

Hayo, Bernd; Kutan, Ali M.; Neuenkirch, Matthias

Working Paper

Communicating with many tongues: FOMC speeches and US financial market reaction

MAGKS Joint Discussion Paper Series in Economics, No. 2008,08

Provided in Cooperation with:

Faculty of Business Administration and Economics, University of Marburg

Suggested Citation: Hayo, Bernd; Kutan, Ali M.; Neuenkirch, Matthias (2008) : Communicating with many tongues: FOMC speeches and US financial market reaction, MAGKS Joint Discussion Paper Series in Economics, No. 2008,08, Philipps-University Marburg, Faculty of Business Administration and Economics, Marburg

This Version is available at:

<https://hdl.handle.net/10419/30104>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

MAGKS



**Joint Discussion Paper
Series in Economics**

by the Universities of
Aachen · Gießen · Göttingen
Kassel · Marburg · Siegen

ISSN 1867-3678

No. 08-2008

Bernd Hayo, Ali M. Kutan and Matthias Neuenkirch

**Communicating with Many Tongues:
FOMC Speeches and U.S. Financial Market Reaction**

Bernd Hayo
Philipps-University Marburg
Faculty of Business Administration and Economics
Universitätsstraße 24, D-35032 Marburg
Tel.: ++49(0)6421-2823091 Fax: ++49(0)6421-282308
Email: hayo@wiwi.uni-marburg.de

Ali M. Kutan
Southern Illinois University Edwardsville and
the William Davidson Institute, Michigan

Matthias Neuenkirch
Philipps-University Marburg

This paper can be downloaded from
http://www.uni-marburg.de/fb02/makro/forschung/magkspapers/index_html%28magks%29

Coordination: Bernd Hayo • Philipps University Marburg • Faculty of Business Administration &
Economics • Universitätsstr. 24, D-35032 Marburg
Tel: ++49-6421-2823091, Fax: ++49-6421-2823088 e-mail: hayo@wiwi.uni-marburg.de

**Communicating with Many Tongues:
FOMC Speeches and U.S. Financial Market Reaction**

Bernd Hayo*, Ali M. Kutan⁺ and Matthias Neuenkirch*

*Philipps-University Marburg

⁺Southern Illinois University Edwardsville and the William Davidson Institute, Michigan

Corresponding author:

Bernd Hayo
Faculty of Business Administration and Economics (FB 02)
Philipps-University Marburg
D-35032 Marburg
Germany
Tel.: ++49(0)6421-2823091
Fax: ++49(0)6421-2823088
Email: hayo@wiwi.uni-marburg.de

* Thanks to Ari Belasen, Michael Ehrmann, Michael Lamla, Helge Berger, participants of the Annual Conference of the Eastern Economic Association in New York, the Verein für Socialpolitik in Graz, MAREM macroeconomics workshop in Bonn and research seminars at the Universities of Duisburg-Essen and Marburg for their helpful comments on earlier versions of the paper. The usual disclaimer applies.

Communicating with Many Tongues: FOMC Speeches and U.S. Financial Market Reaction

Abstract

This paper studies the effects of FOMC communication on U.S. financial markets' returns and volatility using a GARCH model over the period from 1998 to 2006. We build a new data set that includes information on all FOMC speeches, post-meeting statements, monetary policy reports and testimonies. Our results can be summarized as follows: first, the impact on both returns and volatility is larger if the communication channel is more formal. However, since speeches happen much more often than other forms of communication, their absolute aggregate effect on financial markets is economically significant. Second, the effects of Fed communications tend to follow some sort of hierarchy: the Board of Governors (BoG) members have a greater impact than regional presidents, the chairman and vice chairman more influence than other BoG members and voting regional Fed presidents affect markets more than non-voting ones. Finally, news agencies appear to perform the role of a filter for financial market actors, who react more to newswire reports than actual speeches.

