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ABSTRACT

Can the Fed talk the hind legs off the stock market?*

Deliberately or not, by providing its stance on the prospects of the economy, rationalizing past decisions or announcing future actions, central banks influence financial markets' expectations of its future policy. In bad times, monetary policy communication inducing an upward revision of the path of future policy is good news for stocks. During an expansion the effect is weak and on average negative. The response of equities to central bank talk depends critically on the business cycle. There are strong industry specific effects of monetary policy actions and communication. These industry effects relate to the variation in cyclicality of different industries. Firm-specific effects of monetary policy relate to the leverage, the size and the price-earnings ratio of firms.

JEL Classification: E44, E52 and G14
Keywords: business cycle, credit channel, monetary policy, monetary policy announcements and stock market

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Does central bank communication matter? Can it exert any influence on financial markets, in particular on the stock market? If so, what is the effect of central bank communication and where is the effect the largest? Answering these questions is the focus of this paper. We show that there is a role for central bank communication. In contrast to earlier studies we find that central bank communication has an impact on stocks. The impact is expected to be the most pronounced for financially constrained companies in cyclical industries during a recession.

This is an empirical study on the relationship between monetary policy and the market for equities. Compared with earlier research on this topic we add central bank communication to the analysis. There is a vast literature on central bank communication to which both practitioners and academics have contributed. This body of research talks about the potential benefits (drawbacks) of central bank communication, the practical implementation and the potence of central bank communication near the zero lower bound.[1]

A few studies have considered the effect of central bank communication on the stock market. Gürkaynak, Sack, and Swanson (2005) introduced a methodology to consider the effects of central bank communication. Their paper focused on interest rates and the stock market index. They found that central bank communication did not matter that much for the aggregate stock market whereas it may exert a large influence on interest rates. Wongswan (2009) and Hausman and Wongswan (2011) investigated the link between U.S. monetary policy and foreign assets. In line with Gürkaynak, Sack, and Swanson (2005) their results indicate that central bank communication does not matter that much for equities while it does matter for interest rates and exchange rates. In contrast, surprise changes in the federal funds rate (central bank actions) matter a lot for foreign equities.

This study contributes to the literature in different ways. First of all we aim at providing a detailed and systematic analysis of the response of the stock market to central bank communication. To that end we consider the response of individual stocks to monetary policy instead of the response of the aggregate index as in the above cited studies. This approach allows us to consider firm and industry effects. This is of interest because the literature on the credit channel of monetary policy transmission predicts asymmetric responses of firms to a tightening of monetary policy. A firm with severe credit constraints will find it harder to access credit when interest rates go up. This may constrain the supply of their goods (their production) hence their expected future earnings forecasts are affected more and the stock prices drop. However also the demand for a firms' goods

[1]All the deserving literature cannot be cited in the available space. Two reviews on central bank communication are Blinder, Ehrmann, Fratzscher, Haan, and Jansen (2008) and Blinder (2009). A policy maker's view on central bank communication was presented in a speech by Benjamin Bernanke, current chairman of the Federal Reserve, see Bernanke (2007). An extensive empirical study on monetary policy near the zero lower bound is Bernanke and Reinhart (2004). Influential theoretical work with an emphasis on central bank communication and shaping market expectations in normal times and near the zero lower bound can be found in Eggertsson and Woodford (2003, 2004)

may be affected. The interest-rate channel suggests that firms facing a highly cyclical or interest-sensitive demand should be more responsive to monetary policy, see Ehrmann and Fratzscher (2004). Therefor we also expect variation in responses to monetary policy across industry affiliations. In so far that financial markets are forward-looking, we expect the industry effects of central bank talk to be similar to the industry effects of central bank actions. If financial markets participants are convinced by a monetary policy announcement and they revise their expectations accordingly, then the same channels should be active. We find that this is the case. In comparison with Ehrmann and Fratzscher (2004) we empirically confirm that it are indeed the *cyclical* industries which are the most responsive.[2]

Second, we show that innovations in monetary policy conduct matters. Central bank communication has evolved considerably the past two decades and we show that the response of the stock market has changed accordingly. To our knowledge no previous study has taken this into account when analyzing the response of asset prices to monetary policy. Failing to do so may severely underestimate the potential of current central bank communication policies.

Third, we account for the state of the economy. That is, we allow for different effects of central bank communication depending on the business cycle. The finance literature shows that there may be considerable state dependence of the response to *news* in the stock market. Boyd, Hu, and Jagannathan (2005) show that on average an announcement of rising unemployment is good news during expansions and bad news during economic contractions. We find that Federal Reserve communication implying an upward revision of the path of future policy is perceived as good news during recessions whereas the effect is negative (and much weaker) in an expansion. When the business cycle is not taken into account, the effect of central bank communication is averaged away. This explains previous findings that stocks respond very little to central bank communication. In contrast, we find a very pronounced effect during contractions.

There are two empirical approaches to investigating the link between monetary policy and the stock market. Some studies investigate responses of stocks to shocks derived from an identified vector autoregression. Examples of this approach are Thorbecke (1997) and recently D'Amico and Farka (2011) which improved on earlier work by proposing a new identification strategy with the use of high-frequency data. The other approach, known as the event study approach is more popular and our paper fits into this strand of the literature.

[2]In the case of monetary policy actions, Ehrmann and Fratzscher (2004) Bernanke and Kuttner (2005), Basistha and Kurov (2008), Kurov (2010) and Laeven and Tong (2010) consider industry effects. Most of these studies only use a very crude break up of industries. Firm effects are considered by Ehrmann and Fratzscher (2004), Thorbecke (1997) and Perez-Quiros and Timmermann (2000). All three studies point to a link between the size of a firm (as a proxy for credit constraints) and monetary policy -something we explore in some detail as well.

1 The event study approach

The event study approach to investigating the response of financial markets to monetary policy dates back to a study by Cook and Hahn (1989). In their study, the authors regressed raw changes in the Federal funds rate on changes in market interest rates for 75 days on which the Federal Reserve changed the federal funds rate. But markets are forward looking. If a change in the federal funds rate is entirely anticipated, we expect this change to be incorporated in the price. If the policy action is correctly priced in advance, the action itself (when it takes place) should have no effect on asset prices.[3]

Therefore we need a way to extract the unexpected part of the change. A way to do this, was put forward by Kuttner (2001) who showed how to extract monetary policy surprises from federal funds futures data. With these surprise measures or unexpected monetary policy interventions, many studies subsequently estimated regressions of the following form:

$$\Delta y_t = \alpha + \beta \text{Surprise}_t + \epsilon_t, \tag{1}$$

where Δy_t is the change in a stock index, in individual stocks, in portfolios or in market interest rates measured over an interval that brackets the monetary policy announcement. Gürkaynak, Sack, and Swanson (2005) then extended this one factor approach by formally testing whether the variation in short term interest rates on FOMC dates is characterized by one or more factors. Their results provided strong evidence for a two factor view. The first factor is labeled target surprise; while the second is called path surprise. The authors subsequently provided evidence that the latter is associated with FOMC communication. We are going to pursue the two factor approach in this paper. We start by briefly considering how these surprises are constructed.

1.1 Market-based surprise measures of monetary policy

The most popular surprise measures are based on federal funds future contracts. Surprise measures can be constructed from other contracts such as the one-month eurodollar deposit rate, as in Cochrane and Piazzesi (2002), or eurodollar futures as in Rigobon and Sack (2004). Gürkaynak, Sack, and Swanson (2007) considered a broad set of financial market instruments to measure near-term expectations of the federal funds rate. They found that federal funds futures deliver the best forecasts of monetary policy at horizons out to six months suggesting that these contracts are a good choice for constructing monetary policy surprises. Based on their research and following the larger part of the

[3]This intuitive prediction is confirmed in Bernanke and Kuttner (2005), p.1226.

literature, we construct monetary policy surprises with federal funds futures.

