# The Impact of Macroeconomic Announcements on Corporate Bond Spreads

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**Abstract**

This paper examines the impact of macroeconomic announcements on the reaction and volatility of corporate bond spreads, and whether the effect depends on the stage of the economic cycle or varies across periods of unconventional monetary policy. By estimating the effect of ten widely followed macroeconomic indicators on the daily percentage change of various U.S corporate bond spreads several results emerge. First, negative macroeconomic surprises tend to have a negative effect on spreads (i.e spreads increase) while positive surprises lead to a decrease in spreads. Second, the reaction of credit bond spreads towards macroeconomic announcements varies across the business cycle where in expansion periods, spreads tend to be less responsive to macroeconomic news. Third, the sensitivity of credit bond spreads towards macroeconomic announcements increases during periods of unconventional monetary policy. Fourth, although it is found that volatility of corporate spreads increases on announcement days, estimates indicate that the Zero Lower Bound policy had a dampening effect on conditional volatility.

# 1 Introduction

Anectodotical press stories tend to confirm the common notion that daily fluctuations in financial markets are significantly affected by macroeconomic announcements, such as unemployment reports, consumer confidence data and changes in monetary policy among others. At the same time, existing academic studies show ample evidence that bond and stock prices respond to news bundled in macroeconomic data. For example, Balduzzi et al. (2001), Andersen et al. (2007) and Faust et al. (2007) argue that bond and foreign exchange prices react to news on economic sentiment, inflation, output and housing. Most of the work related to the impact of macroeconomic announcements on different financial markets has mainly focused on stocks, government bonds and in some cases exchange rates and commodities. However, very few have examined the impact of incoming economic data on corporate bond spreads and the small number of studies that do exist, tend to focus on emerging market sovereign spreads or have not yet incorporated the time varying nature of the effect of incoming news on asset prices.

This paper studies the impact of macroeconomic announcements on corporate bond spreads and allows the responses to vary with the business cycle and the so called "Zero Lower Bound" (ZLB) policy implemented by the Fed, thus extending the literature by incorporating the time varying characteristics of the effects of new information. Scheduled macroeconomic news contain information about upcoming interest rates and corporate earnings growth, thus influencing market perceptions about the future financial soundness and performance of the corporate sector. Consequently, considering the fact that such announcements also have an impact on bond and stock prices, it is to be expected that corporate bond spreads also exhibit a response. Moreover, in line with previous research, such effect could also depend on the stage of the economic cycle or credit rating. In addition, following the findings of recent studies, this paper also tries to capture the effect of the monetary policy rate level in the context of the recent financial crisis by incorporating the ZLB strategy. Regarding this last point, it can be argued that the ZLB imposes different constraints on the reaction of bond yields of different maturities[1], which could also affect the response of corporate bond spreads. In sum, this study aims at answering three research questions. First, to what extent do fluctuations and volatility of corporate bond spreads are affected by macroeconomic announcements? Second, is the effect of macroeconomic announcements also dependent on the stage of the economic cycle and on credit rating? Third, is the volatility and response of credit spreads to macroeconomic announcements affected by the ZLB policy?

Shedding some light on these latter issues is of crucial importance considering the size of the

[1]See for example Swanson and Williams (2014)

U.S corporate bond market. According to SFIMA[2] the U.S corporate bond market represented nearly 22% of the entire U.S bond market in 2016 with approximately $8.5 trillion in debt outstanding, making it a huge part of the entire bond market and therefore constituting a vital part of the U.S financial system and perhaps of the entire world. Moreover, in past decades corporate bond issuance has grown as more and more companies have been able to gain access to this type of financing.

By estimating the effect of ten widely followed macroeconomic announcements on the daily percentage change of various Bank of America Merril Lynch US corporate bond spreads that differ on maturity and credit rating, I find that negative macroeconomic surprises tend to have a negative effect on spreads (i.e spreads increase) while positive news leads to a decrease in spreads. For example, a one standard deviation positive surprise in Non Farm Payrolls and in the ISM non Manufacturing Index, leads to a decline of 0.26% and 0.15% in High Yield spreads and to a drop of 0.30% and 0.16% in BB spreads respectively. At the same time, the reaction of credit bond spreads towards macroeconomic announcements varies across the business cycle, where in expansion periods spreads tend to be less responsive. In addition, my estimates indicate that the ZLB policy increased the sensitivity of credit bond spreads towards macroeconomic announcements. Moreover, in line with previous research, I find that the volatility of corporate spreads increases on announcement days, however, ARCH estimates indicate that the ZLB policy had a dampening effect on conditional volatility.

In addition to this introduction, this paper is organized as follows. Section 2 provides a brief literature review while in Section 3 I discuss the main hypothesis and testable propositions. In Section 4 I provide short description of the data used followed by a preliminary data analysis in Section 5. Section 6 show the main empirical results and finally Section 7 concludes.

# 2 Literature Review

The literature regarding macroeconomic announcements and fluctuations in financial markets is abundant and has shown ample evidence that bond and stock prices respond to news bundled in macroeconomic data. As for stocks, although initial studies find little evidence that their prices are affected by macroeconomic announcements, more recent literature recognizes that economic news contains information about future interest rates and corporate earnings growth, which can be valued differently over expansions and contractions. In this vein, Boyd et al. (2005) document that news of rising unemployment (bad news) translates into an increase in stock prices during economic expansions and into a decrease during economic contractions. Likewise, Andersen et al. (2007) show that equity markets react differently to the same macroeconomic

[2]Securities Industry and Financial Markets Association

surprises depending on the state of the U.S economy, with bad news having a positive impact during expansions and a negative impact during recessions. More recently, Goldberg and Grisse (2013) show that the responses of the yield curve and exchange rates to economic news vary with the VIX and the level of the Federal Fund Rate and conclude that asset price responses to macroeconomic announcements are time variant and depend on the level of risk perceived by market participants and the level of the monetary policy rate.

Furthermore, de Goeij et al. (2016) investigate whether the sensitivity of asset prices to incoming macroeconomic news is somehow rewarded by the market. By relating a set of macroeconomic news factors to a cross section of stock returns and allowing for different stages of the economic cycle, they find positive price of risk estimates for good macroeconomic news during expansions, but negative price of risk estimates for good macroeconomic news during contractions. Consequently, while existing literature shows that stock responses to the same macroeconomic news depend on the stage of the business cycle, this results suggest that their associated prices of risk also vary over expansion and contractions.

In terms of volatility dynamics the literature is also abundant. For example, Bomfim (2003) analyzes the relationship between monetary policy and daily stock market volatility around regularly scheduled FOMC meetings and days of actual policy decisions (regardless of whether they were regularly scheduled) and concludes that the conditional volatility of stock returns is abnormally low on days preceding announced monetary policy meetings. At the same time, he finds that surprises in the FOMC decision also boosts stock market volatility significantly in the short run, where positive surprises (higher than expected values of the FOMC interest rate) tend to have larger effects on volatility than negative surprises.

Furthermore, Jones et al. (1998) examine the effects of incoming news related to employment and inflation on Treasury bond market volatility and show a significant increase on announcement days, although such increase does not persist since news is incorporated immediately. Li and Engle (1998) show that volatility in the US Treasury bond market responds asymmetrically to announcement shocks, nevertheless, such shocks are not persistent. Likewise, when analyzing the impact of macroeconomic news announcements on the conditional volatility of bond returns, de Goeij et al. (2006) conclude that volatility on announcement days does not persist. However, contrary to Li and Engle (1998), they argue that including pre-announcement effects is relevant since conditional variances are much higher on announcement days than on non-announcement days, a result that suggests that the asymmetric volatility found in the treasury bond market is a product of (or is caused by) these macroeconomic announcement shocks. Also, they show that employment and producer price index reports influence more the intermediate and long end of the curve, while monetary policy news affects short term bond volatility.

Despite the extensive literature relating the effect of macroeconomic announcements on different financial markets, there has been a dearth of attention on the impact of incoming economic news on corporate bond spreads. To the best of my knowledge, there are only a few studies that are somewhat related to this topic. For example, Andritzky el al. (2007) analyze the impact of incoming macroeconomic news on emerging market bond spreads. Nevertheless their focus is mainly on the EMBI index which measures primarily sovereign spreads (or sovereign risk premiums), therefore not paying any attention to the corporate bond market. Probably the study that has more relation to this subject is Huang and Kong (2008). They conclude that macroeconomic announcements, and in particular surprises in retail sales, Non-Farm Payrolls and consumer confidence, affect mainly high yield bonds, and at the same time, they find that conditional volatility of credit spreads on high yield bonds increases on announcement days. However, and perhaps because the sample[3] used in the study coincides with a period of strong economic performance in the U.S, the authors do not explore the possibility that the responses of credit spreads to macroeconomic announcements might vary depending on the stage of the business cycle as suggested by previous literature.

Another feature that the scarce literature regarding corporate bond spreads and macroeconomic announcements has not yet incorporated, is the time variant nature of the effect of incoming news on asset prices. As discussed by Goldberg and Grisse (2013), the response of government bond yields to macroeconomic "surprises" can be different across time, where the level of monetary policy at the time of the news release and the perceived risk conditions as captured by the VIX play an important role in explaining such time variation. At the same time, Swanson and Williams (2014) argue that the ZLB policy implemented by the Fed during the financial crisis, imposed different constraints to the reaction of Treasury bond yields towards macroeconomic announcements, where the sensitivity to incoming news tended to decrease, especially for shorter maturities. These findings along with the fact that the Treasury yield curve is widely used as a benchmark for pricing corporate bonds, suggest that the ZLB policy could also have had an impact on the reaction of credit spreads to economic "surprises", something that has not yet been studied by academic literature.

By allowing the response of credit bond spreads to vary depending on the business cycle and the ZLB policy, this paper not only extends and complements the findings of Huang and Kong (2008), but also contributes to the literature by studying the effects of unconventional monetary policy measures on the sensitivity of asset prices to new information. Finally, this paper might also be related to other research concerning credit risk since an important issue in this latter field is the factors affecting corporate bond spreads. So far, such literature has only

[3]The authors argue that the sample used in their study (January 1997 to June 2003) corresponds to a period of strong economic performance

focused on explanatory variables related to the equity market (leverage and firm value among others) or treasury market variables (interest rate and slope of the yield curve for example), however the focus of this paper is on a set of variables (macroeconomic announcements) that very few have examined.

# 3 Main Hypothesis and Testable Propositions

As mentioned earlier, scheduled macroeconomic news contain information about upcoming interest rates and corporate earnings growth that influence market perceptions about the future financial soundness and performance of the corporate sector. In this sense, positive macroeconomic surprises should translate into better financial perspectives for the corporate sector and therefore lower debt risk premiums, while negative surprises should have the opposite effect. Thus the first hypothesis is:

- **Hypothesis 1:** *Positive macroeconomic surprises should result in a spread compression while negative surprises should result in a spread widening.*

Additionally, following the findings of previous literature (Jones et al. (1998) and Li and Engle (1998) among others) where volatility in the treasury bond market significantly increases on announcement days, it can be expected that corporate bond spreads also exhibit an increase in volatility during announcement days. Thus, the second hypothesis is:

- **Hypothesis 2:** *Volatility of credit spreads is expected to increase on announcement days.*

Credit rating plays an important role in determining the default probability of a bond issuer. Typically, high yield bonds tend to be riskier than their investment grade counterparts which is reflected by the fact that they usually have higher spreads. Given that macroeconomic announcements contain information about the financial soundness and future performance of the corporate sector, they represent a good deal of the systematic risk present in most financial markets, and as a result it is possible that such news is of higher relevance for riskier, lower grade (high yield) corporate bonds. Thus, the third hypothesis is:

- **Hypothesis 3:** *High Yield bond spreads and volatility should be more sensitive to macroeconomic surprises than their Investment Grade counterparts*

Corporate bonds may be viewed as a mix of risk free debt and equity, where the equity "characteristic" becomes more evident as credit quality declines. For example, Blume et al. (1991) argue that low grade bonds exhibit characteristics of high grade bonds and equity while Weinstein (1985) maintains that high yield bonds hold a strong equity component. Given all of

the latter, it can be assumed that corporate bonds and equities tend to respond in a similar way to the overall market environment. Consequently, taking into account the findings of Boyd et al. (2005) and Andersen et al. (2007), where bad news has a positive impact on stocks during expansions and a negative impact during recessions, a similar behavior can be expected from corporate bond spreads specially for lower credit ratings where the "equity" component is larger. The fourth hypothesis is therefore:

- **Hypothesis 4 (a):** *Positive macroeconomic surprises should lead to corporate bond spread widening during expansions and to a spread tightening during contractions.*

- **Hypothesis 4 (b):** *The economic and statistical significance (as captured by the magnitude and p-values of coefficient estimates) of the relationship in Hypothesis 4(a) should be larger for lower credit ratings that have a larger "equity" component.*

As argued by Swanson and Williams (2014), the ZLB policy implemented by the Fed during the financial crisis imposed different constraints to the reaction of Treasury bond yields towards macroeconomic announcements, where the sensitivity to incoming news tended to decrease, especially for shorter maturities. These findings along with the fact that the Treasury yield curve is widely used as a benchmark for pricing corporate bonds, suggest that the ZLB policy could also have had an impact on the reaction of credit spreads to economic surprises, leading to the fifth hypothesis:

- **Hypothesis 5:** *Credit spread volatility and sensitivity to economic surprises should have been somewhat mitigated during the period of ZLB policy.*

# 4 Data

To study the effect of macroeconomic announcements on corporate bond spreads allowing the responses to vary with the business cycle and the ZLB policy, I use three types of data: (1) corporate bond spreads, (2) macroeconomic announcements and their market forecasts and (3) measures of the stage of the business cycle and data for the period before and after the ZLB policy was implemented.

## 4.1 Corporate Bond Spread Data

I obtain daily option-adjusted spreads of the various Bank of America Merril Lynch US Corporate bond indices, from the Federal Reserve Economic database (FRED) for the period January 1997 to December 2016. In particular, for investment grade corporate bonds I obtain credit

spreads for the entire index as well as for three individual rating groups that constitute the index (AAA, AA and BBB) and four different maturities (1-3 years, 3-5 years, 5-7 years and 10-15 years). For high yield corporate bonds I collect data for the entire index as well as for three individual rating groups that constitute the index (BB, B and CCC). Unfortunately, there was no differentiation across different maturities for this particular instrument.

