**(1), 161–182.

Joyce, M., Tong, M. & Woods, R. (2011), 'The united kingdom's quantitative easing policy: design, operation and impact', *Bank of England Quarterly Bulletin* .

Kiley, M. T. (2014), 'The response of equity prices to movements in long-term interest rates associated with monetary policy statements: before and after the zero lower bound', *Journal of Money, Credit and Banking* **46**(5), 1057–1071.

Kim, D. H. & Wright, J. H. (2005), An arbitrage-free three-factor term structure model and the recent behavior of long-term yields and distant-horizon forward rates, Technical report, Federal Reserve Board.

Kim, K., Laubach, T. & Wei, M. (2023), Macroeconomic effects of large-scale asset purchases: New evidence, Technical report, Federal Reserve Board.

Lakdawala, A., Moreland, T. & Schaffer, M. (2021), 'The international spillover effects of us monetary policy uncertainty', *Journal of International Economics* **133**, 103525.

Lunsford, K. G. (2020), 'Policy language and information effects in the early days of federal reserve forward guidance', *American Economic Review* **110**(9), 2899–2934.

Mamaysky, H. (2018), 'The time horizon of price responses to quantitative easing', *Journal of Banking & Finance* **90**, 32–49.

Martin, I. W. & Wagner, C. (2019), 'What is the expected return on a stock?', *The Journal of Finance* **74**(4), 1887–1929.

Nakamura, E. & Steinsson, J. (2018), 'High-frequency identification of monetary non-neutrality: the information effect', *The Quarterly Journal of Economics* **133**(3), 1283–1330.

Rogers, J. H., Scotti, C. & Wright, J. H. (2018), 'Unconventional monetary policy and international risk premia', *Journal of Money, Credit and Banking* **50**(8), 1827–1850.

Romer, C. D. & Romer, D. H. (2000), 'Federal reserve information and the behavior of interest rates', *American economic review* **90**(3), 429–457.

Sims, E. R., Wu, J. C. & Zhang, J. (2022), Unconventional monetary policy according to hank, Technical report, National Bureau of Economic Research.

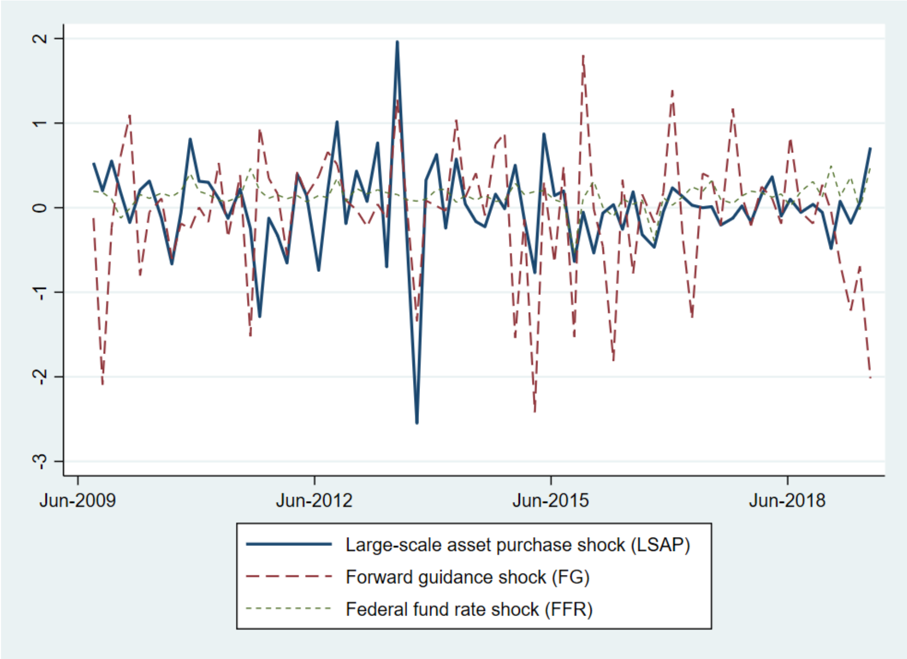
Swanson, E. T. (2021), 'Measuring the effects of federal reserve forward guidance and asset purchases on financial markets', *Journal of Monetary Economics* **118**, 32–53.

Todorov, K. (2020), 'Quantify the quantitative easing: Impact on bonds and corporate debt issuance', *Journal of Financial Economics* **135**(2), 340–358.

Wright, J. H. (2012), 'What does monetary policy do to long-term interest rates at the zero lower bound?', *The Economic Journal* **122**(564), F447–F466.

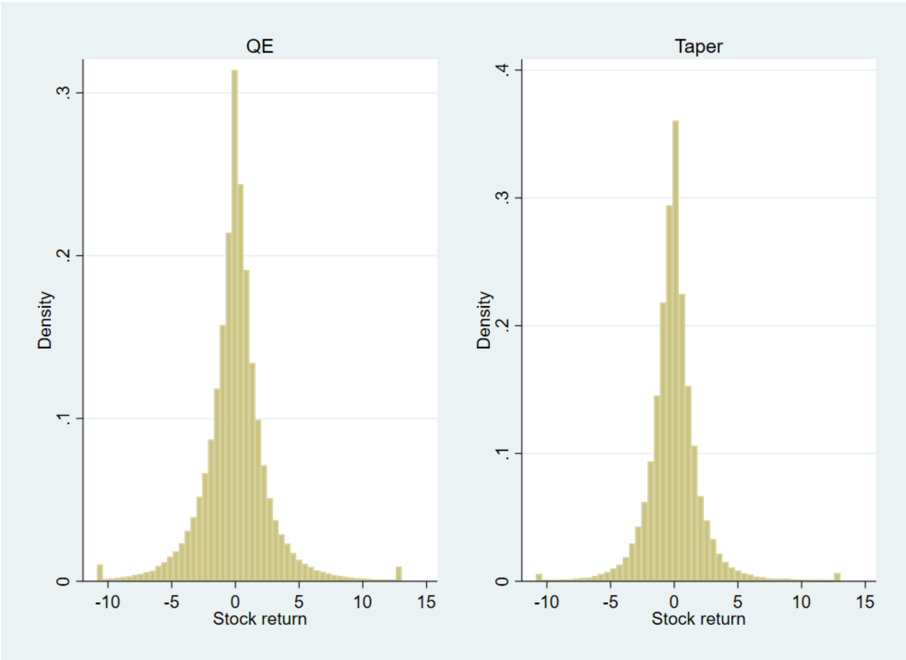
A More results on equity responses

Figure A1: Monetary policy shocks



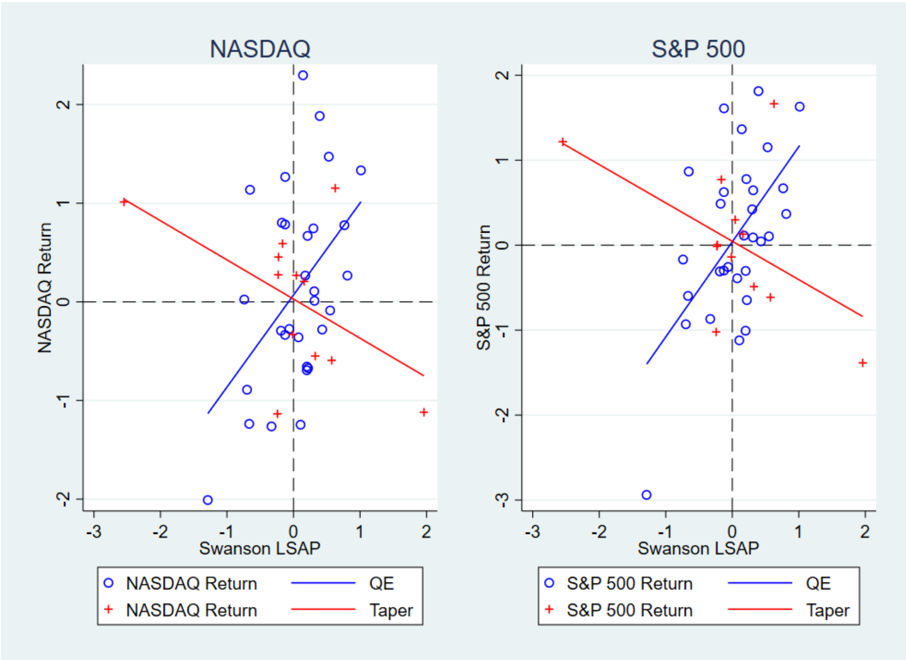
This figure displays the times series of the Swanson (2021) shocks: large-scale asset purchase shock (LSAP), forward guidance shock (FG), and federal fund rate shock (FFR).

