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Investors' Behavior Towards Pre-Scheduled Macroeconomic News

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Abstract

In this thesis, we study how the macroeconomic risk concerning pre-scheduled news affect investors' behavior in the US. On days when key macroeconomic news such as PPI numbers, Labor reports and FOMC statements are scheduled for release, the daily stock market excess return is significantly higher than on non-announcement days. Of the different news releases, the FOMC statement has the largest impact on the stock market. Furthermore, the result reveals an overall increase in realized volatility on announcement days, whereas the implied volatility drops once the news is announced. Our findings demonstrate how investors are compensated for the macroeconomic risk associated with the news releases.

Keywords: Macroeconomic news; Stock market return; Implied volatility

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1.0 Introduction

This thesis provides empirical evidence of significantly higher stock market excess return on days when important macroeconomic news is scheduled for release. By measuring the implied volatility imposed by the Chicago Board Options Exchange Volatility Index (hereafter the VIX), we find that the risk of holding securities around announcement days are anticipated by rational investors. The investors expect to receive important macroeconomic information, but they do not know what the contents will be. The interpretation of the result is that investors require compensation for the risk of learning potential bad news, and once the news are released the implied volatility decreases.

In our study of the stock market and the VIX index, we have included news on Producer Price Index (PPI), labor reports and Federal Open Market Committee (FOMC) decisions. The significance of these news on trading and volatility of financial assets are supported by, for instance, Ederington and Lee (1993), Kim, McKenzie and Faff (2004) and Wilson and Savor (2013). For Treasury bond futures, Ederington and Lee (1993) find that announcements on employment, PPI, CPI (Consumer Price Index) and durable goods orders releases have the greatest price movements effects. The findings are consistent for stocks returns, where Kim, McKenzie and Faff (2004) argues for the importance of the consumer and producer price figures. Wilson and Savor (2013) supports this view, but argues that the release of CPI numbers is of less significance as its release closely follows the PPI release. The PPI release thereby diminishes the announcement effect of the CPI release. As opposed to Wilson and Savor (2013) who solely defines an announcement date to be a day where either of the news arrives, we separate the announcement days into news type. By using this method, we are able to check if some of the news are associated with higher excess returns or larger drops in implied volatility on announcement days.

While lots of studies capture the surprise-effect caused by the information content of macroeconomic news [see e.g. Bollerslev 2007], our study captures the announcement effect. This methodological approach focuses on the arrival dates and the corresponding movements in the US stock market and the VIX index. We use a dummy variable to indicate whether there is an announcement date, which is the same methodology as in Ederington and Lee (1993), Wilson and Savor (2011) and Nikkinen and Sahlström (2004). Our paper disregards the actual contents of the news and any initial expectations investors might have towards them. We rather use a large enough sample to not only include periods of particularly bad or prosperous economic conditions. Our sample include manually collected data from 1988-2016 and uses the same time periods for our analysis of both stock market excess return and implied volatility. This allows us to compare our findings and their relative significance.

As the investors do not know the contents of the upcoming news, they bear the risk of learning that the economy performs worse than expected. Knight (1921) presents a theory assuming investors´ utility functions to be increasingly more concave as a non-negligible event approaches. Therefore, as the event approaches, so does the possibility of learning potential bad news about the economy. Similarly, investors can be said to be more and more risk-averse facing the non-diversifiable risk of macroeconomic uncertainty. Risk averse investors should thus require higher stock returns when macroeconomic news is scheduled to be released, and this is one of our two major hypotheses.

Consistent with this idea, we find that the expected daily stock market excess return is on average 11.8 bps on announcement days versus only 2.5 bps on non-announcement days. On announcement days, the realized volatility is slightly higher for all news combined, while the sharpe ratio is nearly 5 times higher than on non-announcement days. All of the news is associated with an increase in daily excess stock market return on announcement days. However, the FOMC interest rate release is the only significant announcement type. Additionally, it has a coefficient of 22.7 bps, which suggests that investors respond greatly to the release of such news as they are a more important indicator of the future state of the economy. As suggested in Wilson and Savor (2013) the increased risk should make risk inverse investors desire saving, and consequently the risk-free rate is hypothesized to drop on announcement days. However, the risk-free rate in recent years are at such low levels, that there is no significant difference on announcement days.

The risk on announcement days should also be reflected in the VIX index, which captures the stock markets´ expectation of volatility. These approximations are confirmed by among others, Heynen, Kemna and Vorst (1994) who argues that implied volatility is approximately equal to the average expected volatility until maturity. The Black-Scholes formula uses a model of stock price dynamics to measure how an option´s value depend on the volatility of the underlying assets (Black and Scholes, 1973). If we assume the announcements to happen within the lifespan of an option, the implied volatility is expected to gradually increase prior to the announcement and drop once the news are released. This constitutes the second of our two major hypotheses.

As expected, the implied volatility drops on the announcement day for all news types. Before the release of PPI reports, the implied volatility is gradually increasing which is consistent with theory. As in Nikkinen and Sahlström (2001), we find that the implied volatility experiences a jump one day before the news arrival of labour reports, and drops once the news has been released. The change in implied volatility suggest that investors adjust their views on uncertainty the day before the announcement day, and absorb the full effect once the news is released. On days where FOMC interest rate decisions are released, we find the largest drop in implied volatility. However, there are no increase in implied volatility the days prior to the FOMC decisions. A distinction from our thesis and the studies of Nikkinen and Sahlström (2004) and Wilson and Savor (2013), is our investigation of the uncertainty on the different announcement days. Whereas these studies argue that the uncertainty increases when the news are scheduled for release, we find that this is only true for PPI and labor reports. On days when FOMC interest rate decisions are released, the realized volatility is not significantly different form non-announcement days. This explains the non-increasing implied volatility before the news arrival, and thus the drop on the announcement day could be explained by the reduced uncertainty following a FOMC meeting, regardless of the content.

2.0 Literature Review

2.1 Stock market return

This paper is related to the growing literature on how pre-scheduled macroeconomic announcements affect investor behavior and the relationship between risk and return. Our study can serve as a robustness check for previous research by narrowing our focus on three important news types. In this way, we are able to investigate their relative importance, and study the behavior of investors on the announcement days as well as the days surrounding the news releases.

The first evidence of the impact pre-scheduled announcements has on stock market returns is originally presented in Beaver (1968). In his paper, he argues for and finds supporting evidence for the phenomenon of increasing stock prices when firms are expected to announce their annual earnings. The announcements capture the market participants´ expectations, and thus the above average stock returns can be attributed to changes in equilibrium prices, and not by an increase in risk.

Similar studies, such as Bollerslev et.al (2007), have been executed on pre-scheduled macroeconomic news and their implications for the stock and bond market. In this study, the content of the pre-scheduled macroeconomic announcements has received more attention, rather than the announcement event itself. As opposed to Beaver (1968), the study distinguishes itself from the traditional "efficient markets" theory, and find that the stock market reaction to macroeconomic news depend on the general economic conditions. He finds that positive economic shocks are met with a negative response in expansions and a positive response in contractions, and thus it is the gap between the expectations and the actual announcement which determines the response of the market to the news release. Their results thus capture the surprise effect and the uncertainty caused by the information content on market efficiency. While Bollerslev et al. (2007) capture the surprise effect, this study will not focus on whether the news content correspond to market participants expectations. Our research rather emphasizes the announcement effect, that is the effect of the news releases themselves.

Wilson and Savor (2013) capture the announcement effect and find that stock market excess return increases when important macroeconomic news is scheduled for release. The announcement days are associated with higher risk because investors will learn more about the future state of the economy. Thus, they should be compensated with higher return once the news is released. They assume that the β is different from zero, indicating that announcement days are periods with higher systematic risk. Our thesis is based on the same assumptions as in Wilson and Savor (2013). A distinction is our separation of the different announcement days in which the different news types arrives. In addition, we have investigated the days surrounding the announcements to find potential calming effects in the stock market as suggested in Bomfim (2003).