Federal funds futures have a value at expiration of hundred minus the average federal funds rate over the expiry month. Consider the value of such a contract on the day before a FOMC meeting taking place at time t. Denote the with r_{-1} the federal funds rate before the meeting and with r_0 the federal funds rate prevailing after the meeting. The no arbitrage condition demands that the implied spot rate ff^0 on such a future contract before the meeting would be the following:

$$\text{ff}^0_{t-\Delta t} = \frac{d_0}{D_0} r_{-1} + \frac{D_0 - d_0}{D_0} \mathbb{E}_{t-\Delta t}(r_0) + \mu^0_{t-\Delta t}. \tag{2}$$

Here D_0 indicates how many days the month we consider contains, d_0 how many days have elapsed when the FOMC meeting takes place. This equation states that the implied spot rate on the contract $\text{ff}^0_{t-\Delta t}$ (just before the meeting) equals a weighted average of the prevailing interest rate r_{-1} and the interest rate which is expected to prevail after the FOMC meeting $\mathbb{E}_{t-\Delta t}(r_0)$ plus a risk premium $\mu^0_{t-\Delta t}$. After the policy decision is known the implied rate is the following:

$$\text{ff}^0_t = \frac{d_0}{D_0} r_{-1} + \frac{D_0 - d_0}{D_0} r_0 + \mu^0_t, \tag{3}$$

that is, the weighted average of both interest rates. Using the two equations above we can construct the unanticipated component of the monetary policy action:

$$\begin{aligned}
\text{Surprise}_t &\equiv r_0 - \mathbb{E}_{t-\Delta t}(r_0) && (4)\\
&= \left[\text{ff}^0_t - \frac{d_0}{D_0} r_{-1} - \mu^0_t\right] \frac{D_0}{D_0 - d_0} - \left[\text{ff}^0_{t-\Delta t} - \frac{d_0}{D_0} r_{-1} - \mu^0_{t-\Delta t}\right] \frac{D_0}{D_0 - d_0} && (5)\\
&= \left[(\text{ff}^0_t - \text{ff}^0_{t-\Delta t}) + (\frac{d_0}{D_0} r_{-1} - \frac{d_0}{D_0} r_{-1}) - (\mu^0_t - \mu^0_{t-\Delta t})\right] \frac{D_0}{D_0 - d_0} && (6)\\
&= \left[\text{ff}^0_t - \text{ff}^0_{t-\Delta t}\right] \frac{D_0}{D_0 - d_0}. && (7)
\end{aligned}$$

We go from equation (4) to the next equation by using equalities (2) and (3). In the following line we rearrange the terms. We arrive at the final line by assuming that high frequency changes in the risk premium are negligible or $\mu^0_t - \mu^0_{t-\Delta t} \cong 0$. Evidence for this assumption was provided by Piazzesi and Swanson (2008). The scaling factor in (7) adds a complication. At the end of the month this factor blows up the change in the term premium causing measurement error concerns. To alleviate this concern we use the contract that expires in the next month when the scaling factor is larger than four.
Gürkaynak, Sack, and Swanson (2005) investigated whether the effects of monetary policy on asset prices can be characterized by a single factor: the surprise change in the federal

funds target rate. The authors found that the use of one factor as in regression (1) is inadequate and two factors are required. They labeled these factors current federal funds rate target factor and future path of policy factor. The current federal funds rate target factor is the monetary policy surprise above and reflects the surprise associated with a change in the federal funds rate target (or lack thereof). The future path of policy factor is closely associated with Federal Open Market Committee statements and reflects the influence the FOMC committee exerts on market expectations through its communication strategy. In the remainder of this study we refer to these factors as target (factor) and path (factor).[4]

We define the path factor as the change in the four-quarters-ahead eurodollar interest rate futures orthogonal to the target surprise. So the path surprise equals the residual term in the following regression:

$$\Delta\text{Eurodollar future}_t = \alpha + \beta\text{Target Surprise}_t + \epsilon_t. \tag{8}$$

The four-quarters ahead eurodollar futures capture the markets expectations of the policy path for the coming year. The regression above allows for a simple decomposition in a target factor (the target surprises constructed as in (4)) and a residual path factor. This residual path factor corresponds to all news that moves futures rates for the upcoming year on FOMC meeting days without changing the current federal funds rate. This factor should be interpreted as the news that market participants have learned from the FOMC's statement about the expected future path of monetary policy besides what they have learned about the level of the target rate. [5]

Before turning to the regressions we briefly consider some institutional details. Central bank communication has come a long way. Two decades ago the Federal Reserve did not communicate to financial markets and the general public in any way. Since then the Fed has gradually opened up. The latest advance in its communication policy was the organization of press conference after the FOMC meeting (at the FOMC meeting of April 27 2011). These policy changes imply that central bank communication in 1994 and in 2011 are not the same animal. To assure ourselves that we can treat central bank talk in the same fashion over time, we review the institutional changes and present some evidence on the impact of the change we consider the most important for our purposes.

[4] Gürkaynak, Sack, and Swanson (2005) formally tested for the required number of factors using the matrix rank test of Cragg and Donald (1997). Subsequently they constructed the two factors from the first two principal components of a set of short term interest rates with a suitable scaling and rotation to allow for a structural interpretation.

[5] The construction of factors above differs from Gürkaynak, Sack, and Swanson (2005) but is more straighforward and easier to understand. This approach was put forward in Wongswan (2009) and Hausman and Wongswan (2011). Unreported regressions using the (more complex but essentially equivalent) construction of factors from Gürkaynak, Sack, and Swanson (2005) confirmed that both approaches yield very similar results.

2 Central bank talk, transparency and the FOMC

The FOMC has seen a remarkable evolution towards more transparency. In February 1994, the FOMC started to announce changes in the federal funds target rate explicitly. In the same year post-meeting press releases were introduced. These releases contained descriptions of the state of the economy and a rationale for the policy action. Since 2000, the press releases also contain a balance of risks. In 2002 individual votes of FOMC members and the preferred policy choices of dissenting members were added. In June 2003 the statement following the meeting contained forward-looking language for the first time. In December 2004 finally, the FOMC decided to release the minutes of the meeting with only a three week delay. This was the last relevant change in the communication strategy of the FOMC.[6]

Swanson (2006), Yellen (2006) and Kwan (2007) argue that these changes described above have enhanced the transparency and credibility of the Fed and ultimately also the effectiveness of monetary policy. Especially the inclusion of forward-looking language in FOMC communications mattered. Kwan (2007) stresses that these forward-looking statements have significantly improved market participants understanding of near term monetary policy. Such a change in policy regime may matter for our investigation. If these statements have improved Fed communication considerably, then it may enlarge the effect of central bank communication on asset markets. Therefore we begin our empirical inquiry by providing evidence on the change induced by the introduction of forward-looking statements.

2.1 Empirical implications of forward looking statements

We start by showing the basic patterns in the markets' forecast of short-term rates. Following Swanson (2006), we plot in Figure 1 the end-of-month absolute value of the 1-month-ahead federal funds futures forecast error. That is, for each last trading day of the month, we plot the absolute value of the difference between the realized average federal funds rate and the federal funds futures forecast made on the last day of the previous month. To clarify this with an example, consider the hypothetical situation in which the effective federal funds rate in June was on average 2%. If the federal funds futures prediction on May 31 would be 1% (or 3%), the absolute forecast error would be 1%.[7]

[6] Our sample runs through December 2009. Therefore, our dataset does not cover the introduction of the press conference. At this moment we do not have enough observations to perform a meaningful analysis. In time it may be worthwhile to investigate the effect of the press conference on market expectations.

[7] Denote with T the last day of the previous month and with ff_T^1 the implied rate of a federal funds future contract expiring in the current month on the last day of the previous month. Denote with r_t the effective federal funds rate on day t of the current month. The error ϵ plotted in Figure 1 can then be written as: $\epsilon \equiv |\text{ff}_T^1 - \sum_{t=1}^{D_0} \text{ff}_t^0|$ where D_0 denotes the number of days in the current month.

[Figure 1 about here.]

Figure 1 suggests a downward trend in forecast errors from 1994 onwards. Our sample starts in 1994 because in that year the FOMC started making announcements. From the introduction of forward-looking statements onwards forecast errors remained fairly low (except for the financial crisis in 2008). The fitted trend line shows the downward trend in the first subsample and the low level in the second subsample. The rough pattern in Figure 1 is also reflected in the monetary policy surprises. In Figure 2 we have plotted the monetary policy surprises (target surprises) for the whole sample. In the graph, the shaded areas mark recessions according to the NBER recession indicators, the vertical line is drawn to distinguish the two subsamples we discussed above. The graph has a clear message. Ignoring recessions, the introduction of forward-looking statements led to much less variability in target surprises. It seems that nowadays, except during recessions, market participants are barely surprised by monetary policy actions. Both graphs also reveal that some surprises are exceptionally large (for example during the last recession). These observations may be particularly influential and we need to deal with this in our empirical analysis.

[Figure 2 about here.]

Given the graphs above, we may wonder whether this has implications for our further analysis. The evidence suggests that after June 2003, there is indeed a new regime. The forward-looking statements had the purpose of *guiding* market participants. The graphs above suggest that this policy innovation was successful -at least during an expansion. Target surprises became smaller and therefor less informative because the policy path was better communicated to the market. In this sense, the FOMC just communicated better. It is reasonable to expect that the influence of the path factor on asset prices therefore may have changed. To investigate whether or not the effects of target and path surprises are stable across both regimes (before and after the introduction of forward-looking statements), we split our sample and compare the estimated coefficients in both subsamples.