JEL: E52, G14

Keywords: Central bank communication, central bank speeches, Federal Reserve, financial markets, monetary policy

1. Introduction

The role of central bank communication in the conduct of monetary policy has been studied extensively. However, the majority of papers concentrate on the formalized aspects of communication, as they examine statements after interest rate decisions, minutes of the respective committee meetings or monetary policy reports. An even larger number of papers (reviewed in the next section) examine the impact of the rate decisions themselves. However, the delivery of speeches and Congressional hearings (testimonies) makes up a substantive part of central bank communication, too. These less formalized channels of communication have not been subject to many studies. This is rather surprising as the Federal Reserve (Fed) has not only improved its formal communication over the last decade, but also sharply increased the number of “informal” speeches delivered since the late 1990s.¹

The Federal Open Market Committee (FOMC) meets only eight times a year and the frequency of the monetary policy report is semi-annual. Thus, these speeches and testimonies might offer an additional source of information for market participants.² Given its more regular delivery, these speeches could be interpreted as an update to formal statements and monetary policy decisions and hence the market participants might react to them.

Employing daily data on the U.S. bond, stock, and foreign exchange markets, we examine five related research questions. First, do these speeches have an effect on financial markets’ returns as a result of traders adjusting their behavior in the light of the contents of these communications? Second, is the magnitude of such effects of economic significance? Third, are there quantitative differences between the sizes of the impact across different types of communications, i.e. speeches, statements and monetary policy decisions? Fourth, does the position of the speaker within the Federal Reserve System explain the size of the financial markets’ reactions? In particular, we compare the impact of the Board of Governors’ (BoG) announcements with the ones of the regional central bank presidents. In addition, we analyze the influence within the BoG and between voting and non-voting regional presidents. Fifth, do these communications help to calm down financial markets? For instance, during the East Asian or Russian crises during 1997–98 or the 2001 terrorist attacks in the U.S., the respective Committee Members may try to restore confidence in financial markets. Thus, another

¹ This fact can easily be seen by the number of delivered speeches in our sample. In 1998, 114 speeches were delivered by FOMC members, while in 2006, the central bankers spoke 190 times.

² One controversial issue is whether the Fed has superior information regarding the economic conditions (see, for instance, Romer and Romer, 2000 and Sims, 2002). Even if there are doubts about an information advantage of the central bank with regard to the economic outlook, it is likely that the Fed has “inside” information about its future monetary policy course.

hypothesis we test is whether such communications have an effect on the volatility of financial markets' returns.

The remainder of this paper is organized as follows: in the next section, we summarize previous work in the area and further outline the contribution of this paper in the context of the previous work. Section 3 describes the construction of the news dummies based on different types of FOMC communications and explains our data set and empirical methodology. In section 4, we empirically study the effects on the market returns, while section 5 reports the results on the volatility of the returns. Section 6 presents some sensitivity analysis by discussing the findings from alternative specifications and presenting further robustness checks. In section 7, we discuss central bank communication and its representation in the media, while section 8 concludes the paper with some directions for further research.

2. Related literature and our contribution

There is a growing pool of literature investigating the effects of the speeches on financial markets. Blinder et al. (2008) provide a comprehensive survey of the relevant literature. Here, we concentrate on a few selected studies only. An important study closely related to our paper is the work by Ehrmann and Fratzscher (2007). In their panel analysis of three central banks, they examine the market reactions to central bank communication using a GARCH model.³ They do not examine the communication content directly as they use newswire information (Reuters) based on FOMC communication to create their indicators. Comparing our data from the original sources with the newswire information shows that the latter does not necessarily include all the delivered speeches as some of them were not judged to be noteworthy by the business and economics journalists working for Reuters. However, interviews that FOMC members gave to the media were included occasionally (which are not covered by our approach), but again after having been subjected to the news agencies' filtering process.

Ehrmann and Fratzscher (2007) find that speeches or interviews regarding the economic outlook (EO) have a consistently positive impact on daily bond returns up to ten years, with the largest effect at a five-year horizon. News concerning the course of monetary policy (MP) has a positive effect on only a few maturities (three-month; one-, two- and five-year), where likely interest rate hikes drive the yield up and vice versa. They also find that positive news regarding the EO leads to an appreciation of the U.S. dollar, while MP news

³ For the United States, the survey of daily returns starts in May 1999 and ends in May 2004.

does not affect the \$/€ spot exchange rate. On the equity market, an indication of rising interest rates leads to declining returns, whereas positive EO news generates higher returns.

