Monetary Policy and Firm-Level Uncertainty

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Abstract

Uncertainty at the firm-level falls on FOMC announcement days with substantial variation both across firms and over time. We find that this movement is not related to surprises about the expected path of the policy rate but rather to forward guidance driven changes in uncertainty around the expected path. The effect of this monetary policy uncertainty is attenuated for firms that have higher growth opportunities (as measured by Tobin's Q).

Keywords: Monetary policy transmission, firm level uncertainty

JEL codes: E52, E44, E43, E58

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1 Introduction

In the growing literature on the effects of uncertainty, an important component has been the focus on idiosyncratic uncertainty. Several studies have highlighted notable real effects of this firm-level uncertainty (see for example Leahy and Whited (1996), Bloom et al. (2007), Bachmann et al. (2013), Christiano et al. (2014), Bloom et al. (2018) and Ilut et al. (2018)). In this paper we study the role of monetary policy in affecting firm-level uncertainty.

We conduct our analysis using an event-study framework around Federal Open Market Committee (FOMC) announcement days. Firm-level uncertainty is measured with the option-based implied volatility (a proxy for conditional variance) of the firm's expected stock price. We first document that this measure of firm-level uncertainty falls substantially on FOMC announcement days. The size of the fall is roughly equal to one-third of a standard deviation of daily changes on all days. In addition to the average decline there is marked variation over FOMC days and also across firms.

In trying to understand the movement of asset prices on FOMC announcement days, the bulk of the literature studies how they respond to surprise changes in the expected path of the Federal Reserve's policy rate (Kuttner (2001) and Gürkaynak et al. (2005) are two prominent examples). But, we find that these commonly used first-moment measures of monetary shocks do not explain the movement in firm-level uncertainty. Instead, we show that firm-level uncertainty is driven by changes in uncertainty around the expected path of the future policy rate. Monetary policy uncertainty is measured from option prices on Eurodollar futures following Bauer et al. (2021), who show that it is driven by specific forward guidance language used by the FOMC. Our results thus highlight a novel dimension of the monetary transmission mechanism working through uncertainty effects at the firm level.

The literature has documented a relationship between monetary policy and aggregate uncertainty, including on FOMC announcement days.[1] This raises a natural question: How

[1]For example see Bekaert et al. (2013) and the recent work of Bauer et al. (2021) which shows that monetary policy uncertainty is an important component driving aggregate uncertainty on FOMC announcement days.

much of the effect of monetary policy on firm-level uncertainty works through the aggregate channel? Using the VIX index (which measures the implied volatility of the broad S&P 500 index) we find that about half of the effect of monetary policy on firm-level uncertainty works through the VIX. The remaining half of the effect highlights the importance of idiosyncratic uncertainty and suggests a potential role of heterogeneity in the transmission. To explore the role for heterogeneity, we use a wide variety of firm-specific observables including, among others, leverage, sales growth, asset size and liquidity. The interaction of monetary policy uncertainty with Tobin's Q stands out. This is measured as the market value of assets divided by the book value of assets and is intended to capture higher growth opportunities. We find that firms with higher Tobin's Q see their uncertainty response attenuated. It is well known that Tobin's Q is directly related to firm-level investment and also is important in driving the investment response to uncertainty shocks, see for example Leahy and Whited (1996). Our results show that Tobin's Q also matters for how uncertainty at the firm level responds to monetary policy actions.

In addition to the papers on firm-level uncertainty mentioned above, our paper is related to two different strands of the literature. In recent work, several papers have used option-implied firm-level uncertainty, especially in relation to monetary policy. Lakdawala and Moreland (2021) show that leading up to FOMC announcements, firms with high leverage had lower uncertainty before the financial crisis but higher uncertainty since then. Kroner (2021) shows that firms with higher uncertainty respond differently to forward guidance shocks. Ai et al. (2022) and Du et al. (2018) use the movement in firm-level implied volatility leading up to FOMC announcements to predict stock price movements. Dew-Becker and Giglio (2020) study the relationship of cross-sectional uncertainty from options and aggregate economic activity. But none of these papers study how firm-level uncertainty responds to monetary policy announcements and actions, which is the focus of our paper.

Our paper is also related to the growing literature that studies monetary policy uncertainty and its transmission. Using option-based measures of uncertainty, Swanson (2006), Bauer et al.

