Supplementary Appendix for

Long-Term Volatility Shapes the Stock Market's Sensitivity to News

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The Appendix provides further details and supporting evidence for "Long-Term Volatility Shapes the Stock Market's Sensitivity to News." While Section A of the Appendix is part of the main text, this Supplementary Appendix presents Sections B-F.

Data and code availability

- The source code used for this study is publicly available at: github.com/juliustheodor/long-term-volatility-news.
- The main data used in this study is proprietary and comes from TickData and Bloomberg Forecasts. The data must be purchased and redistribution is not permitted.
- In addition, we provide the *MF2-GARCH Toolbox for Matlab* (Conrad and Schoelkopf, 2025). The toolbox can be used to estimate the MF2-GARCH and to forecast volatility. The toolbox is available at: github.com/juliustheodor/mf2garch.

B Further Details on the Effects of Discount Rate News

B.1 One-component GJR-GARCH

The MF2-GARCH nests the one-component GJR-GARCH under the restriction $\lambda_1 = \lambda_2 = 0$. Then, $\tau_t = \lambda_0$ and the conditional variance can be written as

$$\begin{aligned}\sigma^2_{t+2} &= \lambda_0 h_{t+2} = \lambda_0(1-\phi) + \left(\alpha + \gamma \mathbf{1}_{\{\eta_{d,t+1}<0\}}\right)\eta^2_{d,t+1} + \lambda_0\beta h_{t+1} \\ &= \lambda_0(1-\phi) + \left(\alpha + \gamma \mathbf{1}_{\{\eta_{d,t+1}<0\}}\right)\eta^2_{d,t+1} + \beta\sigma^2_{t+1} \\ &= \lambda_0(1-\phi) + \phi\sigma^2_{t+1} + v^{GJR}_{t+1} \end{aligned} \tag{A.16}$$

with

$$v^{GJR}_{t+1} = \left[\alpha\left(\eta^2_{d,t+1} - \sigma^2_{t+1}\right) + \gamma\left(\mathbf{1}_{\{\eta_{d,t+1}<0\}}\eta^2_{d,t+1} - \sigma^2_{t+1}/2\right)\right].$$

For the GJR-GARCH, equation (A.12) reduces to

$$\mathbf{E}_{t+1}[\sigma^2_{t+j+1}] - \mathbf{E}_t[\sigma^2_{t+j+1}] = \phi^{j-1} v^{GJR}_{t+1}. \tag{A.17}$$

It follows that news to required returns can be rewritten as

$$\eta_{r,t+1} = A^{GJR} v^{GJR}_{t+1} \tag{A.18}$$

with

$$A^{GJR} = \delta \sum_{j=1}^{\infty} \rho^j \phi^{j-1} = \frac{\delta\rho}{1-\rho\phi}. \tag{A.19}$$

B.2 Numerical illustration of Equation (8)

We illustrate the contributions of the three news components on discount rate news in equation (8) with a numerical example. The model parameters are chosen as in the example in Section 2.3 in the main text. Figure A.1 plots discount rate news as a function of Z_{t+1}. We decompose discount rate news in the three components that are driven by news to the long-term component (black dashed line), the short-term component (pink dashed line) and the conditional variance (green dashed line). We denote these components by $\eta^{\tau}_{r,t+1} = A^{\tau}\tau_{t+1}\tilde{v}^{\tau}_{t+1}$, $\eta^{h}_{r,t+1} = A^{h}h_{t+1}\tilde{v}^{h}_{t+1}$, and $\eta^{\sigma}_{r,t+1} = A^{\sigma}\sigma^2_{t+1}\tilde{v}^{\sigma}_{t+1}$. The blue solid line shows the overall discount rate news, $\eta_{r,t+1}$, i.e., the sum of the three components. In the left panel, we set $\tau_{t+1} = 1.5$ and $h_{t+1} = 1/1.5$, and in the right panel, we set $\tau_{t+1} = 1/1.5$ and $h_{t+1} = 1.5$. Thus, in both panels, the conditional variance of cash flow news is $\sigma^2_{t+1} = 1$. Holding the level of the conditional variance fixed while varying the level of the short- and long component reveals the relative importance of the two components for the

discount rate effect. As expected, whether h_t is low (left panel) or high (right panel), innovations to the short-term component hardly contribute to the discount rate news (because A^h is close to zero). For $Z_{t+1} > 0$, innovations to the long-term component almost entirely explain the size of the discount rate news. The same observation holds when long-term volatility is high and $Z_{t+1} < 0$. Only when $Z_{t+1} < 0$ and long-term volatility is low, $\eta^{\tau}_{r,t+1}$ and $\eta^{\sigma}_{r,t+1}$ contribute almost equally to discount rate news. Clearly, when holding Z_{t+1} fixed, the absolute size of the discount news is higher when $\tau_{t+1} = 1.5$. More generally, for a given level of Z_{t+1}, the level of τ_{t+1} is a good predictor for the size of the discount rate news.

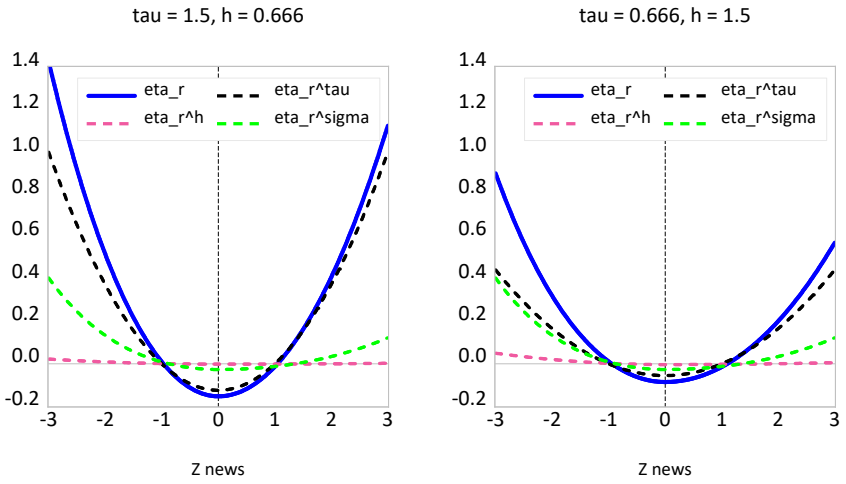

Figure A.1: The figure plots $\eta_{r,t+1}$ as a function of Z_{t+1} news. $\eta_{r,t+1}$ (blue line) is decomposed into the three components $\eta^{\tau}_{r,t+1}$ (black dashed line), $\eta^{h}_{r,t+1}$ (pink dashed line), and $\eta^{\sigma}_{r,t+1}$ (green dashed line). Left panel: $\tau_{t+1} = 1.5$ and $h_{t+1} = 1/1.5$. Right panel: $\tau_{t+1} = 1/1.5$ and $h_{t+1} = 1.5$. Model parameters are given by $\delta = 0.03$, $\rho = 0.9998$, $\kappa = 3$, $\alpha = 0.02$, $\gamma = 0.1$, $\beta = 0.80$, $\lambda_0 = 0.02$, $\lambda_1 = 0.06$, and $\lambda_2 = 0.92$.

B.3 Numerical example volatility feedback

In this section, we provide a more detailed discussion of the interaction of cash flow and discount rate news in the empirical example presented in Section 2.3. The left panel of Figure A.2 displays unexpected returns (green line) when $\tau_{t+1} = 2$ and $h_{t+1} = 1$. The red dashed line represents cash flow news, $\eta_{d,t+1}$. The slope of this line is $\sigma_{t+1} = \sqrt{2}$, which corresponds to an annualized volatility of 22.45%. Discount rate news, $\eta_{r,t+1}$, is shown as a blue dashed line. If there is no news ($Z_{t+1} = 0$ and, hence, $\eta_{d,t+1} = 0$), expectations for future volatility and, hence, required returns are revised downwards. Consequently, news to expected returns are negative ($\eta_{r,t+1} < 0$) and the stock price increases, i.e. the unexpected return is positive. This is analogous to the *no news is good news*

effect, as described in Campbell and Hentschel (1992).[19] The intersections of the dashed blue line with the horizontal axis indicate the level of Z_{t+1} news for which discount rate news is zero. For good/bad news above/below this level, discount rate news is positive, i.e., the good/bad news leads to upward revisions in volatility and required returns. Then, discount rate news dampens/amplifies the effect of the positive/negative dividend news and unexpected returns are smaller than cash flow news. In the right panel of Figure A.2, we set $\tau_{t+1} = 0.5$ and, as before, $h_{t+1} = 1$. Decreasing the level of long-term volatility has two effects. First, in the low volatility regime, the slope of the red dashed line representing cash flow news is flatter and equals $\sqrt{0.5}$ (corresponding to an annualized volatility of 11.22%). Thus, Z_{t+1} news has a weaker cash flow effect when volatility is low. Second, lowering volatility flattens the blue dashed line showing discount rate news. For Z_{t+1} values close to zero, the discount rate curve is shifted towards zero. As a result of these two effects, unexpected returns (orange line) are now less responsive to news.