Finally, they point out that the quantitative impact of news is ascending in the degree of formal importance, at least for the future course of monetary policy. The chairman's impact is larger than that of other FOMC members, while the members of BoG exert a larger influence than the regional presidents. Concerning EO news, these results are mixed. Regarding the degree of conditional volatility on bond and stock markets, EO news has a dampening effect, whereas MP news generates additional volatility.

In another related paper, Reinhart and Sack (2005) examine the effect of various forms of monetary policy communication. Again, newswire headlines are used to obtain the speeches' influence. They use intra-day data to obtain a ranking of the absolute effects of policy statements, testimonies (including the monetary policy reports), speeches and minutes. For all the financial markets studied, they find that the effects of statements and testimonies are larger than those originating from speeches. They also obtain a reversion in the markets' reaction to speeches over the subsequent days. They conclude that Committee-wide communication has a larger and more accurate effect than individual speeches.

Kohn and Sack (2004) examine the impact of FOMC statements as well as the former Chairman Greenspan's speeches and testimonies on the volatility of several assets by using an event study approach. In contrast to speeches, testimonies are found to have a significantly positive effect on asset volatility. They also divide the testimonies' impact into a monetary policy (MP) and an EO channel. While the EO channel raises volatility, MP inclination partly offsets such an effect.

Chirinko and Curran (2005) study Greenspan's speeches, testimonies and FOMC statements, too. They conduct an event study using intra-day data and OLS estimation to examine the communications' impact on 30-year bond futures. They find that, for testimonies and statements, the effects on volatility are significantly larger before the actual delivery or release date. Rigobon and Sack (2004) analyze the impact of the unexpected outcome of FOMC meeting days and monetary policy reports on financial markets. They show that an unexpected increase in short-term interest rates results in a decline of stock prices and in an upward shift in the yield curve that becomes smaller at longer maturities.

Reeves and Sawicki (2007) conduct a similar analysis for the Bank of England with similar results, using both an OLS and a GARCH approach. Minutes and inflation reports are found to have a larger impact on financial markets' volatility than testimonies and speeches,

which are mostly insignificant. The corresponding intra-day effects are larger than the daily effects.

Connolly and Kohler (2004) examine the effect of central bank communication on the volatility of interest rate futures. Using a GARCH model and U.S. data, they find that the effects of testimonies in the context of monetary policy reports are larger than for other Parliamentary hearings. Their estimate for the impact of monetary policy reports is even greater than the one for statements explaining interest rate decisions. The publication of minutes as well as the delivery of speeches has no significant impact on the futures' returns.

Jansen and de Haan (2005) analyze the reaction of the euro-dollar spot rate to statements by European Central Bank (ECB) and national central bank officials. They focus on comments about monetary policy and the external value of the euro and find the Bundesbank dominating the news coverage. ECB statements in turn mainly affect the conditional volatility. Efforts to talk up the euro are not systematically successful. De Haan (2008), who presents a survey of empirical studies on ECB communication, concludes that those studies that explore effects on the level of financial variables provide evidence that communications generally move financial markets in the intended direction and that various forms of ECB communication lead to more market volatility.

Andersson et al. (2006) study how various monetary policy signals sent by the Swedish Riksbank (repo rate changes, inflation reports, speeches and minutes from monetary policy meetings) affect the term structure of interest rates. They find that unexpected movements in the short end of the yield curve are mainly driven by unexpected changes in the repo rate. Speeches are a more important determinant of the longer end of the term structure.

In this paper, we build an extensive data set and study the effects of *all* the speeches and testimonies delivered by FOMC members on several U.S. financial markets' returns and volatility, including bond, stock and foreign exchange markets. These communication events are coded into dummy variables on the basis of their written content. To our best knowledge, and as the recent Blinder et al. (2008) survey indicates, this approach to analyzing communication events is relatively new. We differentiate between news regarding monetary policy and economic outlook as well as that originating from different levels of aggregation. We distinguish between different types of communication and by positional classification (chairmen, vice chairmen, members of the BoG, voting presidents and non-voting presidents). The sample consists of daily observations from 1998 to 2006. Econometrically, we employ a GARCH specification of financial returns to capture the autoregressive conditional heteroscedasticity that characterizes many financial series.

