Investor Sentiment and Central Bank Communication

Hamza Bennani*
WORK IN PROGRESS, PLEASE DO NOT CIRCULATE
University of Paris Nanterre

February 20, 2019

Abstract

This paper aims to test the impact of of Fed chair's overconfidence on investor sentiment. We first use a media-based proxy to compute a measure of Fed chair's overconfidence for the period 1999M01-2018M08, the overconfidence indicator. We relate this variable to investor sentiment. Our results show that an overconfident Fed chair is associated with higher investor sentiment. Further extension shows that a negative change of Fed Chair's overconfidence has a higher impact on investor sentiment than a positive change, thus providing additional evidences of the "negativity" effect of news on investor's attitude.

Keywords: Central Bank Communication; Investor Sentiment; Fed Chair

JEL classification: E52, E58

*Corresponding author: EconomiX-CNRS, University of Paris Nanterre, 200 avenue de la République, 92001 Nanterre (France). Contact: h.bennani@parisnanterre.fr.

I Introduction

Fluctuations in market expectations cause aggregate fluctuations in macroeconomic activity and asset markets. The recent global financial crisis (GFC) is a case in point, as the boom in housing market has been attributed to exuberant beliefs about future prices while the subsequent burst came with a reversal in these beliefs (Angeletos and La'o, 2013).[1] The GFC is thus depicted as a *crisis of beliefs* (see Shleifer and Gennaioli, 2008).

As a result, there has been a renewed interest in the identification of the sources of fluctuations in market expectations that are not necessarily related to fundamentals. The macroeconomics literature has resorted to models to explain fluctuations in terms of "animal spirit", which is considered as an exogenous shock defined as sentiment that can appear without any modification in economic fundamentals.[2] More precisely, investor sentiment is commonly expressed as the degree of "bullishness" or "bearishness" that appears in stock markets: a bullish (bearish) investor expects returns to be above (below) average, whatever average may be (Brown and Cliff, 2004). These models identify sentiment as shock to an expectation variable that is orthogonal to fundamentals, and evaluate the importance of this shock as a source of economic fluctuations. Sentiment shock is a demand-driven fluctuation that is distinct from the New-Keynesian paradigm, which explains shifts in aggregate demand by innovations in people's tastes and abilities.

Empirical and theoretical studies show that variations in investor sentiment affect asset prices and economic activity (cf. section II). Hence, the question is no longer about the impact of investor sentiment, but rather about the determinants of its variations. Indeed, given the empirical evidences showing that investor sentiment can predict cross-sectional and time series stock returns, measures of investor sentiment are closely watched by policymakers; necessitating the need to better understand their drivers. The purpose of this paper is to identify the determinants of investor sentiment. So doing, we highlight an additional driver of investor sentiment beyond macroeconomic and financial variables, namely, central bank communication.

Since the ultimate objectives of a central bank are expressed in terms of macroeconomic variables (i.e., output, employment and inflation) and that the influence of monetary policy instruments on these variables is indirect, central banks need to impact asset prices and interest rates at all maturities in order to achieve their objectives. For this purpose, central banks might try to affect investor sentiment. However, unlike previous studies which look at the impact of conventional and unconventional monetary policy tools on investor sentiment (like e.g., Kurov, 2010 and Lutz, 2015),[3] we focus on another instrument in central banks' toolkit: their communication policy. As a matter of fact, the two last Fed chairs, Janet Yellen and Ben Bernanke, have prioritized

[1] Investors came to believe that financial markets were saddled with highly elevated risk, owing to a number of factors.

[2] Black (1986) and Delong et al. (1990) were the first to augment the standard macroeconomic models with investor sentiment, thus paving the way of behavioral finance.

[3] Kurov (2010) and Lutz (2015) find that a surprise drop in the fed funds rate has a positive impact on investor sentiment that lasts several months; unconventional monetary policy shocks have a similar impact on sentiment.

efforts to improve communication, noting that communication becomes one of the principal tools at monetary policymakers' disposal in times of economic distress (Yellen, 2013).

Furthermore, there is a growing literature showing that the media contribute to (i) shaping market sentiment (Starr 2004), (ii) affecting the behavior of economic agents and (iii) is a source of information for market participants. This follows the line of thought of Shiller (2000), who argues that investors follow the printed word, suggesting that investor sentiment is driven by news' content.[4] Consequently, monetary policymakers, aware of the effect of the press on investor sentiment, might use different tools to influence media coverage and to disseminate their communication, such as press conferences, post-meeting statements, congressional hearings, speeches and interviews. As an illustration, Berger et al. 2011 show that media coverage is responsive to the European Central Bank communication.