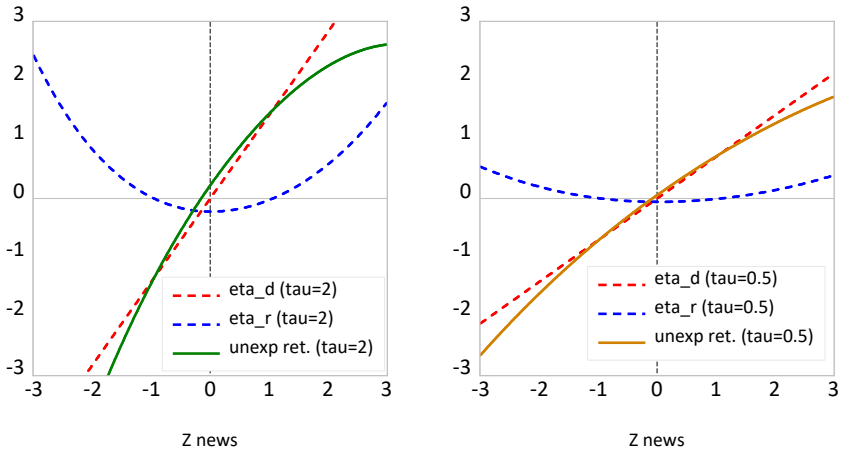

Figure A.2: The figure plots unexpected returns as a function of macroeconomic news Z_{t+1}. In both panels, cash flow news, $\eta_{d,t+1}$, is represented by the red dashed line. The blue dashed line shows discount rate news, $\eta_{r,t+1}$. In the left panel, we assume $\tau_{t+1} = 2$ and $h_{t+1} = 1$. The green line shows unexpected returns. In the right panel, we set $\tau_{t+1} = 0.5$ and $h_{t+1} = 1$. The orange line shows unexpected returns.

[19] Campbell and Hentschel (1992) plot unexpected returns as a function of cash flow news, but the mechanics are the same.

C QML estimation of MF2-GARCH-in-mean

We estimate the MF2-GARCH-in-mean model by quasi-maximum likelihood. In the empirical application, we not do restrict m to be equal to one. Instead, we estimate the model for various values of m and then choose the specification that minimizes the BIC. Using the same notation as in Conrad and Engle (2025), we denote the parameter vector by $\boldsymbol{\theta} = (\mu, \delta, \alpha, \beta, \gamma, \lambda_0, \lambda_1, \lambda_2)'$ and write the Gaussian quasi-loglikelihood function (omitting the constant) $L(\boldsymbol{\theta}|r_T, r_{T-1}, \ldots) = \sum_{t=1}^{T} l_t$ with

$$l_t = -\frac{1}{2}\left[\ln(h_t(\boldsymbol{\theta})) + \ln(\tau_t(\boldsymbol{\theta})) + \frac{\varepsilon_t^2(\boldsymbol{\theta})}{h_t(\boldsymbol{\theta})\tau_t(\boldsymbol{\theta})}\right], \tag{A.20}$$

where $\varepsilon_t(\boldsymbol{\theta}) = r_t - \mathbf{E}_{t-1}[r_t] = r_t - \mu - \delta h_t(\boldsymbol{\theta})\tau_t(\boldsymbol{\theta})$, $h_t(\boldsymbol{\theta}) = (1 - \alpha - \beta) + \alpha\varepsilon_{t-1}^2(\boldsymbol{\theta})/\tau_{t-1}(\boldsymbol{\theta}) + \beta h_{t-1}(\boldsymbol{\theta})$ and

$$\tau_t(\boldsymbol{\theta}) = \lambda_0 + \lambda_1 \frac{1}{m}\sum_{j=1}^{m} \frac{\varepsilon_{t-j}^2(\boldsymbol{\theta})}{h_{t-j}(\boldsymbol{\theta})} + \lambda_2 \tau_{t-1}(\boldsymbol{\theta}).$$

We denote the first and second derivatives of the likelihood by

$$\mathbf{s}_t(\boldsymbol{\theta}) = \frac{\partial l_t}{\partial \boldsymbol{\theta}} \quad \text{and} \quad \mathbf{d}_t(\boldsymbol{\theta}) = \frac{\partial^2 l_t}{\partial \boldsymbol{\theta}\partial \boldsymbol{\theta}'} \tag{A.21}$$

and the vector of true parameters by $\boldsymbol{\theta}_0$. Following the discussion in Conrad and Engle (2025), we expect the asymptotic distribution of the QMLE to be given by

$$\sqrt{T}(\hat{\boldsymbol{\theta}} - \boldsymbol{\theta}_0) \xrightarrow{d} \mathcal{N}(\mathbf{0}, \mathbf{D}^{-1}\boldsymbol{\Omega}\mathbf{D}^{-1}), \tag{A.22}$$

where $\boldsymbol{\Omega} = \boldsymbol{\Omega}(\boldsymbol{\theta}_0) = \mathbf{E}[\mathbf{s}_t(\boldsymbol{\theta}_0)\mathbf{s}_t(\boldsymbol{\theta}_0)']$ and $\mathbf{D} = \mathbf{D}(\boldsymbol{\theta}_0) = -\mathbf{E}[\mathbf{d}_t(\boldsymbol{\theta}_0)]$. Conrad and Engle (2025) show the validity of equation (A.22) in various simulations. However, they focus on the case with no risk-return relation, i.e., in their setting δ is assumed to be zero. We extended their simulations to the case $\delta > 0$ and found that equation (A.22) still leads to valid inference. Although asymptotic theory for the one-component GARCH-in-mean has been derived in Conrad and Mammen (2016), it should be noted that their results only hold for specific choices of the conditional mean function. Extending their results to the MF2-GARCH-in-mean is left for future research.

D Additional Tables

Table A.1: Test for unbiasedness and optimality of the Bloomberg forecasts.

	Panel A: Unbiasedness	***Panel B: Mincer-Zarnowitz Regression***			
	ψ_1	ψ_1	ψ_2	R^2	Wald
	[p-value]	(se)	(se)		[p-value]
Initial Jobless Claims	6.453	-47.812	1.136	0.944	1.969
	[0.052]	(24.199)	(0.068)		[0.140]
Nonfarm Payrolls	33.107	38.017	0.818	0.811	4.241
	[0.423]	(36.351)	(0.064)		[0.015]
Retail Sales	-0.004	-0.238	1.736	0.836	28.279
	[0.942]	(.047)	(0.098)		[0.000]
New Family Houses Sold	4.053	-1.881	1.009	0.961	0.837
	[0.280]	(6.529)	(0.011)		[0.434]
Durable Goods Orders	-0.023	-0.050	1.183	0.693	2.949
	[0.886]	(0.124)	(0.078)		[0.054]
Manufacturers New Orders	0.018	0.015	1.019	0.943	1.053
	[0.617]	(0.035)	(0.016)		[0.350]
Consumer Confidence	0.306	-0.212	1.005	0.956	0.772
	[0.359]	(1.037)	(0.011)		[0.463]
Purchasing Managers Index	0.223	1.628	.974	0.881	1.776
	[0.070]	(1.413)	(0.025)		[0.171]
Consumer Price Index	-0.001	-.034	1.179	0.858	16.161
	[0.962]	(0.008)	(0.032)		[0.000]

Notes: The table reports tests for the unbiasedness and optimality of the Bloomberg forecasts for the sample period between 2001 and 2021. In Panel A, we test for the unbiasedness of the surprises and regress the surprise $S_{j,t} = A_{j,t} - E_{j,t-1}$ on a constant ($S_{j,t} = \psi_1 + u_{j,t}$) and test if the constant is significant ($H_0 : \psi_1 = 0$). The regression provides evidence that the forecasts made by the Bloomberg forecasters are unbiased. In Panel B, we present results of running a Mincer and Zarnowitz (1969) regression to test for the optimality of the forecasts. We regress the realization of the announcement on a constant and the Bloomberg median forecast ($A_{j,t} = \psi_1 + \psi_2 E_{j,t-1} + u_{j,t}$) using Newey-West standard errors with 3 lags. The corresponding hypothesis $H_0 : \psi_1 = 0$ and $\psi_2 = 1$ is tested using a Wald test. For most macroeconomic news under consideration, we can reject the null of a systematic bias in the forecasts.

Table A.2: Summary of MF2-GARCH-in-mean parameter estimates for daily S&P 500 returns.

	δ	α	γ	β	λ_0	λ_1	λ_2
Median	0.032	0.004	0.124	0.854	0.020	0.113	0.866
$[Q_{0.25}; Q_{0.75}]$	[0.029; 0.033]	[0.002; 0.005]	[0.122; 0.141]	[0.845; 0.863]	[0.013; 0.027]	[0.085; 0.177]	[0.795; 0.902]

	$\phi = \alpha + \gamma/2 + \beta$	$\lambda_1 + \lambda_2$	κ	m
Median	0.924	0.979	5.500	67
$[Q_{0.25}; Q_{0.75}]$	[0.913; 0.932]	[0.972; 0.986]	[5.345; 5.634]	[62; 67]

Notes: The table reports the median, the lower and upper quartiles of the MF2-GARCH-in-mean parameter estimates. The MF2-GARCH is estimated on an expanding window of daily return data. The first estimation sample period starts on July 10, 1970, and ends on December 29, 2000. The final estimation sample ends on December 31, 2021.

Table A.3: Contemporaneous correlations between predictor variables.

