Why do Markets React Badly to Good News? Evidence from Fed Funds Futures*

Andra Ghent
Zicklin School of Business
Baruch College, City University of New York
137 E. 22nd St., Rm. 406
New York, NY 10010

email: andra.ghent@baruch.cuny.edu
Ph: (646)660-6929
Fax: (646)660-6931

This Draft: August 13th, 2010

First Draft: November 2006

Abstract

It is well known that U.S. monetary policy is well-approximated by a Taylor rule. This suggests a reason why good macroeconomic news may not always increase equity returns: good news about the real side of the economy implies tighter future monetary policy. I test this hypothesis by assessing the effect of news on both daily and intraday equity returns after controlling for changes in expectations of future monetary policy using Fed Funds Futures. The results do not support the theory. Furthermore, the negative response of stock markets to unanticipated inflation is unchanged by controlling for changes in monetary policy expectations.

JEL: E44, E52, G14.

Keywords: Monetary Policy Expectations. Macroeconomic Surprises. Taylor Rule.

*This paper is a revised version of a chapter of my dissertation; I thank my advisors, Graham Elliott, Margie Flavin, and Valerie Ramey for their guidance and support throughout the writing of this paper. This note has also benefitted from comments from Christian Brownlees, Rob Martin, and Rossen Valkanov as well as funding from the UCSD Institute for Applied Economics and the Eugene M. Lang fellowship.

1 Introduction

Several recent papers examine how asset prices respond to the surprise component in macroeconomic news. In aggregate, the coefficient on positive news surprises is often found to be small although occasionally significant (e.g., Rigobon and Sack 2006). One theory for why the response is often found to be weak is that good news during an expansion primarily conveys information about the future of the risk-free rate as markets expect the Federal Reserve to increase interest rates consistent with a Taylor Rule. Indeed, McQueen and Roley 1993, Boyd, Hu, and Jagannathan 2005, and Andersen, Bollerslev, Diebold, and Vega 2007 find that macroeconomic news may depress equity returns during expansions, when stronger than expected economic conditions are most likely to indicate a future tightening of monetary policy, while markets respond favorably to positive surprises during recessions.

This paper tests whether changes in monetary policy expectations are responsible for the failure of equity markets to respond strongly to macro news shocks. I test this hypothesis by assessing the response of equity returns to macroeconomic news after controlling for changes in the market's expectation of future Federal Reserve policy. Controlling for monetary policy expectations on announcement days enables identification of the effect the news has on other variables affecting stock returns. I incorporate a market-based measure of changes in expectations of the future risk-free rate in a standard event study framework to examine the effect of eight major news announcements on returns. I find no evidence that changes in market expectations of future monetary policy explain the weak response of equity markets to good news about real activity. Rather than the VAR framework Boyd, Hu, and Jagannathan (2005) use to measure the shock to expectations regarding unemployment, this paper constructs survey-based measures of the shock to unemployment and other real variables.

The results contrast with the conclusions drawn by Boyd, Hu, and Jagannathan. Based on the reaction of bond prices to news, Boyd, Hu, and Jagannathan suggest that the negative reaction of stock markets to positive employment news during expansions results from

changes in expectations of the risk-free rate. However, bond yields are not in general weighted averages of expected future short rates (see, for example, Diebold, Rudebusch, and Aruoba 2006) as predicted by the expectations hypothesis. It is therefore necessary to directly assess the effect of news on expected future short rates.

I also find that, contrary to the predictions of the Fisher hypothesis, inflation reduces nominal stock returns even after controlling for changes in monetary policy expectations. Economists have known about the negative correlation between stock returns and inflation since at least Fama and Schwert's (1977) seminal study. While earlier literature focused on the correlation, more recent empirical literature suggests that the relationship runs from inflation to stock prices (see, for example, Lee 1992, Sharpe 2002, and Rigobon and Sack 2006). My findings also here indicate that inflation causes stock prices to fall, ruling out the proxy theory, and, furthermore, that inflation causes stock prices to fall for reasons unrelated to changes in expectation of the short-term discount rate.

The rest of the paper proceeds as follows: Section 2 briefly discusses the different channels through which macroeconomic news may affect asset prices. Section 3 assesses the effect of news on expectations of future monetary policy. Section 4 examines the effect of news on equity and bond returns after controlling for the effect of news on expectations of future monetary policy. Section 5 concludes.

2 Theoretical Framework

As is well-known, U.S. monetary policy is well approximated by a forward-looking Taylor rule. That is, the Federal Reserve responds to increases in expected real activity or expected inflation above trend by increasing the Fed Funds rate. Letting R_t^F be the Fed Funds rate, π_t and Y_t be some measures of inflation and real activity at date t with π and Y their steady-state levels, the market expectation for R_{t+j}^F can be described by

$$E_t R^F_{t+j} = \phi_\pi E_t(\pi_{t+j} - \pi) + \phi_Y E_t\left(Y_{t+j} - Y\right)$$

Suppose information relevant to either $E_t\pi_{t+j}$ or $E_t Y_{t+j}$ arrives at date $\tau \in (t, t+j)$. It immediately follows that

$$E_\tau R^F_{t+j} - E_t R^F_{t+j} = \phi_\pi\left(E_\tau\pi_{t+j} - E_t\pi_{t+j}\right) + \phi_Y\left(E_\tau Y_{t+j} - E_t Y_{t+j}\right)$$

Macroeconomic news surprises that contain information about either π_{t+j} or Y_{t+j} will thus raise market expectations for the future risk-free rate.

