LSAP Surprises, Stock Prices, and the Risk Premium Channel*

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Abstract

Large-scale asset purchases (LSAPs) are widely used across advanced economies, yet their effects on equity prices remain less well understood. We study the United States, a key source of global financial shocks, and find that easing LSAP surprises are frequently followed by stock-market declines during the post-crisis QE period. International estimates likewise associate these surprises with lower equity prices abroad even as government bond yields fall. We interpret the U.S. equity response through a risk premium channel. Specifically, the evidence supports an increase in risk compensation that counteracts the conventional valuation effect of lower risk-free rates. Expansionary LSAP surprises are associated with higher aggregate risk measures, and the negative equity response is stronger among riskier firms and in riskier macroeconomic states. Next, we link this risk-premium effect to a weaker macroeconomic outlook. Our evidence suggests that, in severe downturns, easing LSAP announcements can convey a pessimistic assessment of future economic conditions, thereby raising risk premia and driving down equity prices.

JEL Codes: E42, E52, G12, G18.

Keywords: Large-scale asset purchases, equity returns, risk premium, macroeconomic outlook.

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1 Introduction

Large-scale asset purchases (LSAPs) have become a widely used monetary policy tool across advanced economies. Since the global financial crisis, central banks in the United States, the euro area, the United Kingdom, and Japan have relied on asset purchases to provide accommodation when conventional policy rates offer limited room for easing. Yet their widespread adoption has outpaced our understanding of their transmission to risky asset prices. While a broad consensus has emerged that easing LSAPs lower long-term bond yields, their effects on equity prices, and the mechanisms underlying those effects, remain less settled across economies.[1] This gap raises a common policy question: does accommodation in bond markets translate into higher equity valuations and broader financial easing?

We address this question through the U.S. experience, a benchmark case for studying LSAP transmission. The United States is important not only as a major user of asset purchases, but also because of its central role in the international financial system. U.S. monetary policy serves as a key driver of the global financial cycle, shaping risk-taking, asset prices, and financial conditions beyond national borders (Miranda-Agrippino & Rey 2020). The international repercussions of U.S. asset-purchase announcements are also evident in capital flows to emerging markets (Chari et al. 2021). Understanding how these announcements affect the pricing of equity risk in the United States therefore matters beyond the domestic stock market: it helps characterize the financial impulse originating in a central source of global shocks. The U.S. case thus provides an oppor-

[1] Joyce, Tong & Woods (2011) document mixed and, overall, negative equity-index responses to the initial Bank of England asset-purchase announcements. In contrast, positive equity effects have been documented for QE by the European Central Bank (Georgiadis & Gräb 2016) and the Bank of Japan (Fukuda 2019). See Bhattarai & Neely (2022) for a survey.

tunity to investigate a transmission question shared by asset-purchasing central banks while informing the interpretation of financial disturbances with worldwide implications.

To measure the unexpected component of asset purchase announcements in the U.S., we employ the high-frequency LSAP surprises identified by Swanson (2021). While standard models predict that monetary easing should boost equity markets, we document a starkly anomalous response to these LSAP surprises. Specifically, expansionary LSAPs do not necessarily increase U.S. stock returns. Over the full QE period (the financial crisis included), the average effect of an easing LSAP surprise is minuscule and statistically insignificant; remarkably, once the peak crisis months (many financial anomalies are documented) are excluded, the equity response turns significantly negative. A different pattern emerges during the subsequent Taper period (May 2013 to October 2014), where the estimated effect, although statistically insignificant, turns positive on average. The domestic pattern also has an international counterpart: during QE, country-panel estimates associate U.S. easing LSAP surprises with lower equity prices abroad despite declining government bond yields.

These findings motivate the central question of the paper: Why do LSAP surprises during the QE period drive equity prices in a direction inconsistent with standard predictions? Explanations proposed in the recent literature fall short of fully addressing this pattern. For instance, some studies attribute the muted equity response to the "floating-rate channel" (Kiley 2014; Ippolito, Ozdagli & Perez-Orive 2018), arguing that because LSAPs primarily flatten the medium and long ends of the yield curve while leaving short-term rates constrained near the zero lower bound, firms' floating-rate debt burdens remain largely unchanged. Alternatively, Mamaysky (2018) posit that rational inattention leads to a delayed, and therefore initially muted, market reaction. However, while these theories might explain a lack of positive response, neither the floating-rate channel nor rational inattention can explain why an expansionary LSAP surprise would

significantly *depress* the equity market, nor can they account for the pronounced time-varying nature of these effects.

To explain this anomalous equity response, we provide evidence in two steps. First, guided by a standard valuation decomposition of equity price, we show that expansionary LSAP surprises significantly reduce medium- and long-term Treasury yields, which typically boosts stock prices. Expected dividend growth shows no significant response. Alongside the evidence on risk compensation below, this finding supports a risk-premium interpretation.

We provide several pieces of evidence across multiple dimensions that jointly support this *risk premium channel*, including aggregate risk measures, equity dynamics, cross-sectional heterogeneity, state dependence, and high-frequency covariance. Specifically, easing LSAP surprises are associated with increases in measures of aggregate risk, such as the VIX index, equity premium, risk aversion, and uncertainty. Furthermore, the anomalous equity response is short-lived and gradually fades within weeks, consistent with a temporary adjustment in risk compensation. In line with this interpretation, firms with greater equity risk premium respond more negatively to these surprises. In addition, the equity response is stronger in riskier macroeconomic states. Furthermore, following Cieslak & Schrimpf (2019), we show that FOMC announcements during the QE period induce a positive covariance between equity returns and Treasury yield changes, a pattern more consistent with a risk-premium effect rather than a pure policy-rate effect.

Next, we examine why monetary easing is accompanied by such an increase in risk measures during the QE period. We argue that this pattern is consistent with a deterioration in the macroeconomic outlook. To formalize this interpretation, we also develop a stylized asset-pricing framework that provides a micro-foundation for the link between LSAP surprises, macroeconomic outlook revisions, and equity risk premia. To start with, we illustrate this interpretation with several representative announcements in an

event-study format. Then, we show that, under weak macroeconomic conditions, an expansionary LSAP surprise is associated with a more pessimistic macroeconomic assessment. First, using Greenbook data, we find that downward revisions in the Federal Reserve's internal GDP growth forecasts are followed by more expansionary LSAP surprises. Moreover, a simple diagnostic classification following Jarociński & Karadi (2020) suggests that the anomalous responses in equity returns and VIX are more pronounced among outlook-related LSAP surprises. Second, market expectations move in tandem with Fed forecasts: expansionary LSAP surprises during the QE period are followed by downward revisions in market expectations of future real GDP growth. Moreover, controlling for these shifts in GDP forecasts and VIX attenuates the anomalous equity response, lending further support to our outlook-risk explanation. Third, these downward revisions in market economic forecasts are amplified in worse macroeconomic states, mirroring the state-dependent responses of equity returns and VIX.

We also provide cross-sectional evidence supporting this outlook-related interpretation. If LSAP surprises during the QE period are associated with a more pessimistic macroeconomic outlook, the impact should be more pronounced for procyclical firms. To test this, we construct a measure of cyclicality and observe that firms with greater pro-cyclicality are indeed more adversely affected by an expansionary LSAP surprise, which naturally echoes the earlier finding that riskier firms are more affected as more procyclical firms are inherently riskier under our framework.

Our analysis centers on QE, when asset purchases were a primary policy tool within a relatively coherent policy environment. The risk-premium channel supported by our evidence offers a broader framework for analyzing how LSAPs transmit differently across other periods. Moreover, our main results remain robust when controlling for public macroeconomic news. According to Bauer & Swanson (2023), part of these patterns could reflect a "response-to-news" channel, whereby easing policy responds to deterio-

rating public economic news. However, the evidence suggests that this channel does not fully account for our findings. Besides, as an extension, we find that the outlook related effect of LSAP surprises may differ from that of forward guidance.

Literature. Our paper is closely related to three strands of literature. First, it contributes to the literature on the effects of large-scale asset purchases on asset prices.[2] We document an anomalous finding that expansionary LSAP surprises do not necessarily boost equity prices and can even lower them during periods of severe economic weakness, such as the QE period. We provide evidence consistent with a risk-premium channel, linked to changes in macroeconomic outlook, that differs from more standard LSAP transmission mechanisms, such as balance-sheet effects and policy-rate signaling, as well as from explanations for muted equity responses, such as the floating-rate channel or rational inattention. See Bhattarai & Neely (2022) for a survey.

Second, our findings also speak more generally to the literature on the time-varying and state-dependent effects of unconventional monetary policy. We show that the abnormal equity response to LSAP surprises, together with the associated movements in risk premia and macroeconomic outlook, is significantly stronger under weak macroeconomic conditions. These results provide new evidence why the asset-price effects of unconventional monetary policy may vary systematically across macroeconomic regimes.[3]

Third, our paper relates to the broader literature on central bank signaling effects.[4]

[2]The literature has documented clear and significant effects of LSAPs on bond yields (e.g., Gagnon, Raskin, Remache & Sack 2011, Hancock & Passmore 2011, Todorov 2020), but the effects on equity prices are often reported to be insignificant (e.g., Swanson 2021, Jarociński 2024).

[3]This aligns with the literature on rational inattention (e.g., Weber et al. 2023, Flynn & Sastry 2024), documenting that people pay more attention to economic states and policy when the economy worsens. Our findings are also consistent with Cieslak & Schrimpf (2019), who demonstrate that non-pure policy effects drive a significant part of financial markets' reaction during the financial crisis and the early recovery period, whereas pure policy effects appear more dominant in more normal times. Relatedly, our interpretation also provides a plausible explanation for the markedly different financial-market responses across the QE and Taper periods documented by Chari et al. (2021).

[4]This broader signaling literature encompasses the policy-rate signaling channel (e.g. Krishnamurthy & Vissing-Jorgensen 2011 and Bauer & Rudebusch 2014), as well as the intensely debated "central bank private information effect", in which policy actions convey the central bank's information about future fundamentals. See, for example, Romer & Romer (2000), Campbell, Evans, Fisher, Justiniano, Calomiris & Woodford (2012), and Nakamura & Steinsson (2018).

While a large body of work studies outlook-related signaling mechanisms in the context of federal funds rate changes and forward guidance, less is known about whether similar forces help shape equity-market responses to LSAP surprises. Our paper contributes to this discussion by showing that the abnormal equity response to LSAP surprises is closely associated with deterioration in macroeconomic outlook and with movements in market risk premia. Moving beyond the heavily debated time-series survey evidence, we also bring supportive firm-level and state-dependent evidence to bear on this interpretation.

2 Data and Measurement

Monetary surprises. We adopt the LSAP surprises of Swanson (2021) as our baseline measurement. Using high-frequency (30-minute) information from a set of assets including the first and third federal funds futures contracts, the second, third, and fourth Eurodollar futures contracts, and the 2-, 5-, and 10-year Treasury yields, Swanson (2021) extends the method of Gürkaynak, Sack & Swanson (2005) to extract three factors of monetary policy: federal funds rates factor, forward guidance factor, and large scale asset purchase factor.[5] We focus on the LSAP factor while including the FG and FFR factors as controls. The LSAP factor captures announcement surprises that may combine purchase-policy news with outlook-related communication. We examine their overall equity-market response and the role of outlook-related risk compensation in shaping that response.

The time series of LSAP, FG, and FFR surprises are displayed in Figure A1. After the Taper period, the magnitude of LSAP surprises decreases significantly. As robustness checks, we also employ the surprises of Rogers, Scotti & Wright (2018) and Jarociński (2024), which identify LSAP surprises with different methods. We also con-

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

duct a surprise-free covariance analysis following Cieslak & Schrimpf (2019).

Stock return. Following Gürkaynak, Karasoy-Can & Lee (2022), our main dependent variable is the daily firm-level stock return from the CRSP database.[6] To minimize the effect of outliers, we winsorize the daily return at the 1% level on both sides.[7] Firm-level returns allow us to explore cross-sectional heterogeneity alongside time-series features. The daily responses of equity indexes are also investigated following Nakamura & Steinsson (2018), including the Nasdaq and $S\&P$ 500 indexes. Moreover, based on $S\&P$ 500 futures prices, we also study the intraday (e.g., 180-minute) effects of monetary policy surprises. As explained in the robustness part of Section 3, intraday returns face several challenges, such as inadequate reaction, pre-announcement speculation, information leakage, and microstructure noise. Therefore, following the literature (e.g., Nakamura & Steinsson 2018, Lunsford 2020, Gürkaynak, Karasoy-Can & Lee 2022, and Gorodnichenko, Pham & Talavera 2023), daily windows are employed as the baseline.

Economic forecasts. To capture the internal forecasts of the Federal Reserve, we use the Greenbook forecasts from the Philadelphia Fed, which are publicly available five years after the forecast release dates. Furthermore, to study the effects of LSAP surprises on market expectations, we also employ the professional forecasts of future real output growth, unemployment, and inflation from the Blue Chip Economic Indicator database.

Business cycle and macro news surprises. To assess whether our results are accounted for by a response-to-news channel (Bauer & Swanson 2023), we control for the business cycle and other economic news surprises. The business cycle is measured using the Aruoba-Diebold-Scotti (ADS) Business Conditions Index and Brave-Butters-Kelley (BBK) Leading Index, which summarize major macroeconomic data releases.[8] News

[6] Gürkaynak, Karasoy-Can & Lee (2022) use both one-day and two-day windows, and the results are robust. They use only $S\&P$ 500 firms, while we extend this to all firms to account for possible large-firm bias.

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

[8] The ADS index tracks real business conditions at a daily frequency. The BBK Indexes are constructed from a collapsed dynamic factor analysis of a panel of 500 monthly measures of real economic

surprises are the differences between the data release and consensus expectations prior to the release. These include non-farm payrolls, headline CPI and PPI inflation, retail sales, and the "advance" GDP release, obtained from Lakdawala, Moreland & Schaffer (2021).

Risk measures. To investigate the risk premium channel, we use the CBOE Volatility Index (VIX) from the FRED database and the risk-aversion and uncertainty measures of Bekaert, Engstrom & Xu (2022). We also use the variance premium and conditional variance from Bekaert & Hoerova (2014), the risk appetite measure of Bauer, Bernanke & Milstein (2023), and the aggregate equity premium constructed by Martin & Wagner (2019). To proxy for heterogeneous risk exposure across firms, the individual equity premium developed by Martin & Wagner (2019) and firms' balance sheet information (debt ratio, cash ratio, capital investment ratio, and dividend ratio) from Compustat database are utilized.

Other variables. Additional variables used in this paper are detailed in the corresponding sections. Summary statistics for the main variables are displayed in Table A1.

3 Equity Responses to Monetary Policy Surprises

We follow Nakamura & Steinsson (2018) and Lunsford (2020) and regress asset price changes on monetary policy surprises around FOMC announcements.[9] As discussed by Gürkaynak & Wright (2013), using the event study methodology based on high-frequency data alleviates endogeneity issues related to omitted variable bias and reverse causality. To make the regression concise and avoid bad controls, other low-frequency information

activity and quarterly real GDP growth.

[9] As discussed in Gürkaynak, Sack & Swanson (2005), Swanson (2021), Nakamura & Steinsson (2018), and Lunsford (2020), it is assumed that within the narrow window around FOMC announcements, the contents of these announcements are the main driver of asset prices, and markets are arbitrage-free and relatively efficient, yielding immediate price responses.

is not controlled for in the baseline. As shown in the robustness analysis, this does not alter our main results.

The dependent variable, y_{it}, is the daily equity return of firm i, and the subscript t indexes FOMC announcements. The explanatory variables are the Swanson (2021) surprises to large-scale asset purchases, forward guidance, and the federal funds rate. Since positive FG and FFR surprises represent monetary tightening, we multiply Swanson's LSAP factor by -1 to facilitate comparison. Thus, a positive LSAP surprise indicates tightening, and a negative surprise indicates easing. Under this sign convention, a positive within-period coefficient on LSAP means that tightening surprises raise stock returns and easing surprises lower them.

We first examine the equity response to LSAP surprises during QE within a full-sample interaction specification. During the ZLB period, large-scale asset purchases were used extensively as a primary monetary policy tool from January 2009 to October 2014.[10] As pointed out by Chari, Dilts Stedman & Lundblad (2021), Chairman Bernanke's tapering talk on May 22, 2013 marked a pivotal shift in the policy landscape, with substantially different effects on capital flows before and after that date.[11] Pooling these policy environments could therefore obscure the QE-period equity response.

Following the regime-interaction approach and QE–Taper distinction of Chari, Dilts Stedman & Lundblad (2021), we interact each monetary policy surprise with indicators for the QE period (July 1, 2009–May 21, 2013) and the Taper period (May 22, 2013–October 29, 2014).[12] The sample runs from February 4, 1994 to June 19, 2019, excluding the

[10]Following the initial tapering discussions in May 2013, the FOMC gradually reduced the pace of net asset purchases until concluding the program in October 2014. See Section I for further discussion on subsequent regimes, including the Quantitative Tightening (QT) and QE4 periods.

[11]Although actual tapering operations began later, Bernanke's May 2013 speech established market expectations for tapering, signaling an economic recovery and the onset of policy normalization.

[12]Two points are worth noting regarding this sample split: (i) The division is strictly based on a chronological cutoff rather than the sign of the announcement (i.e., easing versus tightening). (ii) Isolating the QE period—where anomalous equity responses are most prominent—allows us to study a relatively coherent policy regime, while the Taper period serves as a natural benchmark for comparison. A conceptually similar sample-splitting strategy is employed by Lunsford (2020), who studies forward

acute financial crisis period (June 1, 2008–June 30, 2009).[13] We later provide additional subsample results in Table 2. The specification is:

$$y_{it} = \alpha_i + \sum_{k \in \{LSAP, FG, FFR\}} \beta_k k_t + \sum_{k \in \{LSAP, FG, FFR\}} (\gamma_k k_t QE_t + \delta_k k_t Taper_t) + \epsilon_{it}. \tag{1}$$

Here, α_i denotes the intercept, and ϵ_{it} is the error term. The coefficient β_k measures the response outside the QE and Taper periods, while γ_k and δ_k capture the respective differences from that reference period. The corresponding within-period responses are $\beta_k + \gamma_k$ and $\beta_k + \delta_k$.

Table 1 reports four specifications. The interaction approach uses the larger full sample to estimate the QE-period response relative to other observations. Columns (1)–(2) allow responses to differ between QE and all non-QE observations. Given the concentration of LSAP use in QE and Taper and the policy shift documented by Chari, Dilts Stedman & Lundblad (2021), columns (3)–(4) additionally allow separate Taper responses to assess the stability of the QE estimates, using equation 1. Columns (1) and (3) impose a common intercept, while columns (2) and (4) allow firm-specific intercepts through firm fixed effects. Standard errors are two-way clustered at the firm and FOMC announcement-date levels.

Given the short Taper period, we treat it as a suggestive out-of-QE comparison. The mechanism examined during QE also offers a plausible perspective for interpreting LSAP responses in other periods.

guidance by comparing two short subperiods delineated by a language change in FOMC announcements.

[13] Following Nakamura & Steinsson (2018) and Chari, Dilts Stedman & Lundblad (2021), we exclude the peak crisis period to limit confounding from financial anomalies and market disruptions. The FOMC meeting on August 9, 2011, is also excluded in the baseline because the preceding day featured the largest post-crisis equity crash and the U.S. sovereign debt downgrade from AAA to AA+. Including this meeting would confound the effects of LSAP surprises, though qualitative results remain similar (see Table B2).

The LSAP–QE interaction in columns (1)–(2) is positive and significant at the 1% level, with similar estimates with and without firm fixed effects. Allowing separate responses during Taper in columns (3)–(4) leaves this pattern largely unchanged, while the LSAP–Taper interaction is small and statistically insignificant. With firm fixed effects, the implied QE-period LSAP coefficient is $-0.226 + 1.374 = 1.148$ in column (2) and $-0.175 + 1.330 = 1.155$ in column (4): the point estimates associate easing surprises with lower equity returns. The corresponding Taper coefficient in column (4) is $-0.175 + 0.015 = -0.160$. Thus, the QE slope differs from its respective reference-period slope, and the estimates are stable across the fixed-effects and Taper-interaction specifications. This anomalous asset-price response is consistent with Stavrakeva & Tang (2026), who find that U.S. forward guidance easing during the Great Recession appreciates the dollar rather than depreciating it as standard models predict, whereas we study LSAP surprises and equity prices.

Table 1: Equity Responses to Monetary Policy Surprises

	(1)	(2)	(3)	(4)
	stock return			
Variables	QE		QE and Taper	
$LSAP$	-0.219	-0.226	-0.168	-0.175
	(0.150)	(0.151)	(0.225)	(0.228)
$LSAP \times QE$	1.346***	1.374***	1.298***	1.330***
	(0.343)	(0.340)	(0.381)	(0.380)
$LSAP \times Taper$			-0.032	0.015
			(0.317)	(0.324)
FG	-0.209***	-0.208***	-0.198***	-0.195***
	(0.068)	(0.067)	(0.075)	(0.074)
$FG \times QE$	0.168	0.152	0.155	0.133
	(0.264)	(0.268)	(0.266)	(0.271)
$FG \times Taper$			-0.185	-0.244
			(0.338)	(0.341)
FFR	-0.212	-0.212	-0.210	-0.210
	(0.138)	(0.135)	(0.136)	(0.134)
$FFR \times QE$	-1.533*	-1.931**	-1.578*	-2.061**
	(0.807)	(0.836)	(0.810)	(0.847)
$FFR \times Taper$			-0.594	-1.126
			(1.756)	(1.799)
Firm FE	No	Yes	No	Yes
N	1377892	1377643	1377892	1377643
R^2	0.009	0.032	0.009	0.032

Notes: This table reports estimates of equation 1, omitting the Taper interactions in columns (1)–(2). The sample runs from February 4, 1994 to June 19, 2019, excluding the acute financial crisis period (June 1, 2008–June 30, 2009). QE_t and $Taper_t$ indicate the QE and Taper periods. The reference period consists of all non-QE observations in columns (1)–(2) and observations outside both QE and Taper in columns (3)–(4). Within-period responses are the sums of the corresponding main and interaction coefficients. Columns (1) and (3) include a common intercept, and columns (2) and (4) include firm fixed effects. Standard errors are two-way clustered at the firm and FOMC announcement-date levels. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Following the subsample approach of Stavrakeva & Tang (2026), we next examine these differences through separate-sample estimates in Table 2, with the baseline specification provided in its notes. This complementary approach directly estimates the response within each period and tests its significance without relying on sums of main and interaction coefficients. It also distinguishes Full QE from core QE, allowing us to assess sensitivity to including the peak crisis months. All specifications include firm fixed effects. Columns (1)–(3) report results for the full sample, pre-crisis period, and Zero-Lower-Bound (ZLB) period, respectively.[14] The full-sample LSAP coefficient is small and insignificant, consistent with the intensive use of asset purchases during only a relatively short portion of the sample. Before the crisis, large-scale asset purchases were not an active policy tool, making the interpretation of the LSAP factor less directly tied to asset-purchase announcements.[15] The FG and FFR effects are significant and align with standard theoretical predictions. Restricting the sample to the ZLB period, during which LSAPs were primarily used, also yields an insignificant LSAP coefficient, consistent with Swanson (2021).