## 4.2 Macroeconomic Announcements and Survey Data

I obtain survey and announcement data on a set of widely followed macroeconomic variables from Thomson Reuters Datastream.[4]. According to the book *The secrets of Economic Indicators* by Bernard Baumohl, 8 of the 10 macroeconomic announcements summarized in Table 1 have either "high" or "very high" impact on the market. The exceptions are Government Budget and the University of Michigan Consumer Confidence Index. However, these two variables have been included in previous studies[5], which is why they are also considered in this paper.

Table 1: Relevant Macroeconomic Indicators

| **Announcement** | **Abbreviation** | **Unit** | **Frequency** | **Abailable since** |
|---|---|---|---|---|
| GDP Growth | GDP | % Change | Quarterly | Q1 1997 |
| Industrial Production | IP | % Change | Monthly | March 1997 |
| Unemployment Rate | Unemployment | % Level | Monthly | March 1997 |
| Retail Sales | Retail Sales | % Change | Monthly | August 1999 |
| Change in Non Farm Payrolls | NFP | Thousands | Monthly | March 1997 |
| Government Budget | Budget | Billions USD | Monthly | November 1998 |
| Consumer Price Index | CPI | % Change | Monthly | January 1997 |
| ISM Manufacturing Index | ISM | Points | Monthly | February 1998 |
| ISM Non Manufacturing Index | ISM Non Manuf | Points | Monthly | August 2001 |
| Michigan Consumer Confidence | Cons Conf | Points | Monthly | January 1998 |

As it is common in this particular literature, (see for example Balduzzi et al. (2001), Flannery and Protopapadakis (2002), de Goeij et al. (2016) among many others) I define "surprise" as the difference between the actual announcement, $A_{kt}$ and the median in market survey expectations $E_{kt}$. To allow for a meaningful comparison of estimates across macroeconomic variables with different units of measurement, I standardize the surprise by dividing it by the sample standard deviation of the difference between the announcements and market expectations $\sigma_j$.

[4]The survey data comes from the Thomson Reuters Economic Consensus survey to market participants, and it is the median of the pre announcment estimates of the economic indicator by economists

[5]See for example de Goeij and Marquering (2006), Huang and Kong (2008) among others

Thus, the surprise of announcement $k$ at moment $t$ is calculated as:

$$\frac{A_{kt} - E_{kt}}{\sigma_j} \tag{1}$$

The only exception is the unemployment rate, where I multiply equation (1) by -1 so that unemployment rates that are above market expectations are actually negative surprises while unemployment rates that are below market expectations are positive surprises.

### 4.3 Business Cycle Indicators and Monetary Policy of Zero Lower Bound

To measure the US business cycle, I use the National Bureau of Economic Research[6] based recession indicator for the U.S, which, as indicated by its name, provides a gauge of the overall U.S economic activity and signals during which periods was the economy in recession or expanding (not in recession). This indicator is available from 1940 through 2016. The period of the ZLB policy starts on December 16, 2008 and ends on December 16, 2015, when the Fed increased its interest rate for the first time since 2006. Notice that the sample contains an extensive period during which the ZLB policy was being implemented.

## 5 Preliminary Data Analysis

Panel A of Table 2 provides summary statistics on the level of credit spreads for different credit ratings and maturities. As expected, average credit spreads differ substantially among credit quality and tend to increase as the credit rating of bonds decreases. For the pooled indices, it can be seen that high yield (HY) bonds not only have a larger spread than their investment grade (IG) counterparts but also a higher standard deviation. Furthermore, by disaggregating the credit ratings, the negative relationship between credit quality and spread level is more evident. For example, CCC bonds have an average premium of 1183bp and a standard deviation of 573bp while AAA bonds exhibit the lowest average premium and standard deviation of just 83bp and 58bp respectively. In terms of duration, longer maturities tend to have higher spreads on average, consistent with the existence of a term premium at least in the investment grade universe.

Panel B of Table 2 reports summary statistics on the daily log changes in credit spreads for different ratings and maturities. The data is expressed as percentages. As it can be seen, spread changes are on average larger for higher rated bonds, where AAA rated bond spreads

[6]NBER based recession indicators are available at the organization's web page

Table 2: Sumary Statistics of Credit Spreads

Panel A: Spread Levels (bp)

| Rating | Mean | S,D | Skewness | Kurtosis | Max | Min |
|---|---|---|---|---|---|---|
| *Pooled Investment Grade and High Yield* | | | | | | |
| IG | 161 | 94 | 2.8 | 13.1 | 656 | 53 |
| HY | 580 | 279 | 2.2 | 10.0 | 2182 | 241 |
| *Disaggregated Credit Ratings* | | | | | | |
| AAA | 83 | 58 | 4.4 | 25.6 | 607 | 19 |
| AA | 105 | 73 | 3.1 | 14.2 | 515 | 36 |
| BBB | 209 | 112 | 2.7 | 12.6 | 804 | 72 |
| BB | 383 | 191 | 2.3 | 10.8 | 1468 | 136 |
| B | 572 | 265 | 2.0 | 9.4 | 2084 | 236 |
| CCC | 1183 | 573 | 1.6 | 6.1 | 4429 | 414 |
| *Investment Grade Spreads by Duration* | | | | | | |
| IG 1-3 Yrs | 130 | 124 | 3.5 | 16.6 | 814 | 37 |
| IG 3-5 Yrs | 145 | 101 | 2.9 | 13.5 | 698 | 43 |
| IG 5-7 Yrs | 168 | 100 | 2.6 | 11.9 | 680 | 36 |
| IG 7-10 Yrs | 170 | 90 | 2.4 | 11.0 | 623 | 54 |
| IG 10-15 Yrs | 173 | 85 | 1.7 | 8.0 | 584 | 48 |

Panel B: Daily Changes in Log-Credit Spreads (%)

| Rating | Mean | S,D | Skewness | Kurtosis | Max | Min |
|---|---|---|---|---|---|---|
| *Pooled Investment Grade and High Yield* | | | | | | |
| IG | 0.0145 | 1.4 | 0.8 | 62.9 | 24 | -21 |
| HY | 0.0054 | 1.5 | 0.7 | 8.3 | 14 | -9 |
| *Disaggregated Credit Ratings* | | | | | | |
| AAA | 0.0195 | 2.9 | -0.5 | 83.4 | 44 | -54 |
| AA | 0.0123 | 2.5 | -12.7 | 728.4 | 55 | -109 |
| BBB | 0.0129 | 1.2 | 0.2 | 60.7 | 23 | -18 |
| BB | 0.0059 | 1.9 | 0.5 | 27.3 | 26 | -29 |
| B | 0.0021 | 1.7 | 0.7 | 9.6 | 16 | -10 |
| CCC | 0.0046 | 1.5 | 0.0 | 27.2 | 16 | -21 |
| *Investment Grade Spreads by Duration* | | | | | | |
| IG 1-3 Yrs | 0.0109 | 2.1 | -1.2 | 73.4 | 31 | -48 |
| IG 3-5 Yrs | 0.0131 | 1.6 | 0.4 | 45.8 | 25 | -23 |
| IG 5-7 Yrs | 0.0142 | 1.9 | 0.5 | 257.2 | 54 | -53 |
| IG 7-10 Yrs | 0.0157 | 1.4 | 1.2 | 52.3 | 25 | -22 |
| IG 10-15 Yrs | 0.0201 | 1.5 | 2.2 | 54.6 | 32 | -16 |

The data reported in Panel A and Panel B is in basis points (bp) and percentage changes (%) respectively. P-values of the Jarque-Bera test reject the null hypothesis of normality in the data at the 1% confidence level in all cases.

exhibit an annualized percentage change of almost 4.87% while average changes for CCC spreads are just 1.15% per annum[7]. Moreover, spread changes for higher rated bonds display higher standard deviations than their low rating counterparts. This result is consistent with the traditional trade off between risk and return predicted by finance theory. The significantly high (low) returns reported in the last two columns of Panel B correspond to periods of economic or financial distress. For example, the outstanding daily percentage increase (fall) of 55% (-109%) in the AA spreads corresponds to December 30, 1998 (and December 31, 1998) during the "tech bubble". At the same time, the maximum and minimum values for the daily changes in AAA bonds where in 2009, during the U.S financial crisis. Finally, there is significant positive skewness and kurtosis in all cases and the Jarque-Bera tests (not reported) suggest that there is non-normality present in the data.

In order to obtain some intuition on how corporate bond spreads react to macroeconomic announcements, Table 3 compares the daily average percentage log change of spreads on announcement days for different macroeconomic variables, with the average daily percentage spread change on non announcement days (NAD). The bold numbers indicate the rejection of the null hypothesis that daily percentage spread changes on announcement days equals spread changes on non announcement days. The table shows that on announcement days (irrespective of whether the news was good or bad), percentage changes on corporate bond spreads can be quite substantial, especially for lower rated instruments. For instance, looking at the pooled high yield index (HY), average percentage changes on the ISM index announcement days and the ISM Non Manufacturing index announcement days are -0.31% and -0.26% respectively, meaning an annualized spread compression of about 76% and 66% in each case. In contrast, the investment grade spread (IG) appear to react in a more limited way to the aforementioned announcements, where spreads compressions are around -0.08% and -0.001% respectively[8] and are not statistically different from the average on non announcement days.

Table 3 also compares the spread reaction when the announced value of each macroeconomic indicator was higher (good) or lower (bad) than anticipated by analysts. The results suggest that the percentage changes in spreads react differently towards positive and negative shocks, where in general positive surprises lead to a decrease in spreads while negative surprises translate into an increase in spreads. For example, on days where the NFP figures where better than expected, high yield spreads (HY) fall nearly 0.77% on average (or 193% on an annualized basis) while on days where the NFP figures fell short of expectations, high yield spreads increased on average 0.5% (or 124% on an annualized basis). A similar pattern can be observed when industrial production (IP) figures are above or below market expectations.

[7]Annualized changes are calculated by multiplying daily changes in Log-Credit spreads by 250 trading days

[8]This means a spread contraction of 20% and 0.2% in annualized terms in each case

Table 3: Average Daily Changes in Log-Credit Spreads (%)

This table reports the average daily changes in log-credit spreads on all announcement days of various macroeconomic indicators. It also separates between positive news (good) and negative news (bad) across macroeconomic indicators. The last column of the table reports the average daily change on non-announcement days (NAD). Bold numbers indicate the rejection of the null hypothesis that the average daily spread changes on announcement days is equal to the average daily spread changes on non announcement days (NAD), with a confidence level of at least 10%. All data is expressed as percentages (%).

| Rating | ISM | | | ISM non Manuf | | | Cons Conf | | | NFP | | | Retail Sales | | | NAD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | All | Good | Bad | All | Good | Bad | All | Good | Bad | All | Good | Bad | All | Good | Bad | Mean |
| IG | -0.08 | **-0.23** | 0.01 | 0.00 | -0.08 | 0.12 | 0.02 | -0.07 | 0.09 | -0.11 | **-0.41** | 0.12 | 0.02 | 0.02 | 0.06 | 0.01 |
| HY | **-0.31** | **-0.64** | 0.02 | **-0.26** | **-0.44** | -0.04 | 0.04 | 0.05 | 0.02 | -0.05 | **-0.77** | **0.50** | 0.00 | **-0.24** | **0.29** | 0.03 |
| AAA | 0.00 | -0.27 | 0.23 | **0.47** | **0.69** | 0.24 | 0.07 | 0.16 | -0.12 | **-0.35** | **-0.56** | -0.21 | -0.07 | -0.12 | 0.03 | 0.00 |
| AA | -0.01 | -0.14 | 0.03 | -0.05 | -0.04 | -0.04 | 0.13 | 0.13 | 0.08 | -0.10 | -0.46 | 0.17 | 0.09 | 0.09 | 0.19 | -0.01 |
| BBB | -0.10 | **-0.25** | 0.00 | -0.02 | -0.13 | 0.12 | 0.04 | -0.12 | 0.18 | **-0.13** | **-0.39** | 0.07 | -0.04 | -0.08 | 0.04 | 0.02 |
| BB | **-0.28** | **-0.77** | 0.19 | **-0.31** | **-0.50** | -0.06 | 0.22 | 0.21 | 0.21 | -0.09 | **-0.96** | **0.55** | 0.02 | -0.26 | **0.34** | 0.02 |
| B | **-0.30** | **-0.63** | 0.04 | **-0.28** | **-0.47** | -0.05 | 0.04 | 0.13 | -0.08 | -0.05 | **-0.85** | **0.55** | 0.04 | -0.20 | **0.35** | 0.01 |
| CCC | **-0.32** | **-0.52** | -0.13 | **-0.27** | **-0.39** | -0.12 | -0.06 | 0.00 | -0.06 | -0.03 | **-0.55** | **0.37** | -0.05 | **-0.23** | 0.16 | 0.04 |
| IG 1-3 Yrs | 0.11 | -0.22 | **0.37** | 0.08 | 0.14 | 0.05 | 0.02 | -0.08 | 0.15 | -0.13 | **-0.53** | 0.18 | -0.07 | -0.03 | -0.08 | -0.01 |
| IG 3-5 Yrs | 0.03 | -0.10 | 0.09 | -0.06 | -0.20 | 0.14 | 0.06 | -0.03 | 0.13 | **-0.31** | **-0.48** | -0.18 | 0.00 | -0.04 | 0.08 | 0.02 |
| IG 5-7 Yrs | -0.05 | -0.10 | -0.11 | -0.11 | -0.24 | 0.07 | 0.15 | 0.09 | 0.14 | -0.07 | **-0.40** | 0.18 | 0.04 | 0.08 | 0.08 | 0.01 |
| IG 7-10 Yrs | **-0.14** | **-0.32** | -0.05 | -0.01 | -0.05 | 0.05 | 0.04 | -0.04 | 0.10 | -0.05 | **-0.42** | **0.22** | 0.07 | 0.07 | 0.14 | 0.01 |
| IG 10-15 Yrs | **-0.19** | **-0.38** | -0.11 | **-0.18** | -0.22 | -0.13 | 0.10 | 0.03 | 0.18 | 0.00 | -0.12 | 0.08 | 0.05 | 0.11 | 0.01 | 0.03 |

Table 3 (Continued): Average Daily Changes in Log-Credit Spreads (%)

This table reports the average daily changes in log-credit spreads on all announcement days of various macroeconomic indicators. It also separates between positive news (good) and negative news (bad) across macroeconomic indicators. The last column of the table reports the average daily change on non-announcement days (NAD). Bold numbers indicate the rejection of the null hypothesis that the average daily spread changes on announcement days is equal to the average daily spread changes on non announcement days (NAD), with a confidence level of at least 10%. All data is expressed as percentages (%).

