The Transmission of Monetary Policy through Bank Lending: The Floating Rate Channel*

Filippo Ippolito
Universitat Pompeu Fabra,
Barcelona GSE & CEPR

Ali K. Ozdagli†
Federal Reserve Bank of Boston

Ander Perez
Universitat Pompeu Fabra,
Boston University
& Barcelona GSE

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Abstract

We find that *outstanding* bank loans are a vital component of the firm balance sheet channel of monetary policy transmission because, unlike other debt, most bank loans have floating interest rates that are mechanically tied to monetary policy rates. Firms that use more bank debt and do not hedge it display a stronger sensitivity of their stock price, cash holdings, sales, inventory and fixed capital investment to monetary policy. The effect is significantly more powerful for financially constrained firms, consistent with the idea that changes to floating rates induced by monetary policy have an impact on the liquidity and balance sheet strength of these firms. This effect disappears when policy rates are at the zero lower bound, a finding that further supports the floating rate mechanism and reveals a new limitation of unconventional monetary policy. This floating rate channel is potentially as important as the widely studied bank lending channel that works through *new* loans.

Keywords: monetary policy transmission, firm balance sheet channel, bank debt, floating interest rates, financial constraints, hedging

JEL classification: G21, G32, E52

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† Corresponding author. ali.ozdagli@bos.frb.org, 600 Atlantic Ave, Boston MA 02210.

1 Introduction

The firm balance sheet channel is one of the main mechanisms through which monetary policy is thought to interact with credit market imperfections to influence firms' investment, hiring, and output, and it operates by affecting firms' balance sheet strength and ability to access external finance (Bernanke and Gertler (1995), Mishkin (1995)). We test whether outstanding bank loans are an important component of this mechanism, motivated by two observations typically overlooked in the monetary economics literature: monetary policy drives the reference rates underlying floating rate loan arrangements (Figure 1), and the vast majority of corporate loans from banks feature floating rates (Figure 2). Does monetary policy have a strong impact on firms' liquidity positions and their ability to finance future projects by causing changes in the debt service burden of existing floating rate bank loans? We answer this question through the lens of both stock prices and balance sheet variables by creating a new database of firms' hedging activity and merging it with the new Capital IQ database, which includes firm-level information on the usage of bank debt and floating rate debt.

[FIGURES 1 & 2 ABOUT HERE]

We first document that corporations borrow from banks mostly at a floating rate, whereas they issue other forms of debt mostly at a fixed rate. As Figure 2 illustrates, 76 percent of the debt of firms that borrow solely from banks has a floating rate, compared with 9 percent of debt for those firms that have only nonbank debt.[1] Because of their floating rate nature, the presence of outstanding bank loans in a firm's balance sheet should make its stock price more sensitive to monetary policy. Using market-based surprise measures as in Kuttner (2001) and Gürkaynak, Sack and Swanson (2005), we find that while a typical firm's stock price decreases by about 4 to 5 percent in response to a 100 basis point (bp) surprise increase in the federal funds rate, the stock price of a firm that has one standard deviation more bank debt relative to assets decreases by about 1.6 percent more. Moreover, we disentangle the floating rate channel from other transmission mechanisms by identifying firms that hedge their floating rate debt. Our results in Figure 3 show that following a 100 bp surprise increase in the policy rate, all of the additional stock price decline due to the use of bank debt comes from the sample of unhedged firms, consistent with the floating rate channel. Our results are robust to instrumental variables analysis to deal with any possible

[1] This result is in line with Faulkender (2005), who finds that about 90 percent of syndicated bank loans to chemical corporations are issued at a floating rate, and with Vickery (2008), who finds that about 70 percent of loans have a floating rate in the Federal Reserve's Survey of Terms of Business Lending.

endogeneity of the bank debt usage and hedging decisions.

[FIGURE 3 ABOUT HERE]

In the absence of financial frictions, our evidence can be interpreted as a simple cash transfer between a firm's shareholders and its creditors, with no real effects. In the presence of financing frictions, however, the additional interest expense may impact the firm's liquidity position, leverage, and overall balance sheet strength, which in turn could affect the firm's ability to finance profitable investment opportunities. We find that financial constraints increase the policy rate sensitivity of stock prices of unhedged bank debt users significantly, while they do not change this sensitivity for hedged bank debt users, a finding that is consistent with the amplification of the floating rate channel through the effect of financing constraints.

In order to gain a better understanding of the floating rate channel, we also test whether our results with stock prices are reflected in the real and financial decisions of the firms. First, we show that the interest coverage ratio of a firm, measured as interest expense over total cash flow, responds significantly stronger to monetary policy as the share of bank loans over total assets increases, but only if the firm does not hedge against interest rate risk. The effect is sizeable and persists for up to six quarters. This suggests that the exposure to interest rate fluctuations through unhedged bank debt exposes firms to significant liquidity shocks, something which is confirmed by our result that the cash holdings of financially constrained firms that use bank debt and do not hedge are very sensitive to monetary policy, while those of financially unconstrained or hedged bank debt users are not. This finding suggests that a monetary policy tightening might hurt firms exposed to the floating rate channel by draining internal liquid resources of firms with limited access to external finance. Consistent with this implication, we show that there is a strong positive relationship between bank debt usage and the sensitivity of inventory investment, fixed investment, and sales to monetary policy changes for financially constrained firms that do not hedge, but that these effects are absent or are significantly smaller when firms hedge interest rate risk or do not face significant financial constraints. The effects are quantitatively large: six quarters after a 100bp monetary policy tightening, financial constraints are associated with additional decreases in inventories and fixed investment of 22.1% and 15.8%, respectively, for a hypothetical firm fully financed by bank debt and unhedged, but these additional decreases are reduced to less than half when firms are hedged. Taken together, our evidence suggests that the effect of the floating rate channel goes beyond a simple reallocation of cash flows between lenders and shareholders and has significant real implications for the affected firms.

The potential macroeconomic relevance of our monetary policy transmission mechanism is supported by the large fraction of debt which is exposed to interest rate risk. Using a subset of SEC filings, Chernenko and Faulkender (2011) report that floating rate debt represents 41.57 percent of total long-term debt over the period 1993–2003. In our sample, covering 2003-2008, the average percentage of floating rate debt in total debt is 38.31 percent for the entire sample, and 48.98 percent for the sample of bank debt users. The share of this debt that is left unhedged is potentially large, given that less than 50% of bank debt users in our sample use some amount of hedging.[2] We try to provide some measure of the macroeconomic importance of our proposed mechanism by comparing it to the traditional bank lending channel. Using estimates from the literature, we find that a one percentage point rate hike would, on average, generate a \$0.3 cash shortfall on a \$100 dollar business loan from a bank through the bank lending channel. In comparison, the floating rate channel generates a \$0.32 to \$0.88 cash shortfall under the same scenario, suggesting that the floating rate channel is at least as important as the traditional bank lending channel.

Finally, as additional evidence regarding the importance of the floating rate channel, we study the recent zero-lower-bound environment. During this period, the reference rates of floating rate loans were unresponsive to the unconventional monetary policy of long-term asset purchases and therefore any effect of bank debt usage should work through channels other than the floating rate channel. We show that bank debt and hedging have no effect on the monetary policy sensitivity of stock prices during the unconventional policy period. Combined with the importance of the floating rate channel during periods of conventional monetary policy, this finding suggests that the absence of the floating rate channel might have limited the efficacy of unconventional monetary policy during the recent period. This result could shed light on the uncertainty regarding the costs and benefits of unconventional policy, a topic that has gained increased attention recently (e.g. Evans, Fisher, Gourio, and Krane (2015)) as the Federal Reserve contemplates a target rate liftoff.

Related Literature. The literature on the credit channel of monetary policy has put forward two main channels to explain why financing constraints of firms might amplify the effects of monetary policy (Bernanke and Gertler (1995)). The first channel, the *firm balance sheet channel*, captures direct and indirect effects of monetary policy on firms' balance sheet strength and ease of access to external finance. Gertler and Gilchrist (1994) find that inventory investment, sales and short-term debt of an aggregate of small firms are more responsive to changes in monetary policy than those of an aggregate of large firms. Ashcraft and Campello (2007) and Ciccarelli, Maddaloni, and Peydró (2014) control for the possibility that these results might be driven by a contraction of bank lending supply, and both find

[2] The effect is even larger for small and medium sized firms outside of our sample as they rely more on bank debt and usually make little use of hedging derivatives (Vickery (2008)).

evidence of a strong firm balance sheet channel. None of these papers specifies the precise mechanisms through which the firm balance sheet channel operates, which is an important contribution of our paper. We show that a quantitatively significant firm balance sheet channel operates through the impact that monetary policy has on firms' debt service burden when they use bank debt as a source of finance and retain exposure to interest rate risk by not hedging.

While our focus is on outstanding bank debt, these direct cash-flow effects can also occur in a very similar way through the refinancing of short-term debt at new interest rates, which affect firms' net worth in a similar way as long-term floating rate debt does. Our main point is to highlight the role of floating rate bank debt in the firm balance sheet channel, rather than to compare its quantitative relevance with that of the effect of short-term debt. However, long-term floating rate debt differs from short-term debt in some important dimensions which might make it more special relative to short-term debt. First, we find that short-term debt does not increase the sensitivity of firms' stock prices to monetary policy significantly, in contrast to bank debt. Second, the literature has long recognized that long-term debt is more likely to create agency costs of debt finance than short-term debt, such as underinvestment and risk-shifting (Myers (1977), Bodie and Taggart (1978) and Himmelberg and Morgan (1995)), which means that a monetary policy tightening might worsen these agency costs particularly through an increased debt service burden under long-term floating rate bank debt. Third, the effect of floating rate bank debt on the interest coverage ratio is more likely to lead to covenant violations which have important implications for firms' capital expenditures, as shown in Nini, Sufi, and Smith (2012). Finally, while the pass-through of policy rates to floating interest rates of long-term debt is complete and occurs at frequent resetting dates, the pass-through to short-term bank financing rates has been shown to be slow (Bondt, Mojon, and Valla (2005), Illes and Lombardi (2013)).

The second channel, the *bank lending channel*, has focused on why bank lending to firms might be special for the transmission of monetary policy to the real economy (Bernanke and Blinder (1988), Bernanke and Gertler (1995), Stein (1998), Van den Heuvel (2002), and Bolton and Freixas (2006)). All of these theories focus on how the supply of new bank credit might be affected by monetary policy due to the presence of bank financing frictions.[3] Our proposed mechanism focuses instead on the transmission through loans outstanding at the time of monetary policy actions. Also, our mechanism is unrelated to how much banks suffer from financing constraints, so it could be active through all banks at all times, unlike existing

[3] Consistent with a role for bank financial health, the contraction in the supply of lending following a tightening of monetary policy has been found to be stronger in small, less liquid, and more leveraged banks (Kashyap and Stein (2000), Kishan and Opiela (2000), and Jimenez, Ongena, Peydró, and Saurina (2012)), and in banks that are not affiliated with multibank holding companies (Ashcraft (2006)).

mechanisms whose potency may be restricted to a subset of banks during periods of credit market distress.

Our proposed mechanism is closely related to the burgeoning literature that introduces a similar transmission channel for households. Analogous to our mechanism, this literature suggests that monetary policy has real implications by influencing households' cost of servicing their floating rate debt and as a result their disposable income and consumption (Calza, Monacelli, and Stracca (2013), Di Maggio, Kermani, and Ramcharan (2014)).

Finally, this paper is related to recent literature that uses the relationship between stock prices and monetary policy to shed light on questions that are otherwise difficult to answer. For example, the relationship between stock prices and monetary policy surprises is used by Gorodnichenko and Weber (2014) to identify the cost of price stickiness; by English, Van den Heuvel, and Zakrajsek (2014) to study the effect of monetary policy on bank profitability through maturity transformation; and by Chodorow-Reich (2014) to study the effect of unconventional monetary policy on financial institutions.

2 Data Description and Summary Statistics

2.1 Firm-level Data

The sample for our main analysis consists of U.S. firms covered by Capital IQ (CIQ), CRSP, and Compustat from 2003 to 2008, excluding utilities (SIC codes 4900–4949) and financials (SIC codes 6000–6999). We focus on this period because of the lack of wide coverage of bank debt data in CIQ before 2003, and because the federal funds target rate hit the zero lower bound in 2008, after which the quantitative easing program of the Federal Reserve replaced the federal funds target rate as the main monetary policy tool.[4] In an extension in Section 5.2, in which we study the quantitative easing period separately, we extend our sample to also cover 2008 to 2011. We remove observations with negative revenues, missing information on total assets, or a value of total assets under $10 million.

For our stock price analysis, we also discard penny stocks, defined as those with a price of less than $5, as in Amihud (2002). Moreover, we follow the convention in the literature (De Bondt and Thaler (1990), Kashyap, Lamont, and Stein (1994) or Polk and Sapienza (2009)) and focus on firms whose fiscal year ends in December so that balance sheet information about different firms is available to investors at the same time. Various degrees of staleness of balance sheet information across different firms might affect our results, especially because some firm characteristics might be seasonal, not only over the calendar year, but also over

[4] Since data availability limits our sample, in Appendix A we make sure that the reaction of stock prices to monetary policy shocks in our sample is similar to the effect of monetary policy on stock prices before 2003 and in the CRSP universe.

the fiscal year.[5] Our main results remain similar when we include all firms.

For our analysis of balance sheet variables, we use quarterly data. As a result, we have four observations per year, which is half as much as the event study with stock prices allows because there is usually more than one FOMC announcement per quarter. Imposing a December fiscal year-end would reduce the number of observations even further. Moreover, the availability of balance sheet information to investors is not as important for real variables as it is for stock prices, because the information is internally available to managers. Therefore, we also include firms whose fiscal year ends in March, June, September, or December, so that our variables match the measure of monetary policy that we use for that analysis, which is a quarterly aggregate of monetary policy changes.

After the above filters, the sample for our analysis of stock returns contains 9,746 firm-year observations comprising 2,368 unique firms, and the sample for our analysis of balance sheet variables contains 45,694 firm-quarter observations comprising 3,146 unique firms. Exact variable definitions are given in Table A1 in the Appendix. Following common practice in the empirical finance literature, all variables are winsorized at the 1 percent level in both tails of the distribution to prevent extreme values from overinfluencing our regressions.[6] Throughout the analysis, we use demeaned firm-level variables in regressions with interaction terms to facilitate the interpretation of the coefficient estimates of the policy action as the reaction of the average firm.

CIQ compiles detailed information on capital and debt structure from the footnotes of 10-K Securities and Exchange Commission (SEC) filings. In particular, from CIQ we obtain data on the amount of bank debt firms have in their liabilities. Our main measure of bank debt usage, $BankDebt/At$, is defined as total bank debt, which we calculate as drawn credit lines (CL) plus term loans (TL), divided by the total value of book assets (Compustat item AT). For robustness, we also employ two additional measures of bank debt usage: CL plus TL divided by total debt, and TL plus CL plus undrawn credit lines, divided by the total value of book assets. Table I provides key statistics for the balance sheet variables we employ in our study. Across the entire sample (column 1), bank debt represents on average 7.22 percent of the book value of assets and 37.51 percent of total debt. For the subset of firms with some bank debt (column 2), the above ratios rise to 12.93 percent and 54.85 percent. In both samples, approximately half of bank borrowing is in the form of drawn credit lines and the other half in the form of term loans.

[TABLE I ABOUT HERE]

[5] For example, Oyer (1998) finds that in addition to varying with the calendar business cycle, manufacturing firms' sales are higher at the end of the fiscal year.

[6] See, for example, Fama and French (1992) and Sufi (2009).

A comparison between columns 2 and 3 reveals that firms with bank debt do not seem to display characteristics that suggest that they are clearly more sensitive to monetary policy, compared to leveraged firms without bank debt (i.e., those that use other sources of debt). They are similar in size, age, and the likelihood of being rated, and more profitable and less risky, as captured by lower average CAPM beta and cash flow volatility.[7]

We also obtain information on the percentage of firms' debt that is floating or fixed rate from CIQ. Unlike the bank debt variable, which is measured with precision (Colla, Ippolito and Li (2013)), the floating rate debt variable is measured with some error and we only use it as an approximation. It is manually collected by CIQ from the footnotes in 10-K filings, which could lead to errors that are hard to detect systematically. Indeed, the sum of floating plus fixed rate debt often does not add up to total debt. The 5th percentile of the ratio of floating plus fixed rate debt to total debt is 0.83, and the 95th percentile is 1.04.

This caveat notwithstanding, our floating rate debt measure is useful to illustrate a key distinction of bank vs. non-bank debt. A comparison between columns 2 and 3 also reveals that bank debt is more likely to feature floating interest rates than non-bank debt. Floating rate debt represents 12.75 percent of the value of the assets of bank debt users, compared with 1.59 percent for the firms with only non-bank debt. Figure 2 explores in more detail the relation between bank debt and floating rate debt. On the horizontal axis, firm-year observations are grouped into percentile bins of bank debt as a percentage of total debt. On the vertical axis, we report floating rate debt as a percentage of total debt. The figure shows a striking correlation between bank debt and floating rate debt. For those firms for which the entire stock of debt consists of bank debt, about 76 percent of it is floating rate. For those firms whose debt is entirely from non-bank sources, however, only around 9 percent of debt is floating rate. These figures are consistent with Faulkender (2005), according to which 89.9 percent of bank loans are issued with a floating rate, compared to only 7% of floating rate bonds. Aslan and Kumar (2012) report that *all* of the syndicated bank loans in their comprehensive sample drawn from the Loan Pricing Corporation's (LPC) Dealscan database from 1996 through 2007 have floating interest rates.

Given that the CIQ bank debt variable is measured with precision and that the evidence above suggests that a vast majority of bank debt features floating interest rates, while most non-bank debt is issued with fixed rates, we focus in our analysis on bank debt as a proxy for the amount of floating rate debt in firms' balance sheet. For robustness, we also make sure that our results are similar when we use CIQ's floating rate debt measure.

[7] This finding regarding ratings seems to go against earlier work that uses the absence of a credit rating as a proxy for bank debt usage. Table A2 studies the determinants of bank debt usage in a multivariate framework, and shows that indeed, once we control for other firm characteristics, there is a negative relationship between bank debt usage and ratings.

2.2 Interest Rate Hedging Data

We collect data on interest rate hedging activities of U.S. firms using a text-search algorithm that scans 10-K corporate filings with the SEC. Disclosure of derivative hedging is mandatory under the 1998 Financial Reporting Release (FRR) No. 48 of the SEC and the 2001 SFAS No. 133. We do a detailed search of multiple phrases consistent with the use of interest rate derivatives (such as "hedge against interest rate," "hedge interest rate," "interest rate swap"), and then, for those filings for which we have a preliminary reading consistent with interest rate hedging, we check for false positives by controlling for negations, such as "not use any interest-rate swaps," "not use interest-rate swaps," "not currently use any interest-rate swaps," "not hedge interest rate," "not use derivative financial instruments as a hedge against interest rate," "termination of interest rate swap," "fixed to floating interest rate swap," or "do not currently use interest rate swap." Appendix B provides examples of the types of discussions on hedging activities that we find in the 10-K files.