(2021), De Pooter et al. (2021) and Bundick et al. (2019) study the transmission to domestic financial markets while Lakdawala et al. (2021) explore the transmission to international financial markets. A growing literature using alternative measures of monetary policy uncertainty also exists, for example Husted et al. (2020), Creal and Wu (2017), Martínez-García and Doehr (2021), Fasani et al. (2020) and Tillmann (2020). See Cascaldi-Garcia et al. (2020) for an overview of this literature.

2 Results

Our first result is to document a resolution of firm-level uncertainty on FOMC announcement days. Our measure of uncertainty is the implied volatility of the firm's stock price, which is a proxy for market-based conditional variance about the future stock price. For each firm on a given trading day, we calculate a trade-volume weighted average for the implied volatilities of a firm's equity options contracts set to mature within 15 to 45 days. This average acts as our baseline measure of a firm's daily implied volatility. We find similar results when we focus on shorter or longer maturities.

We regress the daily change in this firm-level implied volatility measure on an indicator variable for scheduled FOMC days and one for unscheduled FOMC announcement days. The constant from the regression represents the average change on all other days. As seen in Table 1 the average fall in uncertainty on scheduled FOMC days is -0.4 and strongly statistically significant. This is close to about a third of a standard deviation of the daily change in implied volatility on all days, as shown in Table A.1 in the appendix. On unscheduled FOMC announcements average implied volatility actually goes up, but the effect is not statistically significant. Unscheduled FOMC days typically occur after stressful macro-financial events and thus it is not surprising that firm-level uncertainty goes up on these days.[2] On all other days the change in implied volatility is essentially zero. The above result is for all firms in our

[2]Relatedly, Lakdawala and Schaffer (2019) show that the "information effect" of FOMC announcements tends to be stronger on unscheduled FOMC days.

sample. To allay any concerns about the liquidity of option contracts, we also show the results for the Top 500 liquid firms. Specifically, this includes the 501 firms with a non-missing change in implied volatility for at least 143 of the 198 FOMC meetings during our sample period. All results are very similar for this smaller and more liquid sample of firms. Overall, there is a sizeable reduction in firm-level uncertainty on scheduled FOMC announcement days.

Table 1: Daily change in firm-level implied volatility

	All firms	Top 500 liquid firms
Scheduled FOMC days	-0.40***	-0.50***
	(0.081)	(0.080)
Unscheduled FOMC days	1.56	1.92
	(1.408)	(1.575)
All other days	0.00	0.01
	(0.019)	(0.018)
Observations	8,791,946	2,416,693
R-squared	0.000	0.000

This table shows the regression of daily change in firm-level uncertainty for scheduled FOMC announcements, unscheduled FOMC announcements and all other days from Jan-1996 to Dec-2019. Firm-level uncertainty is the firm-level implied volatility measured by weighting the implied volatility of each option contract (that expires within 15 to 45 days) by its trading volume on a given day. We discard the highest and lowest 1% of Δ ivol values for the full sample. The top 500 liquid firms includes the 501 firms with a non-missing Δ ivol for at least 143 of the 198 FOMC meetings during our sample period. Two-way clustered (by firm and day) standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

In addition to this average reduction in uncertainty there is substantial variation over time and across firms. The top panel of Appendix Figure A.1 shows both the average decline and the time-series movement around that average. Appendix Table A.1 documents the cross-sectional variation. Specifically, the standard deviation across firms is almost twice as large on FOMC days relative to all other days.[3] What is the specific role of monetary policy in driving these changes in firm-level uncertainty? To explore how uncertainty responds to FOMC actions and announcements we consider transmission through two measures of monetary policy shocks.

[3]This is for all firms in our sample. For the top 500 liquid firms it is ten times as large.

First, we use the change in the fed funds futures rate on FOMC announcement days as a first-moment monetary policy shock, as is commonly done in the literature on high-frequency event studies following the work of Kuttner (2001). Our baseline measure (*mps*) is the change in next month's fed funds futures contract (commonly known as MP2). We use this measure to best align with the maturity of the firm-level uncertainty measure. In the Appendix Table A.3 we show that our results are robust to using fed funds and Eurodollar futures of higher maturities to capture forward guidance shocks. There we also show that using higher frequency intra-day measures also gives very similar results.

Second, we use the recently developed measure of changes in monetary policy uncertainty in Bauer et al. (2021). This measure uses Eurodollar futures and options to construct the conditional standard deviation of the expected future short-rate. For our baseline results we use the daily change on FOMC announcement days in the 6-month ahead uncertainty measure, the lowest horizon measure available, but our results are similar if we use higher horizon measures. We label this *mpu*.