2.2 Options and implied volatility

This study does not solely aim to capture the excess return around macroeconomic news announcements, but also to capture the movements in volatility around these dates. Ederington and Lee (1993) investigate how prescheduled macroeconomic news like employment reports, Consumer Price Index (CPI) and Producer Price Index (PPI) affect the volatility of interest rates and foreign exchange futures markets. They use a dummy variable that indicates whether there is an announcement day and measure the difference in actual and mean return. The result suggest that announcement days are days in which the realized volatility increases compared to non-announcement days.

While the historical volatility measures the past, the implied volatility is derived from an option's price and shows what the market implies about the stock's volatility in the future. Shaikh and Padhi (2013) investigate the behavior of the India VIX surrounding the days of announcements regarding Reserve Bank of India monetary policy statements, CPI, employment and GDP figures. Similar to Ederington and Lee (1993) they do not account for the contents of the news but rather on the arrival date of the pre-scheduled news. Uncertainty is registered to increase significantly the days prior to the pre-scheduled release. Once the news' are released, the implied volatility of the India VIX returns to normal levels. Similar results are found in the

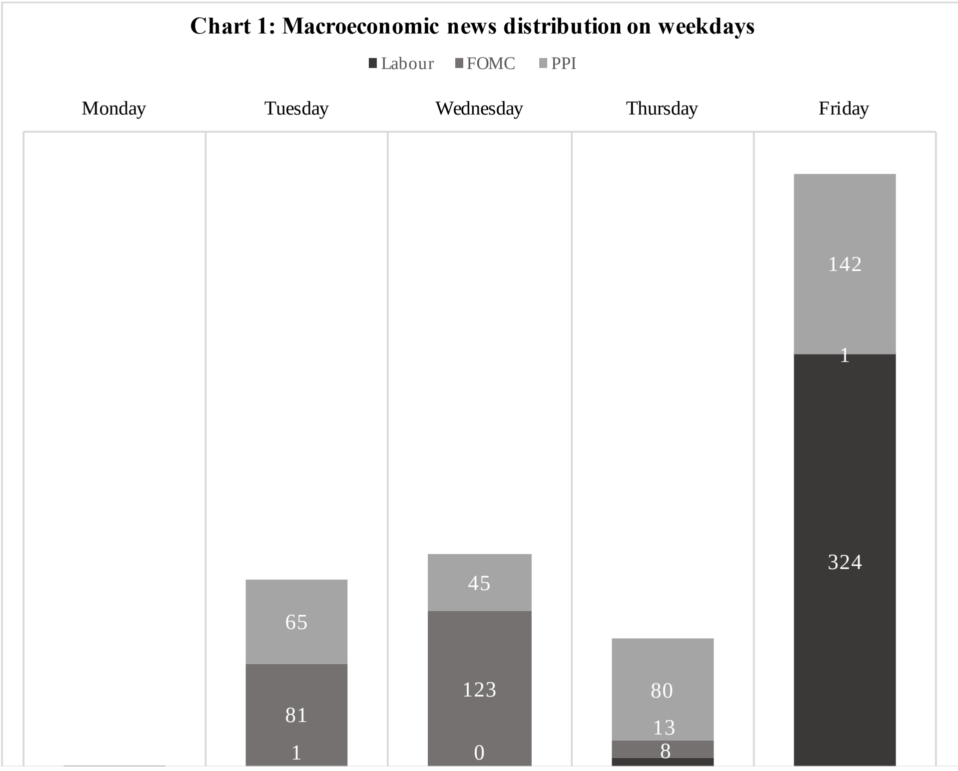
US market by Nikkinen and Sahlström (2001) who examines the behavior of the US VIX around the release of reports on CPI, PPI and employment reports. Both Shaik and Padhi (2013) and Nikkinen and Sahlström (2004) measure the logarithmic changes by using dummy variables that correspond to the different release dates. This methodology enables the authors to investigate the relative importance of the arrival of different macroeconomic news. Our study uses the same methodological approach, but as an extension, we compare the movements of the VIX index with the movements of the stock market using the same macroeconomic announcements for each analysis.

3.0 Data and descriptive statistics

The samples for stock market return and implied volatility are both set to start in 1988. Initially, the sample was set to start in 1986 due to the availability of data on the VIX index. The sample was later adjusted to exclude the 1987 stock market crash, which was anticipated by the options market with VIX values as high as 150 Bates (1991). Our collection of data ends in December 2016 to include the most recent data. Using such a large sample size is crucial, excluding the possibility of obtaining results only from periods of abnormal levels. A sample of 28 years makes sure we not only use data from a time with particularly good or bad economic conditions and good or bad news.

3.1 Macroeconomic news

There are three types of macroeconomic news included in the research. Those are reports on PPI, employment and FOMC interest rates. Earlier studies provided us with the intuition and inspiration for choosing the three news types, and our explanation follow the same arguments as presented in the introduction. The CPI announcements are excluded as the PPI figures are released a few days in advance of CPI. The release of PPI thereby diminishes the effect release of CPI has on the stock market (Wilson and Savor, 2013). All the macroeconomic announcements are collected through reports and are processed manually to correspond to the daily stock market excess return and the VIX index. The PPI and labour reports are obtained from the Bureau of Labor Statistics, whereas the FOMC reports are obtained from the Federal Reserve. Announcements that have not been pre-scheduled, or occurred during non-trading days, are excluded from the sample. The news has been scheduled to be announced roughly once a month, leaving us with 230, 341 and 337 observations of FOMC, PPI and employment releases respectively. Until 1994 the FOMC figures were released one day after the meeting. After this, they released the news the same day. This leaves us with 6409 observations of non-announcement days and 896 announcement days, where 12 days include more than one announcement.



Stock market return has been reported to be affected by the Days-Of-The-Week effect by several studies. Earlier studies, such as Gibbons and Hess (1981) find evidence for the strong and negative mean returns on Mondays. These findings suggest that the systematically different returns during the week may impact how the return varies on announcement days compared to non-announcement days. We have considered the different days of the week in which the news has been released. Only one announcement occurred on a Monday. As opposed to Wilson and Savor (2013), this prohibits us from investigating the hypothesized Monday effect on excess return. Furthermore, we see that a rather large proportion of our announcements occur on a Friday. For instance, almost all of the labour reports were released on Fridays. PPI reports are distributed evenly on the trading days except Mondays, whereas FOMC statements mainly are released on Tuesdays and Wednesdays.

3.2 Stock market excess return

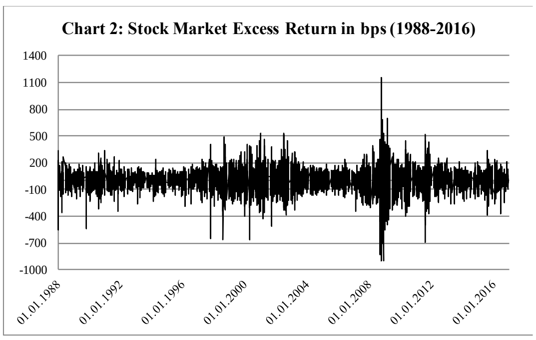
Stock market excess return is calculated as stock market return excess the risk-free rate. For stock return we use the daily value-weighted stock returns including dividends that are obtained from the Center for Research of Security Prices (CRSP) NYSE/Nasdaq/Amex all share index. The daily 30-day Treasury Bill from CRSP is used as the proxy for risk free rate as in Savor and Wilson (2013). Table 1 presents descriptive statistics for daily excess return and the daily risk-free rate:

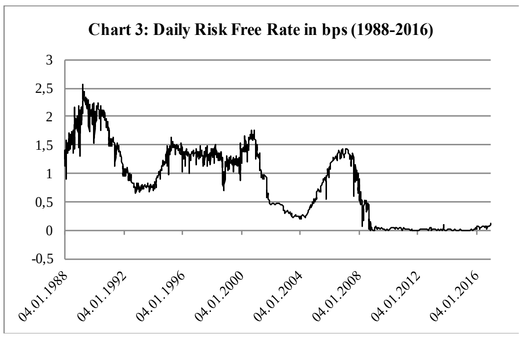
Table 1: Descriptive statistics for Stock Market Excess Return and Risk Free Rate

This table summarizes descriptive statistics for daily stock market excess return and the risk free rate in the period 1988-2016. All numbers are expressed in basis points.