| Rating | Budget | | | Unemployment | | | IP | | | CPI | | | GDP | | | NAD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | All | Good | Bad | All | Good | Bad | All | Good | Bad | All | Good | Bad | All | Good | Bad | Mean |
| IG | 0.01 | 0.03 | 0.03 | -0.11 | -0.24 | -0.08 | 0.08 | -0.03 | 0.15 | 0.07 | 0.11 | 0.03 | 0.18 | -0.01 | 0.29 | 0.01 |
| HY | 0.07 | 0.04 | 0.13 | -0.04 | **-0.52** | -0.03 | 0.02 | **-0.33** | **0.33** | 0.06 | 0.14 | -0.02 | -0.01 | -0.03 | -0.03 | 0.03 |
| AAA | -0.03 | -0.06 | 0.06 | **-0.35** | -0.51 | -0.36 | 0.18 | 0.30 | 0.29 | 0.24 | 0.27 | 0.23 | -0.11 | 0.17 | -0.69 | 0.00 |
| AA | 0.07 | 0.02 | 0.16 | -0.10 | -0.29 | -0.04 | 0.03 | -0.17 | 0.19 | 0.19 | 0.24 | 0.14 | 0.13 | -0.11 | 0.37 | -0.01 |
| BBB | 0.03 | 0.02 | 0.07 | **-0.12** | -0.15 | -0.13 | 0.01 | -0.07 | 0.06 | 0.01 | 0.06 | -0.04 | 0.13 | 0.09 | 0.11 | 0.02 |
| BB | 0.09 | 0.02 | 0.18 | -0.08 | **-0.53** | -0.10 | 0.06 | **-0.40** | **0.49** | 0.09 | 0.20 | -0.02 | -0.14 | -0.25 | -0.08 | 0.02 |
| B | 0.05 | 0.04 | 0.09 | -0.04 | **-0.58** | -0.05 | 0.05 | **-0.35** | **0.38** | 0.09 | 0.18 | 0.01 | 0.00 | 0.09 | -0.15 | 0.01 |
| CCC | 0.10 | 0.05 | 0.20 | -0.02 | -0.30 | 0.01 | -0.08 | **-0.35** | 0.18 | -0.09 | 0.02 | **-0.18** | 0.18 | 0.07 | 0.35 | 0.04 |
| IG 1-3 Yrs | 0.06 | 0.14 | -0.02 | -0.14 | -0.20 | -0.16 | **0.24** | 0.17 | **0.44** | 0.14 | 0.32 | 0.01 | 0.29 | 0.19 | 0.32 | -0.01 |
| IG 3-5 Yrs | -0.04 | 0.00 | -0.08 | **-0.30** | -0.27 | **-0.33** | 0.14 | 0.02 | 0.24 | 0.04 | 0.11 | -0.02 | 0.09 | -0.11 | 0.17 | 0.02 |
| IG 5-7 Yrs | -0.05 | -0.04 | -0.04 | -0.07 | -0.30 | 0.06 | 0.11 | -0.06 | 0.14 | 0.00 | -0.02 | 0.02 | 0.18 | 0.06 | 0.33 | 0.01 |
| IG 7-10 Yrs | 0.06 | -0.01 | 0.18 | -0.05 | -0.20 | 0.02 | 0.06 | 0.00 | 0.15 | 0.03 | 0.04 | 0.03 | 0.10 | 0.11 | -0.01 | 0.01 |
| IG 10-15 Yrs | 0.11 | 0.06 | 0.19 | -0.01 | -0.11 | 0.06 | -0.02 | -0.02 | 0.05 | -0.01 | -0.03 | 0.01 | 0.02 | -0.12 | 0.03 | 0.03 |

This preliminary evidence provides some partial support for the first hypothesis, where positive macroeconomic surprises should result in lower spreads while negative macroeconomic surprises should lead to a increase in spreads. It is also worth noticing that this behavior seems to be more evident for corporate bonds with lower credit rating. Following the findings of previous literature, it is known that investors value the same incoming news differently depending on the stage of the business cycle, and although this behavior is often found in stock returns, corporate bonds are somewhat similar to equities as discussed in Section 3. Thus, it is interesting to study whether corporate bond spreads reflect this particular characteristic.

Table 4 describes average percentage log changes in credit spreads across expansions and contractions. Overall, the results are mostly in line with the findings in previous literature that "good news" is "bad news" during expansions, while in contractions "good news" is in fact "good news". This is mostly evident for instruments with lower credit ratings. For example, when the economy is expanding, negative surprises on the ISM index, ISM non Manufacturing index and unemployment rate are somewhat beneficial for high yield (HY) bonds since spreads tend to decline between 0.23% and 0.08% (or 58% and 21% per annum respectively). On the other hand, during contractions "bad news" on the ISM index, ISM non Manufacturing index and unemployment rate have a negative impact on high yield (HY) spreads, since they tend to increase between 0.33% and 0.20% (or 50% and 81% per annum respectively). It is worth noticing that this pattern is observed for low credit ratings (HY, B, BB and CCC) but it is less obvious for higher quality ratings such as IG, AAA, AA and BBB.

Furthermore, Figure 1 shows how average percentage changes in High Yield (HY) and Investment Grade (IG) spreads correlate with macroeconomic surprises [9]. In line with previous findings, it looks as if the reaction of spreads towards unexpected news varies depending on the business cycle. That is, during expansions "good news" is "bad news" since credit spreads tend to increase, while in contractions "good news" is in fact "good news" since spreads tend to decrease. Although this result is somewhat less clear for the ISM non Manufacturing Index, the sensitivity of spreads towards positive surprises for this particular indicator seems to decrease during an expansion. Additionally, when analyzing the reaction of High Yield (HY) and Investment Grade (IG) spreads towards macroeconomic surprises separately, it appears that the "good news" is "bad news" story is a bit less obvious for IG bonds, since the relationship between news surprises and spread changes tends to "flatten", suggesting a drop in the correlation between these two variables. This suggests that the time varying nature of news "valuation" across the business cycle depends on the credit quality of bonds.

[9] For the sake of brevity, only a few macroeconomic indicators are plotted in Figure 1

Table 4: Daily Changes in Log-Credit Spreads Across the Business Cycle

Panel A: Average Daily Changes in Log-Credit Spreads During Expansions

| Rating | ISM | | ISM non Manuf | | Cons Conf | | NFP | | Retail Sales | | NAD |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Good | Bad | Good | Bad | Good | Bad | Good | Bad | Good | Bad | Mean |
| IG | **-0.22** | 0.05 | -0.06 | 0.02 | 0.07 | 0.12 | **-0.41** | 0.16 | 0.01 | -0.05 | 0.01 |
| HY | **-0.70** | -0.08 | **-0.52** | -0.20 | 0.07 | 0.11 | **-0.88** | **0.58** | **-0.29** | 0.17 | 0.03 |
| AAA | -0.26 | 0.19 | 0.53 | 0.24 | 0.16 | -0.14 | **-0.61** | -0.10 | -0.22 | -0.12 | 0.00 |
| AA | -0.07 | 0.09 | -0.07 | -0.09 | 0.17 | 0.07 | -0.51 | 0.23 | 0.03 | 0.11 | -0.01 |
| BBB | **-0.27** | -0.02 | -0.11 | -0.03 | 0.02 | 0.28 | **-0.40** | 0.11 | -0.11 | -0.06 | 0.02 |
| BB | **-0.76** | 0.06 | **-0.58** | -0.23 | 0.15 | 0.36 | **-1.11** | **0.74** | -0.29 | 0.22 | 0.02 |
| B | **-0.74** | -0.05 | -0.59 | -0.25 | 0.13 | 0.12 | **-0.99** | **0.64** | -0.28 | 0.19 | 0.01 |
| CCC | **-0.55** | -0.19 | **-0.38** | -0.25 | 0.07 | -0.09 | **-0.61** | **0.31** | **-0.33** | 0.05 | 0.04 |
| IG 1-3 Yrs | -0.15 | 0.40 | 0.22 | -0.09 | 0.15 | -0.01 | **-0.53** | 0.12 | -0.11 | -0.21 | -0.01 |
| IG 3-5 Yrs | -0.06 | 0.12 | -0.24 | -0.08 | 0.10 | 0.23 | **-0.47** | -0.08 | 0.01 | 0.01 | 0.02 |
| IG 5-7 Yrs | -0.04 | -0.11 | -0.21 | -0.05 | 0.17 | 0.19 | -0.34 | 0.19 | 0.09 | -0.01 | 0.01 |
| IG 7-10 Yrs | **-0.32** | 0.05 | -0.04 | -0.09 | 0.03 | 0.18 | **-0.47** | 0.27 | 0.06 | 0.00 | 0.01 |
| IG 10-15 Yrs | **-0.43** | -0.11 | -0.28 | -0.26 | 0.15 | 0.23 | -0.06 | 0.14 | -0.01 | 0.01 | 0.03 |

Panel B: Average Daily Changes in Log-Credit Spreads During Contractions

| Rating | ISM | | ISM non Manuf | | Cons Conf | | NFP | | Retail Sales | | NAD |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Good | Bad | Good | Bad | Good | Bad | Good | Bad | Good | Bad | Mean |
| IG | -0.25 | -0.05 | -0.13 | 0.35 | **-0.38** | 0.04 | -0.42 | 0.04 | 0.04 | 0.26 | 0.01 |
| HY | **-0.51** | 0.20 | -0.32 | 0.33 | -0.01 | -0.15 | -0.41 | 0.36 | -0.15 | **0.48** | 0.03 |
| AAA | -0.29 | 0.29 | **0.97** | 0.22 | 0.17 | -0.08 | -0.37 | -0.38 | 0.05 | 0.28 | 0.00 |
| AA | -0.29 | -0.09 | -0.01 | 0.06 | 0.01 | 0.10 | -0.31 | 0.08 | 0.21 | 0.32 | -0.01 |
| BBB | -0.22 | 0.03 | -0.16 | **0.45** | **-0.43** | 0.00 | -0.34 | 0.02 | -0.05 | 0.21 | 0.02 |
| BB | **-0.79** | 0.41 | -0.36 | 0.32 | 0.34 | -0.05 | -0.50 | 0.25 | -0.19 | **0.54** | 0.02 |
| B | -0.41 | 0.19 | -0.25 | 0.41 | 0.11 | -0.42 | -0.39 | 0.42 | -0.07 | **0.61** | 0.01 |
| CCC | **-0.45** | -0.04 | **-0.40** | 0.18 | -0.17 | 0.00 | -0.36 | **0.47** | -0.05 | 0.36 | 0.04 |
| IG 1-3 Yrs | -0.34 | 0.31 | 0.00 | 0.36 | **-0.61** | 0.42 | -0.54 | 0.27 | 0.11 | 0.13 | -0.01 |
| IG 3-5 Yrs | -0.19 | 0.04 | -0.15 | **0.64** | -0.32 | -0.05 | -0.53 | -0.33 | -0.13 | 0.20 | 0.02 |
| IG 5-7 Yrs | -0.24 | -0.10 | -0.30 | 0.32 | -0.11 | 0.07 | -0.59 | 0.16 | 0.05 | 0.21 | 0.01 |
| IG 7-10 Yrs | -0.30 | -0.23 | -0.07 | 0.35 | -0.20 | -0.05 | -0.24 | 0.15 | 0.08 | 0.38 | 0.01 |
| IG 10-15 Yrs | -0.30 | -0.10 | -0.12 | 0.14 | -0.25 | 0.08 | -0.29 | 0.00 | 0.33 | 0.02 | 0.03 |

Table 4 (Continued): Daily Changes in Log-Credit Spreads Across the Business Cycle

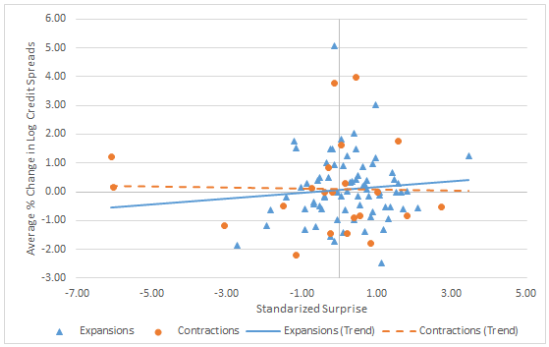
Panel A: Average Daily Changes in Log-Credit Spreads During Expansions

| Rating | Budget | | Unemployment | | IP | | CPI | | GDP | | NAD |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Good | Bad | Good | Bad | Good | Bad | Good | Bad | Good | Bad | Mean |
| IG | 0.03 | -0.13 | -0.23 | -0.06 | -0.05 | -0.11 | 0.09 | -0.08 | 0.21 | 0.19 | 0.01 |
| HY | 0.05 | -0.15 | -0.42 | **-0.23** | **-0.36** | 0.13 | 0.12 | -0.17 | -0.13 | -0.10 | 0.03 |
| AAA | -0.06 | -0.20 | -0.79 | -0.25 | 0.25 | -0.21 | 0.10 | 0.09 | 0.75 | **-1.04** | 0.00 |
| AA | 0.05 | 0.01 | -0.33 | -0.05 | -0.19 | -0.14 | 0.21 | 0.00 | 0.14 | 0.31 | -0.01 |
| BBB | 0.01 | 0.04 | -0.19 | -0.11 | -0.12 | -0.10 | 0.03 | -0.12 | 0.24 | 0.11 | 0.02 |
| BB | 0.12 | -0.07 | **-0.39** | -0.28 | **-0.45** | 0.23 | 0.17 | -0.20 | -0.39 | -0.13 | 0.02 |
| B | 0.04 | -0.19 | -0.52 | **-0.29** | **-0.36** | 0.19 | 0.16 | -0.15 | 0.00 | -0.22 | 0.01 |
| CCC | 0.00 | -0.13 | -0.23 | -0.19 | **-0.46** | 0.01 | 0.02 | **-0.37** | -0.04 | 0.28 | 0.04 |
| IG 1-3 Yrs | 0.13 | -0.14 | -0.37 | -0.24 | 0.14 | 0.14 | 0.16 | -0.11 | 0.24 | 0.24 | -0.01 |
| IG 3-5 Yrs | 0.00 | -0.19 | -0.40 | -0.15 | 0.01 | 0.01 | 0.02 | -0.13 | -0.08 | 0.00 | 0.02 |
| IG 5-7 Yrs | -0.06 | -0.18 | -0.26 | 0.14 | -0.02 | -0.04 | -0.05 | -0.04 | 0.28 | 0.21 | 0.01 |
| IG 7-10 Yrs | -0.02 | 0.03 | -0.21 | -0.01 | 0.01 | -0.08 | -0.01 | -0.07 | 0.22 | -0.06 | 0.01 |
| IG 10-15 Yrs | 0.02 | 0.01 | 0.00 | 0.18 | -0.08 | -0.16 | -0.02 | -0.07 | -0.08 | 0.07 | 0.03 |