Figure A2: Distribution of individual equity returns



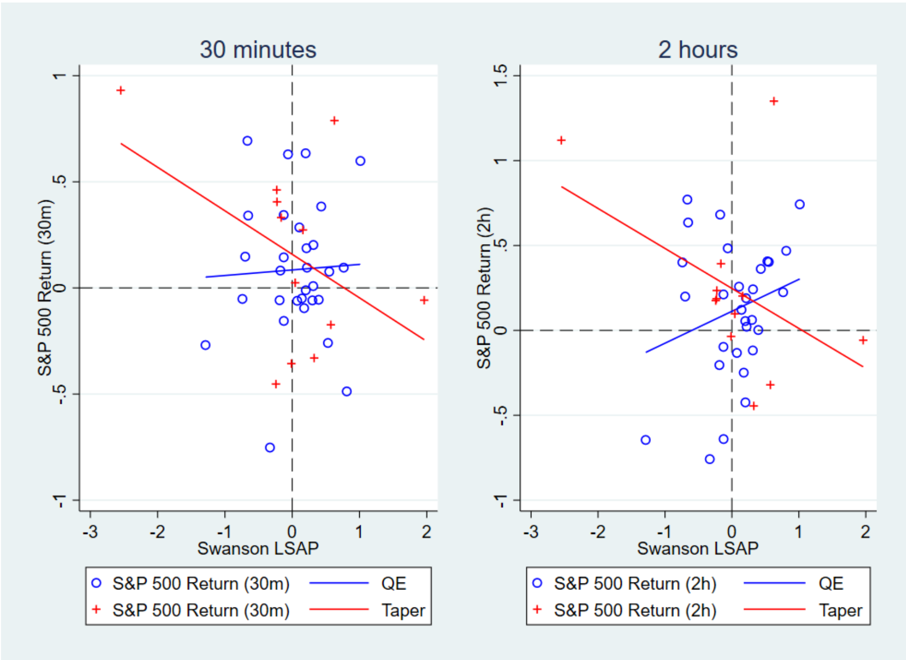
This figure displays the distribution of individual equity returns in the QE and Taper periods. The equity returns are winsorized at 1% on both sides for the whole sample.

Figure A3: Scatter plot of LSAP shocks and equity index returns



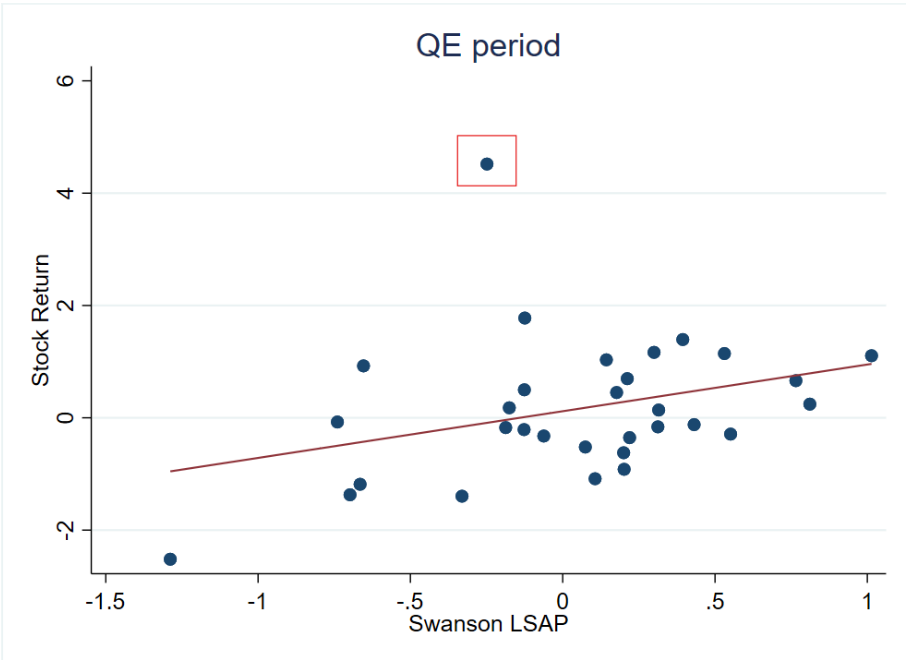
This figure displays the scatter plot of LSAP shocks and the daily NASDAQ and $S\&P500$ index returns around the FOMC announcements. Each point represents a conference.

Figure A4: Scatter plot of LSAP shocks and intraday equity returns



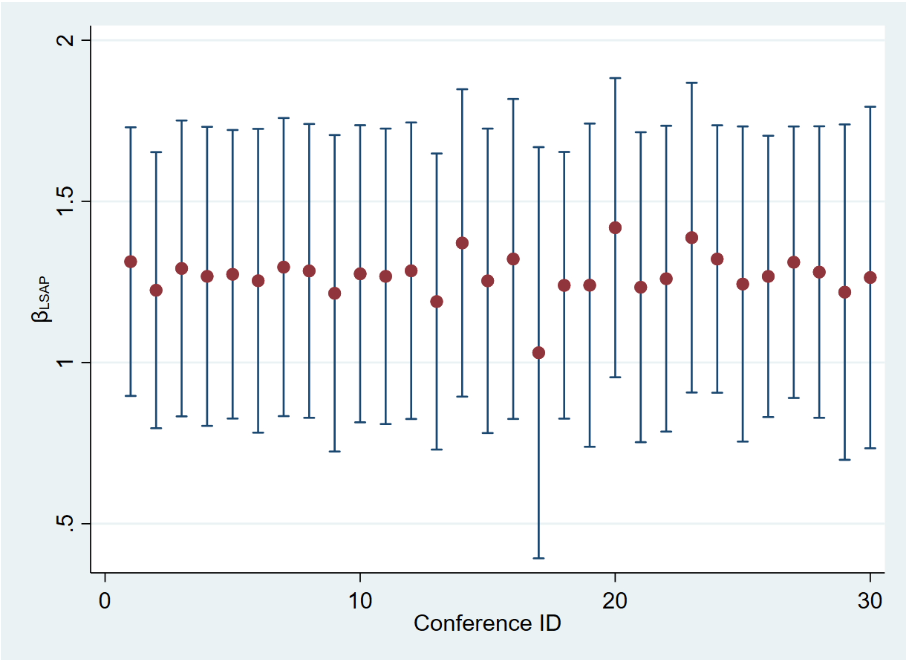
This figure displays the scatter plot of LSAP shocks and the intra-day $S\&P500$ index returns around the FOMC announcements (30-minute window, left; 2-hour window, right). Each point represents a conference.

Figure A5: Scatter plot of LSAP shocks and stock return with the inclusion of the outlier conference



This figure displays the scatter plot of LSAP shocks and the average daily stock returns of individual firms around the FOMC announcements in the QE period (full sample). The point in the box represents the outlier conference on Aug 9, 2011. On the former day, the US experienced the biggest equity crash after the crisis and the US sovereign debt rating fell from AAA to AA+.

Figure A6: Leave one conference out analysis



We repeatedly run the baseline regression in the QE period excluding one conference each time and plot the coefficient of LSAP. The horizontal axis is the conference ID (smaller numbers represent earlier meetings) and the vertical axis is the corresponding coefficient. The confidence interval is $\beta_{LSAP} \pm 1.96$ standard error. We have already dropped the outlier conference on Aug 9, 2011, in all the regressions.

Table A1: The differences of impacts of monetary shocks in QE and Taper periods

	(1)	(2)	(3)
		stock return	
Period	QE	Taper	QE and Taper
LSAP	1.275***	-0.174	-0.173
	(0.233)	(0.630)	(0.609)
FG	-0.272	-0.420	-0.422
	(0.240)	(0.868)	(0.840)
FFR	-3.284***	-1.207	-1.205
	(1.182)	(7.549)	(7.295)
LSAP*QE			1.445**
			(0.652)
FG*QE			0.150
			(0.873)
FFR*QE			-2.072
			(7.388)
QE			-0.141
			(1.024)
Constant	0.423*	0.240	0.469
	(0.223)	(1.105)	(1.022)
N	193411	79939	273475
R^2	0.094	0.120	0.084

Notes: The first two columns are similar to columns (1) and (2) in Table 2. In column (3), we additionally include the time dummy QE and its interaction term with monetary shocks, where QE equals 1 if the time falls into the QE period. The sample of this regression is QE and Taper periods excluding the conference on Aug 9, 2011.

Table A2: The impacts of LSAP shocks on stock return with different fixed effects and standard errors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	stock return							
Period	QE				Taper			
LSAP	1.155***	1.169***	1.275***	1.275***	-0.158	-0.152	-0.174***	-0.174
	(0.306)	(0.301)	(0.017)	(0.238)	(0.582)	(0.589)	(0.030)	(0.661)
FG	-0.063	-0.075	-0.272***	-0.272	-0.442	-0.455	-0.420***	-0.420
	(0.273)	(0.273)	(0.012)	(0.245)	(0.783)	(0.795)	(0.045)	(0.911)
FFR	-2.375**	-2.460**	-3.284***	-3.284**	-1.315	-1.360	-1.207***	-1.207
	(1.042)	(1.036)	(0.078)	(1.208)	(6.790)	(6.813)	(0.247)	(7.923)
Firm FE	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Year FE	No	No	Yes	Yes	No	No	Yes	Yes
Cluster on Firm			Yes				Yes	
Cluster on conference				Yes				Yes
Two-way cluster	Yes	Yes			Yes	Yes		
N	193545	193411	193411	193411	80087	79939	79939	79939
R^2	0.042	0.082	0.094	0.094	0.039	0.120	0.120	0.120

Notes: The specification is similar to the baseline (see Table 2). The only difference is here we use different fixed effects and standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A3: Winsorized at different levels

	(1)	(2)	(3)	(4)
Winsor	0.5%	1%	2%	5%
	Panel A: QE			
LSAP	1.278***	1.275***	1.254***	1.186***
	(0.235)	(0.233)	(0.226)	(0.212)
FG	-0.277	-0.272	-0.257	-0.227
	(0.242)	(0.240)	(0.234)	(0.222)
FFR	-3.294***	-3.284***	-3.217***	-3.009***
	(1.194)	(1.182)	(1.148)	(1.079)
N	193411	193411	193411	193411
R^2	0.091	0.094	0.100	0.105
	Panel B: Taper			
LSAP	-0.177	-0.174	-0.161	-0.143
	(0.632)	(0.630)	(0.619)	(0.599)
FG	-0.418	-0.420	-0.427	-0.434
	(0.872)	(0.868)	(0.854)	(0.826)
FFR	-1.201	-1.207	-1.256	-1.317
	(7.565)	(7.549)	(7.464)	(7.292)
N	79939	79939	79939	79939
R^2	0.118	0.120	0.125	0.129