Again this background, this paper proposes to analyze the impact of media coverage of Fed chair's communication, notably his/her confidence and optimism, on investor sentiment. Since investor sentiment can be defined as optimism or pessimism that individuals have about financial markets, the assumption underlying this approach is that by publicly expressing confidence and optimism, the Fed chair is likely to affect the one of the investors, and thus, their sentiment. To test this hypothesis, we proceed in multiple steps. First, we collect articles from four leading economic and financial newspapers (*The New York Times*, *The Wall Street Journal*, *The Economist* and the *Financial Times*) that cover Fed chair's communication and describe him/her as confident, optimistic or variants such as overoptimistic. Second, we count the words relating to confidence or its opposite in proximity to the central banker name. Third, we follow the literature in finance (Malmendier and Tate, 2008; Malmendier et al., 2011) and use word count to compute a measure that quantifies the degree of overconfidence expressed by the Fed chair and covered by the media. We call this measure the media-based proxy of Fed chair's overconfidence, or to put it more simply, the overconfidence indicator (OI). As a final step, we test the impact of the media-based proxy of Fed chair's overconfidence on investor sentiment. The results show that the media-based proxy has a statistically significant and economic impact on investor sentiment. More precisely, we find that...

This paper is the first to empirically assess the impact of media coverage of Fed chair's communication, and more precisely, Fed chair's overconfidence, on investor sentiment. The remainder of the paper is structured as follows: section 2 provides a review of the literature, section 3 presents the data and the methodology, section 4 the results and section 5 provides further extensions. The last section concludes.

[4]Survey evidence indicates that over 40% of investors rely heavily on the information derived from mass media when choosing their mutual fund investments (Securities and Exchange Commission, 2000).

II Related Literature

Recent theoretical contributions show that sentiment matters to explain business cycle fluctuations. Angeletos and La'o (2013) relax the common assumption that all agents share similar beliefs about the state of the economy. They show that market expectations and economic outcomes may be affected by shocks which they call sentiment. Angeletos et al. (2014) and Milani (2014) estimate fully-specified DSGE models that incorporate sentiment shocks, and show that the sentiment shocks identified within the structure of these models can explain a large fraction of the US business cycle fluctuations. Benhabib et al. (2015) find that sentiment unrelated to fundamentals can affect output and employment. Finally, Benhabib et al. (2016) show that sentiment-driven fluctuations can generate persistence in business cycles, and have cross-sectional and time-series implications for asset prices.

From the empirical side, the literature also finds that investor sentiment can affect asset prices (see e.g., the surveys by Hirshleifer, 2001 and Baker and Wurgler, 2007), which in turn can influence real activities through corporate financing, investment and thus, shape macroeconomic fluctuations. Chauvet and Guo (2003) find that investor sentiment shocks played an important role in several recessions.[5] Brown and cliff (2004, 2005) document that changes in investor sentiment are highly correlated with contemporaneous and long-run stock returns. More precisely, high levels of sentiment result in significantly lower returns over the next 2 or 3 years. Finally, Levchenko and Pandalai-Nayar (2015) identify the sentiment shock as being more important than other factors in explaining business cycle co-movement between the US and Canada. These studies provide evidences in favor of strong co-movements between investor sentiment and the stock market returns and are at odds with standard finance theory.[6]

A parallel strand of the literature shows that investors obtain their information from the mass media, and thus, that investor sentiment can be driven by media coverage of economic and financial news.[7] Carroll (2003) shows that households' macroeconomic expectations derive from news reports of the views of professional forecasters. Blinder and Krueger (2004) show that consumers obtain their economic information largely from TV and newspapers. Doms and Morin (2004) find that consumer sentiment is affected by the tone and volume of reporting and Hayo and Neuenkirch (2015) show that market participants rely on media reporting to learn about central bank events. As a result, the media have a causal impact on financial markets: they stimulate stock trading and enhance the variability of stock prices (Peress, 2014). Media pessimism also leads to downward pressure on market prices, followed by a reversion to fundamentals (see Tetlock, 2007 and Tetlock et al. 2008). Moreover, individual investors overreact to stale news, suggesting that the media play a role even when disclosing already available information (Tetlock,

[5] Baker and Wurgler (2006) offer anecdotal evidences where investor sentiment causes boom and burst in financial markets, such as the October 1987 stock market crash, the Internet bubble and the ensuing Nasdaq and telecom crashes.