Table I reports the summary statistics for our hedging dummy. Overall, about 35 percent of firm-years in our sample feature the usage of floating to fixed rate hedging. Moreover, firms that use bank debt (column 2) are about twice as likely to hedge than those that only use other types of debt (column 3). The binary nature of our hedging variable has two implications for our analysis. First, the difference between columns 2 and 3 is likely an understatement of the relative effect of hedging. Faulkender's (2005) finding that floating-to-fixed rate hedging affects only 0.5% of the bonds suggests that the net effect of hedging for firms without bank debt is negligible. This is a reason that makes bank debt a more suitable variable for the study of the floating rate channel compared to CIQ's floating rate debt measure (in addition to the measurement error mentioned before): in our regressions with floating rate debt (instead of bank debt), two hedgers with the same amount of floating rate debt will be treated the same even if one of them has mostly bank debt and the other has mostly non-bank debt although the effect of hedging on the latter group is negligible. This leads to a noisier estimation of the floating rate channel when using floating rate debt. Second, since not necessarily all bank debt will be hedged at once, our hedging dummy overvalues the protective effect of hedging and hence the associated coefficient of interest (Hedging*(Bank Debt /At)) is likely underestimated. Therefore, our results should be considered a lower bound for the effect of hedging and the floating rate channel. We also report statistics about (Hedging*(Bank Debt /At)) and (Hedging*(Floating Rate Debt /At)) in Table I as the coefficient of this variable is of primary interest to us in the following sections.

In columns 4 and 5 of Table I we report additional statistics for hedgers and non-hedgers among firms with bank debt. Firms that hedge use more bank debt (and floating rate debt) on average, and are more profitable, older and less financially constrained, although their size, on average, is not significantly different. However, they also hold less cash probably because interest rate hedging reduces the precautionary demand for liquidity.

2.3 Monetary Policy Data

Because the equity market will already have responded to anticipated policy actions, we follow the approach of Kuttner (2001) and Bernanke and Kuttner (2005) to dissect the monetary policy actions into the unexpected (*surprise*) component and the anticipated (*expected*) component on an FOMC meeting or an announced change in the federal funds target rate. The identification of the surprise element in the target rate change relies on the price of the current month 30-day federal funds futures contracts, a price that encompasses market expectations of the effective federal funds rate. We follow this method because federal funds futures outperform target rate forecasts based on other financial market instruments or based on alternative methods, such as sophisticated time series specifications and monetary policy rules.[8] Another advantage of looking at one-day changes in near-dated federal funds futures is that federal funds futures do not exhibit predictable time-varying risk premia (and forecast errors) over daily frequencies.[9] The data for the decomposition of the federal funds target rate changes can be obtained from Kenneth Kuttner's webpage.[10] Appendix C summarizes the process which generates this decomposition.

3 The Floating Rate Channel: Evidence from Stock Prices

Our evidence in support of the floating rate channel is based on stock prices and balance sheet data. Both types of data have advantages and disadvantages, and studying both provides a more robust test of our proposed channel. Stock prices, to the extent that they efficiently reflect firms' underlying fundamentals, can provide a more precise identification of a specific transmission mechanism because they react rapidly to policy changes and can be measured immediately after the policy shock occurs, compared to balance sheet variables, such as fixed investment or inventory investment, which might react slowly due to adjustment costs and are measured a long time after the shock has occurred. Their slow reaction might prevent the identification of the full policy impact if the effects occur with a significant lag. And because they are not available immediately, other shocks and mechanisms might come into play, making identification difficult. Additionally, stock prices provide a welfare-relevant measure of the effects, by capturing their present value. Moreover, understanding

[8] See Evans (1998) and Gürkaynak, Sack and Swanson (2005) for details.

[9] See, for example, Piazzesi and Swanson (2008).

[10] http://econ.williams.edu/people/knk1/research

how and why stock prices react to monetary policy has been an important question since, at least, Tobin (1969) and Modigliani (1971) due to its important implications for consumption and investment. For these reasons, we follow Gorodnichenko and Weber (2014), English, Van den Heuvel, and Zakrajsek (2014) and Chodorow-Reich (2014), who also study stock prices to shed light on the transmission of monetary policy. Balance sheet variables, on the other hand, allow us to test more specific implications of our proposed transmission channel, enabling us to more convincingly distinguish our mechanism from alternative ones.

We start by focusing on stock prices, and proceed in three steps. We start by showing that bank debt usage makes firms significantly more responsive to monetary policy, and then show that this additional responsiveness is concentrated in the firms that do not hedge their interest risk, and especially so in the financially constrained ones.

3.1 The Effect of Bank Debt Usage

As our first step, we analyze whether a firm i's stock price change $Ret_{i,t}$ over the day t in which a monetary policy shock $Surprise_t$ occurs and the day after depends on the importance of bank debt as a source of financing, $(BankDebt/At)_{i,t-1}$.[11] For this purpose, we use the following regression,

$$\begin{aligned} Ret_{i,t} &= \beta_0 + \beta_1 Surprise_t + \beta_2 \left(BankDebt/At\right)_{i,t-1} \\ &\quad + \beta_3 Surprise_t * \left(BankDebt/At\right)_{i,t-1} \\ &\quad + \gamma Controls_{i,t-1} + \lambda Surprise_t * Controls_{i,t-1} + \varepsilon_{i,t}, \end{aligned} \tag{1}$$

where $Controls_{i,t-1}$ is a vector of firm characteristics. In this regression, $Ret_{i,t}$ and $Surprise_t$ refer to stock returns and monetary policy surprise at the FOMC announcement date t. Since $(BankDebt/At)_{i,t-1}$ is available yearly and since we want $(BankDebt/At)_{i,t-1}$ and $Controls_{i,t-1}$ to be available to investors simultaneously, we use the last fiscal year-end data available before the date of the monetary policy event in order to capture the information available to investors at the time of the monetary policy announcement, in line with most of the cross-sectional asset pricing literature dating back at least to Fama and French (1992). With a slight abuse of notation, in the case of firm characteristics, $t-1$ refers to the most recent fiscal year-end prior to the federal funds rate target announcement date. In the case of $Surprise_t$ and $Ret_{i,t}$, t refers to the monetary policy announcement date, of which there

[11] We measure returns over a 2-day window for two reasons. First, as Figure 3 shows, it takes more than a day for the full effect of bank debt usage to be incorporated in stock prices. Moreover, the FOMC blackout period, during which Federal Reserve employees are not allowed to comment on current monetary policy, ends on the day following the FOMC announcement, potentially making the inference based on a wider than two-day event window not as reliable.

are many in any given year.

Our firm-level controls include book leverage, firm size, the market-to-book ratio, profitability, and interest rate sensitivity, all of which are described in Table A1 in detail.[12] We control for book leverage because bank debt users are more likely to be highly leveraged, and as such might be more sensitive to monetary policy. We control for firm size and market-to-book ratios because these variables are well-known risk factors for asset prices since the seminal paper of Fama and French (1992), and they can also affect the reaction of stock prices to policy surprises because they are related to financial constraints and investment opportunities.[13] Profitability is included because, as shown in Fama and French (1995), the market-to-book ratio is associated with persistent differences in profitability and firms with bank debt tend to be more profitable, as shown in Table I. In addition, Ehrmann and Fratzscher (2004) report strong evidence that firms with low profitability are more responsive to monetary policy when profitability is measured as cash flow divided by income. Finally, we control for the interest rate sensitivity of operating profits because it might influence the propensity to borrow from banks. This would generate a correlation between bank debt usage and the reaction of stock prices to monetary policy even if there were no causal relationship between these variables.[14]

The results of this regression under various alternative specifications are presented in Table A4 and discussed in detail in Appendix D. The main takeaway is that bank debt usage increases the responsiveness of firms' stock prices to monetary policy significantly. Focusing on column 1, we observe that a one standard deviation (0.114) increase in our bank debt usage measure causes the stock price to increase 1.6 ($= -14 * 0.114$) percentage points more in response to a 1 percentage point surprise decrease in the federal funds rate. To put this effect in perspective, the same surprise decrease in the federal funds rate causes the stock price of the firm with the average amount of bank debt over assets (7.22%) to increase about 4.97 percent on average. This result is very robust, and survives various specifications. We discard

[12] We do not control for market leverage because, as shown in Ozdagli (2012), the value of market leverage can be pinned down using book leverage and the market-to-book ratio, leading to collinearity.

[13] We also add CAPM betas, calculated as in Fama and French (1992), as an additional control in some specifications. Alternatively, we could use Fama-French factors based on these risk characteristics (size, market-to-book, beta) to calculate returns not explained by these factors. We prefer our approach because firm characteristics subsume the effect of the Fama-French risk factors. See, for example, Daniel and Titman (1997) and Ferson and Harvey (1999).

[14] Our particular concern is that firms that use bank debt are special in that they are on average riskier and more interest rate sensitive, which would suggest that we may overestimate the direct impact of bank debt. While controlling for the interest rate sensitivity of operating profits of firms, as we do later, should address these concerns, we look deeper into the relationship between a firm's riskiness and its bank financing behavior in Table A2. Contrary to our concerns, columns 1 and 2 show that bank debt usage is negatively associated with cash flow volatility, and that there is no statistically significant relationship with the interest rate sensitivity of operating profits.

the possibility that the additional responsiveness occurs because firms that use bank debt are potentially more highly leveraged, more severely financially constrained, or more reliant on short-term debt, by controlling for the relevant firm characteristics and by introducing an instrumental variables regression. We also replace bank debt usage, $(BankDebt/At)$, with $(BankDebt/Debt)$, to deal with the possibility that using book leverage as a separate control variable is not enough to argue that the effect of bank debt goes beyond the effect of other types of debt. Overall, we conclude that bank debt usage is important for the responsiveness of a firm to monetary policy and this importance cannot be attributed to other firm characteristics.

3.2 The Floating Rate Channel of Bank Debt

The results obtained in Section 3.1 suggest that bank debt is special for the transmission of monetary policy to stock prices. In this section, we present evidence that suggests that a significant part of the effect is driven by the floating rate nature of bank debt, a transmission mechanism that we call the *floating rate channel*.

The floating rate nature of most bank debt suggests that monetary policy actions should be reflected mechanically in the interest expense associated with existing bank loans because these actions induce changes in the reference rates used in the floating rate agreements.[15] Following this logic, our empirical strategy provides evidence for the floating rate channel by exploiting the variation across firms in their floating-to-fixed interest rate hedging of their bank debt or floating rate debt. If the floating rate channel is quantitatively relevant, we should observe that the effect of bank debt usage on the sensitivity of stock prices to monetary policy should diminish significantly for firms that engage in floating-to-fixed interest rate hedging.

We restrict our sample to those firms that have variable rate debt outstanding in excess of 1% of total assets, to isolate those firms that might have an incentive to engage in interest rate risk hedging as insurance against fluctuations in the interest payments of the existing debt, rather than as a speculative investment opportunity. We divide this sample into those firms that hedge interest rate risk and those that do not, and we test the prediction that firms that use bank debt or floating rate debt and that hedge against interest rate risk should be, all else equal, less responsive to monetary policy shocks than those that do not hedge, by running specification (1) separately on each subsample.

The results of our main tests, provided in Table II, are consistent with our predictions. In columns 1 and 2, we test whether hedging affects the impact of bank debt usage on

[15] The period starting in the fall of 2008 in which the Federal Funds Target Rate reached the zero lower bound was one in which the floating rate channel of monetary policy was unlikely to be operative. Figure 2 clearly shows that both the LIBOR rate and the prime rate have been very stable during this period. We pursue this question in Section 5.2 and show that the floating rate channel was mute during this time period.

the sensitivity to monetary policy. We find that while for the subsample of hedgers bank debt usage does not affect the sensitivity of stock prices to monetary policy, those that do not hedge are significantly more responsive to surprise changes in the federal funds rate. In particular, column 1 shows that the effect of bank debt usage becomes about twice as significant for the subsample of non-hedgers in comparison to our results for the full sample in Section 3.1, whereas the effect for the subsample of hedgers in column 2 becomes both economically and statistically insignificant.[16] Columns 3 and 4 show that this result is robust to the inclusion of a full set of firm level controls, both interacted with surprise and uninteracted, the introduction of firm fixed effects, and clustering errors at the date-industry level. Finally, we interact all regressors in regression (1) with the hedging dummy in order to assess statistical significance of the difference between hedgers and non-hedgers using the following regression

$$\begin{aligned} Ret_t = {} & \beta_0 + \beta_1 Surprise_t + \beta_2 Surprise_t * (BankDebt/At)_{t-1} \\ & + \beta_3 Surprise_t * (BankDebt/At)_{t-1} * Hedge_t \\ & + \lambda Surprise_t * Controls_{t-1} * Hedge_t \\ & + \text{Uninteracted terms and second order interactions} + \varepsilon_t, \end{aligned} \quad (2)$$

in which we drop the reference to the firm-level subindex i for ease of exposition. We find that the difference between hedgers and non-hedgers, captured by β_3, is statistically significant.

Since we argue that the floating rate channel works via floating rate nature of bank debt, we test the robustness of our results by directly looking at floating rate debt. Accordingly, we repeat our exercise by replacing bank debt with floating rate debt in columns 5-8, and obtain similar qualitative results: usage of floating rate debt increases the responsiveness of stock prices to monetary policy only for those firms that do not hedge interest rate risk. We also note that the results are slightly weaker than the ones obtained with bank debt usage. As discussed in Section 2.2, this relative weakness is expected because non-bank floating rate debt is less likely to be hedged (Faulkender (2005)) and our hedging variable is a dummy variable that captures whether the firm hedges any of its floating rate debt rather than the total amount of floating rate debt that has been hedged. In our regressions, two hedgers with the same amount of floating rate debt will be treated the same even if one of them has mostly bank debt and the other has mostly non-bank debt. In addition, there is a moderate

[16] This does not necessarily mean that for non-hedgers bank debt does not play any role for the transmission of monetary policy. It could be the case that multiple transmission channels exist that operate in opposite directions and cancel each other out on average for this particular group of firms. An example of a transmission mechanism that would make bank debt using firms less responsive to monetary policy is one in which bank-firm relationships enable firms to benefit from some degree of insurance against changes in credit availability (Puri, Rocholl and Steffen (2013)).

degree of mismeasurement in our floating rate variable. Both factors lead to a potential underestimation of the floating rate channel when using floating rate debt.

[TABLE II ABOUT HERE]

Finally, to deal with the concern that the previous regression estimates might be biased due to endogeneity affecting firms' hedging decision, we follow Campello, Lin, Ma, Zou (2011) and use an instrumental variables approach that arises from institutional features of the U.S. tax system. The kinks/discontinuities of the tax schedule, especially at the zero income level due to loss offset provisions, create a convexity of tax rates.[17] When the corporate income tax schedule is convex, as is the case in the U.S., firms can reduce their expected tax liabilities by hedging in order to minimize income volatility, as discussed by Smith and Stulz (1985), Graham and Smith (1999), and Petersen and Thiagarajan (2000). The convexity of tax rates provides firms with incentives to hedge (relevance condition). At the same time, tax convexity is unlikely to have a direct first-order effect on the sensitivity of stock prices to monetary policy shocks (exclusion restriction). Therefore, our hedging variable is instrumented by tax convexity, derived from the following formula as in Graham and Smith (1999) and Campello, Lin, Ma and Zou (2011),

$$\begin{aligned} Convexity &= 4.88 + 0.019 \times Vol - 5.50 \times Corr \\ &\quad -1.28 \times DITC + 3.29 \times DNOL + 7.15 \times DSmallNeg \\ &\quad +1.60 \times DSmallPos - 4.77 \times DNOL \times DSmallNeg \\ &\quad -1.93 \times DNOL \times DSmallPos \end{aligned} \tag{3}$$

where Vol is the volatility of taxable income, $Corr$ is the serial correlation of taxable income, $DITC$ is a dummy for investment tax credits, $DNOL$ is a dummy for net operating losses, and $DSmallNeg$ ($DSmallPos$) is a dummy for small negative (positive) taxable income. We calculate the volatility of taxable income and the serial correlation of taxable income on a rolling basis, using historical annual data up to the year of interest, starting in 1989.

Because we are interested in how hedging affects the relationship between bank debt usage and firms' sensitivity to monetary policy shocks and because this term in our regression is non-linear, given by $Surprise_t * (BankDebt/At)_{t-1} * Hedge_t$, we cannot use the traditional instrumental variable approach where the first stage estimates of hedging are used to replace

[17] As Campello, Lin, Ma, Zou (2011) discuss, the presence of nonlinearities in the corporate income tax function is not limited to the transition from positive to negative profits, but is present at other levels of profits as well.

our endogenous variable in the second stage, which is dubbed "the forbidden regression" in the literature. Therefore, we use an alternative approach, suggested in Wooldridge (2002, Ch. 20) and Angrist and Pischke (2009, Ch. 4), in which we use the first stage estimates as instruments; i.e., we use $Surprise_t * (BankDebt/At)_{t-1} * PHedge_t$ as an instrument for $Surprise_t * (BankDebt/At)_{t-1} * Hedge_t$, where $PHedge$ is the predicted probability of hedging that comes from the first stage probit regression of the hedging dummy on the instrumental variables.

[TABLE III ABOUT HERE]

Panel A of Table III presents our results. In column 1, we present the standard fixed effects regression where we interact our bank debt usage with hedging for the subsample of observations that have values for $Convexity$. The results are comparable to Table II quantitatively, and also imply that hedgers' reaction to monetary policy barely increases with greater bank debt usage. The other columns of Table III confirm this finding qualitatively using our instrumental variable approach with different instruments related to tax convexity. In particular, IV1 uses $Convexity$ as an instrument for $Hedge$; IV2 uses the individual components underlying $Convexity$, i.e., the variables forming equation (3), given that our sample is different from Graham and Smith (1999) where this equation comes from; and IV3 uses the same variables as IV2 except Vol to account for the possibility that cash flow volatility can be separately related with the reaction of stock prices to monetary policy shocks. While the instrumental variable results seem quantitatively different, the Hausman test cannot reject the hypothesis that they are the same, also suggesting that the endogeneity of hedging is not a big concern. Moreover, the qualitative result from all these regressions is the same because the sum of the coefficients of $Surprise_t * (BankDebt/At)_{t-1}$ and $Surprise_t * (BankDebt/At)_{t-1} * Hedge_t$ add up to a number statistically insignificantly different from zero, implying that bank debt usage does not significantly affect the sensitivity of stock prices to monetary policy shocks for hedgers.

Panel B of Table III repeats the same exercise for floating rate debt. For most of the specifications, the magnitudes of the coefficient of $Surprise * (FloatingRateDebt/At) * Hedge$ are comparable to the results in the last line of Table II although they are not statistically significant. As in panel A, the Hausman test cannot reject the hypothesis that they are the same.[18]

[18] The instrumental variable approach also addresses other concerns, for example whether the differences in financial constraints of hedgers and non-hedgers as shown in Table I can drive our results. For any remaining concerns on this issue, Appendix E discusses the relationship between hedging and financial constraints in more detail directly and shows that our results are also obtained in a regression in which hedging and financial constraints are included together.