3. Data and econometric methodology

In our analysis, we use a newly constructed inclusive data set that covers summaries of 1439 speeches, 151 congressional hearings, 68 post-meeting statements and 20 monetary policy reports from members of the BoG and the regional Fed presidents. Following the literature (e.g. Kohn and Sack, 2004 and Ehrmann and Fratzscher, 2007), our classification of the different types of communication focuses on monetary policy and economic outlook. The economic outlook (mostly for a 12–18 month horizon) can be “positive,” “neutral/unchanged/no comment” or “negative.” On the other hand, “tightening,” “neutral/unchanged/no comment” and “easing” are the classifications for the monetary policy stance. These categories are coded as separate dummy variables that are split into positive and negative news to take into account possible asymmetric reactions of financial markets.⁴

In designing these categories of news, we carefully read the speeches twice with a considerable time lag and then coded them independently into the respective dummy categories. In the case of a conflict between the two gradings, we checked the relevant speeches yet another time and adjusted our indicators accordingly.⁵ We employed extensive robustness checks to ensure that our results do not depend on the particular coding of ambiguous individual observations.

Communication events after market closure were coded as if they happened on the next day. As there are no explicit expectations about the content of an upcoming speech (like the Bloomberg survey before every FOMC meeting), we are not able to extract a surprise component directly from each communication event. In section 6, we present several approaches to dealing with this problem. Data are obtained from the corresponding official websites of the Fed regional banks and the Board of the Governors of the Federal Reserve System. Table 1 summarizes the frequency of these events.

Table 1: Number of non-zero values for the dummy variables

	MP Tightening	MP Easing	Positive EO	Negative EO
FOMC Statements	35	0	24	17
Monetary Policy Reports	6	1	15	5
FOMC Testimonies	4	2	17	3
BoG Speeches	31	6	92	31
Presidents’ Speeches	88	3	249	60

⁴ Evidence of this type of asymmetry can, for instance, be found in the impact of IMF statements on financial returns in emerging markets (Hayo and Kutan, 2005a).

⁵ In the appendix, we provide a few examples of speeches along with our classification.

As seen in Table 1, the number of comments regarding the EO is larger than those of the MP stance. A positive economic outlook and hawkish comments occur far more often than a negative economic outlook or an indication of an expansionary monetary policy. The first point can be related to an apparent change in the Fed communication strategy. In the early years of the sample period (1998–2006), a speaker concentrates on explaining previous interest rate moves, whereas in the later years, monetary policy speeches are more forward-looking. This point is consistent with Poole (2005), who notes a significant change in the presentation of FOMC meeting statements after 1999. Another point is that cheaper liquidity tends to cause few problems for market participants and thus a rate cut does not have to be prepared by the central bank as extensively as a hike.⁶ This second point is due to the shape of the business cycle during our sample period, which includes only one brief recession over the period 2001–02. Sharp rate cuts occurred in 2001 (475 basis points) and 2002–03 (75 basis points) only. Some cuts in the early part of the sample period relate to the East Asian and Russian financial crises in 1998.

Our U.S. financial market indicators comprise daily closing interest rates on government securities, as well as daily returns on stock and foreign exchange markets over the time period from January 2, 1998 through December 29, 2006.⁷ As dependent variables, we employ daily changes of 3-month, 6-month and 1-year Treasury bills and 2-year Treasury notes.⁸ On stock and foreign exchange markets, we examine the daily growth rates of the S&P 500 Index and the growth rates of the U.S. dollar/euro spot rate (i.e. returns), respectively.⁹ We chose daily data instead of intra-day data for 2 reasons. At a conceptual level, we are interested in the question of whether there are effects of economic importance characterized by some sort of persistence over time instead of just picking out short blips in the data. At a practical level, we find it impossible to time the central bank news precisely in a, say, 10-minute time interval as it is for newswire reports.

To control for global business cycle effects and co-movements on financial markets, European counterparts are added to the regression, as well as the U.S dollar/yen spot rate in

⁶ The findings by Carlson et al. (2006), who show that the cuts in the Federal Funds target rate in early 2001 were not anticipated by market participants, are in accordance with this statement.

