Monetary Policy and Mergers and Acquisitions*

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Abstract

We analyse the effect of monetary policy on mergers and acquisitions (M&A) activity using transaction and balance sheet data of publicly listed U.S. companies. We confirm the predictions of a stylised model with frictional financial markets by showing that contractionary monetary policy significantly decreases M&A activity, especially for financially constrained firms. We furthermore investigate the effect of monetary policy on deal quality, measured as the acquiring firm's abnormal stock returns. We find that contractionary monetary policy reduces beneficial capital reallocation by reducing M&A activity, but the marginal transaction is of higher quality as fewer financially constrained firms engage in M&A.

JEL Classification: E44, E52, G34

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1. Introduction

In this paper we study the effect of monetary policy on mergers & acquisition (M&A) activity of U.S. firms. Previous work on the transmission of monetary policy to firm investment typically investigates the effect of monetary policy on firms' direct tangible capital expenditure, e.g., investment in machinery or buildings. Besides regular capital expenditure, however, M&A constitutes a key instrument through which firms adjust their productive capacities. Also from an aggregate perspective, M&A activity is not merely a redistribution of ownership rights but significantly shapes the capital allocation across firms and influences aggregate economic outcomes (David, 2021).[1] Despite the importance of this activity, however, its connection to monetary policy is not yet well understood. The objective of this paper is, therefore, to examine how monetary policy affects M&A activity and the quality of the resulting capital reallocation across firms.

Our main finding is that contractionary monetary policy significantly dampens M&A activity. This effect is particularly pronounced for financially constrained firms, which is consistent with the credit channel of monetary policy transmission. However, while increasing interest rates lead to fewer transactions, transactions that still take place are perceived by financial markets to be of higher quality as measured by the acquiring firm's cumulative abnormal return (CAR). This is due to a change in the composition of firms that engage in M&A following an increase in the interest rate. Increasing borrowing costs leave only less financially constrained firms in the position to stem a M&A transaction. Those firms are also likely to have better post-merger growth prospects so that their transactions and the resulting capital re-allocation are judged more favourably.

To study the impact of monetary policy on M&A activity, we use aggregate as well as detailed firm- and transaction-level micro data and exploit high-frequency identified monetary policy shocks to isolate exogenous changes in the central bank policy rate. We build a stylised model of a firm's M&A decision to inform our empirical analysis of firms' M&A activity at the micro level. More specifically, we proceed in four steps.

We begin our empirical analysis by investigating how aggregate M&A activity responds to a monetary policy shock. We estimate a Bayesian proxy structural vector autoregression (BP-SVAR) model using high frequency identified monetary policy surprises as external instrument for the interest rate. We find that a contractionary monetary policy shock persistently lowers both the aggregate number of deals as well as the overall deal value: A one

[1]For example, with 850 billion US dollar (USD) worth of transactions, buy-side M&A activity of U.S. public firms was equivalent to around 8% of total U.S. private non-residential fixed investment and around 88% of total capital reallocation in 2018 (Data are from Thomson Reuters SDC Platinum, Bureau of Economic Analysis, and Andrea Eisfeld's website for capital reallocation).

percentage point increase in the 1-year treasury rate decreases the total number of deals by up 19% while the total value of deals decreases by up to 28%. This effects are highly persistent and robust across different specifications of the model.

In a second step, we study a model in which firms optimally choose their M&A policy to better understand the cross-sectional effects underlying our aggregate results. In this model, a potential acquirer chooses whether or not to engage in a M&A transaction upon meeting a target firm. Potential acquirers are heterogeneous in their initial financial position and use internal and external funds to finance the transaction, subject to a borrowing constraint. The model yields two key predictions: (i) the probability of a given firm initiating a M&A transaction is decreasing in the interest rate and (ii) this effect is stronger for relatively more financially constrained firms.

In a third step, we test these predictions by combining detailed transaction-level M&A data with balance sheet data for U.S. publicly listed companies. To study firms' discrete choice to engage in an M&A transaction in response to changes in the monetary policy stance, we estimate a linear probability model. Consistent with the aggregate evidence, we find that a one percentage point increase in the 1-year treasury rate decreases the likelihood of a given firm to initiate a M&A transaction in a given year by 1 percentage point – a 5.5% decrease relative to the unconditional transaction likelihood. This estimate is likely to be a lower bound since the effect of monetary policy on M&A activity extends far above the 1 year horizon as we document using local projections. Interacting the interest rate with different measures of financial constraints, we, furthermore, show that constrained firms react significantly stronger than unconstrained firms, confirming the predictions of our model.

In a fourth and last step, we investigate how the quality of the realised M&A transactions varies with the monetary policy stance. We compute the acquiring firms' CARs around the announcement of a successful M&A transaction, i.e. the value generated by the transaction for the owners of the acquiring firm, as a market-based measure of the transaction quality. We find that M&A announcements are generally associated with substantial positive abnormal returns for the acquiring firm.[2] That is, capital markets perceive that the combined firm will operate more efficiently under the new ownership (by generating synergies or reallocating capital to more productive firms), thus generating net wealth for the owners of the acquiring firm. A contractionary monetary policy stance is associated with *higher* cumulative abnormal returns. This effect, however, disappears when controlling for individual acquirer characteristics, implying, consistent with the evidence from the credit channel, that monetary policy affects the average deal quality by changing the composition of acquiring firms: as fewer financially constrained firms are able to engage in M&A in a

[2] This is consistent, amongst others, with Alexandridis et al. (2017).

high interest rate environment, the average transaction conducted in such environment is perceived more positively. Overall, this suggests that, on average, contractionary monetary policy hampers the amount of reallocation of capital to more productive firms but increases its average quality.

Literature. Our paper contributes to the literature in several ways. Most importantly, we extend the literature on the firm-level investment response to monetary policy by focusing on M&A activity as a novel channel through which firms expand their productive capacities that has previously not received much attention. Previous work in this literature has emphasized the importance of financial constraints in shaping firms' responsiveness to monetary policy (Gertler and Gilchrist, 1994; Cloyne et al., 2018; Ottonello and Winberry, 2020; Jeenas, 2018; Drechsel, 2022). We show that financial constraints matter also for firms' M&A decisions in response to monetary policy and provide suggestive evidence that in response to monetary policy, financial frictions lead to a change in the composition of firms engaging in M&A, affecting the average quality of transactions and their ensuing capital reallocation.

A paper closely related to ours is Adra et al. (2020) which investigates the effect of monetary policy on a variety of M&A outcomes. Contrary to their focus on the outcome of transactions, we study explicitly the firm's M&A decision and use high-frequency changes of interest rate futures measured within a narrow window around monetary policy announcements to identify unexpected movements in the interest rate.

More generally, our paper is also related to the literature studying the state-dependence of firms' M&A decisions. Firms engage in M&A activity for a variety of reasons, such as value creation (e.g., by achieving higher market power, business diversification, lower cost/higher efficiency, or economies of scope), managerial self-interest, or idiosyncratic firm factors like acquisition experience or strategic orientation.[3] These decisions, however, are not taken in isolation but are influenced by both firm-specific circumstances and the macroeconomic environment. To that end, the literature has so far provided evidence that M&A activity is, on the one hand, related to bidder and target valuations (e.g., Shleifer and Vishny, 2003), corporate liquidity (e.g., Almeida et al., 2011) or risk management considerations (e.g., Garfinkel and Hankins, 2011), and, on the other hand, to the macroeconomic environment, i.e. the state of the business cycle (e.g., Maksimovic and Phillips, 2001) or economic (policy) uncertainty (e.g., Bonaime et al., 2018). We focus on the role of monetary policy through its effect on borrowing costs while controlling for these different idiosyncratic M&A motives and aggregate facilitators in our analysis.

[3] See Haleblian et al. (2009) for an extensive survey of M&A motives.

Outline. The remainder of the paper is structured as follows: Section 2 describes the data used in our analyses. Section 3 presents the empirical approach and the results of our aggregate analysis. Section 4 proposes a stylised model of a firm's M&A decision. Section 5 and 6 discuss the approach and results of our firm-level and deal-level analysis, respectively. Section 7 concludes.

2. Data

2.1. Mergers and Acquisitions Data

Our data on M&A transactions are from Refinitiv's Financial Securities Data Company (SDC) and cover M&A transactions of both private and public firms over the period from 1982M1 to 2019M11. Following previous literature, e.g. Bonaime et al. (2018) and Antón et al. (2022), we only consider completed M&A transactions with a value of at least \$1 million USD, in which the acquirer owned less than 50% of the target's shares six months prior to the transaction and owns 90% or more of the shares after the deal is completed.

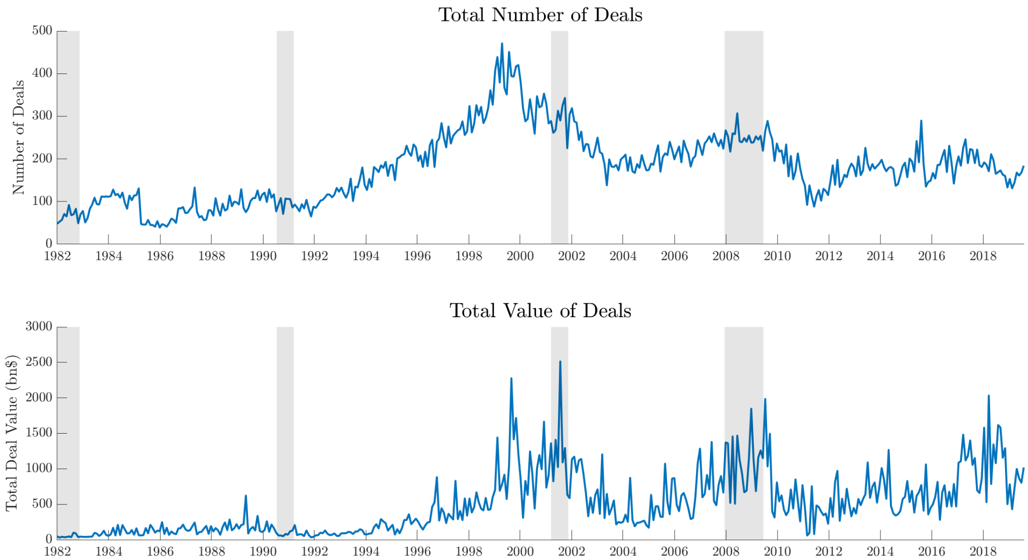
Throughout, we focus on the acquirer's perspective because we can construct the acquisition decision of the universe of public U.S. firms by combining the M&A transaction data with firm balance-sheet information from the Compustat North America database. We do not account for target characteristics since this would either require balance-sheet data on every company worldwide, as this is the universe of potential targets, or introduce severe sample selection by limiting the analysis to transactions among Compustat firms. The latter would then not accurately reflect a firm's M&A decision.

Table 1: Summary Statistics: M&A Activity

	Number of deals	Tot deal value(tn \$)	Avg deal size(mil \$)	Med deal size(mil \$)
Panel A: SDC Sample				
All Deals	198,463	46.77	235.66	23.70
U.S. Acquirer	77,357	22.98	297.02	32.40
Panel B: SDC sample merged with Compustat				
U.S. Public Acquirer	35,578	18.22	333.00	33.50

Note: Statistics calculated on the sample of M&A transactions obtained from SDC following the selection criteria outlined above. The sample spans 1982M1:2019M11. We exclude share buybacks and recapitalisations. U.S. Acquirer refers to companies whose ultimate parent is located in the U.S.

Table 1 presents summary statistics for the full sample of deals obtained from SDC and the sample of deals available after merging the SDC M&A data with firm-level information



Note: This figure depicts the aggregate deal volume (top panel) and value (bottom panel) of acquisitions conducted by US-based companies. Shaded areas indicate U.S. recessions.

Figure 1: M&A Activity by U.S. Acquirers

obtained from Compustat. Public and private U.S.-based acquirers account for approximately 40% of all deals reported in SDC and approximately 50% of aggregate deal value. We are able to match approximately half of all deals involving an U.S. based acquirer with firm-level information from Compustat, both in terms of the number of deals and their total value. In all samples, the distribution of transaction values is skewed, with the mean transaction value significantly above the median transaction volume. The great deal of right-skewness in the distribution of transaction values shows that the majority of deals are small with some very large outliers. Figure 1 depicts the evolution of both the total number of transactions as well as their total deal value over the sample period.

2.2. Firm-level Data

For the firm-level analysis, we use balance-sheet information on the universe of U.S. public firms from the Compustat database. Compustat offers distinct advantages over other firm-level data sources that are important for our study. First, it is available quarterly, a frequency high enough to study monetary policy. Second, it is a long panel, allowing us to use within-firm variation. And third, it contains a rich set of balance-sheet and income-statement information which allows us to construct our key variables of interest. The main disadvantage of Compustat is that it offers balance sheet information on publicly listed companies only. Hence, it excludes private companies which could be subject to more severe financial frictions.

The results of our paper, therefore, likely represent a lower bound with respect to the overall set of U.S. firms.

We use the (historic) Committee on Uniform Security Identification Procedures (CUSIP) code of the ultimate parent of each acquirer in our SDC sample to match it with the Compustat database. We use WorldScope information (accessed via Datastream) about the firm's foundation date (and, if that is missing, firm incorporation date) to compute firm age and merge it with our remaining data using the CUSIP identifier.

We impose the following set of sample restrictions: 1) we drop all firms with fewer than 20 consecutive quarters of reported data; 2) we drop erroneous firm-quarter observations such as negative assets; 3) we drop observations for which the leverage ratio is negative; 4) we drop observations for which the net-liquidity ratio is smaller than -10 or bigger than 10; 5) for all control variables we trim the 1% on the top of their respective distribution (by year); 6) all variables in levels such as assets are deflated using the CPI; 7) we follow others in the literature (e.g. Cloyne et al., 2018) and linearly interpolate single missing values. Appendix A presents the definitions of all variables used in the firm-level regressions and their respective summary statistics.

2.3. Deal Data

We obtain the acquirer cumulative abnormal returns (CAR) around our sample of transactions by submitting the historic CUSIP of each transaction's acquiring firm, along with the announcement date, to WRDS' event study tool. CARs are computed between one day prior and one day after the announcement date. As a robustness check we also consider a window of 2 days before and after the announcement day. As in Adra et al. (2020) or Antón et al. (2022), the abnormal returns are calculated relative to the return predicted by the Fama-French three-factor model, whose parameters are estimated on a 100-day window that ends 50 days before the event window to rule out any bias from insider activity (we consider alternative models as robustness checks). See Table A.3 in Appendix A for the summary statistics of cumulative abnormal returns matched to our set of M&A transaction announcement dates.