[6] The standard finance theory predicts that stock prices reflect the discounted value of expected cash-flows and that irrationality among market participants are erased by arbitrageurs.

[7] The use of news can be motivated by theories of rational inattention, where agents have limited information-processing capacity and therefore cannot absorb all available information.

2011).[8] However, it is important to keep in mind that media coverage may be influenced from three sides: the policymakers, the preferences of the general public and the media itself. The literature suggests that media coverage may be influenced by the journalistic preferences (Groseclose and Milyo 2005). Media coverage also tends to be affected by the views and preferences of the audience (Mullainathan and Shleifer 2005; Gentzkow and Shapiro, 2010). Finally, the central bank can also shape the perception of its actions in the media through its communication policy (see Berger et al., 2011).

III Data

This section describes the variables used to test the impact of media coverage of Fed chair's overconfidence on investor sentiment.

III.1 Media Coverage of Fed Chair's Overconfidence

To provide a quantitative measure of Fed chair's overconfidence, we follow the literature in finance that relies on press portrayal in the major newspapers. As an illustration, Malmendier et al. (2011) use a media coverage proxy to classify a Chief Executive Officer (CEO) as overconfident if he/she is *more* frequently described as "confident" and "optimistic" relative to descriptors such as "frugal", "conservative", "cautious", "practical", "reliable" or "steady". The media-based proxy relies on trait theory, which uses a list of 18000 words compiled by Allport and Odbert (1936) to describe traits. More recently, the literature used factor analysis to reduce the number of traits in the list to five traits (Goldberg, 1981, 1993; McCrae and Costa, 1990, 1997), the Five Factor Model (FFM).[9]

Our measure of Fed chair's overconfidence is based both on media portrayal and the FFM. We use media coverage as a proxy to measure Fed chair's overconfidence for the period 1994M01-2018M08: (i) Alan Greenspan (1994M01-2006M01), (ii) Ben Bernanke (2006M02-2014M01), (iii) Janet Yellen (2014M02-2018M01) and (iv) Jerome Powell (2018M02-2018M08). We start our analysis on January 1994 since newspaper articles covering Fed chair's communication were scarce before that period. This might be due to the fact that the Federal Open Market Committee (FOMC) had not announced its policy decisions before 1994.[10] But on February 4, 1994, the FOMC started issuing a brief statement announcing a decision to change policy. From that period onwards, media coverage of FOMC's policy decisions has largely expanded.

We thus collect data on how the main financial and economic media portray each central banker during the sample period using Factiva database. For each central banker, we first collect the

[8] Hubergman and Regey (2001), Gilbert et al. (2014), Liu et al. (2014b) and Birz (2017) provide empirical evidences and theoretical explanation to the stale news hypothesis.

[9] The five factors are openness, conscientiousness, extroversion, agreeableness and neuroticism. Each of the factors represents several highly correlated sub-factors or traits.

[10] Changes in policy decisions had to be inferred by market participants from actions taken by the Open Market Desk of the New York Fed.

articles published in *The Wall Street Journal*, *The New York Times*, the *Financial Times* and *The Economist* that portray the central banker as (a) "confident", "optimistic", "overoptimistic" and (b) "cautious", "conservative", "steady", "pessimistic", "gloomy","not confident" and "not optimistic" (table X in the appendix provides the frequency of the keywords appearing in the articles).[11] It is important to keep in mind that the keywords used to compute the media-based proxy of Fed chair's overconfidence are not chosen arbitrarily but are derived from the FFM, thus, they describe the personality trait related to confidence and optimism. In a next step, we read each article to check whether the keywords describe the central banker and whether they are negated. Interestingly, we find that the Fed chair usually expresses confidence regarding the development of inflation, output and employment: "*This month Ms Yellen said her confidence in the inflation outlook had been 'bolstered' by recent strong jobs numbers [...]*".[12]

Finally, we develop the media-based proxy of Fed chair's overconfidence using word count. For each month, we compare the number of words used in the published articles and related to the "confident" terms, i.e. category (a), with the number of words related to the "cautious" terms, i.e. category (b). Following Malmendier et al. (2011), we consider that a Fed chair is overconfident if he/she is *more* described by the terms related to the category (a) than by the terms of the category (b). We measure overconfidence for each Fed chair as:

$$OI_t = \frac{a_t - b_t}{Total_t} \tag{1}$$

where a_t reflects the number of words used in the published articles at month t and related to the "confident" terms, b_t the number of words related to the "cautious" terms and $Total_t$ the total number of articles that mention the Fed chair. We control for the total number of articles to address potential bias due to different coverage through time. OI_t is a continuous variable that can be positive (negative) if the number of words related to the "confident" terms is higher (lower) than the number of words related to the "cautious" terms. We multiply the media-based proxy by 10 to ease its numerical interpretation. Figure 1 below shows the evolution of the media-based proxy through the sample period.