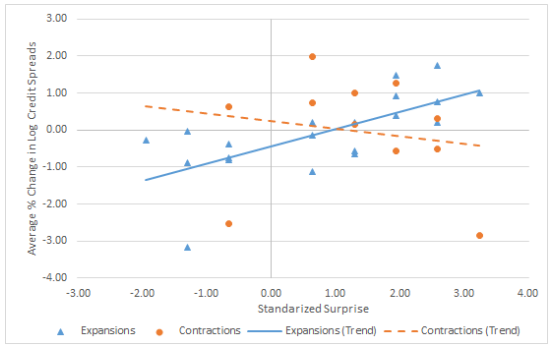
Panel B: Average Daily Changes in Log-Credit Spreads During Contractions

| Rating | Budget | | Unemployment | | IP | | CPI | | GDP | | NAD |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Good | Bad | Good | Bad | Good | Bad | Good | Bad | Good | Bad | Mean |
| IG | 0.03 | 0.27 | -0.25 | -0.12 | 0.03 | **0.56** | 0.15 | 0.31 | -0.54 | 0.65 | 0.01 |
| HY | 0.01 | **0.56** | **-0.68** | **0.33** | -0.24 | **0.64** | 0.18 | 0.33 | 0.21 | 0.22 | 0.03 |
| AAA | -0.07 | 0.46 | -0.06 | -0.55 | 0.41 | **1.10** | 0.57 | 0.56 | -1.20 | 0.51 | 0.00 |
| AA | -0.05 | 0.40 | -0.23 | -0.01 | -0.12 | 0.72 | 0.30 | 0.47 | -0.72 | 0.55 | -0.01 |
| BBB | 0.04 | 0.11 | -0.09 | -0.17 | 0.03 | 0.33 | 0.11 | 0.15 | -0.27 | 0.13 | 0.02 |
| BB | -0.18 | **0.57** | **-0.77** | 0.23 | -0.28 | 0.90 | 0.25 | 0.41 | 0.09 | 0.09 | 0.02 |
| B | 0.05 | **0.51** | -0.68 | **0.39** | -0.32 | **0.70** | 0.22 | 0.41 | 0.31 | 0.09 | 0.01 |
| CCC | 0.14 | **0.70** | -0.41 | 0.37 | -0.11 | **0.45** | 0.02 | 0.27 | 0.31 | 0.55 | 0.04 |
| IG 1-3 Yrs | 0.16 | 0.16 | 0.09 | -0.02 | 0.23 | **0.91** | 0.60 | 0.29 | 0.07 | 0.56 | -0.01 |
| IG 3-5 Yrs | 0.01 | 0.08 | -0.04 | **-0.66** | 0.04 | **0.61** | 0.27 | 0.26 | -0.17 | 0.75 | 0.02 |
| IG 5-7 Yrs | 0.01 | 0.17 | -0.36 | -0.09 | -0.14 | 0.43 | 0.04 | 0.17 | -0.48 | 0.75 | 0.01 |
| IG 7-10 Yrs | 0.02 | 0.42 | -0.20 | 0.09 | -0.03 | **0.53** | 0.15 | 0.25 | -0.14 | 0.17 | 0.01 |
| IG 10-15 Yrs | 0.12 | 0.48 | -0.28 | -0.15 | 0.10 | 0.38 | -0.05 | 0.22 | -0.20 | -0.09 | 0.03 |

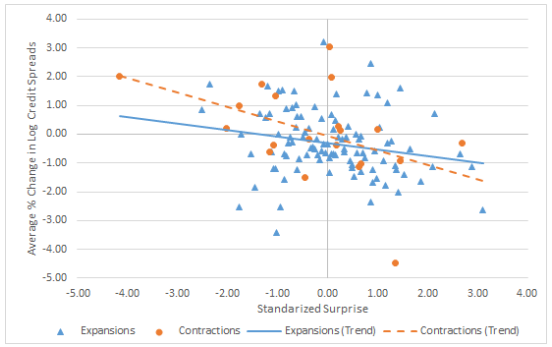
Figure 1: Correlations Between Changes in High Yield (HY) and Investment Grade (IG) Spreads Vs Macroeconomic Surprises



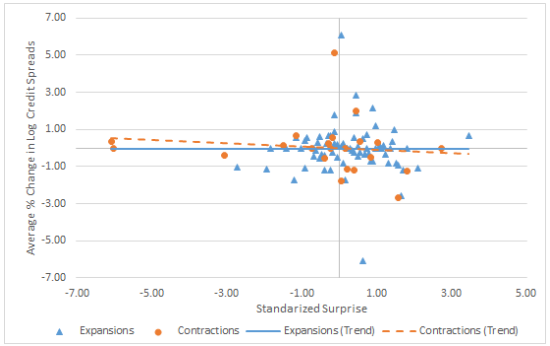

(a) HY Vs Consumer Confidence



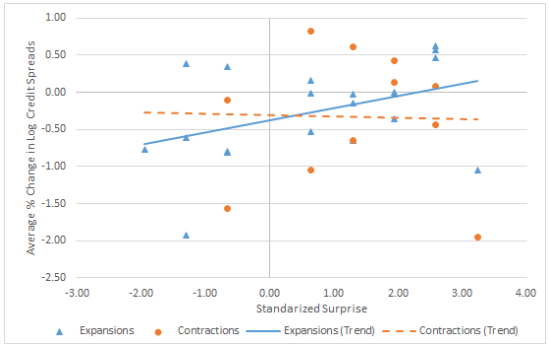

(b) HY Vs Unemployment



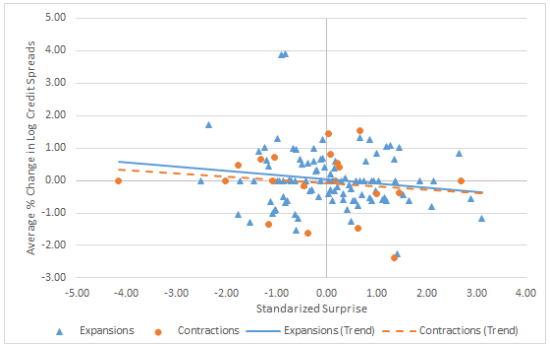

(c) HY Vs Ism Non Manufacturing Index




(d) IG Vs Consumer Confidence

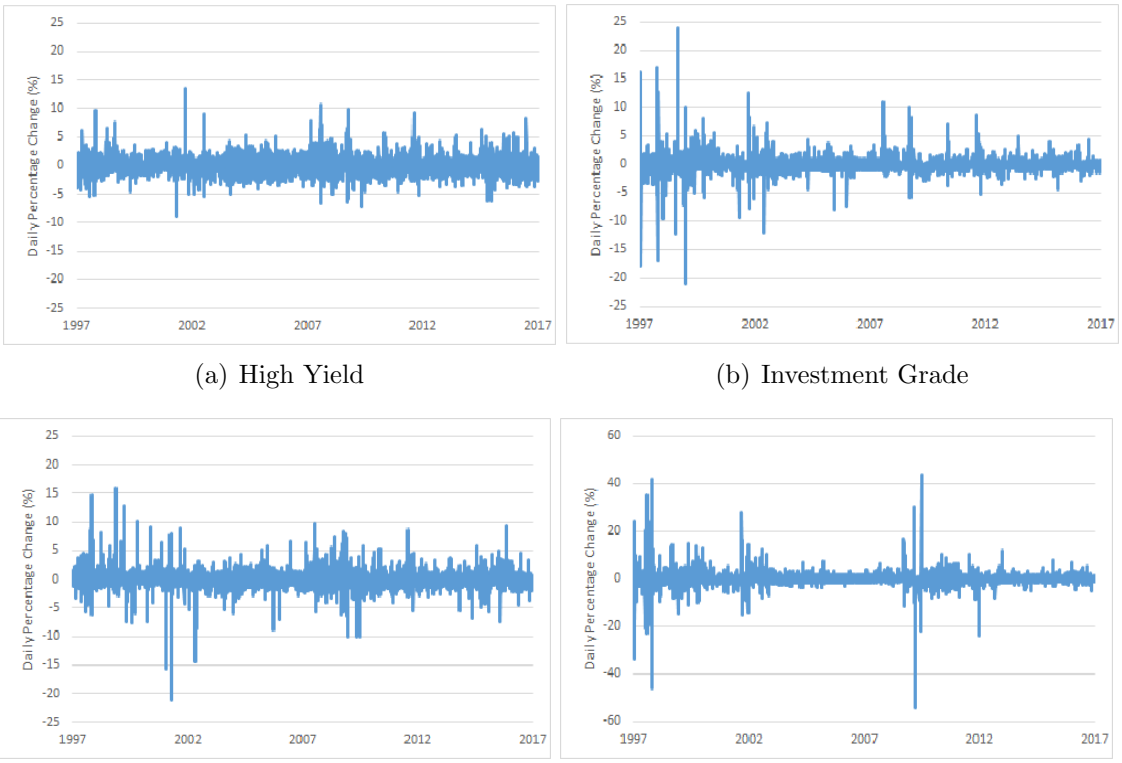



(e) IG Vs Unemployment




(f) IG Vs Ism Non Manufacturing Index

Figure 2: Daily percentage spread changes of selected corporate bond spreads




(a) High Yield

(b) Investment Grade

(c) CCC

(d) AAA

The previous preliminary analysis provides some support for hypothesis 4(a) and 4(b) which stated that the reaction of credit spreads should depend on the stage of the economy and that such relationship should be more significant for lower credit ratings that have a larger equity component.

Regarding the volatility, Figure 2[10] plots the daily percentage spread changes for four different credit ratings. The graph not only suggests that there are signs of volatility clustering and therefore a model including heteroskedasticity is required to describe the dynamics of spread changes, but also that the magnitude of the spread changes is sometimes quite substantial. For example, spread changes for the pooled high yield spreads are as high as 13.5% (on September 14,2001 which is an announcement day) and low as -8.8% (on April 25, 2001 which is not an announcement day).

Furthermore, Table 5 shows the volatility (as measured by the sample standard deviation) of credit spread changes on announcement days of each macroeconomic news compared to the volatility of non announcement days (NAD). Bold numbers represent the rejection of the null

[10]Note that the graph for the AAA spreads has a different scale suggesting that the magnitude of spread changes are also quite substantial

hypothesis that variances on announcement days are equal to the variances on non announcement days. The results from Table 5 suggest that volatility on announcement days is higher than the non announcement day volatility for a number of macroeconomic variables. In particular, announcements in Consumer Confidence (Cons Conf), Non Farm Payrolls (NFP) and unemployment tend to increase the volatility of spread changes of lower rated bonds and bonds with shorter durations. This evidence indicates that some of the extreme movements in corporate spreads might be due to surprises in macroeconomic news, or alternatively that volatility of credit spread changes increases on announcement days.

Table 5: Volatility of Daily Changes in Log Credit Spreads

Variance Ratio Test was used to test the null hypothesis that the standard deviation (variance) of daily spread changes on announcement days equals the standard deviation (variance) of daily spread changes on non announcement days (NAD). Bold numbers indicate the rejection of the null hypothesis with a confidence level of at least 10%.

| Rating | ISM | ISM non Manuf | Cons Conf | NFP | Retail Sales | Budget | Unemployment | IP | CPI | GDP | NAD |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Pooled Investment Grade and High Yield* | | | | | | | | | | | |
| IG | 1.05 | 0.95 | **1.60** | 1.07 | 1.28 | 1.00 | 1.07 | 1.47 | 1.15 | 1.31 | 1.42 |
| HY | 1.49 | 1.42 | 1.50 | **1.72** | **1.78** | 1.41 | **1.72** | **1.67** | 1.46 | 1.25 | 1.44 |
| *Disaggregated Credit Ratings* | | | | | | | | | | | |
| AAA | 1.84 | **4.20** | 2.27 | 2.13 | 2.65 | 1.55 | 2.13 | 3.03 | 2.27 | 2.88 | 3.03 |
| AA | 1.55 | 1.21 | 1.86 | 1.44 | 1.92 | 1.23 | 1.44 | 2.09 | 1.73 | 1.91 | 2.83 |
| BBB | 1.01 | 0.96 | **1.73** | 1.14 | 1.09 | 0.97 | 1.15 | 1.24 | 1.00 | 1.11 | 1.25 |
| BB | 1.75 | 1.69 | **2.52** | **2.09** | **2.30** | 1.62 | **2.09** | **2.13** | 1.78 | 1.55 | 1.86 |
| B | 1.67 | 1.58 | **1.88** | **1.94** | **1.97** | 1.58 | **1.94** | **1.88** | 1.66 | 1.64 | 1.66 |
| CCC | 1.25 | 1.13 | **1.70** | 1.29 | 1.43 | 1.32 | 1.29 | 1.52 | 1.30 | **1.91** | 1.50 |
| *Duration of Investment Grade* | | | | | | | | | | | |
| IG 1-3 Yrs | 1.78 | 1.56 | **3.14** | 1.63 | 1.78 | 1.51 | 1.64 | 2.27 | 1.81 | 1.60 | 2.20 |
| IG 3-5 Yrs | 1.33 | 1.15 | **1.92** | **1.78** | 1.33 | 1.10 | **1.78** | 1.64 | 1.43 | 1.31 | 1.65 |
| IG 5-7 Yrs | 1.68 | 1.03 | 1.59 | 1.68 | 1.25 | 0.96 | 1.69 | 1.58 | 1.37 | 1.61 | 2.14 |
| IG 7-10 Yrs | 1.21 | 0.99 | **1.49** | 1.13 | 1.43 | 1.05 | 1.13 | **1.57** | 1.30 | 1.59 | 1.40 |
| IG 10-15 Yrs | 1.37 | 0.83 | 1.64 | 1.19 | 1.48 | 1.11 | 1.19 | 1.60 | 1.21 | 1.34 | 1.65 |

# 6 Methodology and Empirical Results

This section characterizes the impact of macroeconomic announcements on the various credit spread indices. In addition to investigating average responses of credit spreads across the full

sample, I also study the effects of incoming macroeconomic news separately in expansions and contractions. At the same time, I also examine the impact of the ZLB policy by separating the sample in periods when the policy was being implemented and periods when it was not. Finally, I explore the relationship of macroeconomic announcements and credit spread volatility and if such relationship also varies across periods when the ZLB policy was being executed.