I consider two broad classes of indicators: indicators with information primarily about the real side of the economy (i.e., information relevant to expectations of Y_{t+j}) and those with information about the nominal side of the economy (i.e., information relevant to expectations of π_{t+j}). As a result, of the information structure above, each indicator will in general contain information about two or more factors that affect equity returns. Good news about the real side of the economy implies tighter future monetary policy and higher cash flows. According to standard general equilibrium asset pricing models where the price of an asset is the sum of its expected future discounted dividends, good news about future cash flows should increase equity returns. The cash flow and Fed Funds channel thus work in opposite directions for all broad measures of real U.S. economic activity. This may explain the finding of Boyd, Hu, and Jagannathan (2005), who report that stocks respond negatively to falls in the unemployment rate during an expansion. Boyd, Hu, and Jagannathan suggest that, during expansions, the news the unemployment rate contains about the future risk-free rate may dominate the news it contains about future cash flows. Campbell and Diebold (2009) similarly report that improvements in expected business conditions negatively affect equity returns.

The model also implies that news about the nominal side of the economy includes information about both future inflation and future monetary policy. Kaul (1987, 1990) postulates this is the cause of the negative relationship between inflation and stock returns.

However, several explanations for the negative correlation between inflation and stock returns do not rely on the monetary authority's reaction to news about inflation. First, monetary general equilibrium models (e.g., Marshall 1992) imply that changes in inflation expectations lower stock returns. Because increases in expected inflation lower the return to money, such increases will also lower all real asset returns that substitute for money, including equity.

Modigliani and Cohn (1979) suggest another possible reason for the negative relationship: Investors suffer from one of two forms of money illusion. First, analysts may confuse the nominal and real discount rates such that a rise in inflation that increases nominal bond returns will lead to a fall in equity prices. Ritter and Warr (2002), Campbell and Vuolteenaho (2004), and Cohen, Polk, and Vuolteenaho (2005) all find evidence that investors commit this valuation error. French, Ruback, and Schwert (1983) and Ritter and Warr (2002) also find that investors suffer from the second form of money illusion Modigliani and Cohn suggest: analysts fail to properly adjust profits for the decline in the real value of corporate liabilities that inflation induces.

Feldstein (1980) proposes instead that the nominal nature of the tax code and historically-based depreciation allowances as reasons why higher inflation may lower stock prices. Fama (1981) suggests the proxy theory, whereby higher inflation adversely affects stocks because it is correlated with poor real macroeconomic conditions. Finally, changes in inflation may change the equity risk premium if higher inflation coincides with a change in investors' risk preferences. However, Campbell and Vuolteenaho (2004) find that inflation has little effect on risk premia.

3 The Effect of News on Monetary Policy Expectations

Market efficiency implies that markets should only react to the unanticipated component in macroeconomic news announcements; by the time of the news release, prices already incorporate the anticipated component of the news. The right measure of news is thus the

deviation of the indicator from the market's consensus forecast for it. I further assume that the market reacts to the real-time value of the indicator rather than the true value that may emerge in later data revisions.

Both the consensus forecast and the actual real-time value of the indicators are from the MMS Survey and were purchased from Haver Analytic. I normalize the surprise component of each news announcement by dividing by the standard deviation of the news surprise in the sample as in Balduzzi, Elton, and Green (2001) and Andersen, Bollerslev, Diebold, and Vega (2003, 2007). That is, for each indicator k, the surprise is given by

$$S_{k,t} = \frac{A_{k,t} - E_{k,t}}{\hat{\sigma} k}$$

where $A_{k,t}$ is the actual real-time value of indicator k announced at date t, $E_{k,t}$ is the consensus forecast, and $\hat{\sigma}_k$ is the sample standard deviation of $A_{k,t} - E_{k,t}$. The negative of the unemployment surprise is used such that a decrease in the unemployment rate is recorded as a positive news surprise.

Table 1 describes the units of each of the indicators, the mean absolute deviation for the unscaled forecasting errors, and the mean of $S_{k,t}$ for each of the indicators. The group of indicators that primarily contain information about the real side of the economy includes the Unemployment Rate, Nonfarm Payrolls, New Home Sales, Advance GDP, Consumer Confidence, and Capacity Utilization. Advance GDP is a quarterly series; the remainder of the series are monthly. The second group consists of core CPI and core PPI, both of which are monthly indicators. Relative to the mean value of the indicator, analysts make small forecasting errors for capacity utilization and the unemployment rate but very large errors in forecasting nonfarm payrolls and core CPI inflation. It should be kept in mind that despite the standardization made to be able to compare responses across indicators, analysts in general are much more likely to be surprised by news about inflation than they are about real indicators. It is interesting to note that consensus forecasts usually underpredict real

variables while they systematically overpredict inflation.

Table 1: Summary Statistics for Indicators

		Means			
Indicator	Reporting Units	$A_{k,t}$	$\lvert A_{k,t} - E_{k,t}\rvert$	$S_{k,t}$	No. of Obs.
Unemp. Rate	Levels (SA, %)	5.70	0.119	0.192	223
Nonfarm Payrolls	Ch. in Levels (SA, Thous.)	79.9	77.2	−0.161	223
New Home Sales	Levels (SA, Thous.)	827	49.6	0.115	224
GDP Advance	Q/Q % Ch. (SAAR)	2.70	0.642	0.205	75
Cons. Conf.	SA Index (1985=100)	95.0	4.02	0.048	224
Cap. Utilization	SA Index (max=100)	79.6	0.269	−0.015	223
Core CPI	M/M % Ch. (SA)	0.197	0.074	−0.121	223
Core PPI	M/M % Ch. (SA)	0.123	0.179	−0.111	223

Notes: 1) $A_{k,t}$ denotes the actual number of the indicator released on the announcement day, $E_{k,t}$ denotes the consensus expectation of the indicator, and $S_{k,t} = \frac{A_{k,t}-E_{k,t}}{\hat{\sigma}_k}$ where $\hat{\sigma}_k$ is the standard deviation of $A_{k,t} - E_{k,t}$ in the sample. 2) SA denotes seasonally adjusted. 3) SAAR denotes seasonally adjusted at annualized rate. 4) An unemployment surprise is defined as lower than expected unemployment such that an increase indicates improving macroeconomic conditions. 5) Sample is October 18th, 1991 - May 31st, 2010.