2.4. Monetary Policy Surprises and Identification

Estimating the dynamic causal effects of monetary policy on any economic outcome variable is subject to the potential reverse causality problem that monetary policy affects the economy but the economy also determines the monetary policy stance. To estimate the causal effect of monetary policy on M&A activity, therefore, we need to consider a change in the interest rate that is exogenous to both aggregate and firm-level M&A activity as well as any other macroeconomic factors that could cause interest rates to move. To identify such an exogenous impulse, we rely on the external instruments approach of Mertens and Ravn (2013) and Stock and Watson (2018). As an external instrument we use the monetary policy surprises of Gurkaynak et al. (2005), consisting of changes in the three-month-ahead Fed funds futures contracts recorded in a 30-minute window around the Federal Open Market Committee's (FOMC) monetary policy announcements. The identifying assumption is, hence, that within this narrow time window, no events other than the respective FOMC announcement occur that could affect private sector interest rate expectations. Variations of such high-frequency surprises have been used widely – either directly or as external instruments – to study the effects of monetary policy both in the aggregate, e.g., Gertler and Karadi (2015), Nakamura and Steinsson (2018), or Jarociński and Karadi (2020), and on the firm level, e.g. Ottonello and Winberry (2020), Cloyne et al. (2018), Jeenas (2018), or Gorodnichenko and Weber (2016), amongst many others. Following the convention in the literature, we sum up all surprises within a month (quarter) to obtain a monthly (quarterly) series. Figure A.1a in Appendix A plots the resulting quarterly shock series.

As is common in the literature (e.g. Gertler and Karadi, 2015), we use these monetary policy shock series as instruments for the 1-year Treasury rate throughout our empirical analysis. We use the 1-year Treasury rate instead of the Federal Funds rate as our measure of the monetary policy stance to better capture interest rate movements during the times of the zero lower bound. Moreover, as argued by Döttling and Ratnovski (2022), the 1-year Treasury rate captures interest variations during times of unconventional monetary policy better than the Federal Funds rate due to its longer maturity.

Recent studies suggest the presence of an information effect in the monetary policy surprises identified using high-frequency movements in interest rates around monetary policy announcements (e.g. Nakamura and Steinsson, 2018; Miranda-Agrippino and Ricco, 2021). That is, the movement of interest rates around monetary policy announcements might not be driven by the interest rate decision alone but also by a change in market participants' perceptions of economic conditions induced by the central bank's communication. As a robustness check, we, therefore, also consider the shock series of Miranda-Agrippino and Ricco (2021) which separates the potential information effect from the effect of the actual policy rate change in the series of monetary policy surprises.

3. Macro Evidence

In this section, we present our macroeconomic analysis of the relationship between monetary policy and aggregate M&A activity. We focus on the response of both the aggregate *number* and *value* of M&A transactions, where the aggregate *number* of transactions refers to the total number of transactions recorded in SDC in a given month and the aggregate *value* refers to the sum of those transactions' individual values. We initially consider both private and public firms that are either based in the U.S. themselves or whose ultimate parent is based in the U.S. In Appendix B.2.1 we show that the results are unaffected by excluding non-publicly traded firms.

3.1. Empirical Specification

To analyse the effect of monetary policy on M&A activity we estimate a Bayesian proxy-SVAR (BP-SVAR) with monthly data as in Miranda-Agrippino and Ricco (2021). In reduced form, we can write the model as

$$\mathbf{y}_t = \mathbf{c} + \sum_{l=1}^{p} \mathbf{A}_l \mathbf{y}_{t-l} + \mathbf{u}_t$$

where u_t are the reduced-form error terms with zero mean and covariance matrix $\mathbf{\Sigma}$. Stacking the regressors into a single matrix, this can be written as $\mathbf{Y} = \mathbf{XB} + \mathbf{u}$. Following Miranda-Agrippino and Ricco (2021) and Giannone et al. (2015), we employ a standard Minnesota prior with optimal hyperparameter selection. The prior and posterior distributions are discussed in more detail in Appendix B.

The vector y_t includes either the log of the monthly aggregate (inflation-adjusted) deal value or the total number of deals. To adequately characterise monetary policy decisions we include the 1-year Treasury rate as monetary policy rate, the log level of industrial production (IP), and the log consumer price index (CPI), both obtained from the St. Louis Federal Reserve Bank's FRED database. As discussed before, we use the 1-year Treasury rate instead of the Federal Funds rate to circumvent the problems created by the zero lower bound and to better capture the effects of unconventional monetary policy. To capture the likely transmission channels as identified in the literature, we furthermore include the excess bond premium (EBP) of Favara et al. (2016) as measure of credit market sentiment and Robert Shiller's adjusted price-earnings ratio (CAPE) of the S&P500 as a measure of market valuation. The vector of endogenous variables is, therefore, given by r

$$y_t = [\text{1y-Treasury rate}_t, ln(IP_t), ln(CPI_t), EBP_t, CAPE_t, ln(MA_t)]'$$

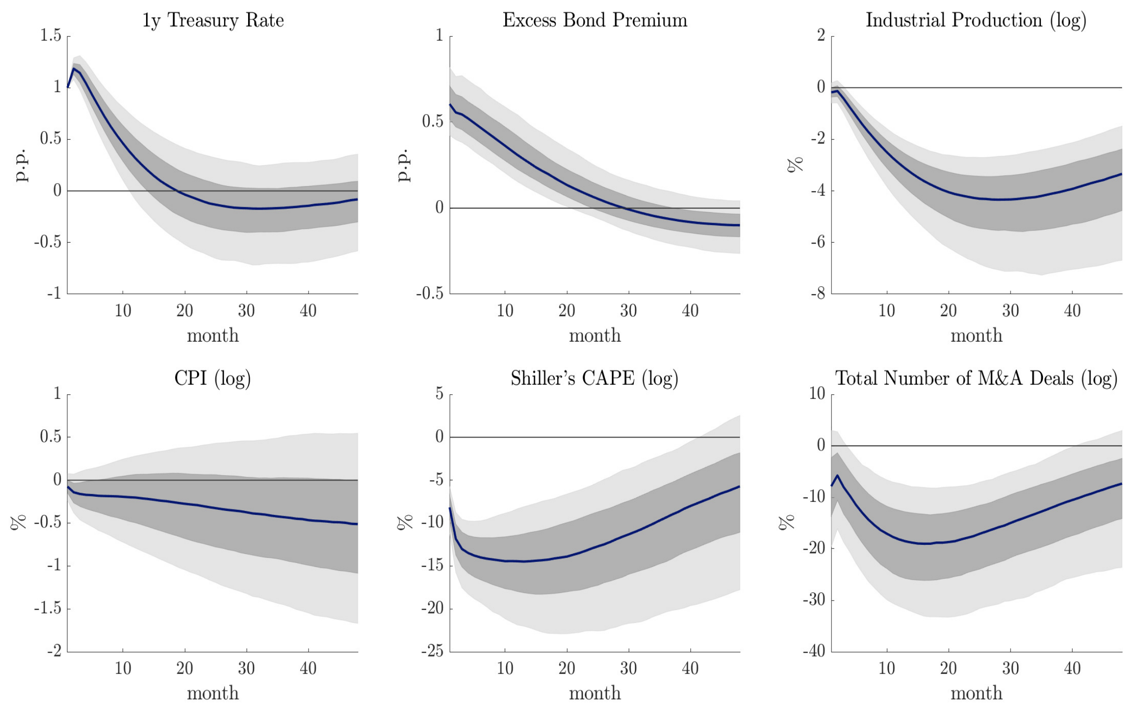
where MA_t represents either the aggregate number or the aggregate value of M&A deals. Our main specification includes $p = 2$ lags, as suggested by the BIC. In Appendix B.2.3, we consider $p = 3$ lags, as suggested by the AIC. We estimate the BP-SVAR residuals on the full sample from 1982M1 to 2019M11 but execute the proxy identification on the residuals from 1990M2 to 2019M11, matching the availability of the instrument. In using partial instrumentation, we follow the standard in the literature as, for example, in Gertler and Karadi (2015) and Cloyne et al. (2018).

3.2. *Main Results*

Figures 2 and 3 present the estimated impulse response functions of our BP-SVAR for the aggregate deal volume and total deal value, respectively.[4] Both the aggregate deal volume and aggregate deal value decrease significantly in response to the contractionary surprise, with a bottom approximately 18 months after the surprise. With a maximum drop of -19%, the total number of M&A transaction decreases less than the total value of M&A transactions, which decreases by up to 28%. In both cases the effect is very persistent and levels off only towards the end of the forecast horizon. The remaining variables respond as expected. A contractionary monetary policy surprise increases the 1-year Treasury rate, worsens funding conditions, and depresses industrial output, the price level, and firm valuations.[5]

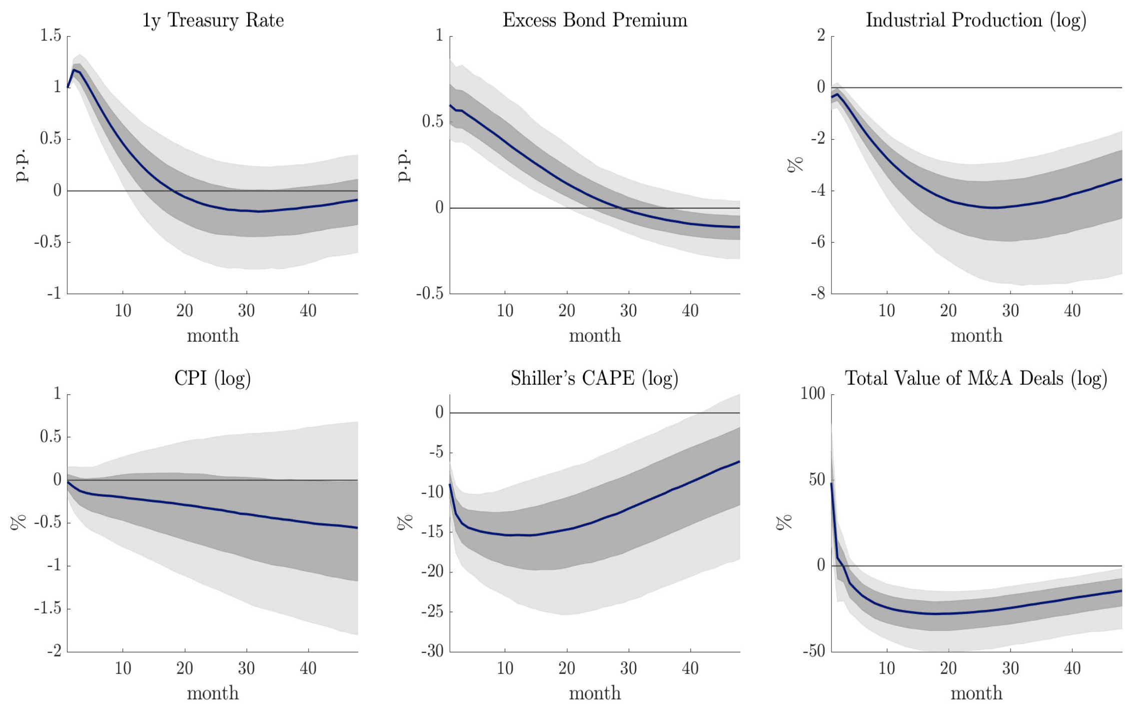
[4]The first-stage regression statistics for the VAR with aggregate deal volume (value) are: $F = 22.52\,(19.86)$; Robust $F = 11.71\,(10.38)$; $R^2 = 6.63\%\,(5.89\%)$; adj. $R^2 = 6.34\%\,(5.60\%)$.

[5]Shiller's CAPE is based on dividing the current month's real stock price by the average inflation-adjusted earnings from the previous 10 years up until the previous month. Therefore, the initial response in particular is driven exclusively by valuations and not by earnings.



Note: Light (dark) grey shaded areas indicate 95% (68%) posterior credible sets obtained by taking 5,000 draws from the posterior distribution.

Figure 2: Response of Aggregate Deal Volume to a Monetary Policy Surprise



Note: Light (dark) grey shaded areas indicate 95% (68%) posterior credible sets obtained by taking 5,000 draws from the posterior distribution.

Figure 3: Response of Aggregate Deal Value to a Monetary Policy Surprise

3.3. *Robustness*

As a robustness check we test whether our results are sensitive to (i) considering only transactions completed by *public* U.S. acquirers (to match our firm-level evidence), (ii) not imposing any prior on the estimation and constructing confidence bands using the delta method instead, i.e. estimating a standard frequentist VAR, and (iii) selecting a lag length of 3 as suggested by the AIC (instead of 2 as suggested by the BIC). The respective IRFs are plotted in Appendices B.2.1 - B.2.3. The results are very similar to our baseline results. In fact, the response of the total number of M&A deals is slightly stronger when we consider only transactions conducted by U.S. public firms or do not impose any Bayesian prior. Extending the lag length, on the other hand, mutes the response somewhat, but it remains highly significant. The response of the total value of M&A deals is somewhat less persistent in the frequentist VAR but remains large and significant. In the other two specifications, the response of the total value of M&A deals is largely unaltered.

4. A Stylised Model of the Firm's M&A Decision

In this section, we lay out a stylised two-period model to illustrate the effect of interest rates on firms' M&A decisions. The goal of the model is to highlight the main mechanism that drives the findings of our aggregate analysis and to derive empirically testable predictions for the firm-level analysis.

Environment. We consider an economy that lasts for two periods, $t = 0, 1$. The economy is populated by a mass of risk-neutral potential acquiring firms indexed by A. The acquiring firms are exogenously presented with the possibility to acquire a potential target firm T. We assume that the potential target firms T do not have the possibility to acquire. Both types of firms, $i = A, T$, produce an output $y_{i,t}$ using a linear production technology that combines capital $k_{i,t}$ and productivity z_i:

$$y_{i,t} = z_i k_{i,t} \qquad \forall i = A, T \tag{1}$$

Potential acquirers and targets discount future profits at rate $\beta_A(r)$ and $\beta_T(r)$, respectively. For both, $i = A, T$, we assume that $\beta_i(r) = \gamma_i \frac{1}{1+r}$ and $\gamma_i < 1$, i.e. we assume that both firms' discount factors respond proportionally to an exogenous fixed real interest rate r but that both firms are more impatient than the financial market (in the spirit of, e.g., Kiyotaki and Moore, 1997).[6] In period 0, acquirers make a M&A decision, $\mathbb{I}^{M\&A} \in \{0, 1\}$, and borrow

[6] The assumption that potential acquirers are more impatient than the financial market pins down the

external funds $b_{A,1}$ at rate r to maximise discounted shareholder dividends.