3 Baseline event study analysis

In this section we undertake our baseline analysis. Our sample consists of companies in the S&P 500 for the period 1994 - 2009. The event days are the FOMC meetings. For each meeting we use the companies which were in the S&P 500 at that time. For details regarding the data used in this paper we refer to the data appendix.

We start by estimating the following linear model for the three samples identified in the previous section:[8]

$$\text{Return}_{it} = \alpha + \beta_1 \text{Target}_t + \beta_2 \text{Path}_t + \epsilon_{it} \tag{9}$$

$$\text{Return}_{it} = \alpha + \beta_1 \text{Target}_t + \beta_2 \text{Path}_t + \beta_3 \text{Target}_t * \text{Rec}_t + \beta_4 \text{Path}_t * \text{Rec}_t + \epsilon_{it} \tag{10}$$

In regression (10) we interact both factors with a dummy variable (Rec) to account for the business cycle. In the context of monetary policy *actions*, several studies have found that stocks react more pronounced during recessions, see for example Basistha and Kurov (2008) or Kurov (2010). We estimate these linear models twice. First we estimate these models over the whole sample. Next, motivated by the graphs in section two, we estimate these models leaving out outliers. The graphs in section two showed that outliers tend to occur during recessions. By removing outliers from the sample we are able to estimate the effect of the business cycle without these influential dates. Outlier dates are likely to occur during recessions when financial markets are in flux. By removing outlier dates we aim to show that our results are not driven by one or a few exceptional trading days but characterize the effects of monetary policy during a downturn. We identify outliers by estimating regression (10) with returns on the S&P 500 index as a dependent variable. Then we use the DFITS statistic of Welsh and Kuh (1977) to find influential dates. Using the cutoff value proposed by Belsley, Kuh, and Welsh (1980) we determine the date to be marked as outliers. A brief overview of the dates marked as outliers as well as alternative procedures to determine outliers can be found in the online appendix to this paper. In this appendix we also discuss the robustness of our results with respect to the outlier choice.

The results of these regressions can be found in Tables 1 and 2.

[Table 1 about here.]

[Table 2 about here.]

Inspection of the estimation results reveals four remarkable results. First, state dependence matters but more so in the late subsample. The coefficients on the interaction terms are in all specifications significant and often improve the fit a lot. Second, outliers play a role. Excluding these changes the sign on the interaction of the recession dummy with the target factor from positive to negative in columns 2 and 6. Negative coefficients on this interaction term are what we would expect and in line with previous research, see Basistha and Kurov (2008) for example. Our results show that the positive sign is driven by a few exceptional results in the financial crisis of 2007-2009. Third, the estimated

[8] In this literature, some authors prefer to use the difference like in regression (1). This is typically the case in studies where only a stock market index and some interest rates are investigated. We prefer to use returns as it facilitates interpretation later on when we want to compare returns of different equities.

coefficients change between the early and the late regime. The coefficients become larger, so changes in the factors yield larger effects in the late regime. Moreover additional (unreported) regressions revealed that the target factor is the important explanatory factor in the early sample, whereas the path factor is more important as explanatory variable in the late sample. Fourth, in the specifications with interaction terms, the coefficients on the target and the path factor are always negative. The coefficient on the path-recession interaction is always positive. The coefficients imply that communication of a (future) tightening during a recession has a positive effect for the average stock return.[9]

We are hesitant to take a strong stance on basing the analysis on the sample with or without outliers. Both choices have their merits. Excluding outliers shows that the results do not depend crucially on a few trading dates. On the other hand, the outlier dates are likely to reflect important policy dates. Excluding them may give an imperfect picture of exceptional times. In the remainder of this study we present results excluding outliers. The key lesson from Tables 1 and 2 is that communication matters in a recession and that the sign on the estimated parameter is positive.

The regression results presented above, hide a large heterogeneity in responses across the stocks. To get an idea of the heterogeneity we estimate regression (9) for each stock separately over both subsamples. In Figure 3 we show the distribution of the target and the path factor. The target factor is slightly negatively skewed in the early period and slightly positive in the late period. The path factor is in both periods positively skewed with an estimated skewness of two and four respectively . In the following sections we investigate responses of stock returns in more detail by considering firm specific and industry specific effects.

[Figure 3 about here.]

4 Industry effects

We concluded the previous section by showing the large heterogeneity in individual stock responses. In this section we relate the responses of stocks to industry affiliation. Industry-specific effects may arise through the interest channel. Industries with a more interest sensitive demand are expected to be more sensitive. This cross-sectional dimension of monetary policy has been studied by a few papers. Peersman and Smets (2005) study the effects of monetary policy on sectoral production indices across OECD and euro area countries. Hayo and Uhlenbrock (1999) study industry effects within Germany. Bernanke and Kuttner (2005) and Ehrmann and Fratzscher (2004) explore the cross-sectional effects of monetary policy to stock returns in the US. Our analysis differs from

[9]Or at least communication which is interpreted by market participants as such, leading to an upward revision of the expected path of future policy.

these studies in two ways. First, we allow for state dependence. Monetary policy may have different effects depending on the business cycle. Second we adhere the two factor view introduced earlier and we distinguish between a current federal funds rate target factor and future path of policy factor.

To gauge the industry specific effects we pool stocks according to the SIC classification system. We re-estimate regression (10) for each industry division. An industry division is the most coarse way to break up the universe of stocks. The results of these separate regressions can be found in Table 3.[10]

[Table 3 about here.]

The upper panel presents the results for the early period and the lower panel presents the results for the late period. All statistically significant coefficients on target, target*rec are negative. The estimated coefficients on the path factor are always negative in expansions (except for mining in the late period) whereas these are positive during recessions (except for wholesale trade and mining in the early regime). In the late regime the estimated coefficients are in general larger in absolute terms. In particular the path surprises during a recession are very big in the late period. To get a more detailed view on the responses of the stocks, we have estimated model (10) for each major group -a finer classification of stocks based on the first 2 digits of the SIC code. Table 4 contains the results. We have estimated this model only for major groups which contain at least five different companies in our sample. This ensures that we have sufficient observations for each separate regression.

[Table 4 about here.]

A similar picture as in the previous table emerges. Since the industry effects may arise because of different reasons it may be hard to pin down the drivers. However it seems that highly cyclical industries are more responsive to monetary policy. If state dependence matters, than we would expect that industries which are more susceptible to the business cycle (cyclical industries) show more pronounced responses

In order to pin this down we need to determine which industries can be classified as cyclical. A way to classify industries from more cyclical to less cyclical was put forward in Boudoukh, Richardson, and Whitelaw (1994) and we follow that approach. In this approach, industries are ranked according to *industrial production growth beta's*. More specifically we constructed sectoral growth rates of industrial production and the growth rate of the aggregate industrial production. The industrial production growth beta is then the estimated coefficient of a regression of the sectoral growth rate on the aggregate growth rate. The results are reported in Table 5.

[10]Two industry divisions (SIC classification) are missing. We do not have enough observations in each subsample for agriculture and public administration to obtain reasonable estimates so we omit these.

[Table 5 about here.]

The table reveals a glaring variation in growth beta's across industries ranging from coefficients below 0.3 for food, beverages, tobacco and electric power generation to coefficients larger than 2 for primary metal and motor vehicles.

To see whether more cyclical industries are more responsive to monetary policy, we estimate our basic regression (10) three times. Once for all industries which are covered by the Federal Reserve Statistical Release data on industrial production (all industries covered in Table 5). Then we estimate this model for the five most cyclical industries in our sample and the five least cyclical industries. The five most cyclical industries have an estimated industrial production growth beta larger than 1.4 in our sample, whereas the five least cyclical industries have an industrial production growth beta below 0.5.

[Table 6 about here.]

The results shown in Table 6 confirm our priors. The evidence shows that industry patterns in the response of stock returns to monetary policy can partially be traced back to the cyclicality of the industry. Industries which are more affected by the business cycle indeed tend to be more responsive.

5 Firm-specific effects

There is a substantive literature on the credit channel of monetary policy transmission documenting asymmetric effects of monetary policy on firms. Ehrmann and Fratzscher (2004) investigated in considerable detail the firm level variation of monetary policy surprises -the target factor in the parlance of this paper. The authors considered proxies of financial constraints and found that firms which were likely to be more financially constraint seemed to be more responsive to monetary policy. In this section we do a similar exercise.