Notes: This table displays the baseline regression results where we winsorize the equity return at different levels. Columns (1)-(4) are winsorized at 0.5%, 1%, 2.5%, and 5% on both sides, respectively. Panel A and B are the results for the QE and Taper periods, respectively. Both year and firm fixed effects are included. Cluster on both the firm and conference. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A4: Three different LSAP shocks

	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: QE					
	Swanson		RSW		Jarocinski	
LSAP	1.036***	1.275***	2.245**	2.208**	0.471***	0.535***
	(0.282)	(0.233)	(1.086)	(0.887)	(0.147)	(0.185)
FG		-0.272		-0.213		-0.236
		(0.240)		(0.217)		(0.310)
FFR		-3.284***		-2.254***		-0.355
		(1.182)		(0.728)		(1.505)
$Info$						-0.167
						(0.240)
N	193411	193411	193411	193411	193411	193411
R^2	0.085	0.094	0.069	0.085	0.078	0.081
	Panel B: Taper					
	Swanson		RSW		Jarocinski	
LSAP	-0.435***	-0.174	-1.761***	-1.794***	-0.484***	0.283**
	(0.077)	(0.630)	(0.216)	(0.295)	(0.092)	(0.124)
FG		-0.420		0.086		-0.979***
		(0.868)		(0.631)		(0.157)
FFR		-1.207		0.516		5.074*
		(7.549)		(3.284)		(2.491)
$Info$						0.302**
						(0.120)
N	79939	79939	79939	79939	79939	79939
R^2	0.119	0.120	0.134	0.134	0.122	0.162

Notes: The specification is similar to the baseline (see Table 2). In Columns (1)(2), (3)(4), and (5)(6), we use the shocks of Swanson (2021), Rogers, Scotti & Wright (2018) and Jarociński (2024) respectively. Apart from the LSAP, FG, and FFR shocks, Jarociński (2024) additionally estimate an information shock $Info$ (Delphic forward guidance). Both year and firm fixed effects are included. Standard errors are clustered on both the firm and conference. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A5: The responses of equity index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Period	QE				Taper			
	$\Delta Nasdaq$		$\Delta S\&P500$		$\Delta Nasdaq$		$\Delta S\&P500$	
LSAP	0.933***	1.069***	1.119***	1.237***	-0.397***	0.155	-0.452**	0.014
	(0.300)	(0.322)	(0.363)	(0.387)	(0.114)	(0.769)	(0.156)	(0.800)
FG		0.055		0.027		-0.865		-0.763
		(0.288)		(0.358)		(1.023)		(1.054)
FFR		-2.187		-1.944		-3.577		-1.758
		(1.475)		(1.625)		(9.055)		(9.468)
N	30	30	30	30	12	12	12	12
R^2	0.219	0.259	0.327	0.359	0.280	0.367	0.272	0.335

Notes: This table reports the responses of the daily equity index (Nasdaq and $S\&P500$ index) returns to LSAP shocks. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A6: Intraday equity return responses

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Period	QE				Taper			
	$\Delta S\&P500(30m)$		$\Delta S\&P500(2h)$		$\Delta S\&P500(30m)$		$\Delta S\&P500(2h)$	
LSAP	0.026	0.012	0.188	0.146	-0.205**	0.236	-0.235*	-0.146
	(0.141)	(0.115)	(0.172)	(0.176)	(0.087)	(0.527)	(0.108)	(0.478)
FG		-0.214**		-0.127		-0.695		-0.250
		(0.080)		(0.154)		(0.729)		(0.657)
FFR		-0.203		0.454		-2.663		3.582
		(0.846)		(0.761)		(5.514)		(5.243)
N	30	30	30	30	12	12	12	12
R^2	0.002	0.149	0.056	0.109	0.213	0.377	0.210	0.447

Notes: This table reports the responses of intra-day $S\&P500$ futures index returns to LSAP shocks. Columns (1)(2)(5)(6) and (3)(4)(7)(8) use 30-minute and 2-hour windows respectively. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A7: The magnitude of stock return

	(1)	(2)	(3)	(4)	(5)
abs(return)	<2%	<5%	<10%	<15%	<20%
			Panel A: QE		
LSAP	0.441***	1.007***	1.261***	1.277***	1.281***
	(0.107)	(0.178)	(0.223)	(0.229)	(0.232)
FG	-0.053	-0.159	-0.248	-0.267	-0.273
	(0.110)	(0.193)	(0.230)	(0.236)	(0.239)
FFR	-1.025**	-2.553***	-3.249***	-3.318***	-3.327***
	(0.499)	(0.896)	(1.125)	(1.156)	(1.170)
N	136504	180392	191034	192575	193025
R^2	0.103	0.115	0.107	0.099	0.094
			Panel B: Taper		
LSAP	-0.037	-0.085	-0.141	-0.175	-0.171
	(0.329)	(0.542)	(0.614)	(0.629)	(0.634)
FG	-0.305	-0.473	-0.441	-0.413	-0.428
	(0.460)	(0.749)	(0.847)	(0.867)	(0.874)
FFR	-0.792	-1.496	-1.272	-1.170	-1.226
	(4.274)	(6.782)	(7.418)	(7.553)	(7.606)
N	62708	76826	79281	79686	79823
R^2	0.157	0.145	0.130	0.126	0.120

Notes: The specification is similar to the baseline regression (see Table 2) and the only difference is here we restrict the sample according to the magnitude of stock return. In columns (1)-(5), the absolute stock returns are smaller than 2%, 5%, 10%, 15%, 20%, respectively. Both year and firm fixed effects are included. Standard errors are clustered on both the firm and conference. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A8: The impacts of LSAP shocks on stock return with the inclusion of the outlier conference

	(1)	(2)	(3)	(4)
	stock return			
Sample	Omit		NOT Omit	
LSAP	1.036***	1.275***	0.990**	0.944**
	(0.282)	(0.233)	(0.370)	(0.389)
FG		-0.272		-0.686
		(0.240)		(0.463)
FFR		-3.284***		0.974
		(1.182)		(2.855)
Constant	-0.052	0.423*	0.110	-0.061
	(0.144)	(0.223)	(0.210)	(0.418)
N	193411	193411	200022	200022
R^2	0.085	0.094	0.069	0.096

Notes: "Omit" means omitting one outlier conference on Aug 9, 2011. "NOT Omit" denotes including this meeting. Both year and firm fixed effects are included. Standard errors are clustered on both the firm and conference. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A9: The responses of stock return with the control of firm information

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	stock return							
Period	QE				Taper			
LSAP	1.275***	1.507***	1.500***	1.517***	-0.174	-0.073	-0.059	-0.060
	(0.233)	(0.276)	(0.274)	(0.278)	(0.630)	(0.772)	(0.784)	(0.819)
FG	-0.272	-0.276	-0.281	-0.309	-0.420	-0.544	-0.528	-0.568
	(0.240)	(0.269)	(0.265)	(0.270)	(0.868)	(1.063)	(1.082)	(1.132)
FFR	-3.284***	-3.902**	-3.802**	-3.781***	-1.207	-1.482	-1.603	-1.713
	(1.182)	(1.417)	(1.394)	(1.357)	(7.549)	(9.130)	(9.169)	(9.403)
Size		-0.026	-0.042	-0.029		0.041	0.081	0.036
		(0.037)	(0.044)	(0.059)		(0.120)	(0.203)	(0.231)
Profitbility			0.090	0.096			-0.061	0.042
			(0.064)	(0.100)			(0.099)	(0.186)
Asset maturity				0.000				0.001
				(0.001)				(0.001)
N	193411	128172	124024	98436	79939	51924	49854	39144
R^2	0.094	0.102	0.101	0.101	0.120	0.115	0.112	0.116

Notes: The specification is similar to the baseline (see Table 2). The only difference here is that we additionally control the one-year lagged firm-specific information, such as *Size* (log total assets, deflated by CPI), *Profitability* (ratio of operating income before depreciation over total assets), and *Asset maturity* (the sum of (i) the product of gross property, plant, and equipment as a fraction of total assets and as a fraction of depreciation and amortization, respectively, and (ii) the product of current assets as a fraction of total assets and as a fraction of cost of goods sold, respectively). Both year and firm fixed effects are included and the standard errors are clustered on both the firm and conference level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A10: The responses of stock return in the QE period with the control of the impacts of business cycle and news

Panel A: Control business cycle					
	ADS_{15d}	ADS_{30d}	ADS_{60d}	BBK_{1m}	$\Delta S\&P500_{30d}$
LSAP	1.242***	1.248***	1.316***	1.409***	1.311***
	(0.244)	(0.237)	(0.236)	(0.276)	(0.272)
N	193411	193411	193411	193411	193411
R^2	0.095	0.099	0.097	0.097	0.098
Panel B: Control past news					
	GDP_{30d}	$Employment_{30d}$	$Retail_{30d}$	CPI_{30d}	PPI_{30d}
LSAP	1.106***	1.217***	1.261***	1.304***	1.232***
	(0.262)	(0.286)	(0.234)	(0.215)	(0.243)
N	193411	193411	193411	193411	193411
R^2	0.100	0.095	0.095	0.095	0.096

Notes: The specification is similar to the baseline (see Table 2) and is conducted over the QE period. The only difference here is that in Panel A-B, we additionally control the business cycle and past news respectively. In each column, we control one variable. ADS_{Xd} is the average of ADS index in the past X days before the announcement. BBK_{1m} is the BBK index in the last month. $\Delta S\&P500_{30d}$ is the change of $S\&P500$ index in the past 30 days. Past news S_{Xd} denotes the cumulative sum of news shocks S in the past X days prior to the meeting. Please refer to Section 2.2 for more details about these measurements. For space-saving, only the coefficients of $LSAP$ are shown. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A11: The responses of stock return in the Taper period with the control of the impacts of business cycle and news