## 6.1 The Response of Credit Spreads to Macroeconomic Announcements

To formally explore whether macroeconomic surprises have an effect on corporate bond spreads, I follow a similar approach used by Flannery and Protopapadakis (2002), Andersen et al. (2007) and Huang and Kong (2008) by initially performing an univariate regression analysis to isolate the impact of each macroeconomic fundamental separately. Specifically, I estimate equation (2) for each credit spread index and for each announcement of fundamental $k$ separately, using only announcement day observations of type $k$. In addition, since in the existing literature it is documented that macroeconomic news also have an effect on government bonds, part of the variation in corporate bond spreads when there are macroeconomic announcements could be due to fluctuations in treasury bond yields. Given that the few studies relating macroeconomic announcements and credit spreads has so far ignored this latter issue, equation (2) also controls for changes in government yields by introducing the returns of 10 year U.S Treasury bonds. Thus equation (2) is as follows:

$$\triangle Spread_t^h = \beta_0^h + \beta_{1,k}^h(Surprise_{k,t}) + \beta_{2,k}^h(r_{10,t}) + \epsilon_t^h \tag{2}$$

where $\triangle Spread_t^h$ is the daily log change in corporate bond index $h$ ($h$= HY, IG, AAA, AA, BBB, BB, B, CCC, IG 1-3 Yrs, IG 3-5 Yrs, IG 5-7 Yrs, IG 7-10 Yrs, IG 7-15 Yrs) and $Surprise_{k,t}$ refers to the standardized surprise of fundamental $k$. Finally, $r_{10,t}$ is the return of U.S 10 year treasury bonds. These returns are calculated using the following duration approximation: $\frac{dP}{P} = -D\frac{dr}{1+r}$ where the duration of the 10 year government bond is assumed to be 7.4 years as in Boyd et al.(2005). Estimates of coeficients $\beta_{1,k}^h$ and $\beta_2^h$ for each regression are reported in Table 6.

First, consider the effect of 10 year Treasury bond returns on credit spread changes as captured by $\beta_2^h$. The coefficient is positive and significant for the majority of cases which means that if 10 year Treasury bond returns are positive (i.e Treasury yields are falling) corporate bond spreads tend to increase. Conversely, when Treasury returns are negative (i.e Treasury yields are increasing) corporate bond spreads decrease. This means that some of the fluctuations of corporate bond spreads on announcement days are explained by movements in Treasury yields.

Table 6: The Effect of Announcement Surprises on Credit Spreads: Univariate Analysis

For each credit index $h$ and for each macroeconomic announcement of type $k$ the following regression is estimated using robust standard erros:

$$\triangle Spread_t^h = \beta_0^h + \beta_{1,k}^h(Surprise_{k,t}) + \beta_{2,k}^h(r_{10,t}) + \epsilon_t^h$$

where $\triangle Spread_t^h$ is the daily log change in corporate bond index $h$ ($h$= HY, IG, AAA, AA, BBB, BB, B, CCC, IG 1-3 Yrs, IG 3-5 Yrs, IG 5-7 Yrs, IG 7-10 Yrs, IG 7-15 Yrs) and $Surprise_{k,t}$ refers to the standardized surprise of fundamental $k$. Finally, $r_{10,t}$ is the return of U.S 10 year treasury bonds. The *, ** and *** signal statistical significance at the 10%, 5% and 1% level respectively.

| Rating | HY | | IG | | AAA | | AA | | BBB | | BB | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Announcement | $\beta_{1,k}^h$ | $\beta_2^h$ | $\beta_{1,k}^h$ | $\beta_2^h$ | $\beta_{1,k}^h$ | $\beta_2^h$ | $\beta_{1,k}^h$ | $\beta_2^h$ | $\beta_{1,k}^h$ | $\beta_2^h$ | $\beta_{1,k}^h$ | $\beta_2^h$ |
| ISM | -0.37** | 0.63 | -0.15* | 0.26 | -0.32* | 0.26 | -0.15 | 0.28 | -0.18** | 0.28 | -0.52*** | 0.74 |
| ISM non Manuf | -0.08 | 2.30*** | -0.03 | 0.83*** | 0.07 | 0.48 | 0.14 | 0.92*** | -0.05 | 0.81*** | -0.07 | 2.87*** |
| Cons Conf | -0.11 | 0.72 | -0.10 | 0.24 | -0.12 | 0.34 | -0.08 | 0.27 | -0.16* | 0.28* | -0.13 | 0.79 |
| NFP | -0.17* | 2.30*** | -0.14 | 0.73*** | -0.18 | 0.53 | -0.15 | 1.03*** | -0.08 | 0.59*** | -0.17 | 2.87*** |
| Retail Sales | 0.12 | 2.49*** | 0.07 | 1.16* | 0.15 | 1.68 | 0.04 | 1.36 | 0.09 | 1.15*** | 0.17 | 3.33*** |
| Budget | -0.08 | 1.79*** | -0.12* | 0.40* | -0.11 | 0.63 | -0.18* | 0.78** | -0.09 | 0.43* | -0.10 | 2.35*** |
| Unemployment | -0.22** | 2.45*** | -0.09 | 0.84*** | -0.02 | 0.67* | -0.15 | 1.16*** | -0.05 | 0.66*** | -0.22** | 3.02*** |
| IP | -0.11 | 2.78*** | -0.04 | 1.48** | 0.10 | 2.70* | -0.11 | 1.81* | -0.01 | 1.23*** | -0.18 | 3.40*** |
| CPI | 0.06 | 1.91*** | 0.03 | 0.52** | 0.02 | 0.43 | 0.01 | 0.38 | 0.03 | 0.59*** | 0.08 | 2.37*** |
| GDP | -0.08 | 1.94*** | -0.13 | 0.54 | 0.19 | 0.81 | -0.26 | 0.04 | -0.04 | 0.63 | -0.11 | 2.23*** |

| Rating | B | | CCC | | IG 1-3 Yrs | | IG 3-5 Yrs | | IG 5-7 Yrs | | IG 7-10 Yrs | | IG 10-15 Yrs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Announcement | $\beta_{1,k}^h$ | $\beta_2^h$ | $\beta_{1,k}^h$ | $\beta_2^h$ | $\beta_{1,k}^h$ | $\beta_2^h$ | $\beta_{1,k}^h$ | $\beta_2^h$ | $\beta_{1,k}^h$ | $\beta_2^h$ | $\beta_{1,k}^h$ | $\beta_2^h$ | $\beta_{1,k}^h$ | $\beta_2^h$ |
| ISM | -0.39** | 0.72 | -0.23* | 0.47 | -0.35** | 0.32 | -0.14 | 0.17 | -0.11 | 0.19 | -0.16* | 0.29 | -0.15* | 0.24 |
| ISM non Manuf | -0.08 | 2.54*** | -0.08 | 1.45*** | 0.17 | 0.82** | -0.09 | 0.55* | -0.12 | 0.73*** | 0.08 | 0.94*** | -0.01 | 0.55*** |
| Cons Conf | -0.06 | 0.78 | -0.07 | 0.54 | -0.22* | 0.35* | -0.10 | 0.34*** | -0.09 | 0.29* | -0.08 | 0.25 | -0.13 | 0.25 |
| NFP | -0.20* | 2.58*** | -0.15* | 1.43*** | -0.24* | 0.70*** | -0.02 | 0.43* | -0.31 | 0.62*** | -0.13 | 0.83*** | 0.13 | 0.55** |
| Retail Sales | 0.13 | 2.76*** | 0.03 | 1.60*** | 0.15 | 1.36* | 0.02 | 0.98* | 0.08 | 1.04* | 0.03 | 1.23* | 0.07 | 1.33* |
| Budget | -0.09 | 2.03*** | -0.08 | 0.92** | -0.07 | 0.53 | -0.05 | 0.22 | -0.08 | 0.44* | -0.14* | 0.42* | -0.13* | 0.77*** |
| Unemployment | -0.22* | 2.76*** | -0.18** | 1.57*** | -0.08 | 0.90*** | -0.03 | 0.45* | -0.19 | 0.88*** | -0.12 | 0.94*** | -0.08 | 0.47* |
| IP | -0.11 | 3.21*** | -0.12 | 1.71*** | -0.03 | 2.19** | 0.00 | 1.58** | -0.03 | 1.44** | 0.01 | 1.50** | 0.00 | 0.99 |
| CPI | 0.07 | 2.37*** | 0.05 | 0.82** | 0.16 | 0.64* | 0.04 | 0.41* | 0.01 | 0.50* | 0.03 | 0.57** | -0.02 | 0.30 |
| GDP | -0.07 | 2.67*** | -0.07 | 0.57 | -0.15 | 0.19 | -0.22 | 0.54 | -0.09 | 0.65 | 0.00 | 0.86 | -0.01 | 0.48 |

Now, consider the effect of macroeconomic announcements on credit spreads captured by $\beta^h_{1,k}$. First, macroeconomic surprises affect High Yield and Investment Grade spreads to different degrees. Most of the macroeconomic indicators considered barely have a significant impact on the spreads of higher quality bonds. Only the ISM and Budget announcements appear to have a negative relationship with spread changes of IG, AAA, AA and BBB bonds.

This result is in line with the findings of Huang and Kong (2008) where surprises of only one (GDP growth) of the 11 macroeconomic indicators considered are relevant for AA-AAA rated bonds. In contrast, Table 6 shows that macroeconomic surprises have a much broader impact on spreads of lower rated bonds. In particular, all low rated indices (HY, BB, B and CCC) respond negatively to positive surprises in the ISM index and the unemployment rate [11]. Furthermore, as credit quality decreases NFP announcements become more relevant since the B and CCC indices also react negatively to positive surprises in this indicator. Again this result is similar to Huang and Kong (2008) who argue that high yield spreads tend to be more reactive to macroeconomic announcements, and in particular to NFP figures.

The above univariate analysis helps determine the importance of each announcement separately. However, by using a multivariate approach I examine the overall explanatory power of these macroeconomic announcements in explaining fluctuations in credit spreads. Thus, equation (3) includes all the macroeconomic variables examined in this paper, where the sample used includes announcement days and non announcement days.

$$\triangle Spread^h_t = \beta^h_0 + \sum_{k=1}^{10} \beta^h_{1,k}(Surprise_{k,t}) + \beta^h_2(r_{10,t}) + \epsilon^h_t \tag{3}$$

where $\triangle Spread^h_t$ is the daily log change in corporate bond spreads, $Surprise_{k,t}$ is equal to zero if day $t$ is not an announcement day for fundamental $k$ and is equal to the standardized surprise of fundamental $k$ if day $t$ is an announcement day. As before, $r_{10,t}$ is the return of U.S 10 year treasury bonds.

Estimates of equation (3) are reported in Table 7. As in the univariate analysis, the coefficient of the 10 Year Treasury returns is positive and significant in all cases, meaning that to some extent fluctuations of corporate bond spreads are explained by movements in Treasury yields. In addition, the signs of most of the coefficients associated with a macroeconomic announcement are as expected and therefore in line with the first hypothesis. That is, negative macroeconomic news tend to increase credit spreads while positive news lead to a decrease in spreads.

[11] As discussed in Section 4, an adjustment was made to the calculation of the unemployment surprises so that when I refer to positive surprises, it means that the actual unemployment rate is below the expected unemployment rate.

Table 7: The Effect of Announcement Surprises on Credit Spreads: Multivariate Analysis

For each credit index $h$ and for each macroeconomic announcement of type $k$ the following regression is estimated using robust standard erros:

$$\triangle Spread_t^h = \beta_0^h + \sum_{k=1}^{10} \beta_{1,k}(Surprise_{k,t}) + \beta_2^h(r_{10,t}) + \epsilon_t^h$$

where $\triangle Spread_t^h$ is the daily log change in corporate bond index $h$ ($h$= HY, IG, AAA, AA, BBB, BB, B, CCC, IG 1-3 Yrs, IG 3-5 Yrs, IG 5-7 Yrs, IG 7-10 Yrs, IG 7-15 Yrs) and $Surprise_{k,t}$ is equal to zero if day $t$ is not an announcement day of type $k$, and is equal to the standarized surprise of announcement $k$ if day $t$ is an announcement day. As before, $r_{10}$ is the return of U.S 10 year treasury bonds. The *, ** and *** signal statistical significance at the 10%, 5% and 1% level respectively. Robust p-values are reported in parenthesis.