We start by adding control variables to our baseline specification. In particular we include the three Fama and French (1992) factors as firm characteristics directly in our regression, like in Laeven and Tong (2010). Details concerning the construction of these three firm specific control variables can be found in the data appendix.[11]

The regression model we then estimate is the following:

$$\begin{aligned}\text{Return}_{it} = \alpha + \beta_1 \text{Target}_t + \beta_2 \text{Path}_t + \beta_3 \text{Target}_t * \text{Rec}_t + \beta_4 \text{Path}_t * \text{Rec}_t \\ + \beta_5 \text{Size}_{it} + \beta_6 \text{MTB}_{it} + \beta_7 \text{Beta}_i * \text{Market Return}_t + \epsilon_{it}\end{aligned} \tag{11}$$

The results of this regression can be found in Table 7. It seems that in this type of event studies, the Fama and French (1992) factors do not matter. The estimated coefficients on the variables of interest remain nearly the same and the factors do not appear to be statistically significant. Therefor we present in the remainder of this section the results without these factors. In an online appendix we provide all the following regressions with these control variables.

[Table 7 about here.]

To investigate the cross-sectional variation across firms we categorize the stocks according to firm level variables. We drop firms active in the utilities industry, the wholesale industry, the financial industry and public administration. These firms are subject to strict regulation or they have strongly differing financing needs and keeping these in our sample would confound the results, see Laeven and Tong (2010). At each FOMC meeting we rank the stocks in our sample according to a characteristic and estimate regression (10) for stocks in the upper and the lower decile. We start by looking at leverage. We follow Vuolteenaho (2002) and construct leverage as the ratio of book equity over the sum of book equity and book debt (see the data appendix for details). Stocks from firms which are heavily leveraged are expected to be more responsive to the target and path factor as interest rate changes (now or in the future) are going to have a larger impact for these

[11] To avoid any confusion we remind the reader that the dependent variable is a (log) return as is custom in this literature and not an excess return as often found in the asset pricing literature. The asset pricing variables serve only as control variables and are of no further interest to us.

firms. Following Ehrmann and Fratzscher (2004), we also consider the price-earnings ratio and the size of the firms measured by the number of employees or by market value. While Ehrmann and Fratzscher (2004) also considered S&P 500 companies, they found that even in that case, relative size matters.[12]

[Table 8 about here.]

Table 8 shows the results of our basic regression (10). Firms which are more financially constrained such as highly leveraged firms or smaller firms seem more sensitive to monetary policy. The coefficients on the target factor and the path factor are more pronounced for these firms (columns 1, 4 and 6). During downturns the target factor becomes more negative for these firms. The coefficient on the path factor is generally negative in normal times but becomes positive and large during recessions. These results are in line with our intuition. Stocks from highly leveraged firms are indeed much more sensitive to monetary policy. Furthermore we show that size plays a role in the transmission of monetary policy. This finding is in line with some papers who have established this earlier. Perez-Quiros and Timmermann (2000) showed the role of size and interpreted size as a proxy for credit constraints. Other papers that use size as a proxy for credit constraints are Gertler and Gilchrist (1994) and Ehrmann and Fratzscher (2004).

Inspection of the last two columns show that firms with a low price-earnings ratio are more responsive to monetary policy than firms with a high price-earnings ratio. This result contradicts the findings of Ehrmann and Fratzscher (2004). The latter found in regressions of returns on the target factor a larger negative coefficient. Their interpretation was that the re-assessment of the earnings expectations of firms with highly priced stocks is more sensitive to changes in interest rates. Our results contradict these findings strongly.

In the analysis above we used a strong categorization by comparing returns belonging to the upper and lower decile of a ranking of stocks on one of the above variables. As a robustness check we compared other categorizations and the results appear to be robust. In the online appendix we compare the responses of returns in the bottom quintile and the top quintile. As can be expected the differences are less sharp yet the conclusions of above remain. Additionally we present the results with the asset pricing control variables. Again the results prove to be robust.

[12]There are a few notable differences between our sample and the sample by Ehrmann and Fratzscher (2004). First, we consider here only the late subsample (see previous sections). Second Ehrmann and Fratzscher (2004) use the composition of the S&P 500 on one moment in time and keep then the composition fixed. This results in only 71 stocks per FOMC meeting on average. We dynamically adjust our sample each FOMC meeting to reflect the S&P 500 composition at that time.

6 Concluding remarks

The results of our empirical investigation allow for some tentative conclusions. We find that in contrast to the previous literature monetary policy communication (central bank talk) may influence stocks. The difference between our conclusions and the existing literature arises because we consider individual stocks and allow the response to differ over the business cycle. In expansions, stocks do not seem to be that responsive to monetary policy talk and if there is a response, it is likely to be negative i.e. the opposite of the direction in which expectations of the policy path are revised. In recessions the response is positive and strong. An intuitive explanation for this positive response is the following. If the Federal Reserve communicates during a recession in such a way that market participants feel that interest rates may go up in the near future (revise their monetary policy path expectations upwards), market participants may feel that the Federal Reserve expects better economic times ahead. Market participants value forecasts of the Federal Reserve and attach importance to these forecasts. A study by Romer and Romer (2000, p.455) corroborates this and the authors found that: *"the Federal Reserve appears to possess information about the future state of the economy that is not known to market participants."* Assuming that the Federal Reserve is reluctant to tighten its policy rate in a recession unless the economic outlook is indeed significantly better, such a tightening could push financial markets participants to revise economic prospects upwards. Such an assumption does not seem to be a stretch given the dual mandate of the Federal Reserve.

Investigating the responses of stocks in more detail showed that there are industry and firm effects at play and that these are similar for both the response to monetary policy actions and to monetary policy communication. Highly cyclical industries appear to be the most responsive. On the firm level, we found that firms which seem to be the most financially constrained are the most responsive. As an example, our estimates imply that the average response of the stocks of the most leveraged firms in the S&P 500 is nearly twice as large as the average response of the stocks of the least leveraged.

We also found that the responses of stocks to monetary policy may vary over time. In particular innovations in monetary policy conduct, for example changes in how the FOMC communicates with financial markets such as the inclusion of forward-looking statements, may alter the response of assets to monetary policy. This should not come as a surprise, yet to our knowledge no study in this literature has paid attention to this. These changes in the way the FED communicates do not alter our earlier results on the way the stock market reacts to FED information about interest rates. However the size of the responses has changed. Many studies in the existing literature make precise statements on the size of the average stock market response the a monetary policy surprise. Our results show that these estimates are sample specific at best. Over

the whole sample, we find that a hypothetical unanticipated cut of 25 basis points in the federal funds rate is associated with about a 1% increase in the average return of S&P 500 stocks. This finding mimics the finding of Bernanke and Kuttner (2005, p.1221): *"We find that, on average, a hypothetical unanticipated 25-basis-point cut in the Federal funds rate target is associated with about a 1% increase in broad stock indexes."* However, if we split the sample when forward-looking statements were introduced -something we argued for in the second section of this paper- the picture changes. We find that after the introduction of these statements a hypothetical unanticipated cut of 25 basis points is associated with an average daily return of more than 3% for stocks in the S&P 500 index (during an expansion). To put the importance of monetary policy communication in perspective. Our results imply that a central bank communication during a recession, inducing an upward revision of the policy path of 25 points may have a huge impact on asset returns, with daily returns of 5% for the most cyclical stocks.

One may ask what these results imply for current monetary policy conduct. By construction both our factors where orthogonal to each other but this does not mean that these levers are entirely independent. Moreover, while monetary policy communication may not be constrained by the zero lower bound, it is constrained by the credibility of the policy maker. In the Summer of 2011 most economist agree that the US economy is not in a recession anymore yet the threat of a double dip lingers. The Federal Reserve has kept the federal funds rate at its historical low even though the US economy is officially out of a recession. We feel that although we used a NBER recession indicator in this study, the results hold more broadly when the economy is in a state of turmoil and financial markets look anxiously at Federal Reserve movements. If this intuition is correct then the impact of monetary policy communication is not restricted to official recessions only.

Years before the 2007-2009 crisis, Benjamin Bernanke, current chairman of the Federal Reserve, outlined three different alternative policies for monetary policy near the zero lower bound, see Bernanke and Reinhart (2004). Not surprising, of these three alternative policies, changing the composition and the size of the balance sheet of the Federal Reserve received the most attention. In this article, we show that a third alternative policy, shaping interest-rate expectations, may be a potent policy instrument too.