Mergers and Acquisitions. We are interested in the acquiring firm's decision whether or not to make a takeover bid for the target in $t = 0$, i.e. the acquiring firm's M&A decision conditional on having matched a target firm. As in Jovanovic and Rousseau (2002), we assume that in the event of a merger, the capital stocks of the two firms are combined additively and enter production using the acquirer's productivity, z_A.[7] We assume that the benefits of a merger accrue only with a one-period delay.[8] The acquirer's production output in period $t = 1$ is, hence, given by

$$y_{A,1} = z_A k_{A,1} = z_A(k_{A,0} + \mathbb{I}^{M\&A} k_{T,0}) \tag{2}$$

Recall that the target firm does not have the possibility to acquire and, hence, to grow its capital stock. Therefore, the target's capital stock and production output are constant over time, $y_{T,1} = z_T k_{T,1} = z_T k_{T,0} = y_{T,0}$.

To acquire the target, the acquiring firm makes a "take-it-or-leave-it" offer just high enough to make the target firm indifferent between accepting the acquisition and continuing as a stand-alone entity. Since the time-0 profits of the target firm still accrue to its original owners, the stand-alone value of the target is equal to its discounted period-1 profits. The target price is, therefore, given by

$$p_T = \beta_T(r) z_T k_{T,1} = \beta_T(r) z_T k_{T,0} \tag{3}$$

Finally, we assume that the capital stock does not depreciate over time and that M&A transactions are the only way for a potentially acquiring firm to grow.

Firm problem. Acquiring firms make their M&A and borrowing decisions in order to maximise discounted shareholder dividends. We assume that the acquirer enters the initial period with a stock of legacy debt $b_{A,0}$. The acquirer's dividends in period $t = 0$ are, hence, determined by a balance sheet constraint and can be written as

$$d_{A,0} = z_A k_{A,0} - (1 + r) b_{A,0} + b_{A,1} - \mathbb{I}^{M\&A} p_T \tag{4}$$

firms' debt choice. The model can be extended to the case $\gamma_A = 1$ but this would complicate the analysis because the debt policy would not be unique.

[7] The model can be extended to the case where the productivity of the two firms is combined using a more general function $f(z_A, z_T)$ which incorporates scale-effects or other synergies. However, this would not meaningfully change the main results of the model.

[8] We think of this assumption as reflecting the post-merger integration process until the merged firm operates fully at its new scale.

where $b_{A,1}$ is the stock of debt chosen for next period. We assume that firms cannot raise new equity, i.e. dividends cannot be negative. The acquirer's dividends in period $t = 1$ depend on its M&A decision in period $t = 0$ and can be summarised as follows:[9]

$$d_{A,1} = z_A k_{A,1} - (1+r) b_{A,1} = z_A (k_{A,0} + \mathbb{I}^{M\&A} k_{T,0}) - (1+r) b_{A,1} \tag{5}$$

We assume that the acquirer's borrowing choice is constrained as follows

$$b_{A,1} \in [0, \frac{\theta}{1+r} z_A k_{A,1}] \tag{6}$$

where $\theta \leq 1$ denotes the tightness of the borrowing constraint. Hence, a firm can only commit to repay a fraction θ of its future output, which includes the proceeds of any eventual merger (see Equation (2)). That is, the acquiring firm can also pledge a share θ of the revenue generated by its M&A decision to raise debt.

Denoting the time-0 value of the acquirer if $\mathbb{I}^{M\&A} = 1$ as $V^M_{A,0}$ and its stand-alone value as $V_{A,0}$, we can, therefore, formulate the acquirer's discrete choice problem as follows

$$\max\{V^M_{A,0}, V_{A,0}\} \tag{7}$$

subject to

$$b_{A,1} \in [0, \frac{\theta}{1+r} z_A k_{A,1}] \tag{8}$$

$$k_{A,1} = k_{A,0} + \mathbb{I}^{M\&A} k_{T,0} \tag{9}$$

$$p_T = \beta_T(r) z_T k_{T,0} \tag{10}$$

$$d_{A,0} \geq 0 \tag{11}$$

where

$$V_{A,0} = \max_{b_{A,1}} \; z_A k_{A,0} - (1+r) b_{A,0} + b_{A,1} + \beta_A(r) \big(z_A k_{A,1} - (1+r) b_{A,1} \big) \tag{12}$$

$$V^M_{A,0} = \max_{b_{A,1}} \; z_A k_{A,0} - (1+r) b_{A,0} + b_{A,1} + \beta_A(r) \big(z_A k_{A,1} - (1+r) b_{A,1} \big) - p_T \tag{13}$$

Solution. Under the assumption that a potential acquirer discounts future profits at rate

[9] Note that the borrowing constraint (6) ensures that the non-negativity constraint on dividends in period $t = 1$ is always slack so we omit it here.

$\beta_A(r) < \frac{1}{1+r}$, it always chooses to borrow up to its borrowing limit, i.e.

$$b^*_{A,1} = \frac{\theta}{1+r} z_A k_{A,1} \tag{14}$$

Using (14) and substituting for p_T and $k_{A,1}$, this implies the following firm values $V_{A,0}$ and $V^M_{A,0}$, respectively,

$$V_{A,0} = \left(1 + \frac{\theta}{1+r} + \beta_A(r)(1-\theta)\right) z_A k_{A,0} - (1+r) b_{A,0} \tag{15}$$

$$V^M_{A,0} = \left(1 + \frac{\theta}{1+r} + \beta_A(r)(1-\theta)\right) z_A k_{A,0} - (1+r) b_{A,0} \\ + \left(\frac{\theta}{1+r} + \beta_A(r)(1-\theta)\right) z_A k_{T,0} - \beta_T(r) z_T k_{T,0} \tag{16}$$

From here we can derive two conditions under which a transaction occurs. First, the transaction must be *optimal*, i.e. the ex-ante discounted present value of the merged firm must exceed the acquirer's stand-alone value, $V^M_{A,0} \geq V_{A,0}$, or,

$$z_A \geq \frac{\beta_T(r)}{\frac{\theta}{1+r} + \beta_A(r)(1-\theta)} z_T \tag{17}$$

For a given productivity of the target firm, z_T, the acquirer needs to have a minimum productivity level, $z^*_A = \frac{\beta_T(r)}{\frac{\theta}{1+r} + \beta_A(r)(1-\theta)} z_T$, in order for the transaction to be optimal for the acquirer. The corresponding minimum productivity ratio, $\frac{z_A}{z_T}$, between acquirer and target falls in the acquirer's patience, β_A, and increases in the target's patience β_T. Moreover, the ratio falls in the tightness of the borrowing constraint. A higher θ implies that a larger fraction of the future gains from capital reallocation can be pledged today to raise new debt. In the limiting case of frictionless financial markets, i.e. $\theta = 1$, and assuming that the target firm discounts at the market rate, i.e. $\gamma_T = 1$, the ratio is unity, implying that a transaction is optimal for the acquirer if it is at least as productive as the target.

Second, the merger must be *feasible*, i.e. the acquirer needs to have sufficient internal funds and borrowing capacity to pay for the target. The transaction is feasible if

$$\left(1 + \frac{\theta}{1+r}\right) z_A k_{A,0} + \frac{\theta}{1+r} z_A k_{T,0} - (1+r) b_{A,0} - \beta_T(r) z_T k_{T,0} \geq 0 \tag{18}$$

The acquirer's ability to fund an acquisition is increasing in its revenue, the first term, as well as the potential gains from capital reallocation, the second term. On the other hand, it is decreasing in the amount of legacy debt, the third term, as well as the price of the potential target firm, the last term. After all expenses are paid, the left-hand side of Equation (18) amounts to the acquirer's maximum time-0 post-merger free cash flow, denoted Γ (more on that below). An implication from Equation (18) is that, in our model, the acquirer can finance any merger for which the productivity gap between acquirer and target, and hence the benefits from capital reallocation, are large enough, i.e. $\frac{\theta}{1+r} z_A \geq \beta_T(r) z_T$. This is a consequence of the ability to pledge merger gains under the borrowing constraint (see Equation (6)).

It follows from Equations (17) and (18) that we observe the firm's M&A decision, conditional upon meeting a potential target, as

$$\mathbb{I}^{M\&A} = \begin{cases} 1 & \text{if Equation (17) and (18) hold} \\ 0 & \text{otherwise} \end{cases} \tag{19}$$

The key ingredient driving this result is the assumption that any acquired capital is being put to work using the productivity of the acquiring firm. Even in a frictionless market, i.e. $\theta = 1$, and when the target firm discounts the future at the market interest rate, firms will find it optimal to engage in M&A as long as their productivity is at least as high as that of the target. Monetary policy in turn can influence the feasibility of the transaction through two counteracting channels. First, an increase in the interest rate tightens the borrowing constraint and increases the repayment value of the initial debt. We call this effect the *financing channel*. Second, an increase in the interest rate decreases the target's price through its discount factor. We call this effect the *valuation channel*.

To see how these two channels contrast, consider the derivative of the time-0 post-merger free cash flow, Γ, with respect to the interest rate:

$$\frac{\partial \Gamma}{\partial r} = \underbrace{-\frac{\theta z_A (k_{A,0} + k_{T,0})}{(1+r)^2} - b_{A,0}}_{\Delta\text{Financing Conditions}} - \underbrace{\frac{\partial \beta_T(r)}{\partial r} z_T k_{T,0}}_{\Delta\text{Target Price}} \tag{20}$$

The overall effect of the interest rate on the feasibility of a M&A transaction depends crucially on the strength of the valuation channel. Without any valuation effects, i.e. a constant target discount factor $\beta_T(r) = \beta_T$, we would have $\frac{\partial \beta_T(r)}{\partial r} = 0$ so that an interest rate increase unambiguously decreases the acquirer's ability to engage in M&A via the financing channel. However, for $\beta_T(r) = \frac{\gamma_T}{1+r}$, as assumed throughout, we have that $\frac{\partial \beta_T(r)}{\partial r} = -\frac{\gamma_T}{(1+r)^2}$ so that the sign of the overall effect is undetermined: an increase in the interest rate decreases available funds via the financing but this is counteracted by a decrease in the target price via the valuation channel.

From Equation (20), we can derive a condition for the target size below which the financing channel dominates the valuation channel and the overall effect of monetary policy on transaction feasibility is unambiguously negative.

$$z_T k_{T,0} \leq \frac{\theta}{\gamma_T}(z_A k_{A,0} + z_A k_{T,0}) + (1+r)^2 b_{A,0} \tag{21}$$

In a frictionless financial market, i.e. $\theta = 1$, this will always be satisfied for any transaction the acquirer deems optimal, i.e. when $z_A \geq z_T$ (see Equation (17)). In this case, an increase in the interest rate has an unambiguously negative effect on a firm's ability to conduct M&A. In the face of borrowing frictions, however, this condition is not generally satisfied, so that – at least in theory – for a certain set of acquirer-target combinations, an increase in the interest rate increases an acquirer's ability to conduct M&A. Also in the frictionless financial market case, however, an interest rate increase has an unambiguously negative effect on an acquirer's ability to finance the transaction, as long as the target firm is sufficiently small relative to the merged firm. Since the overwhelming majority of transactions by U.S. firms involve an acquirer that is larger than the respective target, we consider this as the empirically relevant case.[10]

To analyse the gains from mergers, the empirical M&A literature often estimates the cumulative abnormal stock returns of the involved firms around the announcement date of the transaction. We can connect the acquirer's problem to its cumulative abnormal return as

$$CAR_{A,0} = \frac{V_{A,0}^M - V_{A,0}}{V_{A,0}} = \frac{\left(\frac{\theta}{1+r} + \beta_A(r)(1-\theta)\right)z_{A,0}k_{T,0} - \beta_T(r)z_{T,0}k_{T,0}}{\left(1 + \frac{\theta}{1+r} + \beta_A(r)(1-\theta)\right)z_{A,0}k_{A,0} - (1+r)b_{A,0}} \tag{22}$$

The interest rate can, hence, affect the acquiring firm's CAR through its effect on the acquirer's stand-alone value $V_{A,0}$, the discounted merger gains, as well as the price of the target firm. Furthermore, assuming a set of potential acquirers with a distribution over productivity, z_A, and size, $k_{A,0}$, the interest rate affects the set of firms that can afford to initiate M&A transactions. To see why, first note that for given any given acquirer and target productivity and size, Equation (18) implies a threshold for the acquirer's legacy debt, $b_{A,0}$, below which the transaction is feasible. This threshold, $\bar{b}_{A,0}$, is given by

$$\bar{b}^*_{A,0} = \left(\frac{1+r+\theta}{(1+r)^2}\right) z_A k_{A,0} + \left(\frac{\theta z_A}{(1+r)^2} - \frac{\beta_T(r) z_T}{1+r}\right) k_{T,0} \tag{23}$$

[10] In 90% of transactions in our SDC sample the acquirer has a larger net income than the target and in even more transactions the acquirer has a more assets on his balance sheet than the target.

Under the conditions discussed above, this threshold is decreasing in the interest rate. A higher interest rate, hence, implies that only less financially constrained firms, i.e. firms with lower initial debt, $b_{A,0}$, can still engage in M&A. The effect of interest rates on observed CARs is, therefore, theoretically ambiguous.

This stylised model generates two key predictions about firms' M&A behaviour that we can test in the data. First, from Equation (17) and (18), we would expect that the likelihood of a given firm to initiate a M&A transaction is decreasing in the interest rate.

Hypothesis 1 (H1)**.** *The probability of initiating a M&A transaction is decreasing in the interest rate.*

And second, from Equation (18), we would expect this effect to be stronger for firms that are relatively more financially constrained (i.e. for firms with higher legacy debt $b_{0,A}$).

Hypothesis 2 (H2)**.** *The probability of initiating a M&A transaction decreases more strongly in the interest rate for firms with high legacy debt.*

In the following section, we test these predictions and identify and quantify factors that affect the probability of engaging in a M&A transaction using granular firm-level data for the U.S.

5. Firm-level Evidence

In this section we test the predictions of the previous section using a quarterly panel of publicly listed U.S. firms from Compustat. Since the panel setting does not allow for partial instrumentation of the interest rate, the availability of the monetary policy surprises limits our sample to start in 1990Q1. We confirm the aggregate findings of Section 3 and provide evidence for the existence of a credit channel of monetary policy transmission to M&A transactions.

5.1. The Average Effect

Methodology. In line with the literature on M&A activity (e.g., Bonaime et al., 2018; Owen and Yawson, 2010), we model the decision to become an acquirer in a given period. As discussed above, our focus is on the acquirer's decision to initiate a M&A transaction, since the Compustat database conveniently lets us model the acquisition decision of the universe of public U.S. firms whereas accounting for any target characteristic would either require data on every company worldwide as the universe of potential targets or severely restrict the sample of transactions we can analyse within the Compustat universe. Furthermore, this binary choice model also arises naturally from the optimality conditions of our of firms' M&A choices (see Equation (19)).