	Panel A: Daily Stock Market Excess return	Panel B: Risk Free Rate
Mean	3.62	0.82
Median	7.27	0.83
Maximum	1148.85	2.57
Minimum	-897.71	0.00
Std.deviation	108.95	0.67
Skewness	-0.20	0.20
Kurtosis	8.85	-1.13
N	7310	7310

The daily stock market excess return has a mean level of 3.62 and reaches its maximum and minimum values during the financial crises in the years between 2007 and 2008. These extreme values result in a high kurtosis, but the sample is only slightly skewed. As seen in chart B, the daily risk-free rate decreased following the financial crisis with values close to zero. As a result, the mean level of the risk-free rate is low for the entire sample.





3.3 Implied volatility

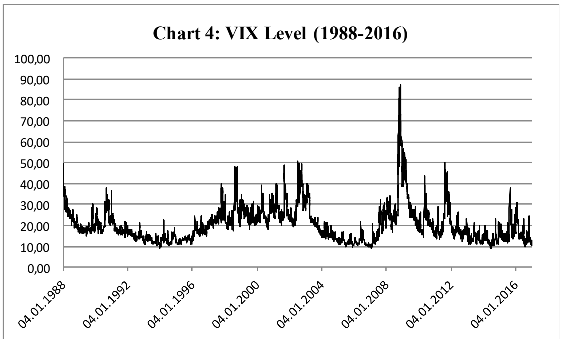
To measure daily implied volatility, we retrieve data from The Chicago Board Options Exchange (CBOE) Volatility Index, hereinafter, VIX. The VIX Index is the systematized implied volatility in the sense that it takes the weighted average of eight OEX option contracts, four puts and four calls. Furthermore, the index uses a variation of the original Black-Scholes formula, the Cox-Ross-Rubinstein binomial framework, which accounts for early exercise and dividends effects during the lifespan of the option. This way, the VIX may serve as a proxy for implied volatility, and functions a good measure for the markets´ expectation. However, despite its upgrade in 2003, which is based on a wider index, the S&P 500, we stick to the original index to include a longer sample. The comparison between the level values and the logarithmic changes are provided in table 2:

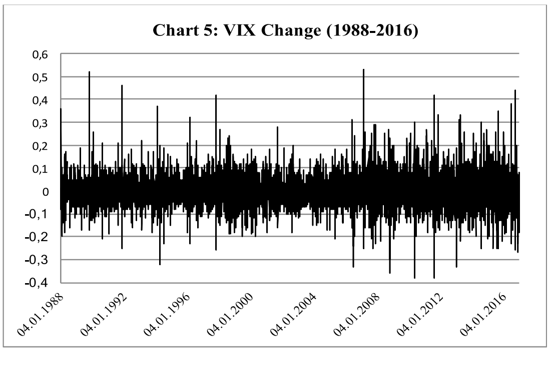
Table 2: Descriptive statistics for Implied Volatility

This table summarizes descriptive statistics for Implied Volatility in the period 1988-2016. Panel A report the level values, and panel B report the change. Change is ln(IV_t/IV_{t-1}), where IVt is implied volatility at day *t*.

	Panel A: Level	Panel B: Change
Mean	20.20	-0.0001
Median	18.13	0.0027
Maximum	87.24	0.53
Minimum	8.24	-0.38
Std.deviation	8.47	0.07
Skewness	1.96	0.58
Kurtosis	6.92	4.48
N	7310	7309

As with stock market excess return, we see that the VIX index reach its maximum level values during the financial crisis. This represent investors´ fear of future stock price fluctuations. In our measurement of implied volatility, we will use the daily logarithmic change to assess how the fear of future volatility changes in the days prior to and after announcement days. The change is slightly positively skewed, and the kurtosis is reduced.





3.4 Construction of MidDay-variable and transformation of the dataset

The dataset for the VIX index is transformed to only measure the days before an announcement conditioned on not having another announcement occurring one or two days before. The same technique is used for the two days following an announcement. When measuring the logarithmic changes of the VIX in the days before and after an announcement, the results are affected by the closely following announcements. Some of the announcements occur consecutively and every other day, and an example has been provided in Table 3:

Table 3: Example of the sample, September 28,1989 - October 17, 1989

This table presents a subsample to illustrate how closely followed news will affect the measurement of the days surrounding the announcements.

09/28/89	09/29/89	10/02/89 Pre FOMC	10/03/89 Pre FOMC	10/04/89 **FOMC**	10/05/89 MidDay	10/06/89 **Labour**
10/09/89 Post Labour	10/10/89 Post Labour	10/11/89 Pre PPI	10/12/89 Pre PPI	10/13/89 **PPI**	10/16/89 Post PPI	10/17/89 Post PPI

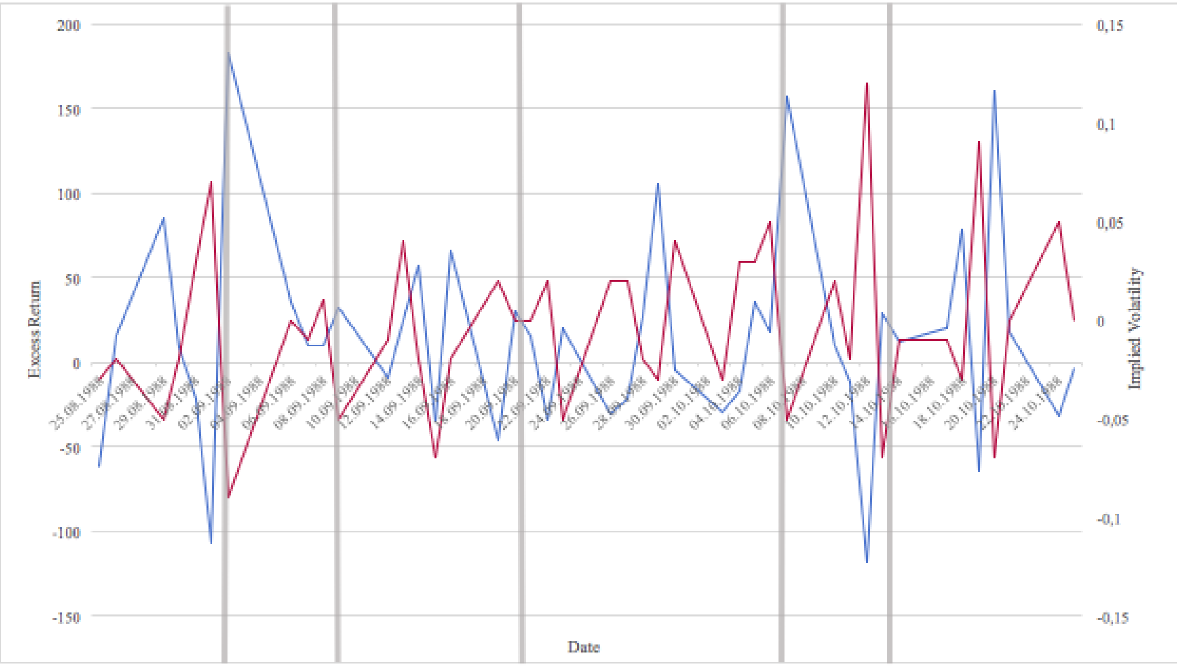
It is expected that the implied volatility will increase before the FOMC, labour - and PPI announcements. However, it is also expected that implied volatility will decrease on the actual announcement dates. The measurement of implied volatility one and two days before the labour announcement would therefore be affected by the FOMC release, and thus biasing the implied volatility downwards. In order to take this into consideration, we have transformed the dataset to only measure the days before an announcement conditioned on not having another announcement occurring one or two days before. The same technique is used for the days following an announcement day. Additionally, we included a dummy variable to account for a day in between of two announcements. This is done in order to check for systematic changes in the middle day. There are 74 observations of the MidDay variable. By using this method, we still have enough observations to present an accurate result. However, the main results are captured both by using this technique and by ignoring this problem.

3.5 Relationship between stock market return and implied volatility

An investigation of a subsample from 25th of August 1988 to 25th of October 1988 illustrates how excess return and implied volatility behave on announcement days. The grey shaded areas indicate 5 announcement days occurring in the subsample. The blue line corresponds to daily stock market excess return, and indicates that the level values are higher on announcement days. The red line corresponds to the logarithmic change of implied volatility and suggests a drop from the day before an announcement.