Viewed alongside the regime differences in Table 1, these pooled estimates need not imply an absence of LSAP effects; they may instead mask heterogeneity across policy environments. Columns (4)–(6) therefore distinguish the Full QE, core QE, and Taper periods. Column (4) covers the Full QE period (January 1, 2009–May 21, 2013). Its positive point estimate suggests that easing LSAP surprises might depress stock returns, although the coefficient remains statistically insignificant.

Unlike the Full QE sample, column (5) excludes the peak crisis months through June 2009 to isolate the core QE period. Here, the anomalous response is economically sizable and statistically significant: expansionary LSAP surprises are associated with a

[14]The definition of full sample, pre-crisis period, and Zero-Lower-bound (ZLB) period is similar to Swanson (2021). A minor difference is that our full sample starts from 1994.

[15]Swanson (2021) likewise omits the LSAP factor from the pre-ZLB stock-return regression (Table 5, panel B). Including the LSAP factor in the regression for this pre-crisis period yields an insignificant coefficient for LSAP.

drop in equity prices. By comparison, column (6) covers the subsequent Taper period (May 22, 2013–October 29, 2014), when the Fed began to normalize policy. The LSAP coefficient turns negative, consistent with standard theoretical predictions, but remains statistically insignificant.

Table 2: The Effect of Monetary Policy Surprises on Stock Returns

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	stock return					
Period	Full sample	Pre-Crisis	ZLB	Full QE	QE	Taper
$LSAP$	-0.019		0.171	0.226	1.169***	-0.152
	(0.163)		(0.300)	(0.366)	(0.301)	(0.589)
FG	-0.193***	-0.192**	-0.449	-0.277	-0.075	-0.455
	(0.068)	(0.083)	(0.276)	(0.398)	(0.273)	(0.795)
FFR	-0.217	-0.318**	1.220	-2.965	-2.460**	-1.360
	(0.133)	(0.143)	(1.457)	(2.255)	(1.036)	(6.813)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N	1377643	871072	335459	219144	193411	79939
R^2	0.027	0.036	0.051	0.052	0.082	0.120

Notes: This table presents baseline regression results for different sample periods. The specification in Column (1) is $stock\ return_{it} = \alpha + \beta_1 LSAP_t + \beta_2 FG_t + \beta_3 FFR_t +$ Firm FE$+\epsilon_{it}$. Columns (1)-(3) use the following nominal sample ranges, respectively: February 4, 1994-June 19, 2019; February 4, 1994-September 14, 2008; and January 1, 2009-November 30, 2015. Following Nakamura & Steinsson (2018), we exclude the acute financial crisis period (June 1, 2008-June 30, 2009) from the estimations in columns (1)-(3). The sample periods for columns (4)-(6) are January 1, 2009-May 21, 2013; July 1, 2009-May 21, 2013; and May 22, 2013-October 29, 2014, respectively. Columns (4) and (5) also exclude the FOMC meeting on August 9, 2011, which took place one day after a sharp decline in the equity market due to the U.S. sovereign debt rating downgrade from AAA to AA+ (results remain qualitatively similar when this meeting is included). All specifications include firm fixed effects, with standard errors two-way clustered at the firm and conference levels. Asterisks indicate statistical significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

The additional QE-interaction estimates in Table B1 support the period difference in LSAP effects, while comparable differences are less evident for the other surprises. The anomalous pattern is thus most visible in LSAP surprises. This distinction is consistent

with the policy setting: in the August 9, 2011 FOMC statement, the Fed announced that it would maintain the federal funds rate at "exceptionally" low levels at least through mid-2013.[16] Given the zero lower bound, this forward guidance likely made policy-rate news less informative than announcements regarding large-scale asset purchases during this period.

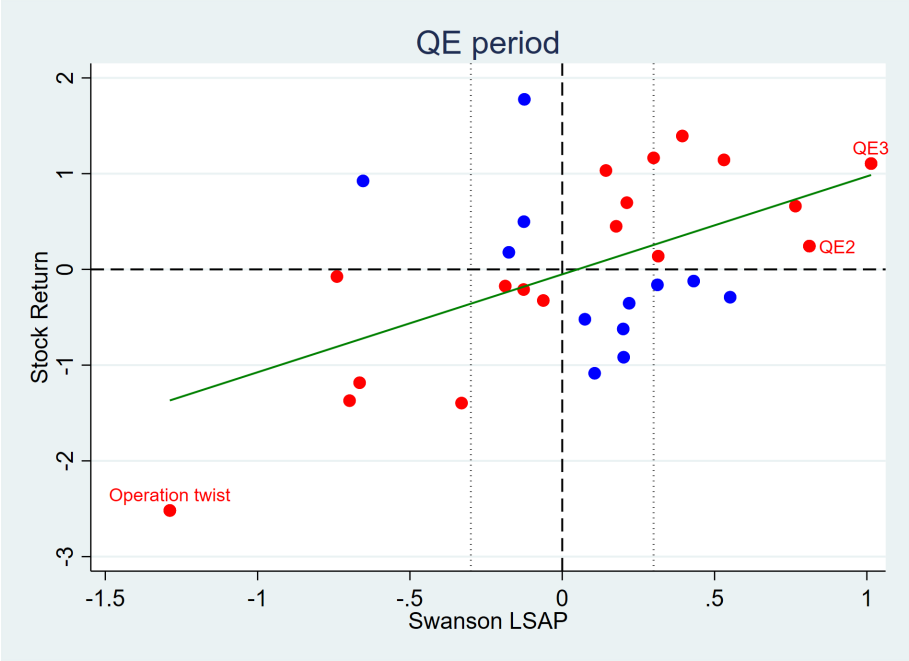
Figure 1 shows that the anomalous response reflects a broader pattern in the QE sample rather than a handful of outliers.[17] Of the 30 meetings, 18 exhibit the anomalous sign (red markers), with contractionary (expansionary) surprises associated with equity price increases (decreases), while 12 follow standard theoretical predictions. Larger monetary policy surprises typically yield more reliable estimates because measurement noise is less likely to obscure them. Among surprises with absolute magnitudes above 0.3, 12 of 16 observations exhibit the anomalous sign pattern.[18]

[16]This meeting was the first time the Fed introduced calendar-based forward guidance, explicitly stating: "The Committee currently anticipates that economic conditions... are likely to warrant exceptionally low levels for the federal funds rate at least through mid-2013."

[17]In the robustness part, we perform a leave-one-conference-out analysis to illustrate this point.

[18]This pattern persists when using alternative thresholds of 0.4 or 0.5.

Figure 1: LSAP Surprises and Stock Returns in the QE Period



Notes: This figure presents scatter plots of LSAP surprises and the average daily stock return across firms around FOMC announcements during the QE period. Each point represents an FOMC meeting. Red markers indicate cases with an "abnormal sign," where contractionary surprises coincide with equity price increases or expansionary surprises coincide with price declines. Blue markers represent cases with the "normal sign." The dotted lines mark LSAP surprise thresholds at 0.3 and -0.3.

Robustness. We report extensive robustness checks in Appendix B to ensure the reliability of the baseline pattern. First, we confirm that our results are robust to including the outlier conference on August 9, 2011, and that the sign pattern remains stable across alternative fixed-effects specifications, standard-error clusterings, and winsorization thresholds. Second, to address potential identification challenges with monetary surprises, we show the results hold when using alternative LSAP surprise series from Rogers, Scotti & Wright (2018) and Jarociński (2024), as well as a surprise-free covariance method. Third, the anomalous pattern is consistently present across different aggregate equity returns, including daily responses of $S\&P$ 500 and Nasdaq indexes, and intraday $S\&P$ 500 futures returns. The intraday estimates are positive across the

reported windows, consistent with the daily equity response, although their statistical precision varies across windows. Fourth, we verify that the results are not driven by extreme tail observations or any single FOMC meeting via sub-sample trimming and a leave-one-conference-out analysis. Finally, our main findings are robust to the inclusion of low-frequency firm-level controls.

Event Sample. The QE sample contains 30 FOMC announcements, reflecting the limited duration of the policy regime. Expanding the sample increases the event count but may pool distinct transmission mechanisms. Comparable event-based analyses also use limited samples: Stavrakeva & Tang (2026) report 33 announcements during the Great Recession and 19 after excluding QE announcements, while Bauer & Swanson (2023) estimate targeted subsample regressions using 10 announcements. Our evidence combines full-sample regime comparisons, leave-one-announcement-out checks, and a covariance analysis covering additional monetary events, alongside the cross-sectional and state-dependent results presented below. The within-QE equity response also remains significant at the 5% level under announcement-level null-imposed wild bootstrap inference.

Period Extensions. We look further back to the early phase of quantitative easing, from January to June 2009, which encompasses four FOMC announcements during the most acute stage of the financial crisis. Although this period is subject to substantial confounding factors, the sign pattern during these months also suggests anomalous equity responses (see Figure I1). Among these meetings, the QE1 announcement (March 18, 2009) stands out as the only case in which the equity-market response follows the conventional sign.[19] The remaining announcements display the abnormal pattern in

[19]Our focus is not on rationalizing the sign of each individual announcement, which is often influenced by announcement-specific factors, but on explaining the systematic abnormal equity response that emerges on average within a relatively coherent policy environment such as the core QE period.

equity responses.

We also extend the analysis to the Quantitative Tightening (QT) and QE4 periods in Table I1. While confounding factors, including the return of conventional monetary policy and the extreme uncertainty surrounding the COVID-19 pandemic, call for cautious interpretation, we find that the anomalous equity responses are not unique to the QE period.

International Asset-Price Responses. We examine whether the domestic pattern extends abroad using one-day local-currency MSCI equity returns and changes in ten-year government bond yields. Applying the full-sample interaction specification to a country panel with country fixed effects and two-way clustering by country and announcement date, we find positive LSAP–QE interactions for both equity returns and yields, significant at the 1% and 5% levels, respectively (Appendix Table I2). The implied QE-period coefficients are 1.349 and 0.040: under our sign convention, these point estimates associate U.S. easing surprises with declines in both foreign equity prices and government bond yields. Thus, lower yields need not coincide with higher equity valuations abroad, giving the domestic pricing puzzle an international counterpart. Evidence from the European Central Bank's asset purchase programmes suggests that this anomalous equity response to large-scale asset purchases may also arise in other advanced economies, though this evidence is preliminary and suggestive (see Figure I2).

For instance, the QE1 surprise was unusually large and occurred at the peak of the financial crisis. The literature generally views this first formal large-scale asset purchase announcement as strongly expansionary. In contrast, our findings suggest that later rounds were associated with more anomalous equity responses. See Bhattarai & Neely (2022) for a survey of the effects of different rounds of QE.

4 The Risk Premium Channel

We have documented that expansionary LSAP surprises influence equity prices in directions inconsistent with standard predictions during the QE period. To understand the drivers of this anomalous equity response, a standard valuation decomposition provides a useful conceptual framework (e.g., Campbell & Shiller 1988). Around a monetary policy announcement, the equity-price response can be written heuristically as:

$$\Delta p_t \approx -\Delta r_t^f + \Delta CF_t - \Delta RP_t \tag{2}$$

where Δr_t^f captures the effect of changes in risk-free discount rates, ΔCF_t summarizes news about expected future cash flows, and ΔRP_t denotes changes in the required compensation for equity risk.

We find that expansionary LSAP surprises significantly lower medium- and long-term Treasury yields, which would conventionally push equity prices upward. Expected dividend growth shows no significant response (see Appendix C). This does not necessarily imply that the cash-flow channel is absent: dividend expectations may imperfectly capture revisions to future cash flows, and imprecise estimates may obscure such revisions. Rather than ruling out cash-flow effects, we examine risk compensation as an important margin of LSAP transmission that has received comparatively less attention in the literature. The evidence below supports an increase in required risk compensation ($\Delta RP_t > 0$) that counteracts the conventional valuation effect of lower risk-free rates.[20]

In this section, we provide several pieces of evidence across multiple dimensions to jointly support this view. First, expansionary LSAP surprises are significantly associated

[20]Two complementary patterns support this interpretation. The equity response fades within approximately three weeks (Figure I3), more consistent with a temporary adjustment in risk compensation than with a persistent downward revision to expected cash flows. Controlling for VIX attenuates the LSAP coefficient more than controlling for GDP forecast revisions (Table F10), suggesting a risk-related component not fully captured by measured growth expectations.

with increases in aggregate risk measures. Moreover, the relatively short-lived equity response is consistent with a temporary adjustment in risk compensation. Second, in the cross-section, firms with greater equity risk premium respond more negatively to these easing surprises. Third, this negative equity-market response is amplified during riskier macroeconomic states. Finally, high-frequency covariance evidence shows that equity returns and Treasury yields tend to move in the same direction around monetary events, a pattern indicative of risk-premium effect rather than pure policy-rate effect.

Our primary focus is on QE, when asset purchases were a primary policy tool within a relatively coherent policy environment. The risk-premium mechanism supported by our evidence provides a broader framework for understanding the state-dependent effects of asset purchases in other periods.[21]

4.1 LSAP Surprises and Aggregate Risk Measures

We begin by examining how the CBOE Volatility Index (VIX) responds to LSAP surprises.[22] Table 3 reports full-sample regressions of daily VIX changes using the interaction specification in Section 3. Column (1) includes the LSAP surprise and its QE interaction. Column (2) adds FG and FFR surprises and their QE interactions, while column (3) additionally allows separate Taper responses to assess the stability of the QE estimates. All three specifications use 202 FOMC announcements.

The LSAP–QE interaction is negative and statistically significant across all specifications, with estimates ranging from -6.053 to -7.390. The implied QE-period LSAP coefficients are -6.213, -6.888, and -6.902, respectively. Under our sign convention, these point estimates associate easing LSAP surprises with increases in VIX. The pattern remains similar after controlling for FG and FFR and allowing separate Taper

[21] We also discuss the implications for other periods in Section 5.

[22] Appendix Table D1 reports alternative risk measures and decompositions that distinguish risk compensation, risk aversion, and uncertainty.

responses. In contrast, the LSAP main coefficients and the Taper interaction are statistically insignificant. The Taper period provides a suggestive comparison outside the QE sample.

Table 3: LSAP Surprises and VIX

	(1)	(2)	(3)
		ΔVIX	
$LSAP$	-0.160	0.285	0.488
	(1.071)	(1.042)	(1.530)
$LSAP \times QE$	-6.053***	-7.173***	-7.390***
	(2.236)	(2.353)	(2.616)
$LSAP \times Taper$			-3.093
			(3.426)
FG		1.874***	1.861***
		(0.610)	(0.669)
$FG \times QE$		-2.333	-2.309
		(1.675)	(1.711)
$FG \times Taper$			4.168
			(4.598)
FFR		1.572**	1.573**
		(0.751)	(0.756)
$FFR \times QE$		5.926	6.215
		(6.327)	(6.429)
$FFR \times Taper$			-1.727
			(21.098)
N	202	202	202
R^2	0.030	0.128	0.132

Notes: The dependent variable is the daily change in VIX around FOMC announcements. Column (1) includes LSAP and its QE interaction; column (2) additionally includes FG, FFR, and their QE interactions; column (3) also includes interactions of all three surprises with the Taper indicator. The sample runs from February 4, 1994 to June 19, 2019, excluding the acute financial crisis period (June 1, 2008–June 30, 2009). QE and Taper are defined as in Section 3. The reference period includes all non-QE observations in columns (1)–(2), and observations outside both QE and Taper in column (3). Within-period responses are the sums of the corresponding main and interaction coefficients. Positive surprises indicate tightening. All specifications are estimated by OLS and include an intercept, which is not reported. Heteroskedasticity-robust standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Alternative Risk Measurements. Complementing the full-sample interaction estimates, Appendix Table D1 examines the within-QE risk response.[23] Columns (1)–(2) associate easing surprises with higher VIX and expected equity premia, consistent with increased risk compensation. Columns (3)–(4) show increases in the risk-aversion and uncertainty measures of Bekaert, Engstrom & Xu (2022), consistent with reduced willingness to bear risk and greater perceived uncertainty. Columns (5)–(6) use the decomposition of Bekaert & Hoerova (2014) to distinguish variance risk compensation from expected variance. Easing surprises are associated with a significant increase in the variance premium. The conditional-variance coefficient is also negative, although its announcement-day estimate is not statistically significant. Finally, column (7) shows a decline in the risk appetite measure of Bauer, Bernanke & Milstein (2023), consistent with the rise in risk aversion.

Dynamic Comovement of Equity and Risk Measurements. Using local projections, we find that the anomalous equity response during QE fades after approximately three weeks (see Figure I3). Complementary announcement-level projections cover all seven risk measures in Appendix Table D1. Their responses generally lose statistical significance after approximately two to three weeks and recede over subsequent horizons (Figure I4). This temporal correspondence with the fading equity response is more consistent with a temporary adjustment in risk compensation than with a persistent downward revision to expected cash flows.

4.2 Riskier Firms are More Affected in the Cross-Section

If this risk premium channel holds, the negative impact of expansionary LSAP surprises should not be uniform across all firms. Specifically, firms with greater risk exposure

[23]Because the risk measures differ in historical coverage, we restrict the analysis to the same 30 QE announcements to ensure comparability across measures. The subsample estimates directly characterize the within-QE responses relevant to the mechanism.

should experience more pronounced price declines. To test this cross-sectional implication, we proxy for firm-level expected equity premia using the firm-level $SVIX$ measure from Martin & Wagner (2019). As shown in Table 4, during the QE period, firms with higher expected equity premia experience more negative equity-return responses to easing LSAP surprises, consistent with the risk-exposure interpretation. By comparison, this cross-sectional pattern is largely absent in the Taper period; the corresponding aggregate VIX estimates are reported in Table 3.

To extend this analysis to a broader set of firms and over longer horizons, we use several balance-sheet variables as proxies for firms' risk exposure, including *Sdebt* (short-term debt over total assets), *Ldebt* (long-term debt over total assets), *Debt* (total debt over total assets), $Cash$ (cash and short-term investment over total assets), $Capital\ Inv$ (capital investment over total assets), and *Dividend* (dividend over total assets).[24,25] As shown in Table D2, during the QE period, firms with greater risk exposure (higher debt ratios, lower cash ratios, higher capital-investment ratios, and lower dividend ratios) are more adversely affected by easing LSAP surprises.

We also report supportive portfolio evidence in Appendix E, where portfolios with greater exposure to LSAP surprises tend to earn higher excess returns during the QE period.

[24]These balance-sheet variables are not pure risk-premium measures; they may also capture financial constraints, duration exposure, industry composition, and sensitivity to aggregate demand. We therefore interpret this evidence as risk-exposure heterogeneity rather than as a direct measurement of firm-level risk premia. Although these variables are not perfect measures of firm risk, firms with higher debt leverage, lower cash holdings, higher capital investment, and lower dividend payouts are typically more exposed to adverse shocks. 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.

[25]We use only industrial firms, including companies engaged in manufacturing, retail, construction, and other commercial operations outside financial services. To reduce the influence of outliers, we winsorize these variables at the 1% level on both tails.

Table 4: The Effect of LSAP Surprises on Stock Returns of Firms with Different Expected Equity Premia

	(1)	(2)	(3)	(4)
	stock return			
Period	QE		Taper	
$LSAP_t$	0.757***		-0.525***	
	(0.056)		(0.063)	
$LSAP_t \times SVIX_{i,t-1}$	5.248***	5.153***	-0.546	-0.505
	(0.622)	(0.647)	(1.094)	(1.108)
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 reports heterogeneous stock-return responses to LSAP surprises by firms' expected equity premia. The specification in columns (1) and (3) is $stock\,return_{it} = \alpha + \beta_1 LSAP_t + \beta_2 (LSAP_t \times SVIX_{it-1}) + \beta_3 SVIX_{it-1} + \text{Firm FE} + \epsilon_{it}$. In columns (2) and (4), we additionally include conference fixed effects to absorb announcement-specific factors. $SVIX_{it-1}$ is the firm-level $SVIX$ measure developed by Martin & Wagner (2019), which proxies for expected equity premia and is measured in the month preceding each announcement. Its sample period runs from August 1999 to September 2013 and covers only $S\&P$ 500 firms. Standard errors are clustered at the firm level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Results are robust to including additional firm characteristics (such as size, profitability, and maturity) and their interactions with monetary policy surprises; these estimates are omitted for brevity.

4.3 Riskier States Amplify the Impact on Equity Returns

Guided by this risk-premium interpretation, asset-pricing theories with time-varying risk aversion (e.g., habit formation theory in Campbell & Cochrane 1999) suggest that the equity-market effect should be state-dependent. Specifically, the negative effect of expansionary LSAP surprises on stock returns should be stronger during riskier macroeconomic states. This time-series implication complements the previous cross-sectional finding that riskier firms are more adversely affected.

To test this idea, we augment the baseline panel regression with interaction terms

between LSAP surprises and several lagged state variables. These state variables include the FOMC announcement sentiment index from Gardner, Scotti & Vega (2022), the unemployment rate, and the VIX index. The results are reported in Table 5.

Table 5: State-Dependent Effects of LSAP Surprises on Stock Returns

	(1)	(2)	(3)
	stock return		
$LSAP$	0.948***	-4.827***	-1.570*
	(0.233)	(1.776)	(0.794)
$LSAP \times sentiment$	-2.019***		
	(0.423)		
$LSAP \times unemp$		0.651***	
		(0.223)	
$LSAP \times VIX$			0.098**
			(0.037)
Control	Yes	Yes	Yes
N	273475	273475	273475
R^2	0.072	0.061	0.058

Notes: This table reports state-dependent stock-return responses to LSAP surprises. Relative to the baseline specification, we additionally include lagged state variables and their interactions with LSAP surprises. $sentiment_{t-1}$ is the one-conference-lagged sentiment index constructed from FOMC announcements in Gardner, Scotti & Vega (2022); $unemp_{t-1}$ is the one-month-lagged unemployment rate; and VIX_{t-1} is the one-day-lagged VIX index. The specification is $stock\ return_{it} = \alpha + \beta_1 LSAP_t + \beta_2(LSAP_t \times X_{t-1}) + \beta_3 X_{t-1} + FG_t + FFR_t +$ Firm FE $+ \epsilon_{it}$, where X_{t-1} denotes the corresponding lagged state variable in each column. The sample includes both the QE and Taper periods, and the results remain robust when the sample is restricted to the QE period. Standard errors are two-way clustered at the conference and firm levels. For brevity, only the coefficients on LSAP-related variables are reported. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Consistent with the risk interpretation, the negative equity response to expansionary LSAP surprises is stronger when macroeconomic conditions are riskier, as reflected in lower sentiment, higher unemployment, or higher VIX. The pattern also holds within the QE period alone, indicating that it is not solely driven by the QE–Taper transition.

If this risk channel holds and the equity return response is stronger in bad states, the VIX response should exhibit a similar state dependency. Indeed, we verify that the VIX index is itself more responsive to LSAP surprises in bad states (Table D3). As noted above, this highly asymmetric, amplified risk response aligns naturally with the time-varying risk aversion framework, where investors' aggregate risk aversion becomes highly convex and spikes sharply when economic conditions deteriorate.