Therefore, we conclude that our results are, at least qualitatively, robust to the potential endogeneity of the interest rate risk hedging decision.

3.3 The Floating Rate Channel for Constrained vs. Unconstrained Firms

In the absence of financial frictions, our evidence on the floating rate channel would be interpreted as a simple transfer of cash between a firm's shareholders and its creditors because monetary policy affects the benchmark rates underlying floating rate liabilities. In this case, the effect of bank debt usage on stock prices would simply represent the expected present value of this transfer over the lifetime of the loan. In the presence of financing frictions, however, the impact could be amplified through the effect of variations in the interest expense on the firm's liquidity position and overall balance sheet strength, which in turn could affect the firm's ability to finance profitable investment opportunities.[19]

To explore this, we analyze the stock price reaction of hedgers vs. non-hedgers within groups of firms with different degrees of financial constraints. We explore whether hedging affects the policy sensitivity of stock prices of financially constrained bank debt users more than it does those of less financially constrained bank debt users, which would be consistent with the amplification of the floating rate channel through the effect of financing constraints. Therefore, we run our original regression (1) separately for hedgers and non-hedgers that face different degrees of constraints, measured by age and the Hadlock and Pierce (2010) (HP) index.[20]

[TABLE IV ABOUT HERE]

The first two rows of Table IV give the coefficients of interest from these regressions. We predict that our floating channel is mute among the hedgers regardless of the degree of financial constraints which is confirmed by the coefficient of $Surprise * (BankDebt/At)$ in

[19] Other frictions might also result in real implications of the interaction of monetary policy actions and floating rate debt. For example, an existing debt overhang problem (Myers 1977) might be worsened by an increase in the claims of banks following a monetary policy tightening. Or an asset substitution problem (Jensen and Meckling (1976)) might arise as the same increase in interest rates might increase the convexity of shareholders' claims and enhance a distortion towards risky investment. In addition, we refer in this paper to the real economic outcomes directly caused by firms' decisions, but we should note that even in the absence of changes in firms' decisions the cash-flow reallocation caused by the floating rate channel can have macroeconomic effects to the extent that debtholders and equityholders have different consumption-savings behavior because of differences in demographic characteristics or risk aversion. These additional effects are outside the scope of our paper.

[20] We choose the HP measure among other candidates, such as Kaplan and Zingales (KZ, 1997) and Whited and Wu (WW, 2006), because Hadlock and Pierce (2010) show that the KZ and WW indices have very little power to predict financial constraints and any power they have comes from firm size and age, the two variables they use to create their composite HP index.

columns 3, 4, 7, and 8 in Table IV as these coefficients are statistically and economically insignificant. Moreover, our amplification mechanism through financial frictions predicts that financially constrained non-hedgers should react the strongest. This is confirmed by columns 1, 2, 5, and 6 in Table IV as the coefficient of $Surprise * (BankDebt/At)$ is larger in magnitude among the more constrained (young and high-HP) non-hedgers in comparison to less constrained non-hedgers. In other words, financing constraints only matter significantly for the effect of bank debt usage on the responsiveness to monetary policy when firms are exposed to interest rate risk because they do not hedge.

This evidence suggests that the effect of our new floating rate channel goes beyond a simple reallocation of cash flows between lenders and shareholders following monetary policy events, possibly reflecting a financial amplification mechanism that works through a firm's interest expense on existing floating rate debt and its liquidity position. If so, our floating rate channel might bear implications for the financing and production choices of the firms as well. We explore this next in Section 4.2.

4 The Floating Rate Channel: Evidence from Balance Sheet Variables

4.1 Impact on Firms' Liquidity Position

In this section, we explore the mechanism through which our floating rate mechanism affects firms' balance sheet strength. We conjecture that monetary policy can have a strong impact on the liquidity position of firms exposed to interest rate risk because their cash flows will be affected by changes in their interest expense. We focus on the behavior of the interest rate coverage ratio and cash holdings of firms following monetary policy events.

The interest rate coverage ratio, defined as the ratio of a firm's interest expense to the sum of interest expense plus cash flow, is a proxy for firm financial distress often used in the empirical literature on firm financial constraints (Whited (1992), Gertler and Gilchrist (1994), and Campello and Chen (2010), for example). A high coverage ratio indicates that the firm may face difficulties trying to meet interest rate payments with current cash flows and may need to access external finance, make use of retained earnings, or decrease investment and hiring to avoid default. The main channel through which our floating rate mechanism operates is by affecting this coverage ratio.

We compute the coverage ratio at the quarterly level as the sum of interest expenses (Compustat item, XINTQ) and cash flow divided by interest expenses, where cash flow is equal to earnings before extraordinary items (IBQ) plus depreciation (DPQ). We test whether a higher bank debt usage as a share of total assets increases the responsiveness of firms' interest rate coverage ratios following monetary policy actions, due to the higher likelihood of this debt being floating rate. We use the following empirical specification:

$$\begin{aligned}\Delta CoverageRatio_{t-1,t+x} &= \beta_0 + \beta_1 \widehat{Change}_t \\ +\beta_2 \left(BankDebt/At\right)_{t-1} &+ \beta_3 \widehat{Change}_t \left(BankDebt/At\right)_{t-1} \\ +\gamma Controls_{t-1} &+ \lambda \widehat{Change}_t \left(Controls_{t-1}\right) + \varepsilon_t, \end{aligned} \tag{4}$$

where $\widehat{Change}_t$ is the cumulative quarterly change in the interest rate, as in Ashcraft and Campello (2007) and Jiménez, Ongena, Peydró, and Saurina (2012, 2014), instead of the cumulative surprise component because cash flow and the interest rate expense on existing debt is not forward-looking the way stock prices are.[21] Our firm-level controls include book leverage, firm size, market-to-book ratio, profitability, interest rate sensitivity, and short-term debt. We include firm and year-quarter fixed effects, and we cluster errors at the industry-quarter level.[22]

The dependent variable ($\Delta CoverageRatio_{t-1,t+x}$) is calculated as the change between the coverage ratio in the quarter before the monetary policy shock and $x \in \{1, 2, 3, 4, 5, 6\}$ quarters ahead. The timing of effects of the floating rate channel is influenced by the frequency with which interest rates of floating rate bank loans are reset to adjust to movements in the reference rate. Because this frequency can range from 1 day to 1 year (Inklaar and Wang (2013)), the effects might occur with a lag of several quarters, although a majority of commercial and industrial (C&I) loans have a resetting frequency of one month or less, according to the Federal Reserve's Survey of Terms of Business Lending.

As in Sections 3.2 and 3.3, we restrict our sample to include firms that have outstanding variable rate debt equivalent to at least 1% of total assets to eliminate firms that may be using interest-rate derivatives for speculative purposes, and we run specification (4) separately for subsamples of hedgers and non-hedgers. Our mechanism predicts that β_3 is positive and significant for non-hedgers and not significantly different from zero for hedgers. The results are displayed in Table V. The estimate of β_3 for the hedged sample is statistically insignificant at all horizons. The estimate for the unhedged sample, however, is always positive after the second quarter following the monetary policy shock, and statistically significant at horizons of 3 and 5 quarters. The difference between the β_3 estimates across subsamples

[21] This argument also holds for other balance sheet variables in this section, as they are more likely to respond to the anticipated component of monetary policy changes as well because adjustment costs prevent them from reacting rapidly to changes in expectations about future policy rates, particularly when the change in the expectation happens shortly before the FOMC announcement. Still, our results in this section remain qualitatively similar when we use the sum of the monetary policy surprises on the FOMC announcements dates in a given year, as in Gorodnichenko and Weber (2014).

[22] Year-quarter fixed effects also control for possible seasonality occurring at the quarterly frequency.

is large and statistically significant at horizons of 5 and 6 quarters. In terms of economic magnitude, a 100bp tightening of monetary policy is associated with an increase in the coverage ratio of 0.09 (0.12) for an unhedged firm fully financed with bank debt, relative to a hedged firm fully financed with bank debt, at a horizon of 5 (6) quarters. This effect on coverage ratio is important not only because sufficiently large increases in the coverage ratio following a monetary policy tightening might force firms to access additional financing to meet interest rate payments and fund their investment and hiring plans but it might also increase the likelihood of a covenant violation, which has important implications for firms' capital expenditures, as shown in Nini, Sufi, and Smith (2012).

[TABLE V ABOUT HERE]

In the presence of financing constraints, firms might need to tap into retained earnings instead. To test this prediction, we compute the change in cash holdings as the difference between total cash and short-term investments at the end of quarter $t + x$ (where $x \in \{1, 2, 3, 4, 5, 6\}$) and at the end of quarter $t-1$, scaled by total assets at the end of the quarter $t-1$. Changes in cash holdings are expressed in basis points, and we use the same regression specification as (4). Firm controls are taken from the empirical literature that focuses on corporate cash accumulation (Bates, Kahle and Stulz (2009)), and include firm size, leverage, market-to-book ratio, and cash flow risk. We test whether the impact of bank debt usage on the sensitivity of cash holdings to monetary policy (coefficient β_3) is significantly stronger for financially constrained firms than for unconstrained firms in the sample of unhedged firms, and whether this difference is absent or is at least significantly smaller in the sample of hedged firms. We classify firms as financially constrained (unconstrained) if their value of the Hadlock and Pierce (2010) (HP) index is above (below) the median, and report the difference between the estimates of β_3 across constrained and unconstrained firms, within each of the subsamples of hedgers and non-hedgers, and also report the statistical significance of the difference.[23]

[TABLE VI ABOUT HERE]

Our results are displayed in Table VI, in which coefficient estimates for β_3 for the four subsamples of firms (hedgers/non-hedgers, constrained/unconstrained) and the estimates for the difference between groups, the coefficient on $\widehat{Change}_t \, (BankDebt/At)_{t-1} \, Constrained_t$,

[23] As explained in Section 3.3, we choose the HP measure because Hadlock and Pierce (2010) show that other indices have very little power to predict financial constraints, and any power they have comes from firm size and age, the two variables they use to create their composite HP index.

are shown for horizons of four and six quarters.[24] Being financially constrained only matters, in a statistically significant way, for the response of cash holdings of bank debt users to monetary policy when firms do not hedge their interest rate risk. More specifically, after four quarters following a 1 percentage point increase in the federal funds rate, a constrained firm fully financed with bank debt experiences on average a 4.2 percent stronger drop in its cash holdings relative total assets than an unconstrained firm if both firms are unhedged. This difference increases to 9.5 percent at a horizon of 6 quarters. Constraints, however, do not affect the responsiveness of cash holdings to monetary policy of bank debt users if they are hedged, at any horizon.

Taken together, the evidence in this section highlights the nature of our floating rate mechanism as a source of economically significant liquidity shocks for firms.

4.2 Real Implications

In this section, we test whether the stronger effect of the floating rate channel for financially constrained firms identified using stock prices, the interest rate coverage ratio, and cash holdings, is associated with significant real outcomes in the affected firms. We focus on the implications for firms' inventory investment, fixed investment, and sales.

The nature of our floating rate mechanism as a liquidity event means it is particularly likely to manifest itself in the behavior of inventory investment, one of the most liquid components of firms' balance sheets. We follow Kashyap, Lamont and Stein (1994) and adopt their empirical specification for our inventory investment regressions, which we augment to introduce monetary policy changes, bank debt usage, and our firm level controls:

$$\begin{aligned}\ln\left(\frac{Inventories_{t+x}}{Inventories_{t-1}}\right) &= \beta_0 + \beta_1 \widehat{Change}_t \\ +\beta_2 \left(BankDebt/At\right)_{t-1} &+ \beta_3 \widehat{Change}_t \left(BankDebt/At\right)_{t-1} \\ +\gamma Controls_{t-1} &+ \lambda \widehat{Change}_t Controls_{t-1} \\ +\ln\left(\frac{Sales_{t,t+x}}{Sales_{t-x-1,t-1}}\right) &+ \ln\left(\frac{Inventories_{t-1}}{Sales_{t-1}}\right) + \varepsilon_t. \qquad (5)\end{aligned}$$

Our firm-level controls include, as before, book leverage, firm size, market-to-book ratio, profitability, interest rate sensitivity, and short-term debt. We add, following Kashyap, Lamont and Stein (1994), the cash to total assets ratio at the end of quarter $t-1$, separately and interacted with change, and also the difference between the log of total sales during quarters t to $t+x$ and the log of total sales during quarters $t-x-1$ to $t-1$, and the log of the inventory to sales ratio at the end of quarter $t-1$. We include firm and year-quarter

[24] The difference between groups is obtained by interacting all variables, including fixed effects, with the financial constraint dummy.

fixed effects, and we cluster errors at the industry-quarter level.

[TABLE VII ABOUT HERE]

Our results for horizons of four and six quarters are displayed in Table VII, in which coefficient estimates for β_3 for the four subsamples of firms (hedgers/non-hedgers, constrained/unconstrained) and the estimates for the coefficient on the triple interaction of $Surprise_t$, $(BankDebt/At)_{t-1}$, and $Constrained_t$ are shown.[25] There is a statistically strong negative relationship between bank debt usage and the sensitivity of inventory investment to monetary policy changes for firms in the unhedged-constrained category. The economic magnitude of the relationship is large for this subgroup: after 6 quarters following a 1 percentage point increase in the Federal funds rate, increasing bank debt usage from 0% to 100% of total assets is associated with a decrease in inventories of on average 21.2%. Bank debt usage instead does not affect the sensitivity of inventory investment to monetary policy in a statistically significant way if firms are financially unconstrained or if they are not exposed to interest rate risk in their bank debt because they hedge.

Previous empirical studies have shown that the inventory investment of financially constrained firms is more sensitive to monetary policy than that of large and rated firms (Gertler and Gilchrist (1994), Kashyap, Lamont and Stein (1994)). Our evidence shows that financial constraints only increase firms' sensitivity to monetary policy if these firms are exposed to interest rate risk through their bank debt, suggesting that our floating rate mechanism is a potentially important driver of this result. This result might be particularly relevant from a macroeconomic perspective given that inventories constitute the most volatile component of GDP (Blinder and Maccini (1991), Davis and Kahn (2008)).

We next study the behavior of sales, which we interpret, in line with existing literature, as a proxy for firm-level output (Gertler and Gilchrist (1994), Bond, Elston, Mairesse, and Mulkay (2003)). We employ empirical specification (4) and use the difference between the log of total sales during quarters t to $t+x$ and the log of total sales during quarters $t-x-1$ to $t-1$ as our dependent variable. As before, we introduce year-quarter fixed effects, which also control for possible seasonality occurring at the quarterly frequency. The results are displayed in Table VIII, and are in line with our previous evidence. Being financially constrained has twice the impact on the sensitivity of sales to monetary policy of unhedged bank debt users than on the sensitivity of hedged bank debt users. Increasing bank debt usage from 0% to 100% of assets is associated with an additional decrease in sales after four(six) quarters of 19.1%(17.8%) following a 100bp monetary policy tightening when the firm is financially

[25] The difference between groups is obtained by interacting all variables, including fixed effects, with the financial constraint dummy.

constrained and unhedged, relative to when it is unconstrained and unhedged. For hedged firms, this same difference is only 7.9%(9.7%).

[TABLE VIII ABOUT HERE]

Finally, we explore the behavior of fixed investment. A large body of empirical research documents the difficulty of finding a relationship between fixed investment and interest rates (Caballero (1999), Sharpe and Suarez (2014)), suggesting that the impact of monetary policy on fixed investment, to the extent that it is significant, might occur mostly through indirect channels such as the one discussed in this paper. To test this prediction, we expand our baseline empirical specification (4) to include the main factors that have been identified in the empirical literature to matter for firm investment (Eberly, Rebelo and Vincent (2012)). These are Tobin's Q, proxied by the market-to-book ratio, cash flow, and lagged investment. We run the following regression:

$$\begin{aligned} \ln\left(\frac{K_{t+x}}{K_{t-1}}\right) &= \alpha_0 + \alpha_1 \widehat{Change}_t + \alpha_2 \left(BankDebt/At\right)_{t-1} + \alpha_3 \widehat{Change}_t \left(BankDebt/At\right)_{t-1} \\ &\quad + \lambda \left(FirmControls\right)_{t-1} + \gamma \widehat{Change}_t \left(FirmControls\right)_{t-1} \\ &\quad + \alpha_4 Q_t + \alpha_5 \left(\frac{CF_t}{K_t}\right) + \alpha_6 \left(\frac{I_{t-1}}{K_{t-1}}\right) + \varepsilon_t, \end{aligned} \quad (6)$$

where our dependent variable is computed as the difference between the log of total fixed capital (measured as property, plant and equipment) x quarters ahead, and the log of capital one quarter before the monetary policy event. Our firm-level controls also include book leverage, firm size, profitability, interest rate sensitivity, and short-term debt, all interacted with $\widehat{Change}_t$ and also introduced separately. We include firm and year-quarter fixed effects, and we cluster errors at the industry-quarter level.

The results are displayed in Table IX. Consistent with our mechanism, financial constraints have a significant effect on the impact of bank debt usage on monetary policy sensitivity of fixed investment only for the subsample of firms that do not hedge against interest rate risk. The economic magnitude of the relationship is large for this subgroup: after 6 quarters following a 1 percentage point increase in the Federal funds rate, a hypothetical financially constrained firm that is fully financed with bank debt suffers a change in total capital which is on average 15.8 percentage points lower than the one a financially unconstrained bank debt user experiences. Financial constraints however do not significantly influence the responsiveness of fixed investment to monetary policy for the subsample of firms that are not exposed to interest rate risk. The effects after four quarters are not statistically significant, which might not be surprising given that investment in tangible capital is more likely to suffer from adjustment costs compared to inventory investment, and this might delay any possible effects.[26]

[TABLE IX ABOUT HERE]

Taken together, the evidence discussed in this section suggests that the effect of the floating rate channel goes beyond a simple reallocation of cash flows between lenders and shareholders and has real implications for the affected firms. The impact of our channel on employment, which we have not analyzed due to the absence of reliable quarterly data on number of workers in our databases, might be significant as well, depending on the costs of adjusting the workforce along both the intensive and extensive margins. Finally, our strong results on the sensitivity of cash holdings in Section 4.1 suggest other latent and subtle mechanisms that are harder to test for: firms may choose to build large cash buffers instead of investing in anticipation of future increases in the rates on their floating rate debt and these ex-ante effects on investment and employment could be large.

5 How Important is the Floating Rate Channel?

5.1 Comparison with the Bank Lending Channel

Is the floating rate channel quantitatively relevant from a macroeconomic perspective? One possible answer comes from studying how large we would expect the effect to be for the overall economy if all firms had borrowed at a fixed rate or had access to hedging. However, because our empirical analysis focuses on local effects it is hard to argue that this analysis provides the true overall effect, given the potential general equilibrium effects underlying this counterfactual.