In all regressions with daily data, I drop observations that fall on days on which two of the indicators are released (e.g., advance GDP and the unemployment report are released on the same day) to better identify the exact effect of that particular indicator. An exception is the employment report which always contains information about two macroeconomic indicators, the unemployment rate and nonfarm payrolls. Nonfarm payrolls and the unemployment rate are released simultaneously in the employment report. To control for the possibility that there is conflicting information in the employment report (for example, a high unemployment rate and strong growth in nonfarm payrolls), I create a variable called Combined Emp. which is the sum of the shock to the unemployment rate and to nonfarm payrolls.

I follow Kuttner (2001), Faust, Swanson, and Wright (2004), and Bernanke and Kuttner (2005) in using Fed Funds futures rates to gauge markets' expectations for future monetary policy. The sample consists of daily data from October 18th, 1991 to May 31st, 2010.[1] The

[1]While the Chicago Board of Trade began offering Federal Funds futures contracts in October 1988, the market was not very liquid until 1991 such that I exclude the data prior to 1991 from the sample.

Fed Funds Futures data is taken from Thomson Financial's Datastream database. The series codes are CFF1191, CFF1291,...., CFF1212. These contracts are available for between five and thirteen months in advance of month m for the sample period and provide a measure of the current stance of monetary policy and the market's expectation for future monetary policy. Hamilton (2009) performs several econometric tests on Fed Funds Futures and finds that they are excellent predictors of future monetary policy. Hamilton's econometric tests are partly in response to work by Piazzesi and Swanson (2008) that argues that Fed Funds Futures are a biased measure of market expectation of Federal Reserve policy. In any case, Gürkaynak, Sack, and Swanson (2007) find that Fed Funds Futures outperform other market-based expectations of monetary policy such that Fed Funds Futures are the best measure available.

Letting $R_t^{f,m}$ denote the Fed Funds futures contract settling $m = 1, .., 6$, full months ahead, the change between date t and $t-1$ in the market's expectation for the risk-free rate m full months ahead is

$$E_t R_m - E_{t-1} R_m = R_t^{f,m} - R_{t-1}^{f,m}.$$

The effect of the surprise on the market's expectation of the Fed Funds rate m months ahead is then estimated for indicator k using

$$R_t^{f,m} - R_{t-1}^{f,m} = \alpha_0 + \alpha_1 S_{k,t} + \varepsilon_t. \tag{1}$$

Table 2 contains the results from estimating this equation for each of the indicators. With the exception of Advance GDP, all the regressions on real news surprises have the expected signs and are almost always significant. The greatest effects are seen in the 6 month ahead contracts. The signs on Advance GDP are always positive but never statistically significant. The lack of significance is likely due to the small sample size since it is the only indicator sampled at a quarterly rather than a monthly frequency instead of any fundamental difference in the way the market reacts to GDP news. Nonfarm payroll surprises have the

largest effect on Fed Funds futures; shocks to unemployment and capacity utilization are the next most important drivers of the change in the Fed Funds rate.

Table 2: The Effect of Surprises on Expectations of Future Monetary Policy

Indicator	1-mo. ahead	2-mo.	3-mo.	4-mo.	5-mo.	6-mo.
Unemployment	**0.0093**	**0.0136**	**0.0190**	**0.0203**	**0.0222**	**0.0232**
	(2.56)	(3.68)	(4.37)	(4.15)	(4.08)	(3.81)
Nonfarm Payrolls	**0.0220**	**0.0311**	**0.0373**	**0.0453**	**0.0513**	**0.0573**
	(6.52)	(9.75)	(9.94)	(11.19)	(11.49)	(11.73)
Combined Emp.	**0.0139**	**0.0200**	**0.0251**	**0.0292**	**0.0328**	**0.0360**
	(6.13)	(9.20)	(10.01)	(10.59)	(10.71)	(10.60)
New Home Sales	**0.0052**	**0.0084**	**0.0087**	**0.0103**	**0.0127**	**0.0144**
	(4.48)	(5.23)	(4.77)	(4.53)	(4.61)	(4.66)
GDP Advance	0.0043	0.0058	0.0077	0.0076	0.0089	0.0085
	(1.12)	(1.41)	(1.61)	(1.40)	(1.37)	(1.17)
Consumer Confidence	0.0029	**0.0066**	**0.0087**	**0.0094**	**0.0105**	**0.0116**
	(1.89)	(2.99)	(3.84)	(3.54)	(3.52)	(3.40)
Capacity Utilization	**0.0122**	**0.0153**	**0.0180**	**0.0201**	**0.0216**	**0.0257**
	(5.23)	(5.78)	(6.02)	(6.13)	(5.86)	(5.97)
Core CPI	**0.0074**	**0.0113**	**0.0126**	**0.0163**	**0.0179**	**0.0211**
	(3.28)	(4.06)	(4.01)	(4.54)	(4.49)	(4.71)
Core PPI	0.0046	**0.0059**	**0.0065**	**0.0085**	0.0078	**0.0086**
	(1.90)	(2.28)	(2.18)	(2.49)	(1.93)	(2.10)

Notes: 1) The numbers in the table are the α coefficients from estimating $R_t^{f,m} - R_{t-1}^{f,m} = \alpha_0 + \alpha_1 S_{k,t} + \varepsilon_t$ for each of the m month ahead Fed Funds Futures contracts for each of the indicators. 2) T-statistics are in parentheses. 3) Bold-faced numbers denote significance at the 5% level. 4) The sample is October 18th, 1991 - May 31st, 2010. 5) An unemployment surprise is defined as lower than expected unemployment such that an increase indicates improving macroeconomic conditions. 6) Combined Emp. is the unemployment shock + non-farm payrolls shock.

Some of the coefficients on PPI surprises are not significant at the 10% level. It is somewhat counterintuitive that core CPI news has a stronger effect than core PPI news since movements in the PPI tend to induce movements in the CPI rather than the converse. The PPI is usually released one day before the CPI. One possible explanation is that agents may be waiting a day to trade on the news until they have information about both indicators such that the coefficient on the CPI is partly capturing the effect of shocks to the PPI as well.