Panel A: Control business cycle					
	ADS_{15d}	ADS_{30d}	ADS_{60d}	BBK_{1m}	$\Delta S\&P500_{30d}$
LSAP	-0.713	-0.751	-1.151	-0.048	0.262
	(0.585)	(0.519)	(0.645)	(0.635)	(0.758)
N	79939	79939	79939	79939	79939
R^2	0.130	0.134	0.140	0.125	0.125
Panel B: Control past news					
	GDP_{30d}	$Employment_{30d}$	$Retail_{30d}$	CPI_{30d}	PPI_{30d}
LSAP	-0.174	-0.250	-0.384	-0.163	-0.133
	(0.630)	(0.568)	(0.666)	(0.658)	(0.724)
N	79939	79939	79939	79939	79939
R^2	0.120	0.130	0.123	0.121	0.122

Notes: The specification is similar to the baseline (see Table 2) and is conducted over the Taper period. The only difference here is that in Panel A-B, we additionally control the business cycle and past news respectively. In each column, we control one variable. ADS_{Xd} is the average of ADS index in the past X days before the announcement. BBK_{1m} is the BBK index in the last month. $\Delta S\&P500_{30d}$ is the change of $S\&P500$ index in the past 30 days. Past news S_{Xd} denotes the cumulative sum of news shocks S in the past X days prior to the meeting. Please refer to Section 2.2 for more details about these measurements. Sometimes there are no specific types of news shocks in the past one month (e.g. GDP news is quarterly) and the corresponding coefficients will be automatically eliminated. For space-saving, only the coefficients of $LSAP$ are shown. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A12: Summary statistics of macro news shocks in different periods

Variable	Observation	Mean	Mean(abs)	Standard dev	Min	Max
Panel A: all samples						
GDP	1,282	0.00	0.05	0.21	-1.68	1.80
Retail	1,282	-0.01	0.08	0.26	-1.76	5.13
Employment	1,282	-0.01	0.03	0.07	-0.45	0.39
CPI	1,282	0.00	0.02	0.06	-0.42	0.42
PPI	1,282	0.00	0.07	0.21	-1.63	1.57
Panel B: QE period						
GDP	208	-0.01	0.03	0.14	-1.34	0.93
Retail	208	0.01	0.07	0.20	-1.40	0.87
Employment	208	-0.01	0.03	0.08	-0.45	0.30
CPI	208	0.00	0.02	0.05	-0.18	0.30
PPI	208	0.01	0.07	0.19	-0.67	1.04
Panel C: Taper period						
GDP	76	0.02	0.05	0.20	-0.99	1.00
Retail	76	-0.02	0.05	0.12	-0.51	0.34
Employment	76	-0.02	0.03	0.07	-0.32	0.12
CPI	76	0.00	0.01	0.04	-0.20	0.18
PPI	76	0.01	0.06	0.14	-0.50	0.50

Notes: This table displays the summary statistics of macro news shocks in different periods: all samples (1994-2019), QE period, and Taper period. The data is obtained from Lakdawala, Moreland & Schaffer (2021).

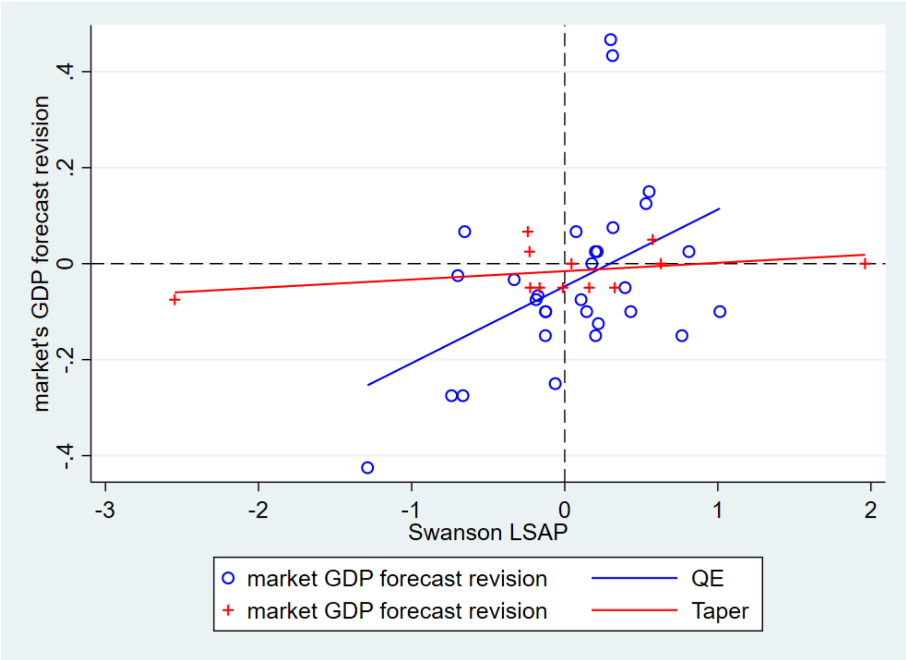
Table A13: The impacts of macro news shocks on the return of equity index

	(1)	(2)	(3)
	$\Delta S\&P500$		
Sample	All samples	QE period	Taper period
GDP	-0.024	0.453	-0.532
	(0.165)	(0.421)	(0.335)
Retail	0.231*	0.406	0.121
	(0.135)	(0.286)	(0.571)
Employment	0.132	0.042	-1.610
	(0.506)	(0.694)	(1.065)
CPI	-0.722	0.080	0.748
	(0.850)	(2.955)	(1.263)
PPI	-0.055	0.143	-0.265
	(0.136)	(0.413)	(0.492)
N	1274	206	76
R^2	0.004	0.011	0.052

Notes: This table displays the impact of macro news shocks on the daily return of the $S\&P500$ equity index in different periods: all samples (1994-2019), QE period, and Taper period. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

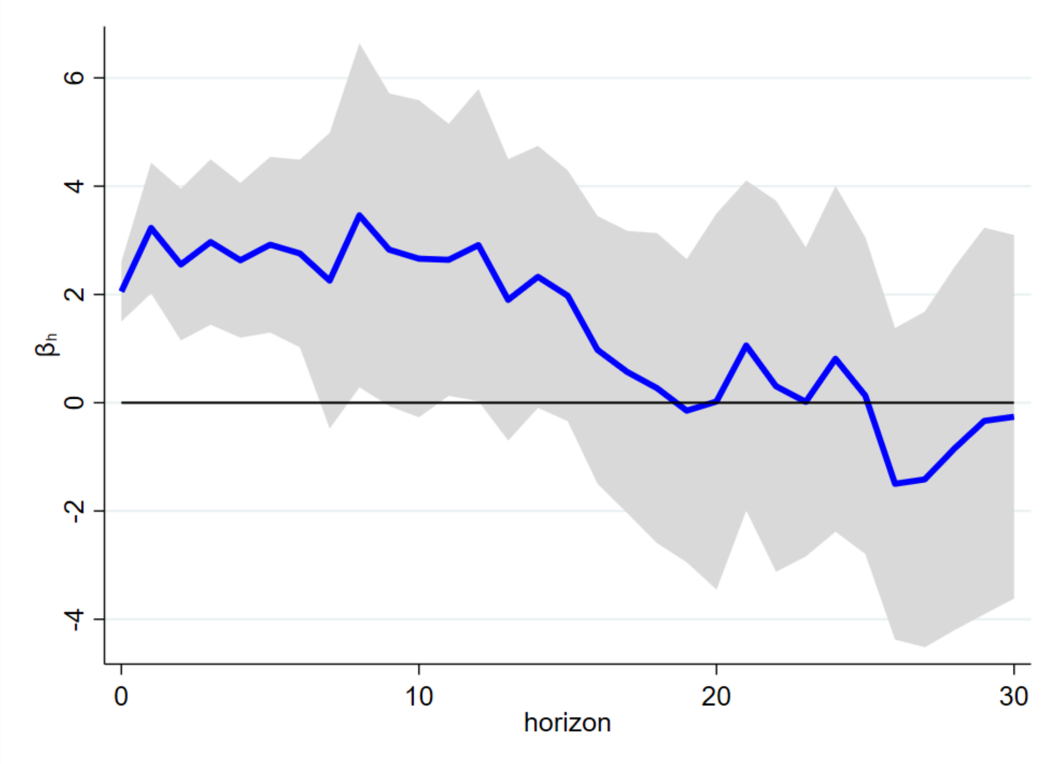
B More results on information effect and mechanism

Figure B1: LSAP and market's real GDP forecast revision in the QE and Taper periods.