Table 2 shows the regressions with a specification in the first column that only includes *mps* as a regressor. Consistent with the finding in the literature that contractionary monetary surprises raise aggregate uncertainty, the effect of *mps* on firm-level uncertainty is positive, for example, see Bauer et al. (2021). But, the coefficient is not statistically significant. More importantly, the constant is still negative and of very similar magnitude to that shown in Table 1, meaning that the first-moment monetary policy shock does not explain the resolution of firm-level uncertainty.

The second column shows the specification with *mpu* added as a regressor. A decrease in monetary policy uncertainty lowers firm-level uncertainty with a strongly significant effect. A one standard deviation reduction in *mpu* lowers firm-level uncertainty by close to one-third standard deviations. This effect of *mpu* is close to the full average fall in firm-level implied volatility on FOMC days. The constant in this specification is statistically indistinguishable from zero for all firms.

Table 2: Regression of firm-level uncertainty on monetary shocks and VIX

	All firms			Top 500 liquid firms		
mps	4.88	1.46	2.71	5.26	1.49	2.72
	(4.567)	(3.277)	(1.935)	(4.716)	(3.532)	(2.103)
mpu		0.43***	0.22***		0.45***	0.24***
		(0.120)	(0.078)		(0.125)	(0.072)
ΔVIX			0.35***			0.37***
			(0.073)			(0.049)
Constant	-0.37***	-0.09	-0.06	-0.46***	-0.16**	-0.12**
	(0.078)	(0.083)	(0.058)	(0.080)	(0.081)	(0.056)
Observations	284,490	284,490	284,490	77,450	77,450	77,450
R-squared	0.048	0.051	0.057	0.011	0.018	0.031

This table shows the regression of firm-level uncertainty on *mps*, *mpu* and ΔVIX from Jan-1996 to Dec-2019. Firm-level uncertainty is the daily change in firm-level implied volatility measured by weighting the implied volatility of each option contract (that expires within 15 to 45 days) by its trading volume on a given day. Sample includes scheduled FOMC announcements only. We discard the highest and lowest 1% of Δ ivol values for the full sample. The top 500 liquid firms includes the 501 firms with a non-missing Δ ivol for at least 143 of the 198 FOMC meetings during our sample period. Two-way clustered (by firm and day) standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The third column adds the change in the VIX as a regressor. The VIX is the implied volatility for the S&P 500 index. Bauer et al. (2021) show that *mpu* has a substantial positive effect on the VIX on FOMC announcement days. Thus the third column will help us understand how much of the effect of *mpu* on firm-level uncertainty is working through the VIX. The coefficient on the change in VIX is positive and statistically significant as expected, implying that a rise in VIX is related to a rise in firm-level uncertainty. Importantly, when we add VIX, the coefficient on *mpu* falls by around 50%. This means that half of the effect of *mpu* works through affecting aggregate uncertainty about the market index. But the other half of the *mpu* effect is independent of the aggregate uncertainty and presumably related to idiosyncratic uncertainty at the firm-level.

Next, we explore if there is any heterogeneity in the firm-level uncertainty response to *mpu*. We consider a variety of firm-level characteristics available from the quarterly Compustat database. These are year-over-year real sales growth, firm size as measured by the log of the book value of assets, price-to-cost margin, receivables-minus-payables to sales, depreciation to assets, firm age, the log of quarterly market capitalization, the ratio of cash and cash equivalents to total assets, leverage as measured as debt to capital and Tobin's Q measured as the market value of assets divided by the book value of assets.[4] We interact each of these variables with *mpu*.[5] For the full sample of firms, Table 3 reports the resulting coefficients for *mps*, *mpu* and the interaction effects, omitting the stand-alone coefficients of the firm characteristics for space considerations. Table 3 shows the results for all firms while in Appendix Table A.2 we show that the results are very similar for the top 500 most liquid firms.

From all the firm characteristics we consider, Tobin's Q stands out as being the most relevant for the transmission of monetary policy uncertainty. A firm with a value of Tobin's Q one standard deviation above average has a one-twentieth standard deviation lower uncertainty response to *mpu* for the full sample of firms and a one-tenth standard deviation lower response

[4]Market value of assets is defined as the book value of assets plus the market value of common stock less the sum of the book value of common stock and deferred taxes.