4 The Effect of News on Equity Returns

Having ascertained that markets understand the Federal Reserve's policy rule, we now turn to the question of how they use this understanding to value assets. To this end, this section estimates the effect of news announcements on returns after including changes in the Fed Funds Futures rates as controls. The data on equities consist of three stock indexes: the Dow Jones Composite Average, the NYSE Composite, and the S&P 500 Composite.

Figure 1 shows the responses of daily returns for the Dow Jones Industrial Average to each of the standardized surprises; the same graphs for changes in the NYSE and the S&P 500 look quite similar to figure 1. Consistent with earlier literature, there is no readily discernible pattern between surprises in the real indicators. There is a weak negative relationship between shocks to core CPI and returns. There are clearly some outliers in the relationships. To ensure that these outliers do not unduly influence the results, before performing the regressions I drop all observations that the Hadi (1994) method identifies as outliers in the equity market and the news shock.

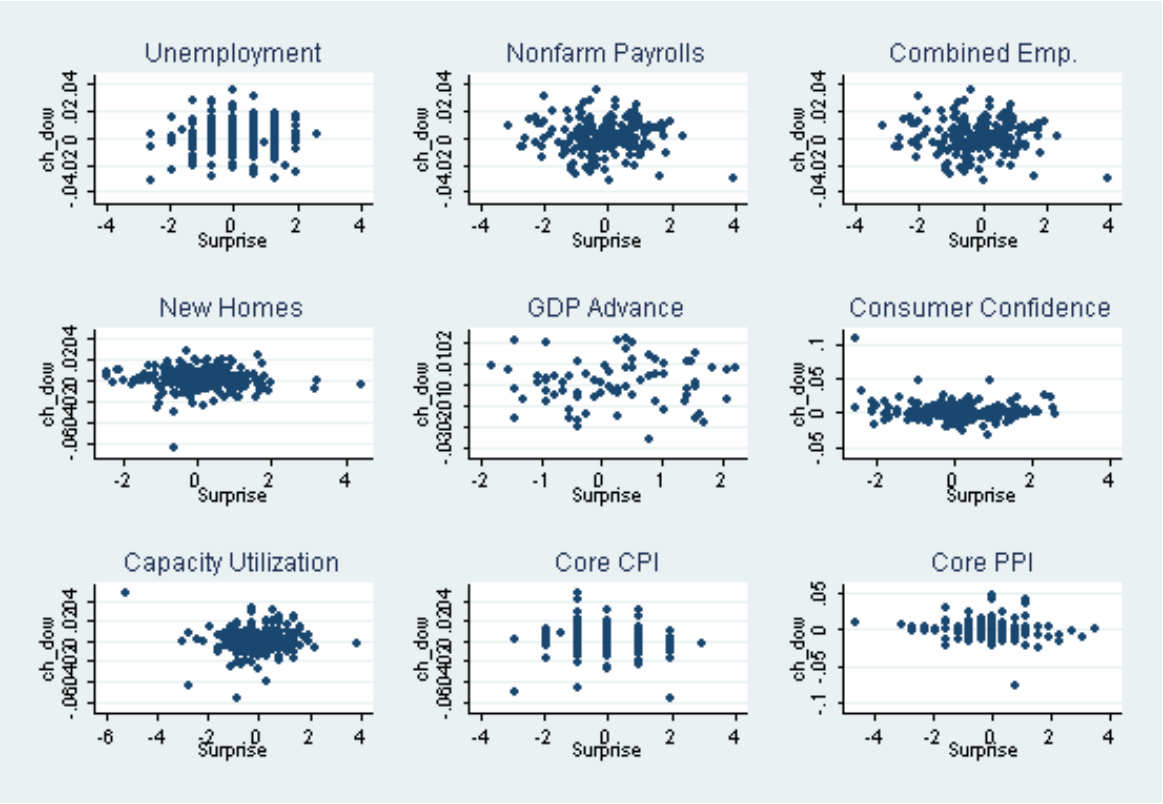

Figure 1: Percent Change in Dow Jones Industrial Average on Announcement Days

I estimate

$$R_t = \gamma + \beta^* S_{k,t} + \sum_{m=1}^{6} \delta_m \left(R_t^{f,m} - R_{t-1}^{f,m} \right) + \varepsilon_t \tag{2}$$

and, since there may be substantial collinearity in the changes Fed Funds Futures rates of different maturity on announcement days,

$$R_t = \gamma + \beta^* S_{k,t} + \delta_3 \left(R_t^{f,3} - R_{t-1}^{f,3} \right) + \varepsilon_t. \tag{3}$$

where $R_t = \frac{P_t^{close} - P_{t-1}^{close}}{P_{t-1}^{close}}$ and P_t^{close} is the price of the asset at the end of day t.

To assess how much of the news effect can be attributed to changes in monetary policy

expectations, I also compare the estimates from (2) and (3) with the results from estimating

$$R_t = \gamma + \beta S_{k,t} + \upsilon_t. \tag{4}$$

Table 3 reports the coefficients on the news variables in equations (3) and (4) for equity markets. The results from estimating equation (2) were quite similar to those obtained from estimating (3). β^* and β are substantively the same for all eight indicators. Although the signs occasionally change, they often change in the "wrong" direction and all of the coefficients related to news about real variables remain insignificant. There is thus no evidence to support the notion that equity markets' response to macroeconomic news is mediated through changes in monetary policy expectations.

Since unemployment and nonfarm payrolls are released on the same day[2], the possibility remains that markets may be reacting insignificantly to one or the other because the other employment indicator provides information that suggests a different view of the labor market than that provided by the one indicator alone. However, the results for the summary variable from the employment report (Combined Emp.) are similar to those from estimating (4) for each indicator separately.

[2]The remainder of the indicators are all usually released on different days from one another.