Chart 6: One-month Subsample for Stock Market Excess Return and Implied Volatility

This chart shows the connection between daily stock market excess return and implied volatility. The blue line correspond to excess return, and the red line correspond to implied volatility. The grey shaded areas denote dates where macroeconomic news are scheduled for release. The subsample runs from 25th of August 1988 - 25th of October 1988



The correlation between daily stock market return and change in implied volatility shows a contemporaneous negative relationship for the whole sample (see appendix 1). Higher (lower) return is associated with optimistic (pessimistic) investors, hence the low VIX levels and high stock market return.

4.0 Empirical Results

The purpose of this thesis is to investigate how investors react and behave when faced with pre-scheduled macroeconomic news announcements. Our main hypotheses are that the stock market return increases on announcement days, and that the implied volatility gradually increases prior to - and drops to normal levels once the news are released. This should be explained by the increased uncertainty on announcement days, and thus we predict the realized volatility to increase accordingly. A more detailed description of our methodology and regressions are given in appendix 2.

4.1 Stock market excess return

4.1.1 Expected stock market excess return

Table 4 presents our main result for expected stock market excess return on announcement days and non-announcement days. The hypothesis is tested by a difference in means analysis. We estimate the t-statistic for difference in means on unpaired daily stock market excess returns, allowing for unequal variances. The daily stock market excess return is on average 11.8 bps on announcement days versus only 2.5 bps on non-announcement days. This gives us a difference of 9.3 bps and a t-statistic equaling 2.41, making the difference significant at a 5% level. This suggests that pre-scheduled macroeconomic news is indeed increasing daily expected stock market excess return.

The standard deviation on announcement days is 113.8 versus 108.2 on non-announcement days, which gives a Sharpe ratio that is about 5 times higher on announcement days. An increasing standard deviation indicates that announcement days are associated with higher risk, which further explains the higher expected stock market excess return. The risk-adjusted return is higher as the investors demand compensation for the increased macroeconomic risk concerning these releases. The stock market return has a negative skewness of -0.54 on announcement days, and -0.15 for non-announcement days. This suggest that the mean on announcement days are less than the mode, due to the long tail in the negative direction. However, the rather small difference in skewness mean that the higher standard deviation and risk premia, also could be explained by the higher exposure to state variable risk on announcement days.

Table 4: T-Statistics for Expected Stock Market Excess Return

This table presents the means of stock market excess returns on announcement days and on non- announcement days with t-statistics. Announcement days are days when PPI numbers, employment numbers and FOMC interest rate decisions are scheduled for release. Market excess return is computed as the difference between the CRSP value-weigthed return and the daily risk-free rate derived from CRSP 30-day Treasury Bills. All numbers are expressed in basis points and numbers in bold are of special interest.

	Announcement	Non-Announcement	Difference
Mean	11.8	2.5	**9.3**
T-statistics	(2.13)	(0.60)	**(2.41)**
1% percentile	-281.5	-315.0	33.5
25% percentile	-38.7	-43.4	4.7
Median	12.0	6.8	5.2
75% percentile	67.0	52.4	14.6
99% percentile	343.9	300.8	43.1
Std.Dev	113.9	108.2	
Skewness	-0.54	-0.15	
Kurtosis	9.99	12.20	
No. of observations	896	6 409	

While this finding suggests that expected stock market excess return increases on days when either of the news is scheduled for release, we have also investigated the mean return for the different news independently. As presented in appendix 3, the release of FOMC interest rates gives the highest expected stock market excess return, with a mean of 26.6. The release of PPI and Labor reports provides means of 4.6 and 7.2 respectively. However, only the FOMC announcements days give a significant difference from non-announcement days. As a result, we have investigated the relative importance further by performing a regression analysis on stock market excess return.

4.1.2 Regression results for stock market excess return

When testing excess return on announcement days, we perform the regressions using Newey West standard errors with 5 lags. Number of lags is decided based on the thumb rule, that for a high number of observations the recommended lag length is 5 (Baum, 2006). However, our results do not change with different specifications. The first, second and third regressions describe how excess return is affected by all scheduled macroeconomic announcements. In the fourth regression, we intend to investigate how the announcements, separated into type of announcement affect excess return.

Table 5: Regression Results of Daily Stock Market Excess Returns

This table presents the OLS-regressions of daily stock market excess return on announcement days, including control variables. The announcement days are dummy variables, equaling 1 if there is an announcement day and 0 on non-announcemet days. All numbers are expressed in basis points.

Coefficient	**(1)**	**(2)**	**(3)**	**(4)**
Intercept	2.500*	0.838	-1.720	0.050
	(0.06)	(0.57)	(0.55)	(0.99)
Ann.Day	9.094**	9.083**	9.799**	
	(0.03)	(0.03)	(0.02)	
Labour				5.406
				(0.44)
PPI				2.193
				(0.33)
FOMC				22.695***
				(0.00)
ERt-1		-0.018	-0.018	-0.019
		(0.36)	(0.92)	(0.34)
$(ERt\text{-}1)^2$		0.00014**	0.00014**	0.00014**
		(0.04)	(0.04)	(0.04)
Monday			0.962	-0.787
			(0.82)	(0.85)
Tuesday			4.632	3.545
			(0.23)	(0.52)
Wednesday			2.485	1.070
			(0.52)	(0.79)
Thursday			4.142	1.590
			(0.27)	(0.69)
No. of observations	7310	7309	7309	7 309
R^2	0.0008	0.0038	0.004	0.0044

****. ** and * indicates significance at the 1%, 5% and 10% level respectively*

From the first regression, we find that on announcement days, daily stock market excess return increases. We obtain a coefficient of 9.094 and a p-value of 0.03. Thus, we may reject the null hypothesis of the insignificance of macroeconomic news on stock market return.

The dependent variable in time series data may often be subject to inertia. We therefore include the variables ER_{t-1} and $(ER_{t-1})^2$ to capture potential dynamics from previous periods. The results from our second regression suggests that some excess return in time t is due to its squared previous return with a p-value of 0.04, making it significant on a 5% level. However, its rather small coefficient shows that it will not have a major impact on the overall return.

Following the third regression, we investigate the Days-Of-The-Week effect. However, none of the days carries significant importance for excess stock market return at any level. The insignificance of the hypothesized Monday effect is explained by the low numbers of announcements on Mondays. Furthermore, Friday is omitted from the result due to collinearity with the dependent variable. The announcement day coefficient is slightly increasing after including the weekdays.

In our fourth and final regression for stock market return, we use a dummy for each type of news to discover which variables that carries the greatest importance for our findings. As indicated in the difference in means analysis, the FOMC releases give higher stock market return. Labor reports and PPI announcements are not significant at any level, while FOMC is significant down to a 1%-level with a coefficient of 22.7. This means that the FOMC interest rate releases carries more information about the future state of the economy for the investors, both in determining the future prospect of employment and different industries. Therefore, it is not surprising that the FOMC interest rate reports have the greatest impact on the stock market. More interesting is the insignificance of labour and PPI reports. This contradicts the findings of Wilson and Savor (2013), who conclude that stock market excess return increases when important macroeconomic news such as FOMC interest rates, PPI and labour reports are scheduled for release.

In addition to investigate how macroeconomic news affect excess return on announcement days, we test how the stock market react to this scheduled news one - and two days before and after the announcements. The results are to be found in appendix 4, and indicates that the stock market is calm the days preceding an announcement. However, these results are not significant, but in accordance with previous literature. For instance, Bomfim (2003) finds significant results for some subsamples that the stock market calms down before pre-scheduled macroeconomic news are released. Similar to us, he fails to get significant results for his entire sample. The only significant result in our sample is that excess return is lower two days before and after the release of the labour reports. Bomfim (2003) presents a possible explanation for the insignificant result. Before 1994, the FOMC statements occurred one day after the decision, creating a one-day lag. After 1994, the statement was released the same day as the meeting and thus Bomfim (2003) capture the calming effect before the FOMC release in the years following the change of practice. However, our subsamples in appendix 8 show no significant calming effect after 1994. The insignificant results rather indicate a drift from two days before the FOMC announcements.