4.4 High-Frequency Covariance Evidence

In addition to the surprise-based analysis above, we implement a surprise-free approach following Cieslak & Schrimpf (2019), which does not rely on LSAP surprise identification. Crucially, this approach also helps address the small-sample concern by incorporating additional monetary events beyond formal FOMC announcements, such as minutes releases and press conferences.[26] Under a risk interpretation, we expect the following comovement around policy announcements: in an easing episode, risk premia rise, equity returns fall, and Treasury yields decline; in a tightening episode, risk premia fall, equity returns rise, and Treasury yields increase. In both cases, equity returns and Treasury yields move in the same direction, which is opposite to the prediction of a conventional monetary policy effect. Thus, if the risk premium channel holds, the covariance between equity returns and Treasury yield changes on monetary-event days should become more positive relative to other days. We test this idea by regressing realized covariance on monetary-event indicators interacted with QE and Taper period dummies:

$$y_t = \alpha + \beta_1(QE_t \times ME_t) + \beta_2(Taper_t \times ME_t) + \epsilon_t. \tag{3}$$

Here, y_t denotes the realized covariance between equity returns and yield changes mea-

[26]Recent literature highlights the critical importance of these non-FOMC announcement events in shaping market expectations; see, for example, Swanson (2023) and Swanson & Jayawickrema (2023).

sured over the -15 to +90 minute window around FOMC announcements.[27] ME_t is a dummy equal to one for a monetary event day, including FOMC statements, minutes releases, and press conferences. QE_t and $Taper_t$ are dummies for the QE and Taper periods, respectively. The regression is estimated on daily available data from July 2009 through December 2017, with non-monetary-event days serving as the comparison benchmark.

The results are reported in Table 6. Columns (1)–(5) correspond to the covariance between equity returns and changes in 3-month, 2-year, 5-year, 10-year, and 30-year Treasury yields. During the QE period, these covariances become more positive, especially at longer maturities, consistent with a greater impact of risk-premium movements. By contrast, during the Taper period, the covariances become more negative in response to monetary events, suggesting a larger role for conventional monetary policy effects. The results are robust to decomposing monetary events into policy decisions, minutes releases, and press conferences (Table D4), controlling for forward guidance (Table D5), and using alternative event windows (-15 to +15 minutes and -15 to +60 minutes; Table D6).

[27] See Cieslak & Schrimpf (2019) for construction details.

Table 6: Monetary Events and Equity-Yield Covariances

	(1)	(2)	(3)	(4)	(5)
	3M	2Y	5Y	10Y	30Y
$QE \times ME$	-0.181	2.321	8.372	13.099	23.769***
	(2.381)	(5.182)	(11.024)	(8.504)	(8.770)
$Taper \times ME$	-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: This table reports how equity-yield covariances respond to monetary events across the QE and Taper periods. The dependent variable in each column is the realized covariance between equity returns and changes in Treasury yields of the indicated maturity, measured over the -15 to +90 minute window around FOMC announcements. The specification is $y_t = \alpha + \beta_1(QE_t \times ME_t) + \beta_2(Taper_t \times ME_t) + \epsilon_t$, where ME_t is a dummy equal to one for a monetary event day, including FOMC statements, minutes releases, and press conferences. QE_t and $Taper_t$ are dummies for the QE and Taper periods, respectively, as defined earlier. The regression is estimated on daily data from July 2009 through December 2017, with non-monetary-event days serving as the baseline. Constant terms are omitted for brevity. Robust standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

5 LSAP Surprises and Macroeconomic Outlook

Section 4 provides evidence that the risk premium channel helps explain the anomalous equity-market responses to LSAP surprises during the QE period. A key question is how to interpret the increase in the equity risk premium following an expansionary surprise. One plausible explanation is that expansionary LSAP surprises are associated with a weaker macroeconomic outlook. During periods of severe economic weakness, an unexpected expansionary LSAP surprise may reflect the Federal Reserve's more pessimistic assessment of future economic and financial conditions. If market participants interpret these surprises as reflecting a weaker outlook, it could naturally translate into heightened risk aversion and risk perception, thereby pushing the aggregate risk premium upward and exerting downward pressure on equity prices.

To formalize this narrative and bridge the valuation decomposition in Section 4 with the macroeconomic outlook, we develop a stylized asset-pricing framework in Appendix J. In this framework, an expansionary LSAP surprise (L) conveys a pessimistic public signal, leading the market to revise its macroeconomic outlook (μ) downward and increasing macroeconomic uncertainty (σ). Under a state-dependent pricing kernel where risk aversion (λ) spikes during economic downturns, the valuation of firm i can be written as:

$$p_{i,0} = -r_f(L) + g_i(\mu) - \underbrace{\beta_i \lambda(\mu)\sigma(L)^2}_{ERP_i} \tag{4}$$

where $-r_f(L)$ is the conventional risk-free rate component, $g_i(\mu)$ captures the cash-flow effect, and ERP_i represents the equity risk premium governed by the firm's macro-risk exposure (β_i), aggregate risk aversion, and uncertainty. This micro-founded equation cleanly maps into the three heuristic components discussed earlier, illustrating how a deteriorating outlook can drive up both risk aversion and uncertainty, thereby generating an increase in the risk premium that can counteract the conventional easing effect and depress equity prices.[28] This framework also provides an explanation for the cross-sectional heterogeneity and the state-dependent responses documented in our previous empirical analysis. See Appendix J for more details.

To test this hypothesis, we first illustrate this interpretation using several representative announcements in an event study. We then verify the logic chain step by step. To start with, we show that downward revisions in the Federal Reserve's internal forecasts are associated with more expansionary LSAP announcement surprises. Using a simple diagnostic classification, we find that the anomalous equity and VIX responses are more

[28]Regarding the muted dividend response, corporate payouts are well documented to be sticky in the near term (e.g., Lintner 1956; Brav et al. 2005). Consequently, a weaker macroeconomic outlook (μ) does not necessarily translate immediately into downward revisions in expected cash-flow growth ($g_i(\mu)$), especially given managers' reluctance to cut dividends for signaling or payout-smoothing reasons. Payout stickiness can reconcile muted dividend-expectation revisions with an important role for risk compensation in equity repricing. We further discuss this mechanism in Appendix J.

pronounced among outlook-related LSAP surprises. Second, we document that market GDP forecasts are revised downward following expansionary LSAP surprises, especially in riskier macroeconomic states. This finding suggests that the weaker macroeconomic outlook associated with these policy surprises is reflected in market expectations and is also consistent with the state-dependent equity price and risk premium responses. Finally, we provide cross-sectional evidence showing that procyclical firms, whose operations are more sensitive to the macroeconomic outlook, are more adversely affected by expansionary LSAP surprises. This pattern naturally corroborates our earlier finding that riskier firms are more severely impacted as firms more exposed to macro fundamentals are inherently riskier under our framework.

5.1 Event Study with Representative Announcements

We first use the three largest LSAP surprises during the QE period in an event study to illustrate this interpretation (Table G1). On the QE2 announcement (November 3, 2010), the LSAP surprise was contractionary; both the Fed's and market GDP forecasts were revised upward, equity returns rose, and the VIX declined, consistent with an improvement in the macroeconomic outlook. On the Operation Twist announcement (September 21, 2011), which featured an expansionary LSAP surprise, the opposite pattern is observed: GDP forecasts were revised downward, equity returns declined, and the VIX increased. On the QE3 announcement (September 13, 2012), another contractionary surprise, equity returns rose, the VIX declined, and the Fed's GDP forecast moved in the same direction as in QE2, while the market GDP forecast showed a less aligned response. Appendix G provides additional background on the corresponding FOMC statements and contemporaneous media coverage.

5.2 Expansionary LSAPs and the Fed's Macroeconomic Outlook

To examine the link between LSAP decisions and the Federal Reserve's internal outlook, we study whether more expansionary LSAP surprises coincide with more negative revisions in the Fed's economic growth forecasts. Following Nakamura & Steinsson (2018) and Gürkaynak, Karasoy-Can & Lee (2022), we use Greenbook forecast revisions for real GDP growth to proxy for the central bank's internal macroeconomic outlook. These forecasts are prepared before FOMC meetings and become publicly available only with a five-year lag, making them a reasonable proxy for the Fed's internal forecasts. We estimate the following specification:

$$LSAP_t = \alpha_0 + \alpha_1 \Delta GDP^f_{CB,t} + \alpha_2 \Delta GDP^f_{CB,t} \times QE + \alpha_3 \Delta GDP^f_{CB,t} \times Taper + \epsilon_t \quad (5)$$

where $LSAP_t$ is the large-scale asset purchase surprise, QE and $Taper$ are dummies for the QE and Taper periods, respectively, as defined earlier, and $\Delta GDP^f_{CB,t}$ denotes the central bank's forecast revision for one-quarter-ahead real GDP growth.

Table 7: Federal Reserve Internal Forecast Revisions and LSAP Surprises

	(1)	(2)
	Large-scale Asset Purchase surprises	
ΔGDP^f_{CB}	-0.038	-0.060
	(0.072)	(0.069)
$\Delta GDP^f_{CB} \times QE$	0.431**	0.442**
	(0.202)	(0.206)
$\Delta GDP^f_{CB} \times Taper$	1.544	1.201
	(0.976)	(0.886)
Other Control Variables	No	Yes
N	184	184
R^2	0.050	0.115

Notes: This table reports the relationship between Federal Reserve internal forecast revisions and LSAP surprises using the full available sample (1994-02-04 to 2016-12-14). In column (1), the specification is $LSAP_t = \alpha_0 + \alpha_1 \Delta GDP^f_{CB,t} + \alpha_2(\Delta GDP^f_{CB,t} \times QE) + \alpha_3(\Delta GDP^f_{CB,t} \times Taper) + \epsilon_t$, where $\Delta GDP^f_{CB,t}$ denotes the Federal Reserve's forecast revision for one-quarter-ahead real GDP growth. These forecasts are prepared several days before each FOMC meeting and are obtained from the Greenbook. QE and $Taper$ are dummies for the QE and Taper periods, respectively, as defined earlier. In column (2), we additionally include inflation forecast revisions ($\Delta Inflation^f_{CB,t}$), unemployment forecast revisions ($\Delta Unemployment^f_{CB,t}$), and their interactions with the QE and Taper dummies. Robust standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

The results are reported in Table 7. In column (1), more expansionary LSAP surprises coincide with more negative GDP growth forecast revisions in the QE period. Our focus is on the within-QE association, which helps explain the macroeconomic outlook accompanying LSAP announcement surprises. The Taper estimates provide an informative out-of-period comparison and are directionally similar, although statistically insignificant. In column (2), we additionally include inflation and unemployment forecast revisions, and the results remain similar. The findings are also broadly similar when we restrict the sample to the QE and Taper periods (Table F1). The within-QE

association is also evident in the separate-period estimates reported in Table F2; Table F3 reports the corresponding Taper estimates for comparison. Moreover, when both the Fed's internal forecasts and prior market expectations are included in the same specification, the association of LSAP surprises with the Fed's internal assessments is more consistently significant across horizons than the association with prior market forecast revisions (Table F4).

By contrast, FG and FFR surprises are not significantly associated with the Fed's forecast revisions (Table F5). This pattern suggests that, during this period, the relationship between policy surprises and the Federal Reserve's internal outlook is most visible in LSAPs rather than in policy-rate news.[29] This interpretation is plausible given that LSAPs served as the primary policy tool during this period and therefore may have been more closely tied to the Federal Reserve's assessment of macroeconomic conditions. This evidence also corroborates the contrasting equity responses to LSAP surprises and conventional FG and FFR surprises, which exhibit the standard, non-anomalous pattern.

We further classify LSAP surprises into outlook-related and more policy-driven observations using a simple diagnostic approach. Following the "poor man's" identification strategy of Jarociński & Karadi (2020), we classify an LSAP surprise as outlook-related when the Fed's pre-announcement forecast revision has the same sign as the LSAP surprise; otherwise, it is classified as more policy-driven.[30] We find that abnormal equity returns and VIX responses are more pronounced among outlook-related surprises than among more policy-driven surprises (Table F6).

Finally, this macroeconomic-outlook interpretation does not require the Federal Reserve to possess and convey strict *private information* about future economic fundamentals that the market lacks, as in the narrow definition of the information effect (e.g.,

[29] Recall the August 9, 2011 FOMC forward guidance statement mentioned earlier.

[30] A more formal decomposition is challenging in the LSAP setting because LSAPs are implemented discontinuously and exhibit asymmetric effects and an uneven empirical distribution. We leave a more formal treatment to future research.

Nakamura & Steinsson 2018). Nor does it require the central bank's internal assessments to be objectively more accurate than those of the market. Rather, the key point is that LSAP surprises may be interpreted as reflecting the central bank's own macroeconomic outlook, and the public revises its expectations accordingly.[31]

5.3 Expansionary LSAP Surprises and Market GDP Forecast Revisions

Having shown that LSAP surprises are associated with the Federal Reserve's internal outlook, we next examine whether they are followed by revisions in market expectations of future economic conditions. Following Nakamura & Steinsson (2018) and Bauer & Swanson (2023), we use Blue Chip consensus forecasts to measure market expectations and estimate the following specification:

$$\Delta GDP^{f}_{XQ,t} = \alpha_0 + \alpha_1 LSAP_t + \alpha_2 LSAP_t \times QE + \alpha_3 LSAP_t \times Taper + Z + \epsilon_t \quad (6)$$

where the dependent variable measures the average revision in the consensus forecast of real U.S. GDP growth over the next 1 to X quarters. Because FOMC meetings may occur before or after the monthly survey date, we construct the dependent variable as the cumulative forecast revision from month $t-1$ to $t+1$ so that the policy announcement

[31]This interpretation can also arise in at least the following ways. First, policy actions may reflect other considerations internal to the Federal Reserve, including policy preferences, tail risks, and financial stability concerns. Second, even when the central bank and the market observe similar public data, the market may find the Federal Reserve's assessment credible given its substantial analytical capacity and large staff of highly trained economists. Third, even if professional forecasters share a similar outlook with the Federal Reserve, markets may still treat an easing intervention as a focal point or "wake-up call" that makes a pessimistic state more salient. In each case, an unexpected expansionary LSAP can still lead markets to interpret the policy action as consistent with a weaker macroeconomic outlook. We do not attempt to pin down the exact source, as this is beyond our scope and remains a subject of intense ongoing debate; we leave this for future study.

falls within the observation window.[32] Z denotes a set of control variables, including FG and FFR surprises and their interactions with the QE and $Taper$ dummies.

Table 8: LSAP Surprises and Market Real GDP Forecast Revisions

	(1)	(2)	(3)	(4)
	ΔGDP^f_{3Q}	ΔGDP^f_{4Q}	ΔGDP^f_{5Q}	ΔGDP^f_{6Q}
$LSAP$	-0.111**	-0.102**	-0.085**	-0.079*
	(0.048)	(0.044)	(0.041)	(0.040)
$LSAP \times QE$	0.291***	0.262***	0.238***	0.235***
	(0.075)	(0.068)	(0.064)	(0.062)
$LSAP \times Taper$	0.114**	0.106**	0.092**	0.089**
	(0.052)	(0.047)	(0.044)	(0.042)
N	203	203	203	203
R^2	0.161	0.155	0.151	0.155

Notes: The specification is $\Delta GDP^f_{XQ,t} = \alpha_0 + \alpha_1 LSAP_t + \alpha_2(LSAP_t \times QE) + \alpha_3(LSAP_t \times Taper) + Z + \epsilon_t$, where the dependent variables are average revisions in market real GDP forecasts over the next 1 to X quarters ($X = 3, 4, 5,$ or 6). QE and $Taper$ are dummies for the QE and Taper periods, respectively, as defined earlier. Z denotes a set of control variables, including FG and FFR surprises and their interactions with the QE and $Taper$ dummies. The regression is estimated over the full sample from February 4, 1994 to June 19, 2019, excluding the peak crisis period from June 1, 2008 to June 30, 2009. Robust standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

[32] Specifically, the dependent variable is

$$\begin{aligned}\Delta GDP^f_{XQ} &= revision^t_{t-1} + revision^{t+1}_t \\ &= \frac{1}{X}\sum_{i=1}^{X}\left(GDP^{iQ}_t - GDP^{iQ}_{t-1}\right) \\ &\quad + \frac{1}{X}\sum_{j=1}^{X}\left(GDP^{jQ}_{t+1} - GDP^{jQ}_t\right),\end{aligned}$$

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 the 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 May 2013, 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.

The results are reported in Table 8. They show that the association between expansionary LSAP surprises and downward revisions in market GDP forecasts is prominent in the QE period, suggesting that the weaker macroeconomic outlook associated with these policy surprises is also reflected in market expectations. The corresponding point estimate is smaller in magnitude in the Taper period. Using column (2) as an example, the implied forecast revision following a one-unit expansionary LSAP surprise is -0.160 in the QE period (0.102-0.262), compared with -0.004 in the Taper period (0.102-0.106). These point estimates indicate an economically meaningful revision in the QE period and a near-zero revision in the Taper period.

In addition to estimating the QE and Taper coefficients jointly, we also consider an alternative specification that estimates the effect separately in each period. The results are very similar; see Table F7.[33] Since most FOMC meetings in the QE period (83%) occurred after the first week of the month, a one-month revision measure from month t to $t+1$ may better align with these announcements. Using this alternative measure for all meetings in the QE and Taper periods yields similar results; see Table F8.

These market forecast revisions help link the macro-outlook evidence to the earlier rise in risk measures, in line with Campbell & Cochrane (1999) and Bauer, Bernanke & Milstein (2023), which show that risk premia tend to rise when economic conditions deteriorate.

Risk-Related Variation beyond GDP Forecast Revisions. During the QE period, if the anomalous equity response is closely linked to outlook-related risk-premium movements, then the LSAP coefficient should decline once we control for (1) market forecast revisions and (2) changes in the VIX. As shown in Table F10, in the QE period, the abnormal LSAP coefficient declines from 1.2 to 1.0 when controlling for market forecast

[33]Consistent with this interpretation, we also find that an expansionary LSAP surprise is associated with lower CPI inflation forecasts in the QE period, whereas the relationship is reversed in the Taper period. This pattern further suggests that these policy surprises are associated with a weaker market outlook during the QE period. These results are reported in Table F9.

revisions, to 0.5 when controlling for VIX changes. When both controls are included, the coefficient even drops to 0.4 and becomes statistically insignificant.[34] The larger attenuation after controlling for VIX suggests that the anomalous equity response contains a risk-related component not fully captured by measured GDP forecast revisions.

Downward Forecast Revisions Are More Pronounced in Riskier Macroeconomic States. If the outlook-related risk premium channel is at play, and given our finding that equity returns and VIX respond more prominently to expansionary LSAP surprises in riskier periods, downward revisions in market economic forecasts should exhibit a similar state dependence. Table F11 reports results in line with this conjecture. They show that under weaker macroeconomic conditions, an expansionary LSAP surprise is followed by larger downward revisions in market real GDP forecasts.[35] This parallel state-dependent pattern tightly links the market's outlook revisions with the subsequent spikes in aggregate risk and the anomalous equity sell-offs. This pattern helps explain why the macroeconomic-outlook effect is more pronounced in the QE period, when economic conditions were weaker than in the Taper period. The finding is also consistent with Altavilla, Brugnolini, Gürkaynak, Motto & Ragusa (2019) and Lunsford (2020), who document that the effects of monetary policy surprises on expectations are stronger during recessions.[36]

[34]Because VIX changes and forecast revisions are themselves equilibrium responses to announcements, this attenuation should be interpreted as a diagnostic pattern rather than as a formal mediation estimate.

[35]The sample here includes both the QE and Taper periods. The same pattern also holds when the sample is restricted to the QE period.

[36]One possible interpretation is rational inattention. Evidence from experiments, surveys, and theory suggests that households, firms, and professional forecasters pay closer attention to economic conditions and policy during bad times. For example, Pfajfar & Žakelj (2014), Cavallo, Cruces & Perez-Truglia (2017), and Weber et al. (2023) show that expectation formation depends on the macroeconomic environment and that consumers become more attentive when inflation is elevated. Flynn & Sastry (2024) show that firms have stronger incentives to pay attention in downturns, generating countercyclical attention in equilibrium. An, Abo-Zaid & Sheng (2023) find that professional forecasters update their information sets more frequently when inflation and unemployment are high and when market volatility and policy uncertainty rise. This literature suggests that the public may pay closer attention to Federal Reserve policy during the weak post-crisis recovery covered by our QE sample than during the Taper period. Consistent with this view, we find that the Google search intensity for terms such as "Federal Reserve" is higher during the QE period than during the Taper period (Figure F1).

5.4 Procyclical Firms are More Adversely Affected

If expansionary LSAP surprises during the QE period are indeed interpreted by the market as a signal of a weaker macroeconomic outlook, their negative equity-market effects should be heterogeneous across firms. Because the core of the risk premium channel in our framework relies on the firm's macro-risk exposure (β_i), the equity prices of highly procyclical firms—whose fundamental values are inherently more sensitive to the aggregate business cycle—should suffer a much steeper penalty when the market revises its economic outlook downward. To test this implication, we construct a measure of firm cyclicality and add its interaction with LSAP surprises to the baseline regression. During the QE period, firms in more procyclical industries respond significantly more negatively to expansionary LSAP surprises; see Table 9.

Within our theoretical framework, firms with greater exposure to macroeconomic fundamentals are inherently riskier. The stronger response among procyclical firms is therefore consistent with the outlook-related risk-premium interpretation and complements our earlier evidence that riskier firms experience larger equity-price declines.

5.5 Further Discussion

A Broader Perspective on LSAP Transmission. Although our empirical analysis centers on QE, the outlook-related risk-premium channel offers a perspective for interpreting LSAP responses in other periods. The overall equity response reflects the balance between conventional policy effects and changes in risk compensation associated with the macroeconomic outlook. Depending on their relative strength, these forces may produce a positive, muted, or negative response to easing. A muted response need not imply that LSAPs have little effect; it may instead reflect counteracting transmission channels. This perspective emphasizes how economic conditions and the outlook conveyed by an announcement can shape asset-price responses, consistent with Jarociński &

Table 9: LSAP Surprises and Stock Returns: The Role of Cyclicality

	stock return			
	3-digit SIC		4-digit SIC	
	(1)	(2)	(3)	(4)
$LSAP$	1.177***		1.183***	
	(0.304)		(0.306)	
$LSAP \times cyclicality$	1.523**	1.554**	1.249**	1.330**
	(0.589)	(0.590)	(0.587)	(0.568)
Firm FE	Yes	Yes	Yes	Yes
Conference FE	No	Yes	No	Yes
N	177186	177186	177186	177186
R^2	0.084	0.173	0.084	0.173

Notes: This table reports QE-period heterogeneous stock-return responses to LSAP surprises by firm cyclicality. *cyclicality* is measured as the coefficient from regressing the industry-level revenue-to-assets ratio on nominal GDP growth over the 1994–2008 sample. A higher value indicates a more procyclical industry. Columns (1) and (2) use 3-digit SIC industries, while columns (3) and (4) use 4-digit SIC industries. In columns (1) and (3), we control for FG and FFR surprises and their interactions with *cyclicality*, with firm fixed effects included. In columns (2) and (4), we additionally include conference fixed effects. Standard errors are two-way clustered at the conference and firm levels. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Karadi (2020), who highlight variation in the relative importance of policy forces across announcements and macroeconomic states.