Panel A: Correlations of high-frequency variables

	Cond. volatility	**Long-term volatility**	**Short-term component**	**GJR-GARCH**	**VIX**	**Risk appetite**	**Term spread**	**Credit spread**	**RV Euro-dollar**	**MOVE**	**RV 10y TF**	**TYVIX**
Conditional volatility	1.000											
Long-term volatility ($\sqrt{\tau}$)	0.646	1.000										
Short-term volatility ($\sqrt{h}$)	0.823	0.143	1.000									
GJR-GARCH	0.957	0.645	0.750	1.000								
VIX	0.934	0.735	0.668	0.916	1.000							
Risk appetite	-0.206	0.044	-0.290	-0.097	-0.154	1.000						
Term spread	0.164	0.336	-0.026	0.145	0.229	0.014	1.000					
Credit Spread	0.535	0.652	0.224	0.547	0.603	-0.023	0.549	1.000				
RV Eurodollar	0.472	0.399	0.280	0.494	0.453	-0.054	0.059	0.141	1.000			
MOVE	0.622	0.676	0.295	0.610	0.658	-0.079	0.482	0.515	0.598	1.000		
RV 10y-Treasury future	0.614	0.709	0.270	0.630	0.655	-0.004	0.569	0.582	0.555	0.888	1.000	
TYVIX	0.656	0.718	0.340	0.625	0.729	-0.088	0.585	0.545	0.462	0.951	0.902	1.000

Panel B: Correlations of low-frequency variables

	Cond. volatility	**Long-term volatility**	**Short-term component**	**FOMC sentiment**	**Output gap**	**Interest rate expectations**	**Inflation**	**Monetary policy uncertainty**	**Macro-economic uncertainty**
Conditional volatility	1.000								
Long-term volatility ($\sqrt{\tau}$)	0.671	1.000							
Short-term volatility ($\sqrt{h}$)	0.809	0.147	1.000						
FOMC sentiment	-0.472	-0.659	-0.129	1.000					
Output gap (quarterly)	-0.093	-0.397	0.173	0.258	1.000				
Interest rate expectations (quarterly)	-0.022	-0.279	0.133	0.099	0.369	1.000			
Inflation	-0.136	-0.309	0.004	0.094	0.496	0.647	1.000		
Monetary policy uncertainty	-0.001	-0.057	0.059	0.022	0.249	0.025	0.035	1.000	
Macroeconomic uncertainty	0.566	0.556	0.309	-0.555	-0.153	-0.212	-0.058	-0.034	1.000

Notes: The table presents the contemporaneous correlations between the economic predictors and volatility components. Panel A reports contemporaneous correlations for variables available at a high frequency (daily), while Panel B reports correlations of the volatility components with monthly or quarterly economic predictors. In Panel B, variables available at a higher frequency (e.g., long-term volatility) are collapsed to either monthly or quarterly frequency by taking their arithmetic mean within each month or quarter. The sample covers the period from 2001 to 2021, except for predictors that are available on a shorter sample. The TYVIX in Panel A is available from January 2003 to May 15, 2020. FOMC sentiment in Panel B is available from January 2001 until December 2020.

Table A.4: Replication of Columns (1) and (2) of Table 3 with the Producer Price Index as additional announcement in the *Prices* group.

	(1) group-specific		(2) announcement-specific	
	$\gamma_{g,\tau}$	$\theta_{2,j}$	$\gamma_{j,\tau}$	$\theta_{2,j}$
Real Activity	1.894***			
	(0.396)			
Initial Jobless Claims		0.048***	3.145***	0.040***
		(0.007)	(0.753)	(0.007)
Nonfarm Payrolls		0.183***	1.724***	0.188***
		(0.029)	(0.508)	(0.031)
Retail Sales		0.081***	1.213*	0.091***
		(0.015)	(0.645)	(0.016)
Investment & Consumption	3.079***			
	(0.529)			
New Family Houses Sold		0.082***	3.513***	0.080***
		(0.015)	(0.689)	(0.015)
Durable Goods Orders		0.038***	1.657**	0.051***
		(0.011)	(0.646)	(0.012)
Manufacturers New Orders		0.025**	2.285	0.028**
		(0.012)	(1.718)	(0.011)
Forward-looking	1.631***			
	(0.380)			
Consumer Confidence		0.118***	2.451***	0.104***
		(0.015)	(0.448)	(0.014)
Purchasing Managers Index		0.140***	1.015*	0.149***
		(0.022)	(0.519)	(0.022)
Prices	-0.216			
	(0.648)			
Producer Price Index		0.021*	-3.631	0.022*
		(0.012)	(2.482)	(0.012)
Consumer Price Index		0.088***	-0.016	0.088***
		(0.021)	(0.683)	(0.021)
Observations	2480		2480	
Adjusted R^2	0.218		0.222	

Notes: We set $k = 10$ minutes. Column (1) reports the results for group-specific sensitivities as in equations (19)-(20), Column (2) for announcement-specific sensitivities. The estimation sample spans the period from June 2004 to December 2021 because Producer Price Index surprises are available from June 2004 onwards. All regressions include a constant. Numbers in parentheses are Newey-West standard errors. Notation: ***p < 0.01, **p < 0.05, *p < 0.1.

Table A.5: Time-varying sensitivity regressions estimated separately for each predictor variable.

	Activity	*Prices*	Observations	Adjusted R^2
	Panel A: Macroeconomic conditions (low-frequency)			
FOMC sentiment	-0.383***	0.140	2690	0.243
	(0.061)	(0.230)		
Output gap	-0.342***	0.344**	2826	0.211
	(0.081)	(0.141)		
Interest rate expectations	-0.051	0.228*	2826	0.190
	(0.066)	(0.121)		
Inflation	-0.301***	0.113	2826	0.218
	(0.036)	(0.112)		
	Panel B: Macroeconomic conditions (high-frequency)			
	Activity	*Prices*	Observations	Adjusted R^2
Term spread	0.482***	-0.102	2826	0.230
	(0.063)	(0.197)		
Credit spread	0.525***	-0.015	2826	0.235
	(0.066)	(0.243)		
RV Eurodollar Futures	0.247***	0.220	2826	0.202
	(0.066)	(0.222)		
	Panel C: Macroeconomic and monetary policy uncertainty			
	Activity	*Prices*	Observations	Adjusted R^2
Monetary policy uncertainty	-0.253***	-0.430**	2826	0.201
	(0.066)	(0.214)		
Macroeconomic uncertainty	-0.087	0.069	2826	0.191
	(0.061)	(0.208)		
MOVE	0.537***	0.221	2826	0.251
	(0.055)	(0.290)		
TYVIX	0.452***	0.231	2338	0.268
	(0.065)	(0.297)		
RV 10y-Treasury futures	0.453***	0.089	2826	0.230
	(0.068)	(0.263)		
	Panel D: Stock market volatility and risk appetite			
	Activity	*Prices*	Observations	Adjusted R^2
GJR-GARCH	0.192	0.405	2826	0.201
	(0.127)	(0.273)		
VIX	0.296***	0.267	2826	0.207
	(0.105)	(0.259)		
Risk appetite	-0.165**	-0.511	2826	0.195
	(0.082)	(0.505)		

Notes: We set $k = 10$ minutes. Each row of the table reports estimates of equation (19) with a sensitivity factor that is based on a single economic predictor variable W_t, i.e. $f_g(\mathbf{X}_t) = 1 + \gamma_{g,W} W_{t-1}$. We only distinguish between two groups, *Activity* and *Price* announcements, and report the coefficients of $\gamma_{g,k}$ for these two groups. All economic predictors are standardized by dividing each by its standard deviation. To mitigate the influence of extreme observations, we winsorize the TYVIX and Eurodollar futures returns at the 99th percentile (top 1%). FOMC sentiment in Panel A is available from January 2001 until December 2020. The TYVIX in Panel C is available from January 2003 to May 15, 2020. For the VIX/TYVIX, we use the VIX/TYVIX on the previous trading day divided by $\sqrt{365}$. In all other columns, the estimation sample spans the period from January 2001 to December 2021. Numbers in parentheses are Newey-West standard errors. Notation: ***p < 0.01, **p < 0.05, *p < 0.1.

Table A.6: Explaining the time-varying sensitivity with additional economic predictors. Remaining parameter estimates from Table 5.