In the spirit of Angrist and Pischke (2008) our baseline econometric specification is a linear probability model that estimates the likelihood of a firm to initiate a M&A transaction in a given period as a function of the monetary policy stance. In particular, we estimate the likelihood of firm i to engage in a M&A transaction between t and $t+3$, i.e. within 1 year following the change in the interest rate:

$$Pr(\text{Transaction}_{i,\{t,t+3\}} = 1) = \alpha_i + \gamma r_t + \mathbf{\Phi x}_{i,t-1} + \mathbf{\Theta w}_{t-1} + \varepsilon_{i,t} \tag{24}$$

where α_i is a firm-level fixed effect and the vectors $\mathbf{x}_t$ and $\mathbf{w}_t$ contain firm and macro controls, respectively. $\mathbf{x}_t$ includes 1) the leverage ratio, 2) firm age, 3) (the log of) real assets, 4) the ratio of net liquidity to total assets, 5) Tobin's Q, 6) the EBITDA-to-asset ratio as measure of profitability, 7) a dummy indicating whether the firm has paid dividends over the past year, and 8) a dummy variable indicating whether a firm has already acquired another firm in the previous five years. As in Jeenas (2018), all constructed financial ratios in $\mathbf{x}_t$ (e.g. the leverage ratio) are measured as averages between t and $t-3$. We also control for the number of M&A transactions in a firm's respective Fama-French 48 industry over the past four quarters to capture potential industry-level merger trends. $\mathbf{w}_t$ contains the same macro controls as the aggregate VAR, i.e. CPI inflation, industrial production growth, the EBP, and Robert Shiller's CAPE. We estimate Equation (24) by 2SLS, using the cumulative series of monetary policy surprises to instrument the 1-year Treasury rate, r_t (see Döttling and Ratnovski, 2022). The sample period runs from 1990Q1 to 2019Q2 to match the availability of the monetary policy surprises.[11] Following the argument of Abadie et al. (2022), the standard errors in our baseline specification are clustered on the firm level only, since we have neither clustering in treatment nor clustering in sampling. However, as shown in Appendix C.2, Table C.5, the results are robust to clustering on both the firm and the quarterly level.

Results. Table 2 displays the average response of the likelihood of engaging in a M&A transaction to a monetary policy surprise. Consistent with the aggregate results presented in Section 3, we find, using the full specification in column 4 of Table 2, that a one percentage point increase in the 1-year Treasury rate reduces the likelihood of engaging in a M&A transaction within the following four quarters by 0.9 percentage points. Considering the

[11] Our full sample ends in 2019q2. However, given that our dependent variable includes a lead of 3 quarters, we effectively make use of firm-level data until 2018Q3.

unconditional likelihood of engaging in a M&A transaction in any given year of 16.3%, this represents an 5.5% decrease in the likelihood of becoming an acquirer.

In line with the literature on M&A determinants, we furthermore find that size, liquidity, valuation (i.e. Tobin's Q), and profitability all increase the likelihood of becoming an acquirer. Higher leverage and prior acquisition history, on the other hand, decrease acquisition likelihood. Most likely, this is because prior acquisitions lead to higher leverage and the integration of past transactions occupies (operational) resources, limiting resources available for new transactions. Firm age has a significantly negative impact on acquisition likelihood. This is somewhat surprising, as Cloyne et al. (2018) highlight the role of firm age as proxy for financial constraints, implying that we would expect the opposite sign. Furthermore, this contrasts with the findings of Owen and Yawson (2010), who provide evidence of a hump-shaped relationship between the corporate life cycle and M&A activity. This difference may in part be due to the different measure of the firm life cycle used by Owen and Yawson (2010) (i.e. the proportion of retained earnings to equity).

Among the macroeconomic variables, we find that inflation and the excess bond premium negatively affect the acquisition likelihood, whereas aggregate valuations positively affect the transaction likelihood, mirroring the effect of firm-level valuations.[12]

[12] We report the results of the first-stage regression for the specification in column (4) in Appendix D, Table D.1, to demonstrate the relevance of the instrument.

Table 2: Effect of Monetary Policy on Acquisition Likelihood

	(1) P(Acq, 1y)	(2) P(Acq, 1y)	(3) P(Acq, 1y)	(4) P(Acq, 1y)
1y Treasury Rate	-0.004***	0.002**	-0.007***	-0.009***
	(0.000)	(0.001)	(0.001)	(0.001)
L.Leverage			-0.015***	-0.015***
			(0.002)	(0.002)
L.Age			-0.002***	-0.003***
			(0.000)	(0.000)
L.Log Total Assets (real)			0.004**	0.004**
			(0.002)	(0.002)
L.Net Liquidity Ratio			0.007***	0.006***
			(0.002)	(0.002)
L.Tobin's Q			0.001***	0.001***
			(0.000)	(0.000)
L.EBITDA-to-assets Ratio			0.029***	0.028***
			(0.006)	(0.006)
L.Dividend Payer			-0.004	-0.005
			(0.005)	(0.005)
L.# Industry Mergers			0.000***	0.000***
			(0.000)	(0.000)
L.Prior Acquisition History			-0.043***	-0.043***
			(0.004)	(0.004)
L.IP Growth				0.003**
				(0.001)
L.CPI Inflation				-0.015***
				(0.003)
L.Excess Bond Premium				-0.024***
				(0.002)
L.Shillers's CAPE				0.001***
				(0.000)
Constant	0.163***			
	(0.001)			
N	452,714	452,714	452,714	452,714
FE	No	Firm	Firm	Firm
Cluster	No	Firm	Firm	Firm
Controls	No	No	Firm	Firm, Macro

Note: The table presents results from the linear probability model (24). The 1-year Treasury Rate is instrumented using cumulative high-frequency identified monetary policy shocks. The firm-level controls for leverage, net liquidity ratio, Tobin's Q, and EBITDA-to-assets ratio are constructed as lagged 4 quarter averages. Standard errors are reported in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

5.2. *The Credit Channel of Monetary Transmission*

It is well known that financial frictions play a key role in shaping heterogeneous responses to monetary policy surprises at the firm level. A channel that arises naturally from our stylised model and that has been studied extensively in the literature is the so called "credit channel" or "financial accelerator channel" of monetary policy transmission (e.g., Kiyotaki and Moore, 1997; Bernanke and Gertler, 1995; Bernanke et al., 1999): the effect of monetary policy on certain types of borrowers is amplified through imperfections in credit markets. More precisely, the credit channel argues that monetary policy can affect a wide range of firm decisions by changing the value of a firm's assets and net worth, which subsequently affects the firm's borrowing constraint. A large literature, therefore, argues that financially more constrained firms have a stronger reaction to monetary policy (see, e.g., Gertler and Gilchrist, 1994; Kashyap and Stein, 1995). We investigate whether this channel plays a role for a firm's M&A decision. To that end, we interact the interest rate with a measure of financial constraints on the firm level, $z_{i,t}$. Following the literature on firms' capital investment response to monetary policy, e.g. Ottonello and Winberry (2020), we use the firm's leverage ratio as our main proxy of financial constraints. As sensitivity checks, in Section 5.3.2 we provide additional results using other proxies for financial constraints, both asset- and earnings-based, that are used in the literature, such as age (Cloyne et al., 2018), liquidity (Jeenas, 2018), or profitability (Drechsel, 2022; Lian and Ma, 2020).

The empirical specification is given by Equation (25). We lag $z_{i,t}$ to ensure that the measure of financial constrainedness is predetermined at the time of the monetary surprise. As before, all constructed financial ratios, including $z_{i,t}$, are measured as four-quarter averages and we estimate Equation (25) via 2SLS, instrumenting the 1-year Treasury rate with the cumulated high frequency monetary policy surprises.

$$Pr(\text{Transaction}_{i,\{t,t+3\}} = 1) = \alpha_i + \gamma r_t + \delta(r_t \times z_{i,t-1}) + \mathbf{\Phi x}_{i,t-1} + \Theta \mathbf{w}_{t-1} + \varepsilon_{i,t} \tag{25}$$

Results. Table 3 reports the heterogeneous responses of firms' likelihood of engaging in a M&A transaction to monetary policy. In line with the predictions of the credit channel, firms with lower leverage react much less to changes in the interest rate compared to their financially more constrained peers. This result suggests that the credit channel of monetary policy not only shapes the response of capital investment, but also of M&A activity. That is, monetary policy affects firms' capital and M&A expenditure not just through its effect on financing costs, but also through its effect on borrowing constraints.

Table 3: Credit Channel of Monetary Policy

	(1) P(Acq, 1y)	(2) P(Acq, 1y)	(3) P(Acq, 1y)	(4) P(Acq, 1y)
1y Treasury Rate	0.001***	0.005***	-0.006***	-0.008***
	(0.000)	(0.001)	(0.001)	(0.001)
1y Treasury Rate × L.Leverage ratio	-0.024***	-0.015***	-0.006***	-0.005***
	(0.001)	(0.001)	(0.002)	(0.002)
L.Leverage			-0.006*	-0.006**
			(0.003)	(0.003)
L.Age			-0.002***	-0.003***
			(0.000)	(0.000)
L.Log Total Assets (real)			0.004**	0.004**
			(0.002)	(0.002)
L.Net Liquidity Ratio			0.006***	0.006***
			(0.002)	(0.002)
L.Tobin's Q			0.001***	0.001***
			(0.000)	(0.000)
L.EBITDA-to-assets Ratio			0.030***	0.029***
			(0.006)	(0.006)
L.Dividend Payer			-0.003	-0.004
			(0.005)	(0.005)
L.# Industry Mergers			0.000***	0.000***
			(0.000)	(0.000)
L.Prior Acquisition History			-0.042***	-0.043***
			(0.004)	(0.004)
L.IP Growth				0.003**
				(0.001)
L.CPI Inflation				-0.015***
				(0.003)
L.Excess Bond Premium				-0.024***
				(0.002)
L.Shillers's CAPE				0.001***
				(0.000)
Constant	0.165***			
	(0.001)			
N	452,712	452,712	452,712	452,712
FE	No	Firm	Firm	Firm
Cluster	No	Firm	Firm	Firm
Controls	No	No	Firm	Firm, Macro
IV	Yes	Yes	Yes	Yes

Note: The table presents results of the linear probability model 25. The 1-year Treasury Rate is instrumented using cumulative high-frequency identified monetary policy shocks. The firm-level controls for leverage, net liquidity ratio, Tobin's Q, and EBITDA-to-assets ratio as well as the interaction term are constructed as lagged 4-quarter averages. Standard errors are reported in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

5.3. *Additional Results and Sensitivity Checks*

In this section we present some additional results and a range of sensitivity checks for our main results. First, we study the dynamic effect of monetary policy on firms' M&A decisions. Second, we analyse two additional factors relevant to a firm's M&A decision, namely, the role of market power and capital investment. We then present a set of sensitivity checks that focus on the identification of the monetary policy surprises and the stability of our main results across sub-samples and industries. Here we study, in particular, (i) whether our results are sensitive to using an alternative monetary policy surprise series for instrumenting the short-term interest rate, (ii) whether our results are robust to excluding the period after the global financial crisis, (iii) whether our results are robust to clustering on both the firm and the quarter level, and (iv) whether our results are robust to excluding firms in the financial, insurance, and real estate (FIRE) sectors. In the following we discuss the results of these sensitivity checks in detail. All results are reported in Appendix C.

5.3.1. *Additional results*

Dynamic Effects. As a first additional result, we investigate the dynamic response of firms' acquisition likelihood to monetary policy. We estimate a linear probability local projection model in the style of Jorda (2005). Instead of estimating the probability of engaging in a M&A transaction within the four quarters following a monetary policy shock, we estimate the likelihood of engaging in a M&A transaction quarter-by-quarter over a horizon of five years. In Appendix C.1.1, Figure C.1 we plot the estimated impulse response function (IRF) of the 1-year Treasury rate as well as the IRF of the 1-year Treasury rate interacted with the lagged leverage ratio as our main indicator of financial constraints. The model is estimated using the same set of controls, fixed effects, and clusters as the baseline model. The average response to a 1 percentage point increase in the 1-year Treasury rate is significantly negative over the whole horizon, bottoming out approximately two years after the initial shock, consistent with the aggregate response. This suggests that our baseline model with a window of just one year actually understates the impact of monetary policy on M&A activity. The interaction with the lagged leverage ratio suggests that highly leveraged firms react more to monetary policy shocks in terms of their M&A decision.

Role of market power. Second, we investigate the role of market power for a firm's M&A decision. Firms with high degrees of market power might be less likely to be financially constrained and might be more likely to engage in M&A transactions to insulate their dominant position. We investigate whether market power plays a role for M&A decisions. To that end, we calculate several different measures of market power. First, we compute the firms' markup relative to their respective Fama-French industry average.[13] Second, we calculate the Lerner index.[14] Third, we calculate the firm's market share.[15] Fourth, we construct a dummy indicating whether the firm is in the 95% percentile of its respective Fama-French industry in terms of its market capitalisation (see Liu et al., 2022).

The results in Appendix C.1.2, Table C.1 suggest that higher market power indeed predicts a higher likelihood of engaging in M&A transactions. The reaction to monetary policy, however, does not seem to be driven by heterogeneity in market power, since basically all relevant interaction terms are insignificant. Only the market share is significant but the magnitude of the effect is economically negligible. This contrasts with Duval et al. (2021) who find that higher mark-up firms adjust their total assets less in response to changes in the interest rate.

M&A and capital investment. Furthermore, we investigate whether the decision to engage in M&A is a compliment to or a substitute for tangible capital investment. We investigate this by interacting the interest rate with a firm's capital expenditure intensity, calculated as the ratio of the firm's real capital expenditure to the firm's capital stock in the previous period[16] and the growth rate of the capital stock,[17] respectively. As before, both are included in the regression as lagged four-quarter averages. We report the results in in Appendix C.1.3, Table C.2. We find no evidence for a relation between a firm's capital investment intensity and its M&A policy, neither overall nor in terms of its response to monetary policy. However, growing firms, i.e. those increasing their (perpetual) capital stock over the past four quarters, are more likely to engage in M&A and also react less to monetary policy changes.

[13] To compute relative mark-ups we use the expression for the markup $\mu_{it} = \theta^v_{it} \frac{P_{it} Q_{it}}{P^V_{it} V_{it}}$ of De Loecker et al. (2020) where θ^v_{it} is the industry-specific output elasticity, and $\frac{P_{it} Q_{it}}{P^V_{it} V_{it}}$ the revenue share of the variable input. Taking logs and demeaning this expression on the industry-quarter level eliminates the industry-specific constant and thus returns the markup of the firm relative to its respective industry. We compute $\frac{P_{it} Q_{it}}{P^V_{it} V_{it}}$ as the ratio of revenue (Compustat item SALES) to cost of goods sold (Compustat item COGS).