The Response-to-News Channel. As suggested by Bauer & Swanson (2023), abnormal forecast revisions may partly reflect a "response-to-news" channel, whereby weak recent economic conditions simultaneously induce easing policy and a weaker market outlook. To assess whether our findings are driven by this channel, we incorporate a comprehensive set of variables capturing recent economic news, business-cycle conditions, and equity-market performance. Appendix H reports this response-to-news test in detail. After controlling for recent macroeconomic news surprises, ADS and BBK business-cycle indicators, and S&P 500 returns, the effect of LSAP surprises on market GDP forecast revisions in the QE period remains statistically significant, and the corresponding equity-return response is also robust. These results suggest that recent public macroeconomic news and pre-announcement market movements do not fully explain the outlook-risk patterns documented above.

LSAP versus Forward Guidance. As an extension, we show that the transmission mechanism of LSAP surprises may differ from that of forward guidance. The comparison points to differences in the risk-compensation and term-premium responses associated with LSAP and forward-guidance surprises. See Appendix I for more details.

6 Conclusion

This paper studies an anomalous pattern in the equity market: easing LSAP announcement surprises were, on average, followed by lower U.S. equity prices during the quantitative easing period. We show that this counterintuitive market reaction is consistent with a risk premium channel. The evidence supports an increase in risk compensation that counteracts the conventional valuation effect of lower risk-free rates. We then link these risk-premium movements to a deterioration in the macroeconomic outlook.

Specifically, amid severe economic weakness, market participants tended to interpret easing LSAP surprises as signals of a more pessimistic future, which drove up aggregate risk premia and depressed stock returns. Together, these findings offer a new perspective on the transmission of large-scale asset purchases, highlighting the critical role of outlook-related risk premia.

Looking ahead, our findings open several avenues for future research. For example, it would be useful to explore how this risk premium channel affects the real economy and how it interacts with other transmission mechanisms within a structural model. In addition, as high-frequency identification methods continue to improve, future research may be able to decompose composite LSAP surprises more cleanly into conventional policy components and outlook-related or other communication components, tracing their distinct macroeconomic and financial effects. Finally, building on our covariance evidence, future research could extend surprise-based analysis to monetary events beyond FOMC announcements, which have proven to be an important source of policy news.

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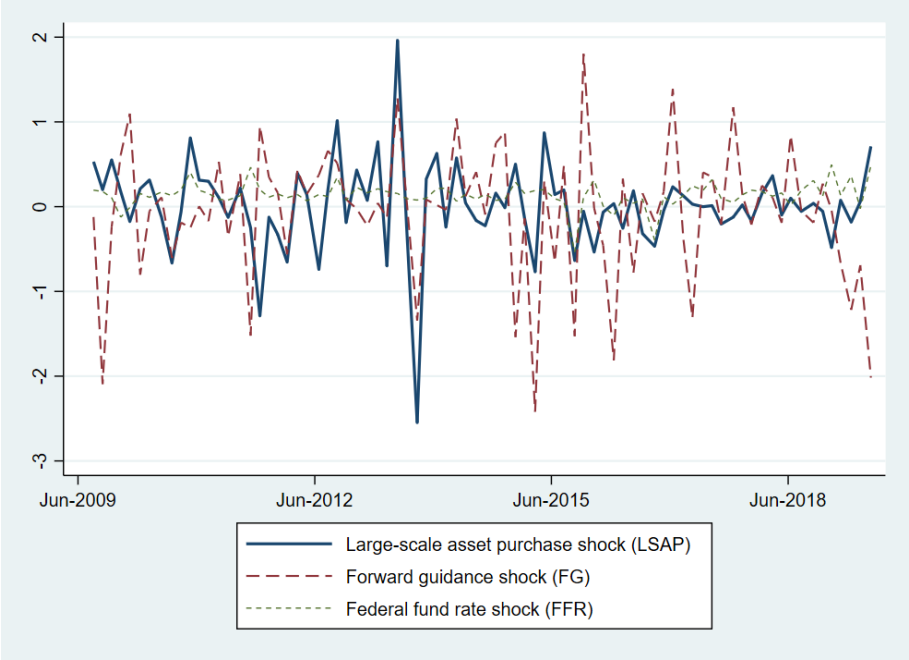
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A Data and Summary Statistics

Figure A1: Monetary Policy Surprises



Notes: This figure displays the time series of the Swanson (2021) surprises: large-scale asset purchase surprise (LSAP), forward guidance surprise (FG), and federal funds rate surprise (FFR).

Table A1: Summary Statistics of Main Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
	QE (2009/07/01-2013/05/21)				
$LSAP$	30	0.05	0.51	-1.29	1.01
FG	30	0.02	0.59	-2.09	1.10
FFR	30	0.15	0.09	-0.12	0.40
$\Delta Bond_{2Y}$	30	0.00	0.03	-0.04	0.06
$\Delta Bond_{5Y}$	30	0.00	0.05	-0.10	0.17
$\Delta Bond_{10Y}$	30	0.01	0.07	-0.11	0.20
ΔGDP^f	30	-0.04	0.18	-0.44	0.44
ΔGDP^f_{CB}	30	-0.09	0.33	-0.90	0.40
ΔVIX	30	-1.51	6.35	-11.95	15.10
$\Delta stock\ return$	193545	0.00	2.67	-10.87	13.04

Notes: This table provides the summary statistics of some main variables for the core QE period. $LSAP$, FG, and FFR denote the large-scale asset purchase surprise, forward guidance surprise, and the federal funds rate surprise, respectively. $\Delta Bond_{*Y}$ represents the daily change of $*-$year Treasury yield around FOMC meetings. ΔGDP^f is the market's forecast revision of the growth of real GDP around the FOMC dates. ΔGDP^f_{CB} is the central bank's forecast revision of the growth of real GDP right before each announcement. ΔVIX is the daily 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.

B Additional Analysis on Equity Responses

We conduct several robustness checks. First, our results are robust to including the outlier conference on August 9, 2011, see Table B2. Robustness checks in Table B3 and Table B4 show that the sign pattern is similar across alternative fixed-effects specifications, standard-error choices, and winsorization.

Second, identifying LSAP surprises is challenging.[37] To ensure our results are not driven by identification errors specific to one surprise series, we also employ the surprises estimated by Rogers, Scotti & Wright (2018)[38] and Jarociński (2024)[39] (Table B5). The results remain robust: an unexpected asset purchase surprise reduces stock prices during the QE period but has the opposite effect during the Taper period. Additionally, following Cieslak & Schrimpf (2019), we also apply a surprise-free covariance method to circumvent the identification issue, which yields consistent results (see Section 4).

Third, the daily responses of equity *indexes* (Nasdaq and $S\&P$ 500) are robust compared to those using individual stock returns. See Table B6 and B7 and Figure B1.[40] Furthermore, intraday returns of the $S\&P$ 500 futures price in the QE period show that the reactions are consistent with the daily responses (Table B8 and Figure B2). However, these intraday results should be interpreted cautiously due to several caveats documented in the literature.[41]

[37]For example, forward guidance is often announced simultaneously with asset purchases, making statistical disentanglement difficult. This concern worsens beyond the zero-lower-bound period when conventional monetary policy is also active. Furthermore, large-scale asset purchases were used intensively only during a short window, and were unevenly distributed. See Swanson (2021) for detailed discussions.

[38]The FG and FFR surprises of RSW correspond to the path and target surprises of Gürkaynak, Sack & Swanson (2005). The RSW LSAP surprise is the residual from regressing the 10-year Treasury yield change (within a 30-minute window) on the path and target surprises. We identify surprises separately for the QE and Taper periods. We refer to this as the "RSW surprise".

[39]Jarociński (2024) estimate four surprises: LSAP, FG, FFR, and information surprises (Delphic forward guidance). Their approach exploits high-frequency financial market reactions that occasionally exhibit extreme movements (fat tails).

[40]In Table B7, we use more samples and the results are close to those of the separate regression in Table B6. We use robust standard errors adjusted for heteroskedasticity. Bootstrap standard errors yield nearly identical results.

[41]Several caveats apply to intraday equity analysis: (1) Limited capture of announcement effects:

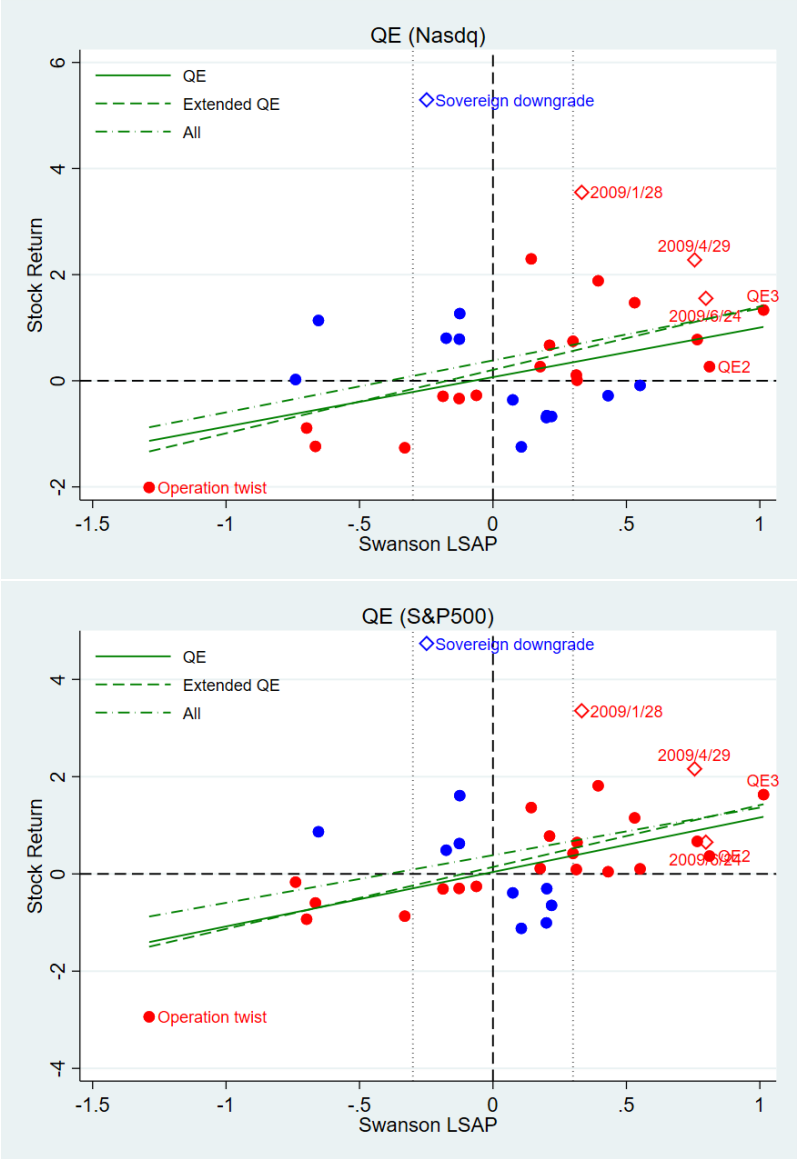
Fourth, to check whether results are driven by extreme tail observations, the regression is run over different returns sub-samples: for absolute returns smaller than 2%, 5%, 10%, 15%, and 20%. The pattern is robust (Table B9). Furthermore, a leave-one-conference-out analysis shows that dropping any single conference does not alter the results (Figure B4).

Finally, our main findings are robust to controlling for low-frequency firm-specific information. We select three variables commonly used in the literature (Gürkaynak, Karasoy-Can & Lee 2022): size, profitability, and asset maturity. These variables are insignificant, and our main results are qualitatively similar (Table B10).

Short windows may not fully reflect investors' delayed responses, particularly given market frictions and the complexity of unconventional policies (Gorodnichenko, Pham & Talavera 2023). These issues are arguably more pronounced when evaluating the broader macroeconomic-outlook implications of unconventional policies. (2) Pre-announcement noise: Speculative behavior and trading volatility often peak in the minutes immediately preceding an announcement. This makes prices captured in a very tight pre-announcement window (e.g., 15–30 minutes prior) highly sensitive to noise and thus unreliable as a benchmark, a problem mitigated by using the previous day's closing price. (3) Information leakage: If some information leaks occasionally hours before the official announcement, markets may price in the leaked news prior to the narrow intraday window. Consequently, short windows might capture only a fraction of the total policy effect, whereas daily windows help alleviate this concern. (4) Microstructure noise: Bid-ask spreads, order imbalances, and high-frequency trading introduce volatility unrelated to FOMC announcements.

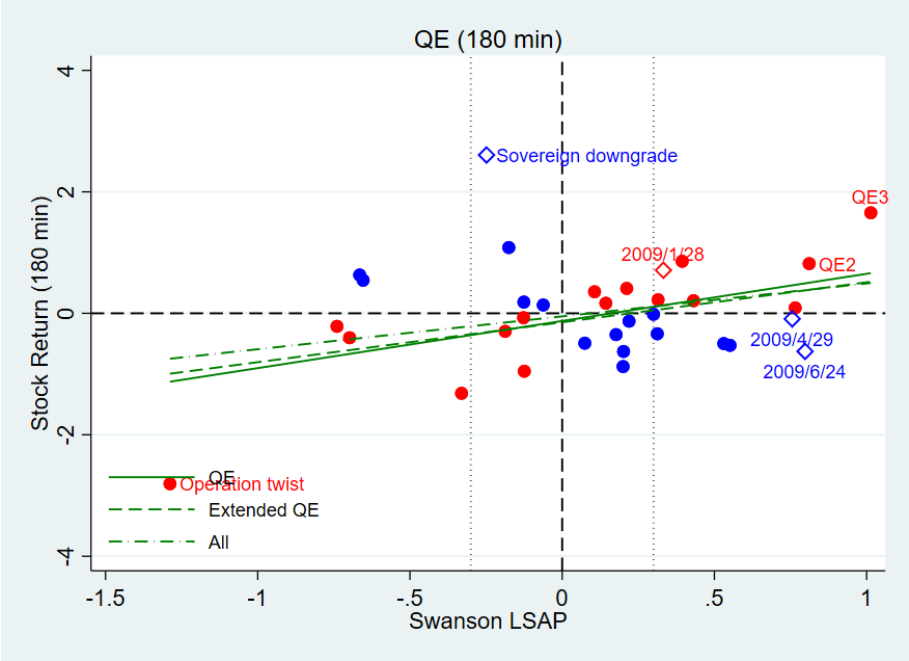
To illustrate the instability of intraday equity returns, we use the S&P 500 futures price on November 3, 2010 (QE2) as an example. It exhibits high volatility within tight windows, with return signs highly sensitive to minute-level window choices (Figure B3). Crucially, provided that the 30-minute policy surprises are orthogonal to subsequent intraday news, expanding the equity return window only adds classical measurement error to the dependent variable. As Nakamura & Steinsson (2018) note, extending the dependent-variable window adds noise without biasing the coefficient of the monetary surprise. Consequently, we follow prior literature in using daily windows as our baseline (e.g., Nakamura & Steinsson 2018, Lunsford 2020, Gürkaynak, Karasoy-Can & Lee 2022, and Gorodnichenko, Pham & Talavera 2023).

Figure B1: Scatter Plot of LSAP Surprises and Equity Index Returns



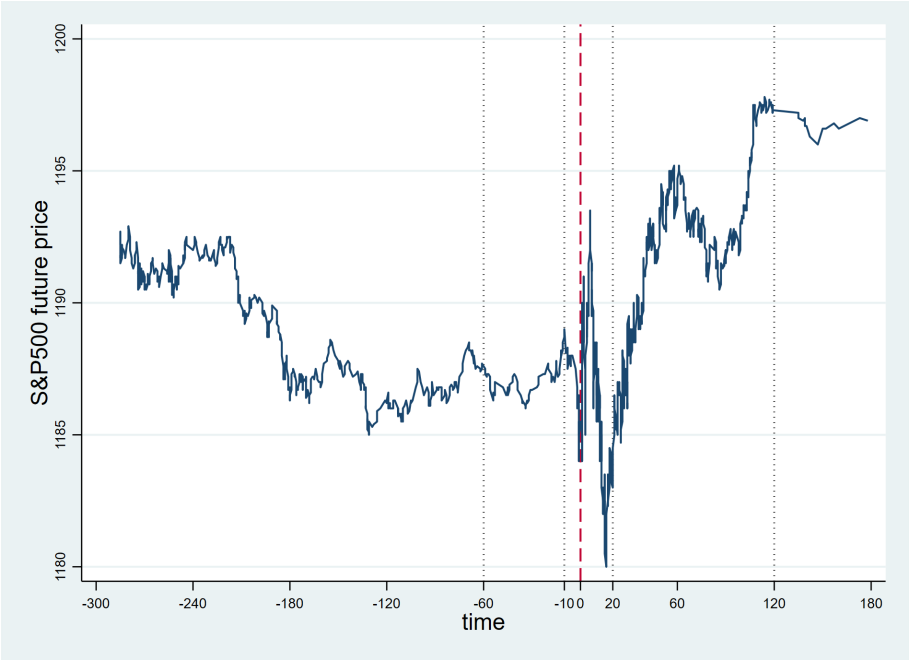
Notes: This figure displays the scatter plot of LSAP surprises and the daily NASDAQ and $S\&P$ 500 index returns around the FOMC announcements in several extensions of the QE period definition. QE is our baseline definition. "Extended QE" includes all the meetings from 2009/01/01 to 2013/05/21, except for the QE1 announcement (2009/03/18) and Sovereign downgrade (2011/08/09). "All" means all the announcements from 2009/01/01 to 2013/05/21, excluding QE1. Each point represents an FOMC meeting. The red color indicates an abnormal sign where contractionary surprises correspond to equity price increases or expansionary surprises cause equity price drops. By comparison, the blue color indicates a normal sign. All conferences beyond the baseline are denoted by a hollow diamond. The dotted line is LSAP $= 0.3$ or -0.3.

Figure B2: Scatter Plot of LSAP Surprises and Intraday Equity Returns



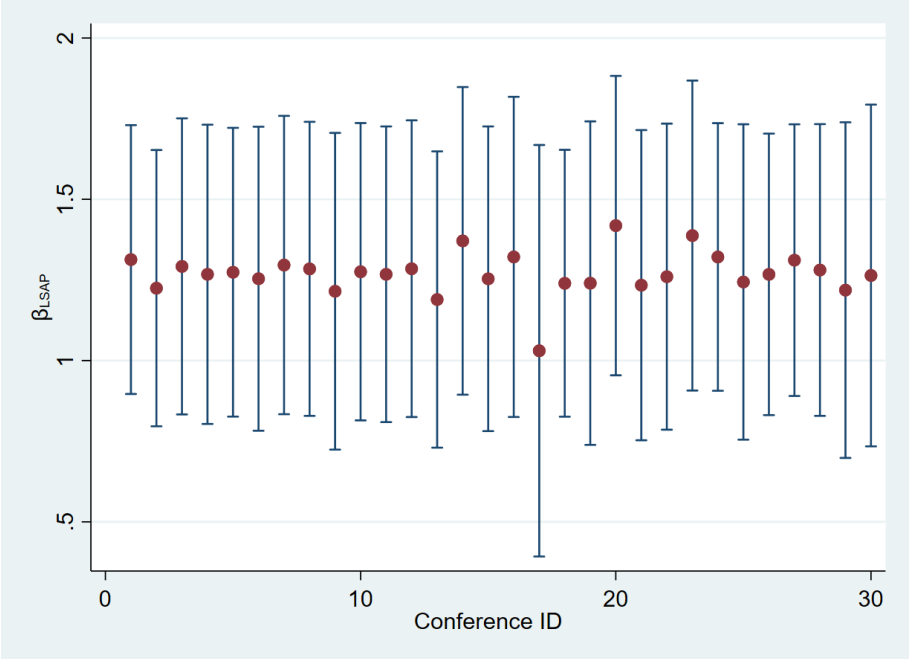
Notes: This figure displays the scatter plot of LSAP surprises and the intraday $S\&P$ 500 futures returns (180 minutes $P_{t+120} - P_{t-60}$) around the FOMC announcements in several extensions of the QE period definition. QE is our baseline definition. "Extended QE" includes all the meetings from 2009/01/01 to 2013/05/21, except for the QE1 announcement (2009/03/18) and Sovereign downgrade (2011/08/09). "All" means all the meetings from 2009/01/01 to 2013/05/21 except for the QE1 announcement. Each point represents an FOMC meeting. The red color indicates an abnormal sign where contractionary surprises correspond to equity price increases or expansionary surprises cause equity price drops. By comparison, the blue color indicates a normal sign. All conferences beyond the baseline are denoted by a hollow diamond. The dotted line is LSAP $= 0.3$ or -0.3.

Figure B3: Time Series of Intraday $S\&P$ 500 Index Future Price on Nov 3, 2010 (QE2)



Notes: This figure displays the intraday time series of the S&P 500 futures price on November 3, 2010 (the QE2 announcement). The horizontal axis represents time in minutes relative to the FOMC announcement, with 0 denoting the exact release time (14:15 ET).

Figure B4: Leave One Meeting Out Analysis



Notes: This figure displays the estimated coefficients of the LSAP surprise from a series of "leave-one-out" baseline regressions over the QE period. In each iteration, we exclude one FOMC meeting from the sample. The horizontal axis represents the chronological conference ID (smaller numbers indicate earlier meetings), and the vertical axis plots the corresponding LSAP coefficient. The error bars indicate the 95% confidence intervals ($\beta_{LSAP} \pm 1.96 \times SE$). Note that the outlier conference on August 9, 2011, is consistently excluded from all these regressions.