	Panel A: Macroeconomic conditions (low-frequency)				
	Symmetry	***Asymmetry: Piece-wise linear***		***Asymmetry: Squared news***	
	(1)	(2)		(3)	
	$\theta_{2,j}$	$\theta^+_{2,j}$	$\theta^-_{2,j}$	$\theta_{2,j}$	$\theta_{3,j}$
Initial Jobless Claims	0.054***	0.034***	0.068***	0.067***	-0.020***
	(0.006)	(0.008)	(0.011)	(0.010)	(0.007)
Nonfarm Payrolls	0.226***	0.252***	0.222***	0.243***	0.017
	(0.027)	(0.034)	(0.037)	(0.025)	(0.014)
Retail Sales	0.102***	0.090***	0.118***	0.124***	-0.026
	(0.018)	(0.017)	(0.031)	(0.029)	(0.016)
Durable Goods Orders	0.083***	0.058***	0.103***	0.083***	-0.010
	(0.015)	(0.022)	(0.023)	(0.015)	(0.010)
Manufacturers New Orders	0.034***	0.017	0.053***	0.036***	-0.011
	(0.013)	(0.021)	(0.016)	(0.013)	(0.008)
New Family Houses Sold	0.065***	0.057***	0.074***	0.083***	-0.022*
	(0.012)	(0.017)	(0.018)	(0.018)	(0.012)
Consumer Confidence	0.137***	0.093***	0.178***	0.136***	-0.024**
	(0.015)	(0.020)	(0.023)	(0.014)	(0.010)
Purchasing Managers Index	0.141***	0.124***	0.163***	0.143***	-0.011
	(0.018)	(0.023)	(0.029)	(0.018)	(0.012)
Consumer Price Index	0.078***	0.047**	0.103***	0.065***	-0.020*
	(0.019)	(0.023)	(0.029)	(0.019)	(0.011)
	Panel B: Macroeconomic conditions (high-frequency)				
	(1)	(2)		(3)	
	$\theta_{2,j}$	$\theta^+_{2,j}$	$\theta^-_{2,j}$	$\theta_{2,j}$	$\theta_{3,j}$
Initial Jobless Claims	0.049***	0.028***	0.064***	0.062***	-0.019***
	(0.006)	(0.007)	(0.011)	(0.010)	(0.007)
Nonfarm Payrolls	0.210***	0.218***	0.212***	0.219***	0.007
	(0.023)	(0.036)	(0.027)	(0.024)	(0.011)
Retail Sales	0.094***	0.083***	0.109***	0.115***	-0.023*
	(0.016)	(0.015)	(0.025)	(0.024)	(0.013)
Durable Goods Orders	0.065***	0.043**	0.085***	0.067***	-0.010
	(0.014)	(0.018)	(0.021)	(0.014)	(0.008)
Manufacturers New Orders	0.037***	0.018	0.057***	0.038***	-0.011
	(0.011)	(0.019)	(0.013)	(0.011)	(0.007)
New Family Houses Sold	0.054***	0.039**	0.070***	0.077***	-0.028***
	(0.012)	(0.017)	(0.014)	(0.015)	(0.009)
Consumer Confidence	0.128***	0.082***	0.176***	0.131***	-0.026***
	(0.014)	(0.016)	(0.021)	(0.013)	(0.009)
Purchasing Managers Index	0.127***	0.108***	0.150***	0.129***	-0.012
	(0.018)	(0.024)	(0.029)	(0.018)	(0.012)
Consumer Price Index	0.079***	0.069***	0.091***	0.078***	-0.004
	(0.017)	(0.024)	(0.027)	(0.017)	(0.012)

	Panel C: Macroeconomic and monetary policy uncertainty				
	(1)	(2)		(3)	
	$\theta_{2,j}$	$\theta^+_{2,j}$	$\theta^-_{2,j}$	$\theta_{2,j}$	$\theta_{3,j}$
Initial Jobless Claims	0.058***	0.027***	0.084***	0.079***	-0.030***
	(0.007)	(0.008)	(0.013)	(0.011)	(0.008)
Nonfarm Payrolls	0.233***	0.224***	0.244***	0.233***	-0.002
	(0.023)	(0.040)	(0.027)	(0.025)	(0.013)
Retail Sales	0.113***	0.089***	0.139***	0.144***	-0.038**
	(0.017)	(0.022)	(0.026)	(0.024)	(0.016)
Durable Goods Orders	0.072***	0.045**	0.098***	0.074***	-0.011
	(0.013)	(0.018)	(0.021)	(0.014)	(0.008)
Manufacturers New Orders	0.041***	0.019	0.068***	0.044***	-0.012
	(0.012)	(0.020)	(0.014)	(0.012)	(0.007)
New Family Houses Sold	0.062***	0.040**	0.084***	0.089***	-0.036***
	(0.013)	(0.018)	(0.017)	(0.017)	(0.011)
Consumer Confidence	0.130***	0.080***	0.182***	0.133***	-0.028***
	(0.015)	(0.019)	(0.022)	(0.014)	(0.010)
Purchasing Managers Index	0.138***	0.123***	0.156***	0.139***	-0.008
	(0.017)	(0.021)	(0.030)	(0.018)	(0.011)
Consumer Price Index	0.068***	0.048**	0.094***	0.068***	-0.015
	(0.017)	(0.020)	(0.028)	(0.016)	(0.010)
	(1)	(2)		(3)	
	$\theta_{2,j}$	$\theta^+_{2,j}$	$\theta^-_{2,j}$	$\theta_{2,j}$	$\theta_{3,j}$
Initial Jobless Claims	0.069***	0.030***	0.102***	0.091***	-0.034***
	(0.007)	(0.010)	(0.011)	(0.010)	(0.008)
Nonfarm Payrolls	0.266***	0.263***	0.274***	0.268***	0.001
	(0.028)	(0.046)	(0.037)	(0.029)	(0.018)
Retail Sales	0.105***	0.082***	0.132***	0.129***	-0.029*
	(0.017)	(0.018)	(0.028)	(0.024)	(0.016)
Durable Goods Orders	0.048***	0.026*	0.060***	0.045***	-0.008*
	(0.010)	(0.014)	(0.017)	(0.011)	(0.005)
Manufacturers New Orders	0.034**	0.006	0.067***	0.037***	-0.012
	(0.014)	(0.022)	(0.015)	(0.012)	(0.008)
New Family Houses Sold	0.075***	0.052**	0.098***	0.105***	-0.041***
	(0.015)	(0.022)	(0.020)	(0.020)	(0.013)
Consumer Confidence	0.130***	0.084***	0.179***	0.133***	-0.025**
	(0.016)	(0.021)	(0.025)	(0.015)	(0.011)
Purchasing Managers Index	0.145***	0.126***	0.169***	0.147***	-0.012
	(0.021)	(0.023)	(0.042)	(0.025)	(0.016)
Consumer Price Index	0.063***	0.054**	0.069**	0.060***	-0.008
	(0.020)	(0.021)	(0.031)	(0.019)	(0.012)
	Panel D: Stock market volatility and risk appetite				
	(1)	(2)		(3)	
	$\theta_{2,j}$	$\theta^+_{2,j}$	$\theta^-_{2,j}$	$\theta_{2,j}$	$\theta_{3,j}$
Initial Jobless Claims	0.049***	0.029***	0.065***	0.062***	-0.018***
	(0.006)	(0.008)	(0.011)	(0.010)	(0.007)
Nonfarm Payrolls	0.194***	0.186***	0.208***	0.197***	-0.001
	(0.022)	(0.034)	(0.030)	(0.024)	(0.011)
Retail Sales	0.096***	0.075***	0.121***	0.125***	-0.031***
	(0.012)	(0.016)	(0.018)	(0.017)	(0.010)
Durable Goods Orders	0.073***	0.043**	0.107***	0.079***	-0.015*
	(0.015)	(0.019)	(0.023)	(0.014)	(0.008)
Manufacturers New Orders	0.044***	0.029	0.063***	0.046***	-0.009
	(0.014)	(0.023)	(0.016)	(0.013)	(0.008)
New Family Houses Sold	0.057***	0.045***	0.072***	0.078***	-0.022**
	(0.012)	(0.015)	(0.018)	(0.018)	(0.011)
Consumer Confidence	0.127***	0.082***	0.179***	0.132***	-0.026***
	(0.013)	(0.015)	(0.022)	(0.013)	(0.009)
Purchasing Managers Index	0.136***	0.119***	0.159***	0.139***	-0.012
	(0.019)	(0.023)	(0.035)	(0.021)	(0.014)
Consumer Price Index	0.073***	0.055**	0.085***	0.066***	-0.009
	(0.017)	(0.024)	(0.025)	(0.016)	(0.010)

Notes: We set $k = 10$ minutes. The coefficient estimates for the additional predictors can be found in Table 5. More details on the estimation can be found in the notes of Table 5. Numbers in parentheses are Newey-West standard errors. Notation: ***p < 0.01, **p < 0.05, *p < 0.1

E Additional Figures

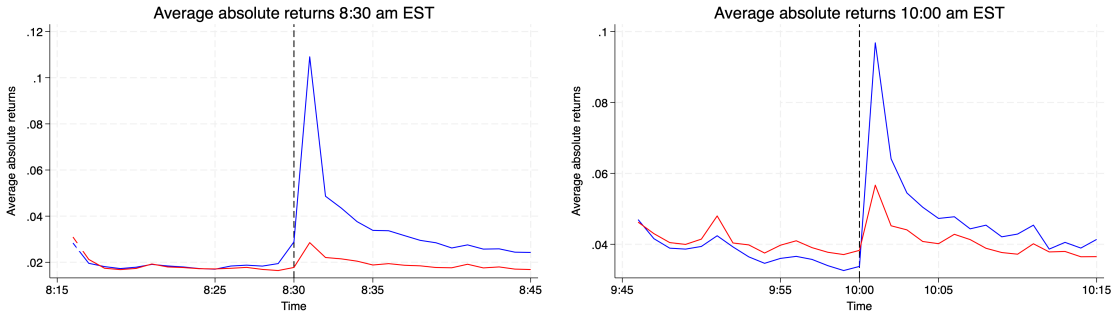

Figure A.3: Average absolute returns in 15-minute windows around the announcements at 8:30 and 10:00 am EST. The average over announcement days considered in our analysis is shown in blue, whereas the average over days not included in our analysis is shown in red.