Instead, we compare the effect of the floating rate channel with that of the bank lending channel, as studies on the latter typically focus on local effects as well. In Appendix F we introduce an analysis based on results from the existing literature and find that a firm that

[26] The coefficient α_3 on the interacted term $\widehat{Change}_t\,(BankDebt/At)_{t-1}$ is positive for most subsamples and horizons, and in Table A8 we find that it is also often positive when using a surprise measure of monetary policy. This means that bank debt usage makes fixed investment relatively less sensitive to monetary policy on average, at horizons of between 4 and 6 quarters, for some subsamples. One possible explanation for this finding is that banks protect their borrowers from a tightening in credit conditions in the context of the lending relationships that they form with their clients. See Rajan and Zingales (1998) and Ehrmann, et al. (2001) for a discussion of the role of lending relationships in alleviating the impact of contractionary monetary policy actions on bank borrowers. In the context of the recent crisis, several papers provide evidence that one channel through which banks protect their relationship borrowers in times of credit market distress is through precommitted credit (Ivashina and Scharfstein (2010), and Campello, Giambona, Graham, and Harvey (2011)). This credit insurance role is compatible with our floating rate channel, and both channels might be operating in parallel.

usually borrows \$100 from financial intermediaries will experience a long-run cumulative \$0.3 external financing shortfall, as an upper bound, if the federal funds rate increases by one percentage point (Oliner and Rudebusch (1996), Holod and Peek (2007)). We also calculate that the same rate hike would cause, through the floating rate channel, a cash shortfall of between \$0.32 (minimum over a one year period) to \$0.88 (maximum over a two year period) on a \$100 loan.

Overall, these calculations suggest that the aggregate financing shortfall caused by the floating rate channel of monetary policy is likely to be at least as large as the shortfall caused by the bank lending channel. For both channels, the total actual effect of this shortfall will be determined by similar amplification mechanisms, such as the borrowers' financial health. The floating rate channel will also have one additional subtle, but potentially important, amplification mechanism: it causes an internal cash shortfall, whereas the bank lending channel causes an external cash shortfall. The external cash shortfall (loss of access) due to the bank lending channel forces the firm to forgo investment projects without affecting its equity position. However, the internal cash shortfall due to the floating rate channel will always reduce the firm's equity and liquidity position and hence potentially have stronger effects on the balance sheet health of the firm.

5.2 Evidence from the Unconventional Policy Period

As an alternative approach to the importance of the floating rate channel, we apply our benchmark regression to a period during which we do not expect the floating rate channel to be operative, so that any remaining effect can be attributed to other banking channels. Since late 2008, when the federal funds target rate hit the zero lower bound, the Federal Reserve has focused on alternative policy measures in order to stimulate the U.S. economy. These measures, typically referred to as quantitative easing or unconventional monetary policy tools, have involved large scale purchases of assets with long maturities. As seen in Figure 1, these purchases did not affect the short-term benchmark interest rates underlying the floating rate bank debt arrangements, as these rates are already at their lowest possible level. If the floating rate channel is important we would expect bank debt usage to have a much less prominent role during the unconventional monetary policy period. Therefore, testing the effect of bank debt usage in the unconventional monetary policy period is useful to gauge the importance of the floating rate channel.

The main challenge for this approach stems from finding a measure of the overall stance of unconventional monetary policy in general, and the surprise component of the Federal Reserve's actions in particular. While one could use the Federal Reserve's balance sheet as a proxy, many of the Fed's actions were announced in advance and hence this would not provide a suitable measure of the monetary policy surprises in the unconventional period.

Instead, we follow Wright (2012) and use the high-frequency price changes in longer-maturity Treasury futures on a very tight event window around FOMC announcements during the unconventional period to capture the unanticipated changes in the stance of monetary policy, as these tight windows do not include any other macroeconomic news. We prefer this identification strategy for unconventional monetary policy surprises over alternative strategies, such as vector-auto-regressions, because the monetary policy surprises identified in this fashion are less model-dependent and the regression results are easier to interpret and to compare to our event study results from the previous sections.[27]

Wright (2012) uses intraday data on two-, five-, ten-, and thirty-year Treasury bond futures trading in the Chicago Mercantile Exchange and identifies a particular set of FOMC announcement dates. The monetary policy surprises on those dates are computed as the first principal component of yield changes from 15 minutes before each of these announcements to 1 hour and 45 minutes afterwards. The announcement dates range from November 25, 2008 to September 21, 2011 and the associated monetary policy surprises calculated this way are presented in Table 5 of Wright (2012). These surprises are scaled so that one unit of the shock leads to a 12bp increase in the ten-year Treasury according to Wright (2012), and this is roughly equivalent to the effect of a 100bp increase in the fed funds target on the ten-year Treasury yield during the conventional period. While the scale is the same as the shocks presented in Table 5 of Wright (2012), the sign is inverted so that a positive surprise in the following regressions should be interpreted as a contractionary shock, consistent with the other regressions in our paper.

Table X repeats our benchmark regression given in equation (1) by substituting the conventional monetary policy surprise with the unconventional monetary surprise after applying the same filters to firms as in our previous analysis. The first column shows that the effect of an unconventional monetary policy surprise that increases the ten-year Treasury yield by 12bp, decreases the stock price of a firm by about 35bp on average. This number is close to the number (55bp) reported in Wright (2012) for the intraday returns of the S&P 500 futures. Any difference stems from our use of panel data regressions with a more comprehensive sample and our use of two-day returns, following the strategy we have employed in the previous sections.

[TABLE X ABOUT HERE]

More interestingly, the second column shows that the effect of bank debt usage on the

[27] Other event studies that focus on the effects of unconventional monetary policy are either more descriptive in nature and do not provide a measure of the monetary policy surprise (e.g. Gagnon et al. (2010) and Krishnamurthy and Vissing-Jorgenson (2011)), or base the surprise on a subset of the assets employed by Wright (2012) (e.g. Chodorow-Reich (2014)).

transmission of monetary policy to stock prices not only diminishes but also goes in the opposite direction of what we observe in the conventional period. In terms of economic magnitude, a one standard deviation (0.13) increase in bank debt usage leads to about a 6bp lower reaction, in comparison to a 35bp reaction of the average firm's stock. One explanation for this pattern might be that bank-firm relationships enable firms to benefit from some degree of insurance provided by their lenders against changes in credit availability. The increased importance of this insurance during the recent financial crisis, combined with the absence of the floating rate channel in the unconventional monetary policy period, can lead to the positive coefficient observed in column 2. Another explanation, which is easier to test, is that we simply need to control for additional variables. Indeed, the third column shows that after including our original control variables, we find that bank debt usage has an economically and statistically insignificant effect on the responsiveness of stock prices to monetary policy shocks. Either interpretation of our results is consistent with the reduced effect of bank debt usage in the unconventional policy period due to the absence of the floating rate channel, a channel that previous sections have proven to be particularly important during the conventional monetary policy period.

As a final test, we look at the effect of hedging on the responsiveness of stock prices to monetary policy shocks. If the difference between hedgers and non-hedgers we presented earlier in Table II truly reflects the importance of the floating rate channel for the effect of bank debt usage on the transmission of monetary policy, we should find that hedging should not influence the effect of bank debt usage during the unconventional monetary policy period. Therefore, the last two columns look at the effect of bank debt usage for hedgers and non-hedgers separately like we did for the conventional period in Table II. We find that the difference between hedgers and non-hedgers actually goes in the opposite direction of what we observe in Table II, with bank debt usage increasing the responsiveness of hedgers and decreasing the responsiveness of non-hedgers. Nevertheless, the effect of bank debt usage is statistically insignificant for both hedgers and non-hedgers. This result is further in line with our argument that the floating rate channel is important for the effect of bank debt usage on the transmission of monetary policy, and that this important channel is mute during the unconventional monetary policy period.

6 Conclusion

According to the firm balance sheet channel of monetary policy, a tightening in monetary policy increases the debt-service burden of borrowers and reduces the value of their collateral and net worth, thereby increasing the external finance premium of financially constrained firms. Our results confirm that bank lending plays an important role in this transmission mechanism. We use firms' hedging activity to provide evidence that an important portion of this transmission is driven by the mechanical relationship between monetary policy and the reference rates for the floating rate arrangements underlying most bank loans to businesses. This channel, which we call the *floating rate channel*, is distinct from earlier channels studied in the empirical literature in that it works through existing debt rather than new debt.

Our results also contribute to the debate about the efficacy of large scale asset purchases (LSAP) as an alternative tool of monetary policy. This debate has identified several channels through which LSAP may affect prices of different financial assets.[28] Financial intermediation does not play a significant role in any of the most relevant channels, which is perhaps not surprising since aggregate bank loan growth relative to total deposits has been low.[29] Our results reveal another reason why LSAP might have a limited impact through bank lending. We find that the floating rate channel is not operative in the unconventional monetary policy period, and hence that bank debt usage plays a much less important role in the transmission of monetary policy during this period, consistent with the fact that the zero lower bound significantly limited the ability of the Federal Reserve to affect the short-term benchmark rates underlying floating rate bank debt.

We hope that our results stimulate further research in this direction to provide a better understanding of how conventional and unconventional monetary policies differ in terms of their transmission to the real economy.

[28] Krishnamurthy and Vissing-Jorgensen (2012) show that quantitative easing might operate through channels related to signaling, demand for long-term safe assets, inflation, mortgage-backed securities (MBS) prepayment, or corporate bond default risk. See also Gagnon et al. (2011), Joyce et al. (2011), Krishnamurthy and Vissing-Jorgensen (2011), Vayanos and Vila (2009), Hamilton and Wu (2011), Christensen and Rudebusch (2012), Swanson (2011), Li and Wei (2013), and D'Amico and King (2013).

[29] http://www.forbes.com/sites/francescoppola/2014/01/21/banks-dont-lend-out-reserves/

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APPENDIX

A - Subsample Robustness of the Effect of Monetary Policy on Stock Prices

We start with the reaction of the aggregate CRSP value-weighted index between February 1994 and June 2008. Following Rigobon and Sack (2005), we focus on this period for two reasons. First, starting in February 1994, the FOMC's policy of announcing target rate changes at pre-scheduled dates virtually eliminated the timing ambiguity associated with rate changes prior to this date. Second, after June 2008, the Federal Reserve switched from announcing a specific target rate to announcing a range for the target rate. Table A3 offers a comparison between the responses of equity prices to federal funds rate changes in different samples. Columns 1 and 2 show that on the day of an FOMC announcement, a 100bp surprise increase in the federal funds rate decreases stock prices by around 300bp when we look either at the value-weighted returns or the individual returns of the entire CRSP universe between 1994 and 2008. This result is comparable to the numbers reported in Bernanke and Kuttner (2005). Columns 3 and 4 show that the reaction of equity prices to surprise changes in monetary policy is stronger in the sample of 2003–2008 than in previous years. However, the sign and significance of the coefficient of surprise is the same for both samples. A comparison of columns 4 and 5 reveals that firms in the sample for which we have bank debt usage data have a reaction to monetary policy shocks very similar to that of the overall CRSP universe during the 2003–2008 period.

[TABLE A3 ABOUT HERE]

B - Examples from 10-K files on hedging activities

The following two paragraphs are examples of the type of discussion on hedging activities that we find in the 10-K files. In fiscal year 2008, BioFuel Energy Corp reports as follows:

> We are subject to interest rate risk in connection with our bank facility. Under the facility, our bank borrowings bear interest at a floating rate based, at our option, on LIBOR or an alternate base rate. (...). In September 2007, the Operating Company, through its subsidiaries, entered into an interest rate swap for a two-year period. The contract is for $60.0 million principal with a fixed interest rate of 4.65%, payable by the Operating Company and the variable interest rate, the one-month LIBOR, payable by the third party.

Similarly, in fiscal year 2006 Netsmart Technologies reports:

> In October 2005, we entered into a revolving credit and term loan agreement with the Bank of America (...). This financing provides us with a five-year term loan of \$2.5 million. The term loan bears interest at LIBOR plus 2.25%. We have entered into an interest rate swap agreement with the Bank for the amount outstanding under the term loan whereby we converted our variable rate on the term loan to a fixed rate of 7.1% in order to reduce the interest rate risk associated with these borrowings.

C - Monetary Policy Surprise Calculation Procedure

Following Bernanke and Kuttner's analysis, we define an event as either an FOMC meeting or an announced change in the funds target rate. Kuttner (2001) and Bernanke and Kuttner (2005) obtain the corresponding surprise change in the target rate by first calculating the change in the rate implied by the corresponding futures contract, given by 100 minus the futures contract price, and then scaling this result by a factor associated with the number of days of the month in which the event occurred because the payoff of the contract is determined by the average realized federal funds effective rate during the month. Accordingly, the unexpected target rate change, for an event taking place on day d of month m, is given by

$$\Delta i^u = \frac{D}{D-d}(f^0_{m,d} - f^0_{m,d-1}),$$

where $f^0_{m,d} - f^0_{m,d-1}$ is the change in the current-month implied futures rate, and D is the number of days in the month. To suppress the end-of-month noise in the federal funds rate, the unscaled change in the implied futures rate is used as the measure of target rate surprise when the event occurs on the last three days of a month. If the event happens on the first day of a month, $f^1_{m-1,D}$ is used instead of $f^0_{m,d-1}$. The expected federal funds rate change is defined as the difference between the actual change minus the surprise:

$$\Delta i^e = \Delta i - \Delta i^u,$$

where Δi is the actual federal funds rate change. The data for the decomposition of the federal funds target rate changes can be obtained from Kenneth Kuttner's webpage.[30]

D - The Effect of Bank Debt Usage on Monetary Policy Sensitivity of Stock Prices

Table A4 presents the results of regression (1) using alternative specifications that become more restrictive across columns. The first column of Table A4 contains the result from a

[30] http://econ.williams.edu/people/knk1/research

basic random-effects panel regression with no controls and suggests that a one standard deviation (0.114) increase in our bank debt usage measure causes the stock price to increase 1.6 ($= -14 * 0.114$) percentage points more in response to a 1 percentage point surprise decrease in the federal funds rate. To put this effect in perspective, the same surprise decrease in the federal funds rate causes the stock price of the firm with the average amount of bank debt over assets (7.22%) to increase about 4.97 percent on average.

[TABLE A4 ABOUT HERE]

Column 2 provides the same regression with the dependent variable being the stock return in excess of that predicted by the Capital Asset Pricing Model (CAPM), which corrects for the correlation of individual stock returns with the aggregate market return. The coefficient of interest (-10.5) is within one standard deviation of the coefficient in column 1 (-14.1). However, the coefficient of *Surprise* changes significantly, and actually turns positive. Of course, this does not mean that a positive (contractionary) rate surprise causes an increase in the stock price of the average firm. We observe this pattern because part of the market return on the FOMC date can be attributed to monetary policy so the CAPM correction of returns prevents us from measuring the full effect of monetary policy. Therefore, while the CAPM correction might be suitable for an event study with idiosyncratic events it is not very desirable for a study of aggregate events like monetary policy surprises. To circumvent this problem, we continue with the unadjusted returns as in column 1 and use the CAPM beta as a control variable for the correlation of individual returns with the market return. For the same reason, instead of correcting returns using the Fama-French 3-factor model we use the firm characteristics underlying the 3-factor model (size, market-to-book, CAPM beta) as control variables.[31] Another advantage of this approach stems from the observation that firm characteristics subsume the effect of the Fama-French risk factors in explaining stock returns, as discussed in Daniel and Titman (1997) and Ferson and Harvey (1999).

In order to address potential identification issues, such as non-spherical disturbances and omitted variables, we progressively add controls, industry fixed effects, both interacted and uninteracted, standard errors clustered at the event-industry level, and firm fixed effects. Non-sphericality would primarily affect the standard errors of our estimates rather than their consistency, which is the main reason why we use clustered errors. However, omitted variables can influence our inference by affecting both the standard errors and the consistency of our

[31] For size, we use book value of assets, rather than market value of equity for two reasons. First, the market equity size premium has declined significantly in the last three decades. Second, since Gertler and Gilchrist (1994), balance sheet (rather than market) size has been widely used as a proxy of firms' financial constraints, which is considered an important factor behind the transmission of monetary policy and therefore more suitable for our purpose.

estimates. Therefore, controls and firm-level fixed effects specifications aim at distinguishing between bank debt being special, or bank debt users being special, for reasons that are not captured in our basic regression in column 1 of Table A4. We also include an instrumental variable analysis.

More specifically, column 3 introduces firm controls and year fixed effects and shows that the coefficient in column 1 remains effectively unchanged. This is also robust to alternative specifications, as shown in columns 4 to 8. In column 4, industry fixed-effects enter the regression both interacted with surprise and uninteracted, with industries classified according to Fama-French 48 sectors available from Kenneth French's website, and errors are clustered at the event-industry level to address possible time-and-cross-section heteroskedasticity in the errors. Column 5 extends the definition of bank debt to include undrawn credit lines.

Another concern stems from the possibility that bank debt usage is caused by cash flow risk, financial constraints or the interest rate sensitivity of firms' demand and our results reflect the importance of these factors rather than bank debt usage, so in column 6 we introduce measures that try to control for these factors. We follow Faulkender (2005) and measure the interest rate sensitivity of firms' operating profits as the correlation between quarterly firm earnings before interest, tax, depreciation and amortization (EBITDA) and three-month average LIBOR rates. We introduce cash flow volatility and CAPM beta as controls for firm risk, and cash holdings as a measure of the ability of the firm to withstand liquidity shocks associated with monetary policy. Finally, to capture financing constraints, we follow Hadlock and Pierce (2010), who show that firm size and age are very useful predictors of the severity of financial constraints, and introduce a measure based solely on these two firm characteristics.[32] We call this measure of financial constraints the HP index. To further deal with this concern, Column 7 replaces industry fixed effects with firm fixed effects to capture unobserved time invariant omitted firm characteristics. Overall the coefficient of bank debt usage barely changes, which adds robustness to the evidence that bank debt usage makes firms more responsive to monetary policy shocks.

Column 8 includes an instrumental variable regression with fixed effects to deal further with the potential endogeneity problem of bank debt usage. Following Faulkender and Petersen (2006) and Santos and Winton (2008) we instrument for bank debt usage using proxies for firm visibility and firm uniqueness. These authors use these proxies to instrument

[32] We use Hadlock and Pierce's estimates for 2000-2004 from Table 6 in their paper because this period is closer to our sample. The HP index is calculated as (-0.548*Size) + (0.025*Size2) – (0.031*Age), where size is the log of inflation adjusted (to 2004) book assets, and age is the number of years for which the firm has stock returns in CRSP to ensure that we have few missing observations. An alternative measure can be derived using the IPO date, but this leads to multiple missing observations, though the results are qualitatively similar. In calculating this index, size is replaced with log($4.5 billion) and age with thirty-seven years if the actual values exceed these thresholds.

for firm access to corporate bond markets and argue that firms that are highly visible and less unique are more likely to be rated. As proxies for visibility, they introduce firms' membership of the S&P 500 index or of the New York Stock Exchange (NYSE). As a proxy for uniqueness, they use a measure of the number of firms in their same industry other than itself that have credit ratings. We instead use them as instruments for bank debt usage following the argument that firms that do not have access to bond markets are likely to be stronger users of bank debt. Our last instrument relies on the observation that banking regulation limits the amount of unsecured loans a bank can issue (Ivashina (2009)). Consistent with this observation, Altman, Gande, and Saunders (2010) find that about 70 percent of the bank loans to corporations are secured, in contrast to 3 percent of bonds. Therefore, we would expect that the collateral of a firm is an important determinant of how much the firm can borrow from a bank, and hence use tangibility as an additional instrument.[33] We find that while we lose statistical significance, the coefficients of the regression are effectively unchanged and the Hausman test cannot reject the hypothesis that they are the same, suggesting that endogeneity is not a big concern.