Table B1: The Differences of Impacts of Monetary Surprises in QE and Taper Periods

	(1)	(2)	(3)
	stock return		
Period	QE	Taper	QE and Taper
$LSAP$	1.169***	-0.152	-0.152
	(0.301)	(0.589)	(0.567)
$LSAP \times QE$			1.318**
			(0.642)
FG	-0.075	-0.455	-0.454
	(0.273)	(0.795)	(0.764)
$FG \times QE$			0.382
			(0.812)
FFR	-2.460**	-1.360	-1.348
	(1.036)	(6.813)	(6.576)
$FFR \times QE$			-1.097
			(6.656)
QE			0.059
			(0.973)
Constant	0.304	0.267	0.250
	(0.229)	(0.983)	(0.945)
N	193411	79939	273475
R^2	0.082	0.120	0.075

Notes: The first two columns are similar to columns (5) and (6) in Table 2. In column (3), we additionally include the time dummy QE and its interaction term with monetary surprises, 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 B2: The Impacts of LSAP Surprises on Stock Returns (Including the Outlier)

	(1)	(2)	(3)
	stock return		
$LSAP$	0.990**	1.013***	0.944**
	(0.370)	(0.276)	(0.389)
FG		-0.770	-0.686
		(0.574)	(0.463)
FFR			0.974
			(2.855)
Constant	0.110	0.087	-0.061
	(0.210)	(0.183)	(0.418)
N	200022	200022	200022
R^2	0.069	0.095	0.096

Notes: This table reports the baseline responses of equity returns to LSAP surprises in the QE period, with the inclusion of the outlier FOMC meeting on August 9, 2011. Standard errors are two-way clustered at the firm and conference levels. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B3: The Impacts of LSAP Surprises on Stock Return with Different Fixed Effects and Standard Errors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	stock return									
Period	QE					Taper				
LSAP	1.155***	1.169***	1.275***	1.275***	1.275***	-0.158	-0.152	-0.174***	-0.174	-0.174
	(0.306)	(0.301)	(0.017)	(0.238)	(0.233)	(0.582)	(0.589)	(0.030)	(0.661)	(0.630)
FG	-0.063	-0.075	-0.272***	-0.272	-0.272	-0.442	-0.455	-0.420***	-0.420	-0.420
	(0.273)	(0.273)	(0.012)	(0.245)	(0.240)	(0.783)	(0.795)	(0.045)	(0.911)	(0.868)
FFR	-2.375**	-2.460**	-3.284***	-3.284**	-3.284***	-1.315	-1.360	-1.207***	-1.207	-1.207
	(1.042)	(1.036)	(0.078)	(1.208)	(1.182)	(6.790)	(6.813)	(0.247)	(7.923)	(7.549)
Firm FE	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Year FE	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Cluster on Firm			Yes					Yes		
Cluster on conference				Yes					Yes	
Two-way cluster	Yes	Yes			Yes	Yes	Yes			Yes
N	193545	193411	193411	193411	193411	80087	79939	79939	79939	79939
R^2	0.042	0.082	0.094	0.094	0.094	0.039	0.120	0.120	0.120	0.120

Notes: The specification is similar to the baseline. The only difference is that different fixed effects and standard errors are used here. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B4: Winsorized at Different Levels

	(1)	(2)	(3)	(4)
Winsor	0.5%	1%	2.5%	5%
	Panel A: QE			
$LSAP$	1.172***	1.169***	1.151***	1.091***
	(0.303)	(0.301)	(0.293)	(0.274)
FG	-0.079	-0.075	-0.064	-0.046
	(0.275)	(0.273)	(0.267)	(0.253)
FFR	-2.476**	-2.460**	-2.407**	-2.254**
	(1.042)	(1.036)	(1.010)	(0.946)
Constant	0.308	0.304	0.296	0.282
	(0.231)	(0.229)	(0.224)	(0.214)
N	193411	193411	193411	193411
R^2	0.081	0.082	0.087	0.090
	Panel B: Taper			
$LSAP$	-0.155	-0.152	-0.141	-0.127
	(0.591)	(0.589)	(0.581)	(0.564)
FG	-0.453	-0.455	-0.459	-0.460
	(0.797)	(0.795)	(0.782)	(0.759)
FFR	-1.354	-1.360	-1.392	-1.426
	(6.826)	(6.813)	(6.731)	(6.567)
Constant	0.269	0.267	0.266	0.266
	(0.986)	(0.983)	(0.968)	(0.939)
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. Panels A and B are the results for the QE and Taper periods, respectively. Standard errors are two-way clustered at the firm and conference levels. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B5: Alternative LSAP Surprises

	(1)	(2)	(3)	(4)
	Panel A: QE			
	RSW		Jarociński	
$LSAP$	2.245**	2.208**	0.390**	0.362**
	(1.086)	(0.887)	(0.188)	(0.152)
FG		-0.213		-0.364*
		(0.217)		(0.204)
FFR		-2.254***		-4.143**
		(0.728)		(1.556)
INFO				0.086
				(0.262)
N	193411	193411	193411	193411
R^2	0.069	0.085	0.065	0.087
	Panel B: Taper			
	RSW		Jarociński	
$LSAP$	-1.761***	-1.794***	-0.358***	-0.283***
	(0.216)	(0.295)	(0.051)	(0.042)
FG		0.086		-0.413*
		(0.631)		(0.192)
FFR		0.516		-6.710***
		(3.284)		(1.554)
INFO				0.412***
				(0.083)
N	79939	79939	79939	79939
R^2	0.134	0.134	0.135	0.162

Notes: This table reports the baseline regression results using alternative monetary policy surprise measures. In Columns (1)-(2) and (3)-(4), the surprises from Rogers, Scotti & Wright (2018) (RSW) and Jarociński (2024) are used, respectively. Apart from the LSAP, FG, and FFR surprises, Jarociński (2024) additionally estimates a Delphic forward guidance surprise INFO. Standard errors are two-way clustered at the firm and conference levels. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B6: The Responses of Equity Indexes (I)

	(1)	(2)	(3)	(4)
	$\Delta Nasdaq$		$\Delta S\&P500$	
$LSAP$	0.933***	1.069***	1.119***	1.237***
	(0.300)	(0.322)	(0.363)	(0.387)
FG		0.055		0.027
		(0.288)		(0.358)
FFR		-2.187		-1.944
		(1.475)		(1.625)
N	30	30	30	30
R^2	0.219	0.259	0.327	0.359

Notes: This table reports the responses of the daily equity index (Nasdaq and $S\&P$ 500 index) returns to LSAP surprises in the QE period. The specification is $y_t = \alpha + \beta_1 LSAP_t + \beta_2 FG_t + \beta_3 FFR_t + \epsilon_t$, where y_t is the daily change of equity index around FOMC announcement. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B7: The Responses of Equity Indexes (II)

	(1)	(2)	(3)	(4)
	$\Delta S\&P500$		$\Delta Nasdaq$	
$LSAP$	0.185	0.034	0.088	-0.017
	(0.327)	(0.347)	(0.476)	(0.453)
$LSAP \times QE$	0.887*	1.206**	0.779	1.111**
	(0.502)	(0.496)	(0.589)	(0.536)
$LSAP \times Taper$	-0.642*	-0.084	-0.494	0.074
	(0.371)	(0.506)	(0.507)	(0.520)
FG		-0.199*		-0.044
		(0.116)		(0.191)
$FG \times QE$		0.224		0.079
		(0.351)		(0.345)
$FG \times Taper$		-0.473		-0.681
		(0.552)		(0.479)
FFR		-0.450**		-1.088***
		(0.175)		(0.377)
$FFR \times QE$		-1.545		-1.666*
		(0.963)		(0.983)
$FFR \times Taper$		-0.521		-1.292
		(2.666)		(2.255)
N	203	203	202	202
R^2	0.043	0.162	0.012	0.232

Notes: This table reports the responses of the daily equity index (Nasdaq and $S\&P$ 500 index) returns to LSAP surprises over the full sample. In column (1), the specification is $\Delta S\&P500_t = \alpha_0 + \alpha_1 LSAP_t + \alpha_2(LSAP_t \times QE) + \alpha_3(LSAP_t \times Taper) + \epsilon_t$. QE and Taper are two time dummies. In column (2), we additionally include FG and FFR surprises, and their interaction terms with time dummies. Columns (3) and (4) are analogous. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B8: Intraday Equity Return Responses

	(1)	(2)	(3)	(4)	(5)	(6)
Window	120	120	180	180	240	240
$LSAP$	0.679*	0.688	0.776*	0.795*	0.853**	0.857*
	(0.382)	(0.450)	(0.406)	(0.459)	(0.407)	(0.461)
FG		0.092		0.012		0.008
		(0.342)		(0.343)		(0.330)
FFR		0.030		-0.298		-0.045
		(1.720)		(1.852)		(1.814)
N	30	30	30	30	30	30
R^2	0.198	0.202	0.233	0.234	0.277	0.277

Notes: This table reports the responses of intraday $S\&P$ 500 futures returns to LSAP surprises in the QE period. Several windows around the FOMC meetings are used: 120 minutes ($P_{t+110} - P_{t-10}$), 180 minutes ($P_{t+120} - P_{t-60}$), 240 minutes ($P_{t+120} - P_{t-120}$), where t is the time of the FOMC announcement. Cumulative windows starting 10 minutes before the announcement and varying the post-announcement endpoint also yield positive LSAP point estimates, consistent with the daily equity response. The point estimates also increase as the post-announcement endpoint extends from 20 to 120 minutes, suggesting a gradual buildup of the anomalous equity response. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B9: The Magnitude of Stock Returns

	(1)	(2)	(3)	(4)	(5)
abs(return)	<2%	<5%	<10%	<15%	<20%
	Panel A: QE				
$LSAP$	0.396***	0.920***	1.156***	1.167***	1.171***
	(0.116)	(0.233)	(0.292)	(0.299)	(0.300)
FG	0.011	-0.003	-0.053	-0.066	-0.073
	(0.113)	(0.222)	(0.265)	(0.272)	(0.274)
FFR	-0.705*	-1.851**	-2.398**	-2.449**	-2.476**
	(0.374)	(0.796)	(1.009)	(1.034)	(1.033)
Constant	0.097	0.203	0.265	0.281	0.292
	(0.087)	(0.182)	(0.222)	(0.228)	(0.229)
N	136504	180392	191034	192575	193025
R^2	0.091	0.098	0.093	0.086	0.083
	Panel B: Taper				
$LSAP$	-0.053	-0.088	-0.131	-0.152	-0.151
	(0.312)	(0.515)	(0.575)	(0.588)	(0.593)
FG	-0.280	-0.469	-0.456	-0.449	-0.459
	(0.412)	(0.690)	(0.775)	(0.793)	(0.800)
FFR	-0.682	-1.478	-1.340	-1.325	-1.361
	(3.746)	(6.075)	(6.680)	(6.815)	(6.869)
Constant	0.111	0.241	0.234	0.244	0.261
	(0.516)	(0.853)	(0.958)	(0.981)	(0.990)
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, with the only difference being that we restrict the sample based on the magnitude of stock returns. In columns (1)-(5), the absolute stock returns are restricted to be less than 2%, 5%, 10%, 15%, and 20%, respectively. Standard errors are two-way clustered at the firm and conference levels. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B10: The Responses of Stock Returns with the Control of Firm Information

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	stock return							
Period	QE				Taper			
LSAP	1.169***	1.368***	1.368***	1.396***	-0.152	-0.139	-0.121	-0.138
	(0.301)	(0.353)	(0.347)	(0.338)	(0.589)	(0.701)	(0.706)	(0.732)
FG	-0.075	-0.042	-0.054	-0.092	-0.455	-0.442	-0.431	-0.447
	(0.273)	(0.301)	(0.294)	(0.295)	(0.795)	(0.943)	(0.950)	(0.988)
FFR	-2.460**	-2.878**	-2.831**	-2.933**	-1.360	-1.038	-1.182	-1.184
	(1.036)	(1.210)	(1.183)	(1.124)	(6.813)	(8.231)	(8.268)	(8.493)
Size		0.083	0.070	0.107		0.060	0.108	0.072
		(0.140)	(0.159)	(0.199)		(0.148)	(0.251)	(0.281)
Profitability			0.099	0.135			-0.072	0.024
			(0.094)	(0.145)			(0.141)	(0.208)
Asset maturity				0.000				0.001
				(0.001)				(0.001)
N	193411	128172	124024	98436	79939	51924	49854	39144
R^2	0.082	0.089	0.088	0.089	0.120	0.115	0.112	0.116

Notes: The specification is similar to the baseline. The only difference here is that we additionally control for 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). The standard errors are two-way clustered at the firm and conference levels. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

C Additional Analysis on Yields and Dividends

Using a specification analogous to Table D1, we estimate the effects of LSAP surprises on Treasury yields. The results are reported in Table C1. The dependent variables are changes in 2-, 5-, and 10-year Treasury yields around FOMC meetings, using data from Gürkaynak, Sack & Wright (2007). We find that an expansionary LSAP surprise lowers medium- and long-term Treasury yields during the QE period. This pattern is unlikely to explain the negative equity-return response, since declines in risk-free rates would, if anything, be expected to support equity prices.

We also decompose bond yields into the term premium and the average expected short rate. Expansionary LSAP surprises reduce both components during the QE period (Table C2).[42] In addition, corporate bond yields also decline following an expansionary surprise (Table C3). Notably, the AAA corporate bond yield spread increases, which is consistent with risk-premium pressure.

Besides, expansionary LSAP surprises may also affect equity prices through expected dividends. To examine this possibility, we use the dividend-expectation measure of Gao & Martin (2021), which is derived from option prices, valuation ratios, and interest rates.[43] The results are reported in Table C4. We do not find strong evidence in support of the dividend channel, as dividend responses are statistically insignificant in the QE period across all three measures.

[42]The decomposition data are from Kim & Wright (2005).

[43]We match the monthly dividend-expectation measures to FOMC announcements by calendar month. As explained in Gao & Martin (2021), the indicator can be interpreted as a lower bound on the expected dividend growth perceived by an unconstrained rational investor with risk aversion of at least one who is willing to invest fully in the stock market and whose beliefs are consistent with historical evidence on the relationship between valuation ratios, returns, and dividend growth.

Table C1: The Impacts of LSAP Surprises on Treasury Yields

	(1)	(2)	(3)
	2Y	5Y	10Y
$LSAP$	-0.005	0.036*	0.080***
	(0.009)	(0.018)	(0.018)
FG	0.029***	0.029**	0.013
	(0.007)	(0.011)	(0.013)
FFR	0.035	-0.094	-0.114
	(0.053)	(0.109)	(0.119)
N	30	30	30
R^2	0.374	0.204	0.320

Notes: This table reports the impacts of LSAP surprises on Treasury yields during the QE period. The specification is similar to Table D1. The dependent variables are the daily changes in 2-, 5-, and 10-year Treasury yields around the FOMC announcements. The Treasury yield data are obtained from Gürkaynak, Sack & Wright (2007). Robust standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table C2: The Responses of Yield Components to LSAP Surprises

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Yield			Term Premium			Average Short Rate		
	2Y	5Y	10Y	2Y	5Y	10Y	2Y	5Y	10Y
$LSAP$	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)
Controls	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

Notes: The specification and sample period are similar to Table C1. The nominal bond yields are decomposed into term premiums and average expected future short rates, following the methodology of Kim & Wright (2005). The dependent variables in Columns (1)-(3), (4)-(6), and (7)-(9) are the daily changes in the overall yield, the term premium, and the average expected future short rate, respectively. For brevity, only the coefficients on the LSAP surprise are displayed. All baseline controls (FG and FFR) are included. Robust standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table C3: The Impacts of LSAP Surprises on Corporate Yields and Credit Spreads

	(1)	(2)	(3)	(4)
	BAA	AAA	$Spread_{BAA}$	$Spread_{AAA}$
$LSAP$	0.087***	0.050***	0.007	-0.030*
	(0.020)	(0.015)	(0.019)	(0.017)
FG	-0.007	0.002	-0.020	-0.010
	(0.021)	(0.016)	(0.017)	(0.012)
FFR	-0.053	0.099	0.062	0.213***
	(0.123)	(0.093)	(0.071)	(0.056)
N	30	30	30	30
R^2	0.423	0.271	0.173	0.291

Notes: This table reports the effects of LSAP surprises on corporate yields and credit spreads during the QE period. The specification is similar to Table C1, replacing Treasury yields with corporate indicators. BAA and AAA denote the daily changes in Moody's seasoned BAA and AAA long-term corporate bond yield indices. $Spread_{BAA}$ and $Spread_{AAA}$ represent the daily changes in the corresponding credit spreads, calculated relative to the 10-year Treasury yield. Robust standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table C4: The Impacts of LSAP Surprises on Dividend Expectations

	(1)	(2)	(3)
	Full sample	Real-time	Random walk
$LSAP$	-7.827	-5.299	8.423
	(11.423)	(7.131)	(122.091)
FG	-1.887	-3.207	210.625
	(5.700)	(4.280)	(284.298)
FFR	36.719	27.227	-359.362
	(42.265)	(31.350)	(755.524)
N	30	30	30
R^2	0.047	0.086	0.007

Notes: This table reports the responses of dividend expectations to LSAP surprises during the QE period. The specification is similar to Table D1. The dependent variable in Column (1) is derived from the full sample data, while the dividend expectation in Column (2) is constructed based on real-time data. Column (3) utilizes the real-time data under the assumption of a random walk process. The monthly dividend expectation data are obtained from Gao & Martin (2021) and matched to FOMC announcements by calendar month. Robust standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

D Appendix on Risk Premium Channels

Table D1: The Effect of LSAP Surprises on Aggregate Risk Measures

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	ΔVIX	$\Delta SVIX$	ΔRA	ΔUNC	ΔVP	ΔCV	$\Delta RApp$
$LSAP$	-6.836***	-4.768***	-3.867**	-2.124**	-6.273**	-1.125	0.849***
	(2.275)	(1.314)	(1.871)	(0.885)	(2.634)	(1.238)	(0.240)
FG	-0.501	-0.579	0.553	-0.830	1.089	0.355	0.283
	(1.557)	(1.021)	(1.117)	(0.868)	(1.554)	(1.324)	(0.255)
FFR	6.301	4.697	10.862	11.446***	15.662	3.474	-2.696*
	(9.587)	(5.921)	(7.076)	(3.080)	(10.742)	(6.201)	(1.414)
N	30	30	30	30	30	30	30
R^2	0.273	0.330	0.308	0.214	0.383	0.012	0.159

Notes: VIX denotes the CBOE Volatility Index; SVIX denotes the expected equity premium of Martin & Wagner (2019). RA and UNC denote risk aversion and uncertainty from Bekaert, Engstrom & Xu (2022). VP and CV denote variance premium and conditional variance from Bekaert & Hoerova (2014). RApp denotes the risk appetite index of Bauer, Bernanke & Milstein (2023); higher values indicate stronger risk appetite. All regressions use the same 30 QE-period FOMC announcements. A negative LSAP surprise denotes easing. Robust standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table D2: Heterogeneous Effects of LSAP Surprises on Stock Returns in the QE Period

	(1)	(2)	(3)	(4)	(5)	(6)
	Sdebt	Ldebt	Debt	Cash	Capital Inv	Dividend
	Panel A: Annual					
$LSAP \times X$	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: Quarterly					
$LSAP \times X$	-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

Notes: This table reports heterogeneous stock-return responses to LSAP surprises in the QE period. The specification is $stock\ return_{it} = \alpha + \beta_1(LSAP_t \times X_{it-1}) + \beta_2 X_{it-1} +$ Conference FE + Firm FE + ϵ_{it}, where X_{it-1} denotes a firm's lagged balance-sheet variable. In columns (1)-(6), the variable used is *Sdebt* (short-term debt ratio), *Ldebt* (long-term debt ratio), *Debt* (total debt ratio), *Cash* (cash ratio), *Capital Inv* (capital investment ratio), and *Dividend* (dividend ratio), respectively. In Panel A, X_{it-1} is measured at the annual frequency; in Panel B, it is measured at the quarterly frequency. Standard errors are clustered at the firm level. For brevity, only the coefficients on $LSAP_t \times X_{it-1}$ are reported. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table D3: The State-dependent Impacts of LSAP Surprises on the VIX

	(1)	(2)	(3)
		ΔVIX	
$LSAP$	-5.892***	21.596	7.853
	(1.630)	(14.838)	(5.942)
$LSAP \times sentiment_{t-1}$	10.401***		
	(3.815)		
$LSAP \times unemp_{t-1}$		-3.061*	
		(1.801)	
$LSAP \times VIX_{t-1}$			-0.547**
			(0.263)
Control	Yes	Yes	Yes
N	42	42	42
R^2	0.192	0.132	0.140

Notes: The specification is $y_t = \alpha + \beta_1 LSAP_t + \beta_2(LSAP_t \times X_{t-1}) + \beta_3 X_{t-1} + \beta_4 FG_t + \beta_5 FFR_t + \epsilon_t$, where y_t is the daily change in the VIX index around the FOMC announcement and X_{t-1} denotes the corresponding state variable, defined as before. The regression is estimated over the QE and Taper periods. Robust standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Results remain consistent using measures of equity premium, risk aversion, and risk appetite.

Table D4: The Impacts of Monetary Events on the Covariance of Stock Returns and Treasury Yield Changes (Decomposition)

	(1)	(2)	(3)	(4)	(5)
	3M	2Y	5Y	10Y	30Y
$QE \times MPD$	-0.822	4.847	17.791	25.284	44.943**
	(5.413)	(11.389)	(24.479)	(18.394)	(18.424)
$QE \times MINUTES$	0.653	0.144	1.398	3.656	6.292
	(1.146)	(3.624)	(6.725)	(5.853)	(5.837)
$QE \times PC$	-0.918	1.395	0.999	5.011	13.384
	(1.140)	(4.202)	(9.301)	(9.974)	(12.928)
$Taper \times MPD$	-5.639	-69.140*	-182.473**	-156.926**	-121.024**
	(4.002)	(38.001)	(90.012)	(77.731)	(54.065)
$Taper \times MINUTES$	0.498	-20.310***	-48.267**	-43.642**	-35.695**
	(0.672)	(7.245)	(18.938)	(17.650)	(15.342)
$Taper \times PC$	-0.199	-34.524***	-78.695***	-67.836***	-63.348***
	(0.688)	(8.727)	(18.520)	(17.220)	(19.710)
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). The constant terms are omitted for brevity. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table D5: Covariance Analysis with the Consideration of Forward Guidance

	(1)	(2)	(3)	(4)	(5)
	3M	2Y	5Y	10Y	30Y
$QE \times ME$	-0.141	1.555	7.886	12.610	21.522**
	(2.480)	(5.220)	(11.385)	(8.745)	(8.711)
$QE \times ME \times ForwardGuid$	-0.927	17.866	11.348	11.427	52.432
	(5.020)	(30.749)	(39.874)	(35.449)	(56.619)
$Taper \times ME$	-2.096	-42.685***	-108.035***	-93.794***	-75.357***
	(1.714)	(16.092)	(38.658)	(33.458)	(23.890)
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 ForwardGuid is a dummy that equals 1 if there is forward guidance in a monetary event. The constant terms are omitted for brevity. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table D6: Covariance Analysis in Different Windows

	(1)	(2)	(3)
Window	[-15, 15]	[-15, 60]	[-15, 90]
$QE \times ME$	5.696	20.958***	23.769***
	(5.111)	(8.011)	(8.770)
$Taper \times ME$	-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 returns and 30-year Treasury yield changes from -15 min to +15/60/90 min of the event, respectively. The constant terms are omitted for brevity. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

E Portfolio Returns by LSAP Exposure

We examine whether the risk premium associated with LSAPs is priced in the cross-section of U.S. equities. Stocks exhibit heterogeneous exposures to LSAP surprises during the QE period. Consistent with standard risk-return theory, investors demand compensation for bearing this systematic risk. Consequently, stocks with greater exposure to LSAPs should command higher excess returns during this period.[44]

To analyze this relationship, we first estimate firm-level equity exposure to LSAP surprises.[45] The coefficient β_i captures each firm's exposure to the LSAP-induced risk premium. A higher positive value of β_i indicates greater sensitivity to LSAP surprises—that is, a stronger price drop when the Fed implements expansionary LSAPs. Figure E1 presents the distribution of the estimated β_i, showing a positive average value that is consistent with our baseline finding that expansionary LSAP surprises generally depress equity markets.