[14] Computed as the ratio of Operating Income Before Depreciation (Compustat item OIBDPQ) minus depreciation (Compustat item DPQ) to overall revenue (Compustat item SALES), see Gutiérrez and Philippon (2017).

[15] We compute the firm's sales market share in its respective Fama-French industry using Compustat sales data only.

[16] Since capital expenditure in Compustat is recorded as year-to-date, CAPXY, we follow the literature and difference this variable within the fiscal year to reconstruct the quarterly series, CAPXQ.

[17] We compute the capital stock using the perpetual inventory method.

5.3.2. Sensitivity Checks

Measures of financial constraints. The literature on financial constraints at the firm level has produced a plethora of balance sheet variables and other firm characteristics that can be used to gauge the extent of a firm's financing constraints. Traditionally, the literature has relied on so-called "asset-based" financing constraints, with a firm's leverage ratio as the most natural and widely used proxy. In addition to the leverage ratio, others have also used a firm's liquidity ratio (Jeenas, 2018). More recently, the corporate finance literature, e.g. Drechsel (2022) or Lian and Ma (2020), has emphasised the role of so-called "earnings-based" constraints which determine the firm's ability to borrow based on its stream of future cash flows. Recently, Cloyne et al. (2018) has emphasised age as informative about a firm's financial position. To test the robustness of our results when considering different proxies for financial constraints popular in the literature, we replace the leverage ratio in Equation (25) with the net liquidity ratio, the EBITDA-to-assets ratio, and firm age. Appendix C.2.1, Table C.3 shows that the results of Section 5.2 are robust to considering different ways to measure a firm's borrowing capacity.

Identification of Monetary Policy Surprises. Some recent work, e.g. by Nakamura and Steinsson (2018) or Miranda-Agrippino and Ricco (2021), argues that the monetary policy surprises obtained as changes in short-rate futures contracts around monetary policy announcements might not capture the pure effect of these policy rate changes but in fact be contaminated by so-called "information effects", i.e. a change in market participants' perceptions of economic conditions induced by the central bank's communication. In this section, therefore, we analyse whether our findings are sensitive to using the information-robust surprises of Miranda-Agrippino and Ricco (2021). This approach disentangles the monetary policy surprises from any information effects in the high-frequency monetary surprises and allows us to isolate the pure effect of monetary policy on M&A activity, without any potential contamination by releases of information about future economic growth. The results for the baseline specification and for the interaction with the leverage ratio are reported in Appendix C.2.2, Table C.4. The average effect of monetary policy is not significant. However, the estimated coefficients on the interaction terms are still highly significant and even stronger (in absolute terms) than in the baseline model.

Sub-Sample Stability and Sectoral Effects. This section investigates whether our findings are affected by (i) dropping the years after the financial crisis, i.e. limiting our sample to 1990Q1:2007Q4; (ii) controlling for effects across industrial sectors, i.e. including year-sector fixed effects or dropping FIRE industries; and (iii) clustering on the firm as well as on the quarterly level. The results for the average effect are presented in Appendix C.2.3, Table C.5 and the results for the credit channel are presented in Table C.6, including the leverage ratio, the liquidity ratio, and the EBITDA-to-assets ratio as a proxies for financial constraints. The results remain largely unchanged. Only the interaction of the interest rate and the leverage ratio in the subsample between 1990Q1:2007Q4 turns insignificant. However, the other two proxies for financial constraints remain significant even in the pre-crisis subsample.

6. Deal Quality

In this section, we shed light on the relationship between monetary policy and the quality of M&A transactions. Based on our stylised model of M&A, we measure deal quality as the gains of merging (see Equation (22)). However, measuring the gains of M&A transactions is fraught with endogeneity issues, making the assessment of M&A transactions in terms of outcomes very difficult. Therefore, it is common in the literature to use an event study approach and rely on the market's assessment of a given transaction (e.g. Bonaime et al., 2018; Antón et al., 2022). To estimate the value generated by the transaction, one computes the CAR of the involved firms around the announcement day of the transaction. We follow this approach and calculate 3-day acquirer CARs around the announcements of all transactions in our sample that could be merged with the respective firm's balance sheet information.

The abnormal return $AR_{i,t}$ of acquirer i at time t is calculated as

$$AR_{i,t} = R_{i,t} - E_{t-1}\left(R_{i,t}\right) \tag{26}$$

That is, the abnormal return on day t of firm i is the difference between the realised stock return $R_{i,t}$ and the expected return $E_{t-1}\left(R_{i,t}\right)$. The expected return is estimated using the three-factor model of Fama and French (1996)

$$E_{t-1}\left(R_{i,t}\right) = \widehat{\beta}_i E_{t-1}\left(R_{m,t} - R_{f,t}\right) + \widehat{\beta}_i^{smb} E_{t-1}\left(SMB_t\right) + \widehat{\beta}_i^{hml} E_{t-1}\left(HML_t\right) \tag{27}$$

where $R_{f,t}$ and $R_{m,t}$ are the risk free rate and the overall market return in period t, respectively, SMP_t is the period t excess returns of small cap stocks over big cap stocks, and HML_t is the period t excess return of value stocks over growth stocks. The relevant parameters of Equation (27) are estimated over days $t-150$ to $t-50$, where period t refers to the time of the announcement. The cumulative abnormal return is then computed as the sum of abnormal returns in a tight window around the announcement day of the transaction. For our analysis, we choose a window starting one day before the announcement day and ending one day after, thus capturing the abnormal returns over three consecutive days.

$$CAR_{i,t} = \sum_{t-1}^{t+1} AR_{i,t} \tag{28}$$

In principle, abnormal returns around M&A transactions can accrue to both the acquirer and the target.[18] The sum of the two abnormal returns constitutes the overall merger gain. Since we consider only the acquirer side in our estimation, we study the impact of monetary policy on deal quality, focusing on the relationship between realised CARs of the acquiring firm and the monetary policy stance. We estimate the relationship between the monetary policy stance and the CAR using the following specification

$$CAR_{t,i} = \alpha + \gamma \bar{r}_{\{t-1,t-4\}} + \beta p_{t-1} + \mathbf{\Phi} \mathbf{w}_{i,t-1} + \mathbf{\Theta} \mathbf{x}_{t-1} + \varepsilon_{i,t} \tag{29}$$

where $\bar{r}_{\{t-1,t-4\}}$ refers to the average interest rate over the preceding four quarters instrumented by the equivalent four-quarter average of the cumulative monetary policy surprise series. p_{t-1} is the end of period value of the Wilshire 5000 Total Market Index, i.e. the market value of all American stocks traded in the U.S. We use the Wilshire 5000 to control for the baseline firm valuations relative to which merger gains are evaluated. As before, the vectors $\mathbf{x}_t$ and $\mathbf{w}_t$ contain firm- and aggregate-level controls, respectively. The results are presented in Table 4.

At this point, it is worthwhile to clarify some aspects of the relationship between monetary policy and acquirer CARs. It is unlikely that monetary policy affects the abnormal returns of a given acquirer in a short window around a M&A announcement directly. Instead, monetary policy can affect observed CARs in a given period through its effect on the overall M&A decision process. First, monetary policy affects the composition of firms that engage in M&A, i.e. it changes the average numerator of the model CAR in Equation (22). Second, monetary policy affects the overall macroeconomic setting in which the deal takes place, thereby affecting deal outcomes, e.g. via financing conditions or expected growth rates. Third, monetary policy can affect overall firm valuations and thereby change the baseline valuations relative to which merger gains are evaluated, i.e. the denominator of the model CAR in Equation (22). Fourth, it affects which firms become acquisition targets. Fifth, monetary policy can affect the bargaining weights between targets and acquirers, thus changing the distribution of the overall CAR. Therefore, the estimated coefficients presented in Table 4 are a composite of several ways in which monetary policy can affect the average CAR around M&A announcements. However, combining these estimates with the results

[18] In fact, the literature overwhelmingly suggests that targets capture the bigger share of the merger gains (see e.g. Betton et al., 2007).

from the previous sections allows us to shed light on the effect of monetary policy on deal quality.

We first note that the average CAR associated with M&A transactions in our sample is significant and large. On average, transactions are associated with an excess return of 0.6% (see first column of Table 4), which is largely in line with the existing literature (see, for example, Betton et al., 2007; Alexandridis et al., 2017). Furthermore, without controlling for acquirer characteristics, the effect of a contractionary monetary policy stance on transaction CARs is positive and significant (even when controlling for baseline firm valuations), suggesting that markets assess the average M&A transaction under a contractionary monetary policy stance as of higher quality than otherwise. However, this effect disappears when controlling for acquirer characteristics. This strongly suggests that monetary policy affects the average deal quality mainly by changing the composition of acquiring firms. If monetary policy affected the transaction quality through any of the other three channels (different target composition, different bargaining weights, different macro outlook), we would expect a significant impact on transaction CARs even after controlling for acquirer characteristics.

We have shown in the previous section that especially financially constrained firms reduce their M&A activity under tighter monetary policy conditions. Combining this result with the result of the CAR regressions suggests the following transmission channel of monetary policy: contractionary monetary policy leads to a smaller number of transactions, but this smaller number of transactions is of higher (market-perceived) quality because the acquiring firms are in better financial shape, thus offering better post-merger perspectives (e.g. because they are able to afford investment in the target firms' productive capacities or are better suited to realise merger gains). Conversely, expansionary monetary policy leads to more transactions. However, the marginal transaction is of somewhat lower (perceived) quality since the marginal acquirer is less financially sound and is expected to realise smaller merger gains. This result is robust to different computations of the acquirer CARs: in Appendix E we show that the results are robust to using 1) Fama-French 3 Factor plus Momentum CARs (see Table E.1), 2) Fama-French 3 Factor CARs $\pm$ 2 days instead of $\pm$ 1 days around the announcement day (see Table E.2), and 3) using model free CARs (see Table E.3). Overall, this suggests that expansionary monetary policy leads to more frequent reallocation of capital to more productive firms (otherwise the average acquirer CAR would not be positive), although the marginal transaction reallocates capital to somewhat less productive firms.

Table 4: Effect of Monetary Policy on M&A Transaction CARs

	(1) CAR	(2) CAR	(3) CAR	(4) CAR
L.1y Treasury Rate (4Q avg.)	0.002***	0.003***	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
L.Wilshire 5000	0.000	0.000**	0.000**	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
L.Shillers's CAPE		-0.001***		-0.000
		(0.000)		(0.000)
L.Excess Bond Premium		-0.002		0.000
		(0.001)		(0.001)
L.IP growth		0.000		-0.000
		(0.001)		(0.001)
L.CPI inflation		-0.007***		-0.003
		(0.002)		(0.002)
L.# of Industry Mergers			-0.000***	-0.000**
			(0.000)	(0.000)
L. Prior Acquisition History			-0.006***	-0.006***
			(0.002)	(0.002)
L.Age			0.000**	0.000**
			(0.000)	(0.000)
L.Dividend Payer			0.008**	0.008***
			(0.003)	(0.003)
L.Leverage			0.006	0.007*
			(0.004)	(0.004)
L.Log Total Assets (Real)			-0.007***	-0.007***
			(0.001)	(0.001)
L.Net liquidity ratio			-0.012**	-0.012**
			(0.005)	(0.005)
L.Tobin's Q			-0.002***	-0.002***
			(0.000)	(0.000)
L.EBITDA-to-assets ratio			-0.051**	-0.052**
			(0.025)	(0.025)
Constant	0.006**	0.021***	0.065***	0.069***
	(0.003)	(0.003)	(0.005)	(0.006)
N	19,643	19,643	19,643	19,643
Controls	No	Macro	Firm	Macro, Firm

Note: The table presents results from the pooled model (29) with different measures of financial constraints as interaction term. The 1-year Treasury Rate is instrumented using cumulative high-frequency identified monetary policy shocks. The firm-level controls and interaction terms are constructed as lagged 4-quarter averages. Standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

7. Conclusion

Mergers and acquisitions play an important role in the reallocation of capital and significantly influence macroeconomic outcomes. Despite its integral role for the macroeconomy, however, its relation to monetary policy is not yet well understood.

In this paper, we study the effect of monetary policy on M&A activity in the U.S. on both the aggregate and the firm level. We find that a contractionary monetary policy stance lowers aggregate M&A activity, both in terms of the total number of deals and their total value.

To analyse the response of M&A activity on the firm level, we first study a stylised model of firms' optimal M&A decision in frictional financial markets. The model yields two key predictions that we test on micro-level M&A transaction- and balance sheet data for public U.S. companies: (i) the probability of a given firm initiating a M&A transaction is decreasing in the interest rate and (ii) this effect is stronger for relatively mode financially constrained firms. Consistent with the aggregate evidence, we find that a one percentage point increase in the 1-year Treasury rate decreases the likelihood of a given firm to initiate a M&A transaction in a given year by 1 percentage point. This represents a 5.5% decrease relative to the unconditional transaction likelihood. In line with the predictions of the model, we find that financially constrained firms react much more to the monetary policy impulse than their less constrained peers.

At last, we show that on average M&A transactions are associated with large positive CARs. Contractionary monetary policy has a positive effect on the average CAR around our sample of M&A transaction announcements. This effect, however, is not robust to including firm characteristics, providing additional evidence of a selection into acquiring following a contractionary monetary policy shock. Taken together, our results suggest that contractionary monetary policy leads to fewer but higher-quality M&A transactions, since firms that are still able to engage in M&A are financially more sound and have better post-merger growth prospects.

From a policy maker's perspective these findings suggest that mergers and acquisitions are a potentially important channel through which monetary policy affects the macroeconomy. The focus of this paper is on providing empirical evidence on the response of M&A activity to monetary policy. It would be interesting to embed the selection into M&A activity in response to monetary policy present in the data in a structural model of monetary policy and M&A activity to quantify its effect on aggregate output and productivity. We leave this exercise for future work.