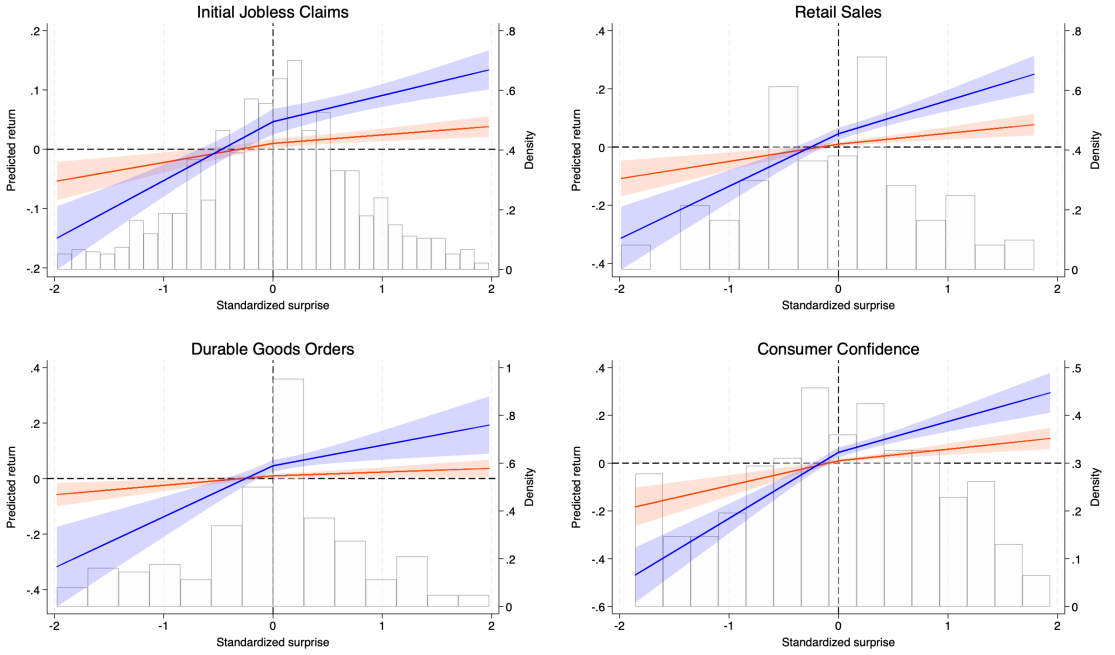

Figure A.4: Returns predicted by the model in Column (2) of Table 4 as a function of macroeconomic news, conditional on long-term volatility being either at the 10% (orange line) or 90% (blue line) quantile. To compute the quantiles, we only consider observations of long-term volatility on days when the corresponding announcements were published. For instance, when looking at the Initial Jobless Claims announcement, the 10% quantile corresponds to an annualized long-term volatility of 10.9% (e.g., September 6, 2018), and the 90% quantile corresponds to an annualized long-term volatility of 20.9% (e.g., May 17, 2001). For the calculation of the predicted return of an announcement, the surprises of all other announcements were set to zero. Predicted returns are plotted with 90%-confidence intervals. The histogram refers to the distribution of the surprises of the corresponding announcement.

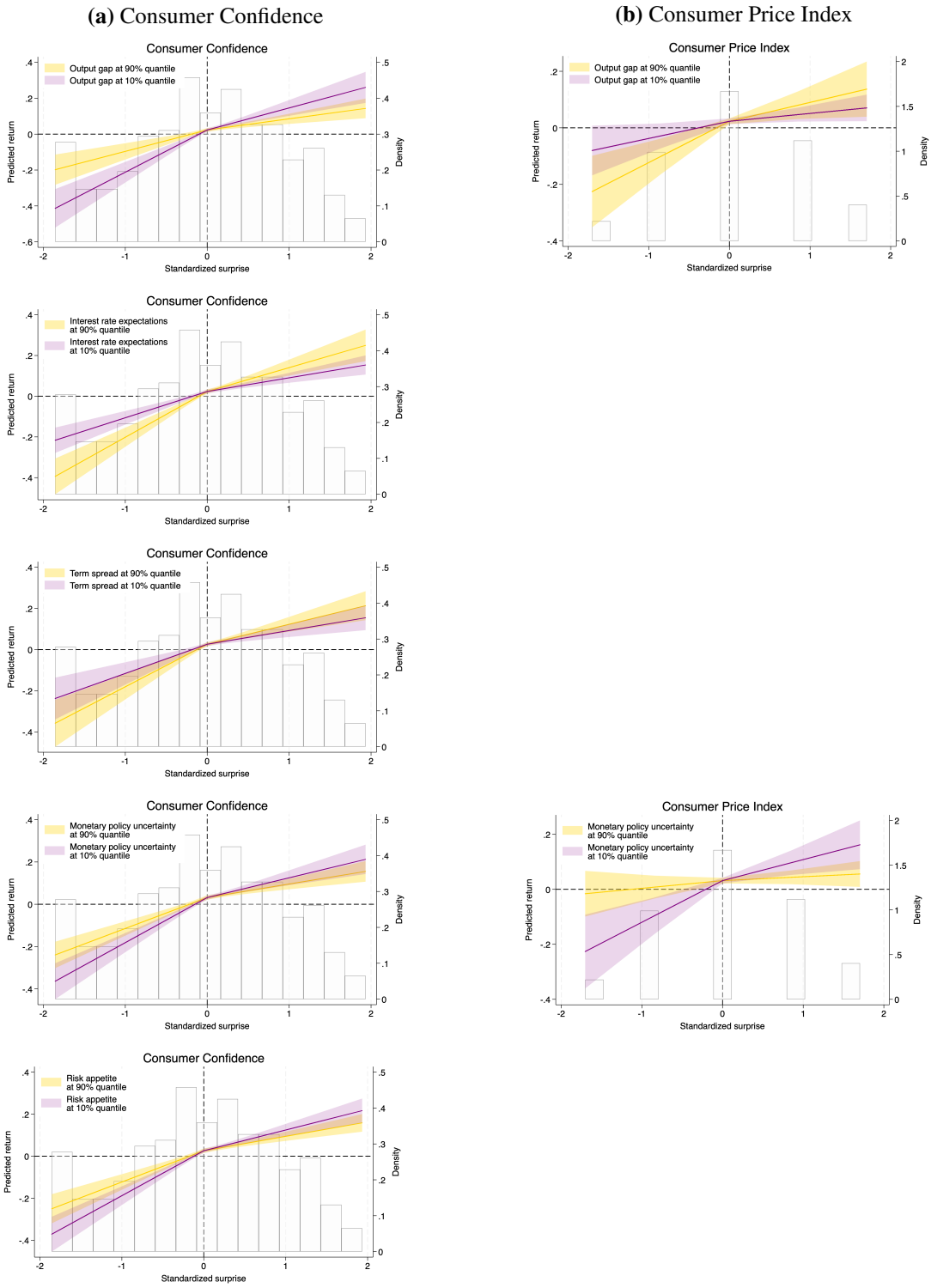

Figure A.5: Returns predicted by the model in Column (2) of Table 5 as a function of Consumer Confidence (Column (a)) and Consumer Price Index (Column (b)) news, conditional on the economic predictors being either at the 10% (purple line) or 90% (yellow line) quantile. From the four panels in Table 5, we display results for the output gap, interest rate expectations, term spread, monetary policy uncertainty, and risk appetite (from top to bottom). Predicted returns are only shown for predictor variables for which the estimate of $\gamma_{g,k}$ is significant. We fix the remaining economic predictors in the regression at their sample means and set all other announcement surprises to zero. Predicted returns are plotted with 90%-confidence intervals. The histogram refers to the distribution of the surprises of the Consumer Confidence/Consumer Price Index announcement.

F Results Robustness

F.1 Additional Tables Robustness

Table A.7: Regressions using the long-term variance instead of the long-term volatility.

	Symmetry				***Asymmetry: Piece-wise linear***			***Asymmetry: Squared news***		
	(1)		(2)		(3)			(4)		
	$\gamma_{g,\tau}$	$\theta_{2,j}$	$\gamma_{g,\tau}$	$\theta_{2,j}$	$\gamma_{g,\tau}$	$\theta^{+}_{2,j}$	$\theta^{-}_{2,j}$	$\gamma_{g,\tau}$	$\theta_{2,j}$	$\theta_{3,j}$
$\dot{\tau}_t$	0.655***									
	(0.099)									
Real Activity			0.682***		0.696***			0.675***		
			(0.146)		(0.152)			(0.153)		
Initial Jobless Claims		0.048***		0.047***		0.026***	0.062***		0.060***	-0.018**
		(0.006)		(0.007)		(0.008)	(0.012)		(0.011)	(0.007)
Nonfarm Payrolls		0.195***		0.193***		0.188***	0.200***		0.198***	0.003
		(0.024)		(0.025)		(0.035)	(0.032)		(0.026)	(0.011)
Retail Sales		0.093***		0.091***		0.072***	0.113***		0.119***	-0.028***
		(0.013)		(0.014)		(0.015)	(0.022)		(0.021)	(0.011)
Investment & Consumption			1.078***		1.026***			1.086***		
			(0.221)		(0.236)			(0.227)		
New Family Houses Sold		0.600***		0.059***		0.053***	0.066***		0.077***	-0.020*
		(0.012)		(0.012)		(0.017)	(0.018)		(0.018)	(0.011)
Durable Goods Orders		0.072***		0.061***		0.036**	0.096***		0.068***	-0.014*
		(0.016)		(0.014)		(0.018)	(0.021)		(0.013)	(0.007)
Manufacturers New Orders		0.043***		0.035***		0.023	0.050***		0.036***	-0.007
		(0.013)		(0.012)		(0.021)	(0.014)		(0.011)	(0.007)
Forward-looking			0.629***		0.602***			0.604***		
			(0.151)		(0.170)			(0.171)		
Consumer Confidence		0.126***		0.127***		0.083***	0.182***		0.135***	-0.027***
		(0.014)		(0.015)		(0.017)	(0.026)		(0.016)	(0.010)
Purchasing Managers Index		0.137***		0.139***		0.122***	0.162***		0.142***	-0.012
		(0.019)		(0.019)		(0.024)	(0.033)		(0.019)	(0.013)
Prices			-0.153		-0.168			-0.152		
			(0.246)		(0.286)			(0.304)		
Consumer Price Index		0.059***		0.081***		0.060***	0.097***		0.076***	-0.010
		(0.017)		(0.018)		(0.022)	(0.027)		(0.017)	(0.011)
No news is good news						$\theta_{1,\tau}$			$\theta_{1,\tau}$	
$\dot{\tau}_t$						0.029***			0.027***	
						(0.011)			0.010	
Observations	2826		2826		2826			2826		
Adjusted R^2	0.227		0.229		0.236			0.239		