We then sort firms into deciles based on their estimated β_i (with Decile 10 representing the highest β group) and construct equally weighted portfolios for each decile. For each portfolio, we estimate the risk-adjusted excess return (the portfolio alpha) that remains unexplained by common risk factors.[46]

The estimated excess returns (α_j) for each portfolio during the QE period are plotted in the left panel of Figure E2. Portfolios with greater exposure to the LSAP shocks tend to exhibit larger excess returns. In contrast, as illustrated in the right panel of Figure

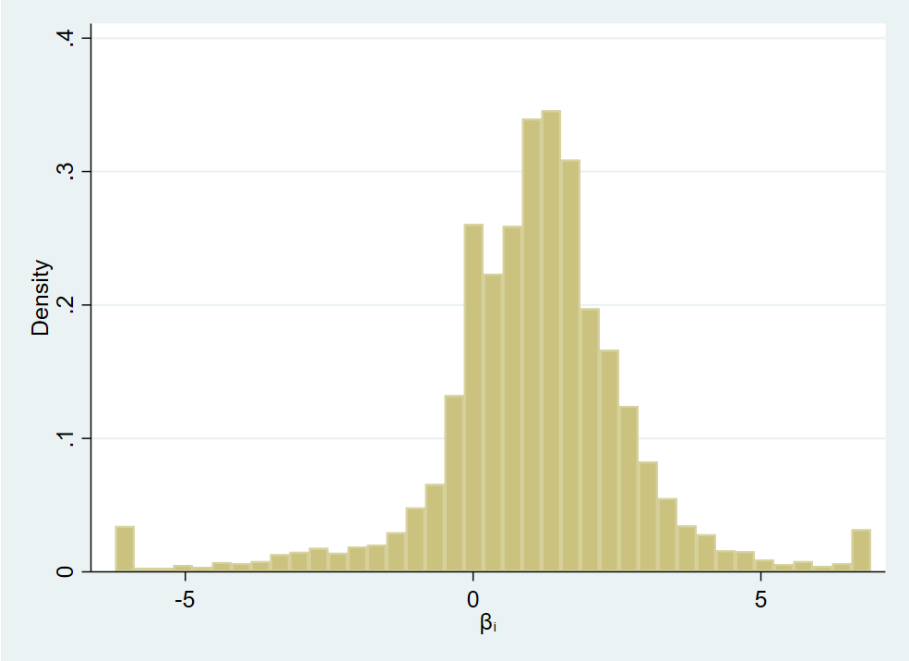
[44]This cross-sectional relationship arises because firms that are more sensitive to LSAP shocks—specifically, those experiencing sharper price declines when expansionary surprises convey a deteriorating macroeconomic outlook—are perceived as riskier, thereby requiring a higher risk premium to attract investors.

[45]Specifically, we estimate the following time-series regression for each firm i during the QE period: $Return_{i,t} = \alpha_i + \beta_i LSAP_t + \gamma_i FG_t + \delta_i FFR_t + \epsilon_{i,t}$, where the dependent variable is the firm's daily equity return on FOMC announcement days.

[46]We estimate the Fama-French five-factor model for each portfolio $j \in \{1, 2, \ldots, 10\}$: $Return_{j,t} - RF_t = \alpha_j + \beta_{1,j} MKT_t + \beta_{2,j} SMB_t + \beta_{3,j} HML_t + \beta_{4,j} RMW_t + \beta_{5,j} CMA_t + \epsilon_{j,t}$, where $Return_{j,t}$ is the portfolio's daily return on FOMC dates, and RF_t is the risk-free rate. MKT, SMB, HML, RMW, and CMA represent the market, size, value, profitability, and investment factors, respectively, obtained from Kenneth French's data library. The intercept α_j captures the risk-adjusted excess return.

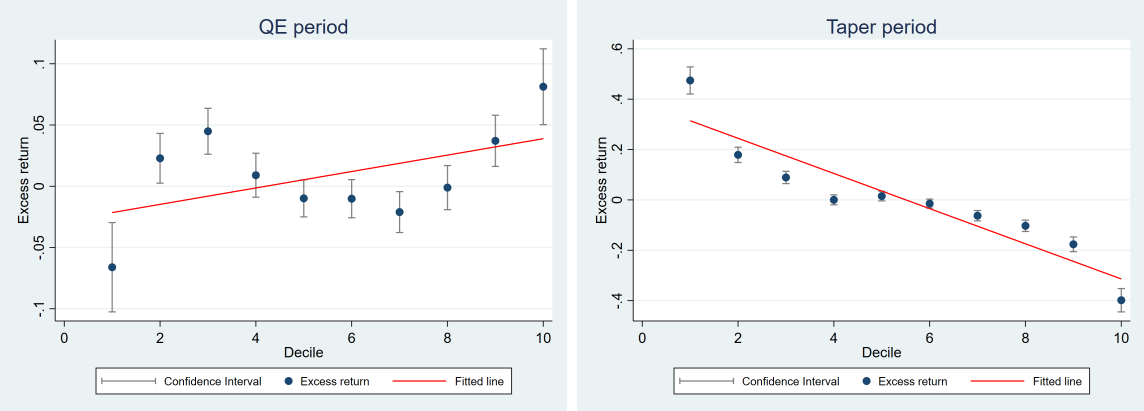
E2, this relationship reverses during the Taper period, when the conventional monetary policy channel regained dominance.

Figure E1: Distribution of Firm-Level Equity Exposures to LSAP Surprises



Notes: This figure displays the cross-sectional distribution of firm-level equity exposures to LSAP surprises. The exposures are estimated using the following time-series regression for each firm i: $Return_{i,t} = \alpha_i + \beta_i LSAP_t + \gamma_i FG_t + \delta_i FFR_t + \epsilon_{i,t}$, where the dependent variable is the daily equity return on FOMC announcement days t. The regression is estimated over the QE period. The coefficient β_i captures the individual firm's exposure to the LSAP shocks. A larger positive value of β_i indicates that the firm experiences a sharper price decline in response to an expansionary LSAP surprise.

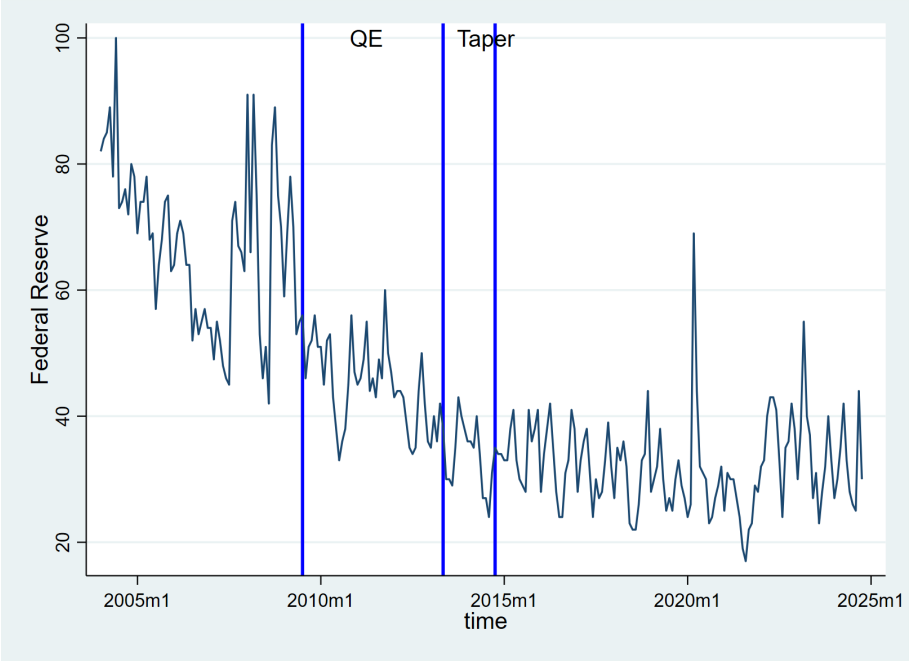
Figure E2: Portfolio Excess Returns Sorted by Exposures to LSAP Surprises



Notes: This figure plots the risk-adjusted excess returns (alphas) of equity portfolios sorted by their exposures to LSAP surprises. The left and right panels present the results for the QE and Taper periods, respectively. The horizontal axis denotes the portfolio deciles, where Decile 10 contains firms with the highest exposure to LSAP shocks (i.e., the largest estimated β_i). The vertical axis represents the portfolio excess returns estimated from the Fama-French five-factor model. The error bars represent the 95% confidence intervals, constructed using heteroskedasticity-robust standard errors.

F Additional Analysis on Macroeconomic Outlook

Figure F1: Google Search Index of "Federal Reserve"



Notes: This picture shows the Google search index of the keywords "Federal Reserve". A higher value indicates greater search intensity.

Table F1: Federal Reserve Internal Forecast Revisions and LSAP Surprises in the QE and Taper Periods

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

Notes: This table reports the regression of LSAP surprises on the Federal Reserve's internal forecast revisions during the QE and Taper periods. The specification is $LSAP_t = \alpha + \beta_1 \Delta GDP^f_{CB,t} + \beta_2 \Delta Inflation^f_{CB,t} + \beta_3 \Delta Unemployment^f_{CB,t} + \epsilon_t$, where $\Delta GDP^f_{CB,t}$, $\Delta Inflation^f_{CB,t}$, and $\Delta Unemployment^f_{CB,t}$ denote the revisions in the Fed's forecasts for real GDP growth, inflation, and the unemployment rate, respectively. These forecasts are formed several days prior to each FOMC meeting and are obtained from the Greenbook. Columns (1) to (7) correspond to forecast horizons ranging from 0 to 6 quarters ahead. Robust standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table F2: Federal Reserve Internal Forecast Revisions and LSAP Surprises in the QE Period

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

Notes: This table reports the regression of LSAP surprises on the Federal Reserve's internal forecast revisions during the QE period. The specification is similar to Table F1. ΔGDP^f_{CB}, $\Delta Inflation^f_{CB}$, and $\Delta Unemployment^f_{CB}$ denote the revisions in the Fed's forecasts for real GDP growth, inflation, and the unemployment rate, respectively. These forecasts are formed several days prior to each FOMC meeting and are obtained from the Greenbook, which is released to the public with a five-year lag. Columns (1) to (7) correspond to forecast horizons ranging from 0 to 6 quarters ahead. Robust standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table F3: Federal Reserve Internal Forecast Revisions and LSAP Surprises 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: This table reports the regression of LSAP surprises on the Federal Reserve's internal forecast revisions during the Taper period. The specification is similar to Table F1. ΔGDP^f_{CB}, $\Delta Inflation^f_{CB}$, and $\Delta Unemployment^f_{CB}$ denote the revisions in the Fed's forecasts for real GDP growth, inflation, and the unemployment rate, respectively. These forecasts are formed several days prior to each FOMC meeting and are obtained from the Greenbook, which is released to the public with a five-year lag. Columns (1) to (7) correspond to forecast horizons ranging from 0 to 6 quarters ahead. Robust standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table F4: Federal Reserve Internal Forecasts, Market Expectations, and LSAP Surprises

	(1)	(2)	(3)	(4)	(5)	(6)
Forecast horizon	1Q	2Q	3Q	4Q	5Q	6Q
	LSAP					
ΔGDP^f_{CB}	0.526*	0.690**	0.706*	0.386	0.685***	0.788***
	(0.294)	(0.326)	(0.375)	(0.326)	(0.248)	(0.282)
ΔGDP^f_{Market}	0.916	1.022	1.188*	1.415	1.323	0.270
	(0.849)	(0.932)	(0.683)	(0.844)	(0.824)	(0.576)
N	42	42	42	42	40	29
R^2	0.143	0.159	0.142	0.075	0.130	0.180

Notes: This table reports the regression of LSAP surprises on both the Federal Reserve's and the market's pre-announcement GDP forecast revisions. The specification is $LSAP_t = \alpha + \beta_1 \Delta GDP^f_{CB,t} + \beta_2 \Delta GDP^f_{Market,t} + \epsilon_t$, estimated over the QE and Taper periods. $\Delta GDP^f_{Market,t}$ is the average market GDP forecast revision in period t (from 1 to 7 quarters ahead), obtained from the Blue Chip Economic Indicators survey. The Blue Chip survey is typically conducted on the first few business days of each month and published shortly thereafter. In contrast, the Fed's Greenbook forecasts are finalized roughly one week prior to each FOMC meeting. Columns (1) to (6) correspond to the different forecast horizons of the central bank. The results remain qualitatively similar when restricting the sample to the QE period alone. Robust standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table F5: Federal Reserve Internal Forecast Revisions and FG/FFR Surprises

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

Notes: This table reports the regression of FG (Panel A) and FFR (Panel B) surprises on the Federal Reserve's internal forecast revisions. The regressions are estimated over the combined QE and Taper periods, and the specification is similar to Table F1. ΔGDP^f_{CB}, $\Delta Inflation^f_{CB}$, and $\Delta Unemployment^f_{CB}$ denote the revisions in the Fed's forecasts for real GDP growth, inflation, and the unemployment rate, respectively. These forecasts are formed several days prior to each FOMC meeting and are obtained from the Greenbook, which is released to the public with a five-year lag. Columns (1) to (7) correspond to forecast horizons ranging from 0 to 6 quarters ahead. The results remain qualitatively similar when restricting the sample to the QE period alone. Robust standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table F6: LSAP Surprises: Outlook-Related vs. More Policy-Driven

	(1)	(2)
Dependent variables	$\Delta S\&P500$	ΔVIX
$LSAP_{outlook}$	1.446***	-7.204**
	(0.441)	(2.640)
$LSAP_{policy}$	0.287	-3.357
	(0.506)	(6.028)
FG	0.028	-0.514
	(0.372)	(1.572)
FFR	-1.946	5.935
	(1.615)	(9.356)
N	30	30
R^2	0.377	0.240

Notes: This table compares responses to outlook-related ($LSAP_{outlook}$) and more policy-driven ($LSAP_{policy}$) LSAP surprises, classified by the sign of the Fed's pre-announcement forecast revision as described in the main text. The specification is similar to Table D1, except that LSAP surprises enter separately for the two groups. The dependent variables are the daily returns of the S&P 500 index (Column 1) and the changes in the VIX index (Column 2). The regressions are estimated over the QE period. Robust standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table F7: The Effect of LSAP Surprises on Market GDP Forecast Revisions: QE vs. Taper

	(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***	0.167***	0.171***	-0.002	-0.011	-0.013	-0.013
	(0.056)	(0.051)	(0.046)	(0.045)	(0.041)	(0.034)	(0.031)	(0.029)
FG	-0.102**	-0.091**	-0.088**	-0.087**	0.027	0.038	0.039	0.036
	(0.042)	(0.040)	(0.038)	(0.038)	(0.063)	(0.052)	(0.048)	(0.044)
FFR	-0.523**	-0.464**	-0.460**	-0.465**	0.413	0.477	0.508	0.537*
	(0.200)	(0.185)	(0.186)	(0.187)	(0.370)	(0.330)	(0.305)	(0.282)
N	30	30	30	30	12	12	12	12
R^2	0.331	0.307	0.310	0.319	0.302	0.339	0.374	0.432

Notes: This table reports the effects of monetary policy surprises on the market's real GDP forecast revisions, comparing the QE and Taper periods. The specification is $\Delta GDP^f_{XQ,t} = \alpha + \beta_1 LSAP_t + \beta_2 FG_t + \beta_3 FFR_t + \epsilon_t$. The dependent variable $\Delta GDP^f_{XQ,t}$ is the average revision in the market's consensus forecast for real GDP growth over the next 1 to X quarters, obtained from the Blue Chip Economic Indicators. Columns (1)-(4) and (5)-(8) present the results for the QE and Taper periods, respectively. Robust standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table F8: The Effect of LSAP Surprises on Market GDP Forecast Revisions: QE vs. Taper (One-Month Window)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Period	QE				Taper			
Horizon	3Q	4Q	5Q	6Q	3Q	4Q	5Q	6Q
$LSAP$	0.080**	0.072**	0.067**	0.067**	0.031	0.023	0.019	0.014
	(0.032)	(0.029)	(0.025)	(0.025)	(0.020)	(0.021)	(0.019)	(0.018)
FG	-0.042*	-0.036*	-0.037**	-0.034**	-0.031	-0.023	-0.019	-0.013
	(0.022)	(0.019)	(0.017)	(0.016)	(0.031)	(0.031)	(0.029)	(0.027)
FFR	-0.101	-0.102	-0.093	-0.097	0.164	0.183	0.223	0.308*
	(0.131)	(0.122)	(0.119)	(0.120)	(0.179)	(0.189)	(0.171)	(0.157)
N	30	30	30	30	12	12	12	12
R^2	0.187	0.169	0.175	0.172	0.613	0.529	0.572	0.629

Notes: This table presents a robustness check using a one-month window for forecast revisions. The specification is similar to Table F7. One-month forecast revisions $\Delta GDP'_{XQ}$ are used here as the dependent variables, which means the next month's average forecast revision of the market over the next 1 to X quarters. Specifically, $\Delta GDP'_{XQ} = \sum_{i=1}^{X}(GDP_{t+1}^{iQ} - GDP_t^{iQ})/X$, where GDP_{t+1}^{iQ} is the month $t+1$ forecast of the GDP growth rate in the next i quarter (relative to the quarter in month $t+1$), and GDP_t^{iQ} is the month t forecast for the same target. Robust standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table F9: The Impacts of LSAP Surprises on the Market's Inflation Forecast Revisions

	(1)	(2)	(3)	(4)
	CPI inflation forecast revision			
Period	QE		Taper	
$LSAP$	0.075***	0.095***	-0.022**	-0.038
	(0.023)	(0.022)	(0.008)	(0.029)
FG		-0.001		0.037
		(0.018)		(0.049)
FFR		-0.348**		-0.392
		(0.160)		(0.341)
N	30	30	12	12
R^2	0.143	0.237	0.076	0.219

Notes: The specification is similar to Table F7. The dependent variables are cumulative forecast revisions of the CPI-measured inflation rate over a two-month window, averaged over the next four quarters. The results are robust to using other forecast horizons. Robust standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table F10: LSAP Surprises and Stock Returns with Risk and Market Forecast Controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Period	QE				Taper			
$LSAP$	1.169***	1.037***	0.544**	0.394	-0.152	-0.155	-0.612**	-0.605**
	(0.301)	(0.348)	(0.261)	(0.290)	(0.589)	(0.566)	(0.210)	(0.199)
FG	-0.075	-0.006	-0.115	-0.040	-0.455	-0.445	0.371	0.346
	(0.273)	(0.252)	(0.185)	(0.171)	(0.795)	(0.720)	(0.313)	(0.296)
FFR	-2.460**	-2.111*	-1.876**	-1.488*	-1.360	-1.242	1.864	1.542
	(1.036)	(1.111)	(0.772)	(0.873)	(6.813)	(5.607)	(2.068)	(1.962)
ΔGDP^f_{4Q}		0.757		0.836		-0.245		0.696
		(0.801)		(0.583)		(2.903)		(1.457)
ΔVIX			-0.091***	-0.092***			-0.074***	-0.074***
			(0.017)	(0.016)			(0.013)	(0.013)
N	193,411	193,411	193,411	193,411	79,939	79,939	79,939	79,939
R^2	0.082	0.084	0.116	0.118	0.120	0.120	0.161	0.161

Notes: This table reports the stock-return responses to LSAP surprises after sequentially adding controls related to the risk premium channel. The dependent variable is the firm-level daily stock return. The specification in Columns (1) and (5) is similar to the baseline, estimated over the QE and Taper periods, respectively. Columns (2) and (6) additionally control for the market's average GDP forecast revisions over the next four quarters (ΔGDP^f_{4Q}). Columns (3) and (7) control for the daily changes in the VIX index (ΔVIX), capturing the aggregate risk sentiment. Columns (4) and (8) include both controls simultaneously. Constant terms are included but omitted for brevity. Standard errors are two-way clustered at the conference and firm levels and are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table F11: State-Dependent Effects of LSAP Surprises on Market GDP Forecast Revisions

	(1)	(2)	(3)
		ΔGDP^f_{4Q}	
$LSAP$	0.197***	-0.887***	-0.174**
	(0.035)	(0.258)	(0.086)
$LSAP \times Sentiment$	-0.262***		
	(0.084)		
$LSAP \times Unemp$		0.126***	
		(0.032)	
$LSAP \times VIX$			0.015***
			(0.004)
Controls	Yes	Yes	Yes
N	42	42	42
R^2	0.366	0.409	0.336

Notes: This table investigates how the effects of LSAP surprises on market GDP forecast revisions depend on the prevailing economic state. The specification is $\Delta GDP^f_{4Q,t} = \alpha + \beta_1 LSAP_t + \beta_2(LSAP_t \times X_{t-1}) + \gamma X_{t-1} + \delta_1 FG_t + \delta_2 FFR_t + \epsilon_t$, where the dependent variable is the market's average consensus real GDP growth forecast revision over the next four quarters. X_{t-1} denotes the lagged economic state variables: *Sentiment* is the economic condition sentiment extracted from the previous FOMC announcement Gardner et al. (2022), $Unemp$ is the one-month lagged unemployment rate, and VIX is the one-day lagged VIX index. For brevity, only the coefficients on the LSAP surprise and its interaction terms are displayed. The results for other forecast horizons are qualitatively similar. Robust standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

G Anecdotal Evidence from Major LSAP Announcements

Background Information. To illustrate the anomalous equity market responses during the QE period, we review three major FOMC announcements. These specific meetings are chosen because they feature the largest LSAP surprises in absolute magnitude within our core QE sample.

On November 3, 2010, the Federal Reserve committed to purchasing $600 billion in longer-term Treasury securities by the middle of 2011, a program commonly referred to as QE2. Prior to the announcement, a *Wall Street Journal* survey of private-sector economists in early October 2010 found that the consensus expectation for the size of QE2 was around $750 billion (Krishnamurthy & Vissing-Jorgensen 2011).[47] Because the actual purchase amount fell short of market expectations, the announcement constituted a *tightening* (contractionary) LSAP surprise. However, the equity market exhibited an anomalous positive return on that day.

For the other two major interventions—Operation Twist (September 21, 2011)[48] and QE3 (September 13, 2012)[49]—the identified directions of the Swanson surprises align well with historical narratives and institutional details, even in the absence of precise quantitative survey data (see Swanson 2021 for a comprehensive justification). Crucially, following both of these major announcements, we again observe anomalous equity market reactions that run counter to standard monetary policy transmission channels.

[47] Jon Hilsenrath and Jonathan Cheng, "Fed Gears Up for Stimulus," *Wall Street Journal*, October 26, 2010.

[48] Operation Twist was officially announced on September 21, 2011. The Federal Reserve committed to purchasing $400 billion in longer-term Treasury securities (maturities of 6 to 30 years) while simultaneously selling an equivalent amount of short-term Treasury securities (maturities of 3 years or less). This intervention is identified as an *expansionary* LSAP surprise in Swanson (2021).

[49] On September 13, 2012, the FOMC announced QE3, pledging to buy $40 billion per month in mortgage-backed securities (MBS) until there was substantial improvement in the labor market. While QE3 was an open-ended commitment, the uncertainty surrounding its ultimate size, coupled with market expectations for even more aggressive upfront purchases, resulted in a sense of disappointment, thereby translating into a *contractionary* LSAP surprise.