A Data appendix

In this appendix we provide details for all variables used in this paper. We present these variables in the order of appearance in the text. The sample consists of all FOMC meetings from the beginning of 1994 until the end of 2009, 144 in total. The meeting after the terrorist attacks of 9/11 is dropped. The dates of the FOMC meetings can be found at the website of the Federal Reserve: `www.federalreserve.gov/monetarypolicy/fomc.htm`.

A.1 Baseline event study analysis

- Surprises: As explained in the text.
- Recession indicators: These indicators are based on NBER recession turning points, see `www.nber.org`.
- Return: Stock return are calculated as $100 * \log(\text{price}_t) - \log(\text{price}_{t-1})$. Daily stock prices were retrieved from CRSP.

A.2 Industry Effects

- Industry classification: This classification is based on the SIC codes as found in COMPUSTAT.
- Industrial production growth rates: Quarterly data on industrial production was obtained from the Federal Reserve Board, data release G.17, see `www.federalreserve.gov/releases/g17/`

A.3 Firm effects

All COMPUSTAT data are retrieved from the CRSP/COMPUSTAT merged annual fundamentals file.

- Size: Size is constructed as the log of total assets. Total assets correspond to COMPUSTAT item AT.
- MTB: Market-to-Book is constructed as the ratio of market equity to book equity. Market equity is calculated as the stock price multiplied with the number of shares outstanding. Both items were retrieved from CRSP. The construction of book equity follows the construction in Vuolteenaho (2002). That is we use total common equity if available, COMPUSTAT item CEQ. If available, we add income taxes payable (item TXP) and deferred taxes and investment tax credit (item TXDITC). If total common equity is unavailable we use common equity - liquidation value (item

CEQL) again adding short- and/or long-term deferred taxes if these are available. Negative or zero book equity is treated as missing.

- Leverage: Leverage is calculated as the ratio of book equity to the sum of book equity and book debt. Book debt is constructed as debt in current liabilities - total (item DLC), long-term debt - total (item DLTT) and preferred stock at carrying value (item UPSTK). This construction mimics the construction in Vuolteenaho (2002). A high score on this index (near 1) means that a firm is very little leveraged. This needs to be kept in mind when ranking firms to their degree of leverage.

- Employees: This corresponds to COMPUSTAT item EMP.

- Market value: This corresponds to marked equity as constructed above.

- Price-earnings: This is constructed as the ratio of price per share to earnings per share. The stock price was retrieved from CRSP, earnings per share corresponds to COMPUSTAT item EPSPI.

B Additional Results (not for publication)

In this web appendix we present additional results and robustness checks in five subsections. First, we discuss the outlier dates which are excluded from the sample. Second, we discuss alternative approaches to detecting outlier dates. We show which outlier dates with such approaches would be chosen and to which extent the results in the main text would be altered. Third, we present some regression results from the baseline event study analysis with different approaches of constructing standard errors / regression specifications. Fourth, we present some robustness checks on the firm effects. Fifth, we conclude by presenting some (sobering) thoughts on this type of study and the validity of the results.

B.1 Discussion of the outlier dates

As explained in the text we have chosen the outlier dates as follows. First we estimate

$$\text{Return}_{\text{S\&P500},t} = \alpha + \beta_1 \text{Target}_t + \beta_2 \text{Path}_t + \beta_3 \text{Target}_t * \text{Rec}_t + \beta_4 \text{Path}_t * \text{Rec}_t + \epsilon_{\text{S\&P500},t}$$

Then we calculate the DFITS statistic for each observation, see Welsh and Kuh (1977). This statistic is defined as the change in the predicted value when one observation is left out the regression. This change is subsequently scaled by the estimated standard deviation at that point.

We drop observations above the cutoff value suggested by Belsley, Kuh, and Welsh (1980). Eliminating observations on the basis of statistics and subsequently using standard inference should be done cautiously. We do not necessarily want to drop observations with large residuals for example. Since the results with and without these outliers are in line with each other we are confident that we do not loose too much important information. In the next subsection we investigate alternative approaches to detect outliers and in the final subsection we offer additional thoughts.

The above procedure resulted in the following outlier dates: 1998: October 15; 2001: January 3 and April 18; 2008: January 22, 30, March 18, September 29, October 7, December 16; 2009: March 18. It should be noted that except the first two outlier dates, all outlier dates fall in a recession. Moreover, in the larger part of the paper we restrict ourselves to a subsample in which all outlier dates fall in a recession. Ignoring the outliers does not alter our results that much. The reader may confirm this by the sixth column of tables 1 and 2.

It may be of interest to the reader why these dates were outliers. The table below provides some details on the meeting which may shed some light on this. Further analysis of these specific meetings lies outside the scope of this study.

[Table 9 about here.]

B.2 Alternative choices of outlier dates

As explained in the previous section we have determined the outlier dates by estimating a regression over the entire sample and then using the DFITS statistic. Alternative approaches could use a regression with recession dummies, estimate a regression over subsamples or use an other diagnostic statistic. We determine in this subsection outliers along these lines. The following table provides an overview:

[Table 10 about here.]

The resulting dates show considerable overlap, which strengthens our belief that we have taken a reasonable approach to select outlier dates. Specifically if we test for outliers using the whole sample and we do not allow for state dependence then we get somewhat more outliers not in a recession. If we focus on the late subsample then only one new outlier is identified when we allow for state dependence. The use of Cook's distance (a similar outlier statistic) also leads to similar outlier dates. Our choice for determining outlier dates is based on the fact that we drop many dates relative to the approaches above. This is not necessarily a good thing, however the main results remain the same as in the case when we do not drop any dates (see above). This gives us some confidence that the results are fairly robust with respect to the choice of outlier dates.

B.3 Robust errors

Another concern may arise because of our choice of specification. We chose to present regression results in which we included firm fixed effects and heteroskedasticity robust standard errors. In the table below we present the results of estimating equation (10) in our paper, which we repeat here:

$$\text{Return}_{it} = \alpha + \beta_1 \text{Target}_t + \beta_2 \text{Path}_t + \beta_3 \text{Target}_t * \text{Rec}_t + \beta_4 \text{Path}_t * \text{Rec}_t + \epsilon_{it}.$$

We estimate this regression over the late subsample and with outliers dropped. This corresponds to column six of table 2 in the paper.

[Table 11 about here.]

The table shows that the main findings of our paper are fairly robust. The ease comparison we repeat the result from the paper in the first column (column six of table 2 in the paper). In the second column we cluster the standard errors at the level of the industry group. In the third column we cluster the standard errors at the date level. In the fourth column we do the same but now we drop the firm fixed effects. In the fifth column we present bootstrapped errors with firm fixed effects. In the last column we present two way clustered errors. In an influential paper, Petersen (2009) showed that clustering standard errors at two levels often alters the results in empirical finance research. We follow his advice and use his code to check this. The last column presents these results.

The bottom line of the table is the following. Whatever approach we take, the target factor and the path factor in a recession remain statistically significant. Therefore we feel that our results are fairly robust across these specifications.

B.4 Firm effects

Here we present robustness checks of the results on firm effects. The first table presents the results of the same regressions as in that section when we add Fama and French (1992) factors as control variables. The second table uses an 20^{th} percentile - 80^{th} percentile categorization instead of the lower and upper decile.

[Table 12 about here.]

[Table 13 about here.]

B.5 About monetary policy event studies

In this final subsection of the web appendix we would like to reflect briefly on this type of monetary policy event studies. As we tried to show throughout this web appendix, it

is possible to obtain some robust results with this approach. But the results should be interpreted with some caution. Earlier studies often made very exact statements e.g. "*a hypothetical unanticipated 25-basis-point cut in the Federal funds rate target is associated with a 1% increase in broad stock market indexes.*", see Bernanke and Kuttner (2005). Unfortunately we cannot make such precise statements and we hope that the reader is convinced after reading our paper. As institutional arrangements change, so may the results of this type of study change. Recently, on April 27 2011, current chairman Benjamin Bernanke chaired for the first time in the history of Federal Reserve a press conference after the FOMC meeting. It is likely that will not be the final change in the institutional arrangements surrounding FOMC meetings. Some of these changes have had a large impact, others had a more modest impact. In our view, the two most important changes happened in 1994 and 2003. We have accounted for both in this paper. Up until now the literature has ignored these institutional details. We feel that it is important if we want to have *somewhat reasonable confindence* in the point estimates.

Another issue is whether one should drop or keep influential dates. To accommodate mainstream criticism, we chose to present our results while explicitly accounting for outliers. However the larger part of the FOMC meetings are not supposed to be meaningful! The interesting FOMC meetings are the special FOMC meetings. The meetings when real decisions have to be made and the Federal Reserve needs to take a stance. Of the latter type we have had quite a lot in recent years. These meetings also took place near the lower zero bound. This is the case where theory suggests that monetary policy still may have some leeway through forward guidance. Fortunately our results remain fairly stable, whether or not we account for outliers.