Finally, column 9 provides the same specification as in column 7 but replaces bank debt with floating rate debt. While the statistical significance of floating rate debt drops somewhat, as expected due to the points mentioned in the data section, it is similar in size to the coefficient of bank debt in column 7 and still statistically significant.

A possible concern in Table A4 is that bank debt may be proxying for the use of short-term debt. This concern finds support in the descriptive statistics reported in Table I which shows that bank debt users have a higher percentage of short-term debt than nonbank-debt users (3.71 percent versus 1.09 percent, calculated as a share of total assets) and that the Pearson pair-wise correlation between these two variables is 0.27. For example, to the extent that changes in monetary policy affect primarily the short end of the yield curve, one can expect firms with a shorter average maturity of debt to be more sensitive to increases in interest rates.

To test this hypothesis, we rewrite the specification provided in equation (1) in terms of short-term debt divided by the book value of assets, $STDebt/At$. Formally, the complete

[33] Because we are interested in how bank debt usage affects firms' sensitivity to monetary policy shocks and because this term in our regression is non-linear, given by $Surprise_t * (BankDebt/At)_{i,t-1}$, we cannot use the traditional instrumental variable approach where the first stage estimates of $(BankDebt/At)_{i,t-1}$ are used to replace our endogenous variable in the second stage, which is dubbed "the forbidden regression" in the literature. Therefore, we use an alternative approach suggested in Angrist and Pischke (2009, Ch. 4) where we use $Surprise_t * (Instrument)_{i,t-1}$ as an instrument for $Surprise_t * (BankDebt/At)_{i,t-1}$.

regression specification is:

$$\begin{aligned} Ret_t &= \beta_0 + \beta_1 Surprise_t + \beta_2 \left(BankDebt/At\right)_{t-1} + \beta_3 \left(STDebt/At\right)_{t-1} \\ &\quad + \beta_4 Surprise_t * \left(BankDebt/At\right)_{t-1} + \beta_5 Surprise_t * \left(STDebt/At\right)_{t-1} \\ &\quad + \gamma Controls_{t-1} + \lambda Surprise_t * Controls_{t-1} + \varepsilon_t. \end{aligned} \tag{7}$$

Table A5 provides the empirical results of this test. Columns 1 and 2 show the results of a version of regression (7) in which the terms containing $(BankDebt/At)_{t-1}$ are removed. We observe that the amount of short-term debt in a firm's balance sheet is not significantly associated with the strength of the sensitivity to surprises in the federal funds rate. The coefficient in column 1 (-10.30) is not only statistically insignificant but also economically very small: one standard deviation in short-term debt usage leads to only a ($10.30 * 0.05 =$) 0.5 percentage point increase in the sensitivity to monetary policy of stock prices, a far lower figure than the 1.6 percentage points for bank debt usage. Introducing additional controls in column 2 makes this effect even smaller. Columns 3 and 4 provide a complete specification of (7), including bank debt, both interacted and not interacted with *Surprise*. The coefficient β_5 remains insignificant, while the coefficient β_4 retains the sign, size, and significance of the specifications reported in Table A4. We conclude that the higher sensitivity of bank debt users to federal funds rate surprises is not due to their higher exposure to short-term debt.

Finally, one potential concern is that our bank debt usage variable, $BankDebt/At$, might be correlated with other leverage variables and our results reflect the importance of debt in general rather than bank debt in particular. One way we address this concern is by adding book leverage directly in Table A4. As another way to address the same issue, we normalize total bank debt with total debt to create an alternative measure of bank debt usage, $BankDebt/Debt$. We use this new measure to replace our original measure and repeat the regressions in Table A4. The new results, presented in Table A6 in the appendix confirm our results from Table A4. In particular, we find that a one standard deviation in $BankDebt/Debt$ (0.40) leads to approximately a ($0.40 * 3 =$) 1.2 percentage point increase in the responsiveness of stock prices to monetary policy surprises, which is in the ballpark of our previous result (1.6 percentage points) using $BankDebt/At$.[34] Hence, we continue to use $BankDebt/At$ in the following analysis.

E - Effect of Hedging: Controlling for Financial Frictions

[34] As before, the floating rate debt coefficient is somewhat smaller due to mismeasurement. A similar issue also appears when we include undrawn credit lines in column 4 because there are some firms in our sample that have very little debt but very large undrawn credit lines.

One concern in our previous regressions is that the estimates might be biased due to an omitted variable bias associated with the relationship between financial constraints and firms' hedging behavior. Some theories predict that hedging activities are positively related to the severity of financing constraints. If external finance is costly, firms may find it optimal to hedge against low cash flow realizations to avoid having to forgo positive net-present-value (NPV) projects (Froot, Scharfstein, and Stein (1993)) or to avoid nonlinear costs of financial distress (Stulz (1984)).[35] The empirical evidence, however, does not provide support for this prediction, and has documented that firms that are more likely to face financial constraints, such as small firms, are *less* likely to manage risk (Stulz (1996)).[36] Motivated by these findings, Rampini, Sufi, and Viswanathan (2012) introduce and test a theory that suggests there is a trade-off between hedging and financing, because both activities compete for the same collateral. In equilibrium, firms that are more financially constrained hedge less. The important role of financing constraints in firms' willingness and ability to hedge suggests that one should control for financial constraints and how these constraints interact with both the ability to raise debt and to hedge.[37]

To deal with this concern, we study how much of the effect of hedging survives after controlling for financial frictions, which we measure using firm age and the HP index. In particular, we estimate an expanded version of regression (2)

[35] Other motivations for the use of hedging have to do with corporate governance and managerial incentives (Chava and Purnanandam (2007)), and with market timing (Faulkender (2005)). More generally, the value creation of hedging has been examined by Nance, Smith, and Smithson (1993), Mian (1996) and Graham and Rogers (2002).

[36] Columns 5 and 6 of Table A2 show that this is the case also in our sample. Larger, rated, more profitable and less financially constrained (low HP index) firms are more likely to hedge than their smaller, unrated, less profitable or more financially constrained counterparts.

[37] One important question is why most bank lending arrangements involve a floating rate instead of a fixed rate despite the fact that many firms hedge the interest rate risk associated with these loans. One answer could arise from the trade-off between firms' needs and banks' cost of capital. A firm that wants to borrow at a fixed rate may have limited access to other fixed-rate sources of financing, such as bonds, whereas the bank might prefer to lend at floating rates, in which case hedging bridges the gap between the desire of the bank and the firm. As discussed by Vickery (2008), there are at least two reasons why banks might prefer to lend at floating rates. First, rising interest rates can cause deposit outflows from the banks and it is costly for banks to replace these outflows with other sources of financing. Lending at a floating rate would provide a partial hedge against these outflows. Second, floating rate business loans can be used to hedge the maturity mismatch between deposits and long-term mortgage loans.

$$
\begin{aligned}
Ret_t = \beta_0 &+ \beta_1 Surprise_t + \beta_2 Surprise_t * (BankDebt/At_{t-1}) \\
&+ \beta_3 Surprise_t * (BankDebt/At)_{t-1} * Hedge_t \\
&+ \beta_4 Surprise_t * (BankDebt/At)_{t-1} * FinFrictions_{t-1} \\
&+ \lambda_1 Surprise_t * Controls_{t-1} * Hedge_t \\
&+ \lambda_2 Surprise_t * Controls_{t-1} * FinFrictions_{t-1} \\
&+ \text{Uninteracted terms and Second Order Interactions} + \varepsilon_t \qquad (8)
\end{aligned}
$$

and check if β_3, the coefficient of $Surprise_t * (BankDebt/At)_{t-1} * Hedge_t$, remains similar to what we have calculated before in Table II and whether it still eliminates the full effect of the $Surprise_t * (BankDebt/At)_{t-1}$, i.e., $\beta_3 + \beta_2 = 0$. Columns 1 and 2 of Table A7 show that the estimates of β_3 have a magnitude very similar to the one we have calculated in Table II for the coefficient on the triple interaction term $Surprise_t * (BankDebt/At)_{t-1} * Hedge_t$ and that it nullifies the effect of $Surprise_t * (BankDebt/At_{t-1})$. Similar evidence is obtained in columns 3 and 4 when we use floating rate debt instead of bank debt. These results suggest that the floating rate channel is a unique and distinct channel that works separately from possible effects of financial frictions.

[TABLE A7 ABOUT HERE]

F - Bank Lending Channel vs Floating Rate Channel

According to the estimations in Holod and Peek (2007), a one percentage point permanent rate hike would be associated with a 0.01 (for publicly-held banks) to 0.1 percentage point (for privately-held banks) decrease in C&I loans as a fraction of total bank assets over a four quarter period. Moreover, C&I loans are about 10 percent of total assets for both public and private banks, and public banks hold about 80 percent of total assets (Nichols, Wahlen, and Wieland (2009)). Therefore, the weighted average effect is a 0.3 percent decrease in C&I loans over a four quarter period ((0.01/0.1)*0.8+(0.1/0.1)*0.2=0.3). This result is also in line with Oliner and Rudebusch (1996): over eight quarters they find a 0.6 percent decrease in C&I loans to small firms who hold half the bank loans whereas no loan decline is observed for large firms, implying a 0.3 percent decrease for total loans. Moreover, since this effect is the same as the effect from Holod and Peek (2007) over the first year, we can conclude that this is the long-run effect of a permanent increase in the federal funds rate. Overall, this suggests that a firm that usually borrows $100 from the bank will experience a cumulative $0.3 shortfall if the federal funds rate increases by one percentage point. This effect includes any amplification mechanism that works through bank balance sheets. Of course, this effect might be an upper bound for the true supply effect because part of the effect can be attributed to the potential decline in loan demand due to reduced demand for goods and services associated with the tightening of monetary policy. Moreover, Oliner and Rudebusch (1996) find that loans to large firms actually increase after a tightening, suggesting a reallocation of credit from small firms to large firms that further alleviates the effects of the bank lending channel.

How does this compare to the floating rate channel? A one percentage point rate hike would increase the interest expense by $1 on a $100 loan. However, some loans are fixed rate and some floating rate loans are hedged, which we will take into account. As shown in Vickery (2008), about 70 percent of total bank loans in the Federal Reserve's survey of business lending is made at a floating rate which is close to what Figure 2 suggests (about 75 percent) in our sample. If we continue with the same assumption that half of C&I loans are made to small businesses this would imply that about 65 percent of C&I loans to small businesses are at a floating rate (0.65*0.5+0.75*0.5=0.7). Moreover, we find that firms that do not use hedging derivatives hold about 30 percent of the loans in our sample, where almost all firms are large according to the definition of the Quarterly Financial Report for Manufacturing, Mining, and Trade Corporations (QFR) used by Oliner and Rudebusch (1996), which has a cutoff of $25 million in total assets to qualify firms as large in 2014. Small and medium sized firms usually make little use of hedging derivatives (Vickery (2008)). Therefore, as an initial approximation, we assume that no small firm hedges. As a second approximation, we will assume that small firms have the same hedging behavior as the firms with less than 25 million dollars in assets in our sample (37 percent in terms of total loan size) which is an upper bound for hedging derivative usage because these firms are on the upper tail of the size distribution. Using these numbers, we calculate the total percentage of C&I loans that are floating rate and unhedged as a number between 0.32 and 0.44 (0.65*(1-0.37)*0.5+0.75*0.3*0.5=0.32 and 0.65*1*0.5+0.75*0.3*0.5=0.44). Therefore, the average cash shortfall after the one percentage point rate hike would be between $0.32 and $0.44 on a $100 loan over four quarters, or $0.64 to 0.88 over two years, assuming the effect on the interest expense persists over this time horizon, which seems to be the case according to unreported regressions in which we study the effect of bank debt usage and hedging on the response of the interest expense of firms to monetary policy.[38]

[38] One implicit assumption is that the rate on the C&I loans is reset frequently. According to the Survey of Terms of Business Lending of November 2006, 27 percent of the C&I loans are subject to repricing at any time, 28 percent of the loans have daily repricing, and 23 percent of the loans have a repricing period of 2-30 days.

TABLES AND FIGURES

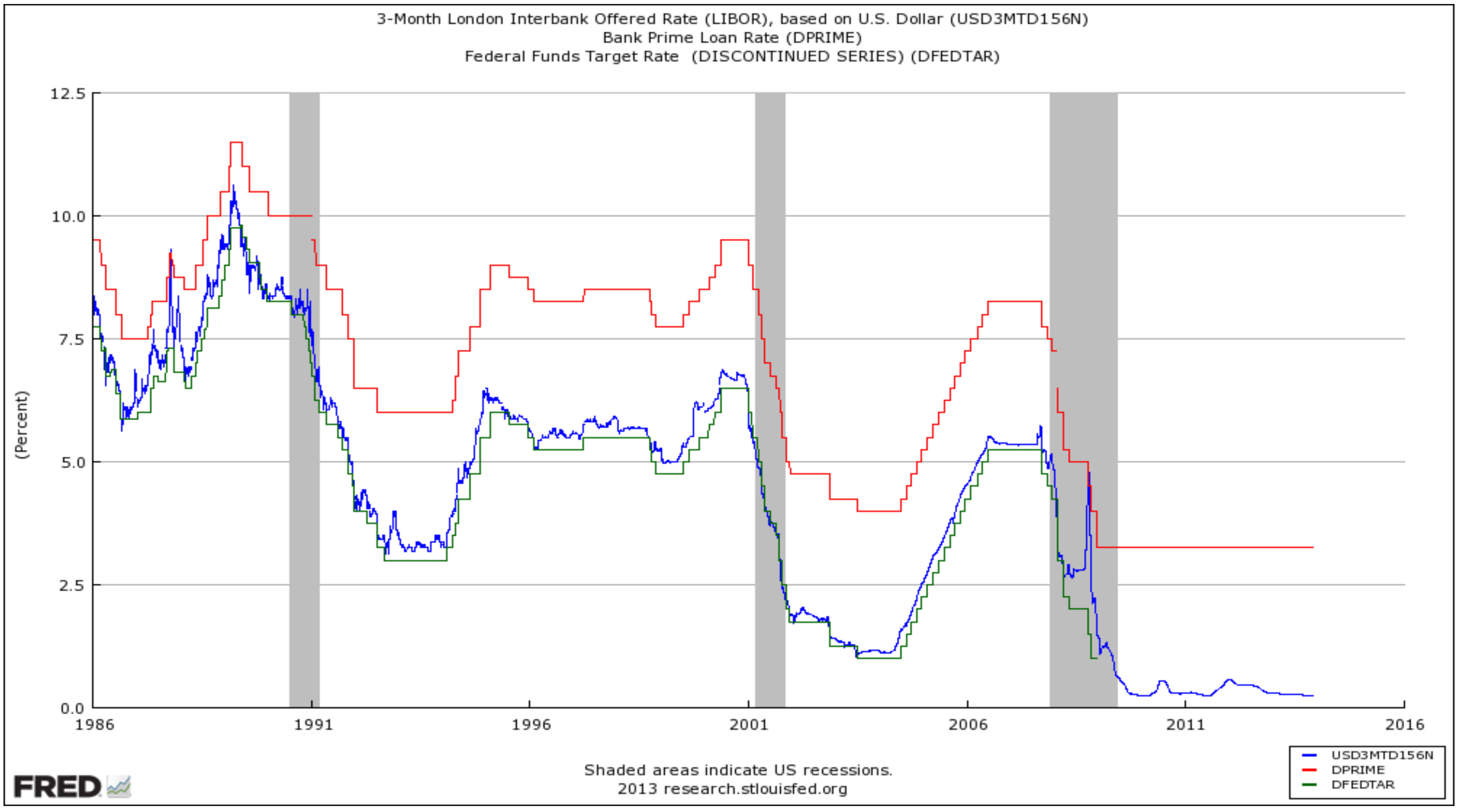

Figure 1

The relation between the Federal Funds Target Rate and Floating-Rate Debt Reference Rates

This figure displays the relation between two of the most common reference rates used in floating rate loans, the 3-Month London Interbank Offered Rate (LIBOR) and the Bank Prime Loan Rate, and the Federal Funds Target Rate, from January 1986 until November 2013. The data is from the Federal Reserve Bank of St. Louis FRED Economic Data.

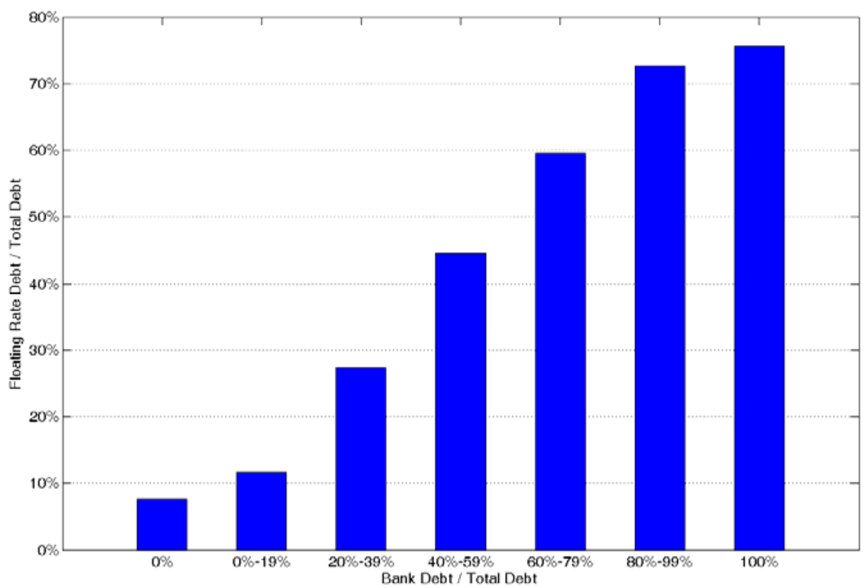

Figure 2

The relation between bank debt and floating-rate debt

This figure displays the relation between bank debt and floating-rate debt as a percentage of a firm's total debt. Firms are grouped in the horizontal axis according to bank debt as a percentage of total debt. The vertical axis shows the corresponding percentages of floating-rate debt as a percentage of total debt.