| Announcement | HY | IG | AAA | AA | BBB | BB | B | CCC | IG 1-3 Yrs | IG 3-5 Yrs | IG 5-7 Yrs | IG 7-10 Yrs | IG 10-15 Yrs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ISM | -0.25 | -0.11 | -0.27** | -0.10 | -0.15** | -0.37* | -0.25 | -0.16 | -0.30** | -0.10 | -0.08 | -0.13 | -0.14* |
| | (0.13) | (0.12) | (0.04) | (0.33) | (0.03) | (0.05) | (0.17) | (0.18) | (0.01) | (0.24) | (0.38) | (0.11) | (0.07) |
| ISM Non Manuf | -0.15** | -0.05 | 0.14 | 0.11 | -0.08 | -0.16* | -0.15* | -0.12* | 0.17 | -0.09 | -0.14** | 0.04 | -0.03 |
| | (0.05) | (0.38) | (0.34) | (0.15) | (0.17) | (0.08) | (0.08) | (0.10) | (0.10) | (0.22) | (0.03) | (0.53) | (0.63) |
| Cons Conf | -0.28 | -0.16 | -0.17 | -0.14 | -0.20** | -0.32 | -0.25 | -0.17 | -0.29** | -0.12 | -0.11 | -0.13 | -0.17 |
| | (0.25) | (0.11) | (0.19) | (0.25) | (0.04) | (0.28) | (0.39) | (0.30) | (0.03) | (0.17) | (0.23) | (0.18) | (0.11) |
| NFP | -0.26*** | -0.14* | -0.09 | -0.19* | -0.06 | -0.30*** | -0.31*** | -0.20*** | -0.19 | 0.05 | -0.29 | -0.16** | 0.13 |
| | (0.00) | (0.06) | (0.56) | (0.05) | (0.54) | (0.00) | (0.00) | (0.01) | (0.11) | (0.77) | (0.24) | (0.03) | (0.24) |
| Retail Sales | 0.01 | -0.02 | -0.00 | -0.05 | -0.00 | -0.02 | 0.01 | -0.05 | 0.06 | -0.05 | 0.01 | -0.06 | -0.06 |
| | (0.93) | (0.69) | (1.00) | (0.63) | (0.93) | (0.82) | (0.86) | (0.53) | (0.40) | (0.51) | (0.90) | (0.43) | (0.68) |
| Budget | -0.07 | -0.11** | -0.11 | -0.17*** | -0.08 | -0.09 | -0.08 | -0.06 | -0.06 | -0.05 | -0.08 | -0.13** | -0.12** |
| | (0.38) | (0.02) | (0.26) | (0.01) | (0.16) | (0.34) | (0.39) | (0.36) | (0.32) | (0.38) | (0.16) | (0.02) | (0.01) |
| Unemployment | -0.13* | 0.00 | 0.15 | -0.04 | 0.02 | -0.11 | -0.12 | -0.11* | 0.01 | 0.11 | -0.08 | -0.05 | -0.06 |
| | (0.06) | (0.98) | (0.19) | (0.61) | (0.73) | (0.20) | (0.12) | (0.05) | (0.88) | (0.16) | (0.36) | (0.47) | (0.38) |
| IP | -0.17 | -0.10 | -0.03 | -0.18 | -0.05 | -0.26* | -0.18 | -0.14 | -0.13 | -0.07 | -0.09 | -0.05 | -0.03 |
| | (0.13) | (0.49) | (0.92) | (0.36) | (0.66) | (0.09) | (0.15) | (0.13) | (0.56) | (0.62) | (0.51) | (0.73) | (0.85) |
| CPI | 0.06 | 0.03 | 0.01 | 0.02 | 0.03 | 0.07 | 0.06 | 0.07 | 0.16* | 0.04 | 0.01 | 0.04 | -0.01 |
| | (0.42) | (0.56) | (0.92) | (0.83) | (0.54) | (0.36) | (0.50) | (0.31) | (0.08) | (0.56) | (0.88) | (0.57) | (0.78) |
| GDP | -0.08 | -0.14 | 0.20 | -0.27 | -0.05 | -0.10 | -0.07 | -0.09 | -0.18 | -0.22 | -0.10 | -0.01 | -0.01 |
| | (0.52) | (0.33) | (0.56) | (0.20) | (0.67) | (0.51) | (0.64) | (0.56) | (0.37) | (0.12) | (0.56) | (0.97) | (0.94) |
| $r_{10}$ | 1.75*** | 0.57*** | 0.69*** | 0.71*** | 0.55*** | 2.09*** | 1.97*** | 1.14*** | 0.77*** | 0.50*** | 0.53*** | 0.59*** | 0.48*** |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Constant | -0.01 | 0.01 | 0.02 | 0.01 | 0.01 | -0.01 | -0.01 | -0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 |
| | (0.62) | (0.54) | (0.61) | (0.86) | (0.49) | (0.68) | (0.50) | (0.79) | (0.81) | (0.51) | (0.77) | (0.55) | (0.39) |
| R-squared | 0.32 | 0.04 | 0.01 | 0.02 | 0.05 | 0.28 | 0.31 | 0.14 | 0.03 | 0.02 | 0.02 | 0.04 | 0.02 |

Another thing worth noticing is that although surprises in several macroeconomic indicators have an impact on credit spreads, surprises in Non Farm Payrolls (NFP) and the ISM non Manufacturing index are particularly relevant for lower rated bonds. Given that past studies (Jones et al (1998)) have found that NFP reports are one of the most important variables for Treasury bond markets as well as for stock markets, it is not surprising that it should also matter for corporate spreads.

At the same time, since the ISM non Manufacturing index is considered an excellent leading indicator [12], it appears that surprises about the future health of the U.S economy have an impact on lower rated bond spreads. The results also indicate that macroeconomic announcements affect primarily spreads of low rated corporate bonds, specifically HY, BB, B and CCC rated instruments which is consistent with hypothesis 3. The latter suggests that whilst the Investment Grade bond market and the High Yield bond market are generally considered to be related, they are completely different segments of the corporate bond market. Consequently, the risk factors that drive credit spreads and their relative importance is different across these two markets.

## 6.2 The Response of Credit Spreads to Macroeconomic Announcements Across the Business Cycle

Next, I proceed to investigate whether the effects of macroeconomic announcements on credit spreads depend on the stage of the economic cycle or varies in periods of monetary policy of ZLB. Similar to the approach of Boyd et al (2005), equation (4) will be estimated for each credit spread index and for each macroeconomic fundamental $k$ separately using only announcement day observations of type $k$. As a result equation (4) is as follows:

$$\triangle Spread_t^h = \beta_0^h + \beta_{1,k}^h(Surprise_{k,t}(1 - D_t)) + \beta_{2,k}^h(Surprise_{k,t}D_t) + \beta_{3,k}^h(r_{10,t}) + \epsilon_t^h \qquad (4)$$

where all variables are the same as in equation (2) and $D_t$ is a dummy variable that takes on the value of zero in contractions and one in expansions. As discussed above, $\beta_{3,k}^h$ controls for fluctuations of government bond yields. Under equation (4), any difference in the response of credit spreads across the business cycle should be captured by the $\beta_{1,k}^h$ and $\beta_{2,k}^h$ coefficients. In particular, if "good news" is "bad news" during expansions then $\beta_{2,k}^h$ should be positive and if "good news" is "good news" during contractions then $\beta_{1,k}^h$ should be negative. Table 8 reports the estimates of equation (4) across different stages of the business cycle.

[12] See Baumohl.B: *The secrets of Economic Indicators*

Table 8: The Effect of Announcement Surprises on Credit Spreads: Expansions & Contractions

For each credit index $h$ and for each macroeconomic announcement of type $k$ the following regression is estimated using robust standard erros:

$$\triangle Spread_t^h = \beta_0^h + \beta_{1,k}^h(Surprise_{k,t}(1 - D_t)) + \beta_{2,k}^h(Surprise_{k,t}D_t) + \beta_{3,k}^h(r_{10,t}) + \epsilon_t^h$$

where $\triangle Spread_t^h$ is the daily log change in corporate bond index $h$ ($h$= HY, IG, AAA, AA, BBB, BB, B, CCC, IG 1-3 Yrs, IG 3-5 Yrs, IG 5-7 Yrs, IG 7-10 Yrs, IG 7-15 Yrs) and $Surprise_{k,t}$ is equal to zero if day $t$ is not an announcement day of type $k$, and is equal to the standarized surprise of announcement $k$ if day $t$ is an announcement day. $D_t$ is a dummy variable equal to zero in contractions and one in expansions. As before, $r_{10}$ is the return of U.S 10 year treasury bonds. The *, ** and *** signal statistical significance at the 10%, 5% and 1% level respectively. Robust p-values are reported in parenthesis.

| Rating | HY | | IG | | AAA | | AA | | BBB | | BB | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Announcement | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ |
| ISM | -0.39** | -0.36*** | -0.13 | -0.16* | -0.53*** | -0.19 | -0.14 | -0.15 | -0.19* | -0.17** | -0.60*** | -0.47*** |
| | (0.04) | (0.00) | (0.20) | (0.05) | (0.01) | (0.18) | (0.31) | (0.20) | (0.08) | (0.02) | (0.00) | (0.00) |
| ISM non Manuf | -0.18* | 0.00 | -0.11 | 0.04 | 0.19 | -0.02 | 0.05 | 0.21* | -0.17 | 0.04 | -0.22* | 0.06 |
| | (0.10) | (0.99) | (0.27) | (0.60) | (0.22) | (0.92) | (0.65) | (0.07) | (0.10) | (0.58) | (0.09) | (0.59) |
| Cons Conf | -0.15 | -0.07 | -0.13 | -0.06 | -0.12 | -0.10 | -0.12 | -0.03 | -0.17 | -0.14 | -0.10 | -0.18 |
| | (0.17) | (0.60) | (0.17) | (0.61) | (0.37) | (0.55) | (0.30) | (0.83) | (0.13) | (0.28) | (0.58) | (0.31) |
| NFP | -0.22* | -0.14* | -0.06 | -0.18* | 0.09 | -0.30 | -0.00 | -0.22* | 0.05 | -0.14 | -0.16 | -0.17 |
| | (0.09) | (0.09) | (0.67) | (0.07) | (0.51) | (0.14) | (0.98) | (0.08) | (0.82) | (0.11) | (0.26) | (0.11) |
| Retail Sales | 0.10 | 0.15 | 0.01 | 0.18 | 0.05 | 0.35 | -0.03 | 0.19 | 0.05 | 0.17* | 0.12 | 0.26 |
| | (0.32) | (0.25) | (0.94) | (0.14) | (0.82) | (0.23) | (0.85) | (0.37) | (0.55) | (0.10) | (0.36) | (0.12) |
| Budget | -0.13 | 0.00 | -0.17*** | -0.03 | -0.21*** | 0.07 | -0.22** | -0.10* | -0.14** | 0.01 | -0.16 | 0.01 |
| | (0.24) | (0.98) | (0.00) | (0.80) | (0.00) | (0.67) | (0.01) | (0.08) | (0.01) | (0.91) | (0.21) | (0.97) |
| Unemployment | -0.24** | -0.21** | -0.02 | -0.14 | 0.05 | -0.07 | -0.07 | -0.21 | -0.00 | -0.09 | -0.25** | -0.20* |
| | (0.02) | (0.04) | (0.82) | (0.16) | (0.64) | (0.73) | (0.54) | (0.11) | (1.00) | (0.34) | (0.05) | (0.05) |
| IP | -0.24 | 0.02 | -0.26 | 0.18* | -0.31 | 0.51*** | -0.34 | 0.12 | -0.16 | 0.14* | -0.33* | -0.02 |
| | (0.11) | (0.84) | (0.17) | (0.06) | (0.39) | (0.01) | (0.18) | (0.43) | (0.32) | (0.07) | (0.09) | (0.82) |
| CPI | 0.02 | 0.07 | -0.02 | 0.06 | -0.09 | 0.07 | -0.04 | 0.04 | -0.01 | 0.06 | 0.10 | 0.06 |
| | (0.86) | (0.31) | (0.86) | (0.41) | (0.62) | (0.56) | (0.76) | (0.68) | (0.88) | (0.44) | (0.48) | (0.47) |
| GDP | 0.06 | -0.11 | -0.82 | 0.03 | -1.63** | 0.61* | -1.21 | -0.04 | -0.23 | 0.00 | 0.31 | -0.20 |
| | (0.92) | (0.32) | (0.12) | (0.84) | (0.04) | (0.09) | (0.14) | (0.79) | (0.21) | (0.97) | (0.63) | (0.11) |

Table 8 (Continued): The Effect of Announcement Surprises on Credit Spreads: Expansions & Contractions

For each credit index $h$ and for each macroeconomic announcement of type $k$ the following regression is estimated using robust standard erros:

$$\triangle Spread_t^h = \beta_0^h + \beta_{1,k}^h(Surprise_{k,t}(1 - D_t)) + \beta_{2,k}^h(Surprise_{k,t}D_t) + \beta_{3,k}^h(r_{10,t}) + \epsilon_t^h$$

where $\triangle Spread_t^h$ is the daily log change in corporate bond index $h$ ($h$= HY, IG, AAA, AA, BBB, BB, B, CCC, IG 1-3 Yrs, IG 3-5 Yrs, IG 5-7 Yrs, IG 7-10 Yrs, IG 7-15 Yrs) and $Surprise_{k,t}$ is equal to zero if day $t$ is not an announcement day of type $k$, and is equal to the standarized surprise of announcement $k$ if day $t$ is an announcement day. $D_t$ is a dummy variable equal to zero in contractions and one in expansions. As before, $r_{10}$ is the return of U.S 10 year treasury bonds. The *, ** and *** signal statistical significance at the 10%, 5% and 1% level respectively. Robust p-values are reported in parenthesis.

| Rating | B | | CCC | | IG 1-3 Yrs | | IG 3-5 Yrs | | IG 5-7 Yrs | | IG 7-10 Yrs | | IG 10-15 Yrs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Announcement | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ |
| ISM | -0.41*** | -0.37 | -0.27* | -0.20** | -0.44*** | -0.30** | -0.20* | -0.10 | -0.15 | -0.09 | -0.02 | -0.24*** | -0.15 | -0.16* |
| | (0.00) | (0.11) | (0.09) | (0.05) | (0.01) | (0.03) | (0.05) | (0.32) | (0.17) | (0.38) | (0.84) | (0.01) | (0.19) | (0.08) |
| ISM non Manuf | -0.18 | 0.00 | -0.22* | 0.03 | -0.02 | 0.32** | -0.20 | -0.00 | -0.22* | -0.04 | -0.05 | 0.18** | -0.09 | 0.05 |
| | (0.12) | (0.97) | (0.09) | (0.72) | (0.90) | (0.03) | (0.14) | (0.99) | (0.07) | (0.64) | (0.62) | (0.04) | (0.37) | (0.60) |
| Cons Conf | -0.09 | -0.01 | -0.15 | 0.05 | -0.27* | -0.14 | -0.07 | -0.13 | -0.05 | -0.16 | -0.09 | -0.06 | -0.15* | -0.11 |
| | (0.52) | (0.97) | (0.19) | (0.73) | (0.05) | (0.43) | (0.49) | (0.36) | (0.58) | (0.22) | (0.31) | (0.57) | (0.09) | (0.57) |
| NFP | -0.25* | -0.18* | -0.33** | -0.07 | -0.37*** | -0.18 | 0.26 | -0.15 | -0.17* | -0.37 | 0.00 | -0.20** | 0.10 | 0.15 |
| | (0.09) | (0.07) | (0.02) | (0.36) | (0.01) | (0.27) | (0.55) | (0.19) | (0.07) | (0.33) | (0.98) | (0.03) | (0.28) | (0.34) |
| Retail Sales | 0.11 | 0.17 | 0.03 | 0.02 | 0.11 | 0.24 | -0.07 | 0.21 | -0.00 | 0.25** | -0.07 | 0.23 | 0.01 | 0.20 |
| | (0.33) | (0.25) | (0.77) | (0.89) | (0.38) | (0.19) | (0.44) | (0.11) | (0.98) | (0.04) | (0.56) | (0.12) | (0.98) | (0.19) |
| Budget | -0.14 | 0.00 | -0.11 | -0.01 | -0.11 | -0.00 | -0.11** | 0.07 | -0.13*** | 0.02 | -0.18*** | -0.06 | -0.10* | -0.20*** |
| | (0.26) | (1.00) | (0.18) | (0.91) | (0.13) | (0.99) | (0.01) | (0.56) | (0.01) | (0.89) | (0.00) | (0.53) | (0.10) | (0.01) |
| Unemployment | -0.25** | -0.20* | -0.25*** | -0.12 | -0.05 | -0.10 | 0.12 | -0.14 | -0.00 | -0.33** | -0.09 | -0.15 | 0.07 | -0.19 |
| | (0.04) | (0.08) | (0.01) | (0.15) | (0.71) | (0.42) | (0.29) | (0.18) | (0.98) | (0.04) | (0.23) | (0.17) | (0.41) | (0.14) |
| IP | -0.23 | 0.02 | -0.21 | -0.03 | -0.38 | 0.33* | -0.21 | 0.21* | -0.21 | 0.14 | -0.20 | 0.22** | -0.19 | 0.19* |
| | (0.14) | (0.86) | (0.16) | (0.74) | (0.14) | (0.08) | (0.25) | (0.09) | (0.27) | (0.18) | (0.27) | (0.04) | (0.37) | (0.09) |
| CPI | 0.01 | 0.10 | -0.09 | 0.12 | 0.20 | 0.15 | 0.01 | 0.05 | 0.03 | -0.00 | -0.01 | 0.05 | -0.17** | 0.05 |
| | (0.98) | (0.18) | (0.48) | (0.18) | (0.21) | (0.21) | (0.95) | (0.55) | (0.81) | (0.99) | (0.95) | (0.45) | (0.03) | (0.47) |
| GDP | 0.07 | -0.10 | -0.26 | -0.03 | -0.83 | 0.00 | -0.72 | -0.10 | -0.74 | 0.06 | -0.41 | 0.09 | -0.25 | 0.05 |
| | (0.91) | (0.48) | (0.56) | (0.85) | (0.25) | (1.00) | (0.17) | (0.44) | (0.18) | (0.71) | (0.48) | (0.61) | (0.54) | (0.71) |