[11] Words such as "disciplined", "conscientious", "reliable", "frugal" and "practical" are used in the literature to describe CEO overconfidence but are not used to describe central bankers in the media.

[12] Fleming, S. (2015). "Set for lift-off: All eyes on Fed's signals as rate rise expected". *Financial Times*, December 15.

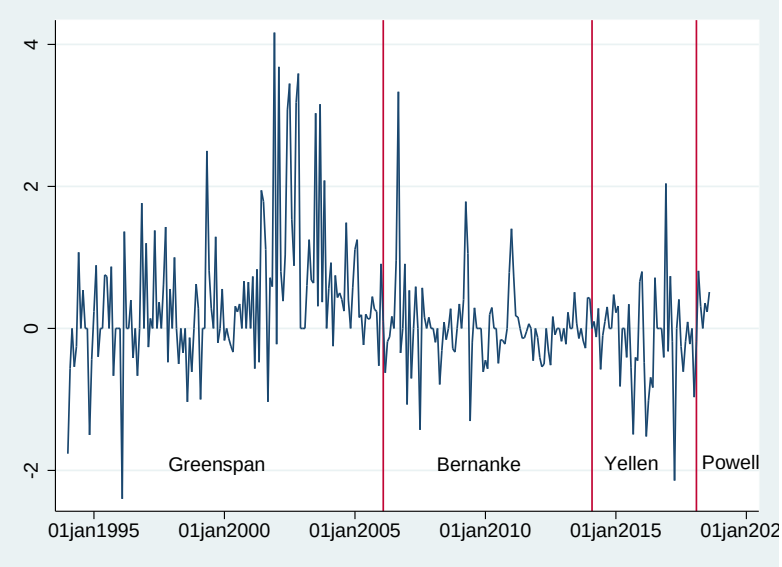

Figure 1: Overconfidence Indicator

Figure 1 shows that the media-based proxy does not display any apparent trend through time, except at the beginning of the 2000s. The nineties are characterized by a varying degree of Fed chair's overconfidence with positive and negative values. The bottom points of the media-based proxy observed on 1997 and 1998 might correspond to shocks related to the Asian financial crisis and the collapse of Long-Term Capital Management. Nevertheless, monetary policy is thought to have performed well in the nineties with a more systematic response to deviations of inflation and output (Bernanke, 2004). This likely explains the relative stability of the media-based proxy observed during that period. However, the overconfidence indicator increased at the beginning of the 2000s and reached its maximum value in mid-2003. This increase follows the burst of the dot-com bubble and corresponds to an era of economic expansion and an accommodative monetary policy. These economic conditions might explain the confidence and the optimism expressed by the Fed chair (i.e., Alan Greenspan) and covered by the media. Nevertheless, the proxy started to decline progressively from that period until attaining the through on mid-2008, a period coinciding with the collapse of Lehman Brothers and the start of the GFC. Interestingly, the peaks observed during Bernanke's term correspond to specific events related to the GFC. For instance, the peak on March 2009 happens when the Fed announced that it will pump an extra 1 trillion into the financial system by buying Treasury bonds and mortgage securities. Similarly, the peak observed at the end of 2010 happens at a time when the Fed implemented a second round of quantitative easing to pump 600 billion into the banking system. Finally, figure 1 shows that the media-based proxy is negative during Yellen's term for an extended period of time. This might be explained by the criticisms that Yellen faced for its fuzzy communication about the future pace of the unconventional policy measures, and the resulting confusion felt by the

media.[13]

III.2 Investor Sentiment

There are various ways to measure investor sentiment, including surveys, mutual fund flows, premia on dividend-paying stocks, closed-end fund discounts and first day returns on initial public offerings (IPOs).

Regarding survey measures, Robert Shiller has conducted investor attitude surveys since 1989. UBS/Gallup surveys randomly-selected investor households, and Investors Intelligence (II) surveys financial newsletter writers. Fisher and Statman (2000) show that the level of II sentiment does not have any significant effect on future Standard and Poor's equity returns, which raises doubt as to whether II index can be considered as an effective measure of investor sentiment. Baker and Wrugler (2007) suggest that economists always treat surveys with some degree of suspicion, because of the potential gap between how people respond to a survey and how they actually behave. Furthermore, Da et al. (2015) note that survey-based sentiment measures are not available in high frequency and become increasingly less reliable when non-response rates are high or the incentive for truth-telling is low.