Table 3: News Effects on Equity Returns

Indicator	Dow		NYSE		S&P500	
	β	β^*	β	β^*	β	β^*
Unemp.	0.760	0.818	0.501	0.869	0.689	1.004
	(0.98)	(1.06)	(0.65)	(1.08)	(0.84)	(1.16)
Nonfarm Payrolls	0.509	0.495	−0.552	−0.296	−0.535	−0.448
	(0.64)	(0.52)	(−0.70)	(−0.32)	(−0.63)	(−0.45)
Combined Emp.	0.587	0.689	0.019	0.351	0.106	0.350
	(1.12)	(1.10)	(0.04)	(0.57)	(0.19)	(0.53)
New Homes	−0.222	−0.335	−0.620	−0.862	−0.334	−0.556
	(−0.30)	(−0.42)	(−0.92)	(−1.19)	(−0.43)	(−0.67)
GDP Adv.	0.445	1.058	−0.085	0.668	−0.057	0.614
	(0.31)	(0.74)	(−0.05)	(0.43)	(−0.03)	(0.38)
Cons. Conf.	0.729	0.508	0.881	0.695	0.963	0.641
	(0.99)	(0.67)	(1.30)	(0.99)	(1.25)	(0.81)
Cap. Util.	−0.569	−0.909	−1.354	−2.168	−0.195	−1.152
	(−0.55)	(−0.79)	(−1.17)	(−1.81)	(−0.18)	(−0.98)
Core CPI	**−1.953**	**−2.362**	**−1.846**	**−2.170**	−1.608	**−1.98**
	(−2.30)	(−2.65)	(−2.37)	(−2.65)	(−1.94)	(−2.27)
Core PPI	−1.181	−0.984	−1.185	−0.988	−1.434	−1.241
	(−1.62)	(−1.35)	(−1.49)	(−1.24)	(−1.71)	(−1.48)

Notes: 1) The numbers in the table are the β and β^* coefficients ($x1000$) on the news surprises from estimating $R_t = \gamma + \beta S_{k,t} + \upsilon_t$ and $R_t = \gamma + \beta^* S_{k,t} + \delta_3 \left(R_t^{f,3} - R_{t-1}^{f,3} \right) + \varepsilon_t$ for each of the indicators. 2) T-statistics are in parentheses. 3) Bold-faced numbers denote significance at the 5% level. 4) The sample is October 18th, 1991 - May 31st, 2010. 5) An unemployment surprise is defined as lower than expected unemployment such that an increase indicates improving macroeconomic conditions. 6) Combined Emp. is the unemployment shock + non-farm payrolls shock.

Table 4 reports the δ_3 coefficients from estimating (3)**.** The coefficients from estimating the equations for unemployment, nonfarm payrolls, GDP Advance, and PPI are negative although they are not usually statistically significant at the 5% level. The coefficients for the remainder of the indicators have the wrong sign and the positive coefficients for capacity utilization are statistically significant. These results suggest that equity markets react inconsistently with theory to both the information about future cash flows and the information about future monetary policy the news contains.

The results so far indicate that, if there exists an asymmetry in the reaction of equity markets to news about the real side of the economy, it is not because agents form different

expectations about monetary policy depending on whether the economy is below or above its long run trend in real activity. It may still be the case that the lack of a response to news about the real side of the macroeconomy is due to an asymmetry and unrelated to cyclical differences in the content of the news for monetary policy expectations. To explore this possibility, I check whether the asymmetry McQueen and Roley (1993), Boyd, Hu, and Jagannathan (2005), and Andersen, Bollerslev, Diebold, and Vega (2007) find exists in these data. Table 5 reports the results of the regression when I exclude all observations that fall on the NBER recession dates in 1991, 1992, 2001, and 2007-2010 such that the sample covers only expansionary periods as of the writing of this paper.

In this sample and at this frequency, there is no evidence of asymmetry in the response of equities to macro news: The results in table 5 are very similar to those reported in table 3 where both recession and expansion dates are included. In any case, by using changes in policy expectations as a control variable, this paper rules out the possibility that any asymmetries that do exist are due to asymmetric changes in policy expectations. Instead, the results suggest that the lack of significance this paper and other work may be due to "noisy" news surprises as Rigobon and Sack (2006) argue.

Table 4: Responses to Changes in Monetary Policy Expectations

Indicator	Dow	NYSE	S&P500
Unemp.	−5.55	−18.95	−16.24
	(−0.44)	(−1.52)	(−1.21)
Nonfarm Payrolls	0.42	−7.30	−2.47
	(0.03)	(−0.52)	(−0.16)
Combined Emp.	−4.27	−13.94	−10.27
	(−0.30)	(−0.98)	(−0.67)
New Homes	11.21	23.91	22.11
	(0.39)	(0.91)	(0.73)
GDP Adv.	**−80.01**	**−98.37**	**−87.67**
	(−2.13)	(−2.41)	(−2.06)
Cons. Conf.	26.31	21.76	38.43
	(1.10)	(0.98)	(1.54)
Cap. Util.	23.00	**84.48**	**65.50**
	(0.71)	(2.23)	(2.02)
Core CPI	31.82	25.16	28.57
	(1.48)	(1.28)	(1.36)
Core PPI	**−35.72**	−35.48	−34.82
	(−2.10)	(−1.92)	(−1.78)

Notes: 1) The numbers in the table are the coefficients ($\delta_3 x1000$) on the changes in monetary policy expectations from estimating equation $R_t = \gamma + \beta^* S_{k,t} + \delta_3 \left(R_t^{f,3} - R_{t-1}^{f,3} \right) + \varepsilon_t$ for each of the indicators. 2) T-statistics are in parentheses. 3) Bold-faced numbers denote significance at the 5% level. 4) The sample is October 18th, 1991 - May 31st, 2010. 5) An unemployment surprise is defined as lower than expected unemployment such that an increase indicates improving macroeconomic conditions. 6) Combined Emp. is the unemployment shock + non-farm payrolls shock.