Notes: We set $k = 10$ minutes. Column (1) reports the results of estimating (16) while imposing the sensitivity to be the same across announcements with $\boldsymbol{\gamma}'_X \mathbf{X}_t = \gamma_\tau \tilde{\tau}_t$. Column (2) reports the results for group-specific sensitivities as in equations (19)-(20). Column (3), we report results of estimating (21) using $f_g(\mathbf{X}_t)$ as in equation (20). In the columns denoted by $\theta^{+}_{2,j}$, we report the coefficient estimates for good news, and in the columns denoted by $\theta^{-}_{2,j}$, we report the coefficient estimates for bad news. In Column (4), we report results of estimating (22) where we include squared terms only for good news of Retail Sales, Initial Jobless Claims, and New Family Houses Sold. In the column denoted by $\theta_{2,j}$, we report the coefficient estimates for the surprises, and in the column denoted by $\theta_{3,j}$, we report the coefficient estimates for the squared surprises. $\dot{\tau}_t$ was obtained from an expanding window estimation and demeaned. The estimation sample spans the period from January 2001 to December 2021. Numbers in parentheses are Newey-West standard errors. Notation: ***p < 0.01, **p < 0.05, *p < 0.1.

Table A.8: Regressions using $k = 2$ and $k = 20$ minute estimation windows.

	Panel A: $k = 2$ ***Minutes***							***Panel B:*** $k = 20$ ***Minutes***						
	(1)		(2)			(3)		(4)		(5)			(6)	
	$\gamma_{g,\tau}$	$\theta_{2,j}$	$\gamma_{g,\tau}$	$\theta^{+}_{2,j}$	$\theta^{-}_{2,j}$	$\gamma_{g,\tau}$	$\theta_{2,j}$ $\theta_{3,j}$	$\gamma_{g,\tau}$	$\theta_{2,j}$	$\gamma_{g,\tau}$	$\theta^{+}_{2,j}$	$\theta^{-}_{2,j}$	$\gamma_{g,\tau}$	$\theta_{2,j}$ $\theta_{3,j}$
Real Activity	1.727***		1.747***			1.742***		1.558***		1.540***			1.488***	
	(0.366)		(0.372)			(0.369)		(0.374)		(0.375)			(0.368)	
Initial Jobless Claims		0.038***		0.026***	0.045***		0.046*** -0.011***		0.047***		0.041***	0.052***		0.054*** -0.009
		(0.005)		(0.006)	(0.007)		(0.007) (0.004)		(0.007)		(0.009)	(0.012)		(0.011) (0.007)
Nonfarm Payrolls		0.158***		0.154***	0.164***		0.163*** 0.005		0.194***		0.202***	0.194***		0.204*** 0.010
		(0.021)		(0.031)	(0.026)		(0.022) (0.010)		(0.028)		(0.036)	(0.037)		(0.027) (0.013)
Retail Sales		0.069***		0.054***	0.084***		0.089*** -0.021***		0.096***		0.080***	0.113***		0.121*** -0.025*
		(0.010)		(0.010)	(0.015)		(0.014) (0.007)		(0.017)		(0.018)	(0.028)		(0.025) (0.014)
Investment & Consumption	2.202***		2.168***			2.313***		2.939***		2.713***			2.753***	
	(0.423)		(0.381)			(0.374)		(0.643)		(0.604)			(0.607)	
New Family Houses Sold		0.054***		0.042***	0.070***		0.071*** -0.018*		0.063***		0.077***	0.047**		0.065*** -0.001
		(0.009)		(0.014)	(0.013)		(0.012) (0.011)		(0.018)		(0.025)	(0.024)		(0.025) (0.017)
Durable Goods Orders		0.062***		0.043***	0.086***		0.066*** -0.011***		0.053***		0.035	0.081***		0.061*** -0.012
		(0.009)		(0.012)	(0.012)		(0.008) (0.004)		(0.017)		(0.023)	(0.023)		(0.015) (0.008)
Manufacturers New Orders		0.023***		0.013	0.034***		0.023*** -0.005		0.036***		0.014	0.060***		0.038*** -0.013*
		(0.008)		(0.012)	(0.013)		(0.008) (0.005)		(0.013)		(0.021)	(0.017)		(0.013) (0.007)
Forward-looking	1.693***		1.619***			1.630***		2.148***		2.061***			2.071***	
	(0.293)		(0.295)			(0.293)		(0.358)		(0.390)			(0.385)	
Consumer Confidence		0.098***		0.062***	0.141***		0.103*** -0.020***		0.141***		0.109***	0.182***		0.147*** -0.018*
		(0.009)		(0.010)	(0.015)		(0.009) (0.005)		(0.015)		(0.019)	(0.025)		(0.015) (0.009)
Purchasing Managers Index		0.077***		0.069***	0.087***		0.078*** -0.005		0.156***		0.131***	0.193***		0.161*** -0.014
		(0.011)		(0.015)	(0.017)		(0.011) (0.007)		(0.020)		(0.027)	(0.033)		(0.020) (0.014)
Prices	0.133		0.170			0.172		-0.026		0.047			0.127	
	(0.450)		(0.512)			(0.509)		(0.736)		(0.787)			(0.838)	
Consumer Price Index		0.086***		0.070***	0.097***		0.082*** -0.006		0.081***		0.063**	0.093***		0.075*** -0.011
		(0.014)		(0.019)	(0.021)		(0.014) (0.009)		(0.019)		(0.027)	(0.027)		(0.019) (0.011)
No news is good news				$\theta_{1,\tau}$			$\theta_{1,\tau}$				$\theta_{1,\tau}$			$\theta_{1,\tau}$
$\dot{\tau}_t$				0.017**			0.015**				0.018			0.017
				(0.007)			(0.007)				(0.012)			(0.012)
Observations	2826		2826			2826		2826		2826			2826	
Adjusted R^2	0.263		0.269			0.273		0.201		0.204			0.205	

Notes: In Panel A, the estimation window is of size $k = 2$ minutes, and in Panel B, the estimation window is of size $k = 20$ minutes. Columns (1) and (2) report the results for group-specific sensitivities as in equations (19)-(20). In Columns (2) and (4), we report results of estimating (21) using $f_g(\mathbf{X}_t)$ as in equation (20). In the columns denoted by $\theta^{+}_{2,j}$, we report the coefficient estimates for good news, and in the columns denoted by $\theta^{-}_{2,j}$, we report the coefficient estimates for bad news. In Columns (3) and (6), we report results of estimating (22) where we include squared terms only for good news of Retail Sales, Initial Jobless Claims, and New Family Houses Sold. In the column denoted by $\theta_{2,j}$, we report the coefficient estimates for the surprises, and in the column denoted by $\theta_{3,j}$, we report the coefficient estimates for the squared surprises. The estimation sample spans the period from January 2001 to December 2021. Numbers in parentheses are Newey-West standard errors. Notation: ***p < 0.01, **p < 0.05, *p < 0.1.

Table A.9: Regressions excluding monetary policy decision days of the Fed and the ECB.

	Symmetry				***Asymmetry: Piece-wise linear***			***Asymmetry: Squared news***		
	(1)		(2)		(3)			(4)		
	γ_τ	$\theta_{2,j}$	$\gamma_{g,\tau}$	$\theta_{2,j}$	$\gamma_{g,\tau}$	$\theta^+_{2,j}$	$\theta^-_{2,j}$	$\gamma_{g,\tau}$	$\theta_{2,j}$	$\theta_{3,j}$
$\tilde{\tau}_t$	0.674***									
	(0.103)									
Real Activity			0.661***		0.660***			0.642***		
			(0.147)		(0.154)			(0.155)		
Initial Jobless Claims		0.049***		0.049***		0.033***	0.062***		0.061***	-0.015*
		(0.008)		(0.008)		(0.009)	(0.015)		(0.013)	(0.008)
Nonfarm Payrolls		0.195***		0.196***		0.192***	0.202***		0.201***	0.004
		(0.024)		(0.026)		(0.036)	(0.033)		(0.026)	(0.012)
Retail Sales		0.099***		0.099***		0.082***	0.118***		0.125***	-0.026**
		(0.014)		(0.015)		(0.016)	(0.024)		(0.023)	(0.011)
Investment & Consumption			1.144***		1.117***			1.131***		
			(0.240)		(0.244)			(0.231)		
New Family Houses Sold		0.061***		0.061***		0.064***	0.058***		0.073***	-0.014
		(0.013)		(0.013)		(0.020)	(0.016)		(0.017)	(0.012)
Durable Goods Orders		0.072***		0.060***		0.036*	0.093***		0.068***	-0.014*
		(0.017)		(0.015)		(0.019)	(0.023)		(0.014)	(0.007)
Manufacturers New Orders		0.045***		0.038**		0.021	0.056***		0.039***	-0.011
		(0.017)		(0.016)		(0.029)	(0.016)		(0.015)	(0.009)
Forward-looking			0.678***		0.660***			0.662***		
			(0.159)		(0.180)			(0.179)		
Consumer Confidence		0.123***		0.123***		0.078***	0.178***		0.131***	-0.027***
		(0.014)		(0.015)		(0.018)	(0.026)		(0.015)	(0.010)
Purchasing Managers Index		0.137***		0.137***		0.122***	0.156***		0.139***	-0.009
		(0.019)		(0.018)		(0.025)	(0.031)		(0.019)	(0.013)
Prices			0.116		0.216			0.266		
			(0.269)		(0.375)			(0.421)		
Consumer Price Index		0.074***		0.087***		0.056**	0.108***		0.077***	-0.015
		(0.017)		(0.019)		(0.026)	(0.026)		(0.019)	(0.010)
No news is good news					$\theta_{1,\tau}$			$\theta_{1,\tau}$		
$\dot{\tau}_t$					0.029**			0.027**		
					(0.012)			(0.012)		
Observations	2470		2470		2470			2470		
Adjusted R^2	0.236		0.237		0.244			0.246		