Therefore, we follow Baker and Wurgler (2006) (BW) who compute a sentiment index that combines several market-based variables that reflect investor's optimism and pessimism. They form a composite index of sentiment that is based on the common variation in six underlying proxies for market-based sentiment:

• The closed-end fund discount: value-weighted average difference between the net asset values of closed-end stock mutual fund shares and their market prices;

• NYSE share turnover: log of the raw turnover ratio detrended by the past 5-year average, where raw turnover ratio is the ratio of reported share volume to average shares listed from the NYSE Fact Book;

• The number on IPOs: monthly number of initial public offerings;

• First-day returns of IPOs: monthly average first-day returns of initial public offerings;

• The equity share in new issues: gross monthly equity issuance divided by gross monthly equity plus debt issuance; and

• The dividend premium: log difference of the value-weighted average market-to-book ratios of dividend payers and nonpayers.

Since each sentiment proxy is likely to include a sentiment component as well as idiosyncratic, non-sentiment-related components which reflect economic fundamentals,[14] Baker and Wurgler (2006) use principal components analysis to isolate the common component in the six proxies. They construct a second index that explicitly removes business cycle variation (growth in the industrial production index, growth in consumer durables, nondurables, and services, and a dummy variable for NBER recessions) from each of the proxies and use the residuals from these

[13] See: Luce E., (2015). "Waiting for Yellen". *Financial Times*, September 20.

[14] For instance, IPO volume depends, in part, on prevailing investment opportunities.

regressions as sentiment proxies. The resulting orthogonalized sentiment index is intended to capture investor's less-than-rational behavior. The data are available from Jeffrey Wurgler's website and cover the period between July 1965 and November 2015.[15] Figures 2 below shows the evolution of the orthogonalized sentiment index.

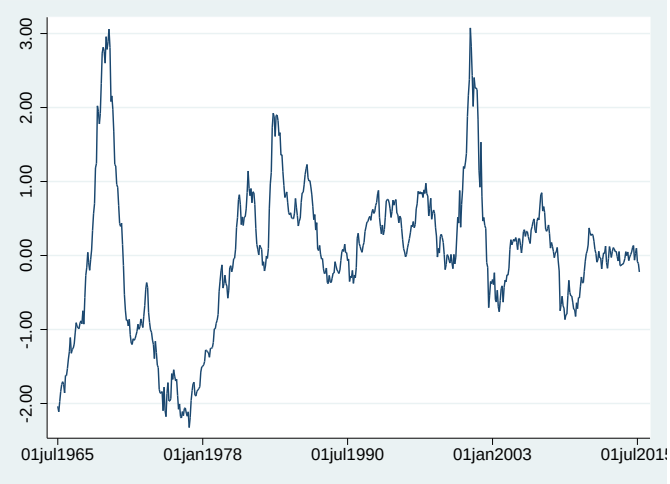

Figure 2: Orthogonolized sentiment index

Baker and Wurgler (2006) find that their orthogonalized sentiment proxy is in line with most of the speculative episodes of these last decades (for more details, see Baker and Wurgler, 2007 p. 1658) and that it is negatively related to the returns of smaller stocks, high volatility stocks, unprofitable stocks, non-dividend-paying stocks, extreme-growth stocks, and distressed stocks. Moreover, the BW sentiment index has been widely used in a number of studies, such as Yu and Yuan (2011), Baker et al. (2012), Stambaugh et al. (2012), Yu (2013), Berger and Turtle (2015) and Sibley et al. (2016). Their empirical results are consistent with the fact that investor sentiment drives prices and returns in the market, which in turn affects macroeconomic activity.

IV Empirical Setup

Investor sentiment is a combination of expectations based on economic fundamentals and expectations unrelated to fundamentals, like e.g. irrational exuberance (see Shleiffer and Summers, 1990 and Brown and Cliff, 2005). Since the six proxies used to construct the BW sentiment index are closely related to risk factors, stock market conditions, and the overall business environment,[16] we need to disentangle the component of the BW sentiment index that is related to economic fundamentals from the component that is related to non-fundamentals. We suppose

[15] http://people.stern.nyu.edu/jwurgler/.

[16] As an illustration, the number of IPOs and average first day return on IPOs are tied to overall economic and market conditions and recent stock market performance.

that the non-fundamental component of the sentiment index is likely to be affected by media coverage of Fed chair's overconfidence.