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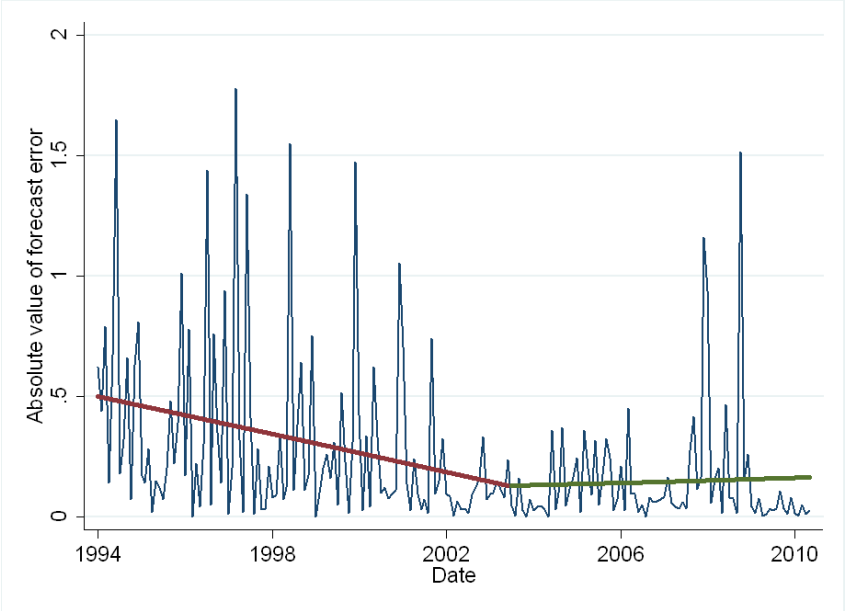

Figure 1: Federal funds futures market forecast errors. The forecast error is realized average federal funds rate for a given month minus the forecast implied by the one month ahead federal funds future of the previous month. The sample runs from begin 1994 until the end of 2009. The graph is based on the last trading day of each month. The sample is split in two when forward-looking statements were included. A fitted trend line for each subsample was added.

Figure 2: This graph shows a plot of the monetary policy surprises. The shaded areas depict periods marked as recession by the NBER turning points. The vertical line serves as a demarkation line to distinguish between both subsamples.

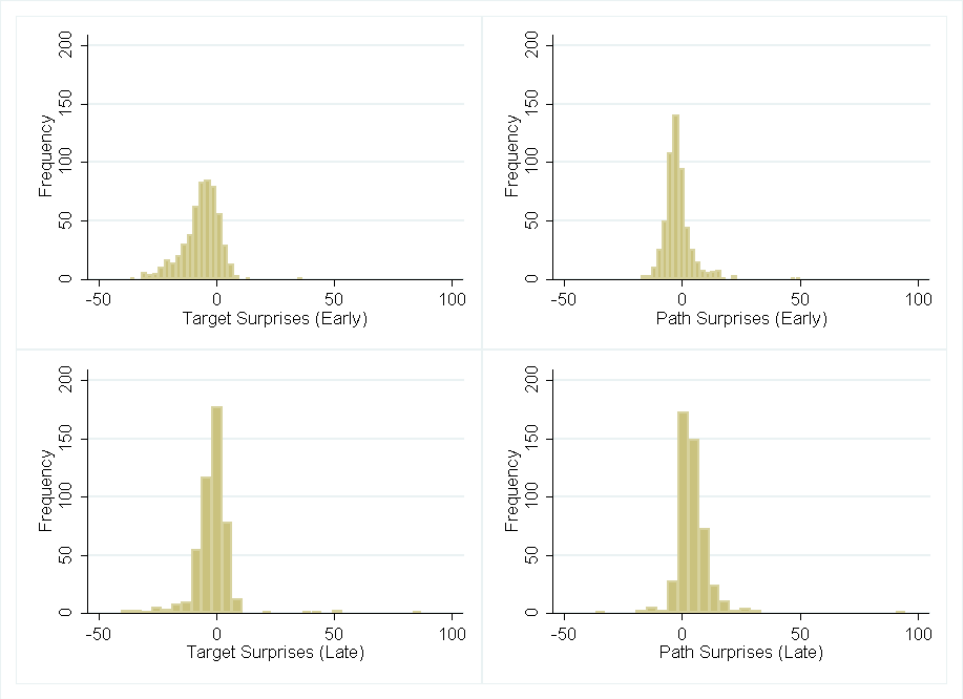

Figure 3: The histograms show the estimated parameters from estimating equation 9 for each stock separately. Stocks for which we have fewer than 30 observations are excluded. In the early period, the target factor has an estimated mean of -5.9, a estimated median of -5.0 and an estimated interquartile range of 8.5. In case of the path factor, we estimate these sample statistics to be -1.8, -2.6, 4.2 respectively. In the late period these sample statistics for the target factor are -1.4, -0.6, 6.1 and for the path factor 4.4, 3.4, 5.6.

Table 1: Baseline event study

	(1) Whole b/t	(2) Whole b/t	(3) Early b/t	(4) Early b/t	(5) Late b/t	(6) Late b/t
Target	-4.009***	-6.965***	-7.104***	-6.541***	-1.535***	-13.734***
	(-19.18)	(-23.51)	(-28.05)	(-21.57)	(-5.34)	(-24.12)
Target*Rec		3.902***		-2.977***		12.605***
		(9.63)		(-5.14)		(20.12)
Path	1.918***	-1.933***	-1.133***	-1.387***	4.647***	-2.845***
	(9.23)	(-12.90)	(-5.86)	(-7.19)	(13.23)	(-15.33)
Path*Rec		11.113***		8.166***		12.350***
		(21.98)		(10.61)		(23.04)
N	68862	68862	38632	38632	30230	30230
r2	0.03	0.06	0.06	0.07	0.04	0.08

Give here the appropriate notes
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This table presents the results from estimating regressions (9) and (10). The sample consists of daily stock returns on FOMC meetings from 1994 until 2009. We omitted the FOMC meeting on September 17 because of the exceptional character of this meeting in the wake of 9/11. The reported p-values are based on heteroskedasticity robust standard errors. Firm fixed effects were included in all regression specifications.

Table 2: Baseline event study (excluding outliers)

	(1) Whole b/t	(2) Whole b/t	(3) Early b/t	(4) Early b/t	(5) Late b/t	(6) Late b/t
Target	-4.109***	-3.858***	-3.416***	-2.942***	-14.133***	-13.281***
	(-19.40)	(-17.96)	(-15.68)	(-13.04)	(-20.11)	(-23.88)
Target*Rec		-13.980***		-11.617***		-6.549**
		(-15.59)		(-12.29)		(-3.21)
Path	0.587***	-2.087***	-1.122***	-1.450***	3.847***	-2.950***
	(4.38)	(-16.36)	(-6.95)	(-8.74)	(16.75)	(-16.10)
Path*Rec		17.625***		8.829***		20.517***
		(40.51)		(11.34)		(39.34)
N	64205	64205	37189	37189	27016	27016
r2	0.02	0.06	0.03	0.04	0.05	0.15

Give here the appropriate notes
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This table presents the results from estimating regressions (9) and (10). The sample consists of daily stock returns on FOMC meetings from 1994 until 2009. We omitted the FOMC meeting on September 17 because of the exceptional character of this meeting in the wake of 9/11. We also omitted ten dates marked as outliers as explained in the text. The reported p-values are based on heteroskedasticity robust standard errors. Firm fixed effects were included in all regression specifications.

Table 3: Industry effects

	Industry Division	Target	Target*Rec	Path	Path*Rec
Early Sample	Mining	-4.040***	-7.522*	-0.633	-13.06***
	Construction	-4.290*	5.573	-6.885***	3.664
	Manufacturing	-2.916***	-13.01***	-1.782***	12.14***
	Transportation	-2.044***	-7.844***	0.253	4.096*
	Wholesale trade	-0.777	-4.918	-0.0313	-7.205*
	Retail trade	-2.860***	-11.35***	-2.568***	3.706
	Financial Services	-2.504***	-14.67***	-1.939***	10.99***
	Services	-5.022***	-9.363**	-0.437	12.04***
Late Sample	Mining	-15.99***	-31.62***	2.617**	11.02***
	Construction	-5.828	-71.26*	-10.66***	68.28***
	Manufacturing	-11.42***	-4.331	-2.472***	15.91***
	Transportation	-12.37***	2.047	-1.804***	10.11***
	Wholesale trade	-15.72***	10.74	-1.108	9.890**
	Retail trade	-17.59***	-1.005	-4.028***	18.90***
	Financial Services	-17.72***	-10.75	-5.428***	40.24***
	Services	-8.560***	-3.906	-3.065***	16.24***

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In this table we present the results from estimating regression (10) for major groups separately. We present only the results for major groups containing at least five different companies in our sample. As earlier we have excluded outliers. The top panel presents the results for the early regime, the bottom panel the results for the late regime (see text). We omitted ten dates marked as outliers (similar to the regressions reported in table 2). The reported p-values are based on heteroskedasticity robust standard errors. Firm fixed effects were included in all regression specifications.