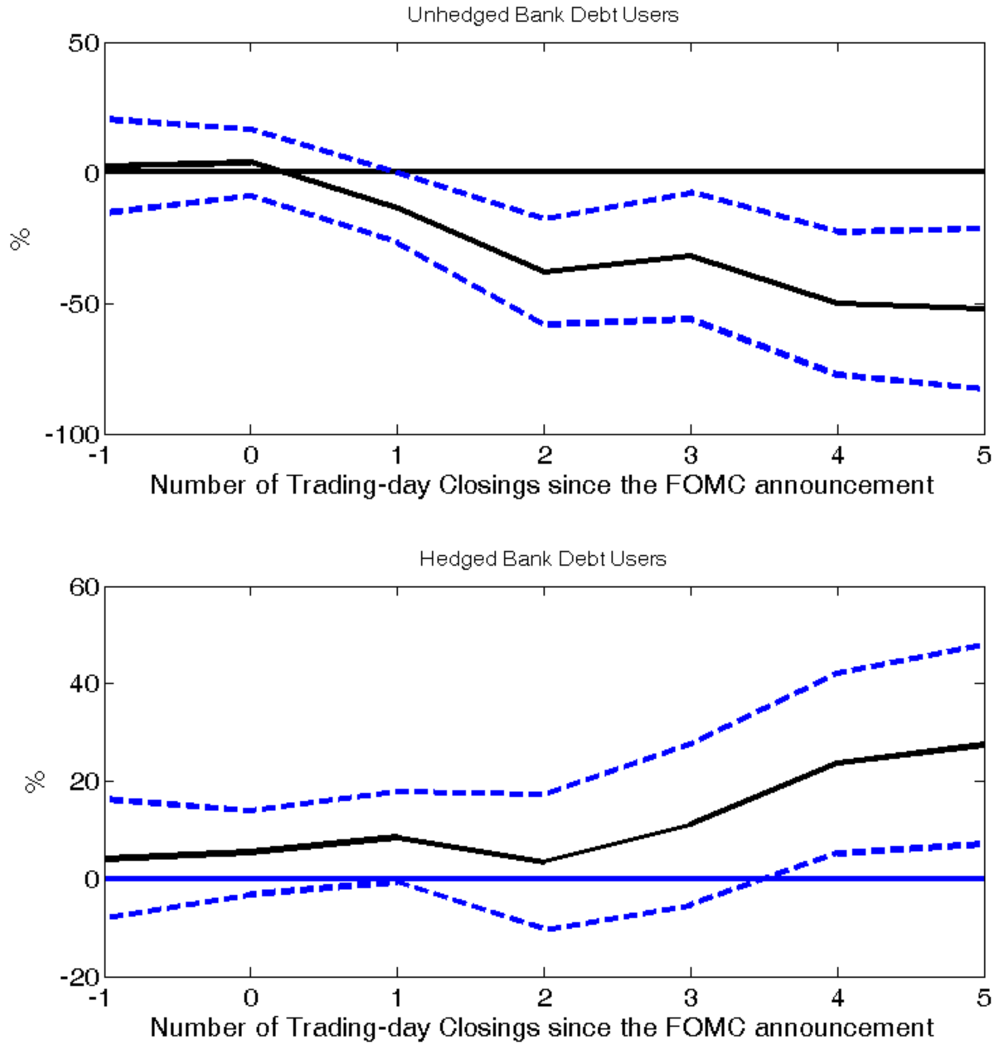

Figure 3

Cumulative Reaction to monetary policy tightening associated with Bank Debt Usage: Hedgers vs Non-hedgers

This figure displays the average additional effect of a 1 percentage point surprise increase in the Federal Funds target rate on the cumulative stock price return of a hypothetical firm that is financed exclusively with bank debt, relative to a firm with no bank debt. In the bottom (top) panel the sample consists of firms that hedge (do not hedge) interest rate risk. The estimates are a result of running regression (1) with the cumulative stock return over multiple trading days as the dependent variable. Dotted lines capture the 95% confidence interval around our estimates.

Table I
Descriptive Statistics

This table provides summary statistics for the entire sample and for different subsamples. The entire sample consists of U.S. firms covered by Capital IQ, CRSP, and Compustat from 2003 to 2008 with December fiscal year-end, excluding utilities (SIC codes 4900-4949) and financials (SIC codes 6000-6999). We remove firm-year observations with negative revenues, missing information on total assets, or a value of total assets under 10 million. We also discard penny stocks, defined as those with a price of less than $5. After the above filters, the sample contains 9,746 firm-year observations comprising 2,368 unique firms. Complete variable definitions are given in the appendix. All variables are winsorized at the 1% level in both tails of the distribution, and total assets are expressed in terms of year-2000 dollars.

	(1)		(2)		(3)		(4)		(5)	
							Firms with Bank Debt			
	Entire Sample		Firms w/ Bank Debt		Leveraged w/out Bank		Hedgers		Non-hedgers	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Term Loans/At	3.95%	9.02%	7.08%	11.12%	0.00%	0.00%	8.93%	12.70%	5.09%	8.88%
Drawn Credit Lines/At	3.09%	6.55%	5.53%	7.96%	0.00%	0.00%	6.12%	8.51%	5.06%	7.36%
Bank Debt /At	7.22%	11.66%	12.93%	13.03%	0.00%	0.00%	15.52%	14.33%	10.33%	11.01%
Bank Debt / Total Debt	37.51%	40.07%	54.85%	37.37%	0.00%	0.00%	50.35%	36.26%	58.89%	37.97%
Floating-Rate Debt/At	9.77%	13.44%	12.75%	14.16%	1.59%	5.86%	15.37%	15.77%	10.04%	11.73%
Float-Rate Debt / Tot. Debt	38.31%	40.47%	48.98%	39.80%	8.95%	24.65%	47.04%	38.14%	50.62%	41.26%
Undrawn Credit Line/At	9.85%	10.56%	11.92%	10.36%	8.19%	9.89%	12.99%	9.61%	11.11%	10.95%
(Bank Debt + Und CL)/At	17.14%	16.64%	24.85%	16.55%	8.19%	9.89%	28.51%	16.89%	21.43%	15.36%
Short-Term Debt /At	2.55%	5.15%	3.71%	5.95%	1.85%	4.25%	3.65%	6.13%	3.71%	5.76%
Profitability	4.94%	15.73%	6.44%	13.14%	4.35%	16.46%	8.91%	7.24%	4.31%	16.40%
Size (Total Assets)	4,274.32	23990	5,019.50	28,893.11	5,404.67	20,292.93	5,071.905	23,784.68	4,677.726	32,800.7
Book Leverage	28.15%	29.58%	38.06%	28.43%	26.87%	29.38%	45.19%	27.21%	31.07%	27.71%
Earnings-Interest Rate Sensitivity	-13.23%	35.46%	-14.18%	34.03%	-11.82%	36.96%	-15.63%	33.43%	-12.98%	34.44%
Rated Dummy	32.98%	47.02%	42.19%	49.39%	36.23%	48.08%	57%	49.52%	28.76%	45.27%
Market-to-Book Assets	1.98	1.57	1.61	1.2	2.13	1.61	1.42	0.92	1.79	1.38
Cash/At	22.35%	24.26%	12.63%	18.02%	27.19%	23.31%	7.44%	9.83%	17.44%	22.07%
CAPM Beta	1.32	1.20	1.22	1.11	1.37	1.23	1.11	0.93	1.35	1.24
Cash Flow Volatility	1.11%	0.49%	1.03%	0.46%	1.14%	0.44%	0.95%	0.42%	1.10%	0.48%
Hadlock-Pierce Fin. Con. Measure	-2.85	0.59	-2.96	0.56	-2.89	0.61	-3.12	0.49	-2.82	0.57
Age	16.78	17.01	18.27	17.49	18.08	18.95	20.20	19.31	16.63	15.72
Hedging Dummy	34.80%	47.63%	48.20%	49.97%	26.46%	44.12%	100.00%	0.00%	0.00%	0.00%
Hedging*(Bank Debt /At)	4.22%	10.18%	7.48%	12.61%	0.00%	0.00%	15.52%	14.33%	0.00%	0.00%
Hedging*(Floating-Rate Debt/At)	5.75%	12.11%	7.60%	13.49%	0.71%	3.94%	15.37%	15.77%	0.00%	0.00%
Interest Rate Coverage Ratio	0.14	0.19	0.18	0.20	0.12	0.18	0.22	0.20	0.14	0.18
Inventory (quarterly growth %)	2.02%	21.70%	1.70%	18.97%	2.37%	23.10%	1.71%	17.96%	1.73%	19.03%
Sales (quarterly growth %)	2.16%	21.1%	1.85%	19.86%	2.40%	21.19%	1.51%	17.48%	2.04%	21.67%
Prop. Pla. & Equip. (q. growth %)	2.13%	5.42%	1.92%	5.14%	2.15%	5.50%	1.80%	5.12%	2.05%	5.09%
Observations (annual)	9,746	9,746	5,439	5,439	2,509	2,509	2,463	2,463	2,647	2.647
Observations (quarterly)	45,694	45,694	23,035	23,035	11,932	11,932	10,117	10,117	11,645	11,645

Table II

The Role of Bank Debt Usage and Interest Rate Risk Exposure in the Transmission of Monetary Policy

This table examines how bank and floating rate debt usage impacts the effect of monetary policy on stock prices, and how this impact varies with their hedging activity. Hedgers are defined on a yearly basis as those firms that report having hedged their interest rate risk from floating to fixed in their 10-K annual reports. Only firms with floating rate debt constituting more than 1% of total assets are included. Bank Debt/At is defined as bank debt (term loans plus drawn revolving credit) over book value of assets (At). FloatingRateDebt /At is defined as floating rate debt over book value of assets (At). All regressions also include an unreported constant term, as well as ln(assets), book leverage, profitability, market-to-book, interest rate sensitivity, and their interaction with surprise. All firm characteristics are lagged by one year and winsorized at 1%. Parentheses contain t-statistics. The asterisks denote *** for p<0.01, ** for p<0.05, * for p<0.1.

	(1) Non-Hedgers	(2) Hedgers	(3) Non-Hedgers	(4) Hedgers	(5) Non-Hedgers	(6) Hedgers	(7) Non-Hedgers	(8) Hedgers
Surprise	-4.10***	-8.62***	-5.08*	-6.83**	-4.59***	-8.22***	-5.76**	-6.34**
	(-4.07)	(-9.05)	(-1.91)	(-2.35)	(-4.76)	(-8.96)	(-2.20)	(-2.16)
BankDebt/At	0.35	0.26	0.13	1.94***				
	(0.86)	(1.14)	(0.13)	(3.12)				
FloatingRateDebt /At					0.25	0.21	0.77	1.19**
					(0.65)	(0.96)	(0.84)	(2.14)
Surprise *(BankDebt/At)	-25.18***	1.41	-38.02***	3.45				
	(-3.04)	(0.26)	(-3.09)	(0.38)				
Surprise *(FloatingRateDebt /At)					-20.81***	-2.72	-30.79**	-3.71
					(-2.60)	(-0.53)	(-2.36)	(-0.40)
Surprise*(BankDebt/At)*Hedging	26.71***		41.46***					
	(2.71)		(2.85)					
Surprise*(FloatingRateDebt /At)*Hedging					17.78*		27.07*	
					(1.90)		(1.74)	
Firm Controls	NO	NO	YES	YES	NO	NO	YES	YES
Firm FE	NO	NO	YES	YES	NO	NO	YES	YES
Surprise*Firm Controls	NO	NO	YES	YES	NO	NO	YES	YES
Cluster (Fed event*IndustryFF48)	NO	NO	YES	YES	NO	NO	YES	YES
Observations	11,796	12,335	11,788	12,335	11,796	12,335	11,788	12,335

Table III

The Role of Interest Rate Risk Exposure in the Transmission of Monetary Policy: Instrumental Variables Analysis

All variables are as defined in Table 1. Column (1) is the fixed effects regression for the sample of firms that have data on tax convexity, our instrument for hedging from Graham and Smith (1999) and Campello, Lin, Ma, Zou (2011). IV1 uses tax convexity as instrument, IV2 uses the underlying variables used in the calculation of tax convexity directly as instruments, and IV3 uses the same specification as in IV2 omitting volatility of taxable income. Only firms with floating rate debt constituting more than 1% of total assets are included. A constant, non-interacted terms, and the policy surprise interacted with firm size, book leverage, profitability and the market-to-book ratio are included but not reported. All regressions include an unreported constant term. All firm characteristics are lagged by one year and winsorized at 1%. Parentheses contain t-statistics. The asterisks denote *** for p<0.01, ** for p<0.05, * for p<0.1.

Panel A: Bank Debt

	(1)	(2) IV1	(3) IV2	(4) IV3
Surprise	-5.79***	-3.43*	-3.92**	-3.31*
	(-3.34)	(-1.73)	(-1.97)	(-1.67)
Surprise*(BankDebt/At)	-49.30***	-122.79***	-104.77***	-123.59***
	(-3.72)	(-3.82)	(-3.18)	(-3.79)
Surprise*(BankDebt/At)*Hedging	59.25***	175.73***	147.08***	176.92***
	(3.55)	(3.56)	(2.90)	(3.53)
Hausman test (p-value)		1.000	0.999	0.995
Firm FE	YES	YES	YES	YES
Firm Controls	YES	YES	YES	YES
Surprise*Firm Controls	YES	YES	YES	YES
Observations	12,060	12,060	12,034	12,034

Panel B: Floating Rate Debt

	(1)	(2) IV1	(3) IV2	(4) IV3
Surprise	-6.75***	-5.79***	-6.01***	-5.66***
	(-3.94)	(-3.13)	(-3.23)	(-3.05)
Surprise*(FloatingRateDebt/At)	-24.84*	-65.31**	-51.91	-66.37**
	(-1.90)	(-2.06)	(-1.61)	(-2.07)
Surprise*(FloatingRateDebt/At)*Hedging	22.22	86.23*	64.79	87.65*
	(1.35)	(1.78)	(1.31)	(1.79)
Hausman test (p-value)		1.000	0.999	0.999
Firm FE	YES	YES	YES	YES
Firm Controls	YES	YES	YES	YES
Surprise*Firm Controls	YES	YES	YES	YES
Observations	12,060	12,060	12,034	12,034

Table IV

Interest Rate Risk Exposure and the Transmission of Monetary Policy: The Role of Financing Constraints

Hedgers are defined on a yearly basis as those firms that report having hedged their interest rate risk from floating to fixed in their 10-K annual reports. Financial constraints are proxied with the firm's age and the Hadlock and Pierce (2010) measure given by HP = $-0.548*Size+0.025*Size^2-0.031*Age$. Firm size is defined to be the log of assets (inflation adjusted to 2004). Age is defined as the current year minus the first year that the firm has a non-missing stock price in CRSP. Firm size and age are at the 1% tails on the low end, and at the $4.5 billion and thirty-seven year points on the high end. The financial constraint measure takes value 1 if the firm's age is below the median or firm's HP statistic is above the median in a given year. Only firms with floating rate debt constituting more than 1% of total assets are included. Bank Debt/At is defined as bank debt (term loans plus drawn revolving credit) over book value of assets (At). All regressions also include an unreported constant term, as well as ln(assets), book leverage, profitability, market-to-book, interacted with surprise and uninteracted. All firm and lender characteristics are lagged by one year and winsorized at 1%. Parentheses contain t-statistics. The asterisks denote *** for p<0.01, ** for p<0.05, * for p<0.1

VARIABLES	(1) Non-Hedgers OLD	(2) Non-Hedgers YOUNG	(3) Hedgers OLD	(4) Hedgers YOUNG	(5) Non-Hedgers LOW HP	(6) Non-Hedgers HIGH HP	(7) Hedgers LOW HP	(8) Hedgers HIGH HP
Surprise	-6.23***	-3.05	-6.33**	-7.03***	-1.18	-6.31**	-5.90**	-9.46***
	(-3.73)	(-1.48)	(-2.52)	(-2.74)	(-0.52)	(-2.40)	(-2.29)	(-3.05)
Surprise*(BankDebt/At)	-20.30	-56.73***	3.81	3.20	-29.19**	-46.11***	4.05	7.01
	(-1.49)	(-3.49)	(0.37)	(0.29)	(-1.96)	(-3.06)	(0.46)	(0.51)
Surprise*(BankDebt/At)*Constrained (columns 1–2; 3–4; 5–6; 7–8)	-36.43*		-0.61		-16.92		2.96	
	(-1.74)		(-0.04)		(-0.79)		(0.19)	
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm Controls	YES	YES	YES	YES	YES	YES	YES	YES
Surprise*Firm Controls	YES	YES	YES	YES	YES	YES	YES	YES
Observations	6,713	5,075	7,303	5,032	5,785	6,003	8,561	3,774
R-squared	0.01	0.01	0.01	0.02	0.01	0.01	0.02	0.02
Number of gvkey	432	409	407	337	354	486	469	288

Table V

The Effect of Monetary Policy on the Interest Coverage Ratio

This table examines how monetary policy affects firms' interest coverage ratio and how this effect varies with bank debt usage and interest rate risk hedging. The quarterly coverage ratio is equal to the sum of interest expenses (XINTQ) and cash flow divided by interest expenses. Cash flow is equal to earnings before extraordinary items (IBQ) plus depreciation (DPQ). The dependent variable is computed as the difference between the coverage ratio x quarters after the monetary policy shock and the coverage ratio during the quarter before the monetary policy shock, where x={4,6}. *Change* is the sum of all changes in the federal funds rate that occur during a quarter. *Hedgers* are defined as those firms that report having hedged their interest rate risk from floating to fixed in their 10K annual reports. Only firms with floating rate debt constituting more than 1% of total assets are included. *Bank Debt/At* is defined as bank debt (term loans plus drawn revolving credit) over book value of assets (At). All regressions also include an unreported constant term. Unreported controls include ln(assets), book leverage, market-to-book, profitability and interest rate sensitivity of operating income. All firm controls are lagged by one quarter and winsorized at 1%. Parentheses contain t-statistics. The asterisks denote *** for p<0.01, ** for p<0.05, * for p<0.1.