4.1.2 Risk free rate

Our intuition is that the increased risk on announcement days should lead to reduced risk-free rate, due to the increased saving by risk-averse investors in uncertain economic states. The difference in risk free rate on announcement days and non-announcement days are provided in table 6:

Table 6: Summary statistics for 30-day T-bill returns

This table summarizes the descriptive statistics for 30-day T-bill returns on announcement days and non-announcement days. Panel A includes all observations, and panel B exclude outliers. All numbers are expressed in basis points.

	Panel A: All observations			**Panel B: Excluding ouliers (1% and 99%)**		
	Announcement	Non-announcement	Difference	Announcement	Non-Announcement	Difference
Mean	0.8187	0.8223	-0.0036	0.8085	0.8049	0.0036
	(0.14)	(0.04)	**(0.15)**	(0.15)	(0.04)	**(0.17)**
Std.deviation	0.7	0.7		0.7	0.6	
Skewness	0.2	0.2		0.1	0.1	
Kurtosis	1.8	1.9		1.7	1.7	
N	896	6409		889	6144	

The risk-free rate is approximately equal on announcement days and non-announcement days, also after excluding outliers. This is due to the decreasing level values of the risk-free rate for the whole sample. We are therefore unable to capture the savings effect, which was captured in Wilson and Savor (2013).

4.1.3 Realized volatility

As the different news is associated with different levels of increasing stock market return, we further evaluate the difference in realized volatility on announcement days. As indicated in the difference in means analysis, the standard deviation increases on the days when either of the news are released. By doing a variance comparison test, we find that this increase is significant at a 5%-level. This suggests that announcement days are fundamentally riskier than other days, and the results are presented in table 7:

Table 7: Realized volatility of Daily Stock Market Excess Return

This table presents the Standard Deviation and Barlett´s F-statistics. All numbers are expressed in basis points.

Coefficient	**Standard Deviation**	**F-statistics**
Non announcement	108.2	
All Announcements	113.9	1.1**
Labour Announcements	115.3	1.14**
PPI Announcements	116.0	1.15**
FOMC Announcements	104.9	0.95

*Note: ***,**,* indicate significance at a 1%, 5% and 10% level*

However, after separating the announcement days by news type, we find that not all announcement days are associated with higher risk. Only on days where PPI figures and labour reports are scheduled for release, the realized volatility increases. The standard deviations are 116.0 and 115.3, respectively, and the difference from non-announcement days are significant at a 5%-level. On days where FOMC decisions are released, the standard deviation decreases to 104.9. The difference between realized volatility on FOMC announcement days and non-announcement days are not significant at any level. This indicates that on days when FOMC interest rates are released, the uncertainty is unchanged regardless of the content. The results for all announcements combined and labour reports are robust for non-normality and are found in appendix 5.

4.2 Implied volatility

Our study of implied volatility is tested using ARCH- and GARCH fitted models. We initially expect the implied volatility to decrease on announcement days and the results are presented in Table 8.

From the first regression, it is clear that the volatility behaves as expected and drops significantly on all types of news releases. The FOMC-, labour- and PPI announcements are significant at a 1% - 5% and 10%-level, respectively.

Following our second regression, in which variables for one - and two days before and after the release of macroeconomic news are included, we obtain mixed results. From a theoretical view, we expect the VIX index to gradually increase the days preceding the announcement days. This prediction is only true for the PPI reports. As opposed to Nikkinen and Sahlström, who only get a significant increase one day before the PPI announcement, we obtain significant results both one and two days before. This could be explained by our dataset, which contains 23 more years than their sample. Ahead of the release of labour reports, the VIX index seems to be experiencing a jump one day before, which is significant at all levels. The intuition is that the uncertainty associated with the macroeconomic news is reflected in the market's expectations of the average stock return volatility over the remaining time of the option contract. The change in implied volatility suggest that investors adjust their views on uncertainty the day before the announcement day, and absorb the full effect once the news are released. FOMC statements do not affect the VIX index significantly neither one - or two days before its release. This is consistent with the findings of Nikkinen and Sahlström (2004). However, they do not explain the insignificant result as a result of the unchanged realized volatility on FOMC announcement days.

Table 8: Regression Results for Implied Volatility

This table presents the Arch- and Garch fitted models for implied volatility. Implied volatility is defined as the logarithmic daily change of the VIX index. The first regression includes the announcement days for Labour reports, PPI numbers and FOMC interest rates decisions. The second regression includes dummy variables for two days before and after the announcements and a MidDay control variable. The third regression includes control variabels for weekdays.

Coefficient	(1)	(2)	(3)
Intercept	0.002**	0.000	-0.006***
	(0.03)	(0.76)	(0.00)
LabourDummy	-0.022***	-0.022***	-0.018***
	(0.00)	(0.00)	(0.00)
PPIDummy	-0.005*	-0.005	-0.004
	(0.10)	(0.15)	(0.21)
FOMCDummy	-0.019***	-0.017***	-0.021***
	(0.00)	(0.00)	(0.00)
AR(1)	-0.087***	-0.088***	-0.087***
	(0.00)	(0.00)	(0.00)
ARCH(1)	0.184***	0.196***	0.204***
	(0.00)	(0.00)	(0.00)
GARCH(1)	0.642***	0.614***	0.592***
	(0.00)	(0.00)	(0.00)
LabourDummy(-2)		-0.0004	-0.005
		(0.93)	(0.26)
LabourDummy(-1)		0.024***	0.023***
		(0.00)	(0.00)
LabourDummy(+1)		-0.005	0.0005
		(0.19)	(0.89)
LabourDummy(+2)		0.005	0.002
		(0.23)	(0.66)
PPIDummy(-2)		0.006*	0.005
		(0.08)	(0.18)
PPIDummy(-1)		0.009**	0.008**
		(0.03)	(0.05)
PPIDummy(+1)		0.002	0.004
		(0.49)	(0.21)
PPIDummy(+2)		-0.008**	-0.008**
		(0.04)	(0.04)
FOMCDummy(-2)		-0.006	-0.002
		(0.19)	(0.62)
FOMCDummy(-1)		0.0007	0.0005
		(0.90)	(0.92)
FOMCDummy(+1)		0.0002	-0.002
		(0.95)	(0.57)
FOMCDummy(+2)		-0.004	-0.003
		(0.41)	(0.60)
MidDay		0.008	0.010
		(0.18)	(0.12)
Tuesday			0.009***
			(0.00)
Wedensday			0.011***
			(0.00)
Thursday			0.007***
			(0.01)
Friday			0.002
			(0.42)
F-Statistics	16.96	8.80	7.54
Prob.of F-Stat.	0.00	0.00	0.00
R^2	0.007	0.012	0.014
No. of observations	7310	7309	7309

****, ** and * indicates significance at the 1%, 5% and 10% level respectively*

Including the dummy variables for one - and two days after the news releases provide us neither with significant results nor any pattern explaining the behavior of the VIX. Additionally, PPI reports are often released a few days before the CPI reports. This might affect our results from the VIX index after a PPI release, as the CPI announcements are not included in our sample.

In the third regression, we have included the constructed MidDay variable as well as weekday dummy variables. The results from regression one and two are not greatly affected by including these. Furthermore, Tuesday, Wednesday and Thursday are significant, but only slightly positive. Among the macroeconomic news, the release of Labor reports had the greatest impact on implied volatility. This finding is similar to the one of Nikkinen and Sahlstrøm (2001). However, after controlling for weekdays the impact of the FOMC interest rate release is slightly larger than the Labor report release. This is because almost all of the Labor reports were released on Fridays, and thus the inclusion of the weekdays changes the coefficients.