Table 4: Industry effects

Industry Division	Major Group	Target	Target*Rec	Path	Path*Rec
Mining	Oil and Gas Extraction	-15.21***	-22.13*	2.066*	10.47***
Construction	Building Construction	-3.178	-91.22*	-14.11***	82.77***
Manufacturing	Primary metal	-29.06***	-24.68	-1.397	30.60***
	Fabricated metal	-22.89***	-0.614	-3.179***	20.03***
	Rubber	-21.19**	5.463	-4.114	20.25***
	Petroleum	-18.17***	3.438	0.583	14.30***
	Paper	-14.33***	34.10	-2.511*	16.60***
	Printing and Publishing	-13.69*	1.973	-0.397	14.10***
	Apparel, finished products	-13.35*	-24.58	-0.850	20.04***
	Industrial/commercial machinery	-11.81***	-8.183	-4.077***	20.75***
	Chemicals	-11.78***	2.718	-0.610	8.275***
	Transportation equipment	-11.38***	-39.76***	-0.752	21.62***
	Electronic equipment	-7.513***	-4.518	-5.150***	20.60***
	Food and Kindred products	-7.424***	1.715	-1.483*	9.501***
	Tobacco Products	-6.505	31.03*	-3.648	7.721*
	Photo/Medical/Optical Goods, Clocks	-5.843**	-9.568	-3.006***	12.22***
Transportation	Communications	-12.94***	7.299	-2.859***	13.07***
	Electricity, Gas, Sanitary	-10.70***	3.962	-1.441**	6.947***
Wholesale	Wholesale nondurable	-16.11***	17.06	-1.459	8.492
Retail Trade	Food stores	-21.81**	-3.003	-1.369	19.35***
	General merchandise stores	-21.22***	-5.774	-6.185***	19.91***
	Home furniture	-20.24**	19.95	-3.399	19.74*
	Miscellaneous Retail	-17.18***	-1.804	-2.645*	12.19**
	Apparel and accessory stores	-13.41**	10.10	-4.359**	27.35***
	Eating and drinking places	-10.55*	-0.931	-5.453***	21.41***
Financial services	Security and commodity brokers	-20.55***	-13.21	-6.654***	36.67***
	Nondepository Credit Institutions	-19.79***	-62.97**	-7.161***	60.18***
	Insurance carriers	-17.62***	-18.12	-3.717***	34.77***
	Depository Institutions	-16.64***	5.997	-7.379***	42.51***
	Investment offices	-16.21***	15.91	-2.311	42.49***
Services	Business Services	-8.199***	3.921	-3.153***	15.87***
	Health Services	-8.094	-14.92	-4.133	14.42**

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In this table we present the results from estimating regression (10) for major groups separately. The sample is restricted to the late period. We present only the results for major groups containing at least five different companies in our sample. We omitted ten dates marked as outliers (similar to the regressions reported in table 2). The reported p-values are based on heteroskedasticity robust standard errors. Firm fixed effects were included in all regression specifications.

Table 5: Cyclicality of industrial sectors

Industrial Sector	Beta
Motor vehicles and parts	2.819***
Primary metal	2.378***
Plastics and rubber products	1.565***
Electronic equipment	1.483***
Furniture	1.483***
Machinery	1.377***
Wood production	1.305***
Fabricated metal products	1.288***
Computer and electronic products	1.265***
Nonmetallic mineral products	1.234***
Textile production	1.211***
Chemical	1.004***
Paper	0.980***
Apparel and leather goods	0.862***
Miscellaneous	0.738***
Printing	0.611***
Petroleum and coal products	0.600***
Mining	0.494**
Aerospace and miscellaneous transportation	0.428*
Natural gas distribution	0.407**
Electric and gas utilities	0.312***
Electric power generation	0.292**
Food, beverage, tobacco	0.236**

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This table presents the industrial production growth beta's. These beta's are estimated using the following model for each separate sector: $\text{IPG}_t = \alpha + \beta \text{Aggregate IPG}_t + \epsilon_t$ where IPG stands for industrial production growth. We estimate this for each sector for which have data available (see data appendix). The data is sampled quarterly from 1972 until 2009. The reported p-values are based on Newey-West standard errors.

Table 6: Cyclicality

	(1) All b/t	(2) Cyclical b/t	(3) Not cyclical b/t
Target	-11.580***	-19.818***	-9.998***
	(-16.45)	(-5.67)	(-8.94)
Target*Rec	-6.223*	-12.145	5.287
	(-2.52)	(-0.98)	(1.02)
Path	-1.958***	-1.801	-1.546***
	(-7.84)	(-1.53)	(-4.19)
Path*Rec	14.184***	25.409***	8.308***
	(25.01)	(10.31)	(9.99)
N	14260	1205	3152
r2	0.11	0.12	0.08

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This table presents the results from estimating regression (10).The sample is restricted to the late period. Only firms are considered which are covered by the data on industrial production we used to construct industrial production growth beta's (see text and data appendix). We omitted the FOMC meeting on September 17 because of the exceptional character of this meeting in the wake of 9/11. We also omitted ten dates marked as outliers as explained in the text. The reported p-values are based on heteroskedasticity robust standard errors. Firm fixed effects were included in all regression specifications.

Table 7: Firm effects

	(1) Without control variables	(2) With control variables
Target	-11.195***	-11.292***
	(-13.79)	(-13.55)
Target*Rec	-7.138*	-6.984*
	(-2.37)	(-2.42)
Path	-1.504***	-1.506***
	(-4.78)	(-4.77)
Path*Rec	15.147***	15.114***
	(20.13)	(19.93)
Size		0.001
		(0.01)
MTB		0.002
		(0.68)
Beta		-0.965
		(-0.47)
N	9374	9374
r2	0.11	0.11

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In this table we present the results from estimating regressions (10) and (11). The sample is restricted to the late period. Firms active in the utilities industry, the wholesale industry, the financial industry or public administration are dropped (see text). We omitted the FOMC meeting on September 17 because of the exceptional character of this meeting in the wake of 9/11. We also omitted ten dates marked as outliers as explained in the text. The reported p-values are based on heteroskedasticity robust standard errors. Firm fixed effects were included in all regression specifications.

Table 8: Firm effects

	(1) Leverage High	(2) Leverage Low	(3) Employees High	(4) Employees Low	(5) Market Value High	(6) Market Value Low	(7) Price-earnings High	(8) Price-earnings Low
Target	-11.730***	-10.131***	-6.661**	-13.220***	-10.091***	-11.777***	-4.572	-11.876***
	(-4.54)	(-4.07)	(-2.99)	(-5.28)	(-5.91)	(-3.70)	(-1.33)	(-4.43)
Target*Rec	-22.814*	1.756	-5.114	-26.565*	13.207*	-36.134*	-9.769	-14.450
	(-1.98)	(0.24)	(-0.71)	(-2.07)	(2.37)	(-2.45)	(-1.09)	(-1.47)
Path	-2.747*	-1.698	-2.961**	0.068	-2.018***	-2.393*	-0.671	-0.989
	(-2.07)	(-1.48)	(-2.64)	(0.05)	(-3.48)	(-2.09)	(-0.60)	(-0.81)
Path*Rec	23.181***	11.931***	12.818***	21.533***	8.702***	29.796***	10.216***	14.912***
	(6.24)	(5.05)	(5.32)	(5.93)	(7.21)	(7.56)	(4.51)	(6.58)
N	910	967	953	897	967	910	852	795
r2	0.17	0.11	0.11	0.15	0.12	0.21	0.15	0.14

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This table presents the results from estimating regression (10). The sample consists of stock returns on FOMC meetings from 1994 until 2009. Firms active in the utilities industry, the wholesale industry, the financial industry or public administration are dropped (see text). We omitted the FOMC meeting on September 17 because of the exceptional character of this meeting in the wake of 9/11. We also omitted ten dates marked as outliers as explained in the text. The reported p-values are based on heteroskedasticity robust standard errors. Firm fixed effects were included in all regression specifications.