Notes: We set $k = 10$ minutes and exclude monetary policy decision days from the estimation. Column (1) reports the results of estimating (16) while imposing the sensitivity to be the same across announcements with $\boldsymbol{\gamma}'_X \mathbf{X}_t = \gamma_\tau \tilde{\tau}_t$. Column (2) reports the results for group-specific sensitivities as in equations (19)-(20). Column (3), we report results of estimating (21) using $f_g(\mathbf{X}_t)$ as in equation (20). In the columns denoted by $\theta^+_{2,j}$, we report the coefficient estimates for good news, and in the columns denoted by $\theta^-_{2,j}$, we report the coefficient estimates for bad news. In Column (4), we report results of estimating (22) where we include squared terms only for good news of Retail Sales, Initial Jobless Claims, and New Family Houses Sold. In the column denoted by $\theta_{2,j}$, we report the coefficient estimates for the surprises, and in the column denoted by $\theta_{3,j}$, we report the coefficient estimates for the squared surprises. The time series of ECB press conference days is taken from the *The Euro Area Monetary Policy Event-Study Database* from Altavilla et al. (2019). The estimation sample spans the period from January 2001 to December 2021. Numbers in parentheses are Newey-West standard errors. Notation: ***p < 0.01, **p < 0.05, *p < 0.1.

Table A.10: Separate regressions for 8:30 am and 10:00 am announcements.

Panel A: 8:30 am EST

	Symmetry				***Asymmetry: Piece-wise linear***			***Asymmetry: Squared news***		
	(1)		(2)		(3)			(4)		
	γ_τ	$\theta_{2,j}$	$\gamma_{g,\tau}$	$\theta_{2,j}$	$\gamma_{g,\tau}$	$\theta^+_{2,j}$	$\theta^-_{2,j}$	$\gamma_{g,\tau}$	$\theta_{2,j}$	$\theta_{3,j}$
$\tilde{\tau}_t$	1.641***									
	(0.321)									
Real Activity			0.681***		0.665***			0.647***		
			(0.146)		(0.146)			(0.147)		
Initial Jobless Claims		0.047***		0.047***		0.032***	0.058***		0.057***	-0.014*
		(0.006)		(0.007)		(0.008)	0.013		(0.011)	(0.007)
Nonfarm Payrolls		0.192***		0.193***		0.195***	0.197***		0.200***	0.005
		(0.025)		(0.025)		(0.035)	0.032		(0.026)	(0.011)
Retail Sales		0.091***		0.091***		0.076***	0.109***		0.117***	-0.025**
		(0.014)		(0.014)		(0.015)	0.023		(0.021)	(0.011)
Investment & Consumption			0.924***		0.958***			1.008***		
			(0.325)		(0.326)			(0.313)		
Durable Goods Orders		0.075***		0.065***		0.042**	0.095***		0.070***	-0.013*
		(0.016)		(0.013)		(0.018)	0.020		(0.012)	(0.007)
Prices			-0.155		-0.151			-0.129		
			(0.245)		(0.291)			(0.312)		
Consumer Price Index		0.059***		0.081***		0.060***	0.097***		0.076***	-0.010
		(0.017)		(0.018)		(0.023)	0.027		(0.017)	(0.011)
No news is good news						$\theta_{1,\tau}$			$\theta_{1,\tau}$	
$\dot{\tau}_t$						0.011			0.009	
						(0.012)			(0.011)	
Observations	1857		1857		1857			1857		
Adjusted R^2	0.228		0.230		0.233			0.236		

Panel B: 10:00 am EST

	Symmetry				***Asymmetry: Piece-wise linear***			***Asymmetry: Squared news***		
	(1)		(2)		(3)			(4)		
	γ_τ	$\theta_{2,j}$	$\gamma_{g,\tau}$	$\theta_{2,j}$	$\gamma_{g,\tau}$	$\theta^+_{2,j}$	$\theta^-_{2,j}$	$\gamma_{g,\tau}$	$\theta_{2,j}$	$\theta_{3,j}$
$\tilde{\tau}_t$	1.766***									
	(0.306)									
Investment & Consumption			1.260***		1.097***			1.229***		
			(0.368)		(0.287)			(0.300)		
Manufacturers New Orders		0.041***		0.032***		0.012	0.061***		0.036***	-0.011
		(0.013)		(0.011)		(0.023)	(0.017)		(0.011)	(0.007)
New Family Houses Sold		0.059***		0.057***		0.042**	0.076***		0.077***	-0.023**
		(0.012)		(0.011)		(0.017)	(0.020)		(0.017)	(0.012)
Forward-looking			0.622***		0.619***			0.603***		
			(0.151)		(0.170)			(0.169)		
Consumer Confidence		0.124***		0.128***		0.073***	0.194***		0.138***	-0.032***
		(0.015)		(0.015)		(0.020)	(0.029)		(0.016)	(0.011)
Purchasing Managers Index		0.135***		0.140***		0.111***	0.173***		0.143***	-0.016
		(0.018)		(0.019)		(0.026)	(0.034)		(0.019)	(0.013)
No news is good news						$\theta_{1,\tau}$			$\theta_{1,\tau}$	
$\dot{\tau}_t$						0.065***			0.060***	
						(0.022)			(0.019)	
Observations	969		969		969			969		
Adjusted R^2	0.232		0.227		0.249			0.252		

Notes: We set $k = 10$ minutes and separate announcements at 8:30 and 10:00 am EST into two separate regressions. In Panel A, we present the results for including announcements scheduled for 8:30 am EST, and in Panel B, we present results for including only announcements scheduled for 10:00 am EST in the regression. Column (1) reports the results of estimating (16) while imposing the sensitivity to be the same across announcements with $\boldsymbol{\gamma}'_X \mathbf{X}_t = \gamma_\tau \tilde{\tau}_t$. Column (2) reports the results for group-specific sensitivities as in equations (19)-(20). Column (3), we report results of estimating (21) using $f_g(\mathbf{X}_t)$ as in equation (20). In the columns denoted by $\theta^+_{2,j}$, we report the coefficient estimates for good news, and in the columns denoted by $\theta^-_{2,j}$, we report the coefficient estimates for bad news. In Column (4), we report results of estimating (22) where we include squared terms only for good news of Retail Sales, Initial Jobless Claims, and New Family Houses Sold. In the column denoted by $\theta_{2,j}$, we report the coefficient estimates for the surprises, and in the column denoted by $\theta_{3,j}$, we report the coefficient estimates for the squared surprises. The estimation sample spans the period from January 2001 to December 2021. Numbers in parentheses are Newey-West standard errors. Notation: ***p < 0.01, **p < 0.05, *p < 0.1.

Table A.11: Regressions using S&P 500 returns and announcements published at 10:00 am.

	Symmetry				***Asymmetry: Piece-wise linear***			***Asymmetry: Squared news***		
	(1)		(2)		(3)			(4)		
	γ_τ	$\theta_{2,j}$	$\gamma_{g,\tau}$	$\theta_{2,j}$	$\gamma_{g,\tau}$	$\theta^+_{2,j}$	$\theta^-_{2,j}$	$\gamma_{g,\tau}$	$\theta_{2,j}$	$\theta_{3,j}$
$\tilde{\tau}_t$	1.788***									
	(0.314)									
Investment & Consumption			1.316***		1.173***			1.305***		
			(0.350)		(0.284)			(0.292)		
Manufacturers New Orders		0.042***		0.032***		0.015	0.057***		0.035***	-0.009
		(0.012)		(0.011)		(0.021)	(0.016)		(0.010)	(0.007)
New Family Houses Sold		0.060***		0.057***		0.042**	0.076***		0.078***	-0.025**
		(0.011)		(0.011)		(0.017)	(0.019)		(0.017)	(0.011)
Forward-looking			0.628***		0.633***			0.613***		
			(0.154)		(0.175)			(0.173)		
Consumer Confidence		0.122***		0.126***		0.071***	0.191***		0.135***	-0.031***
		(0.015)		(0.015)		(0.022)	(0.029)		(0.016)	(0.011)
Purchasing Managers Index		0.135***		0.140***		0.110***	0.174***		0.143***	-0.016
		(0.018)		(0.018)		(0.026)	(0.032)		(0.019)	(0.013)
No news is good news					$\theta_{1,\tau}$			$\theta_{1,\tau}$		
$\dot{\tau}_t$					0.064***			0.058***		
					(0.022)			(0.019)		
Observations	967		967		967			967		
Adjusted R^2	0.240		0.236		0.258			0.260		