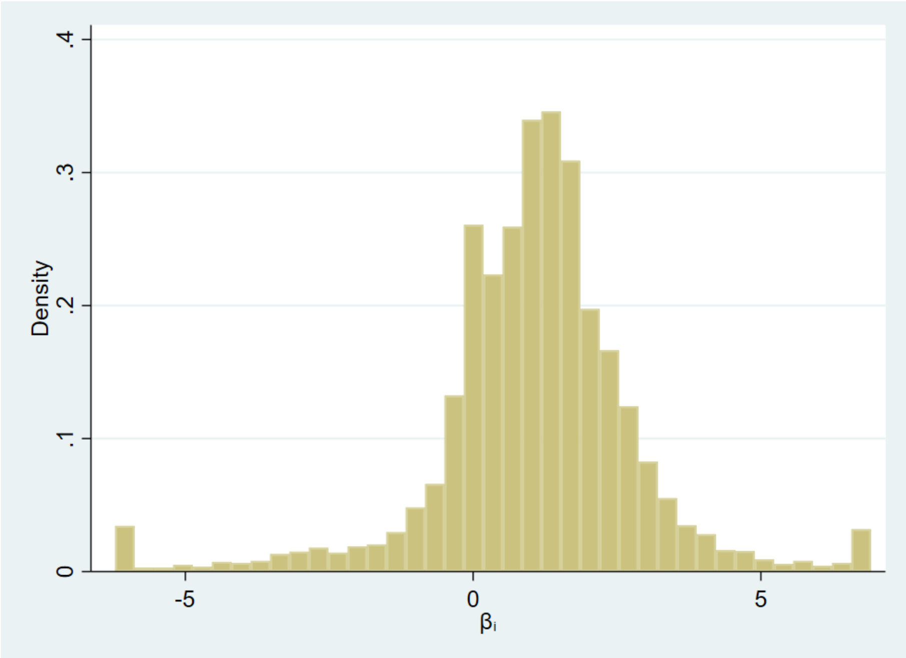
The blue and red points/lines represent the QE and Taper periods respectively. Here we use the average revision of 1 to 4 quarters ahead as an example and the results are similar for other horizons.

Figure B2: The dynamics of the information effect in the QE period



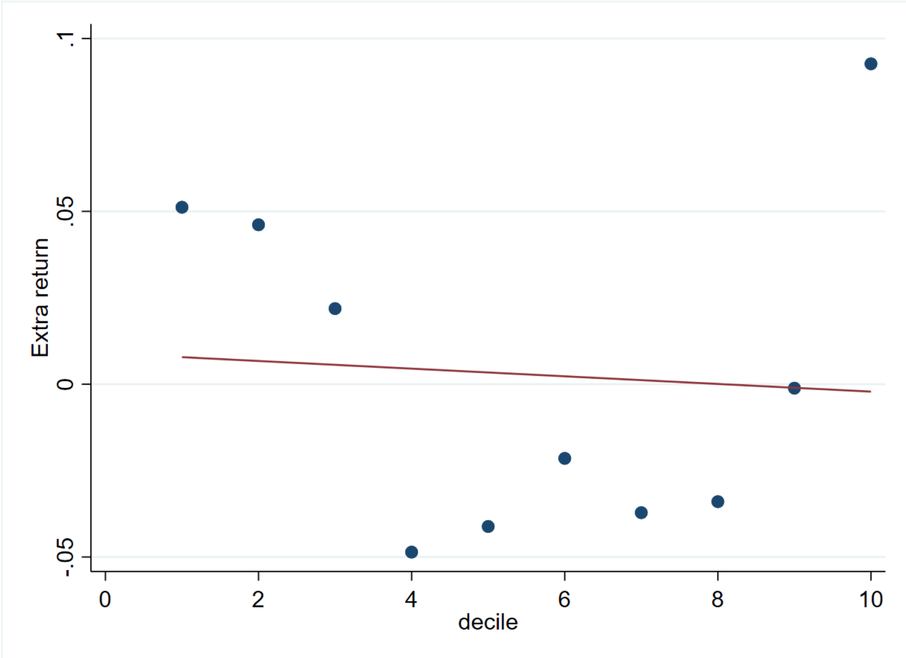
This figure plots the dynamic impacts of $LSAP$ in the QE period. The specification is $\Delta P_{i,t+h} = \alpha_h + \beta_h LSAP_t + \gamma_h FG_t + \theta_h FFR_t + \sum_{n=1}^{3} \Delta P_{i,t-n} + i.year + i.firm + \epsilon_{i,t}^h$, where t takes on the dates of FOMC announcements, and $t+h$ denotes the date h business days after an FOMC announcement, i represents a firm, P is the equity price of an individual firm, $\Delta P_{i,t+h} = (P_{i,t+h} - P_{i,t-1})/P_{i,t-1} * 100$, $h = 0/1/2/ \ldots /30$, $\Delta P_{i,t-n} = (P_{i,t-n} - P_{i,t-n-1})/P_{i,t-n-1} * 100$, $n = 1/2/3$. Both the year and firm fixed effects are included. Standard errors are clustered on both the conference and firm levels. $\beta_h/\gamma_h/\theta_h$ is the response coefficient to $LSAP/FG/FFR$ associated with a specific horizon. Here we plot the β_h and h. The grey area is the $\pm$ 1.96-standard-error band of β_h.

Figure B3: Distribution of the individual equity exposure to the Fed information effect of LSAP



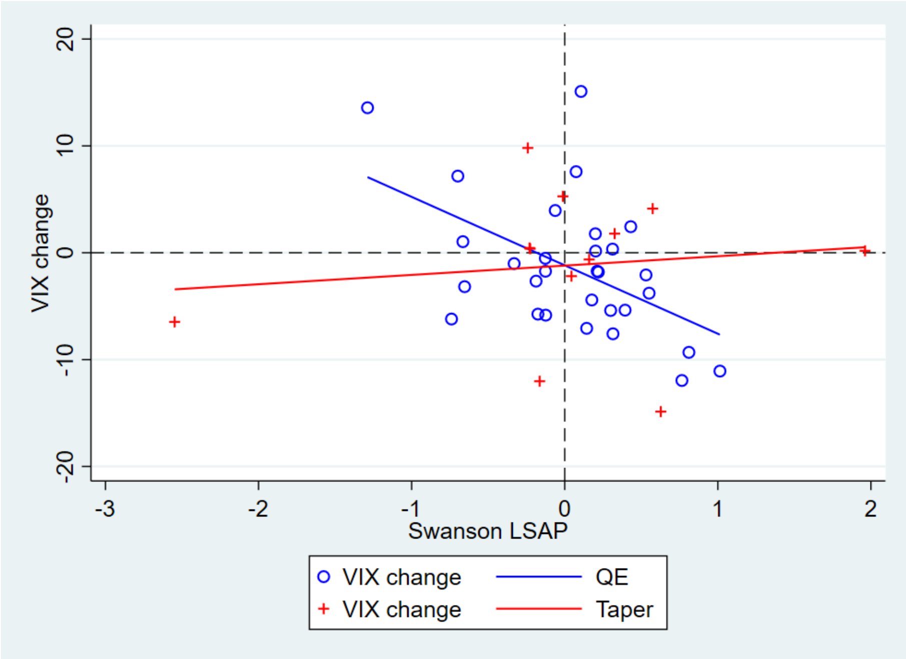
This figure displays the distribution of the individual equity exposure to the Fed information effect of LSAP. The specification is $StockReturn_{it} = \alpha_i + \beta_i LSAP + \gamma_i FG + \delta_i FFR + \epsilon_{it},\ i = 1, 2, 3, ...,$ where the dependent variable is the daily equity return of each firm, and i denotes the index of firms. We conduct this regression in the QE period. The individual equity exposure to the Fed information effect of LSAP is measured by β_i. A higher and positive value means this firm suffers more from an easing LSAP shock, namely more exposed to the information effect of LSAP.

Figure B4: Excess return and the information effect exposure to LSAP shocks in the Taper period



This figure plots the relationship between portfolio excess return and the information effect exposure to LSAP shocks in the Taper period. The horizontal axis is the index of each decile, and the biggest decile denotes the portfolio with the largest exposure. The vertical axis is the corresponding excess return beyond Fama-French five risk factors.

Figure B5: LSAP and the percent change of VIX index in the QE and Taper periods



The blue and red points/lines represent the QE and Taper periods, respectively. Here the VIX change is the daily percent change of the VIX index.

Table B1: The impact of Central Bank's private information on LSAP shocks in the QE period

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Forecast horizon	0Q	1Q	2Q	3Q	4Q	5Q	6Q	7Q
	LSAP							
ΔGDP^f_{CB}	0.108	0.399*	0.774***	0.477	0.394	0.631	1.040*	0.846**
	(0.096)	(0.217)	(0.264)	(0.412)	(0.410)	(0.374)	(0.511)	(0.211)
$\Delta Inflation^f_{CB}$	-0.084	-0.301	-0.365	0.732	0.149	-0.658	-0.279	-1.777
	(0.212)	(0.216)	(0.324)	(0.520)	(0.895)	(0.523)	(0.420)	(0.916)
$\Delta Unemployment^f_{CB}$	0.456	-0.127	0.653	-0.032	-0.251	-0.138	0.606	-0.209
	(0.410)	(0.467)	(0.453)	(0.586)	(0.582)	(0.565)	(0.433)	(0.560)
N	30	30	30	30	30	28	21	7
R^2	0.043	0.188	0.221	0.219	0.115	0.208	0.294	0.752

Notes: In this table, we regress $LSAP$ shock on the Central bank's private information in the QE period. ΔGDP^f_{CB}, $\Delta Inflation^f_{CB}$, $\Delta Unemployment^f_{CB}$ denote the Central Bank's forecast revision on real GDP growth, inflation, unemployment rate right before each announcement, respectively. This information is obtained from the Green Book and is publicly available only 5 years later. From columns (1) to (8), the forecast horizon is 0 to 7 quarters, respectively. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B2: The impact of Central Bank's private information on LSAP shocks in the Taper period

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Forecast horizon	0Q	1Q	2Q	3Q	4Q	5Q	6Q
				LSAP			
ΔGDP^f_{CB}	0.149	1.101	1.893	2.618	0.695	2.075	1.949
	(0.712)	(0.984)	(1.594)	(1.941)	(1.491)	(1.952)	(1.846)
$\Delta Inflation^f_{CB}$	-0.884	-1.687	-0.419	-0.547	0.146	0.108	-0.522
	(0.867)	(1.344)	(2.127)	(2.408)	(5.262)	(3.358)	(3.326)
$\Delta Unemployment^f_{CB}$	1.982	-1.143	2.625	2.604	1.160**	0.518	0.210
	(2.232)	(2.433)	(2.075)	(2.003)	(0.448)	(0.869)	(2.300)
N	12	12	12	12	12	12	8
R^2	0.120	0.351	0.292	0.303	0.035	0.109	0.186