[5]In unreported results we also interact them with *mps* and find no significant effect.

Table 3: Regression of firm-level uncertainty on monetary shocks with interactions

	All firms									
mps	1.93	2.00	2.02	1.92	1.99	1.97	2.05	2.28	1.82	2.19
	(3.217)	(3.261)	(3.263)	(3.260)	(3.196)	(3.194)	(3.269)	(3.100)	(3.243)	(2.838)
mpu	0.42***	0.41***	0.41***	0.42***	0.42***	0.41***	0.42***	0.41***	0.43***	0.42***
	(0.120)	(0.120)	(0.120)	(0.120)	(0.119)	(0.118)	(0.122)	(0.115)	(0.121)	(0.107)
sales x *mpu*	0.03									0.06*
	(0.034)									(0.035)
assets x *mpu*		0.07**								0.04
		(0.036)								(0.101)
liq x *mpu*			-0.06*							-0.01
			(0.033)							(0.040)
pcm x *mpu*				0.05						-0.00
				(0.036)						(0.069)
recpay x *mpu*					0.02					0.04
					(0.029)					(0.069)
dep x *mpu*						-0.03				-0.01
						(0.020)				(0.022)
mcap x *mpu*							0.03			-0.04
							(0.036)			(0.086)
tobQ x *mpu*								-0.07***		-0.05***
								(0.019)		(0.011)
lev x *mpu*									0.07**	0.05
									(0.028)	(0.028)
Constant	-0.11	-0.11	-0.10	-0.12	-0.11	-0.11	-0.10	-0.10	-0.10	-0.11
	(0.083)	(0.082)	(0.082)	(0.083)	(0.082)	(0.081)	(0.084)	(0.081)	(0.083)	(0.081)
Observations	174,292	187,463	187,381	184,597	180,496	173,082	187,094	155,552	175,900	125,974
R-squared	0.057	0.056	0.056	0.055	0.056	0.056	0.056	0.059	0.057	0.064

This table shows the regression of firm-level uncertainty on *mps*, *mpu* and the interactions of firm-level characteristics with *mpu* from Jan-1996 to Dec-2019. Firm-level uncertainty is the daily change in firm-level implied volatility measured by weighting the implied volatility of each option contract (that expires within 15 to 45 days) by its trading volume on a given day. Sample includes scheduled FOMC announcements only. We discard the highest and lowest 1% of Δ ivol values for the full sample. Two-way clustered (by firm and day) standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

for the top 500 most liquid firms. Tobin's Q is typically used in the literature as a proxy for firms that are profitable and have higher growth opportunities. In addition to the overall importance of Tobin's Q for firm-level investment, the literature has also discussed theories wherein Tobin's Q matters for the investment response to uncertainty shocks, see Leahy and Whited (1996) for a discussion. Our FOMC event-study results show that Tobin's Q also matters for the firm-level uncertainty response to monetary policy.

3 Conclusion

Firm-level uncertainty (as measured from options data) shows a marked average reduction on FOMC announcement days with variation across firms and over time. We show that this movement of firm-level uncertainty is directly tied to FOMC induced changes in uncertainty about the future short-term interest rate. Our results highlight this additional dimension of the monetary transmission that had been ignored in the literature so far. Finally we find that monetary policy uncertainty's impact on firm-level uncertainty is lower for firms that have higher values of Tobin's Q.

References

Ai, H., Han, L. J., Pan, X. N., and Xu, L. (2022). The cross section of the monetary policy announcement premium. *Journal of Financial Economics*, 143(1):247–276.

Bachmann, R., Elstner, S., and Sims, E. R. (2013). Uncertainty and economic activity: Evidence from business survey data. *American Economic Journal: Macroeconomics*, 5(2):217–49.

Bauer, M. D., Lakdawala, A. K., and Mueller, P. (2021). Market-Based Monetary Policy Uncertainty*. *The Economic Journal*. ueab086.

Bekaert, G., Hoerova, M., and Duca, M. L. (2013). Risk, uncertainty and monetary policy. *Journal of Monetary Economics*, 60(7):771–788.

Bloom, N., Bond, S., and Van Reenen, J. (2007). Uncertainty and investment dynamics. *The review of economic studies*, 74(2):391–415.

Bloom, N., Floetotto, M., Jaimovich, N., Saporta-Eksten, I., and Terry, S. J. (2018). Really uncertain business cycles. *Econometrica*, 86(3):1031–1065.