Illustration of Mechanism. The Operation Twist announcement (September 21, 2011) is a prime example of our mechanism at work. The FOMC statement explicitly noted: "Information received since the Federal Open Market Committee met in August indicates that economic growth remains slow. Recent indicators point to continuing weakness in overall labor market conditions, and the unemployment rate remains elevated"; and "Moreover, there are significant downside risks to the economic outlook, including strains in global financial markets". Although it was an unexpected easing policy, the market and media overwhelmingly interpreted it as bad news, implying a higher market risk. This surge in risk aversion and market uncertainty caused equity markets to plummet.[50]

Similarly, in the QE3 announcement (September 13, 2012), the Fed provided positive signals regarding economic fundamentals: "Information received since the Federal Open Market Committee met in August suggests that economic activity has continued to expand at a moderate pace in recent months," and "The housing sector has shown some further signs of improvement, albeit from a depressed level. Inflation has been subdued, although the prices of some key commodities have increased recently." Although this constituted a tightening surprise in our measure, equity prices increased substantially due to the strengthening of market confidence.

In Table G1, we conduct a formal event study for these major announcements. The signs of the policy surprises, alongside the responses of market and Fed forecast variables as well as market risk indicators, are overall consistent with the risk premium channel and our outlook-based interpretation.

[50] As reported by *The Guardian*: "Stock markets tumbled on Thursday and the pound slumped to a one-year low against the US dollar as investors took fright at a gloomy warning about the world economic outlook from the US central bank. The US Federal Reserve's Operation Twist—its latest attempt to stimulate the American economy—failed to calm financial markets. The FTSE 100 index in London plunged 266 points to 5022, a 5% drop. Other European markets also suffered heavy losses." Source: `https://www.theguardian.com/business/2011/sep/22/stock-markets-tumble-operation-twist`.

Table G1: Event Study of the Three Largest LSAP Surprises

FOMC	Date	$LSAP$	$\Delta S\&P500$	ΔGDP^f_{CB}	ΔGDP^f	ΔVIX
QE2	Nov 3, 2010	0.81	0.37	0.30	0.04	-9.32
Operation Twist	Sep 21, 2011	-1.29	-2.94	-0.50	-0.44	13.57
QE3	Sep 13, 2012	1.01	1.63	0.40	-0.13	-11.08

Notes: This table displays the magnitudes of the LSAP surprises and the corresponding responses of key indicators for the three major FOMC announcements discussed in Section G. These specific meetings feature the three largest LSAP surprises in absolute magnitude within our core QE sample. $\Delta S\&P500$ and ΔVIX are the daily changes in the S&P 500 index and the VIX index, respectively. ΔGDP^f_{CB} is the Federal Reserve's internal Greenbook forecast revision for real GDP growth formulated prior to the announcement. ΔGDP^f is the market's consensus GDP forecast revision around the announcement window. Detailed definitions of these variables are provided in the main text.

H Additional Analysis on the BS Critique

As suggested by Bauer & Swanson (2023), anomalous market forecast revisions could alternatively reflect a *response-to-news* channel, wherein recently released poor economic data simultaneously prompt the Federal Reserve to ease policy and cause the market to downgrade its economic outlook. To account for this potential confounding channel, we follow their methodology by controlling for variables that capture pre-announcement macroeconomic news and equity market performance.

Specifically, we incorporate three comprehensive indices: the Aruoba-Diebold-Scotti (ADS) Business Conditions Index, the Brave-Butters-Kelley (BBK) Leading Index, both of which summarize major macroeconomic data releases, and also the S&P 500 index, to capture the equity market movement. In addition to these composite measures, we also control for several specific macroeconomic news surprises, defined as the difference between the actual data release and the market consensus expectation. These specific surprises include non-farm payroll employment, headline CPI and PPI inflation, retail sales, and advance GDP releases. These news surprise data are from Lakdawala, Moreland & Schaffer (2021).

Adding these rigorous pre-announcement controls to the forecast-revision regressions leaves the coefficients on the LSAP surprises virtually unchanged (see Table H1). Furthermore, the baseline equity-return pattern remains robust to the inclusion of these controls (detailed in Table H2). Together, these tests provide supporting evidence that our findings are not mechanically absorbed by standard measures of recent public news, business-cycle conditions, and equity-market performance.

Table H1: Market GDP Forecast Revisions Controlling for Response-to-News Effects

	(1)	(2)	(3)	(4)
	ΔGDP^f_{3Q}	ΔGDP^f_{4Q}	ΔGDP^f_{5Q}	ΔGDP^f_{6Q}
$LSAP$	-0.026	-0.031	-0.020	-0.017
	(0.041)	(0.038)	(0.037)	(0.037)
$LSAP \times QE$	0.202**	0.188***	0.169**	0.170**
	(0.078)	(0.070)	(0.067)	(0.065)
$LSAP \times Taper$	0.071	0.070*	0.056	0.056
	(0.043)	(0.041)	(0.039)	(0.038)
Controls	Yes	Yes	Yes	Yes
N	202	202	202	202
R^2	0.417	0.391	0.376	0.372

Notes: This table reports the regression of market GDP forecast revisions on LSAP surprises after accounting for the potential response-to-news channel. The specification is similar to Table 8. We additionally control for a comprehensive set of pre-announcement news and economic conditions: specific macroeconomic data surprises (S_{GDP}, $S_{Employment}$, S_{Retail}, S_{CPI}, and S_{PPI}) released before the FOMC meeting, the average of the ADS business conditions index over the 30 days prior to the FOMC meeting (ADS_{30d}), the previous month's BBK leading index (BBK_{1m}), and the change in the S&P 500 index over the 30 days preceding the announcement ($\Delta S\&P500_{30d}$). More details on these measurements are provided in Section 2. For brevity, only the coefficients on the LSAP surprise and its interaction terms with the QE and Taper period dummies are displayed. Robust standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table H2: Stock Return Responses in the QE Period Controlling for Response-to-News Effects

	(1)	(2)	(3)
$LSAP$	0.860**	0.870**	1.089***
	(0.355)	(0.363)	(0.375)
FG		0.202	0.094
		(0.242)	(0.257)
FFR			-2.738*
			(1.409)
Controls	Yes	Yes	Yes
N	193,411	193,411	193,411
R^2	0.097	0.098	0.104

Notes: This table reports robustness checks for the baseline firm-level equity return regression (Table 2) during the QE period, accounting for the potential response-to-news channel. We additionally control for a comprehensive set of pre-announcement news and economic conditions: specific macroeconomic data surprises (S_{GDP}, $S_{Employment}$, S_{Retail}, S_{CPI}, and S_{PPI}) released before the FOMC meeting, the average of the ADS business conditions index over the 30 days prior to the FOMC meeting (ADS_{30d}), the previous month's BBK leading index (BBK_{1m}), and the change in the S&P 500 index over the 30 days preceding the announcement ($\Delta S\&P500_{30d}$). More details on these measurements are provided in Section 2. For brevity, the coefficients on these news controls are omitted, and only the coefficients on the monetary policy surprises are displayed. Standard errors are two-way clustered at the conference and firm levels and are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

I Further Extensions and Discussions

The Early QE Period. We extend the analysis back to January–June 2009, adding four FOMC announcements excluded from the core QE sample because they occurred during the acute financial crisis. Figure I1 plots these announcements alongside the baseline observations. The March 18, 2009 QE1 announcement is the only one of the four with a conventional equity response; the other three exhibit the anomalous sign pattern. Thus, the pattern is also visible before the core QE period, although the unusually large QE1 announcement illustrates that individual events need not share the same response. Given the substantial financial disruptions and announcement-specific factors during these months, this extension provides a descriptive comparison rather than a clean estimate of the early-QE transmission mechanism. Our interpretation concerns the systematic response within the core QE sample, not the sign of every announcement.

The QT and QE4 Periods. We extend our baseline regressions to the quantitative tightening (QT) period. We define the start of the QT period as June 14, 2017, when the Fed decided to gradually reduce the Federal Reserve's securities holdings by decreasing its reinvestment of the principal payments from the System Open Market Account. The end date is July 31, 2019, when the committee concluded the reduction of its aggregate securities holdings two months earlier than previously indicated. Because the original Swanson (2021) surprises end in June 2019, we extend them to 2022 using a similar methodology. As shown in Table I1, during the QT period, a contractionary asset purchase surprise is associated with an increase in equity prices and a reduction in the VIX.

However, we must be cautious in interpreting this QT result. During this period, monetary policy had normalized and was no longer constrained by the zero lower bound. Consequently, the conventional federal funds rate and forward guidance channels were fully active, which could potentially confound the isolated impact of LSAP surprises on

equity returns. Furthermore, the transmission of macroeconomic outlooks via balance sheet policies may exhibit asymmetries between tightening and easing cycles. While exploring these dynamics is an intriguing question, it falls outside the scope of our paper, which focuses on the core QE period when asset purchases were the primary policy tool.

As for the QE4 period (April 29, 2020 to September 22, 2021), the Fed initially announced massive asset purchases on Sunday, March 15, 2020. However, because this statement was released at 5:00 p.m. when regular markets were closed, we choose the subsequent meeting on April 29, 2020, as the effective starting point of our QE4 sample. The period ends on September 22, 2021, the meeting prior to Chair Powell's November 3 indication that the FOMC would begin tapering asset purchases. During QE4, the effects of LSAP surprises on all variables share the same directional signs as those in the core QE period, although the estimates are statistically insignificant. This insignificance aligns with Gardner, Scotti & Vega (2022), who find that sentiment indices and other macroeconomic variables perform poorly in explaining equity reactions during the COVID-19 pandemic, with equity responsiveness being markedly lower than in previous recessions. One plausible explanation is that under the extreme, unprecedented uncertainty of the pandemic, the sheer magnitude of the uncertainty shock overwhelmed the marginal signal conveyed by policy interventions. More importantly, the COVID-19 shock likely compromises the fundamental identification assumptions of high-frequency monetary surprises. A core premise of this methodology is that financial markets are highly efficient, meaning pre-announcement asset prices fully incorporate existing expectations. Faced with a once-in-a-century crisis characterized by extreme market dysfunction and chaos, such an assumption becomes highly untenable, rendering the extraction of clean policy surprises exceedingly difficult.

International Responses to U.S. LSAP Surprises. We examine whether the do-

mestic equity response extends to international markets using one-day local-currency MSCI equity returns and changes in ten-year government bond yields. Table I2 applies equation 1 to a country panel, including country fixed effects and standard errors two-way clustered by country and FOMC announcement date. The sample runs from February 4, 1994 to June 19, 2019, excluding the acute financial crisis period.

The LSAP–QE interaction is positive and significant at the 1% level for equity returns and at the 5% level for bond yields. Relative to the reference period outside both QE and Taper, the equity response therefore shifts toward the anomalous sign during QE, while yields become more responsive to LSAP surprises. The implied QE-period coefficients are $-0.124 + 1.473 = 1.349$ for equity returns and $0.015 + 0.025 = 0.040$ for yields. Under our sign convention, these point estimates associate easing LSAP surprises with declines in both international equity prices and government bond yields. During Taper, the equity interaction is negative but statistically insignificant, whereas the yield interaction remains positive and significant at the 5% level.

This evidence indicates that the domestic equity sign pattern has an international counterpart. The reported significance levels apply to the interaction coefficients, rather than the within-period coefficient sums. Moreover, the international regressions do not distinguish risk-premium adjustments from cash-flow revisions or identify the mechanism through which U.S. announcements affect foreign markets.

Evidence from the ECB Asset Purchase Programmes. We further investigate whether similar anomalous equity responses to quantitative easing are present in the euro area. To do this, we plot the asset purchase surprises of the European Central Bank (ECB) against the daily returns of the EURO STOXX index. The ECB asset purchase surprises are sourced from the high-frequency identification in Miranda-Agrippino & Nenova (2022), which uses the same methodology as Swanson (2021). As illustrated in Figure I2, excluding the two most extreme outlier events, the distribution of observations

exhibiting anomalous signs (e.g., expansionary surprises paired with equity declines) is roughly symmetric to those displaying conventional signs. This suggestive evidence indicates that the anomalous equity responses to large-scale asset purchases are not unique to the United States, but may instead represent a broader phenomenon present across major advanced economies.

Dynamic Comovement of Equity and Risk Measurements. We next examine the persistence of the anomalous equity market responses during the QE period. Using the local projection method Jordà (2005), we estimate the following specification for horizons $h = 0, 1, 2, \ldots, 30$ business days:

$$\Delta P_{i,t+h} = \alpha_h + \beta_h LSAP_t + \gamma_h FG_t + \theta_h FFR_t + \sum_{n=1}^{3} \phi_{n,h} \Delta P_{i,t-n} + \mu_i + \nu_{year} + \epsilon_{i,t}^h,$$

where t denotes the date of an FOMC announcement, and $t + h$ denotes the date h business days after the announcement. The subscript i indexes the firm. $P_{i,t}$ is the equity price, and the dependent variable is the cumulative percentage return defined as $\Delta P_{i,t+h} = (P_{i,t+h} - P_{i,t-1})/P_{i,t-1} \times 100$. To absorb pre-announcement momentum, we include three lags of daily percentage returns, $\Delta P_{i,t-n} = (P_{i,t-n} - P_{i,t-n-1})/P_{i,t-n-1} \times 100$, for $n = 1, 2, 3$. The terms μ_i and ν_{year} represent firm and year fixed effects, respectively. Standard errors are two-way clustered at the conference and firm levels.

The parameter of interest is β_h, which captures the dynamic response of equity prices to the LSAP surprise over horizon h. The estimated coefficients β_h are plotted against the horizon h in Figure I3. The results indicate that the negative equity response to easing surprises persists for approximately three weeks before gradually diminishing.

We complement the firm-level estimates with announcement-level projections for the S&P 500 and all seven risk measures in Table D1, using horizons $h = 0, \ldots, 20$ trading days and controlling for FG and FFR. Figure I4 reports the cumulative responses relative to the trading day before each announcement. The risk responses generally lose

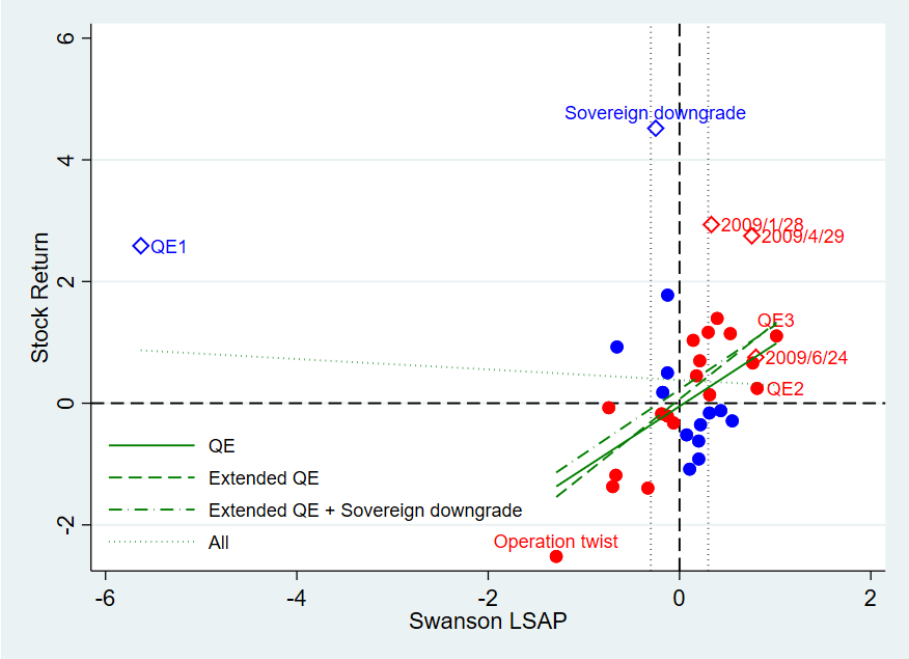
statistical significance after approximately two to three weeks and recede over subsequent horizons. Their temporal correspondence with the fading equity response supports a temporary adjustment in risk compensation.

Different Transmission Channels: LSAPs vs. Forward Guidance. The transmission mechanism through which LSAP surprises convey the macroeconomic outlook differs substantially from that of forward guidance. As shown in Table 1 of Lunsford (2020), from February 2000 to June 2003, when easing forward guidance (FG) surprises significantly worsen market economic expectations, FG surprises had a small and insignificant impact on the VIX index. In contrast, as discussed earlier in Table D1, LSAP surprises exhibit a significant impact on the VIX index in the QE period.

Meanwhile, while Lunsford (2020) finds that expansionary FG surprises increase Treasury term premia (Table 2 of his paper), expansionary LSAP surprises decrease the term premium (Table C2). Furthermore, Lunsford (2020) shows that the forward guidance surprise has no impact on the corporate bond yield spread (Table 3 of his paper), whereas the worsening macroeconomic outlook embedded in LSAPs (through an expansionary surprise) weakly increases this spread (Table C3).

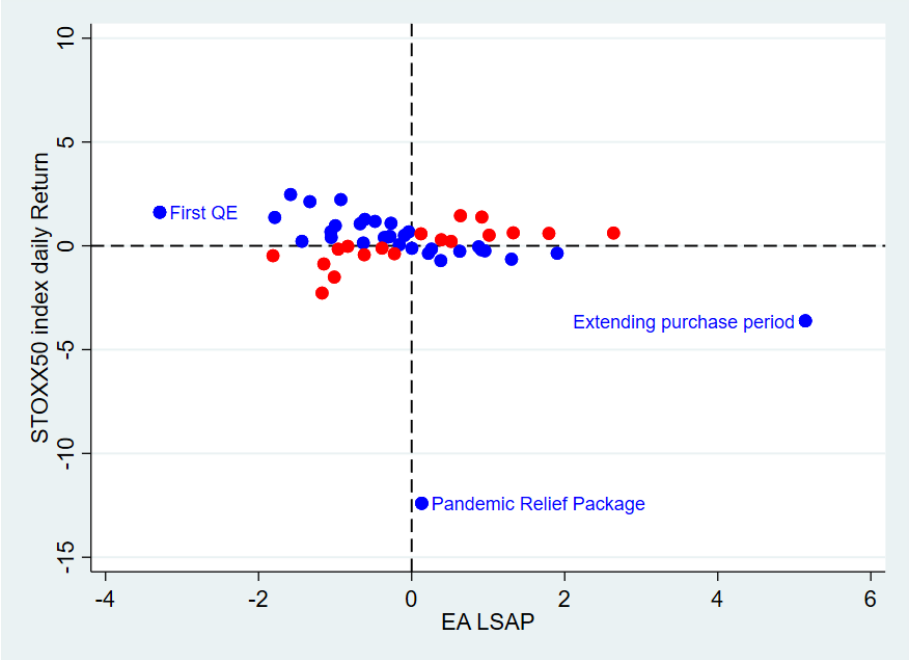
To sum up, the comparison points to differences in the risk-compensation and term-premium responses associated with LSAP and forward-guidance surprises. These differences may originate from distinct policy contexts: LSAP surprises during the post-crisis QE period likely conveyed the Fed's internal, pessimistic assessments about financial stability and economic uncertainty, thereby triggering heightened risk aversion. Conversely, forward guidance announcements during the February 2000–June 2003 period primarily updated the market on future fundamentals without severely elevating aggregate risk perceptions. Despite this intriguing suggestive evidence, a more comprehensive comparison warrants further exploration in future research.

Figure I1: Scatter plot of LSAP surprises and equity returns in the extended QE definitions



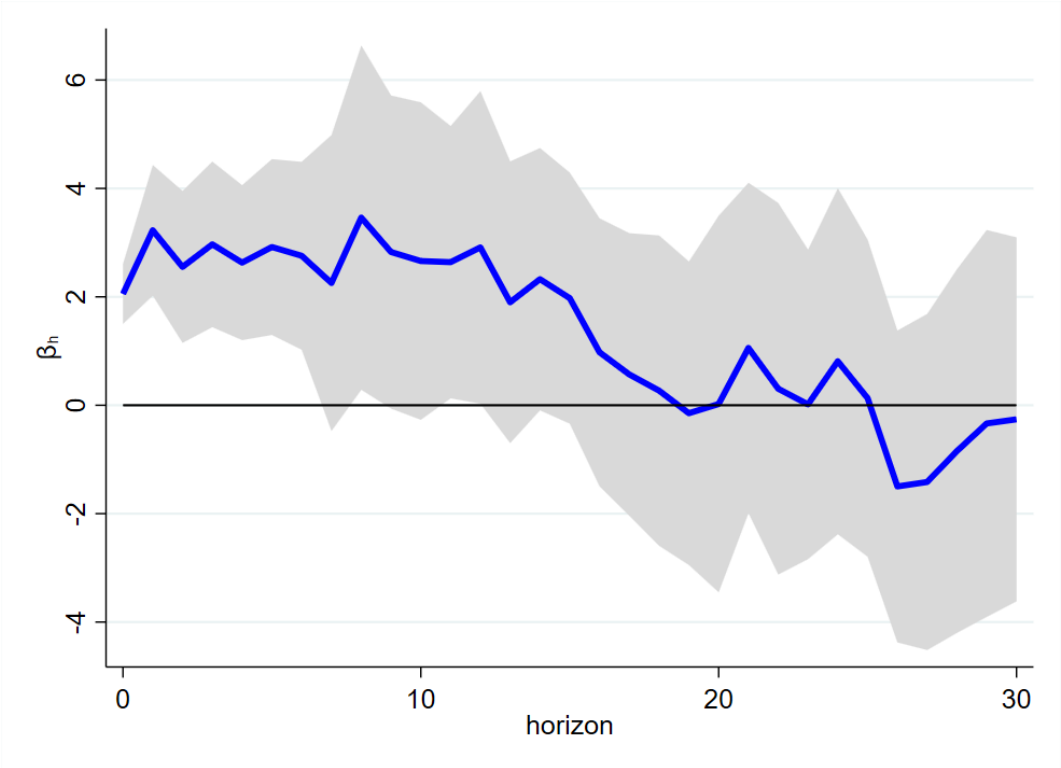
Notes: This figure displays the scatter plot of LSAP surprises and the average daily stock returns of individual firms around the FOMC announcements in several extensions of the QE period definition. QE is our baseline definition. "Extended QE" includes all the meetings from 2009/01/01 to 2013/05/21, except for the QE1 announcement (2009/03/18) and Sovereign downgrade (2011/08/09). "All" means all the meetings from 2009/01/01 to 2013/05/21. Each point represents an FOMC meeting. The red color indicates an abnormal sign where contractionary surprises correspond to equity price increases or expansionary surprises cause equity price drops. By comparison, the blue color indicates a normal sign. All conferences beyond the baseline are denoted by a hollow diamond. The dotted vertical line is LSAP $= 0.3$ or -0.3.