4.3 Robustness tests - Exclusion of outliers and subsamples

4.3.1 Exclusion of outliers

The significance of the macroeconomic announcements on stock market excess return, have been controlled by excluding observations outside the 1st and 99th percentile. As presented in appendix 6, we find that the return is still significantly higher on announcement days. However, in contrast to Wilson and Savor (2013), the return decreases after excluding the outliers. Also, we find that FOMC interest rate decisions still explain most of the movements in stock market excess return on announcement days. However, the regression coefficient is reduced from 22.7 to 17.1, with the new result being significant at a 1%-level. Neither the labour announcements nor the PPI announcements result in significantly higher stock market return. The decreasing significance of the FOMC decisions after excluding outliers are in accordance with previous literature. Bernanke and Kuttner (2005) measures the impact of changes in the Fed Funds rate on the equity market, and they too find their results to be sensitive to outliers. A possible explanation to this result might be the investors´ altered expectations when presented with surprising news about the interest rate. Bernanke and Kuttner (2005) believes the investors´ expectations of future return and dividends are correlated with the interest rate decisions. Thus, the stock market return will be vulnerable to FOMC statements, and hence investors might overreact.

4.3.2 Subsamples

To serve as a second robustness check for our findings, we divide our sample into four subsamples (see appendix 7-9). This is done in order to investigate if our main results hold for all subsamples, or if different economic conditions affect our findings.

As presented in appendix 7, three out of four time periods have higher expected stock market excess return on announcement days than non-announcement days. The deviation is the first six years of our sample, 1988 - 1994, where the expected stock market excess return decreases on announcement days. During these years, the economy of the US was in a state of recession in the time of July 1990 - March 1991. An explanation to the decrease is that investors possibly expect to learn bad news about an economy already being in a bad state and good news about an economy already being in a good state. Following the recession in the early 1990s a shift in the US economy occurs. In the following sub sample of 1995 - 2001, the expected stock market excess return is 26.43bps on announcement days, and 1.69 on non-announcement days. In the late 1990s the US´ economy was no longer in a recession, on the contrary, it was characterized by growth in GDB and healthy employment figures much due to the improvement of IT production and equipment. This sub sample is also the only subsample where the difference in excess return on announcement and non-announcement days are significant.

From the regression of stock market excess return presented in appendix 8, we see that on labour announcement days, only the 1995-2001 subsample is positive and significant. The PPI announcement days are positive for the same subsample, but not significant. The FOMC announcement days are positive and significant in two out of four subsamples.

The subsamples of the VIX index (appendix 9), show that the implied volatility significantly drops on labour announcement days in period 1995-2001 and 2009-

2016. The jump one day before the labour announcements is significant in 1988-1994 and in 2002-2008. No significant jumps in the VIX are found before the FOMC statements, which is consistent with the results for the whole sample. On the actual FOMC announcement day, the implied volatility decreases for all subsamples, but only the period of 2009-2016 is significant. The days post the release of FOMC statements have varying results. In 1988 - 1994, the VIX significantly drops on the day after the FOMC statements, while it in 2009 - 2016 increases towards the levels as to before the announcement. The release of PPI reports has no consistent impact throughout the sample. In the first and last subsample, the VIX are not even decreasing on the announcement day and the only significant results are found in 1995 - 2001 when the VIX increases on day before - and after its release.

Investigating each subsample show varying results. The deviations could possibly be explained by the different economic states in each subsample and further the investors´ expectations. However, our results are mainly robust and supports our hypothesis of increasing stock market return and decreasing implied volatility on announcement days.

5.0 Conclusion

We study how investors react when faced with macroeconomic announcements on labour, PPI and FOMC decisions. An analysis of this news is important to demonstrate the trade-off between risk and return and their relative importance for the investors. We expect the macroeconomic risk concerning the announcements to be reflected by increased stock market return on announcement days. Furthermore, the VIX index is expected to gradually increase prior to the announcements, and drop to normal levels once the contents of the reports are known.

Our study provides empirical support for our beliefs, the investors are indeed accounting for and adjusting their behavior towards the release of this news. On days when PPI- and labour– and FOMC statements are scheduled for release the daily stock market excess return is 11.8 bps, while only 2.5 bps for non-announcement days. However, after separating the announcements by news type, the FOMC statements seems to carry greater importance for the investors. Labour and PPI reports are not significant on either level. As opposed to the other news types, FOMC announcement days are not associated with higher risk. This is further reflected in the VIX index where the hypothesized increase prior to the announcements is non-existing. On the other hand, the VIX is gradually increasing before the PPI announcements while ahead of the labour reports, the VIX experiences a jump one day before its release. Consistent with initial hypotheses, all news types are significantly decreasing the VIX index on the actual announcement days.

Our results are in accordance with existing literature on the subject, and this study can therefore serve as a robustness check. By including the actual contents of the news and acknowledging different economic conditions, our study could possibly be enhanced by providing a deeper understanding of how expectations affect investors´ behavior.

References

Bates, D. S. (1991). The Crach of '87: Was it Expected? The Evidence from Options Markets. *The Journal of Finance*.

Baum, C. F. (2006). An introduction to Modern Econometrics using Stata. *Stata Press books*.

Beaver, W. H. (1968). The Information Content of Annual Earnings Announcements . *Journal of Accounting Research*, ss. 67-92.

Bernanke, B. S., & Kuttner, K. (2005, May). What Explains the Stock Market's Reaction to Federal Reserve Policy? *The Journal of Finance*.

Black, F., & Scholes, M. (1973). The Pricing of Options and Corporate Liabilities. *Journal of Political Economy*, ss. 637-54.

Bollerslev, T., Andersen, T., Diebold, F., & Vega, C. (2007). Real-time price discovery in global stock, bond and foreign exchange markets. *Journal of International Economics* , ss. 251-277.

Bomfim, A. N. (2003). Pre-announcement effects, news effects, and volatility: Monetary policy and the stock market. *Journal of Banking & Finance*, ss. 133-151.

Ederington, L. H., & Lee, J. (1993, September). How Markets Process Information: News Releases and Volatility. *The Journal of Finance*.

Gibbons, M. R., & Hess, P. (1981). Day og the Week Effects and Assets Returns. *The Journal of Business*, ss. 579-96.

Heynen, R., Kemna, A., & Vorst, T. (1994). Analysis of the Term Structure of Implied Volatilities. *Journal of Financial and Quantitative Analysis*, ss. 31-56.

Kim, S.-J., McKenzie, M., & Faff, R. (2004, July). Macroeconomic news announcements and the role of expectations: evidence for US bond, stock and foreign exchange markets. *Journal of Multinational Financial Management*.

Knight, F. H. (1921). *Risk, Uncertainty and Profit.* New York: Augustus M. Kelly, Bookseller.

Nikkinen, J., & Sahlstrom, P. (2001). Impact of Scheduled U.S. Macroeconomic News on Stock MArket Uncertainty: A Multinational Perspective. *Multinational Finance Journal*.

Nikkinen, J., & Sahlstrom, P. (2004). Impact of the federal open market committee's meetings and scheduled macroeconomic news on stock market uncertainty. *International Review of Financial Analysis*.

Shaikh, I., & Padhi, P. (2013). The Information Content of Implied Volatility Index (India VIX). *Global Business Perspectives*, ss. 359-378.

Wilson, M., & Savor, P. (2013, April). How Much Do Investors Care About Macroeconomic Risk? Evidence From Scheduled Economic Announcements. *The Journal of Financial and Quantitative Analysis*.

Appendix

Appendix 1: Correlation between Stock Market Excess Return and Implied Volatility

Table A: Correlation between Stock Marked Excess return and Implied Volatility

This table presents the correlation between daily stock market excess return and implied volatility on announcement days and non-announcement days.

Non-Announcement	All Announcement days	FOMC Announce	Labour Announce	PPI Announce
-0.722	-0.749	-0.715	-0.794	-0.794

Appendix 2: Methodology and Regressions

We will in the coming sections describe our hypotheses and methods for the investigation of daily stock market excess return and implied volatility around pre-scheduled macroeconomic news announcements. Announcement days are those days where PPI, FOMC interest rates and Labor reports are scheduled for release.