Bundick, B., Herriford, T., and Smith, A. (2019). Forward guidance, monetary policy uncertainty, and the term premium. *Monetary Policy Uncertainty, and the Term Premium (July 2017)*.

Cascaldi-Garcia, D., Sarisoy, C., Londono, J. M., Rogers, J. H., Datta, D., RT Ferreira, T., Grishchenko, O. V., Jahan-Parvar, M. R., Loria, F., Ma, S., et al. (2020). What is certain about uncertainty? *International Finance Discussion Paper*, (1294).

Christiano, L. J., Motto, R., and Rostagno, M. (2014). Risk shocks. *American Economic Review*, 104(1):27–65.

Creal, D. D. and Wu, J. C. (2017). Monetary policy uncertainty and economic fluctuations. *International Economic Review*, 58(4):1317–1354.

De Pooter, M., Favara, G., Modugno, M., and Wu, J. (2021). Monetary policy uncertainty and monetary policy surprises. *Journal of International Money and Finance*, 112:102323.

Dew-Becker, I. and Giglio, S. (2020). Cross-sectional uncertainty and the business cycle: evidence from 40 years of options data. Technical report, National Bureau of Economic Research.

Du, B., Fung, S., and Loveland, R. (2018). The informational role of options markets: Evidence from fomc announcements. *Journal of Banking & Finance*, 92:237–256.

Fasani, S., Mumtaz, H., Rossi, L., et al. (2020). Monetary policy uncertainty and firm dynamics.

Gürkaynak, R. S., Sack, B., and Swanson, E. T. (2005). Do actions speak louder than words? the response of asset prices to monetary policy actions and statements. *International Journal of Central Banking*.

Husted, L., Rogers, J., and Sun, B. (2020). Monetary policy uncertainty. *Journal of Monetary Economics*, 115:20–36.

Ilut, C., Kehrig, M., and Schneider, M. (2018). Slow to hire, quick to fire: Employment dynamics with asymmetric responses to news. *Journal of Political Economy*, 126(5):2011–2071.

Kroner, N. (2021). Firm-level uncertainty and the transmission of forward guidance to investment. *Available at SSRN 3931591*.

Kuttner, K. N. (2001). Monetary policy surprises and interest rates: Evidence from the fed funds futures market. *Journal of Monetary Economics*, 47(3):523–544.

Lakdawala, A. and Moreland, T. (2021). Monetary policy and firm heterogeneity: The role of leverage since the financial crisis. *Available at SSRN 3405420*.

Lakdawala, A., Moreland, T., and Schaffer, M. (2021). The international spillover effects of us monetary policy uncertainty. *Journal of International Economics*, 133:103525.

Lakdawala, A. and Schaffer, M. (2019). Federal reserve private information and the stock market. *Journal of Banking and Finance*, 106:34–49.

Leahy, J. V. and Whited, T. M. (1996). The effect of uncertainty on investment: some stylized trends. *Journal of Money, Credit & Banking*, 28(1):64–84.

Martínez-García, E. and Doehr, R. (2021). Monetary policy uncertainty and economic fluctuations at the zero lower bound. *Available at SSRN 3962462*.

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

Swanson, E. T. (2006). Have increases in federal reserve transparency improved private sector interest rate forecasts? *Journal of Money, Credit, and Banking*, 38(3):791–819.