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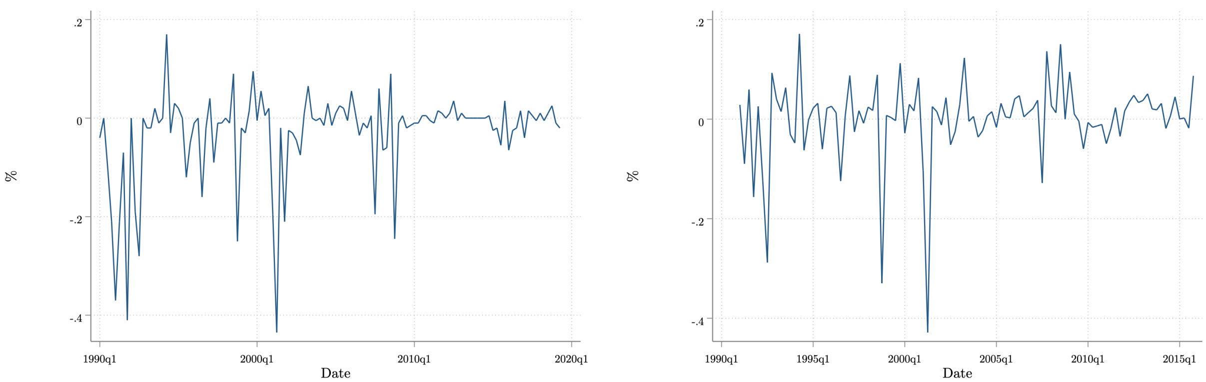
Appendix A. Data

Monetary Policy Surprises. For our main results, we use the high-frequency identified monetary policy surprises by Gurkaynak et al. (2005).[19] We also examine the sensitivity of our results to using the information-robust monetary policy surprises by Miranda-Agrippino and Ricco (2021) which disentangle monetary policy surprises into macroeconomic information and pure policy shocks. The two shock series are plotted in Figure A.1a and Figure A.1b, respectively.



(a) High-frequency Surprises (b) Information-robust high-frequency surprises

Note: The first panel shows the quarterly sum of monetary policy surprises of Gurkaynak et al. (2005). The second panel shows the quarterly sum of information-robust high-frequency surprises by Miranda-Agrippino and Ricco (2021).

Figure A.1: Monetary Policy Shocks

Variable Definitions and Summary Statistics. For our firm-level analysis, we use detailed quarterly financial statement data for publicly listed U.S. companies from Compustat. Table A.1 provides the precise variable definitions, including the item codes from Compustat. In Table A.2, we provide summary statistics for the main balance sheet variables of interest.

In Table A.3, we provide summary statistics for our matched set of cumulative abnormal returns for different models of the expected return.

[19]We thank Peter Karadi for providing us with an updates series up to May 2019.

Table A.1: Variable Definitions

Variable	Definition
Age	–
Leverage	(DLCQ + DLTTQ)/ATQ
Total Assets	ATQ
Net Liquidity	(ACTQ - LCTQ)/ATQ
Tobin's Q	(ATQ + PRCCQ*CSHOQ - CEQQ)/ATQ
EBITDA-to-Assets	EBITDAQ/L.ATQ
Dividend Payer	$\mathbb{1}_{DVQ>0,\{t,t-3\}}$
Acquisition history	$\mathbb{1}_{Transaction>0,\{t,t-19\}}$
# Industry Mergers	$\Sigma_{i \in ffind} \mathbb{1}_{i,Transaction>0,\{t,t-3\}}$

Note: Age is constructed using WorldScope information (accessed via Datastream) on the firm's foundation date. If this is missing, we use the firm's incorporation date (BEGDAT) from CRSP.

Table A.2: Summary Statistics of Balance Sheet Variables

	Observations	Mean	Std. Dev	Min	Max
Age	798,482	24.40	27.45	0.00	235.00
Leverage Ratio	699,740	0.30	0.62	0.00	18.11
Net Liquidity Ratio	608,405	0.13	0.77	-10.00	7.13
Tobin's Q	642,829	3.29	11.86	0.44	467.56
EBITDA to Total Assets	574,603	-0.01	0.20	-5.56	0.17
Log Total Assets (real)	738,846	5.31	2.81	-6.97	15.09

Note: Firm-level variables are trimmed at the 1^{st} and 99^{th} percentile. Trimming is done by year.

Table A.3: Summary Statistics of Cumulative Abnormal Returns

Expected Return Model	N	Mean	Std. Dev	p5	p25	p50	p75	p95
Market (3 days)	27,507	0.014	0.097	-0.091	-0.021	0.005	0.038	0.139
FF 3-F (3 days)	27,507	0.012	0.097	-0.095	-0.022	0.004	0.036	0.135
FF 3-F&M (3 days)	27,507	0.012	0.098	-0.096	-0.023	0.004	0.036	0.136
FF 3-F (5 days)	27,491	0.012	0.109	-0.116	-0.029	0.004	0.043	0.155

Note: FF 3-F denotes the Fama-French three-factor model, FF 3-F&M denotes the Fama-French three-factor model with momentum, and the number of days in parenthesis displays the total event window size.

Appendix B. VAR Specification and Robustness

B.1. Prior and Posterior Distribution

In reduced form, the model can be written as

$$\mathbf{y}_t = \mathbf{C} + \sum_{l=1}^{p} \mathbf{A}_l \mathbf{y}_{t-l} + \mathbf{u}_t$$

where u_t are the reduced-form error terms with zero mean and covariance matrix $\mathbf{\Sigma}$. Stacking the regressors into a single matrix, this can be written as $\mathbf{Y} = \mathbf{X}\mathbf{B} + \mathbf{u}$. The prior and the posterior belong to the normal-inverse-Wishart distribution, where the posterior takes the form:

$$p(\mathbf{\Sigma}|\mathbf{Y}) = \mathcal{IW}(\alpha_1, \mathbf{S}_1)$$

$$p(\mathbf{B}|\mathbf{Y}) = \mathcal{MT}(\mathbf{B}_1, \mathbf{S}_1, \mathbf{\Phi}_1, \alpha_1)$$

where $\mathcal{IW}$ denotes the Inverted Wishart distribution and $\mathcal{MT}$ is a matrix-variate student distribution with mean $\mathbf{B}_1$, scale matrices $\mathbf{S}_1$ and $\mathbf{\Phi}_1$, and degrees of freedom α_1. The parameters describing the posterior distribution are related to the prior in the following way

$$\mathbf{B}_1 = \mathbf{\Phi}_1[\mathbf{\Phi}_0^{-1}\mathbf{B}_0 + \mathbf{X}'\mathbf{Y}]$$

$$\mathbf{S}_1 = \mathbf{Y}'\mathbf{Y} + \mathbf{S}_0 + \mathbf{B}_0'\mathbf{\Phi}_0^{-1}\mathbf{B}_0 - \mathbf{B}_1'\mathbf{\Phi}_1^{-1}\mathbf{B}_1$$

$$\mathbf{\Phi}_1 = [\mathbf{\Phi}_0^{-1} + \mathbf{X}'\mathbf{X}]^{-1}$$

$$\alpha_1 = \alpha_0 + T$$

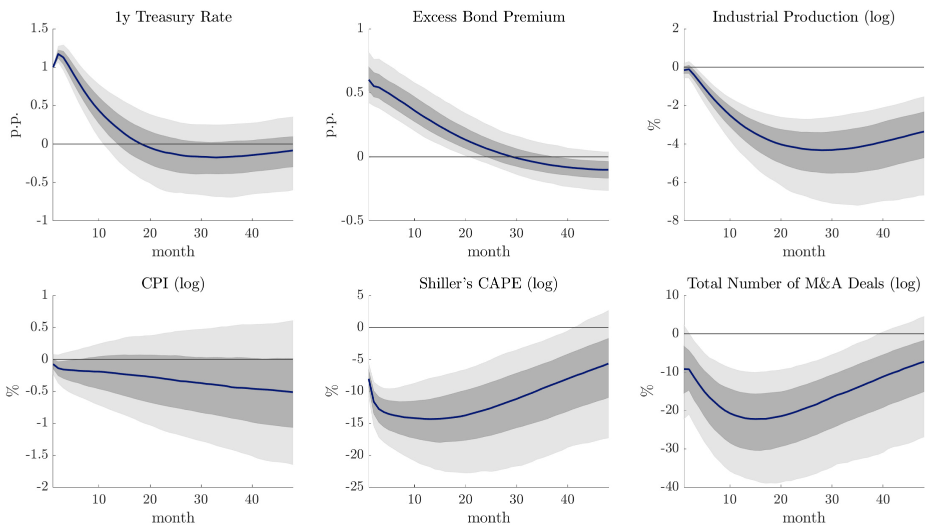
We use a conventional Minnesota prior for B_1, setting the own first lag coefficients to one and all other coefficients (including the intercept) to zero. This assumes that all the non-stationarity in the variables is stochastic, and accounted for by the unit-root embedded in the priors. We furthermore set $\alpha_0 = n + 2$, the prior scale matrix S_0 to the diagonal covariance matrix obtained from individual AR(1) regressions for each of the respective endogenous variables, and finally

$$\mathbf{\Phi}_0 = \text{diag}\left(\lambda_c, \phi_{1,1}, ..., \phi_{1,n}, ..., \phi_{p,1}, ..., \phi_{p,n}\right)$$

where $\lambda_c = 10^5$ is the prior variance on the intercept, $\phi_{li} = \left(\frac{1}{\sigma_i^2}\right)\left(\frac{\lambda^2}{l^2}\right)$, and λ controls the overall tightness of the priors (with a smaller value placing more weight on the prior). Extending the argument in Giannone et al. (2015), we treat the parameter λ as an additional model parameter coming from a gamma distribution with mean 0.4 and standard deviation 0.1, and choose it as the maximiser of the posterior likelihood.

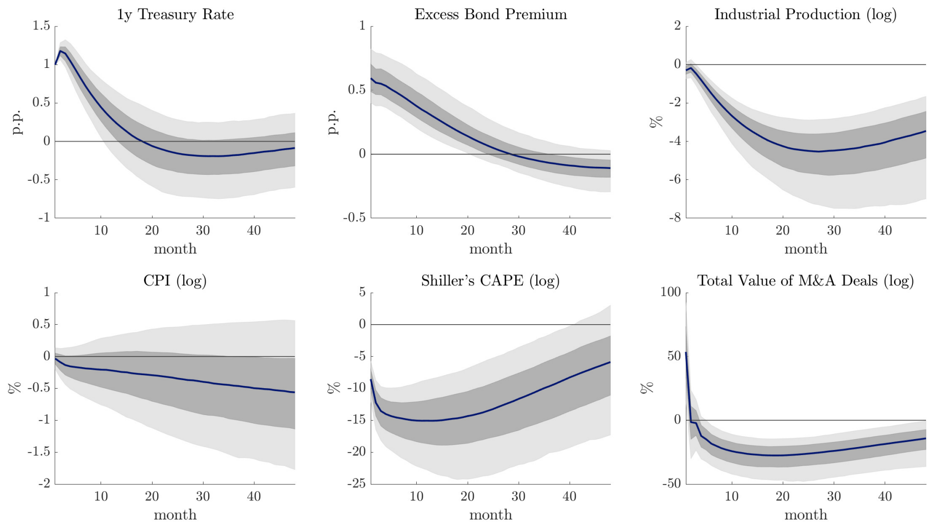
B.2. VAR Robustness

B.2.1. Only Public Firms



Note: Light (dark) grey shaded areas indicate 95% (68%) posterior credible sets obtained by taking 5,000 draws from the posterior distribution.

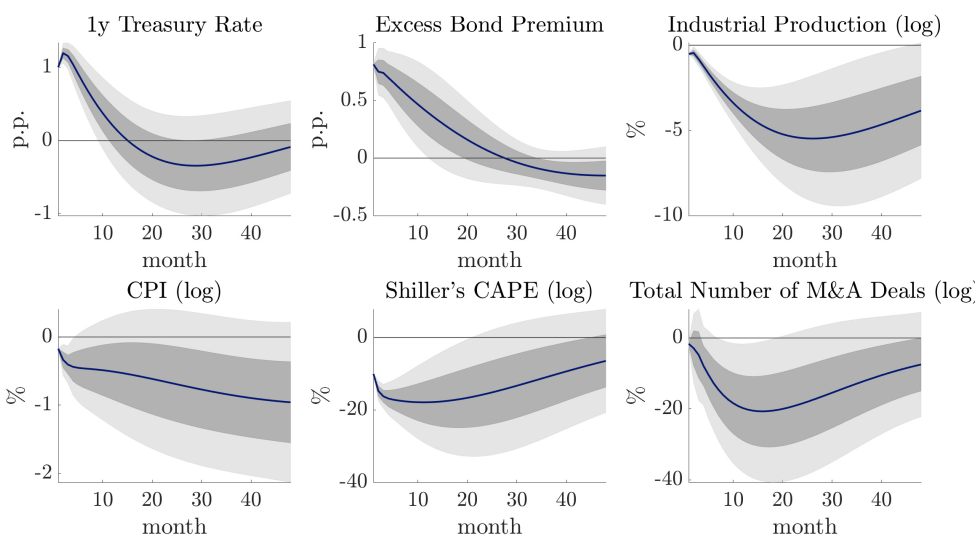
Figure B.1: Response of Aggregate Deal Volume to a Monetary Policy Shock



Note: Light (dark) grey shaded areas indicate 95% (68%) posterior credible sets obtained by taking 5,000 draws from the posterior distribution.

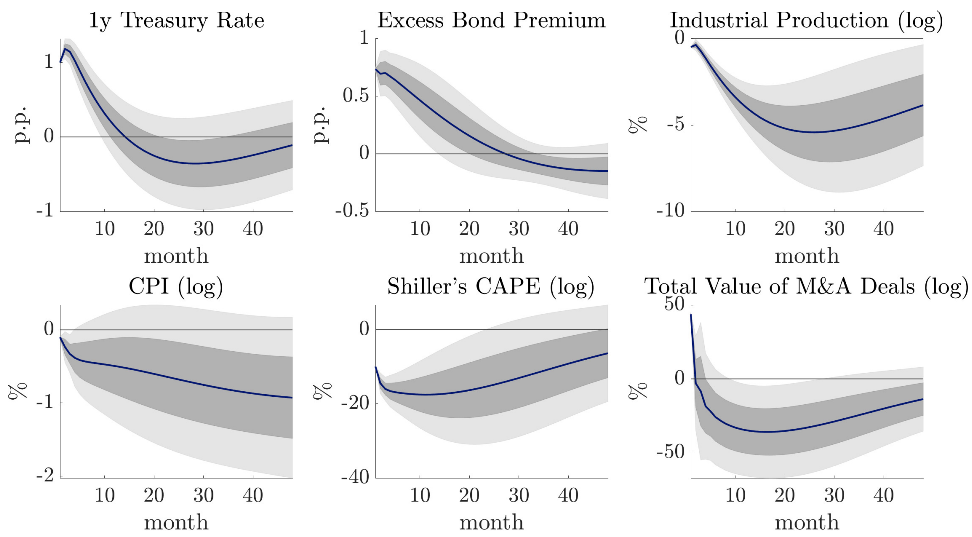
Figure B.2: Response of Aggregate Deal Volume to a Monetary Policy Shock

B.2.2. No Bayesian Prior



Note: Light (dark) grey shaded areas indicate 95% (68%) confidence intervals computed using the Delta method.