Figure I2: European Central Bank Asset-Purchase Surprises and Equity Returns



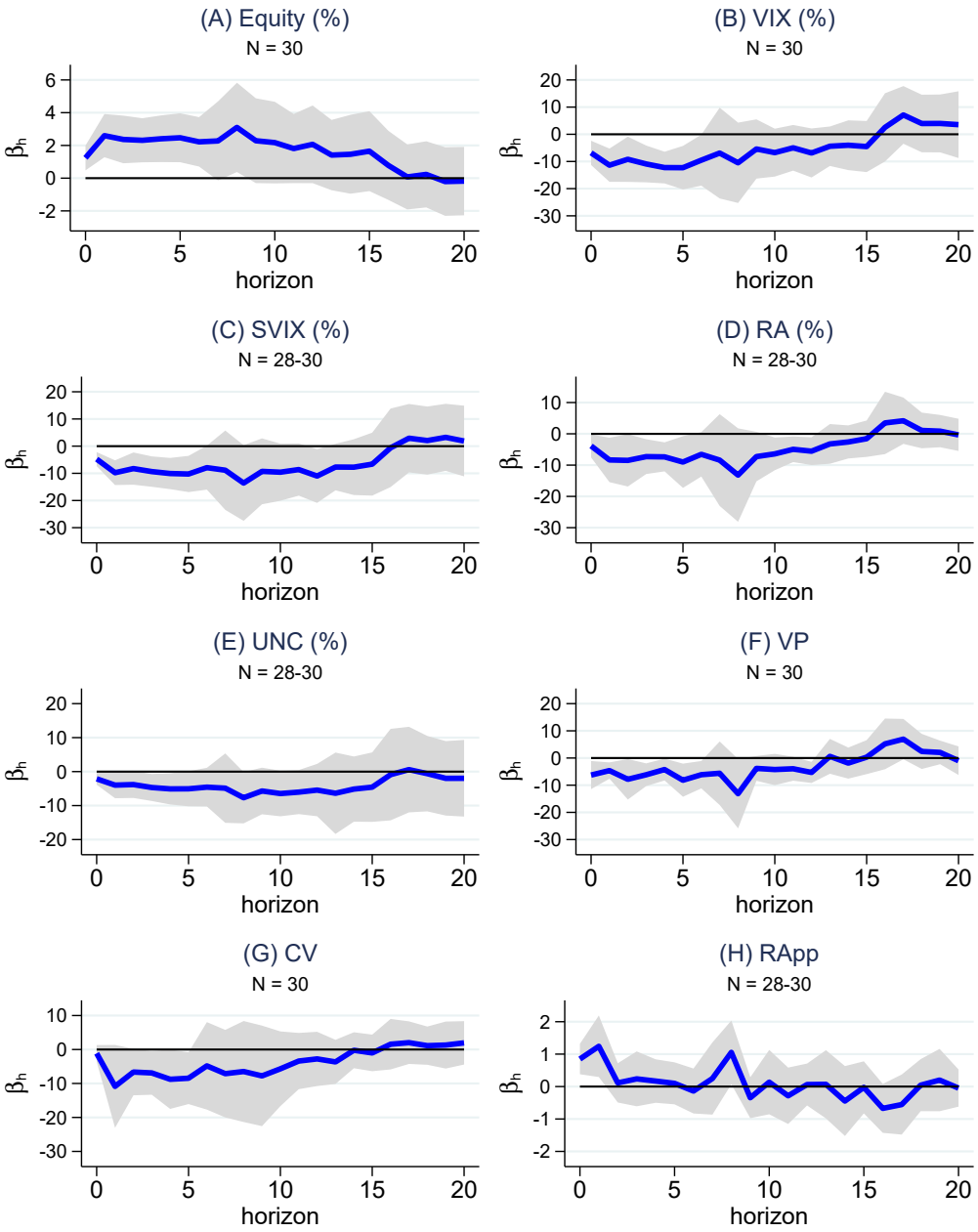
Notes: This figure displays a scatter plot of the European Central Bank (ECB) asset-purchase surprises against the daily returns of the EURO STOXX index around monetary policy announcements from January 2015 to March 2021. The surprises are sourced from Miranda-Agrippino & Nenova (2022), who employ a high-frequency identification methodology similar to Swanson (2021). Each point represents a distinct ECB meeting. Red points indicate abnormal equity responses (i.e., contractionary surprises coinciding with equity price increases, or expansionary surprises coinciding with equity price declines). In contrast, blue points represent normal equity responses. Three pivotal meetings are explicitly labeled: (1) *First QE* (January 22, 2015), when the ECB officially launched its large-scale asset purchase program; (2) *Extension of Purchase Period* (December 3, 2015), when the ECB extended the QE program by six months beyond its original end date; and (3) *Pandemic Relief Package* (March 12, 2020), when the ECB announced massive interventions under the Pandemic Emergency Purchase Programme.

Figure I3: Dynamic Equity Responses to LSAP Surprises in the QE Period



Notes: This figure plots the dynamic impacts of LSAP surprises on firm-level equity returns during the QE period, estimated using the local projection method. The specification is $\Delta P_{i,t+h} = \alpha_h + \beta_h LSAP_t + \gamma_h FG_t + \theta_h FFR_t + \sum_{n=1}^{3} \phi_{n,h} \Delta P_{i,t-n} + \mu_i + \nu_{year} + \epsilon_{i,t}^h$. Here, t denotes the date of an FOMC announcement, and $t+h$ denotes the date h business days after the announcement ($h = 0, 1, 2, \ldots, 30$). The dependent variable $\Delta P_{i,t+h} = (P_{i,t+h} - P_{i,t-1})/P_{i,t-1} \times 100$ is the cumulative percentage return of firm i's equity price. The model controls for three lags of daily percentage returns, $\Delta P_{i,t-n} = (P_{i,t-n} - P_{i,t-n-1})/P_{i,t-n-1} \times 100$ for $n = 1, 2, 3$, to absorb pre-announcement momentum. μ_i and ν_{year} represent firm and year fixed effects, respectively. Standard errors are two-way clustered at the conference and firm levels. The solid line plots the estimated coefficient of interest, β_h, across different horizons h. The shaded area represents the 95% confidence interval constructed using ± 1.96 standard errors.

Figure I4: Dynamic Comovement of Equity and Aggregate Risk Measures



Notes: The panels report announcement-level projections for the S&P 500 and the seven risk measures in Table D1, controlling for FG and FFR. Outcomes are cumulative changes from the pre-announcement trading day to horizon h. Blue lines plot LSAP coefficients; gray bands are $\widehat{\beta}_h \pm 1.96$ robust standard errors. Negative surprises denote easing. Each horizon uses available announcements without filling missing observations; sample sizes are indicated in the panels.

Table I1: The Impacts of LSAP Surprises in the QT and QE4 Periods

	(1)	(2)	(3)	(4)	(5)
	Panel A: QT Period				
	$Return_{i,t}$	$\Delta S\&P500$	ΔGDP^{f}_{4Q}	ΔVIX	$\Delta Yield_{10Y}$
$LSAP$	1.041**	1.080**	0.062	-12.408**	0.025**
	(0.396)	(0.371)	(0.098)	(4.574)	(0.009)
FG	-0.106	-0.200	0.042	0.610	0.026***
	(0.286)	(0.211)	(0.039)	(1.902)	(0.005)
FFR	0.235	0.255	0.101	-15.733**	-0.058***
	(0.794)	(0.775)	(0.091)	(5.422)	(0.018)
N	121,295	18	18	18	18
R^2	0.085	0.329	0.081	0.498	0.639
	Panel B: QE4 Period				
	$Return_{i,t}$	$\Delta S\&P500$	ΔGDP^{f}_{4Q}	ΔVIX	$\Delta Yield_{10Y}$
$LSAP$	4.988	3.853	1.192	-22.467	0.099
	(4.054)	(3.180)	(2.142)	(49.237)	(0.079)
FG	-5.199	-4.615	2.361	18.556	-0.090
	(6.478)	(5.410)	(2.532)	(70.278)	(0.131)
FFR	-15.282***	-11.969**	-18.537**	100.872	0.016
	(3.451)	(3.864)	(7.522)	(102.812)	(0.055)
N	95,351	12	12	12	12
R^2	0.191	0.417	0.605	0.143	0.613

Notes: This table reports the impacts of LSAP surprises during the quantitative tightening (QT, Panel A) and QE4 (Panel B) periods. The specifications correspond to the baseline regressions for various dependent variables and are estimated separately for the two periods. $Return_{i,t}$ denotes the firm-level daily stock return (as in Table 2), while the other columns utilize aggregate macro-finance variables. $\Delta Yield_{10Y}$ denotes the daily change in the 10-year Treasury yield around FOMC announcements. The definitions of the other variables are identical to those used in the main text. Standard errors are reported in parentheses (two-way clustered at the conference and firm levels for Column 1, and robust standard errors for Columns 2-5). ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

J A Stylized Conceptual Framework

To formalize our empirical narrative and provide a micro-foundation for the mechanisms discussed in Section 5, we present a stylized two-period asset pricing model ($t \in \{0, 1\}$). The model connects central bank policy signals, market expectations of the macroeconomic outlook, state-dependent risk aversion, and cross-sectional equity pricing.

J.1 Information Structure and the Macroeconomic Outlook

Let the future aggregate economic fundamental (e.g., aggregate output or consumption growth) realized at $t = 1$ be denoted by X. At $t = 0$, prior to the central bank's announcement, the market holds a prior belief about this fundamental, with an initial expectation μ_0 and an initial uncertainty σ_0^2.

We denote the LSAP announcement surprise as L, where a more negative value represents a more expansionary surprise. The central bank potentially acts following a reaction function based on its internal assessment of the economy. Our evidence in Section 5 suggests that downward revisions in the central bank's internal forecasts are associated with more expansionary LSAP announcement surprises. Therefore, we model L as an increasing function of the central bank's internal expectation of X.

Crucially, this setup diverges from the traditional information effect literature (e.g., Nakamura & Steinsson 2018), as it does not rely on the assumption that the Federal Reserve holds exclusive private knowledge about future fundamentals. Furthermore, it is not necessary for the central bank's economic projections to be more precise than market forecasts. The essential mechanism is simply that policy decisions are endogenous to macroeconomic conditions. Consequently, the policy surprise L serves as a public indicator of the central bank's internal outlook, prompting investors to adjust their own macroeconomic expectations in response. This interpretation can also arise in at least the following ways: the market might find the Fed's assessment credible given its

Table I2: International Asset-Price Responses to U.S. Monetary Policy Surprises

	(1)	(2)
	MSCI equity return (local currency)	Ten-year yield change
$LSAP$	-0.124	0.015**
	(0.186)	(0.007)
$LSAP \times QE$	1.473***	0.025**
	(0.472)	(0.010)
$LSAP \times Taper$	-0.493	0.040**
	(0.357)	(0.019)
FG	-0.169***	0.017***
	(0.053)	(0.003)
$FG \times QE$	-0.122	0.005
	(0.336)	(0.007)
$FG \times Taper$	0.061	-0.014
	(0.385)	(0.019)
FFR	-0.276**	0.018**
	(0.136)	(0.007)
$FFR \times QE$	-1.653*	-0.021
	(0.944)	(0.025)
$FFR \times Taper$	-0.954	0.129
	(1.822)	(0.079)
Constant	0.202***	-0.007***
	(0.056)	(0.002)
Country FE	Yes	Yes
N	8361	5067
R^2	0.071	0.126

Notes: This table applies equation 1 to a country panel. The dependent variables are one-day local-currency MSCI equity returns in column (1) and one-day changes in ten-year government bond yields in column (2). The sample runs from February 4, 1994 to June 19, 2019, excluding the acute financial crisis period (June 1, 2008–June 30, 2009). QE_t and $Taper_t$ indicate the U.S. QE and Taper periods. Positive LSAP, FG, and FFR surprises indicate tightening. The reference period consists of observations outside both QE and Taper; within-period responses are the sums of the corresponding main and interaction coefficients. Both columns include country fixed effects. Standard errors in parentheses are two-way clustered at the country and FOMC announcement-date levels. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

vast analytical capacity, interpret the policy as reflecting shifts in policy preferences or unobserved tail risks, or simply treat the intervention as a "wake-up call" that makes a pessimistic state more salient. We do not attempt to disentangle these specific channels, as any of them yields the same theoretical implication for expectation revisions.

We assume the market's **posterior (updated) expectation** of the fundamental is given by:

$$X \sim N(\mu, \sigma^2) \tag{7}$$

where $\mu = \mathbb{E}_0[X]$ represents the posterior expected **macroeconomic outlook** and σ^2 represents the **macroeconomic uncertainty** after incorporating the policy surprise L.

Because the posterior mean μ is updated from the market's prior μ_0 based on this signal, it can be formally expressed as a function of the surprise: $\mu = \mu(L)$ with $\mu(0) = \mu_0$.[51] The direction of this update depends on how the market interprets the policy intervention. Based on our empirical evidence in Section 5, the market infers that an expansionary surprise ($L < 0$) during the QE period is driven by the central bank's pessimistic view of the economy, leading the market to revise its own outlook downward relative to its prior ($\Delta\mu \equiv \mu(L) - \mu(0) \equiv \mu - \mu_0 < 0$). This implies a positive relationship between the policy surprise and the expected fundamental:

$$\mu'(L) > 0 \tag{8}$$

Furthermore, as a pessimistic signal often induces disagreement and ambiguity about future economic paths, the posterior uncertainty $\sigma = \sigma(L)$ is also likely to depend on the policy surprise, where $\sigma(0) = \sigma_0$. Driven by our empirical observation in Section 4 that aggregate risk and uncertainty measures spike following easing surprises, we model the posterior uncertainty as strictly higher than the prior uncertainty σ_0 when an expan-

[51] Intuitively, in the absence of a policy surprise, the posterior expectation coincides with the prior. Furthermore, the posterior mean μ is strictly increasing in the prior μ_0.

sionary surprise is observed ($\sigma'(L) < 0$). Thus, an expansionary surprise ($L < 0$) simultaneously drives up macroeconomic uncertainty relative to its prior ($\Delta\sigma \equiv \sigma - \sigma_0 > 0$).

J.2 State-Dependent Pricing Kernel

To capture aggregate risk premium dynamics, we assume a representative investor whose stochastic discount factor (SDF) from $t = 0$ to $t = 1$ takes the standard log-normal form:

$$M_1 = \exp\left(-r_f(L) - \frac{1}{2}\lambda(\mu)^2\sigma(L)^2 - \lambda(\mu)(X - \mu)\right) \tag{9}$$

where $r_f(L)$ is the risk-free rate, which decreases with expansionary policy ($r_f'(L) > 0$).

Crucially, $\lambda(\mu)$ represents the aggregate **risk aversion** to macroeconomic shocks. Following the habit-formation literature (e.g., Campbell and Cochrane, 1999), we assume the level of macro risk aversion is state-dependent. Specifically, it is decreasing and convex with respect to the macroeconomic outlook:

$$\lambda'(\mu) < 0, \quad \lambda''(\mu) > 0 \tag{10}$$

The economic intuition is that as the expected fundamental μ deteriorates and approaches the subsistence habit level, investors' risk aversion not only increases ($\lambda'(\mu) < 0$) but does so at an accelerating rate ($\lambda''(\mu) > 0$). This convexity is a standard property in habit-formation models, generating the highly asymmetric, spike-like behavior of risk premia during severe economic downturns. This theoretical pattern is consistent with our empirical evidence on the state-dependent responses of the VIX index (Table D3).

J.3 Equity Pricing and the Transmission Mechanism

Consider firm i, whose cash flow at $t = 1$, denoted by $D_{i,1}$, is exposed to the aggregate economic shock with sensitivity β_i:

$$D_{i,1} = \exp\left(g_i(\mu) + \beta_i(X - \mu) - \frac{1}{2}\beta_i^2\sigma(L)^2\right) \tag{11}$$

where this standard log-normal specification (e.g., Martin 2017) captures three key margins. First, $g_i(\mu)$ represents the expected cash flow growth, which depends on the expected macroeconomic state μ. Second, $\beta_i(X - \mu)$ explicitly models the firm's heterogeneous exposure to aggregate macroeconomic shocks, providing a foundation for our cross-sectional analysis on firm cyclicality. Third, the $-\frac{1}{2}\beta_i^2\sigma(L)^2$ term is a standard Jensen's inequality correction.

The price of equity i at $t = 0$ is given by $P_{i,0} = \mathbb{E}_0[M_1 D_{i,1}]$. Evaluating the log-normal expectation yields the cleanly separated valuation equation:

$$p_{i,0} = -r_f(L) + g_i(\mu) - \underbrace{\beta_i\lambda(\mu)\sigma(L)^2}_{ERP_i} \tag{12}$$

Thus, the required equity risk premium for firm i is $ERP_i = \beta_i\lambda(\mu)\sigma(L)^2$.

Differentiating the log equity price with respect to the LSAP surprise L yields the core transmission mechanism:

$$\begin{aligned}\frac{dp_{i,0}}{dL} = & \underbrace{-r_f'(L)}_{<0 \text{ (Conventional Easing)}} \\ & + \underbrace{g_i'(\mu)\mu'(L)}_{\geq 0 \text{ (Cash-Flow Effect)}} \\ & + \underbrace{-\beta_i\left[\lambda'(\mu)\mu'(L)\sigma(L)^2 + 2\lambda(\mu)\sigma(L)\sigma'(L)\right]}_{>0 \text{ (Outlook-Driven Risk Premium)}}.\end{aligned} \tag{13}$$

This formulation highlights that the net equity response is determined by a race among three forces. In principle, both the cash-flow response (the second term) and a rising risk premium (the third term, driven by both spiking risk aversion and heightened uncertainty) could decrease equity prices following an expansionary surprise ($L < 0$). As documented in Section 4, our empirical evidence supports an important role for risk compensation, while measured dividend-expectation revisions are statistically insignificant. Muted dividend-expectation revisions can be reconciled with this risk interpretation if corporate payouts exhibit short-term stickiness (i.e., $g_i'(\mu)$ is small), meaning firms are reluctant to immediately cut dividends despite a deteriorating macroeconomic outlook, often for signaling or payout-smoothing reasons (e.g. Lintner 1956; Brav et al. 2005).

J.4 Rationalizing the Empirical Findings

This stylized framework cleanly rationalizes the key empirical patterns documented in the main text:

1. Aggregate Risk Premium Spike. The aggregate equity risk premium in our model is governed by the product of risk aversion and macroeconomic uncertainty: $\lambda(\mu)\sigma(L)^2$. An expansionary surprise ($L < 0$) has two reinforcing effects on this product. First, it lowers the outlook ($\mu'(L) > 0 \Rightarrow \Delta\mu < 0$), which drives up the aggregate risk aversion ($\lambda'(\mu) < 0 \Rightarrow \Delta\lambda > 0$). Second, the pessimistic signal directly elevates macroeconomic uncertainty ($\sigma'(L) < 0 \Rightarrow \Delta\sigma > 0$). These effects are consistent with the increase in VIX following an expansionary LSAP surprise.

2. The Anomalous Equity Decline. If the outlook-driven risk premium effect dominates the conventional risk-free rate effect, the net derivative $\frac{dp_{i,0}}{dL}$ is positive. Therefore, in response to an expansionary LSAP surprise ($L < 0$), the equity price declines ($\Delta p_{i,0} < 0$).

3. Cross-Sectional Heterogeneity (Procyclicality and Risk Exposure). The

model directly yields predictions regarding firm procyclicality, which is governed by the macro-risk exposure β_i. Taking the cross-derivative of the transmission equation with respect to β_i yields a clean theoretical prediction:

$$\frac{\partial^2 p_{i,0}}{\partial L \partial \beta_i} = -\left[\lambda'(\mu)\mu'(L)\sigma(L)^2 + 2\lambda(\mu)\sigma(L)\sigma'(L)\right] > 0 \tag{14}$$

This confirms that the price drop induced by a pessimistic policy signal ($L < 0$) is strictly larger (more negative) for more procyclical firms (higher β_i).

Importantly, in our framework, a firm's required equity risk premium is directly proportional to its macro-risk exposure: $ERP_i = \beta_i \lambda(\mu)\sigma(L)^2$. This direct mapping implies that more procyclical firms are inherently riskier, holding other factors fixed. Naturally, firms with a higher equity risk premium will experience a sharper decline when the central bank signals a deteriorating macroeconomic outlook. This perfectly aligns with our cross-sectional findings: in Section 4, we show that firms with higher expected equity premia (such as those with higher $SVIX$) are more severely impacted; and in Section 5, we show that stronger procyclicality indeed leads to more adverse equity responses. While real-world aggregate equity risk may also be driven by other common factors or firm-idiosyncratic risks not captured by this stylized single-factor framework, incorporating them would not alter the core qualitative conclusion of our mechanism.

4. State Dependence (Macroeconomic State). Our empirical results in Sections 4 and 5 show that the anomalous responses of equity returns, aggregate risk measures (e.g., VIX), and market economic forecasts are all significantly amplified during bad macroeconomic states (i.e., when the initial expectation μ_0 is low). The model naturally accommodates these predictions.

First, consider the response of the market's macroeconomic forecast to the policy surprise. In this framework, the revision in the market's expectation of the fundamental,

denoted as $\Delta\mu \equiv \mu - \mu_0$, perfectly corresponds to the **market forecast revision** observed in our empirical studies. The sensitivity of this revision to the policy surprise is governed by $\mu'(L)$. As documented in Section 5, an expansionary surprise ($L < 0$) triggers a much larger downward revision in economic forecasts when the economy is already weak ($\frac{\partial}{\partial \mu_0}(\mu'(L)) < 0$). A plausible explanation for this state dependence is rational inattention: investors may pay closer attention to central bank signals during severe economic downturns. Regardless of the exact underlying mechanism, because risk aversion is strongly and negatively related to the macroeconomic outlook ($\lambda'(\mu) < 0$), this empirically amplified forecast revision mechanically translates into a much sharper spike in the risk premium.

Second, we analyze how the risk-compensation component of the equity response varies with the macroeconomic state. Taking the derivative of the risk premium effect (the third term in the equity response equation) with respect to the initial state μ_0 yields:

$$\begin{aligned}
&\frac{\partial}{\partial \mu_0}\left(-\beta_i\left[\lambda'(\mu)\mu'(L)\sigma(L)^2 + 2\lambda(\mu)\sigma(L)\sigma'(L)\right]\right) \\
&= -\beta_i\Bigg[\underbrace{\lambda''(\mu)\frac{\partial \mu}{\partial \mu_0}\mu'(L)\sigma(L)^2}_{>0} \\
&\qquad + \underbrace{\lambda'(\mu)\frac{\partial \mu'(L)}{\partial \mu_0}\sigma(L)^2}_{>0} \\
&\qquad + \underbrace{2\lambda'(\mu)\frac{\partial \mu}{\partial \mu_0}\sigma(L)\sigma'(L)}_{>0}\Bigg] < 0.
\end{aligned} \tag{15}$$

Because $\lambda(\mu)$ is convex ($\lambda''(\mu) > 0$), the forecast revision is amplified in bad initial states ($\frac{\partial \mu'(L)}{\partial \mu_0} < 0$), and risk aversion increases as the outlook worsens ($\lambda'(\mu) < 0$), all three terms inside the bracket are strictly positive (noting that the posterior outlook naturally moves in the same direction as the prior, $\frac{\partial \mu}{\partial \mu_0} > 0$). This negative cross-derivative implies that the risk-compensation component of the equity response is amplified in weaker

initial states.