We follow the asset pricing literature and consider that variables such as the unemployment rate, inflation, production growth rate, interest rate, yield spreads and market volatility constitute relevant proxies for economic fundamentals. However, even though we include what we consider as the most important and relevant business cycle variables to ease the concern of using too many variables, there is still the risk that we omit other important variables. Our empirical analysis is based on the assumption that these variables reflect economic fundamentals, thus, our results should be interpreted accordingly. We highlight the link between the BW sentiment index and the (non)-fundamental variables as follows

$$Sent_t = a + \beta_1 \underbrace{OI_t}_{\text{non-fundamental}} + \beta_2 \underbrace{X_{Macro,t} + \beta_3 X_{Fin,t}}_{\text{fundamental}} + \varepsilon_t \tag{2}$$

where BW_t reflects the orthogonalized sentiment index à la Baker and Wurgler (2006) and OI_t the media-based proxy of Fed chair's overconfidence. $X_{Macro,t}$ is the vector of macroeconomic variables that includes the unemployment rate ($Unemp_t$), change in inflation (CPI_t) and the growth rate of industrial production (Ind_t). We also include 4 additional variables from financial markets in the vector $X_{Fin,t}$ that have been frequently used as indicators of the business cycle: the 3-month Treasury Bill rate ($Tbill_t$), the default spread (Def_t) defined as the difference in yields between BAA and AAA rate corporate bonds, the term spread ($Term_t$) defined as the difference in yields between the 10-year Treasury bond and the 3-month T-bill and the CBOE volatility index ($MktVol_t$). Finally, ε_t is the error term.

The data are obtained from the Federal Reserve Bank of St Louis. The inclusion of many different explanatory variables at the same time might give rise to multicollinearity problems. Hence, we calculate the variance inflation factors (VIFs). In all cases, all VIFs are well below the rule of thumb threshold of 10. Table 1 below provides the summary statistics of the data and includes the means, standard deviations, as well as the correlations with the BW sentiment index. Interestingly, even though the sentiment index is supposed to be orthogonal to business cycle variables, it is still significantly correlated with many of the fundamental economic variables. Hence, at the 1% significance level, sentiment is correlated with unemployment, inflation, the term spread and market volatility.

Table 1: Summary Statistics

	Mean	Std	Corr. with Sent	p-value	No. of Obs.
$Sent_t$	-0.046	0.98	1.00	0.00	603
$Unemp_t$	6.06	1.65	-0.16	0.00	638
CPI_t	0.33	0.32	-0.16	0.00	638
Ind_t	0.19	0.72	-0.07	0.06	638
$Tbill_t$	4.75	3.27	0.1	0.01	638
Def_t	1.05	0.22	-0.03	0.39	638
$Term_t$	1.83	1.08	-0.17	0.00	440
$MktVol_t$	19.27	7.51	-0.1	0.00	344

This table reports summary statistics for the orthogonalized BW sentiment index and 7 macroeconomic and financial variables. We present the means, standard deviations, the correlations with the sentiment index and the number of observations. The 7 variables are: the unemployment rate ($Unemp_t$), change in inflation (CPI_t), change in industrial production (Ind_t), the T-bill rate ($Tbill_t$), the default spread (Def_t), the term spread ($Term_t$), and the CBOE volatility index ($MktVol_t$). Our sample period is from July 1965 until December 2016. All variables are measured at a monthly frequency.

Since it is possible that these variables are influenced by sentiment and thus carry information about it, the estimated parameters from Eq. 2 may be biased and inconsistent. To tackle this issue, the independent variables related to those parameters are instrumentalized. However, an additional issue is the presence of heteroskedasticity, which invalids the diagnostic tests for endogeneity and over-identification. As suggested by Baum et al. (2003), this problem can be addressed with the Generalized Method of Moments (GMM) estimator introduced by Hansen (1982). The GMM estimator uses the orthogonality conditions to allow for efficient estimation in the presence of heteroskedasticity of unknown form. For the instruments, we use a constant and the lagged values of the explained and explanatory variables since they should signal future developments of the independent variables while being uncorrelated with the error term. Moreover, we face the problem that some instrumental variables are not necessary and distort our results. Hansen (1982) suggests a test for the validity of instruments by making a standard J-test for the validity of the over-identifying restrictions. Finally, since the BW sentiment index is standardized to have zero mean and unit variance, we also standardize the right-hand side variables of eq. (2).