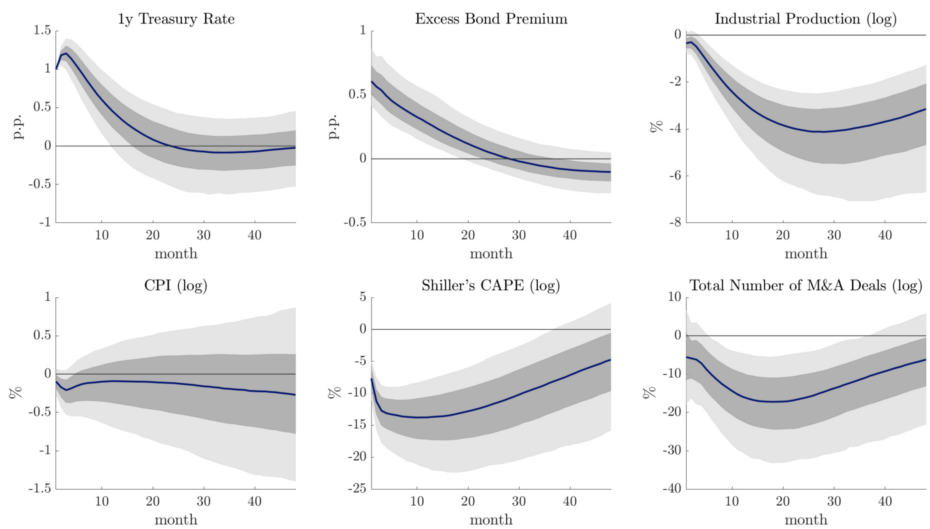
Figure B.3: Response of Aggregate Deal Volume to a Monetary Policy Shock



Note: Light (dark) grey shaded areas indicate 95% (68%) confidence intervals computed using the Delta method.

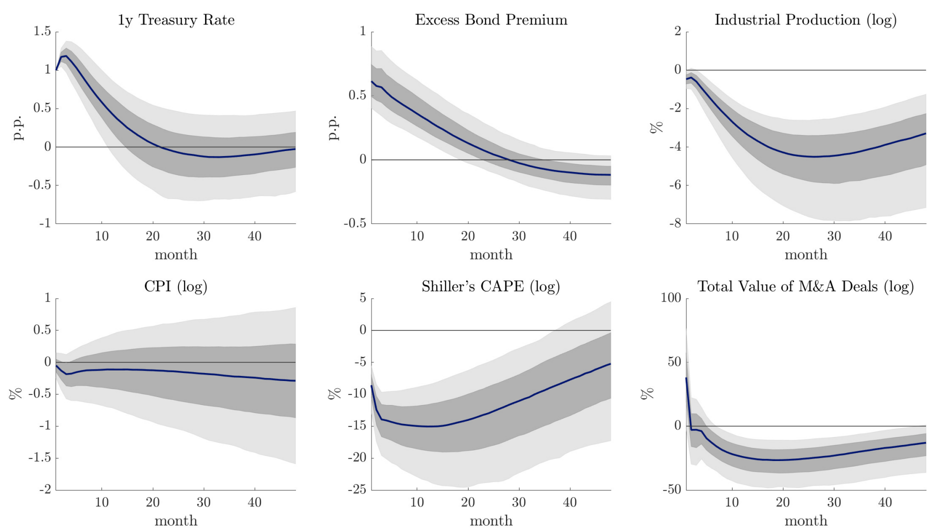
Figure B.4: Response of Aggregate Deal Volume to a Monetary Policy Shock

B.2.3. AIC Lag Length



Note: Light (dark) grey shaded areas indicate 95% (68%) posterior credible sets obtained by taking 5,000 draws from the posterior distribution.

Figure B.5: Response of Aggregate Deal Volume to a Monetary Policy Shock



Note: Light (dark) grey shaded areas indicate 95% (68%) posterior credible sets obtained by taking 5,000 draws from the posterior distribution.

Figure B.6: Response of Aggregate Deal Volume to a Monetary Policy Shock

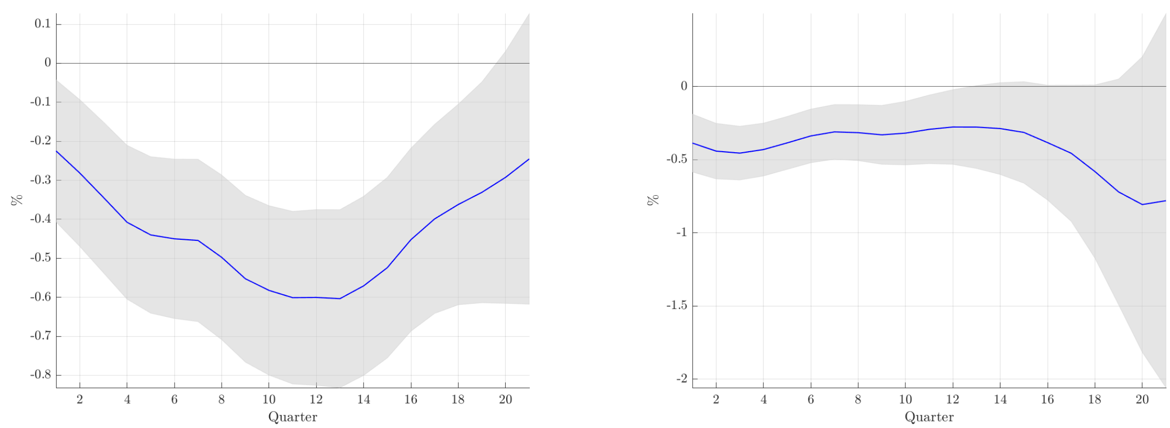
Appendix C. Firm-level Sensitivity Analysis

In this appendix, we report the additional results and sensitivity checks of our firm-level analysis outlined in Section 5.3.2.

C.1. Additional Results

C.1.1. Dynamic Effects

To examine the dynamic response of the acquisition likelihood to a monetary policy shock, we estimate a linear probability local projection model in the style of Jorda (2005). That is, instead of estimating the probability of engaging in a M&A transaction in the 4 quarters following a monetary policy shock, we estimate the quarter by quarter likelihood of engaging in a M&A transaction over a horizon of 20 quarters. We estimate both an unconditional or baseline effect and a conditional effect depending on the firm's financial constraints.



(a) Dynamic Effect: Baseline

(b) Dynamic Effect: Interaction Leverage Ratio

Note: The two panels show the dynamic response of the acquisition likelihood to a monetary policy shock as well as the interaction with the leverage ratio as our main indicator of financial constraints. Shaded areas indicate 95% confidence intervals.

Figure C.1: Dynamic Effect of Monetary Policy on M&A

C.1.2. The Role of Market Power

As described in section 5.3, firms with high degrees of market power might be less likely to be financially constrained and might be more likely to engage in M&A transactions to insulate their dominant position. In Table C.1 the results from several different measures of market power and how they impact the response of firms' M&A decision in reaction to monetary policy.

Table C.1: Monetary Policy, M&A, and Market Power

	(1) P(Acq, 1y)	(2) P(Acq, 1y)	(3) P(Acq, 1y)	(4) P(Acq, 1y)
1y Treasury Rate	-0.010***	-0.011***	-0.010***	-0.009***
	(0.001)	(0.001)	(0.001)	(0.001)
1y Treasury Rate × L.Markup	-0.000			
	(0.001)			
1y Treasury Rate × Lerner Index		0.001		
		(0.003)		
1y Treasury Rate × Market Share			0.000*	
			(0.000)	
1y Treasury Rate × Industry Leader				-0.004
				(0.004)
L.Markup	0.010**			
	(0.004)			
L.Lerner Index		0.090***		
		(0.014)		
L.Market Share			-0.002	
			(0.002)	
L.Industry Leader				0.076***
				(0.018)
N	432,107	393,976	452,702	452,714
FE	Firm	Firm	Firm	Firm
Cluster	Firm	Firm	Firm	Firm
Controls	Firm, Macro	Firm, Macro	Firm, Macro	Firm, Macro

Note: The table presents results from the linear probability model (25) with different measures of market power as interaction terms. The 1-year Treasury Rate is instrumented using cumulative high-frequency identified monetary policy shocks. The firm-level controls and interaction terms are constructed as lagged 4-quarter averages. Standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

C.1.3. M&A and Capital Investment

We investigate whether the decision to engage in M&A is a compliment to or a substitute for tangible capital investment. In Table C.2 the results from interacting the interest rate with a firm's capital expenditure intensity, calculated as the ratio of the firm's real capital expenditure to the firm's capital stock in the previous period and the growth rate of the capital stock, respectively, as described in section 5.3.

Table C.2: Monetary Policy, M&A, and Investment

	(1) P(Acq, 1y)	(2) P(Acq, 1y)
1y Treasury Rate	-0.010***	-0.010***
	(0.001)	(0.001)
1y Treasury Rate × L.CAPEX Intensity	0.000	
	(0.000)	
1y Treasury Rate × L.(Perpetual Capital) Investment		0.011***
		(0.003)
L.CAPEX Intensity	0.000	
	(0.000)	
L.(Perpetual Capital) Investment		0.008
		(0.013)
N	442,300	316,365
FE	Firm	Firm
Cluster	Firm	Firm
Controls	Firm, Macro	Firm, Macro

Note: The table presents results from the linear probability model (25) with different measures of capital investment as interaction terms. The 1-year Treasury Rate is instrumented using cumulative high-frequency identified monetary policy shocks. The firm-level controls and interaction terms are constructed as lagged 4-quarter averages. Standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

C.2. *Sensitivity Checks*

C.2.1. *Measures of financial constraints*

In Table C.3 we report the results from using different measures of financial constraints in identifying the role of the credit channel for the transmission of monetary policy shocks to firm's M&A decisions.

Table C.3: Different Measures of Financial Constraints

	(1) P(Acq, 1y)	(2) P(Acq, 1y)	(3) P(Acq, 1y)	(4) P(Acq, 1y)
1y Treasury Rate	-0.008***	-0.008***	-0.010***	-0.010***
	(0.001)	(0.001)	(0.001)	(0.001)
1y Treasury Rate × L.Age	-0.000			
	(0.000)			
1y Treasury Rate × L.Leverage ratio		-0.005***		
		(0.002)		
1y Treasury Rate × L.Liquidity ratio			0.004***	
			(0.001)	
1y Treasury Rate × L.EBITDA-to-assets ratio				0.026***
				(0.004)
L.Age	-0.003***	-0.003***	-0.003***	-0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
L.Leverage	-0.015***	-0.059	-0.016***	-0.016***
	(0.002)	(0.068)	(0.002)	(0.002)
L.Net Liquidity Ratio	0.006***	0.006***	0.024	0.006***
	(0.002)	(0.002)	(0.030)	(0.002)
L.EBITDA-to-assets Ratio	0.028***	0.029***	0.030***	0.374**
	(0.006)	(0.006)	(0.006)	(0.158)
N	452,714	452,603	452,701	452,547
FE	Firm	Firm	Firm	Firm
Cluster	Firm	Firm	Firm	Firm
Controls	Firm, Macro	Firm, Macro	Firm, Macro	Firm, Macro

Note: The table presents results from the linear probability model (25) with different measures of financial constraints as interaction term. The 1-year Treasury Rate is instrumented using cumulative high-frequency identified monetary policy shocks. The firm-level controls and interaction terms are constructed as lagged 4-quarter averages. For convenience, we restate the result based on the leverage ratio in Table 3, column (4). Standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

C.2.2. *Identification of Monetary Policy Shocks*

In Table C.4, we report the robustness of our results to using the information-robust high-frequency monetary policy surprises by Miranda-Agrippino and Ricco (2021).

Table C.4: Information Robust Monetary Policy Shocks

	(1) P(Acq, 1y)	(2) P(Acq, 1y)	(3) P(Acq, 1y)	(4) P(Acq, 1y)	(5) P(Acq, 1y)
1y Treasury Rate	-0.018**	-0.006*	-0.004	-0.008**	-0.007*
	(0.008)	(0.004)	(0.004)	(0.004)	(0.004)
1y Treasury Rate × L.Leverage ratio			-0.010***		
			(0.002)		
1y Treasury Rate × L.Liquidity ratio				0.004***	
				(0.002)	
1y Treasury Rate × L.EBITDA-to-assets ratio					0.029***
				(0.005)	
L.Leverage		-0.017***	-0.001	-0.019***	-0.020***
		(0.003)	(0.004)	(0.003)	(0.003)
L.Age		-0.002**	-0.002**	-0.002**	-0.002**
		(0.001)	(0.001)	(0.001)	(0.001)
L.Log Total Assets (real)		0.004**	0.004**	0.004**	0.004**
		(0.002)	(0.002)	(0.002)	(0.002)
L.Net Liquidity Ratio		0.007***	0.005***	-0.003	0.007***
		(0.002)	(0.002)	(0.004)	(0.002)
L.Tobin's Q		0.001***	0.001***	0.001***	0.001***
		(0.000)	(0.000)	(0.000)	(0.000)
L.EBITDA-to-assets Ratio		0.035***	0.037***	0.037***	-0.017
		(0.007)	(0.007)	(0.007)	(0.011)
L.Dividend Payer		-0.006	-0.005	-0.005	-0.006
		(0.005)	(0.005)	(0.005)	(0.005)
L.# Industry Mergers		0.000***	0.000***	0.000***	0.000***
		(0.000)	(0.000)	(0.000)	(0.000)
L.Prior Acquisition History		-0.052***	-0.052***	-0.052***	-0.053***
		(0.004)	(0.004)	(0.004)	(0.004)
L.IP Growth		0.003*	0.003	0.003*	0.003
		(0.002)	(0.002)	(0.002)	(0.002)
L.CPI Inflation		-0.015***	-0.014***	-0.015***	-0.014***
		(0.003)	(0.003)	(0.003)	(0.003)
L.Excess Bond Premium		-0.023***	-0.023***	-0.024***	-0.024***
		(0.003)	(0.003)	(0.003)	(0.003)
L.Shillers's CAPE		0.001***	0.001***	0.001***	0.001***
		(0.000)	(0.000)	(0.000)	(0.000)
N	406,938	406,938	406,938	406,938	406,938
FE	Firm	Firm	Firm	Firm	Firm
Cluster	Firm	Firm	Firm	Firm	Firm
Controls	No	Firm, Macro	Firm, Macro	Firm, Macro	Firm, Macro
Sample	1991q1 - 2015q4	1991q1 - 2015q4	1991q1 - 2015q4	1991q1 - 2015q4	1991q1 - 2015q4

Note: The table presents results from the linear probability models (25) (column 1) and (25) with different measures of financial constraints (column 2-5) with information robust high-frequency monetary policy surprises as instrument for the 1-year Treasury Rate. The firm-level controls and interaction terms are constructed as lagged 4-quarter averages. Standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

C.2.3. Sub-sample Stability and Sectoral Effects

In Table C.5, we report robustness checks of the average effect of monetary policy on the acquisition likelihood. We focus on our preferred specification including the full set of firm-level, macroeconomic, and M&A control variables. Column (1) estimates the average effect on the pre-crisis sample from 1990Q1 to 2007Q4. Column (2) estimates the average effect over the entire sample including industry-year fixed effects alongside the firm fixed effects. Column (3) estimates the average effect over the entire sample excluding the finance, insurance, and real estate (FIRE) sectors. Finally, column (4) reports the average effect when standard errors are clustered at the firm and the quarter level.