Notes: This Table presents results using S&P 500 returns instead of E-mini future returns, and we set $k = 10$ minutes. Column (1) reports the results of estimating (16) while imposing the sensitivity to be the same across announcements with $\boldsymbol{\gamma}'_X \mathbf{X}_t = \gamma_\tau \tilde{\tau}_t$. Column (2) reports the results for group-specific sensitivities as in equations (19)-(20). Column (3), we report results of estimating (21) using $f_g(\mathbf{X}_t)$ as in equation (20). In the columns denoted by $\theta^+_{2,j}$, we report the coefficient estimates for good news, and in the columns denoted by $\theta^-_{2,j}$, we report the coefficient estimates for bad news. In Column (4), we report results of estimating (22) where we include squared terms only for good news of Retail Sales, Initial Jobless Claims, and New Family Houses Sold. In the column denoted by $\theta_{2,j}$, we report the coefficient estimates for the surprises, and in the column denoted by $\theta_{3,j}$, we report the coefficient estimates for the squared surprises. The estimation sample spans the period from January 2001 to December 2021. Numbers in parentheses are Newey-West standard errors. Notation: ***p < 0.01, **p < 0.05, *p < 0.1.

Table A.12: Regression excluding the COVID-19 pandemic.

	Symmetry				***Asymmetry: Piece-wise linear***			***Asymmetry: Squared news***		
	(1)		(2)		(3)			(4)		
	γ_τ	$\theta_{2,j}$	$\gamma_{g,\tau}$	$\theta_{2,j}$	$\gamma_{g,\tau}$	$\theta^+_{2,j}$	$\theta^-_{2,j}$	$\gamma_{g,\tau}$	$\theta_{2,j}$	$\theta_{3,j}$
$\tilde{\tau}_t$	0.477***									
	(0.078)									
Real Activity			0.409***		0.427***			0.426***		
			(0.091)		(0.093)			(0.095)		
Initial Jobless Claims		0.064***		0.065***		0.028***	0.095***		0.087***	-0.032***
		(0.008)		(0.008)		(0.009)	(0.015)		(0.012)	(0.009)
Nonfarm Payrolls		0.276***		0.285***		0.265***	0.300***		0.282***	-0.035**
		(0.028)		(0.028)		(0.045)	(0.036)		(0.030)	(0.017)
Retail Sales		0.119***		0.124***		0.104***	0.145***		0.151***	-0.007
		(0.018)		(0.019)		(0.022)	(0.029)		(0.027)	(0.016)
Investment & Consumption			0.994***		0.898***			0.981***		
			(0.201)		(0.214)			(0.207)		
New Family Houses Sold		0.069***		0.070***		0.052**	0.091***		0.101***	-0.040***
		(0.014)		(0.015)		(0.021)	(0.020)		(0.020)	(0.012)
Durable Goods Orders		0.076***		0.063***		0.038**	0.099***		0.070***	-0.014*
		(0.016)		(0.015)		(0.019)	(0.022)		(0.014)	(0.008)
Manufacturers New Orders		0.050***		0.040***		0.023	0.062***		0.042***	-0.009
		(0.014)		(0.012)		(0.023)	(0.015)		(0.012)	(0.008)
Forward-looking			0.563***		0.548***			0.555***		
			(0.142)		(0.161)			(0.160)		
Consumer Confidence		0.143***		0.139***		0.088***	0.199***		0.146***	-0.029***
		(0.016)		(0.017)		(0.019)	(0.028)		(0.017)	(0.011)
Purchasing Managers Index		0.160***		0.156***		0.138***	0.176***		0.156***	-0.008
		(0.021)		(0.020)		(0.026)	(0.034)		(0.021)	(0.014)
Prices			-0.160		-0.174			-0.157		
			(0.258)		(0.310)			(0.330)		
Consumer Price Index		0.063***		0.080***		0.056**	0.100***		0.076***	-0.012
		(0.019)		(0.020)		(0.023)	(0.033)		(0.019)	(0.013)
No news is good news					$\theta_{1,\tau}$			$\theta_{1,\tau}$		
$\dot{\tau}_t$					0.032***			0.029***		
					(0.011)			(0.010)		
Observations	2555		2555		2555			2555		
Adjusted R^2	0.274		0.277		0.287			0.289		

Notes: We set $k = 10$ minutes. Column (1) reports the results of estimating (16) while imposing the sensitivity to be the same across announcements with $\boldsymbol{\gamma}'_X \mathbf{X}_t = \gamma_\tau \tilde{\tau}_t$. Column (2) reports the results for group-specific sensitivities as in equations (19)-(20). Column (3), we report results of estimating (21) using $f_g(\mathbf{X}_t)$ as in equation (20). In the columns denoted by $\theta^+_{2,j}$, we report the coefficient estimates for good news, and in the columns denoted by $\theta^-_{2,j}$, we report the coefficient estimates for bad news. In Column (4), we report results of estimating (22) where we include squared terms only for good news of Retail Sales, Initial Jobless Claims, and New Family Houses Sold. In the column denoted by $\theta_{2,j}$, we report the coefficient estimates for the surprises, and in the column denoted by $\theta_{3,j}$, we report the coefficient estimates for the squared surprises. The estimation sample spans the period from January 2001 to December 2019. Numbers in parentheses are Newey-West standard errors. Notation: ***p < 0.01, **p < 0.05, *p < 0.1.

F.2 Extension to the European stock market

Motivated by Boehm and Kroner (2025) and Kerssenfischer and Schmeling (2024), who show that the European stock market responds strongly to U.S. macroeconomic announcements, we investigate whether our findings can be extended to this market. We repeat our analyses from Sections 4.2.2 to 4.2.4 using daily returns of the EURO STOXX 50, which is composed of 50 blue-chip stocks from eleven countries in the Eurozone. High-frequency return data for this index are available on TickData from 2003 onwards. Table A.13 presents estimates of equations (16), (19) and (21) using EURO STOXX 50 returns. Again, we find evidence in support of *predictions P1* to *P3*. For all announcements but CPI inflation, the response of the EURO STOXX 50 to U.S. macroeconomic announcements is sensitive to the level of the S&P 500's long-term volatility component. Our evidence is consistent with Boehm and Kroner (2025) who propose time variation in global risk-premia as an explanation for the global financial cycle.

Table A.13: Evidence for volatility feedback based on EURO STOXX 50 returns.

	Symmetry				***Asymmetry: Piece-wise linear***		
	(1)		(2)		(3)		
	γ_τ	$\theta_{2,j}$	$\gamma_{g,\tau}$	$\theta_{2,j}$	$\gamma_{g,\tau}$	$\theta^+_{2,j}$	$\theta^-_{2,j}$
$\tilde{\tau}_t$	1.377***						
	(0.206)						
Real Activity			1.209***		1.155***		
			(0.309)		(0.342)		
Initial Jobless Claims		0.060***		0.061***		0.039***	0.078***
		(0.007)		(0.007)		(0.012)	(0.012)
Nonfarm Payrolls		0.246***		0.251***		0.284***	0.231***
		(0.030)		(0.031)		(0.045)	(0.041)
Retail Sales		0.075*		0.078*		0.075***	0.091
		(0.044)		(0.043)		(0.017)	(0.084)
Investment & Consumption			2.028***		1.836***		
			(0.392)		(0.400)		
New Family Houses Sold		0.071***		0.075***		0.061***	0.096***
		(0.015)		(0.016)		(0.021)	(0.024)
Durable Goods Orders		0.098***		0.090***		0.046***	0.143***
		(0.014)		(0.015)		(0.015)	(0.022)
Manufacturers New Orders		0.040**		0.036**		0.006	0.074***
		(0.016)		(0.016)		(0.027)	(0.019)
Forward-looking			1.552***		1.440***		
			(0.346)		(0.378)		
Consumer Confidence		0.149***		0.147***		0.090***	0.219***
		(0.019)		(0.019)		(0.027)	(0.032)
Purchasing Managers Index		0.171***		0.167***		0.150***	0.189***
		(0.027)		(0.027)		(0.032)	(0.049)
Prices			-0.281		-0.081		
			(0.977)		(1.091)		
Consumer Price Index		0.052***		0.064***		0.042*	0.079***
		(0.019)		(0.019)		(0.025)	(0.027)
No news is good news					$\theta_{1,\tau}$		
$\dot{\tau}_t$					0.039***		
					(0.014)		
Observations		2459		2459		2459	
Adjusted R^2		0.213		0.214		0.226	

Notes: We set $k = 10$ minutes and use the demeaned long-term volatility component $\tilde{\tau}_t$ of the S&P 500 (as in the previous analysis). Column (1) presents non-linear least squares estimates as described in equation (16) using $f(\mathbf{X}_t)$ as in equation (18). Column (2) reports the results for group-specific sensitivities as in equations (19)-(20). In Column (3), we report results of estimating (21) using $f_g(\mathbf{X}_t)$ as in equation (20). EURO STOXX 50 data is available from TickData from July 2003 onwards. Numbers in parentheses are Newey-West standard errors. Notation: ***p < 0.01, **p < 0.05, *p < 0.1.

Appendix References

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