V Results

V.1 Baseline Model

Tables 2 below shows estimation results of eq. (2) when considering the orthogonalized BW sentiment index as a dependent variable. The sample period is 1994M01-2015M09. To ease the concern that we use too many variables and over-fit the model, we estimate three separate sets of regressions. In the first (second) set, we only include macroeconomic (financial) variables. In

the third set, we include all variables. We focus our analysis on the parameters that exhibit consistency in significance and value across the different specifications.

Table 2: Investor Sentiment and Fed chair's Overconfidence

Variable	Specification 1	Specification 2	Specification 3
$Const$	2.08***	0.35	2.07***
	(0.31)	(0.23)	(0.5)
OI_t	2.93***	8.82***	3.27***
	(1.06)	(1.25)	(0.67)
$Unemp_t$	-0.3***		-0.15***
	(0.04)		(0.048)
CPI_t	-0.05		0.005
	(0.16)		(0.09)
IPI_t	-0.2		-0.02
	(0.12)		(0.06)
$Tbill_t$		0.04	-0.07
		(0.03)	(0.05)
Def_t		-0.37**	-0.33**
		(0.15)	(0.16)
$Term_t$		-0.18***	-0.19**
		(0.06)	(0.08)
Vix_t		0.01	-0.01
		(0.007)	(0.007)
J-test	0.9	0.9	0.9
Adjusted R^2	0.25	0.33	0.35
Obs.	253	253	253

The dependent variable is the orthogonalized BW sentiment index, $Sent_t$. Standard errors are shown in between brackets. Estimates are obtained using 2-steps GMM. *, **, *** denote significance at the 10%, 5%, and 1% level, respectively. J-test is the p-value of the test of over-identifying restrictions. The list of instrumental variables includes a constant and the lags of the dependent variable and the independent variables.

Tables 2 shows that financial variables are better able to explain the variation of the sentiment index than the macroeconomic variables. As an illustration, the first specification with macroeconomic variables has an adjusted R^2 of 25% while the second specification with financial variables has an adjusted R^2 of 33%.

Interestingly, we find that the media-based proxy of Fed chair's overconfidence has a significant and positive impact on investor sentiment regardless of the specification considered in the analysis. Hence, when the Fed chair is more (less) described by the media with "confident" terms relative to "cautions" terms, investor sentiment tends to increase (decrease). More precisely, a one-unit increase of the overconfidence indicator implies an increase of investor sentiment by 3.27 unit when considering both macroeconomic and financial variables in the estimation.

Regarding the rest of the variables, the results show that the unemployment rate has a negative and significant impact on investor sentiment. Hence, when unemployment rate increases by

1% point, investor sentiment decreases by 0.15 (0.30) unit when including (excluding) financial market variables. For the financial variables, the default and the term spreads affect negatively and significantly investor sentiment. More precisely, A 1% increase of the default (term) spread implies a decrease of investor sentiment by 0.35 (0.19) unit point, on average.
All in all, these results provide the first empirical evidences showing that media coverage of Fed chair's overconfidence has a significant impact on investor sentiment. Moreover, we also find that some macroeconomic and financial variables can significantly affect the level of sentiment. The findings show that a variable unrelated to fundamentals, such as media coverage of Fed chair's overconfidence, matters to explain the variation of investor sentiment beyond macroeconomic and financial conditions.

V.2 Negativity Effect

Past research in political science and psychology has shown that individual's behavior to positive and negative information is asymmetric, that is, the effect of a 1-unit increase in negative news is not the opposite of 1-unit increase in positive news. For instance, there is evidence that negative information plays a greater role in voting behavior than positive information (Aragones 1997; Campbell et al. 1960; Kernell 1977).[17]Several theories have been proposed by the psychology literature to explain this asymmetry, such as the perspective theory or the cognitive weighting theory (for more details, see Soroka (2006)). In economics, prospect theory (Kahneman and Tversky, 1979) suggests a similar asymmetry of positive and negative news on individual's behavior. Prospect theory highlights that people care more strongly about a loss in utility than they do about a gain of equal magnitude. Hence, the psychology literature shows that asymmetry is the product of differences in perception, while the economics literature conceives asymmetry as the process of reacting differently to positive and negative news. Earlier studies find empirical evidences of this asymmetry. Nofsinger and Prucyk (2003) consider the volume and volatility effects of 21 macroeconomic news announcements on S&P100 stock index options. They find that bad (good) news is associated with higher (lower) volume and volatility. Soroka (2006) makes a content analysis of economic news in *The Times* and provides evidence of asymmetries in individuals' attitudes to positive and negative information. Finally, Akhtar et al. (2012) find that when a lower (higher) consumer sentiment index is announced, equity and futures markets experience a significant negative (no) announcement day effect.
We draw on the psychological and the economics literatures to test the asymmetric response of investor sentiment to central bank communication. More precisely, we test whether there is a "negativity" or a "positivity" effect, that is, whether investor sentiment reacts differently to a negative or a positive change of Fed chair's overconfidence.[18] The estimation takes the following