Notes: In this table, we regress $LSAP$ shock on the Central bank's private information in the Taper period. ΔGDP^f_{CB}, $\Delta Inflation^f_{CB}$, $\Delta Unemployment^f_{CB}$ denote the Central Bank's forecast revision on real GDP growth, inflation, unemployment rate right before each announcement, respectively. This information is obtained from the Green Book and is publicly available only 5 years later. From columns (1) to (7), the forecast horizon is 0 to 6 quarters, respectively. The results for 7 quarters are omitted due to limited observations. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B3: The impact of Central Bank's private information and market expectation on LSAP shocks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Forecast horizon	1Q	2Q	3Q	4Q	5Q	6Q	7Q
	LSAP						
ΔGDP^f_{CB}	0.537*	0.702**	0.720*	0.410	0.698***	0.789***	0.783**
	(0.302)	(0.332)	(0.372)	(0.313)	(0.244)	(0.278)	(0.240)
ΔGDP^f_{Market}	0.807	0.902	1.091	1.315	1.194	0.249	-3.680*
	(0.921)	(0.997)	(0.715)	(0.817)	(0.809)	(0.534)	(1.642)
N	42	42	42	42	40	29	9
R^2	0.140	0.155	0.138	0.071	0.125	0.180	0.613

Notes: In this table, we regress $LSAP$ shocks on the pre-announcement GDP forecast revisions of the central bank and the market simultaneously. Here ΔGDP^f_{Market} is the average market GDP forecast revision across 1 to 7 quarters ahead, which is obtained from Blue Chip. Columns (1) to (7) represent different forecast horizons of the central bank. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B4: The impact of Central Bank's private information on FG and FFR shocks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Forecast horizon	0Q	1Q	2Q	3Q	4Q	5Q	6Q	7Q
				Panel A: FG				
ΔGDP^f_{CB}	-0.276	-0.233	0.243	0.131	-0.370	-0.307	-0.012	0.381
	(0.264)	(0.447)	(0.338)	(0.391)	(0.391)	(0.482)	(0.574)	(0.500)
$\Delta Inflation^f_{CB}$	-0.002	0.039	-0.767	-0.590	-0.034	-0.160	0.079	4.259*
	(0.176)	(0.247)	(0.542)	(0.467)	(1.034)	(0.630)	(0.530)	(2.086)
$\Delta Unemployment^f_{CB}$	0.326	0.324	0.807	0.608	0.397	0.338	-0.228	1.128
	(0.544)	(0.629)	(0.747)	(0.765)	(0.613)	(0.487)	(0.484)	(0.901)
N	42	42	42	42	42	40	29	9
R^2	0.084	0.032	0.068	0.044	0.075	0.055	0.012	0.507
				Panel B: FFR				
ΔGDP^f_{CB}	-0.007	-0.024	0.036	0.045	0.042	0.023	-0.033	-0.069
	(0.030)	(0.029)	(0.061)	(0.077)	(0.064)	(0.061)	(0.152)	(0.061)
$\Delta Inflation^f_{CB}$	-0.015	-0.001	-0.040	-0.041	0.092	-0.007	-0.008	-1.149**
	(0.029)	(0.034)	(0.058)	(0.055)	(0.117)	(0.064)	(0.110)	(0.372)
$\Delta Unemployment^f_{CB}$	0.024	-0.048	0.032	0.003	-0.007	-0.036	-0.087	-0.522*
	(0.061)	(0.045)	(0.097)	(0.093)	(0.075)	(0.045)	(0.109)	(0.210)
N	42	42	42	42	42	40	29	9
R^2	0.010	0.019	0.020	0.027	0.045	0.024	0.034	0.705

Notes: In this table, we regress FG and FFR shocks on the Central bank's private information in panels A and B respectively. ΔGDP^f_{CB}, $\Delta Inflation^f_{CB}$, $\Delta Unemployment^f_{CB}$ denote the Central Bank's forecast revision on real GDP growth, inflation, unemployment rate right before each announcement, respectively. This information is obtained from the Green Book and is publicly available only 5 years later. From Columns (1) to (8), the forecast horizon is 0 to 7 quarters, respectively. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B5: The impacts of LSAP shocks on the market's real GDP forecast revision (one month)

	(1)	(2)	(3)	(4)
	$F.\Delta GDP^f_{3Q}$	$F.\Delta GDP^f_{4Q}$	$F.\Delta GDP^f_{5Q}$	$F.\Delta GDP^f_{6Q}$
	Panel A: QE			
LSAP	0.080**	0.072**	0.063**	0.061**
	(0.035)	(0.029)	(0.025)	(0.026)
FG	-0.050**	-0.036*	-0.037**	-0.036**
	(0.023)	(0.019)	(0.016)	(0.016)
FFR	-0.080	-0.100	-0.082	-0.094
	(0.132)	(0.115)	(0.106)	(0.108)
N	30	30	30	30
R^2	0.197	0.163	0.164	0.154
	Panel B: Taper			
LSAP	0.055**	0.047**	0.044**	0.038**
	(0.018)	(0.018)	(0.017)	(0.016)
FG	-0.065**	-0.056*	-0.053*	-0.045*
	(0.027)	(0.024)	(0.023)	(0.022)
FFR	0.027	0.064	0.065	0.163
	(0.150)	(0.157)	(0.146)	(0.128)
N	12	12	12	12
R^2	0.682	0.518	0.564	0.583

Notes: The specification is similar to Table 4. Here we use one-month forecast revisions as the dependent variables. $F.\Delta GDP^f_{XQ}$ means the next month's average forecast revision of the market over the next X quarters. Specifically, $F.\Delta GDP^f_{XQ} = \sum_{i=1}^{X}(GDP^{iQ}_{t+1} - GDP^{iQ}_{t})/X$, where GDP^{iQ}_{t+1} is the month $t+1$ forecast of GDP growth rate in the next i quarter (relative to the quarter in month $t+1$) and GDP^{iQ}_{t} is the month t forecast for the same target. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B6: The impacts of LSAP shocks on the market's inflation and unemployment forecast revision

	(1)	(2)	(3)	(4)
	CPI inflation rate		unemployment rate	
Period	QE	Taper	QE	Taper
LSAP	0.099***	-0.044	-0.010	0.098
	(0.024)	(0.027)	(0.091)	(0.064)
FG	0.011	0.044	0.068	-0.124
	(0.019)	(0.045)	(0.064)	(0.087)
FFR	-0.336**	-0.085	0.623	-1.781**
	(0.163)	(0.325)	(0.470)	(0.766)
N	30	12	30	12
R^2	0.230	0.132	0.086	0.605

Notes: The specification is similar to Table 4. Here we use two-month average forecast revisions of CPI-measured inflation rate and unemployment rate as the dependent variables. The forecast horizon here is 4 quarters and the results are robust to use other horizons. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B7: The impacts of monetary events on the covariance of stock return and treasury yield change (decomposition)

	(1)	(2)	(3)	(4)	(5)
	3M	2Y	5Y	10Y	30Y
QE*MPD	-0.822	4.847	17.791	25.284	44.943**
	(5.413)	(11.389)	(24.479)	(18.394)	-18.424
QE*MINUTES	0.653	0.144	1.398	3.656	6.292
	(1.146)	(3.624)	(6.725)	(5.853)	-5.837
QE*PC	-0.918	1.395	0.999	5.011	13.384
	(1.140)	(4.202)	(9.301)	(9.974)	-12.928
Taper*MPD	-5.639	-69.140*	-182.473**	-156.926**	-121.024**
	(4.002)	(38.001)	(90.012)	(77.731)	-54.065
Taper*MINUTES	0.498	-20.310***	-48.267**	-43.642**	-35.695**
	(0.672)	(7.245)	(18.938)	(17.650)	-15.342
Taper*PC	-0.199	-34.524***	-78.695***	-67.836***	-63.348***
	(0.688)	(8.727)	(18.520)	(17.220)	-19.71
N	6155	6155	6155	6155	6155
R^2	0.001	0.010	0.024	0.020	0.015

Notes: The specification is similar to Table 6. The only difference here is that we decompose monetary events into monetary policy decisions (MPD), minutes releases (MINUTES), and press conferences (PC). Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B8: Covariance analysis with the consideration of forward guidance

	(1)	(2)	(3)	(4)	(5)
	3M	2Y	5Y	10Y	30Y
QE*ME	-0.141	1.555	7.886	12.610	21.522**
	(2.480)	(5.220)	(11.385)	(8.745)	-8.711
QE*ME*FG	-0.927	17.866	11.348	11.427	52.432
	(5.020)	(30.749)	(39.874)	(35.449)	-56.619
Taper*ME	-2.096	-42.685***	-108.035***	-93.794***	-75.357***
	(1.714)	(16.092)	(38.658)	(33.458)	-23.89
N	6155	6155	6155	6155	6155
R^2	0.000	0.008	0.018	0.015	0.012

Notes: The specification is similar to Table 6. The only difference here is that we include the interaction terms of QE, ME, and FG, where FG is a dummy that equals 1 if there is forward guidance in a monetary event. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B9: Covariance analysis in different windows

	(1)	(2)	(3)
Window	[-15, 15]	[-15, 60]	[-15, 90]
QE*ME	5.696	20.958***	23.769***
	(5.111)	(8.011)	(8.770)
Taper*ME	-52.113**	-69.501***	-75.357***
	(20.566)	(23.017)	(23.888)
N	6155	6155	6155
R^2	0.030	0.014	0.011