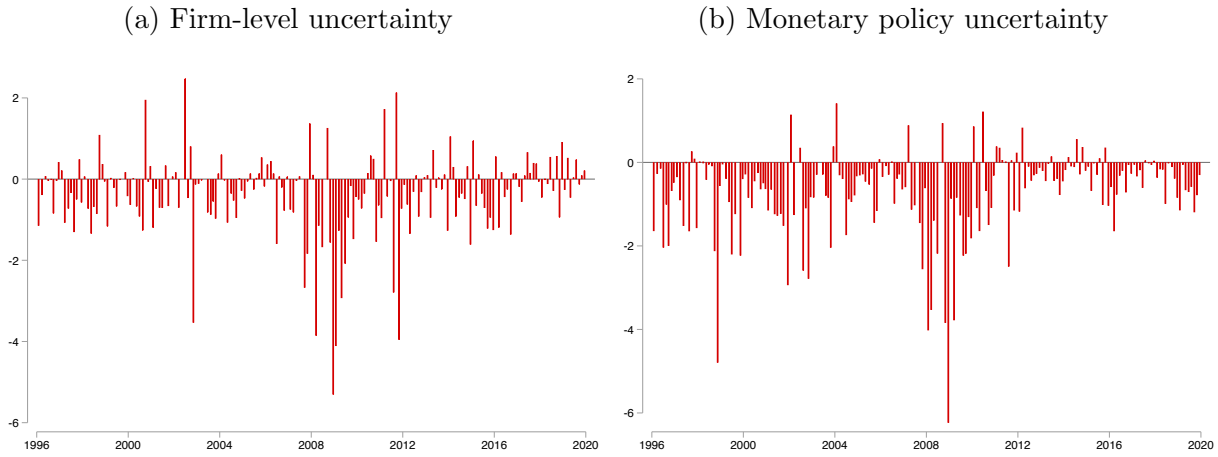
Tillmann, P. (2020). Monetary policy uncertainty and the response of the yield curve to policy shocks. *Journal of Money, Credit and Banking*, 52(4):803–833.

A.1 Appendix

A.1.1 Data details

Our measure of firm-level uncertainty comes from the OptionMetrics dataset. OptionMetrics reports a daily implied volatility for each option traded. Since a firm's equity can have more than one associated option contract, we aggregate to the firm level by weighting each option contract (that expires within 15 to 45 days) by its trading volume on a given day. We use this volume-weighted average of implied volatilities as our baseline measure. For monetary policy surprises our baseline measure is MP2 which is the change in the next month's fed funds futures contract data from CME. We also use alternative measures of monetary surprises based on fed funds and Eurodollar futures data from CME. Our baseline monetary policy uncertainty measure is the uncertainty about the 6 month ahead interest rate from Bauer et al. (2021). All firm characteristics data are from the quarterly Compustat database.

Figure A.1: Change on FOMC announcement days



Panel (a) plots the change in firm-level uncertainty (averaged across firms for each day) on FOMC announcement days. Panel (b) plots the change in our baseline monetary policy uncertainty measure.

Table A.1: Summary statistics

	Scheduled FOMC days				All other days			
	Mean	Standard deviation			Mean	Standard deviation		
		pooled	across firms	over time		pooled	across firms	over time
Δ ivol (all firms)	-0.40	7.54	4.95	1.01	0.01	7.35	2.32	1.32
Δ ivol (top 500 liquid firms)	-0.47	5.21	0.51	0.98	0.01	5.12	.04	1.27
mps	-0.01			0.04				
mpu	-0.73			1.02				
Δ vix	-0.53			1.65	0.01			1.61

The table shows the summary statistics for the sample from Jan-1996 to Dec-2019. Δ ivol is the daily change in firm-level implied volatility measured by weighting the implied volatility of each option contract (that expires within 15 to 45 days) by its trading volume on a given day. We discard the highest and lowest 1% of Δ ivol values for the full sample. The top 500 liquid firms includes the 501 firms with a non-missing Δ ivol for at least 143 of the 198 FOMC meetings during our sample period. Standard-deviation for these firm-level implied volatilities are constructed as follows: "pooled" pools together all firm-day observations, "over time" first averages across firms on a given day and then calculates standard-deviation over time and "across firms" first averages over time for a given firm and then calculates standard-deviation across firms. *mps* is the daily change in next month's fed funds futures contract (commonly known as MP2). *mpu* is the change in monetary policy uncertainty from Bauer et al. (2021). vix is the daily change in the CBOE volatility index based on options on the S&P 500 index.

Table A.2: Regression of firm-level uncertainty on monetary shocks with interactions