Dep variable: $CoverageRatio_{t+x}$ - $CoverageRatio_{t-1}$	(1)	(2)	(3)	(4)	(5)	(6)
	x=1 quarter ahead	x=2 quarters ahead	x=3 quarters ahead	x=4 quarters ahead	x=5 quarters ahead	x=6 quarters ahead
<u>*Non-hedgers*</u>						
(Sum) Change* BankDebt/At	-0.11	3.56	6.04*	4.69	8.72**	7.88
	(-0.04)	(1.00)	(1.71)	(1.46)	(2.28)	(1.14)
<u>*Hedgers*</u>	-3.05	-0.18	1.82	-1.06	-0.33	-3.89
(Sum) Change* BankDebt/At	(-0.71)	(-0.08)	(0.54)	(-0.29)	(-0.15)	(-1.15)
Hedger(Sum) Change* BankDebt/At*	-2.93	-3.74	-4.21	-5.74	-9.05**	-11.77**
	(-0.72)	(-0.87)	(-0.76)	(-1.01)	(-1.98)	(-2.08)
Firm Controls	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES
Change*Firm Controls	YES	YES	YES	YES	YES	YES
Year-quarter dummies	YES	YES	YES	YES	YES	YES
Industry-Quarter Clustering	YES	YES	YES	YES	YES	YES
Observations (non-hedgers regressions)	7,669	7,511	7,332	7,193	7,076	6,963
Observations (hedgers regressions)	7,445	7,351	7,238	7,134	7,036	6,941

Table VI

The Effect of Monetary Policy on Cash Holdings

This table examines how monetary policy affects firm cash holdings and how this effect varies with bank debt usage and interest rate risk hedging. Cash holdings are calculated as cash and short-term investments divided by total assets. *Change in Cash Holdings*$_{t-1,t+x}$ is computed as the difference (in basis points) between the cash holdings *x* quarters ahead, and cash holdings at the end of the quarter before the monetary policy change occurs, scaled by total assets at the end of the quarter before the monetary policy change occurs. *Change* is the sum of all changes in the federal funds rate that occur during a quarter. *Hedgers* are defined as those firms that report having hedged their interest rate risk from floating to fixed in their 10K annual reports. Only firms with floating rate debt constituting more than 1% of total assets are included. *Bank Debt/At* is defined as bank debt (term loans plus drawn revolving credit) over book value of assets (At). All regressions also include an unreported constant term. Unreported controls include ln(assets), book leverage, market-to-book, profitability and interest rate sensitivity of operating income. All firm controls are lagged by one quarter and winsorized at 1%. Parentheses contain t-statistics. The asterisks denote *** for p<0.01, ** for p<0.05, * for p<0.1.

Dependent variable: $(Cash_{t+x} - Cash_{t-1})/Assets_{t-1}$	x=4 quarters ahead				x=6 quarters ahead			
	Non-hedgers		Hedgers		Non-hedgers		Hedgers	
	Constrained (high HP)	Unconstrained (low HP)	Constrained (high HP)	Unconstrained (low HP)	Constrained (high HP)	Unconstrained (low HP)	Constrained (high HP)	Unconstrained (low HP)
(Sum) Change (ommited)								
BankDebt/At	700.68	140.01	152.40	221.87	420.47	496.87	358.07*	241.59
	(1.56)	(0.38)	(0.82)	(1.39)	(0.81)	(1.36)	(1.74)	(1.48)
(Sum) Change *BankDebt/At	-3.22	0.99	-0.53	-0.20	-7.06**	2.39	-1.00	1.00
	(-1.43)	(0.86)	(-0.67)	(-0.22)	(-2.37)	(1.54)	(-0.57)	(1.06)
(Sum) Change BankDebt/At*Constrained*	-4.21*		-0.33		-9.45***		-1.99	
	(-1.74)		(-0.33)		(-3.15)		(-1.08)	
Firm Controls	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Change*Firm Controls	YES	YES	YES	YES	YES	YES	YES	YES
Year-quarter dummies	YES	YES	YES	YES	YES	YES	YES	YES
Industry-Quarter Clustering	YES	YES	YES	YES	YES	YES	YES	YES
Observations	3,812	3,764	2,032	5,204	3,663	3,667	1,934	5,075

Table VII
The Effect of Monetary Policy on Inventory Investment

This table examines how monetary policy affects firm inventory investment and how this effect varies with bank debt usage and interest rate risk hedging. Inventories are calculated as Total Inventories (INVTQ), and *Change in Inventories*$_{t-1,t+x}$ is computed as the difference between the log of inventories *x* quarters ahead and the log of inventories at the end of the quarter before the monetary policy change occurs. *Change* is the sum of all changes in the federal funds rate that occur during a quarter. *Hedgers* are defined as those firms that report having hedged their interest rate risk from floating to fixed in their 10K annual reports. Only firms with floating rate debt constituting more than 1% of total assets are included. *Bank Debt/At* is defined as bank debt (term loans plus drawn revolving credit) over book value of assets (At). All regressions also include an unreported constant term. Controls include the inventory to sales ratio, the change in cumulative sales over the *x* quarters following the monetary policy change and the *x* quarters before, and cash holdings over assets, and also (unreported): ln(assets), book leverage, market-to-book, profitability and interest rate sensitivity of operating income. All firm controls are lagged by one quarter and winsorized at 1%. Parentheses contain t-statistics. The asterisks denote *** for p<0.01, ** for p<0.05, * for p<0.1.

Dependent variable: ln(Inventory$_{t+x}$) - ln(Inventory$_{t-1}$)

	x=4 quarters ahead				x=6 quarters ahead			
	Non-hedgers		Hedgers		Non-hedgers		Hedgers	
	Constrained (high HP)	Unconstrained (low HP)	Constrained (high HP)	Unconstrained (low HP)	Constrained (high HP)	Unconstrained (low HP)	Constrained (high HP)	Unconstrained (low HP)
(Sum) Change (<u>ommited</u>)								
BankDebt/At	-55.43	-1,082.20	672.17	1,547.13	1,204.72	-2,817.44	-473.70	1,068.42
	(-0.03)	(-0.69)	(0.61)	(1.40)	(0.60)	(-1.60)	(-0.38)	(0.84)
(Sum) Change *BankDebt/At	-16.81**	7.59	7.78	-6.06	-21.20***	0.99	5.31	-2.44
	(-2.05)	(0.57)	(1.64)	(-1.62)	(-2.83)	(0.09)	(1.07)	(-0.49)
(Sum) Change BankDebt/At*Constrained*	-24.39**		13.83**		-22.18*		7.74	
	(-2.21)		(2.35)		(-1.72)		(1.39)	
ln(Inventory$_{t-1}$/ Sales$_{t-1}$)	-3,144.56***	-3,824.72***	-4,857.47***	-602.85	-3,626.21***	-4,301.13***	-6,462.38***	-1,388.76
	(-9.75)	(-7.95)	(-7.24)	(-0.80)	(-10.78)	(-7.70)	(-9.68)	(-1.53)
ln(Sales$_{t-1,t+x}$)	0.51***	0.52***	0.65***	0.65***	0.54***	0.60***	0.87***	0.82***
	(10.04)	(9.41)	(5.45)	(7.34)	(11.63)	(12.14)	(10.30)	(15.00)
Cash$_{t-1}$/At$_{t-1}$	6,150.26***	6,864.56***	18,180.29***	7,091.18***	6,494.47***	7,590.74***	15,304.41***	7,736.34***
	(4.48)	(5.51)	(6.06)	(3.92)	(4.78)	(5.36)	(4.85)	(3.79)
Firm Controls	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Change*Firm Controls	YES	YES	YES	YES	YES	YES	YES	YES
Year-quarter dummies	YES	YES	YES	YES	YES	YES	YES	YES
Industry-Quarter Clustering	YES	YES	YES	YES	YES	YES	YES	YES
Observations	2,964	3,171	1,448	4,243	2,863	3,082	1,371	4,130

Table VIII

The Effect of Monetary Policy on Sales

This table examines how monetary policy affects firm sales and how this effect varies with bank debt usage and interest rate risk hedging. *Change in Sales*$_{t-x-1,t+x}$ is calculated as the difference between the ln of the accumulated quarterly sales over x quarters starting in the quarter (t) in which the monetary policy action occurs, and the ln of the accumulated quarterly sales in the x quarters preceding the monetary policy action. *Change* is the sum of all changes in the federal funds rate that occur during a quarter. *Hedgers* are defined as those firms that report having hedged their interest rate risk from floating to fixed in their 10K annual reports. Only firms with floating rate debt constituting more than 1% of total assets are included. *Bank Debt/At* is defined as bank debt (term loans plus drawn revolving credit) over book value of assets (At). All regressions also include an unreported constant term. Unreported controls include ln(assets), book leverage, market-to-book, profitability and interest rate sensitivity of operating income. All firm controls are lagged by one quarter and winsorized at 1%. Parentheses contain t-statistics. The asterisks denote *** for p<0.01, ** for p<0.05, * for p<0.1.

Dependent variable: $\ln(Sales_{t,\,t+x}) - \ln(Sales_{t-x-1,\,t-1})$	x=4 quarters ahead				x=6 quarters ahead			
	Non-hedgers		Hedgers		Non-hedgers		Hedgers	
	Constrained (high HP)	Unconstrained (low HP)	Constrained (high HP)	Unconstrained (low HP)	Constrained (high HP)	Unconstrained (low HP)	Constrained (high HP)	Unconstrained (low HP)
(Sum) Change (<u>ommited</u>)								
BankDebt/At	-2,353.22***	-1,066.41	319.36	-395.46	-2,671.31***	-392.00	938.17**	-516.16
	(-2.86)	(-1.32)	(0.77)	(-0.77)	(-2.95)	(-0.43)	(2.03)	(-0.95)
(Sum) Change *BankDebt/At	-6.43	12.71*	-5.12**	4.83**	-6.29	16.89**	-5.51***	6.31**
	(-1.59)	(1.79)	(-2.47)	(2.14)	(-1.60)	(2.23)	(-2.87)	(2.39)
(Sum) Change BankDebt/At*Constrained*	-19.13***		-7.88**		-17.84***		-9.69***	
	(-3.71)		(-2.39)		(-3.25)		(-2.79)	
Firm Controls	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Change*Firm Controls	YES	YES	YES	YES	YES	YES	YES	YES
Year-quarter dummies	YES	YES	YES	YES	YES	YES	YES	YES
Industry-Quarter Clustering	YES	YES	YES	YES	YES	YES	YES	YES
Observations	3,813	3,770	2,037	5,207	3,664	3,671	1,940	5,078

Table IX

The Effect of Monetary Policy on Fixed Investment

This table examines how monetary policy affects firm fixed investment and how this effect varies with bank debt usage and interest rate risk hedging. Inventories are calculated as Total Inventories (INVTQ), and *Fixed Investment* $_{t-1,t+x}$ is computed as the difference between the log of property, plant and equipment (PPEGTQ) *x* quarters ahead and the log of PPEGTQ at the end of the quarter before the monetary policy change occurs. *Change* is the sum of all changes in the federal funds rate that occur during a quarter. *Hedgers* are defined as those firms that report having hedged their interest rate risk from floating to fixed in their 10K annual reports. Only firms with floating rate debt constituting more than 1% of total assets are included. *Bank Debt/At* is defined as bank debt (term loans plus drawn revolving credit) over book value of assets (At). All regressions also include an unreported constant term. Controls include the lagged investment to capital ratio, the lagged cash holdings to capital ratio, and the market to book ratio, and also (unreported): ln(assets), book leverage, market-to-book, profitability and interest rate sensitivity of operating income. All firm controls are lagged by one quarter and winsorized at 1%. Parentheses contain t-statistics. The asterisks denote *** for p<0.01, ** for p<0.05, * for p<0.1.

Dependent variable: $\ln(PPE_{t+x}) - \ln(PPE_{t-1})$	x=4 quarters ahead				x=6 quarters ahead			
	Non-hedgers		Hedgers		Non-hedgers		Hedgers	
	Constrained (high HP)	Unconstrained (low HP)	Constrained (high HP)	Unconstrained (low HP)	Constrained (high HP)	Unconstrained (low HP)	Constrained (high HP)	Unconstrained (low HP)
(Sum) Change (<u>*ommited*</u>)								
BankDebt/At	-2,007.41	-1,002.06	1,031.09	-119.24	-717.06	-483.32	831.46	-245.13
	(-1.20)	(-1.02)	(1.27)	(-0.29)	(-0.34)	(-0.49)	(0.97)	(-0.56)
(Sum) Change *BankDebt/At	4.14	9.65*	3.27*	-1.15	-1.39	14.44***	1.52	1.30
	(0.51)	(1.67)	(1.74)	(-0.58)	(-0.20)	(2.84)	(0.74)	(0.62)
(Sum) Change BankDebt/At*Constrained*	-5.50		4.41		-15.82**		0.21	
	(-0.79)		(1.59)		(-2.03)		(0.07)	
Market-to-Book	281.38**	476.11***	-88.34	773.48***	330.31*	481.26***	-26.30	866.56***
	(2.21)	(5.23)	(-0.54)	(7.14)	(1.93)	(5.27)	(-0.13)	(7.30)
CashFlow/Capital	5,652.95**	3,212.44	6,407.42**	2,888.91**	11,226.57***	5,846.00***	3,430.26	5,405.10***
	(2.09)	(1.19)	(2.21)	(2.34)	(2.93)	(2.91)	(1.33)	(3.26)
Lagged Investment/Capital	16,219.03***	13,070.66***	9,663.72***	12,616.35***	17,210.22***	13,567.38***	9,220.25***	12,262.66***
	(5.45)	(8.12)	(4.60)	(9.04)	(5.06)	(8.17)	(4.53)	(6.72)
Firm Controls	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Change*Firm Controls	YES	YES	YES	YES	YES	YES	YES	YES
Year-quarter dummies	YES	YES	YES	YES	YES	YES	YES	YES
Industry-Quarter Clustering	YES	YES	YES	YES	YES	YES	YES	YES
Observations	3,813	3,770	2,037	5,207	3,664	3,671	1,940	5,078

Table X

Bank Debt Specialness in the Unconventional Period

All regressions include firm fixed effects. Hedgers are defined on a yearly basis as those firms that report having hedged their interest rate risk from floating to fixed in their 10-K annual reports. Calculation of other variables is presented in Tables III. Parentheses contain t-statistics. The asterisks denote *** for p<0.01, ** for p<0.05, * for p<0.1.

	(1)	(2)	(3)	(4)	(5)
VARIABLES	ALL	ALL	ALL	Hedgers	Non-Hedgers
Surprise	-0.33***	-0.35***	-0.31***	-0.24***	-0.24***
	(-11.67)	(-12.19)	(-10.63)	(-3.36)	(-5.42)
Surprise*(BankDebt/At)		0.43**	0.00	-0.23	0.15
		(1.98)	(0.00)	(-0.61)	(0.28)
Surprise*LnAssets			-0.11***	-0.12***	-0.08***
			(-5.27)	(-3.46)	(-2.89)
Surprise*Book Leverage			0.24*	0.65***	0.14
			(1.92)	(3.03)	(0.74)
Surprise*Profitability			-0.15	-0.87	-0.05
			(-0.69)	(-1.40)	(-0.18)
Surprise*M/B			-0.12***	-0.19***	-0.09***
			(-5.05)	(-2.89)	(-2.97)
Observations	38,097	36,736	36,568	10,918	15,256
R-squared	0.00	0.00	0.01	0.02	0.01
Number of gvkey	1,903	1,792	1,779	679	1,030

APPENDIX

Table A1
Description of Firm Level Variables
Item codes are from Compustat. CIQ items come from Capital IQ.

Variable	Construction
Bank Debt/At 1	[Drawn Credit Lines (CIQ) + Term Loans (CIQ)] / Assets (AT)
Bank Debt/At 2	[Drawn Credit Lines (CIQ) + Term Loans (CIQ) + Undrawn Credit Lines (CIQ)]/ Assets (AT)
Book Leverage	(Total Debt (DLC+DLTT)) / (Total Debt + Book Value of Equity)
Book Value of Equity	Common/Ordinary Equity – Total (CEQ)
Cash/At	Cash and Short-Term Investments (CHE)/Total Assets (AT)
Cash Flow	Quarterly level measure: earnings before extraordinary items (IBQ) + depreciation (DPQ).
Cash Flow Volatility	Standard Deviation of Operating Income Before Depreciation (OIBDP) over Previous 12 Quarters Scaled by Total Assets (AT)
CAPM Beta	CAPM Beta using last 60 months.
Floating Interest Rate Debt	Debt with floating interest rate (CIQ)
Hedging Dummy	A dummy variable that takes the value 1 if a firms reports floating-to-fixed interest-rate hedging activities in its 10-K
Interest Rate Coverage Ratio	Quarterly level measure: (interest expenses (XINTQ) + cash flow) / interest expenses
Interest Rate Sensitivity	Correlation between quarterly firm EBITDA and three-month average LIBOR rates
Inventory Investment	Quarterly level measure: logarithm of Inventories (INVTQ) in quarter ‘t’ - logarithm of Inventories in quarter ‘t-1’ (Inventory is deflated to base year 2000)
Investment in Capital	Quarterly level measure: logarithm of Property, Plant and Equipment (PPEGTQ) in quarter ‘t’ - logarithm of Property, Plant and Equipment in quarter ‘t-1’ (Property, Plant and Equipment is deflated to base year 2000)
Market-to-Book Assets	[Market Value of Equity + Total Debt + Preferred Stock Liquidating Value (PSTKL)] / Total Assets (AT)
Market Value of Equity	Stock Price (PRCC_F) × Common Shares Used to Calculate EPS (CSHO)
Profitability	Operating Income before Depreciation (OIBDP) / Total Assets (AT)
Rated	A dummy variable that takes the value of one if the firm has a long term credit rating from S&P, and zero otherwise
Sales Growth	Logarithm of total sales (SALEQ) during quarters ‘t’ to ‘t+s’ – logarithm of total sales during quarters “t-s-1” to “t-1” (sales are deflated to base year 2000)
Short-Term Debt	Debt in current liabilities (DLC) and is equal to the total amount of short-term notes and the current portion of long-term debt that is due in one year.
Size (At)	Logarithm of Book Value of Total Assets (AT) , deflated to base year 2000
Tangibility	(Inventories (INVT) + Net Plant, Property, Equipment (PPENT))/Total Assets (AT)
Total Debt	Long-Term Debt (DLTT) + Debt in Current Liabilities (DLC)

Table A2
Which Firms Use Bank, Floating-Rate and Short-Term Debt, and Interest Rate Hedging

This table examines the use of bank debt, floating-rate debt, short-term debt and interest rate hedging, using firm-year data. A constant is included but not reported. All firm characteristics are winsorized at the 1% level. Standard errors are clustered at the firm level. Columns 1-4 use an OLS specification, as in Lemmon, Roberts and Zender (2008), while columns 5 and 6 use a Probit specification. Parentheses contain t-statistics. The asterisks denote *** for p<0.01, ** for p<0.05, * for p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)
	Bank/At	Bank/At	Floating-Rate Debt/At	Short-Term Debt/At	Hedging	Hedging
LnAssets	0.01***		0.00**	-0.00***	0.21***	
	(16.24)		(2.55)	(-10.13)	(40.54)	
Profitability	-0.03***	-0.02***	0.01***	-0.01***	1.42***	1.43***
	(-10.08)	(-7.45)	(4.69)	(-4.67)	(19.78)	(20.10)
Market to Book	-0.00***	-0.00***	-0.00***	-0.00	-0.14***	-0.14***
	(-3.86)	(-7.22)	(-3.11)	(-1.27)	(-22.25)	(-22.98)
Book Leverage	0.18***	0.18***	0.04***	0.05***	0.38***	0.40***
	(113.33)	(114.16)	(34.31)	(44.82)	(14.27)	(14.99)
Unrated	0.03***	0.03***	0.00	0.00***	-0.37***	-0.58***
	(20.13)	(17.13)	(1.31)	(3.35)	(-21.33)	(-37.48)
Interest Rate Sensitivity	0.01	0.00	0.00	-0.00	-0.01	-0.05***
	(1.56)	(0.83)	(0.05)	(-0.12)	(-0.73)	(-2.68)
Cash Flow Volatility	-0.50	-0.70	0.33	-0.52**	-12.79***	-13.74***
	(-1.04)	(-1.46)	(1.10)	(-2.33)	(-6.31)	(-6.82)
Tangibility	0.03***	0.03***	0.01***	0.01***	0.25***	0.28***
	(6.66)	(7.16)	(2.94)	(3.71)	(6.73)	(7.58)
Age	-0.00***		-0.00***	0.00***	0.00***	
	(-5.35)		(-6.44)	(6.14)	(3.18)	
HP Index		-0.01***				-0.48***
		(-4.78)				(-34.32)
Bank/At			0.76***	0.09***	3.04***	2.92***
			(268.07)	(41.96)	(48.57)	(47.29)
Year FE	YES	YES	YES	YES	YES	YES
Industry FF48 FE	YES	YES	YES	YES	YES	YES
Observations	69,179	69,179	67,127	69,179	64,654	64,654
Number of gvkey	2,564	2,564	2,503	2,564		

Table A3

Response of Equity Prices to Federal Funds Rate Changes: Comparison across Samples

The table reports the results from regressions of equity returns on the surprise and expected components of the change in the federal funds rate, all expressed in percentage terms. Outliers are excluded following the analysis of Bernanke and Kuttner (2005) based on a Cook's D statistic greater than 0.1. As in Bernanke and Kuttner (2005), for the period 1994-2002 outliers include October 15, 1998, January 3, 2001, March 20, 2001, April 18, 2001, and September 17, 2001 which are discussed in their paper. For the period 2003-2008, outlier dates are January 22, 2008, and March 18, 2008. Both of which are characterized by very large rate cuts. On January 21, 2008, in response to deteriorating market conditions, the Federal Open Market Committee (FOMC) held an unscheduled meeting (conference call) despite the national holiday (Martin Luther King day). They decided on a rate cut of 75 basis points (bp), which they announced shortly before the opening of U.S. markets. Although the rate cut was almost entirely unexpected, with an unprecedented surprise of -74bp, stock prices declined by almost 100bp compared to their closing price before the holidays. Shortly after, on March 18, 2008, the FOMC announced another unusually large cut in the federal funds rate (-75bp) in response to turmoil in the markets and the collapse of Bear Stearns. Stocks rallied in response, although the federal funds futures data suggested that some market participants had expected an even larger rate cut (about 100bp).