2.1 Stock Market Excess return

The hypothesis is tested with both a difference in means test and regressions using Newey West standard errors with 5 lags. Newey West is used due to its ability to handle heteroscedasticity and possibly autocorrelation up to some lag. We find, after inspecting the scatter plot and performing the Breusch-Pagan test for heteroscedasticity, that we can reject the null hypothesis of constant variance. In addition, after performing a test for higher-order serial correlation in the disturbances, the Breusch-Godfrey test indicates first order autocorrelation. Number of lags is decided based on the thumb rule, that for a high number of observations the recommended lag length is 5 (F, Baum, 2006). However, our results do not change with different specifications. Our regression models when estimating excess return on announcement dates are as listed below:

1) $ER = \alpha + \beta 1 Ann + \varepsilon$
2) $ER = \alpha + \beta 1 Ann + \beta 2 ER_{t-1} + \beta 3 (ER_{t-1})^2 + \varepsilon$
3) $ER = \alpha + \beta 1 Ann + \beta 2 ER_{t-1} + \beta 3 (ER_{t-1})^2 + \beta 4 Labor + \beta 5 PPI + \beta 6 FOMC + \varepsilon$

4) $ER = \alpha + \beta 1Ann + \beta 2ER_{t-1} + \beta 3(ER_{t-1})^2 + \beta 4Monday + \beta 5Tuesday + \beta 6Wednesday + \beta 7Thursday + \beta 8Friday + \varepsilon$

Regression (1) describes how excess return is affected by scheduled macroeconomic announcements. The dependent variable ER is daily excess return, which is calculated as the difference between the daily value weighted stock returns including dividends and the risk-free rate. *Ann* denotes the dummy variable equaling 1 if any of the reports are released that day. α equal the excess return in case of a non-announcement day. A $\beta 1Ann$ > 0 indicates that excess return increases on an announcement day.

Regressions (2 and 3) include lags and control variables. Due to inertia of the dependent variable, an announcement might not immediately affect the dependent variable. Thus, the lagged variables are included to capture potential important dynamics of the structure of the dependent variable (Chris Brooks, Intro, page. 154). t denotes the announcement date. The variable $\beta 2ER_{t-1}$ is the excess return previous day, and $\beta 3(ER_{t-1})^2$ is the squared excess return previous day. In regression 3, we include dummy variables corresponding to each day of the week. This is done in order to check for systematic variance in excess return throughout the week.

Finally, in regression (4), we intend to investigate how the announcements, separated into type of announcement, affect excess return. The release of the three types of macroeconomic news are hypothesized as having a significant effect on excess return. As in regression (2) and (3), we include lags and control variables.

2.2 Implied volatility Regressions - ARCH/GARCH

For implied volatility, we modify the dependent variable to the logarithmic daily change of the VIX index. When plotting the level values of the VIX index, we see a tendency of seasonality which is consistent with theory. This is confirmed after performing an autocorrelation test, and hence we mitigate this problem by taking the first difference in logarithms. After plotting the difference in logarithms, we see some indications of volatility clustering, where we have periods of higher variance and periods of lower variance. This is a common observation of financial time series. The clustering volatility might suggest that the residual is conditionally heteroscedastic. The ARCH and GARCH models may therefore be a good choice for this particular regression. The Weisberg/Breusch-Pagan test for heteroscedasticity gives a p-value of 0.019, and we can reject the null hypothesis of constant variance. Thereafter, we use the Breusch-Godfrey test to check for autocorrelation in the disturbance term. The test indicates that first order autocorrelation is present, and thus we add an AR (1) term to the model. The p-value equals 0.00, and hence we can reject the null hypothesis of no serial autocorrelation.

ARCH models estimate future volatility as a function of prior volatility. To accomplish this, ARCH fits models of autoregressive conditional heteroscedasticity. We test ARCH effects by using Engle´s Lagrange multiplier test. Because the Lagrange Multiplier test shows a p-value of 0.000, which is well below 0.05, we reject the null hypothesis of no ARCH (1) effects. Thus we can further estimate the ARCH (1) parameter by specifying ARCH (1). The first-order generalized ARCH model (GARCH, Bollerslev 1986) is the most commonly used specification for the conditional variance in empirical work and is typically written GARCH (1, 1). GARCH models provide approximate descriptions of conditional volatility for a wide range of volatility processes, and the LM test shows that the GARCH (1,1) specification is adequate.

The following regression denotes the basic structure for the measure of implied volatility:

$$\ln\left(\frac{IV_t}{IV_{t-1}}\right) = \alpha + \beta 1 LabourDummy_t + \beta 2 PPIDummy_t + \beta 3 FOMCDummy_t + \varepsilon$$

The dependent variable is the logarithmic change of implied volatility between the announcement day and the trading day before. The independent variables are dummy variables for each type of macroeconomic news equaling 1 should its corresponding type of news occur. LabourDummy, PPIDummy and FOMCDummy are the dummy variables for announcements at time t. We expect the volatility to drop once the news are released, and increase when there are no announcements present. The null hypothesis is therefore that including the dummy variable of a macroeconomic news release will have no effect on implied volatility, while we are looking for negative coefficients for each type of news. Furthermore, $\alpha > 0$ indicates that the implied volatility increases given a dummy value of 0 and no present announcements. Additionally, we have included three more regressions including the days surrounding and weekday dummies.

Appendix 3: T-statistics for expected stock market excess return by announcement type

Table B: T-Statistics for Expected Stock Market Excess Return by News type

This table presents the means of stock market excess returns on announcement days and on non-announcement days with t-statistics. Each columumn present the mean on announcement days and the difference between the announcement day and non announcement days. Excess return is computed as the difference between the CRSP value-weigthed return and the risk-free rate derived from CRSP 30-day Treasury Bills. All numbers are expressed in basis points and numbers in bold are of special interest.

	Non-announce	FOMC Ann	FOMC Diff	PPI Ann	PPI Diff	Labour Ann	Labour Diff
Mean	2.5	26.6	**24.1**	4.6	**2.1**	7.2	**4.7**
T-statistics	[0.60]	[3.17]	**[3.32]**	[0.15]	**[0.32]**	[0.56]	**[0.73]**
1% percentile	-315.0	-232.1	82.9	-257.8	57.2	-290.5	24.5
25% percentile	-43.4	-29.3	14.1	-44.8	-1.4	-47.3	-3.9
Median	6.8	16.4	9.6	10.3	3.5	9.8	3.0
75% percentile	52.4	78.8	26.4	55.9	3.5	69.4	17.0
99% percentile	300.8	337.8	37.0	367.5	66.7	289.7	-11.1
Skewness	-0.15	0.82		-1.38		-0.46	
Kurtosis	12.20	7.04		15.75		5.2	
N	6409	230		341		337	

Appendix 4: Stock Market Excess Return on the days surrounding the macroeconomic announcements

Table C: Regression Results of Daily Stock Market Excess Returns

This table presents the OLS-regressions of daily stock market excess return on announcement days and the days surrounding. All numbers are expressed in basis points.

Coefficient	Estimate	P-value
Intercept	2.1	0.24
LabourDumn	**11.8**	**0.04**
LabourDummy(-1)	-8.2	0.19
LabourDummy	3.6	0.58
LabourDummy(+1)	-3.4	0.57
LabourDummy(+2)	**-12.8**	**0.05**
PPIDummy(-2)	-4.9	0.48
PPIDummy(-1)	-7.3	0.20
PPIDummy	1.5	0.82
PPIDummy(+1)	2.6	0.69
PPIDummy(+2)	0.1	0.99
FOMCDummy(-2)	-4.5	0.47
FOMCDummy(-1)	11.01	0.2
FOMCDummy	**22.5**	**0.002**
FOMCDummy(+1)	-1.1	0.90
FOMCDummy(+2)	1.7	0.80
ER_{-1}	-0.02	0.33
$(ER_{-1})^2$	**0.00014**	**0.038**
N	7309	
R-squared	0.0065	

Note: Estimates that are significant at a five percent level are given in boldface. P-vaules are given brackets.

Appendix 5: Realized Volatility robust for non-normality

Table D: Realized volatility of Daily Stock Market Excess Return

This table presents the Standard Deviation and Brown and Forsythe alternative formualtion of Levene´s test statistic. All numbers are expressed in basis points.

Coefficient	Standard Deviation	F-statistics
Non announcement	108.2	
All Announcements	113.9	5.09**
Labour Announcements	115.3	5.59**
PPI Announcements	116.0	0.53
FOMC Announcements	104.9	0.25

*Note: ***,**,* indicate significance at a 1%, 5% and 10% level*

Appendix 6: Daily stock market Excess Return Excluding Outliers (1% and 99%)

Table E: Regression Results of Daily Stock Market Excess Returns (Ex. outliers 1% and 99%)

This table presents the OLS-regressions of daily stock market excess return on announcement days, including control variables. The announcement days are dummy variables, equaling 1 if there is an announcement day and 0 on non-announcemet days. All numbers are expressed in basis points.