[17]More specifically, U.S. presidents are penalized electorally for negative economic trends but gain few electoral benefits from positive trends (Bloom and Price 1975; Claggett 1986; Headrick and Lanoue 1991; Kiewiet 1983; Lanoue 1987; Mueller 1973; Nannestad and Paldam 1997)

[18]Chen et al. (2004) document a "positivity effect" by showing that firms added to the S&P500 experience a positive price return, while firms that are removed do not experience a negative price return.

form

$$Sent_t = a + \beta_1 \Delta OI_{pos,t} + \beta_2 \Delta OI_{neg,t} + \beta_3 X_{Macro,t} + \beta_4 X_{Fin,t} + \ \varepsilon_t \tag{3}$$

where $\Delta OI_{pos,t}$ ($\Delta OI_{neg,t}$) is the positive (negative) change of Fed chair's overconfidence. $\Delta OI_{pos,t}$ ($\Delta OI_{neg,t}$) is different (equal) to 0 where there is a positive change, and is equal (different) to 0 where there is a negative change. The rest of the left-hand and right-hand side variables are similar to eq. (2). Table 3 below shows the results of the estimation for the period 1994M02-2015M09.

Table 3: Investor Sentiment and Fed chair's Overconfidence

Variable	Specification 1	Specification 2	Specification 3
$Const$	1.49***	0.26*	2.39***
	(0.27)	(0.14)	(0.69)
$\Delta OI_{pos,t}$	3.6***	6.69***	3.81***
	(0.97)	(0.53)	(1.35)
$\Delta OI_{neg,t}$	-4.1***	-6.62***	-9.9***
	(0.91)	(0.55)	(2.32)
$Unemp_t$	-0.26***		-0.11*
	(0.04)		(0.06)
CPI_t	0.16		-0.33
	(0.13)		(0.27)
IPI_t	-0.08		-0.46**
	(0.09)		(0.18)
$Tbill_t$		-0.03	-0.16**
		(0.02)	(0.07)
Def_t		-0.71***	-1.15***
		(0.082)	(0.27)
$Term_t$		-0.28***	-0.27***
		(0.04)	(0.1)
Vix_t		0.03***	0.01
		(0.004)	(0.01)
J-test	0.9	0.9	0.9
Adjusted R^2	0.25	0.34	0.37
Obs.	251	248	255

The dependent variable is the orthogonalized BW sentiment index, $Sent_t$. Standard errors are shown in between brackets. Estimates are obtained using 2-steps GMM. *, **, *** denote significance at the 10%, 5%, and 1% level, respectively. J-test is the p-value of the test of over-identifying restrictions. The list of instrumental variables includes a constant and the lags of the dependent variable and the independent variables.

Table 3 shows that a positive (negative) change of the overconfidence indicator is associated with higher (lower) investor sentiment. Although the specifications including only the macroeconomic variables and all variables (i.e. columns (1) and (3)) show that the "negativity" effect has a

higher impact on investor sentiment than the "positivity" effect, it is not possible to draw a similar conclusion when we only include the financial variables in the empirical analysis (column (2)).

Some parameters related to macroeconomic and financial variables have consistent value and significance across the different specifications. As an illustration, we find that higher unemployment implies lower investor sentiment and an increase of the default and term spreads decrease investor sentiment.

Overall, the findings show that investor sentiment reacts differently to a positive or a negative change of Fed chair's overconfidence, hence a positive (negative) change of the overconfidence indicator lead to higher (lower) sentiment. Nevertheless, we do not find conclusive evidence that the "negativity" effect has a higher impact on investor sentiment than the "positivity" effect, except when we include only the macroeconomic variables and all variables in the estimation procedure.

Conclusion

TBA

References

TBA

Appendix

Table 4: Frequency of the keywords

Keyword	**Frequency**
confident	178
optimistic	431
overoptimistic	14
Total	*623*
cautious	356
conservative	23
steady	20
pessimistic	20
gloomy	21
not confident	19
not optimistic	14
Total	*453*

This table reports the number of words used in the articles and published in *The Wall Street Journal*, *The New York Times*, the *Financial Times* and *The Economist* to describe the Fed chair during the period 1994M01-2018M08.