For the sake of clarity, the $\beta^h_{3,k}$ coefficients are not reported, however, they are in most cases positive and statistically significant, in line with the intuition discussed in Section 6.1. Although the sign of the $\beta^h_{2,k}$ coefficient is not quite as expected, estimates indicate that the reaction of credit bond spreads towards macroeconomic surprises somewhat decreases during expansions specially for lower rated bonds. For example, the sensitivity (i.e magnitude of coefficients[13]) of HY spreads to surprises in the ISM index falls during expansions. A similar effect can be found for the NFP report and unemployment figures. Moreover, note how the drop in sensitivity is only present on those indices with lower credit rating and it is larger as credit quality decreases. For instance, the decline in sensitivity to unemployment surprises in the pooled HY index is of 3bp (the coefficient changes from -0.39 to -0.36) while for the BB, B and CCC indices is 5bp, 5bp and 13bp respectively. Even tough these findings appear to contradict the traditional "good news" is "bad news" story documented in previous research, they do suggest that "good news" during expansions is "not as good" as in contractions since its effect on spreads is reduced. Perhaps the most likely explanation of this result is that the equity component present in corporate bonds is not sizable enough to turn "good news" into "bad news" during expansions. Instead, such component is only large enough to mitigate the effects of positive surprises during periods of economic growth. Consequently, corporate bond spreads reflect only partially the well documented behavior present in stock markets where "good news" is "bad news", providing only partial support for hypothesis 4(a). On the other hand, empirical evidence shows that as the equity component of corporate bonds increases (i.e credit quality worsens) the fall in sensitivity of spreads towards macroeconomic shocks is larger, which is somewhat consistent with hypothesis 4(b).

It is worth mentioning that the latter discussion only holds for three of the ten macroeconomic variables considered in this paper, which suggests that the empirical evidence is weak. Nevertheless, since many studies regarding macroeconomic announcements and asset price reaction use intraday data, I argue that perhaps using daily data might not be sufficient to capture the complete time varying nature of the reaction of corporate bond spreads. Conceivably, using higher frequency data (intra day) might reveal some more interesting and robust results, however, I leave this for future research.

## 6.3 The Response of Credit Spreads to Macroeconomic Announcements Across Periods of Unconventional Monetary Policy (ZLB)

In order to determine if the ZLB has an impact on the response of corporate bond spreads towards macroeconomic announcements, I employ a similar approach as in equation (4):

[13]Measured as an absolute value

$$\triangle Spread_t^h = \beta_0^h + \beta_{1,k}^h(Surprise_{k,t}(1 - D_t)) + \beta_{2,k}^h(Surprise_{k,t}D_t) + \beta_{3,k}^h(r_{10,t}) + \epsilon_t^h \qquad (5)$$

where $D_t$ denotes a dummy variable taking the value of one during the ZLB period and zero otherwise. As mentioned in Section 4, the ZLB period starts on December 16, 2008 and ends on December 16, 2015 when the Fed increased its interest rate for the first time since 2006. As before, $\beta_{3,k}^h$ controls for fluctuations of government bond yields.

Under equation (5), $\beta_{1,k}^h$ should be negative in line with the results in Section 6.1 where spreads decrease in response to positive macroeconomic surprises. At the same time, any difference in the reaction of credit spreads before and after the period of ZLB should be captured by the $\beta_{2,k}^h$ coefficient. In particular, if the ZLB policy in fact reduced the sensitivity of credit spreads towards economic surprises, this coefficient should be smaller (in absolute value) than $\beta_{1,k}^h$. In other words, as this latter coefficient comes closer to zero, then the ZLB policy in fact reduced the sensitivity of credit spreads towards macroeconomic shocks.

Table 9 reports estimates for equation 5. For the sake of clarity, estimates of $\beta_{3,k}^h$ are not reported, however they are all positive and in the majority of cases statistically significant, in line with the intuition discussed in Section 6.1. Furthermore, the sign of the $\beta_{1,k}^h$ is negative and statistically significant for a number of macroeconomic announcements, consistent with the findings in Section 6.1. However, in contrast to what was expected, estimates of $\beta_{2,k}^h$ indicate that the sensitivity of corporate bond spreads towards macroeconomic shocks increased during the ZLB period. For example, positive surprises of the ISM index translate into a reduction of -0.34% in HY spreads during "normal" periods, while the same positive surprises of the ISM index lead to a decrease of -0.44% in HY spreads during the ZLB period. The same is true for unemployment surprises, only this time the decrease in HY spreads due to positive shocks is -0.17% during "normal" periods and -0.28% during the ZLB period. It is also worth noticing that this pattern is not only present in the pooled HY index but also in indices with lower credit quality such as BBB, BB, B and CCC. Perhaps the only indicator that is in line with expectations is the NFP report, since the response of HY, BB, B and CCC spreads appears to decrease during the ZLB period. Furthermore, and although evidence is weak, it seems that the ZLB did impose some restriction to those indices with shorter maturities since the reaction towards some macroeconomic surprises of the IG index with 1-3 years of maturity appears to decrease during the ZLB period. This result is not surprising and it is somewhat in line with the findings of Swanson and Williams (2014), who argue that the ZLB reduced the sensitivity of short term bonds (one year to maturity or less) while longer term bonds remained quite responsive to macroeconomic announcements.

Table 9: The Response of Credit Spreads to Macroeconomic Announcements Across Periods of ZLB Policy

For each credit index $h$ and for each macroeconomic announcement of type $k$ the following regression is estimated using robust standard erros:

$$\triangle Spread_t^h = \beta_0^h + \beta_{1,k}^h(Surprise_{k,t}(1 - D_t)) + \beta_{2,k}^h(Surprise_{k,t}D_t) + \beta_{3,k}^h(r_{10,t}) + \epsilon_t^h$$

where $\triangle Spread_t^h$ is the daily log change in corporate bond index $h$ ($h$= HY, IG, AAA, AA, BBB, BB, B, CCC, IG 1-3 Yrs, IG 3-5 Yrs, IG 5-7 Yrs, IG 7-10 Yrs, IG 7-15 Yrs) and $Surprise_{k,t}$ is equal to zero if day $t$ is not an announcement day of type $k$, and is equal to the standarized surprise of announcement $k$ if day $t$ is an announcement day. $D_t$ is a dummy variable equal to one during periods where the ZLB policy was implemented and zero otherwise. As before, $r_{10}$ is the return of U.S 10 year treasury bonds. The *, ** and *** signal statistical significance at the 10%, 5% and 1% level respectively. Robust p-values are reported in parenthesis.

| Rating | HY | | IG | | AAA | | AA | | BBB | | BB | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Announcement | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ |
| ISM | -0.34** | -0.44*** | -0.12 | -0.21** | -0.41*** | -0.12 | -0.12 | -0.20 | -0.15* | -0.22** | -0.48*** | -0.58*** |
| | (0.01) | (0.01) | (0.15) | (0.05) | (0.01) | (0.58) | (0.31) | (0.12) | (0.06) | (0.02) | (0.00) | (0.00) |
| ISM non Manuf | -0.06 | -0.18 | -0.02 | -0.07 | -0.04 | 0.59 | 0.18* | -0.05 | -0.05 | -0.07 | -0.05 | -0.13 |
| | (0.46) | (0.40) | (0.80) | (0.65) | (0.78) | (0.29) | (0.05) | (0.79) | (0.45) | (0.62) | (0.60) | (0.59) |
| Cons Conf | 0.10 | -0.47*** | -0.06 | -0.18** | 0.00 | -0.32* | 0.03 | -0.27* | -0.13 | -0.20*** | 0.05 | -0.44** |
| | (0.23) | (0.00) | (0.57) | (0.03) | (0.98) | (0.06) | (0.84) | (0.05) | (0.28) | (0.00) | (0.74) | (0.01) |
| NFP | -0.18** | -0.09 | -0.14 | -0.11 | -0.39*** | 0.98* | -0.15 | -0.16 | -0.07 | -0.09 | -0.19** | -0.02 |
| | (0.02) | (0.61) | (0.10) | (0.52) | (0.00) | (0.08) | (0.18) | (0.45) | (0.44) | (0.59) | (0.05) | (0.92) |
| Retail Sales | 0.06 | 0.31 | 0.02 | 0.21 | 0.14 | 0.19 | -0.04 | 0.30 | 0.04 | 0.23* | 0.09 | 0.42* |
| | (0.46) | (0.12) | (0.82) | (0.18) | (0.49) | (0.64) | (0.81) | (0.32) | (0.53) | (0.07) | (0.42) | (0.06) |
| Budget | -0.10 | -0.01 | -0.16*** | 0.05 | -0.17** | 0.13 | -0.19** | -0.11 | -0.12** | 0.05 | -0.11 | -0.05 |
| | (0.30) | (0.96) | (0.00) | (0.57) | (0.02) | (0.59) | (0.01) | (0.21) | (0.05) | (0.49) | (0.32) | (0.77) |
| Unemployment | -0.17* | -0.28** | -0.08 | -0.10 | -0.09 | 0.06 | -0.13 | -0.17 | -0.00 | -0.11 | -0.15 | -0.32** |
| | (0.05) | (0.01) | (0.33) | (0.39) | (0.57) | (0.75) | (0.23) | (0.24) | (0.98) | (0.30) | (0.16) | (0.02) |
| IP | -0.06 | -0.20* | -0.11 | 0.07 | -0.12 | 0.44** | -0.20 | 0.02 | -0.07 | 0.08 | -0.17 | -0.20 |
| | (0.66) | (0.08) | (0.42) | (0.50) | (0.60) | (0.04) | (0.25) | (0.89) | (0.57) | (0.42) | (0.28) | (0.15) |
| CPI | -0.00 | 0.26 | -0.01 | 0.18 | -0.06 | 0.28 | -0.08 | 0.33** | -0.00 | 0.15 | 0.02 | 0.27 |
| | (0.98) | (0.11) | (0.89) | (0.17) | (0.59) | (0.14) | (0.31) | (0.03) | (0.96) | (0.13) | (0.82) | (0.13) |
| GDP | -0.04 | -0.11 | -0.30 | -0.01 | 0.01 | 0.32 | -0.39 | -0.16 | -0.04 | -0.03 | 0.08 | -0.24 |
| | (0.87) | (0.46) | (0.37) | (0.91) | (0.99) | (0.11) | (0.41) | (0.30) | (0.86) | (0.71) | (0.80) | (0.13) |

Table 9 (Continued): The Response of Credit Spreads to Macroeconomic Announcements Across Periods of ZLB Policy

For each credit index $h$ and for each macroeconomic announcement of type $k$ the following regression is estimated using robust standard erros:

$$\triangle Spread_t^h = \beta_0^h + \beta_{1,k}^h(Surprise_{k,t}(1 - D_t)) + \beta_{2,k}^h(Surprise_{k,t}D_t) + \beta_{3,k}^h(r_{10,t}) + \epsilon_t^h$$

where $\triangle Spread_t^h$ is the daily log change in corporate bond index $h$ ($h$= HY, IG, AAA, AA, BBB, BB, B, CCC, IG 1-3 Yrs, IG 3-5 Yrs, IG 5-7 Yrs, IG 7-10 Yrs, IG 7-15 Yrs) and $Surprise_{k,t}$ is equal to zero if day $t$ is not an announcement day of type $k$, and is equal to the standarized surprise of announcement $k$ if day $t$ is an announcement day. $D_t$ is a dummy variable equal to one during periods where the ZLB policy was implemented and zero otherwise. As before, $r_{10}$ is the return of U.S 10 year treasury bonds. The *, ** and *** signal statistical significance at the 10%, 5% and 1% level respectively. Robust p-values are reported in parenthesis.