Notes: The specification is similar to Table 6. In columns (1)-(3), the dependent variables are the realized covariance of equity return and 30-Y treasury yield change from -15 min to +15/60/90 min of the event, respectively. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B10: The state-dependent impacts of LSAP shocks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		ΔGDP^f_{4Q}			ΔVIX			*stock return*	
LSAP	0.195***	-0.865***	-0.157*	-5.892***	21.596	7.853	1.086***	-5.490***	-1.642**
	(0.033)	(0.257)	(0.087)	(1.630)	(14.838)	(5.942)	(0.155)	(1.496)	(0.806)
LSAP*$sentiment$	-0.259***			10.401***			-1.999***		
	(0.078)			(3.815)			(0.365)		
LSAP*$unemp$		0.123***			-3.061*			0.752***	
		(0.032)			(1.801)			(0.184)	
LSAP*VIX			0.014***			-0.547**			0.112***
			(0.004)			(0.263)			(0.040)
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	42	42	42	42	42	42	273475	273475	273475
R^2	0.359	0.395	0.323	0.192	0.132	0.140	0.083	0.073	0.069

Notes: Compared with the baseline regression, here we additionally include economic state variables and their interaction terms of LSAP shocks. *sentiment* is the one-conference lagged economic conditions described in the FOMC announcements. This data is from Gardner, Scotti & Vega (2022); *unemp* is the one-month lagged unemployment rate; VIX is the one-day lagged VIX index. Specifically, for the first six columns, the regression equation is $\Delta y_t = \alpha + \beta_1 LSAP_t + \beta_2 LSAP_t * X_{t-1} + X_{t-1} + FG_t + FFR_t + \epsilon_t$, where X_{t-1} denotes lagged economic state and y represents market's real GDP growth forecast revision (here we use the 4-quarter average forecast revision as an example, results for other horizons are quite similar) or VIX change around the FOMC meetings. Robust standard errors are in parentheses. For the last three columns, the specification is $\Delta y_{it} = \alpha + \beta_1 LSAP_t + \beta_2 LSAP_t * X_{t-1} + X_{t-1} + FG_t + FFR_t + i.year + i.firm + \epsilon_{it}$, where the dependent variable is the stock return. Both year and firm fixed effects are included. The standard errors are clustered on both the conference and firm levels. For space-saving, only the coefficients of $LSAP$-related variables are displayed. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B11: The state-dependent impacts of LSAP shocks in the QE period

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		ΔGDP^f_{4Q}			ΔVIX			*stock return*	
LSAP	0.142***	-1.757***	-0.103	-6.881***	-8.375	-2.385	1.212***	0.779	0.807
	(0.035)	(0.429)	(0.174)	(2.351)	(25.061)	(9.178)	(0.183)	(1.932)	(0.779)
LSAP**sentiment*	-0.555***			10.118			-1.400*		
	(0.177)			(9.203)			(0.717)		
LSAP**unemp*		0.222***			0.168			0.050	
		(0.050)			(2.803)			(0.233)	
LSAP*VIX			0.012*			-0.201			0.031
			(0.007)			(0.368)			(0.036)
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	30	30	30	30	30	30	193411	193411	193411
R^2	0.477	0.490	0.339	0.313	0.274	0.281	0.100	0.098	0.098

Notes: The specification is similar to Table B10. The only difference is here we restrict the sample to the QE period. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B12: The impacts of LSAP shocks in QE4 period

	(1)	(2)	(3)	(4)	(5)
	Panel A: QE				
	stock return	$\Delta S\&P500$	ΔGDP^f_{4Q}	ΔVIX	$Yield_{10Y}$
LSAP	1.117***	1.045**	0.223***	-0.047*	0.044***
	(0.347)	(0.465)	(0.044)	(0.027)	(0.014)
FG	-0.520	-0.092	-0.132***	0.001	0.009
	(0.351)	(0.424)	(0.044)	(0.019)	(0.009)
FFR	-2.303	0.161	-0.429**	-0.024	-0.085
	(1.572)	(1.195)	(0.198)	(0.102)	(0.078)
N	193411	30	30	30	30
R^2	0.077	0.272	0.365	0.143	0.247
	Panel B: QE4				
	stock return	$\Delta S\&P500$	ΔGDP^f_{4Q}	ΔVIX	$Yield_{10Y}$
LSAP	4.988	3.853	2.240	-0.151	0.099
	(4.054)	(3.180)	(2.775)	(0.418)	(0.079)
FG	-5.199	-4.615	0.475	0.111	-0.090
	(6.478)	(5.410)	(3.794)	(0.612)	(0.131)
FFR	-15.282***	-11.969**	-18.133*	0.815	0.016
	(3.451)	(3.864)	(7.934)	(0.817)	(0.055)
N	95351	12	12	12	12
R^2	0.191	0.417	0.534	0.143	0.613

Notes: This table compares the impacts of LSAP shocks in the QE and QE4 periods. The specification is similar to the baseline regression and is conducted separately in these two periods. Here $Yield_{10Y}$ denotes the daily 10-year treasury yield change around FOMC announcements. The notations and definitions of other variables are similar as before. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B13: The impacts of LSAP shocks in QE4 period (RSW shock)

	(1)	(2)	(3)	(4)	(5)
	Panel A: QE				
	stock return	$\Delta S\&P500$	ΔGDP^f_{4Q}	ΔVIX	$Yield_{10Y}$
$LSAP_{rsw}$	2.208**	2.559**	0.368**	-0.112	0.116***
	(0.887)	(1.244)	(0.145)	(0.073)	(0.039)
$Path_{rsw}$	-0.213	-0.028	-0.087**	-0.003	0.013**
	(0.217)	(0.399)	(0.042)	(0.016)	(0.006)
$Target_{rsw}$	-2.254***	-0.987	-0.156	0.015	0.015
	(0.728)	(0.859)	(0.112)	(0.056)	(0.039)
N	193411	30	30	30	30
R^2	0.085	0.246	0.247	0.100	0.212
	Panel B: QE4				
	stock return	$\Delta S\&P500$	ΔGDP^f_{4Q}	ΔVIX	$Yield_{10Y}$
$LSAP_{rsw}$	4.715	3.665	-1.109	0.248	0.043
	(7.303)	(6.757)	(3.362)	(0.679)	(0.099)
$Path_{rsw}$	-1.053	-1.803	4.863	-0.303	0.113*
	(6.312)	(6.051)	(2.812)	(0.640)	(0.058)
$Target_{rsw}$	-4.650*	-3.852	-3.394*	0.113	0.050**
	(2.467)	(2.201)	(1.477)	(0.246)	(0.021)
N	95351	12	12	12	12
R^2	0.201	0.466	0.589	0.157	0.606

Notes: The specification is similar to Table B12. The only difference is here we use RSM shocks. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B14: The procyclical impacts of LSAP shocks on stock returns (4-digit industry)

	(1)	(2)	(3)	(4)
	stock return			
Sample	QE		Taper	
LSAP	1.050***	1.291***	-0.432***	-0.160
	(0.285)	(0.235)	(0.079)	(0.662)
LSAP*cyclicity	1.256**	1.394**	0.370*	-0.252
	(0.515)	(0.570)	(0.193)	(1.474)
FG		-0.268		-0.440
		(0.239)		(0.912)
FG*cyclicity		0.077		0.957
		(0.309)		(2.036)
FFR		-3.341***		-1.231
		(1.188)		(7.920)
FFR*cyclicity		-1.434		4.674
		(2.508)		(16.233)
N	177186	177186	73432	73432
R^2	0.087	0.096	0.121	0.122

Notes: *cyclicity* is the coefficient of regressing the ratio of revenue to asset on nominal GDP growth for each industry (the sample is from 1994 to 2008). A higher value means more pro-cyclical. Here, the industry code uses SIC 4-digit classification. We include both year and firm fixed effects. The standard errors are clustered on both the conference and firm levels. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B15: The impacts of LSAP shocks on stock return controlling information effect

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Sample	QE					Taper				
LSAP	1.275***	1.098***	0.677***	0.516**	0.448*	-0.174	-0.277	-0.584**	-0.580**	-0.428
	(0.233)	(0.283)	(0.207)	(0.227)	(0.261)	(0.630)	(0.606)	(0.243)	(0.237)	(0.279)
FG	-0.272	-0.186	-0.263	-0.183	-0.176	-0.420	-0.173	0.328	0.314	0.119
	(0.240)	(0.219)	(0.185)	(0.173)	(0.191)	(0.868)	(0.846)	(0.366)	(0.352)	(0.390)
FFR	-3.284***	-2.861**	-2.381**	-1.991*	-2.163*	-1.207	1.358	1.678	1.462	1.350
	(1.182)	(1.248)	(0.988)	(1.039)	(1.079)	(7.549)	(6.304)	(2.238)	(2.060)	(1.882)
ΔGDP^f_{4Q}		0.943		0.882*	0.915*		-4.489		0.450	-0.374
		(0.748)		(0.481)	(0.460)		(2.751)		(1.472)	(1.509)
ΔVIX			-0.087***	-0.087***	-0.087***			-0.074***	-0.075***	-0.073***
			(0.019)	(0.019)	(0.022)			(0.013)	(0.014)	(0.013)
$GDP^f_{CB,5Q}$					0.257					-0.524
					(0.372)					(0.767)
N	193411	193411	193411	193411	180506	79939	79939	79939	79939	79939
R^2	0.094	0.097	0.120	0.123	0.130	0.120	0.126	0.161	0.161	0.162

Notes: Compared with Table 2, here we additionally control information-channel-related variables. The definitions of these variables are the same as before. The standard errors are clustered on both the conference and firm levels. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B16: The heterogeneous impacts of LSAP shocks on stock returns (quarterly data)