Date	Details
October 15, 1998	First intermeeting move since 1994 and statement pointing to "unsettled conditions in financial markets... restraining aggregate demand" increases expectations of further easings.
Januray 3, 2001	Large surprise intermeeting ease reportedly causes financial markets to mark down probability of a recession; Fed is perceived as being "ahead of the curve" and as needing to ease less down the road as a result.
April 18, 2001	FOMC decides to lower federal funds target rate with 50 basis points. The FOMC FOMC is worried about economic slowdown and states: "As a consequence, the Committee agreed that an adjustment in the stance of policy is warranted during this extended intermeeting period."
January 22, 2008	Unplanned FOMC meeting by conference call. "To further its long-run objectives, the Committee in the immediate future seeks conditions in reserve markets consistent with reducing the federal funds rate to an average of around 3.5 percent." This was a 75 basis point cut.
January 30, 2008	This was a planned meeting only one week after an unplanned conference call. The FOMC decided to lower the target federal funds rate by an additional 50 basis points to 3 percent.
March 18, 2008	The combination of a slowing growth, inflationary pressures, and financial market disruptions encouraged the FOMC members to approve another 75 basis point cut in the federal funds rate.
September 29, 2008	This was an unplanned meeting by conference call. "In light of severe pressures in dollar funding markets abroad, the Committee unanimously approved both extending the liquidity-related swap arrangements with foreign central banks an additional three months, through April 30, 2009, and increasing substantially the sizes of those existing arrangements.
October 7, 2008	An unplanned meeting in which the FOMC decided to cut the target federal funds rate with 50 basis points.
December 16, 2008	The FOMC installs a *target range* for the federal funds rate between 0 and 25 basis points. The federal funds rate is effectively at the zero lower bound, instead of specific target the FOMC uses now a range
March 18, 2009	From the FOMC statement: "In these circumstances, the Federal Reserve will employ all available tools to promote economic recovery and to preserve price stability." The chairman of the Federal Reserve announced that the Fed would increase its balance sheet further by buying mortgage-backed securities and that it would purchase long-term treasury securities in the next six months.

Note: The details for the first two dates were literally taken from a discussion in Gürkaynak, Sack, and Swanson (2005). The details for the other dates come from the statements after the FOMC meetings along with readings from the financial press.

Sample	Recession dummy	Outlier statistic	Dates
Whole	No	DFITS	04/17/99, 10/15/98, 01/03/01, 04/18/01, 01/22/08 03/18/08, 07/24/08, 09/29/08, 10/07/08, 12/16/08, 03/18/09
Late	No	DFITS	01/22/08, 03/18/08, 09/29/08, 10/07/08, 12/16/08, 03/18/09
Late	Yes	DFITS	09/18/2007, 01/22/08, 09/29/08, 10/07/08, 12/16/08, 03/18/09
Whole	Yes	Cook's distance	01/03/01, 01/22/08, 09/29/08, 10/07/08, 12/16/08, 03/18/09

Table 9: Robustness checks

	(1) return b/se	(2) return b/se	(3) return b/se	(4) return b/se	(5) return b/se	(6) return b/se
Target	-13.281***	-13.281***	-13.281**	-13.331**	-13.281***	-13.331**
	0.556	0.829	4.782	4.724	0.383	4.683
Target*Rec	-6.549**	-6.549*	-6.549	-6.573	-6.549***	-6.573
	2.040	2.738	11.199	11.067	1.435	10.774
Path	-2.950***	-2.950***	-2.950	-2.970	-2.950***	-2.970
	0.183	0.420	1.842	1.850	0.199	1.854
Path*Rec	20.517***	20.517***	20.517***	20.554***	20.517***	20.554***
	0.521	1.970	3.322	3.329	0.708	3.690
Firm fixed effects	Yes	Yes	Yes	No	Yes	No
Cluster level	/	Group	Date	Date	/	Group + Date
Standard errors	Robust	/	/	/	Bootstrapped	/
N	27016	27016	27016	27016	27016	27016
r2	0.15	0.15	0.15	0.13	0.15	0.13

Give here the appropriate notes
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This table presents the results from estimating regression (10).The sample is restricted to the late period. We omitted the FOMC meeting on September 17 because of the exceptional character of this meeting in the wake of 9/11. We also omitted ten dates marked as outliers as explained in the text.

Table 10: Firm effects

	(1) Leverage High	(2) Leverage Low	(3) Employees High	(4) Employees Low	(5) Market Value High	(6) Market Value Low	(7) Price-earnings High	(8) Price-earnings Low
Target	-12.628***	-9.710***	-6.275**	-15.098***	-9.920***	-11.917***	-4.274	-11.978***
	(-4.62)	(-3.78)	(-2.78)	(-5.54)	(-5.83)	(-3.58)	(-1.23)	(-4.27)
Target*Rec	-21.237	0.983	-5.952	-23.090*	12.702*	-35.899*	-9.428	-14.324
	(-1.94)	(0.14)	(-0.85)	(-1.97)	(2.33)	(-2.48)	(-1.08)	(-1.56)
Path	-2.821*	-1.670	-2.983**	-0.072	-1.931**	-2.365*	-0.504	-0.992
	(-2.11)	(-1.45)	(-2.66)	(-0.05)	(-3.28)	(-2.05)	(-0.44)	(-0.81)
Path*Rec	22.795***	12.172***	13.114***	20.828***	8.723***	29.795***	10.628***	14.834***
	(6.05)	(5.09)	(5.35)	(5.80)	(7.16)	(7.48)	(4.67)	(6.39)
Size	0.077	-0.239	-0.168	0.182	0.280	-0.777	-1.134*	0.212
	(0.12)	(-0.60)	(-0.52)	(0.49)	(1.16)	(-1.09)	(-2.23)	(0.55)
MTB	-0.001	-0.019	0.043	0.003	0.037*	-0.006	-0.197	0.063
	(-0.13)	(-0.36)	(0.78)	(0.62)	(2.43)	(-1.00)	(-1.83)	(0.56)
Beta	-9.256	6.515	2.498	-23.687*	-0.067	1.267	10.550	-4.705
	(-1.11)	(1.39)	(0.50)	(-2.40)	(-0.02)	(0.14)	(1.51)	(-0.57)
N	910	967	953	897	967	910	852	795
r2	0.18	0.11	0.11	0.17	0.12	0.21	0.16	0.14

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This table presents the results from estimating regression (11). The sample is restricted to the late period. Firms active in the utilities industry, the wholesale industry, the financial industry or public administration are dropped (see text). We omitted the FOMC meeting on September 17 because of the exceptional character of this meeting in the wake of 9/11. We also omitted ten dates marked as outliers as explained in the text. The reported p-values are based on heteroskedasticity robust standard errors. Firm fixed effects were included in all regression specifications.

Table 11: Firm effects

	(1) Leverage High	(2) Leverage Low	(3) Employees High	(4) Employees Low	(5) Market Value High	(6) Market Value Low	(7) Price-earnings High	(8) Price-earnings Low
Target	-9.978***	-9.732***	-9.546***	-12.688***	-10.627***	-13.338***	-9.407***	-12.301***
	(-5.17)	(-5.67)	(-6.18)	(-6.77)	(-7.14)	(-5.80)	(-4.62)	(-6.30)
Target*Rec	-14.999*	-7.472	0.681	-14.105	4.512	-23.417*	-2.446	-9.030
	(-2.05)	(-1.35)	(0.13)	(-1.72)	(1.07)	(-2.46)	(-0.40)	(-1.26)
Path	-2.188**	-1.691*	-2.202**	-1.039	-1.311**	-1.744*	-1.406	-1.587*
	(-2.74)	(-2.02)	(-3.21)	(-1.25)	(-2.74)	(-2.05)	(-1.78)	(-2.16)
Path*Rec	20.020***	13.546***	12.660***	19.276***	9.618***	24.399***	11.779***	14.757***
	(9.24)	(9.03)	(8.39)	(7.69)	(9.63)	(9.62)	(7.56)	(10.29)
N	1848	1913	1898	1822	1913	1848	1696	1631
r2	0.15	0.11	0.11	0.14	0.12	0.16	0.12	0.16

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This table presents the results from estimating regression (10). The sample is restricted to the late period. Firms active in the utilities industry, the wholesale industry, the financial industry or public administration are dropped (see text). We omitted the FOMC meeting on September 17 because of the exceptional character of this meeting in the wake of 9/11. We also omitted ten dates marked as outliers as explained in the text. The reported p-values are based on heteroskedasticity robust standard errors. Firm fixed effects were included in all regression specifications.