	Top 500 liquid firms									
mps	1.30	1.47	1.42	1.41	1.37	1.17	1.52	1.71	1.21	1.14
	(3.767)	(3.756)	(3.804)	(3.813)	(3.734)	(3.788)	(3.781)	(3.615)	(3.729)	(3.428)
mpu	0.44***	0.44***	0.43***	0.43***	0.43***	0.42***	0.43***	0.40***	0.43***	0.41***
	(0.127)	(0.131)	(0.131)	(0.132)	(0.130)	(0.128)	(0.133)	(0.118)	(0.132)	(0.111)
sales x *mpu*	0.00									0.04
	(0.046)									(0.042)
assets x *mpu*		0.15***								0.00
		(0.046)								(0.099)
liq x *mpu*			-0.06							0.08**
			(0.037)							(0.039)
pcm x *mpu*				0.14***						0.14***
				(0.017)						(0.028)
recpay x *mpu*					-0.00					0.01
					(0.044)					(0.063)
dep x *mpu*						-0.02				0.01
						(0.042)				(0.042)
mcap x *mpu*							0.10**			0.07
							(0.038)			(0.098)
tobQ x *mpu*								-0.12**		-0.22***
								(0.061)		(0.073)
lev x *mpu*									0.03	-0.01
									(0.038)	(0.032)
Constant	-0.17**	-0.18**	-0.18**	-0.18**	-0.18**	-0.18**	-0.18**	-0.19**	-0.17**	-0.20**
	(0.082)	(0.083)	(0.084)	(0.084)	(0.083)	(0.081)	(0.085)	(0.078)	(0.084)	(0.080)
Observations	56,812	58,982	58,939	58,735	57,303	54,654	58,944	44,491	56,000	37,863
R-squared	0.019	0.019	0.018	0.019	0.018	0.019	0.018	0.019	0.018	0.023

This table shows the regression of firm-level uncertainty on *mps*, *mpu* and the interactions of firm-level characteristics with *mpu* from Jan-1996 to Dec-2019. Firm-level uncertainty is the daily change in firm-level implied volatility measured by weighting the implied volatility of each option contract (that expires within 15 to 45 days) by its trading volume on a given day. Sample includes scheduled FOMC announcements only. We discard the highest and lowest 1% of Δ ivol values for the full sample. The top 500 liquid firms includes the 501 firms with a non-missing Δ ivol for at least 143 of the 198 FOMC meetings during our sample period. Two-way clustered (by firm and day) standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A.3: Regression of firm-level uncertainty on monetary shocks: Alternate *mps*

Panel A: All firms

	Intra-day monetary surprises			Daily monetary surprises		
	$mps = MP1$	$mps = FF4$	$mps = PC$	$mps = MP1$	$mps = FF4$	$mps = PC$
mpu	0.40***	0.40***	0.36***	0.43***	0.43***	0.43***
	(0.114)	(0.113)	(0.114)	(0.120)	(0.121)	(0.128)
mps	4.48	4.06	5.87**	2.53	1.45	0.98
	(2.898)	(3.149)	(2.779)	(3.776)	(3.310)	(3.042)
Constant	-0.12	-0.12	-0.13*	-0.09	-0.09	-0.09
	(0.080)	(0.079)	(0.076)	(0.083)	(0.084)	(0.084)
Observations	275,720	275,720	275,720	284,490	284,490	284,490
R-squared	0.052	0.052	0.053	0.051	0.051	0.051

Panel B: Top 500 liquid firms

	Intra-day monetary surprises			Daily monetary surprises		
	$mps = MP1$	$mps = FF4$	$mps = PC$	$mps = MP1$	$mps = FF4$	$mps = PC$
mpu	0.40***	0.41***	0.37***	0.44***	0.45***	0.47***
	(0.117)	(0.117)	(0.118)	(0.124)	(0.126)	(0.130)
mps	5.30*	4.29	5.87**	3.28	1.28	0.18
	(2.864)	(3.083)	(2.727)	(3.978)	(3.527)	(3.147)
Constant	-0.19**	-0.18**	-0.20***	-0.17**	-0.16*	-0.16*
	(0.077)	(0.077)	(0.075)	(0.081)	(0.082)	(0.083)
Observations	75,719	75,719	75,719	77,450	77,450	77,450
R-squared	0.019	0.019	0.019	0.018	0.018	0.018

This table shows the regression of firm-level uncertainty on *mps* and *mpu* from Jan-1996 to Dec-2019. The three different measures of *mps* are i)current month fed funds futures (MP1), ii)three month ahead fed funds futures (FF4) and iii)first prinicipal component following Nakamura and Steinsson (2018) each constructed with daily and intra-day (30 minute) windows. Firm-level uncertainty is the daily change in firm-level implied volatility measured by weighting the implied volatility of each option contract (that expires within 15 to 45 days) by its trading volume on a given day. Sample includes scheduled FOMC announcements only. We discard the highest and lowest 1% of Δ ivol values for the full sample. The top 500 liquid firms includes the 501 firms with a non-missing Δ ivol for at least 143 of the 198 FOMC meetings during our sample period. Two-way clustered (by firm and day) standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$