Coefficient	**(1)**	**(2)**	**(3)**	**(4)**
Intercept	3.133***	1.999	0.607	1.784
	(0.004)	(0.101)	(0.815)	(0.51)
Ann.Day	6.067*	6.131*	6.723*	
	(0.075)	(0.072)	(0.057)	
Labour				4.160
				(0.513)
PPI				0.627
				(0.90)
FOMC				17.11***
				(0.008)
ERt-1		0.023*	0.023	0.023*
		(0.063)	(0.063)	(0.07)
$(ERt-1)^2$		0.00013	0.00012	0.0001
		(0.139)	(0.139)	(0.138)
Monday			2.01	0.837
			(0.563)	(0.82)
Tuesday			0.691	-0,77
			(0.838)	(0.82)
Wednesday			0.840	-0,08
			(0.80)	(0.98)
Thursday			3.069	1.23
			(0.35)	(0.72)
No. of observations	7 164	7 163	7 163	7 163
R^2	0.0005	0.0014	0.0015	0.0021

****. ** and * indicates significance at the 1%, 5% and 10% level respectively*

Appendix 7: Expected Stock Market Excess Return Subsamples

Table F: Stock market excess return - subsamples

This table presents how stock market excess return differs on announcement days and non-announcement days when our sample is divided in four subsamples

	Announcement	Non-announce	Difference
1988-2016	11.84	2.50	9.34
			[2.31]
1988-1994	-1.10	4.18	-5.28
			[-0.80]
1995-2001	26.43	1.69	24.47
			[2.88]
2002-2008	8.33	-1.04	9.37
			[0.99]
2009-2016	13.32	4.82	8.5
			[1.15]

Appendix 8: Stock Market Excess Return Regressions – Subsamples

Table E: Regression Results of Daily Stock Market Excess Returns for each Subsample

This table presents the regression results of the daily stock market excess return for four subsamples. (-1) indicates one day prior to the corresponding news release, (+1) indicates one day post the release and so forth. All numbers are expressed in basis points.

Coefficient	**1988 - 1994**	**1995 - 2001**	**2002 - 2008**	**2009 - 2016**
Intercept	2.593	-1.443	-3.340	6.610*
	(0.280)	(0.729)	(0.434)	(0.074)
LabourDummy	-12.500	32.688**	-4.280	-0.140*
	(0.238)	(0.035)	(0.753)	(0.099)
LabourDummy(-1)	-23.020***	5.644	-17.480	-10.202
	(0.000)	(0.702)	(0.253)	(0.470)
LabourDummy(-2)	1.281	16.244	18.580	15.791
	(0.858)	(0.265)	(0.185)	(0.229)
LabourDummy(+1)	-0.941	7.394	-0.130	-11.567
	(0.908)	(0.548)	(0.538)	(0.389)
LabourDummy(+2)	-15.644**	-21.322*	-28.316*	5.130
	(0.045)	(0.083)	(0.058)	(0.708)
PPIDummy	-1.033	19.440	-5.611	-3.368
	(0.929)	(0.160)	(0.731)	(0.746)
PPIDummy(-1)	0.062	-17.891	-8.014	0.215
	(0.929)	(0.154)	(0.572)	(0.986)
PPIDummy(-2)	4.932	-10.294	6.700	-11.814
	(0.579)	(0.431)	(0.742)	(0.647)
PPIDummy(+1)	0.007	-13.181	3.842	-2.592
	(0.999)	(0.238)	(0.814)	(0.823)
PPIDummy(+2)	-12.434	13.510	6.445	-6.041
	(0.135)	(0.254)	(0.717)	(0.647)
FOMCDummy	1.403	21.780	40.990**	26.853*
	(0.889)	(0.101)	(0.013)	(0.090)
FOMCDummy(-1)	13.109	22.231*	34.290	2.169
	(0.177)	(0.091)	(0.256)	(0.875)
FOMCDummy(-2)	-0.270	-1.572	12.000	-16,214
	(0.980)	(0.912)	(0.514)	(0.180)
FOMCDummy(+1)	4.590	7.370	15.770	-32.500*
	(0.652)	(0.650)	(0.441)	(0.078)
FOMCDummy(+2)	-0.988	-7.162	15.702	-3.913
	(0.917)	(0.587)	(0.304)	(0.0776)
ER_{t-1}	0.114***	0.054*	-0.081**	-0.054
	(0.000)	(0.059)	(0.049)	(0.124)
$(ER_{t-1})^2$	0.000***	0.000*	0.000	0.000
	(0.000)	(0.078)	(0.185)	(0.456)
R-squared	0.03	0.02	0.02	0.01
N	1769	1762	1762	2013

***. ** and * indicates significance at the 1%, 5% and 10% level respectively

Appendix 9: Implied Volatility Subsamples

Table H: Regression results of implied volatility for each subsample

This table presents the regression results of the daily change in the VIX from subsamples of 6 years from 1988 - 2016.(-1) indicates one day prior to the corresponding news release, (+1) indicates one day post the release and so forth. All numbers are expressed in basis points.

Coefficient	1988 - 1994	1995 - 2001	2002 - 2008	2009 - 2016
Constant	0.000	0.000	0.000	-0.001
	(0.921)	(0.651)	(0.894)	(0.784)
LabourDummy	-0.014*	-0.038***	-0.007	-0.029***
	(0.067)	(0.000)	(0.276)	(0.000)
LabourDummy(-1)	0.033***	0.016*	0.024***	0.016*
	(0.000)	(0.052)	(0.004)	(0.064)
LabourDummy(-2)	0.008	-0.000	-0.003	-0.002
	(0.410)	(0.993)	(0.703)	(0.849)
LabourDummy(+1)	-0.009	0.003	-0.004	-0.009
	(0.196)	(0.710)	(0.661)	(0.214)
LabourDummy(+2)	0.006	0.001	0.011	0.005
	(0.502)	(0.897)	(0.118)	(0.537)
PPIDummy	0.006	-0.010	-0.011	0.002
	(0.282)	(0.192)	(0.178)	(0.799)
PPIDummy(-1)	0.004	0.020***	0.002	0.008
	(0.645)	(0.005)	(0.797)	(0.421)
PPIDummy(-2)	0.004	0.010	0.001	0.009
	(0.587)	(0.216)	(0.825)	(0.263)
PPIDummy(+1)	-0.008	0.016***	-0.003	-0.003
	(0.231)	(0.007)	(0.654)	(0.687)
PPIDummy(+2)	-0.006	-0.009	-0.005	-0.012
	(0.276)	(0.250)	(0.486)	(0.158)
FOMCDummy	-0.010	-0.021*	-0.016*	-0.025***
	(0.265)	(0.076)	(0.094)	(0.009)
FOMCDummy(-1)	-0.000	0.001	-0.011	0.011
	(0.980)	(0.923)	(0.292)	(0.310)
FOMCDummy(-2)	0.004	0.001	-0.024**	-0.009
	(0.600)	(0.926)	(0.038)	(0.407)
FOMCDummy(+1)	-0.017**	-0.006	0.004	0.029***
	(0.027)	(0.454)	(0.594)	(0.000)
FOMCDummy(+2)	0.000	0.003	-0.012	-0.005
	(0.938)	(0.755)	(0.181)	(0.594)
AR(1)	-0.05	-0.82**	-0.13***	-0.82**
	(0.136)	(0.016)	(0.000)	(0.011)
ARCH(1)	0.16***	0.15***	0.115***	0.218***
	(0.000)	(0.000)	(0.000)	(0.000)
GARCH(1)	0.05	0.78***	1.21***	0.670***
	(0.643)	(0.000)	(0.000)	(0.000)
F-stat	3.12	4.34	1.68	2.17
F-prob	0.001	0.00	0.05	0.006
N	1769	1762	1762	2014

****. ** and * indicates significance at the 1%, 5% and 10% level respectively*