Table 5: News Effects on Equity Returns, Expansion Dates Only

Indicator	Dow		NYSE		S&P500	
	β	β^*	β	β^*	β	β^*
Unemp.	0.170	0.488	−0.116	0.524	−0.107	0.447
	(0.19)	(0.52)	(−0.14)	(0.60)	(−0.12)	(0.46)
Nonfarm Payrolls	0.825	1.255	−0.476	0.077	−0.344	0.107
	(1.01)	(1.33)	(−0.62)	(0.09)	(−0.40)	(0.11)
Combined Emp.	0.430	0.757	−0.254	0.215	−0.014	0.162
	(0.79)	(1.14)	(−0.50)	(0.34)	(−0.02)	(0.23)
New Homes	−0.508	−0.742	−1.139	−1.098	−0.603	−0.978
	(−0.70)	(−0.93)	(−1.94)	(−1.72)	(−0.84)	(−1.25)
GDP Adv.	0.915	1.260	0.514	0.941	0.474	0.882
	(0.62)	(0.88)	(0.34)	(0.66)	(0.28)	(0.54)
Cons. Conf.	−0.300	−0.335	0.116	0.043	0.120	−0.036
	(−0.36)	(−0.40)	(0.16)	(0.06)	(0.14)	(−0.04)
Cap. Util.	−0.660	−0.885	−1.298	−1.687	−0.714	−0.931
	(−0.48)	(−0.61)	(−1.04)	(−1.29)	(−0.54)	(−0.67)
Core CPI	**−2.733**	**−2.802**	**−2.613**	**−2.467**	**−2.458**	**−2.323**
	(−2.96)	(−2.83)	(−3.19)	(−2.81)	(−2.78)	(−2.45)
Core PPI	−1.363	−1.113	−1.441	−1.154	**−1.661**	−1.373
	(−1.83)	(−1.50)	(−1.87)	(−1.51)	(−1.98)	(−1.65)

Note: 1) The numbers in the table are the coefficients ($x1000$) on the news surprises from estimating $R_t = \gamma + \beta S_{k,t} + \upsilon_t$ and $R_t = \gamma + \beta^* S_{k,t} + \delta_3 \left(R_t^{f,3} - R_{t-1}^{f,3} \right) + \varepsilon_t$ for each of the indicators with observations falling on NBER recession dates dropped. 2) T-statistics are in parentheses. 3) Bold-faced numbers denote significance at the 5% level. 4) The full sample is October 18th, 1991 - May 31st, 2010. 5) Combined Emp. is the unemployment shock + non-farm payrolls shock.

The only news that consistently has statistically significant effects is core CPI news while core PPI news usually has economically significant effects. The coefficients on core CPI news change when the regressions also control for changes in monetary policy expectations, they remain highly statistically significant in both the full sample and in the expansion sample. The negative reaction to inflation shocks is consistent with the results of Rigobon and Sack (2006). However, the evidence here rules out the possibility that equity markets respond badly to inflation surprises simply because they imply tighter future monetary policy. Since this paper uses an event study framework, the findings are also evidence against Fama's (1981) proxy theory. Finally, because the Fed Funds rate is closely related to other future risk-free rates, the findings in tables 3 and 5 indicate that theories for the correlation between

inflation and stock returns that rely on investors confusing nominal discount rates cannot explain all of the effect. Instead, the results suggest instead that investors suffer from less obvious forms of money illusion, such as improper adjustments for changes in the real value of corporate obligations after inflationary shocks, or that inflation induces falls in equities because the US tax code is nominal rather than real.

Intraday Results

I also consider a specification in which I use intraday data to verify the robustness of the main results on the response of equity markets to news surprises. The advantage of using daily data is a longer time series over which to identify the relationship; Fed Funds Futures are not sufficiently liquid to use high frequency data throughout the 1990s. The main benefit of using intraday data is to more precisely identify the effect of the shock of a particular announcement since there may be other significant news announcements that occur on the same day as one of the major macroeconomic releases. A further advantage of using intraday data is that it mitigates concerns that Rigobon and Sack (2003, 2004) raise regarding the possibility that monetary policy reacts to the stock market which would, of course, contaminate the results with endogeneity. Although the Federal Reserve has repeatedly stated that it does not target asset prices in setting monetary policy, it remains possible that the Federal Reserve does indirectly uses stock prices in setting monetary policy to the extent that they influence inflation or real activity. However, it seems far less likely that the Federal Reserve sets monetary policy based on intraday changes in stock prices.

The sample is January 1st 2003 - May 31st, 2009. The intraday data on Fed Funds futures is Time and Sales data from the CME Group. The data for January 1st to November 23rd 2003 is based on pit trade sessions; the remainder of the Fed Funds futures data is based on electronic trade sessions. The starting point of the data corresponds to the first date that data on the time of the news release is readily available. While time of news release could be located further back than 2003, prior to 2003 Fed Funds futures are thinly traded such

that using intraday data further back seems ill-advised. The data on equity prices was taken from the TAQ database which contains intraday data on all trades on the NYSE; the equity price index is the price of IShares S&P500 index fund (symbol: IVV). This is a highly liquid index fund with an average of around 9000 trades on each announcement day.

I take the three-month ahead fed funds contract price immediately before the news release as the pre-announcement fed funds price. The pre-announcement equity price is the price at the time closest to the fed funds pre-announcement trade time; this time is almost always within seconds of the fed funds pre-announcement price time for announcements made when the NYSE is open. If there are no trades on the S&P 500 index fund prior to the news release on that announcement day, which sometimes happens for announcements made before 9:30 a.m. EST, I take the previous day's close price as the equity price prior to the announcement.

Based on the findings of Erenburg, Kurov, and Lasser (2006) that the price discovery process is complete for all ten of the indicators they consider within four minutes of the announcement, I take the post-announcement Fed Funds price as the price for the first trade made five minutes after the announcement. I take the post-announcement equity price as the price for the first trade made after the Fed Funds trade time or the price for the first trade made five minutes after the market has opened for announcements in which there is no trading on announcement day prior to the announcement time.