Table C.5: Sensitivity Tests - Average Effect

	(1) P(Acq, 1y)	(2) P(Acq, 1y)	(3) P(Acq, 1y)	(4) P(Acq, 1y)
1y Treasury Rate	-0.004***	-0.002	-0.009***	-0.009***
	(0.001)	(0.001)	(0.001)	(0.002)
L.Leverage	-0.033***	-0.014***	-0.015***	-0.015***
	(0.005)	(0.003)	(0.002)	(0.003)
L.Age	-0.000	-0.002***	-0.003***	-0.003***
	(0.001)	(0.001)	(0.000)	(0.001)
L.Log Total Assets (real)	0.004**	0.004**	0.004***	0.004**
	(0.002)	(0.002)	(0.002)	(0.002)
L.Net Liquidity Ratio	0.010***	0.007***	0.006***	0.006***
	(0.003)	(0.002)	(0.002)	(0.002)
L.Tobin's Q	0.003***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
L.EBITDA-to-assets Ratio	0.083***	0.028***	0.029***	0.028***
	(0.011)	(0.006)	(0.006)	(0.007)
L.Dividend Payer	-0.001	-0.003	-0.004	-0.005
	(0.005)	(0.005)	(0.005)	(0.005)
L.# Industry Mergers	0.000***	-0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
L.Prior Acquisition History	-0.084***	-0.047***	-0.042***	-0.043***
	(0.005)	(0.004)	(0.004)	(0.005)
L.IP Growth	0.005***	0.003**	0.003**	0.003
	(0.002)	(0.001)	(0.001)	(0.005)
L.CPI Inflation	-0.018***	-0.002	-0.016***	-0.015
	(0.003)	(0.002)	(0.003)	(0.010)
L.Excess Bond Premium	-0.027***	-0.008***	-0.024***	-0.024***
	(0.002)	(0.002)	(0.002)	(0.004)
L.Shillers's CAPE	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
N	309,994	442,665	438,440	452,714
FE	Firm	Firm, Industry x Year	Firm	Firm
Cluster	Firm	Firm	Firm	Firm, Quarter
Controls	Firm, Macro	Firm, Macro	Firm, Macro	Firm, Macro
FIRE Sector	Yes	Yes	No	Yes
Sample	1990Q1 - 2007q4	1990Q1 - 2019Q2	1990Q1 - 2019Q2	1990Q1 - 2019Q2

Note: The table presents results from the linear probability model (24) for different sample sizes (column 1), different fixed effects (column 2), different sectors (column 3), and different clustering (column 4). The 1-year Treasury Rate is instrumented using cumulative high-frequency identified monetary policy shocks. The firm-level controls and interaction terms are constructed as lagged 4-quarter averages. Standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

In Table C.6, we repeat the above sensitivity checks for our main results pertaining to the role of financial constraints.

Table C.6: Sensitivity Tests - Credit Channel (Leverage Ratio)

	(1) P(Acq, 1y)	(2) P(Acq, 1y)	(3) P(Acq, 1y)	(4) P(Acq, 1y)
1y Treasury Rate	-0.004***	-0.000	-0.008***	-0.008***
	(0.001)	(0.001)	(0.001)	(0.002)
1y Treasury Rate × L.Leverage Ratio	-0.001	-0.006***	-0.005***	-0.005***
	(0.003)	(0.002)	(0.002)	(0.002)
L.Leverage	-0.029**	-0.004	-0.007**	-0.006*
	(0.012)	(0.003)	(0.003)	(0.003)
L.Age	-0.000	-0.002***	-0.003***	-0.003***
	(0.001)	(0.001)	(0.000)	(0.001)
L.Log Total Assets (real)	0.004**	0.004**	0.004***	0.004**
	(0.002)	(0.002)	(0.002)	(0.002)
L.Net Liquidity Ratio	0.010***	0.006***	0.006***	0.006***
	(0.003)	(0.002)	(0.002)	(0.002)
L.Tobin's Q	0.003***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
L.EBITDA-to-Assets Ratio	0.083***	0.030***	0.029***	0.029***
	(0.011)	(0.006)	(0.006)	(0.007)
L.Dividend Payer	-0.001	-0.003	-0.004	-0.004
	(0.005)	(0.005)	(0.005)	(0.005)
L.# Industry Mergers	0.000***	-0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
L.Prior Acquisition History	-0.084***	-0.046***	-0.042***	-0.043***
	(0.005)	(0.004)	(0.004)	(0.005)
L.IP Growth	0.005***	0.003**	0.003*	0.003
	(0.002)	(0.001)	(0.001)	(0.005)
L.CPI Inflation	-0.018***	-0.002	-0.015***	-0.015
	(0.003)	(0.002)	(0.003)	(0.010)
L.Excess Bond Premium	-0.027***	-0.008***	-0.024***	-0.024***
	(0.002)	(0.002)	(0.002)	(0.004)
L.Shillers's CAPE	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
N	309,994	442,665	438,440	452,714
FE	Firm	Firm, Industry x Year	Firm	Firm
Cluster	Firm	Firm	Firm	Firm, Quarter
Controls	Firm, Macro	Firm, Macro	Firm, Macro	Firm, Macro
FIRE Sector	Yes	Yes	No	Yes
Sample	1990Q1 - 2007q4	1990Q1 - 2019Q2	1990Q1 - 2019Q2	1990Q1 - 2019Q2

Note: The table presents results from the linear probability model (25) for different sample sizes (column 1), different fixed effects (column 2), different sectors (column 3), and different clustering (column 4). The 1-year Treasury Rate is instrumented using cumulative high-frequency identified monetary policy shocks. The firm-level controls and interaction terms are constructed as lagged 4-quarter averages. Standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Appendix D. First-stage Results

We report the first-stage results for both the unconditional and conditional estimations in Table D. As can be seen, the monetary policy shock predicts positively and significantly the short-term Treasury rate. The Kleibergen-Paap F statistic is well above the respective critical values.

Table D.1: First-stage Results

Dep. Var.	1y Rate	1y Rate x Leverage	1y Rate x EA Ratio	1y Rate x Liquidity
	(1)	(2)	(3)	(4)
IV	2.248***	2.251***	2.253***	2.271***
	(0.007)	(0.008)	(0.007)	(0.008)
IV × Leverage		3.073***		
		(0.0427)		
IV × EA Ratio			3.581***	
			(0.055)	
IV × Liquidity				3.144***
				(0.058)
Observations	426,289	426,289	426,289	426,289
Kl.-Paap F stat.	24,000	5,400	5,200	4,900
Stock-Yogo crit. val.	16.38	7.03	7.03	7.03
FE	Firm	Firm	Firm	Firm
Cluster	Firm	Firm	Firm	Firm

Note: The table presents the fist stage results from the linear probability models (25) (column 1) and (25) with different measures of financial constraints (column 2-5). "IV" refers to the instrumental variable, i.e. the cumulative series of quarterly monetary policy surprises. "EA Ratio" refers to the EBITDA-to-Asset ratio. "1y Rate" refers to the 1-year Treasury Rate. "Leverage" and "Liquidity" refer to the leverage and liquidity ratio, respectively. All regressions include the usual set of firm-level, M&A, and macroeconomic control variables. Standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Appendix E. Deal Quality Sensitivity Analysis

In this Appendix, we report the results from the sensitivity checks of our deal quality analysis outlined in Section 6. We re-estimate our main specification for three different models of the acquirer cumulative abnormal returns: we compute the CAR relative to 1) the Fama-French 3 Factor model plus momentum $\pm$ 1 day around the announcement date (Figure E.1); 2) the Fama-French 3 Factor model $\pm$ 2 days around the announcement date (Figure E.2); 3) the market return $\pm$ 1 day around the announcement date (Figure E.3).

Table E.1: Deal Quality Sensitivity - Fama-French 3 Factor plus Momentum CARs

	(1) CAR	(2) CAR	(3) CAR	(4) CAR
L.1y Treasury Rate (4Q avg.)	0.002***	0.003***	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
L.Wilshire 5000	0.000	0.000**	0.000**	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
L.Shillers's CAPE		-0.001***		-0.000
		(0.000)		(0.000)
L.Excess Bond Premium		-0.002		0.000
		(0.001)		(0.001)
L.IP growth		-0.000		-0.000
		(0.001)		(0.001)
L.CPI inflation		-0.006**		-0.003
		(0.003)		(0.002)
L.# of Industry Mergers			-0.000***	-0.000**
			(0.000)	(0.000)
L.Prior Acquisition History			-0.006***	-0.006***
			(0.002)	(0.002)
L.Age			0.000**	0.000**
			(0.000)	(0.000)
L.Dividend Payer			0.008**	0.008***
			(0.003)	(0.003)
L.Leverage			0.006	0.006
			(0.004)	(0.004)
L.Log Total Assets (Real)			-0.007***	-0.007***
			(0.001)	(0.001)
L.Net liquidity ratio			-0.012**	-0.012**
			(0.005)	(0.005)
L.Tobin's Q			-0.002***	-0.002***
			(0.000)	(0.000)
L.EBITDA-to-assets ratio			-0.055**	-0.057**
			(0.025)	(0.025)
Constant	0.006**	0.020***	0.065***	0.069***
	(0.003)	(0.003)	(0.005)	(0.006)
N	19,643	19,643	19,643	19,643
Controls	No	Macro	Firm	Macro, Firm

Note: The table presents results of the pooled model (29) for CARs computed relative to Fama-French 3 Factor plus Momentum expected returns. The 1-year Treasury Rate is instrumented using cumulative high-frequency identified monetary policy shocks. The firm-level controls for leverage, net liquidity ratio, Tobin's Q, and EBITDA-to-assets ratio as well as the interaction term are constructed as lagged 4-quarter averages. Standard errors are reported in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table E.2: Deal Quality Sensitivity - 5 Day Fama-French 3 Factor CARs

	(1) CAR	(2) CAR	(3) CAR	(4) CAR
L.1y Treasury Rate (4Q avg.)	0.002***	0.003***	0.000	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
L.Wilshire 5000	0.000	0.000**	0.000*	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)
L.Shillers's CAPE		-0.001***		-0.000
		(0.000)		(0.000)
L.Excess Bond Premium		-0.002		0.000
		(0.001)		(0.001)
L.IP growth		0.000		0.000
		(0.001)		(0.001)
L.CPI inflation		-0.007**		-0.003
		(0.003)		(0.003)
L.# of Industry Mergers			-0.000***	-0.000***
			(0.000)	(0.000)
L.Prior Acquisition History			-0.005**	-0.005**
			(0.002)	(0.002)
L.Age			0.000**	0.000**
			(0.000)	(0.000)
L.Dividend Payer			0.009***	0.009***
			(0.003)	(0.003)
L.Leverage			0.012***	0.012***
			(0.004)	(0.004)
L.Log Total Assets (Real)			-0.007***	-0.007***
			(0.001)	(0.001)
L.Net liquidity ratio			-0.010*	-0.010*
			(0.006)	(0.006)
L.Tobin's Q			-0.002***	-0.002***
			(0.000)	(0.000)
L.EBITDA-to-assets ratio			-0.034	-0.035
			(0.028)	(0.029)
Constant	0.007**	0.024***	0.069***	0.073***
	(0.003)	(0.004)	(0.006)	(0.006)
N	19,632	19,632	19,632	19,632
Controls	No	Macro	Firm	Macro, Firm

Note: The table presents results of the pooled model (29)for CARs computed relative to 5 day Fama-French 3 Factor expected returns. The 1-year Treasury Rate is instrumented using cumulative high-frequency identified monetary policy shocks. The firm-level controls for leverage, net liquidity ratio, Tobin's Q, and EBITDA-to-assets ratio as well as the interaction term are constructed as lagged 4-quarter averages. Standard errors are reported in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table E.3: Deal Quality Sensitivity - Model-free CARs

	(1) CAR	(2) CAR	(3) CAR	(4) CAR
L.1y Treasury Rate (4Q avg.)	0.002***	0.003***	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
L.Wilshire 5000	0.000	0.000	0.000*	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)
L.Shillers's CAPE		-0.001***		-0.000
		(0.000)		(0.000)
L.Excess Bond Premium		-0.001		0.001
		(0.001)		(0.001)
L.IP growth		0.000		0.000
		(0.001)		(0.001)
L.CPI inflation		-0.007***		-0.004
		(0.002)		(0.002)
L.# of Industry Mergers			-0.000*	-0.000
			(0.000)	(0.000)
L.Prior Acquisition History			-0.006***	-0.005***
			(0.002)	(0.002)
L.Age			0.000**	0.000**
			(0.000)	(0.000)
L.Dividend Payer			0.008**	0.008***
			(0.003)	(0.003)
L.Leverage			0.009**	0.009**
			(0.004)	(0.004)
L.Log Total Assets (Real)			-0.007***	-0.007***
			(0.001)	(0.001)
L.Net liquidity ratio			-0.013**	-0.013**
			(0.005)	(0.005)
L.Tobin's Q			-0.001***	-0.001***
			(0.000)	(0.000)
L.EBITDA-to-assets ratio			-0.057**	-0.057**
			(0.025)	(0.025)
Constant	0.008***	0.020***	0.069***	0.072***
	(0.003)	(0.003)	(0.005)	(0.006)
N	19,643	19,643	19,643	19,643
Controls	No	Macro	Firm	Macro, Firm

Note: The table presents results of the pooled model (29) for CARs computed relative to the overall market return. The 1-year Treasury Rate is instrumented using cumulative high-frequency identified monetary policy shocks. The firm-level controls for leverage, net liquidity ratio, Tobin's Q, and EBITDA-to-assets ratio as well as the interaction term are constructed as lagged 4-quarter averages. Standard errors are reported in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.