Column 1 contains returns for a value-weighted equity index. Columns 2-5 report returns for individual firm-date observations over different sample periods. Column 5 includes only observations for which data on bank debt is available. The firm level regressions contain random effects. Parentheses contain t-statistics. The asterisks denote *** for p<0.01, ** for p<0.05, * for p<0.1.

	(1) Daily Value-weighted Index 1994-2008	(2) Daily Returns All Firms 1994-2008	(3) Daily Returns All Firms 1994-2002	(4) Daily Returns All Firms 2003-2008	(5) Two-day Returns Our Sample 2003-2008
Expected	0.421	0.209***	0.193***	0.133***	-0.641***
	(1.00)	(8.40)	(5.73)	(3.90)	(8.13)
Surprise	-3.359**	-2.704***	-2.424***	-4.665***	-4.451***
	(-2.05)	(-32.46)	(-25.67)	(-25.64)	(11.60)
# Observations	115	536,357	363,290	173,067	66,200

Table A4

Is Bank Debt Special for the Transmission of Monetary Policy?

This table examines how the reaction of firm equity prices to surprise changes in the federal funds rate varies with their level of bank dependence. The sample consists of U.S. firms covered by Capital IQ, CRSP and Compustat from 2003 to 2008, excluding utilities (SIC 4900-4949) and financials (SIC 6000-6999). We focus on firms with December fiscal year end to avoid asynchronous balance sheet items and use 2-day returns in order to allow the effect of bank-debt to be fully incorporated in stock prices. We remove firm-year observations with negative revenues, missing information on total assets, or a value of total assets under 10 million. We also discard penny stocks, defined as those with a price of less than $5. The sample comprises 43 monetary policy events from 2003 to 2008. Firm characteristics are demeaned and are lagged by one year and winsorized at the 1% level. The regression specification is as in equation (1). Unreported terms include a constant and non-interacted coefficients. In specification (6) we add undrawn credit lines to bank debt and normalize the resulting ratio to have the same standard deviation as the original BankDebt/At. Standard errors are clustered at the date level in specifications (1)-(2) and two-way clustered at the date and industry levels in specifications (4)-(7). Industries are Fama-French 48 industries. Square brackets around the estimates of the coefficient of surprise in columns (4)-(7) are introduced to indicate that, due to the interaction of surprise with industry fixed effects, these estimates cannot be interpreted as the estimate applicable to the average firm. Parentheses contain t-statistics. The asterisks denote *** for $p<0.01$, ** for $p<0.05$, * for $p<0.1$. Hadlock and Pierce (2010) measure given by $HP = -0.548*Size+0.025*Size^2-0.031*Age$.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	No Controls	CAPM Control	Other Controls	Industry FE & Event-Industry Clustering	Inc. Undrawn Credit Lines	Other Controls	Firm Fixed Effects	Instrumental Variable	Floating Rate Debt
Surprise	-4.97***	1.28***	-8.02***	[-7.44]	[-8.07]	[-9.83]	-8.04***	-8.07***	-8.81***
	(-13.03)	(3.66)	(-17.72)	(-0.83)	(-0.90)	(-1.10)	(-3.33)	(-17.12)	(-3.63)
Surprise*(BankDebt/At)	-14.10***	-10.52***	-16.34***	-16.77***	-14.62***	-15.22***	-16.37***	-14.50	-13.79**
	(-4.35)	(-3.54)	(-4.17)	(-3.82)	(-3.10)	(-3.30)	(-2.69)	(-0.58)	(-2.48)
Surprise*LnAssets			-0.95***	-1.12***	-1.06***	-0.07	-0.94***	-1.00**	-1.01**
			(-3.67)	(-4.19)	(-3.99)	(-0.15)	(-2.64)	(-2.06)	(-2.53)
Surprise*Book Leverage			3.28**	3.83*	2.59	4.24**	3.15	2.44	4.49*
			(1.96)	(1.85)	(1.32)	(1.98)	(1.28)	(0.40)	(1.71)
Surprise*Profitability			-16.10***	-11.49**	-11.08**	-8.16	-15.36**	-15.68***	-16.54
			(-6.10)	(-2.19)	(-2.13)	(-1.33)	(-2.08)	(-4.06)	(-1.45)
Surprise*M/B			-0.02	-0.41	-0.41	-0.71	0.01	0.10	0.43
			(-0.08)	(-0.77)	(-0.78)	(-1.31)	(0.01)	(0.25)	(0.42)
Surprise*Int Rate Sensitivity						-7.05**			
						(-2.24)			
Surprise*Cash-Flow Volatility						-77.57			
						(-0.55)			
Surprise*Beta						1.47**			
						(2.16)			
Surprise*Cash Holdings						3.37			
						(0.96)			
Surprise*HP						4.22***			
						(3.42)			
Firm FE	NO	NO	NO	NO	NO	NO	YES	YES	YES
FF48 Industry FE	NO	NO	NO	YES	YES	YES	NO	NO	NO
Year FE	NO	NO	YES	YES	YES	YES	YES	YES	YES
Surprise*FF48 Industry FE	NO	NO	NO	YES	YES	YES	NO	NO	NO
Cluster (Fed event*IndustryFF48)	NO	NO	NO	YES	YES	YES	YES	NO	YES
Observations	64,682	64,557	64,428	62,871	62,746	55,506	64,428	63,626	41,710

Table A5

Short-Term Debt and the Response of Equity Prices to Federal Funds Rate Changes

This table examines how the reaction of firm equity prices to surprise changes in the target federal funds rate varies with their usage of short-term debt. Short-Term Debt/At is defined as debt in current liabilities (item 34) over book value of assets. Columns 2 and 4 include (unreported) log(assets), profitability, book leverage, the market-to-book ratio, and their interaction with policy surprise. All firm characteristics are lagged by one year, demeaned, and winsorized at 1%. Parentheses contain t-statistics. The asterisks denote *** for p<0.01, ** for p<0.05, * for p<0.1.

	(1)	(2)	(3)	(4)
Surprise	-5.04***	-8.11***	-4.97***	-8.02***
	(-13.32)	(-18.07)	(-13.03)	(-17.73)
Surprise*(ShortTermDebt/At)	-10.30	-8.30	-4.36	-5.26
	(-1.38)	(-1.06)	(-0.56)	(-0.66)
Surprise*(BankDebt/At)			-13.64***	-15.99***
			(-4.09)	(-4.05)
Firm Controls	NO	YES	NO	YES
Surprise*Firm Controls	NO	YES	NO	YES
Year FE	NO	YES	NO	YES
Observations	65,893	65,649	64,658	64,428

Table A6

Is Bank Debt Special for the Transmission of Monetary Policy? Normalizing Bank Debt with Total Debt

This table examines how the reaction of firm equity prices to changes in the federal funds rate varies with their level of bank dependence. The sample consists of U.S. firms covered by Capital IQ, CRSP and Compustat from 2003 to 2008, excluding utilities (SIC 4900-4949) and financials (SIC 6000-6999). We focus on firms with December fiscal year end to avoid asynchronous balance sheet items and use 2-day returns in order to allow the effect of bank-debt to be fully incorporated in stock prices. We remove firm-year observations with negative revenues, missing information on total assets, or a value of total assets under 10 million. We also discard penny stocks, defined as those with a price of less than $5. The sample comprises 43 monetary policy events from 2003 to 2008. Firm characteristics are demeaned and are lagged by one year and winsorized at the 1% level. The regression specification is as in equation (1). Unreported terms include a constant and non-interacted coefficients. In specification (5) we add undrawn credit lines to bank debt and normalize the resulting ratio to have the same standard deviation as the original BankDebt/At. Standard errors are clustered at the date level in specifications (1)-(2) and two-way clustered at the date and industry levels in specifications (4)-(7). Industries are Fama-French 48 industries. Parentheses contain t-statistics. The asterisks denote *** for p<0.01, ** for p<0.05, * for p<0.1.

	(1) No Controls	(2) With Controls	(3) Event-indust. Clustering	(4) Including Credit Lines	(5) Other Controls	(6) Firm Fixed Effects	(7) Instrumental Variable	(8) Floating Rate Debt
Surprise	-5.60***	-8.20***	[-8.27]	[-8.58]	[-10.51]	-8.19***	-8.22***	-8.57***
	(-13.65)	(-16.33)	(-0.92)	(-0.96)	(-1.17)	(-3.51)	(-14.32)	(-3.51)
Surprise*(BankDebt/Debt)	-2.18**	-3.04***	-3.06***	-1.61	-3.14***	-2.85**	-3.20	-1.53
	(-2.12)	(-2.73)	(-2.87)	(-1.58)	(-2.75)	(-2.18)	(-0.35)	(-0.95)
Surprise*LnAssets		-0.77***	-1.05***	-0.79***	-0.15	-0.73*	-0.79	-0.85**
		(-2.76)	(-3.74)	(-2.83)	(-0.32)	(-1.90)	(-0.86)	(-2.16)
Surprise*Book Leverage		0.38	0.52	-0.05	0.80	0.30	0.52	1.32
		(0.25)	(0.28)	(-0.02)	(0.40)	(0.13)	(0.32)	(0.50)
Surprise*Profitability		-21.36***	-14.62**	-15.21**	-12.29	-21.73**	-22.41***	-17.99
		(-6.93)	(-2.26)	(-2.35)	(-1.53)	(-2.40)	(-4.53)	(-1.58)
Surprise*M/B		0.40	-0.16	-0.02	-0.23	0.45	0.40	0.55
		(1.20)	(-0.25)	(-0.04)	(-0.33)	(0.57)	(0.75)	(0.55)
Surprise*Int Rate Sensitivity					-7.42**			
					(-2.44)			
Surprise*Cash-Flow Volatility					-91.93			
					(-0.62)			
Surprise*Beta					1.83**			
					(2.44)			
Surprise*Cash Holdings					1.19			
					(0.32)			
Surprise*HP					3.94***			
					(3.13)			
Firm FE	NO	NO	NO	NO	NO	YES	YES	YES
FF48 Industry FE	NO	NO	YES	YES	YES	NO	NO	NO
Year FE	NO	YES	YES	YES	YES	YES	YES	YES
Interacted FF48 Industry FE	NO	NO	YES	YES	YES	NO	NO	NO
Cluster (Fed event*IndustryFF48)	NO	NO	YES	YES	YES	YES	NO	YES
Observations	53,054	53,028	51,963	51,963	45,972	53,028	52,398	41,665

Table A7

Bank Debt Specialness and Firm Financing Constraints

This table examines how the effect of monetary policy on firm stock prices varies with their exposure to bank debt and their level of financial constraints. Financial constraints are proxied with the firm's age and the Hadlock and Pierce (2010) measure given by HP = -0.548*Size+0.025*Size^2-0.031*Age. Firm size is defined to be the log of assets (inflation adjusted to 2004). Age is defined as the current year minus the first year that the firm has a non-missing stock price in CRSP. Firm size and age are at the 1% tails on the low end, and at the $4.5 billion and thirty-seven year points on the high end. The financial constraint measure takes value 1 if the firm's age is below the median or firm's HP statistic is above the median in a given year. Only firms with floating rate debt constituting more than 1% of total assets are included. A constant, non-interacted terms, and the policy surprise interacted with firm size book leverage, profitability and the market-to-book ratio are included but not reported. All firm characteristics are lagged by one year and winsorized at the 1% level. Industries are defined according to the Fama French 48 sector grouping. Parentheses contain t-statistics. The asterisks denote *** for p<0.01, ** for p<0.05, * for p<0.1.

	(1)	(2)	(3)	(4)
VARIABLES	AGE	HP	AGE	HP
Surprise	-4.92***	-2.31	-5.47***	-2.80
	(-3.25)	(-1.18)	(-3.69)	(-1.47)
Surprise*Financial Constraint Measure	0.67	-3.85	0.56	-4.28*
	(0.36)	(-1.57)	(0.31)	(-1.79)
Surprise*Hedging	-1.95		-0.83	-1.29
	(-0.95)		(-0.42)	(-0.63)
Surprise*(BankDebt/At)	-28.00**	-29.20**		
	(-2.50)	(-2.46)		
Surprise*(BankDebt/At)*Financial Constraint Measure	-16.79	-12.50		
	(-1.43)	(-1.04)		
Surprise*(BankDebt/At)*Hedging	41.25***	40.41***		
	(3.36)	(3.27)		
Surprise*(FloatingRateDebt /At)			-19.31*	-25.18**
			(-1.73)	(-2.21)
Surprise*(FloatingRateDebt /At)*Financial Constraint Measure			-17.02	-5.33
			(-1.48)	(-0.45)
Surprise*(FloatingRateDebt /At)*Hedging			24.55**	26.06**
			(2.04)	(2.16)
Firm FE	YES	YES	YES	YES
Firm Controls	YES	YES	YES	YES
Surprise*Firm Controls	YES	YES	YES	YES
Observations	24,123	24,123	24,123	24,123
R-squared	0.01	0.01	0.01	0.01
Number of gvkey	1,283	1,283	1,283	1,283

Table A8

The Effect of Monetary Policy on Fixed Investment – Analysis using Monetary Policy Surprises

This table examines how monetary policy affects firm fixed investment and how this effect varies with bank debt usage and interest rate risk hedging. Inventories are calculated as Total Inventories (INVTQ), and *Fixed Investment* $_{t-1,t+x}$ is computed as the difference between the log of property, plant and equipment (PPEGTQ) *x* quarters ahead and the log of PPEGTQ at the end of the quarter before the monetary policy surprise occurs. *Surprise* is the sum of all surprises in the federal funds rate that occur during a quarter. *Hedgers* are defined as those firms that report having hedged their interest rate risk from floating to fixed in their 10K annual reports. Only firms with floating rate debt constituting more than 1% of total assets are included. *Bank Debt/At* is defined as bank debt (term loans plus drawn revolving credit) over book value of assets (At). All regressions also include an unreported constant term. Controls include the lagged investment to capital ratio, the lagged cash holdings to capital ratio, and the market to book ratio, and also (unreported): ln(assets), book leverage, market-to-book, profitability and interest rate sensitivity of operating income. All firm controls are lagged by one quarter and winsorized at 1%. Parentheses contain t-statistics. The asterisks denote *** for p<0.01, ** for p<0.05, * for p<0.1.

Dependent variable: $\ln(PPE_{t+x}) - \ln(PPE_{t-1})$	x=4 quarters ahead				x=6 quarters ahead			
	Non-hedgers		Hedgers		Non-hedgers		Hedgers	
	Constrained (high HP)	Unconstrained (low HP)	Constrained (high HP)	Unconstrained (low HP)	Constrained (high HP)	Unconstrained (low HP)	Constrained (high HP)	Unconstrained (low HP)
(Sum) Surprise (*ommited*)								
BankDebt/At	-1,764.02	-828.41	989.51	-93.86	-618.15	-312.49	841.93	-258.83
	(-1.07)	(-0.84)	(1.21)	(-0.23)	(-0.30)	(-0.31)	(0.97)	(-0.59)
(Sum) Surprise	15.27	42.02***	2.28	-3.08	-18.73	48.24***	1.99	-1.03
*BankDebt/At	(0.64)	(2.75)	(0.51)	(-0.54)	(-1.05)	(3.27)	(0.39)	(-0.17)
(Sum) Surprise BankDebt/At*Constrained*	-26.74		5.36		-66.97**		3.01	
	(-1.65)		(0.74)		(-4.19)		(0.40)	
Market-to-Book	283.36**	467.50***	-106.77	769.00***	337.19**	475.44***	-40.56	863.15***
	(2.20)	(5.13)	(-0.67)	(7.15)	(1.98)	(5.18)	(-0.21)	(7.30)
CashFlow/Capital	5,746.04**	3,162.56	6,435.81**	2,858.27**	11,257.96***	5,782.55***	3,500.91	5,374.71***
	(2.11)	(1.16)	(2.23)	(2.31)	(2.94)	(2.87)	(1.36)	(3.24)
	16,215.94***	13,209.57***	9,745.25***	12,662.08***	17,325.72***	13,773.10***	9,317.81***	12,314.08***
Lagged Investment/Capital	(5.44)	(8.18)	(4.67)	(9.06)	(5.08)	(8.26)	(4.59)	(6.73)
Firm Controls	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Surprise*Firm Controls	YES	YES	YES	YES	YES	YES	YES	YES
Year-quarter dummies	YES	YES	YES	YES	YES	YES	YES	YES
Industry-Quarter Clustering	YES	YES	YES	YES	YES	YES	YES	YES
Observations	3,813	3,770	2,037	5,207	3,664	3,671	1,940	5,078