Columns 1 and 2 of table 6 present the results from estimating (4) and (3) using intraday data. With higher frequency data, the stock market's response to nonfarm payrolls and consumer confidence is positive and statistically significant; the coefficients on the remainder of the real surprises are insignificant. The results do not support the notion that the stock market's reaction to good news about the real economy is confounded by changes in monetary policy expectations, however. Rather, controlling for changes in monetary policy expectations reduces most of the coefficients on surprises about real variables and renders the coefficient on nonfarm payrolls insignificant. Consistent with the findings from daily

data, higher than expected inflation, both as measured by core CPI and core PPI, depresses stocks.

Table 6: News Effects on Intraday Equity Returns, Data on S&P500

Indicator	Full Sample		Expansion Dates Only	
	β	β^*	β	β^*
Unemp.	0.036	0.024	−0.022	−0.020
	(0.44)	(0.31)	(−0.21)	(−0.20)
Nonfarm Payrolls	**0.275**	0.115	**0.304**	**0.422**
	(2.79)	(0.78)	(3.79)	(2.71)
Combined Emp.	**0.184**	0.106	**0.220**	**0.194**
	(2.87)	(1.42)	(3.11)	(2.16)
New Homes	0.041	0.015	0.029	0.016
	(1.57)	(0.53)	(1.16)	(0.57)
GDP Adv.	0.080	0.047	**0.228**	**0.225**
	(0.96)	(0.52)	(2.98)	(2.57)
Cons. Conf.	**0.228**	**0.188**	**0.195**	**0.131**
	(6.77)	(4.82)	(4.47)	(2.83)
Cap. Util.	0.034	0.039	0.047	0.026
	(0.83)	(0.88)	(0.80)	(0.40)
Core CPI	**−0.190**	**−0.130**	**−0.137**	−0.084
	(−4.14)	(−2.48)	(−2.88)	(−1.46)
Core PPI	**−0.116**	**−0.123**	**−0.100**	**−0.086**
	(−3.14)	(−2.91)	(−3.10)	(−2.24)

Notes: 1) The numbers in the table are the β and β^* coefficients on the news surprises from estimating $R_t = \gamma + \beta S_{k,t} + \upsilon_t$ and $R_t = \gamma + \beta^* S_{k,t} + \delta_3 \left(R_t^{f,3} - R_{t-1}^{f,3} \right) + \varepsilon_t$ for each of the indicators. 2) T-statistics are in parentheses. 3) Bold-faced numbers denote significance at the 5% level. 4) Full sample is January 1st, 2003 - May 31st, 2009. 5) An unemployment surprise is defined as lower than expected unemployment such that an increase indicates improving macroeconomic conditions. 6) Combined Emp. is the unemployment shock + non-farm payrolls shock. 7) The post-announcement Fed Funds price is the price for the first trade made **five** minutes after the announcement.

Table 7: News Effects on Intraday Equity Returns, 15 Min. Window

Indicator	Full Sample		Expansion Dates Only	
	β	β^*	β	β^*
Unemp.	0.036	0.021	−0.022	−0.029
	(0.45)	(0.27)	(−0.23)	(−0.32)
Nonfarm Payrolls	**0.233**	0.049	**0.256**	0.210
	(2.33)	(0.35)	(2.89)	(1.51)
Combined Emp.	**0.159**	0.076	**0.180**	0.116
	(2.48)	(1.03)	(2.70)	(1.38)
New Homes	0.0351	0.004	0.029	0.002
	(0.99)	(0.10)	(0.85)	(0.06)
GDP Adv.	**0.184**	**0.166**	**0.222**	0.197
	(2.66)	(2.14)	(2.72)	(2.03)
Cons. Conf.	**0.238**	**0.176**	**0.193**	**0.116**
	(5.25)	(3.68)	(3.32)	(1.93)
Cap. Util.	0.033	0.043	0.049	0.035
	(0.75)	(0.90)	(0.78)	(0.51)
Core CPI	**−0.233**	**−0.181**	**−0.167**	**−0.111**
	(−5.26)	(−3.60)	(−3.61)	(−2.04)
Core PPI	**−0.099**	**−0.109**	**−0.087**	**−0.091**
	(−2.59)	(−2.69)	(−2.49)	(−2.40)

Notes: 1) The numbers in the table are the β and β^* coefficients on the news surprises from estimating $R_t = \gamma + \beta S_{k,t} + \upsilon_t$ and $R_t = \gamma + \beta^* S_{k,t} + \delta_3 \left(R_t^{f,3} - R_{t-1}^{f,3} \right) + \varepsilon_t$ for each of the indicators. 2) T-statistics are in parentheses. 3) Bold-faced numbers denote significance at the 5% level. 4) Full sample is January 1st, 2003 - May 31st, 2009. 5) An unemployment surprise is defined as lower than expected unemployment such that an increase indicates improving macroeconomic conditions. 6) Combined Emp. is the unemployment shock + non-farm payrolls shock. 7) The post-announcement Fed Funds price is the price for the first trade made **fifteen** minutes after the announcement.

Columns 3 and 4 of table 6 present the results from estimating (4) and (3) using intraday data on expansion dates only; I drop data from December 2007 onwards in this specification. In this data set, there is no evidence that stocks respond worse to good news about the real side of the economy during expansions; the coefficients in columns 3 and 4 give the same overall picture of the stock market's reaction to news as those in columns 1 and 2.

Finally, I test the robustness of the results to the trading window. Table 7 presents the results from using a fifteen minute trading window rather than the five minute window used to generate the results in table 6. In this specification, I take the post-announcement

Fed Funds price as the price for the first trade made fifteen minutes after the announcement and the post-announcement equity price as the price for the first trade made after the Fed Funds trade time or the price for the first trade made fifteen minutes after the market has opened for announcements in which there is no trading on announcement day prior to the announcement time. The results are quite similar to those found using a five minute trading window.