	(1)	(2)	(3)	(4)	(5)	(6)
	Sdebt	Ldebt	Debt	Cash	Capital Inv	Dividend
			Panel A: QE			
LSAP*X	-0.019	0.328***	0.244***	-0.282***	1.184**	-1.706**
	(0.206)	(0.084)	(0.088)	(0.080)	(0.560)	(0.679)
N	121972	129126	121759	130256	57399	125895
R^2	0.187	0.190	0.187	0.189	0.208	0.194
			Panel B: Taper			
LSAP*X	-0.032	-0.275***	-0.137**	0.138**	-0.313	-1.231**
	(0.127)	(0.057)	(0.060)	(0.063)	(0.449)	(0.565)
N	48566	51917	48500	52435	24211	50661
R^2	0.170	0.174	0.171	0.172	0.176	0.175

Notes: The regression equation is $stock\ return_{it} = \alpha + \beta_1 LSAP_t * X_{it-1} + \beta_2 X_{it-1} + i.conference + i.firm + \epsilon_{it}$, where X_{it-1} denotes a firm's one-quarter lagged balance sheet variable. In columns (1)-(6), the variable we use is *Sdebt* (short-term debt ratio), *Ldebt* (long-term debt ratio), *Debt* (total debt ratio), *Cash* (cash ratio), *Capital Inv* (capital investment ratio), *Dividend* (dividend ratio), respectively. We control both the conference and firm fixed effects. The standard errors are clustered at the firm level. For space-saving, we only display *LSAP*-related coefficients. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

C Bond and dividend responses

Table C1: The impacts of LSAP shocks on treasury yields

	(1)	(2)	(3)	(4)	(5)	(6)
	QE			Taper		
	2Y	5Y	10Y	2Y	5Y	10Y
LSAP	-0.005	0.036*	0.080***	-0.013	0.055**	0.084**
	(0.009)	(0.018)	(0.018)	(0.008)	(0.020)	(0.025)
FG	0.029***	0.029**	0.013	0.068***	0.060	-0.015
	(0.007)	(0.011)	(0.013)	(0.015)	(0.035)	(0.038)
FFR	0.035	-0.094	-0.114	-0.116	-0.296	-0.341
	(0.053)	(0.109)	(0.119)	(0.097)	(0.234)	(0.311)
N	30	30	30	12	12	12
R^2	0.374	0.204	0.320	0.728	0.783	0.726

Notes: The dependent variables are the change of 2/5/10-year treasury yields around the FOMC announcements. The treasury yield data are from Gürkaynak, Sack & Wright (2007). Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table C2: Intra-day treasury yield responses to LSAP shocks

	(1)	(2)	(3)	(4)	(5)	(6)
	2Y 30m	5Y 30m	10Y 30m	2Y 2h	5Y 2h	10Y 2h
			Panel A: QE			
LSAP	-0.008**	0.020***	0.048***	-0.012**	0.015*	0.050***
	(0.003)	(0.006)	(0.010)	(0.005)	(0.007)	(0.012)
FG	0.042***	0.052***	0.035***	0.041***	0.052***	0.036***
	(0.004)	(0.005)	(0.005)	(0.004)	(0.006)	(0.005)
FFR	0.041*	-0.004	0.045	0.029	-0.038	0.013
	(0.022)	(0.040)	(0.040)	(0.024)	(0.037)	(0.067)
N	30	30	30	30	30	30
R^2	0.900	0.856	0.795	0.747	0.693	0.601
			Panel B: Taper			
LSAP	-0.015*	0.017	0.033*	-0.013	0.034	0.046
	(0.007)	(0.021)	(0.017)	(0.011)	(0.034)	(0.027)
FG	0.053***	0.059*	0.019	0.053***	0.049	0.000
	(0.009)	(0.028)	(0.023)	(0.015)	(0.047)	(0.037)
FFR	-0.031	-0.164	-0.150	-0.017	-0.255	-0.197
	(0.069)	(0.211)	(0.162)	(0.118)	(0.375)	(0.281)
N	12	12	12	12	12	12
R^2	0.913	0.927	0.926	0.901	0.881	0.820

Notes: The specification is similar to Table C1. Columns (1)(2)(3) and (4)(5)(6) use 30 minutes and 2 hours window respectively. The dependent variables in columns (1)(4), (2)(5) and (3)(6) are 2/5/10-year nominal treasury yield changes respectively. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table C3: The responses of treasury yields to LSAP shocks with different maturities

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	1Y	2Y	3Y	4Y	5Y	6Y	7Y	8Y	9Y	10Y
	Panel A: QE									
LSAP	-0.012***	-0.005	0.007	0.022	0.036*	0.048**	0.059***	0.068***	0.075***	0.080***
	(0.003)	(0.009)	(0.014)	(0.016)	(0.018)	(0.018)	(0.019)	(0.019)	(0.018)	(0.018)
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	30	30	30	30	30	30	30	30	30	30
R^2	0.572	0.374	0.256	0.210	0.204	0.219	0.242	0.268	0.295	0.320
	Panel B: Taper									
LSAP	-0.007	-0.013	0.007	0.033*	0.055**	0.070**	0.079**	0.084**	0.085**	0.084**
	(0.006)	(0.008)	(0.013)	(0.017)	(0.020)	(0.023)	(0.024)	(0.025)	(0.025)	(0.025)
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	12	12	12	12	12	12	12	12	12	12
R^2	0.490	0.728	0.753	0.772	0.783	0.785	0.779	0.766	0.748	0.726

Notes: The specification is similar to Table C1. The dependent variables are the change in nominal treasury yields with a maturity of 1-10 years. This data is from Gürkaynak, Sack, and Wright (2007). For space-saving, only the coefficients of $LSAP$ are displayed. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table C4: The responses of yield components to LSAP shocks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Yield			Term premium			Average short rate		
	2Y	5Y	10Y	2Y	5Y	10Y	2Y	5Y	10Y
	Panel A: QE								
LSAP	0.012	0.032***	0.045***	0.010**	0.020***	0.029***	0.002	0.012**	0.016***
	(0.008)	(0.011)	(0.012)	(0.004)	(0.006)	(0.008)	(0.004)	(0.005)	(0.005)
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	30	30	30	30	30	30	30	30	30
R^2	0.266	0.256	0.268	0.248	0.256	0.270	0.315	0.258	0.265
	Panel B: Taper								
LSAP	0.012	0.033**	0.048**	0.010**	0.020**	0.030**	0.002	0.013*	0.018**
	(0.009)	(0.014)	(0.017)	(0.004)	(0.007)	(0.010)	(0.005)	(0.007)	(0.007)
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	12	12	12	12	12	12	12	12	12
R^2	0.731	0.779	0.801	0.785	0.799	0.812	0.673	0.751	0.779

Notes: The specification is similar to Table C1. The bond yields are decomposed into term premiums and average expected future short rates. The data is from Kim and Wright (2005). The dependent variables in columns (1)(2)(3), (4)(5)(6), and (7)(8)(9) are yield change, term premium change, and the change of average expected future short rate, respectively. For space-saving, only the coefficients of $LSAP$ are displayed. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table C5: The impacts of LSAP shocks on corporate yield and credit spread

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Period	QE				Taper			
	BAA	AAA	$spread_{BAA}$	$spread_{AAA}$	BAA	AAA	$spread_{BAA}$	$spread_{AAA}$
LSAP	0.087***	0.050***	0.007	-0.030*	0.069**	0.061***	-0.015	-0.022
	(0.020)	(0.015)	(0.019)	(0.017)	(0.021)	(0.016)	(0.017)	(0.020)
FG	-0.007	0.002	-0.020	-0.010	-0.045	-0.042	-0.031	-0.027
	(0.021)	(0.016)	(0.017)	(0.012)	(0.032)	(0.026)	(0.027)	(0.030)
FFR	-0.053	0.099	0.062	0.213***	-0.246	-0.314	0.096	0.027
	(0.123)	(0.093)	(0.071)	(0.056)	(0.250)	(0.180)	(0.122)	(0.186)
N	30	30	30	30	12	12	12	12
R^2	0.423	0.271	0.173	0.291	0.578	0.507	0.818	0.811

Notes: The specification is similar to Table C1. Here we replace the treasury yield with the corporate yield and credit spread. BAA and AAA denote the daily change of Baa and Aaa indexes of long-term seasoned corporate bond yields from Moody. $sprea_{BAA}$ and $spread_{AAA}$ represent the corresponding spread changes of corporate yield relative to the 10-year treasury yield. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table C6: The impacts of LSAP shocks on dividend expectations

	(1)	(2)	(3)	(4)	(5)	(6)
	QE			Taper		
	Full sample	Real time	Random walk	Full sample	Real time	Random walk
LSAP	-7.827	-5.299	8.423	3.322	9.837	-99.982
	(11.423)	(7.131)	(122.091)	(7.519)	(7.906)	(150.892)
FG	-1.887	-3.207	210.625	-1.983	-11.934	88.840
	(5.700)	(4.280)	(284.298)	(11.084)	(11.056)	(231.550)
FFR	36.719	27.227	-359.362	27.991	-118.886	869.466
	(42.265)	(31.350)	(755.524)	(84.349)	(96.165)	(1825.791)
N	30	30	30	12	12	12
R^2	0.047	0.086	0.007	0.100	0.270	0.053

Notes: This table reports the responses of dividend expectations to LSAP shocks. The dependent variables of columns (1) and (4) are derived from full sample data, while the dividend expectation in columns (2) and (5) are based on real-time data. Columns (3) and (6) use the real-time data and assume a random walk process. The data is obtained from Gao & Martin (2021). Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.