| Rating | B | | CCC | | IG 1-3 Yrs | | IG 3-5 Yrs | | IG 5-7 Yrs | | IG 7-10 Yrs | | IG 10-15 Yrs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Announcement | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ | $\beta_{1,k}^h$ | $\beta_{2,k}^h$ |
| ISM | -0.37** | -0.45** | -0.17 | -0.33** | -0.44*** | -0.17 | -0.14 | -0.14 | -0.06 | -0.22 | -0.09 | -0.30*** | -0.06 | -0.33*** |
| | (0.02) | (0.01) | (0.13) | (0.02) | (0.00) | (0.23) | (0.16) | (0.28) | (0.51) | (0.12) | (0.36) | (0.01) | (0.48) | (0.00) |
| ISM non Manuf | -0.07 | -0.11 | -0.03 | -0.28 | -0.21* | -0.04 | -0.07 | -0.15 | -0.10 | -0.20 | 0.10 | -0.01 | -0.03 | 0.06 |
| | (0.43) | (0.62) | (0.65) | (0.26) | (0.08) | (0.85) | (0.40) | (0.42) | (0.16) | (0.28) | (0.18) | (0.95) | (0.75) | (0.65) |
| Cons Conf | 0.22 | -0.53*** | 0.14 | -0.41*** | -0.17 | -0.30** | -0.06 | -0.16 | -0.01 | -0.23* | -0.03 | -0.17* | -0.07 | -0.24** |
| | (0.10) | (0.00) | (0.22) | (0.00) | (0.27) | (0.01) | (0.65) | (0.10) | (0.92) | (0.08) | (0.78) | (0.08) | (0.61) | (0.05) |
| NFP | -0.24*** | -0.02 | -0.14* | -0.22 | -0.29** | -0.01 | 0.00 | -0.11 | -0.33 | -0.18 | -0.11 | -0.24 | 0.21 | -0.29** |
| | (0.01) | (0.94) | (0.05) | (0.19) | (0.03) | (0.96) | (1.00) | (0.57) | (0.27) | (0.32) | (0.17) | (0.20) | (0.10) | (0.05) |
| Retail Sales | 0.05 | 0.40** | 0.02 | 0.04 | 0.09 | 0.36 | -0.02 | 0.16 | 0.05 | 0.18 | -0.03 | 0.22 | -0.02 | 0.37** |
| | (0.60) | (0.04) | (0.77) | (0.87) | (0.44) | (0.12) | (0.83) | (0.33) | (0.59) | (0.19) | (0.82) | (0.21) | (0.89) | (0.04) |
| Budget | -0.11 | 0.01 | -0.09 | -0.02 | -0.05 | -0.15 | -0.07 | 0.03 | -0.12** | 0.09 | -0.18*** | 0.03 | -0.13** | -0.15 |
| | (0.28) | (0.94) | (0.22) | (0.91) | (0.54) | (0.17) | (0.24) | (0.77) | (0.04) | (0.27) | (0.00) | (0.72) | (0.04) | (0.19) |
| Unemployment | -0.17* | -0.28** | -0.13 | -0.24** | -0.11 | -0.05 | -0.00 | -0.06 | -0.20 | -0.17 | -0.09 | -0.17 | -0.14 | 0.00 |
| | (0.08) | (0.04) | (0.10) | (0.02) | (0.43) | (0.72) | (0.99) | (0.58) | (0.18) | (0.14) | (0.27) | (0.16) | (0.26) | (1.00) |
| IP | -0.07 | -0.17 | -0.08 | -0.18 | -0.25 | 0.32 | -0.10 | 0.16 | -0.11 | 0.08 | -0.02 | 0.05 | -0.05 | 0.08 |
| | (0.60) | (0.17) | (0.54) | (0.13) | (0.21) | (0.14) | (0.48) | (0.24) | (0.43) | (0.56) | (0.90) | (0.68) | (0.75) | (0.43) |
| CPI | 0.00 | 0.29* | -0.01 | 0.25 | 0.10 | 0.39 | -0.03 | 0.26** | -0.06 | 0.22* | -0.01 | 0.19 | -0.04 | 0.03 |
| | (0.98) | (0.07) | (0.87) | (0.15) | (0.38) | (0.11) | (0.69) | (0.04) | (0.60) | (0.05) | (0.87) | (0.17) | (0.50) | (0.79) |
| GDP | -0.09 | -0.05 | -0.17 | -0.01 | -0.34 | -0.02 | -0.49 | -0.03 | -0.11 | -0.07 | -0.14 | 0.10 | -0.05 | 0.02 |
| | (0.72) | (0.80) | (0.56) | (0.98) | (0.44) | (0.89) | (0.12) | (0.84) | (0.78) | (0.59) | (0.72) | (0.49) | (0.85) | (0.77) |

Given that most of the indices used in this study have maturities longer than one year[14], the fact that the ZLB did not inflict much of a restriction to corporate bond sensitivity is consistent with the findings of Swanson and Williams (2014). Consequently, these results show that contrary to hypothesis 5, the ZLB policy did not impose any restrictions to the reaction of corporate bond spreads to macroeconomic announcements. Instead, empirical evidence suggests that the ZLB actually increased the sensitivity of spreads towards macroeconomic surprises.

Turning now as to why spread sensitivity increased after the ZLB policy implementation, one possible explanation involving the communication strategy adopted by the Fed[15] during a large part of the ZLB period comes to mind. According to Kurov and Stan (2016) the Fed conditioned the future of monetary policy on economic data during that period. For instance, speaking before the U.S congress on May 2013, Fed Chairman Ben Bernanke stated that the Fed would start reducing its "Quantitative Easing" measures (which would increase market interest rates) if warranted by economic data.[16] As a result, it is likely that the Fed's communication strategy made investors turn their attention even more to macroeconomic announcements, since monetary policy, and therefore bond prices as well as returns, where heavily conditioned to U.S economic performance. Consequently, the "new" informational content carried in macroeconomic surprises became more valuable for investors, leading to a higher response of corporate bond spreads towards macroeconomic shocks.

## 6.4 Volatility of Credit Spreads Across Periods of Unconventional Monetary Policy

Finally, in order to examine whether corporate bond spread volatility was somehow affected by the ZLB policy, I follow an approach similar to that suggested by Bierens et al. (2003) and Huang and Kong (2008). These authors argue that a traditional GARCH conditional variance specification is not suitable for credit spread portfolios (indices) due to the "vanishing" memory effect of portfolio rebalancing, which is why they propose an ARCH(1) model with limited memory.

For the purpose of this study, a simplified version of the latter approach will be implemented. In particular the ARCH(1) model to be estimated is described below:

$$\triangle Spread_t^j = \beta_0^j + \beta_1^j(r_{10,t}) + \beta_2^j(I_t^a) + \epsilon_t^j \tag{6}$$

[14]According to the Federal Reserve Economic database (FRED) in order to include a particular corporate bond into any of the indices used, it must have more than one year of remaining maturity.

[15]Commonly known as "Forward Guidance"

[16]Subsequently, Chairman Janet Yellen stated that increases in the Federal Funds Rate would only happen if economic performance was strong enough.

$$h_t^2 = \omega + \alpha^j \epsilon_{t-1} + \rho_1^j (I_t^a(D_t)) + \rho_2^j (I_t^a(1 - D_t)) \tag{7}$$

where $\triangle Spread_t^j$ is the daily log change in corporate bond index $j$ ($j$= HY, IG, AAA, AA, BBB, BB, B, CCC, IG 1-3 Yrs, IG 3-5 Yrs, IG 5-7 Yrs, IG 7-10 Yrs, IG 10-15 Yrs), $I_t^a$ takes on the value of one if day $t$ is an announcement day and zero otherwise and finally $D_t$ is a dummy variable equal to one during the ZLB period and zero otherwise. As before $r_{10,t}$ is the return of U.S 10 year treasury bonds. In addition, it is assumed that $\epsilon_t \mid \Omega_{t-1} \sim N(0, h_t^2)$ where $\Omega_{t-1}$ denotes the information set at $t$-1 and $h_t^2$ is the conditional variance of corporate bond spreads. Note that under this specification if $\rho_2^j$ is positive then corporate bond spread volatility increases during announcement days and if $\rho_1^j < \rho_2^j$ then the ZLB policy actually dampened corporate bond spread volatility during announcement days.

The estimated parameters are shown in Table 10. It is worth mentioning that some of the $\rho_2^j$ estimates have a negative sign and are statistically significant. However, and perhaps with the exception of the AAA and IG 5-7 Yrs indices, all of these estimates appear to be rather small in magnitude, which would imply that the economic significance is negligible. Furthermore, $\rho_2^j$ is positive and statistically significant for the majority of cases, consistent with the traditional documented behavior of increased market volatility during announcement days (see for example Huang and Kong (2008) and Jones et al. (1998) among others). As a result, empirical evidence shows that at least in periods of "normal" monetary policy (i.e before the ZLB policy was implemented), announcement days tend to increase the volatility of corporate bond spreads.

On the other hand, when the ZLB policy was being implemented corporate bond spread volatility on announcement days is somewhat dampened. For example, for the BB index, spread volatility rises by 0.5% on announcement days on periods of "normal" monetary policy while during periods of ZLB policy volatility only increases by 0.16%. At the same time, for the BBB index, spread volatility increases by 0.35% on announcement days during normal periods but it actually decreases by 0.42% when the ZLB was being enforced. A similar pattern can be observed on the majority of indices, even some cases that initially suggested a drop in volatility on announcement days before the ZLB (i.e negative $\rho_2^j$) experience the "dampening" effect of unconventional monetary policy since $\rho_1^j < \rho_2^j$. Furthermore, p-values shown in the last row of Table 10 signal the rejection of the null hypothesis $\rho_1^j = \rho_2^j$, providing additional evidence that the ZLB policy had a "dampening" effect on corporate bond spread volatility during announcement days.

Overall these results suggest that although the ZLB policy increased the sensitivity of credit spreads towards macroeconomic surprises, it actually had the contrary effect on the conditional volatility of spreads during announcement days, since empirical evidence shows that the ZLB actually dampened credit spread volatility.

Table 10: Macroeconomic Announcements and Conditional Volatility of Corporate Bond Spreads

For each credit index $j$ ($j$= HY, IG, AAA, AA, BBB, BB, B, CCC, IG 1-3 Yrs, IG 3-5 Yrs, IG 5-7 Yrs, IG 7-10 Yrs, IG 10-15 Yrs) the following ARCH(1) model is estimated :

$$h_t^2 = \omega + \alpha^j \epsilon_{t-1} + \rho_1^j (I_t^a (D_t)) + \rho_2^j (I_t^a (1 - D_t))$$

where $h_t^2$ is the conditional variance of corporate bond spreads and $I_t^a$ takes on the value of one if day $t$ is an announcement day and zero otherwise. Finally $D_t$ is a dummy variable equal to one during the ZLB period and zero otherwise. The *, ** and *** signal statistical significance at the 10%, 5% and 1% level respectively. p-values are reported in parenthesis. The last row shows p-Values for the Wald test for the null hypothesis $\rho_1^j = \rho_2^j$.

| | HY | BB | B | CCC | IG | AAA | AA | BBB | IG 1-3 Yrs | IG 3-5 Yrs | IG 5-7 Yrs | IG 7-10 Yrs | IG 10-15 Yrs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Mean Equation* | | | | | | | | | | | | | |
| $\beta_0$ | -0.06*** | -0.04 | -0.07*** | 0.00 | -0.07*** | -0.08** | -0.06** | -0.04*** | -0.07*** | -0.07*** | -0.10*** | -0.06*** | -0.02*** |
| | (0.00) | (0.10) | (0.00) | (0.89) | (0.00) | (0.03) | (0.01) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| $\beta_1$ | 2.05*** | 2.34*** | 2.32*** | 1.20*** | 0.52*** | 0.77*** | 0.68*** | 0.50*** | 0.70*** | 0.49*** | 0.54*** | 0.60*** | 0.48*** |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| $\beta_2$ | -0.03 | -0.10** | -0.02 | -0.11*** | -0.01 | 0.13*** | 0.02 | -0.06** | -0.02 | -0.02 | -0.01 | 0.02 | -0.05* |
| | (0.35) | (0.04) | (0.56) | (0.00) | (0.83) | (0.00) | (0.52) | (0.01) | (0.63) | (0.51) | (0.69) | (0.44) | (0.08) |
| *Variance Equation* | | | | | | | | | | | | | |
| $\omega$ | 0.89*** | 2.02*** | 1.37*** | 1.52*** | 1.08*** | 5.60*** | 2.09*** | 0.79*** | 2.45*** | 1.60*** | 2.91*** | 1.03*** | 1.56*** |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| $\alpha$ | 0.40*** | 0.21*** | 0.32*** | 0.28*** | 0.45*** | 0.37*** | 0.43*** | 0.55*** | 0.48*** | 0.42*** | 0.84*** | 0.43*** | 0.38*** |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| $\rho_1$ | 0.88*** | 0.16*** | 0.82*** | -0.32*** | -0.59*** | 0.82*** | -1.01*** | -0.42*** | -1.19*** | -0.94*** | -2.35*** | -0.46*** | -1.09*** |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| $\rho_2$ | -0.01*** | 0.50*** | -0.03*** | -0.02** | 0.06*** | -1.78*** | 0.06* | 0.35*** | 0.72*** | -0.11*** | -1.15*** | 0.15*** | 0.11*** |
| | (0.00) | (0.00) | (0.00) | (0.04) | (0.00) | (0.00) | (0.06) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| P-value | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Further research could explore this findings even in more depth by studying whether the ZLB had the same "suppressing" effects on the conditional volatility of other asset classes such as stocks or government bonds. Likewise, more sophisticated techniques for modeling the conditional variance could provide additional confirmation of these findings. For example, it could be interesting to expand the analysis by using a GARCH (1,1) model that allows for a regime switch in the variance equation whenever there are periods of unconventional monetary policy such as the one presented in Bomfim (2003).

# 7 Conclusion

This paper examines the effect of macroeconomic announcements on the reaction and volatility of corporate bond spreads, and whether the effect depends on the stage of the economic cycle or varies across periods of unconventional monetary policy. By using daily option adjusted spreads of the various Bank of America Merril Lynch US corporate bond indices and survey announcement data on a set of widely followed macroeconomic indicators from Thomson Reuters Datastream, I find that on average negative macroeconomic surprises tend to increase credit spreads (i.e have a negative effect on spreads) while positive news lead to a decrease in spreads. Consistent with the results of previous studies regarding Treasury and stock markets, surprises in Non Farm Payrolls (NFP) and the ISM non Manufacturing index are particularly relevant for riskier bonds. Evidence also indicates that macroeconomic announcements affect primarily spreads of low grade bonds. In particular, a one standard deviation positive surprise in Non Farm Payrolls and in the ISM non Manufacturing Index, leads to a decline of 0.26% and 0.15% in High Yield spreads and to a drop of 0.30% and 0.16% in BB spreads respectively, in line with the findings of Huang and Kong (2008).

Furthermore, when controlling for the stages of the business cycle the results appear to contradict the well documented behavior present in stock markets where "good news" is "bad news" in expansions. However, estimates do show that the reaction of credit bond spreads towards macroeconomic surprises decreases during expansions. I argue that the equity component present in corporate bonds its not big enough to reflect the traditional "good news" is "bad news" story, nevertheless, such component is sufficiently large to mitigate the positive impact of "good news" on corporate spreads during expansions. This implies that, instead of having a scenario where "good news" is "bad news" during expansions, corporate bond spreads exhibit a somewhat similar behavior where "good news" in expansions is "not as good" as in contractions.

Regarding the effect of unconventional monetary policy (ZLB), I find that corporate bond spread sensitivity towards macroeconomic surprises increases during such periods. Although

this result is contrary to what was expected, it is argued that such behavior could be a consequence of the "forward guidance" strategy implemented by the Fed. Further research could explore this in more detail by perhaps studding whether a similar pattern is present in stock markets. Finally, the ARCH(1) model estimates indicate that while corporate bond spread volatility increases on announcement days, the ZLB policy had a dampening effect on the conditional volatility on such days. Overall, these result suggest that although the ZLB policy increased the sensitivity of credit bond spreads towards macroeconomic announcements, it had the contrary effect on the conditional volatility of spreads.

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