5 Conclusions

This paper has examined the extent to which the stock market's reaction to macroeconomic news is mediated through changes in monetary policy expectations as measured by Federal Funds Futures contracts. Contrary to existing literature that does not control directly for changes in monetary policy expectations, I find no evidence that stock markets respond weakly to good news about the real side of the economy because of changes in monetary policy expectations. I also find that higher than expected inflation reduces equity returns even after controlling for changes in monetary expectations. These findings are robust to the use of both daily and intraday data and the use of data only from NBER expansions.

References

Andersen, T.G., T. Bollerslev, F.X. Diebold, and C. Vega, 2003. Micro Effects of Macro Announcements: Real-Time Price Discovery in Foreign Exchange. American Economic Review 93, 38-62.

Andersen, T.G., T. Bollerslev, F.X. Diebold, and C. Vega, 2007. Real-Time Price Discovery in Stock, Bond, and Foreign Exchange Markets. Journal of International Economics 73, 251-277.

Balduzzi, P., E.J. Elton, and T.C. Green, 2001. Economic News and Bond Prices: Evidence

from the U.S. Treasury Market. Journal of Financial and Quantitative Analysis 36, 523-543.

Bernanke, B.S. and K.N. Kuttner, 2005. What Explains the Stock Market's Reaction to Federal Reserve Policy? Journal of Finance 60, 1221-1257.

Boyd, J.H., J. Hu, and R. Jagannathan, 2005. The Stock Market's Reaction to Unemployment News: Why Bad News is Usually Good for Stocks. Journal of Finance 60, 649-672.

Campbell, J.Y. and T. Vuolteenaho, 2004. Inflation Illusion and Stock Prices. American Economic Association Papers and Proceedings 94, 19-23.

Campbell, S.D. and F.X. Diebold, 2009. Stock Returns and Expected Business Conditions: A Half a Century of Direct Evidence. Journal of Business and Economic Statistics 27, 266-278.

Cohen, R.B., C. Polk, and T. Vuolteenaho, 2005. Money Illusion in the Stock Market: The Modigliani-Cohn Hypothesis. Quarterly Journal of Economics 120, 639-668.

Diebold, F.X., G.D. Rudebusch, and S.B. Aruoba, 2006. The Macroeconomy and the Yield Curve: A Dynamic Latent Factor Approach. Journal of Econometrics 131, 309-338.

Erenburg, G., A. Kurov, and D.J. Lasser, 2006. Trading Around Macroeconomic Announcements: Are All Traders Created Equal? Journal of Financial Intermediation 15, 470-493.

Fama, E.F., 1981. Inflation, Rational Valuation and the Market. Financial Analysts Journal March-April, 24-44.

Fama, E.F. and G.W. Schwert, 1977. Asset Returns and Inflation. Journal of Financial Economics 5, 115-146.

Faust, J., E.T. Swanson, and J.H. Wright, 2004. Identifying VARS Based on High Frequency Futures Data. Journal of Monetary Economics 51, 1107-1131.

Feldstein, M., 1980. Inflation and the Stock Market. American Economic Review 70, 839-847.

French, K.R., R.S. Ruback, and G.W. Schwert, 1983. Effects of Nominal Contracting on Stock Returns. Journal of Political Economy 91, 70-96.

Grigori, E., A. Kurov, and D.J. Lasser, 2006. Trading Around Macroeconomic Announcements: Are All Traders Created Equal? Journal of Financial Intermediation 15, 470-493.

Gürkaynak, R.S., B.P Sack, and E.T. Swanson, 2007. Market-Based Measures of Monetary Policy Expectations. Journal of Business and Economic Statistics 25, 201-212.

Hadi, A.S., 1994. A Modification of a Method for the Detection of Outliers in Multivariate Samples. Journal of the Royal Statistical Society, Series B (Methodological) 56, 393-396.

Hamilton, J.D, 2009. Daily Changes in Fed Funds Futures Prices. Journal of Money, Credit & Banking 41, 567-582.

Kaul, G., 1987. Stock Returns and Inflation: The Role of the Monetary Sector. Journal of Financial Economics 18, 253-276.

Kaul, G., 1990. Monetary Regimes and the Relation Between Stock Returns and Inflationary Expectations. Journal of Financial and Quantitative Analysis 25, 307-321.

Kuttner, K.N., 2001. Monetary Policy Surprises and Interest Rates: Evidence from the Fed Funds Futures Market. Journal of Monetary Economics 47, 523-544.

Lee, B.-S., 1992. Causal Relations Among Stock Returns, Interest Rates, Real Activity, and Inflation. Journal of Finance 47, 1591-1603.

Marshall, D.A., 1992. Inflation and Asset Returns in a Monetary Economy. Journal of Finance 47, 1315-1342.

McQueen, G. and V.V. Roley, 1993. Stock Prices, News, and Business Conditions. Review of Financial Studies 6, 683-707.

Modigliani, F. and R.A. Cohn, 1979. Inflation, Rational Valuation and the Market. Financial Analysts Journal March-April, 24-44.

Piazzesi, M. and E.T. Swanson, 2008. Future Prices as Risk-Adjusted Forecasts of Monetary Policy. Journal of Monetary Economics 55, 677-691.

Rigobon, R. and B. Sack, 2003. Measuring the Reaction of Monetary Policy to the Stock Market. Quarterly Journal of Economics 118, 639-669.

Rigobon, R. and B. Sack, 2004. The Impact of Monetary Policy on Asset Prices. Journal of Monetary Economics 51, 1553-1575.

Rigobon, R. and B. Sack, 2006. Noisy Macroeconomic Announcements, Monetary Policy, and Asset Prices. NBER Working Paper 12420.

Ritter, J.R., and R.S. Warr, 2002. The Decline of Inflation and the Bull Market of 1982-1989. Journal of Financial and Quantitative Analysis 37, 29-61.

Sharpe, S.A., 2002. Reexamining Stock Valuation and Inflation: The Implications of Analysts' Earnings Forecast. Review of Economics and Statistics 84, 632-648.