⁷ Data sources: bond and foreign exchange market series: Federal Reserves' Statistical Releases H10 and H15; stock market series: Yahoo! Finance database; European Bond yields: Deutsche Bundesbank statistical database; surveys of macroeconomic announcements: Bloomberg newswire. Due to different holidays and different non-trading days for the various assets, some days are excluded. After adjusting the data set, there remain 2204 observations. The returns are calculated after these adjustments.

⁸ An Augmented Dickey–Fuller test shows that the interest rate series are all integrated of order 1. The test statistics are: -0.806 (3 month: level), -11.9** (3 month: differences); -0.6312, -18.5** (6 month); -0.8358, -44.4** (1 year); -1.1324, -45.4** (2 years).

⁹ In 1998, the US dollar/ECU spot rate is used instead.

the exchange rate model.¹⁰ We also control for movements in the Federal Funds target rate as well as for the market's expectations of output and inflation by including the respective Consensus Forecasts provided by the Federal Reserve Bank of Philadelphia. Quarterly Consensus Forecasts, current values of GDP and CPI as well as a level variable for the GDP and CPI one year ahead enter the equation as level variables.

Finally, the surprise components of several macroeconomic announcements commonly watched by market participants are included in the estimations. We choose twelve particularly important news items for monetary policy from the list given by Ielpo and Guégan (2007): Advance GDP, Trade Balance and Industrial Production to capture the growth expectations; the ISM manufacturing index and the Conference Board Consumer Confidence for producer and consumer confidence; Housing Starts for real estate effects; Non-Farm Payroll and the Unemployment Rate to proxy for labor market conditions; Retail Sales for actual consumption and finally the Consumer and Producer Price Index for inflation as well as the expectations for the upcoming meeting of the Fed regarding the future course of monetary policy. These enter the equations as separate positive or negative impulse dummies on the day of their announcement.¹¹

The descriptive statistics reported in the Appendix indicate that all financial markets series exhibit excess kurtosis, but in the foreign exchange series this value is quite small (see Table A1 in the Appendix). Due to two outliers, short maturities show pronounced skewness. Methodologically, we start with an OLS estimation of the baseline models, which are then evaluated using diagnostic testing. We find significant ARCH effects (Engle, 1982) on all the markets at the 5 percent level or better except for the foreign exchange market.¹²

Specification for level estimations

To increase the estimation efficiency, we employ a GARCH specification (Bollerslev, 1986) for the bond market and stock market series. A GARCH(1,1) model is found to be sufficient to remove the ARCH components in the residuals. The general specification¹³ is as follows:

¹⁰ European government securities of the same maturity are used for the bond market; in 1998, German bond yields are used. The Eurostoxx 50 index is used as a control for common stock market movements.

¹¹ This specification, using impulse dummies (coded as 0/1), generates more significant results for the respective variable than employing the standardized surprise component.

¹² We also tried GARCH specifications for the FX market. In the cases where we achieved stable estimates, the GARCH terms were insignificant.

¹³ The specification follows Hayo and Kutan (2005a) and Hayo and Kutan (2005b). Estimation within an EGARCH framework (Nelson, 1991) was not possible, as the algorithm did not converge. Doornik and Ooms (2008) suggest that the presence of dummy variables could cause such problems. We also included dummies in the mean equation to capture day of the week effects; however, they were insignificant in all the estimated

$$\begin{aligned}
(1) \quad & \text{returns}_t = \gamma + \sum_{r=1}^6 \delta_r \cdot \text{returns}_{t-r} + \sum_{r=1}^6 \zeta_r \cdot \text{other markets' and European returns}_{t-r} \\
& + \eta \cdot \text{FFTR movements} + \theta \cdot \text{Consensus Forecasts} + \iota \cdot \text{Macroeconomic Announcements} \\
& + \lambda \cdot 09/11/2001 + \sum_{r=1}^1 \nu \cdot \text{Communication Dummies}_{t-r} + \sigma \cdot h_t + \mu_t
\end{aligned}$$

with: $\mu_t = \varepsilon_t h_t^{1/2}$,

$$h_t = \alpha_0 + \alpha_1 (\mu_{t-1} - \kappa_1)^2 + \kappa_2 \tau (\mu_{t-1} - \kappa_1)^2 + \beta_1 h_{t-1},$$

$\tau = 1$ if $u_{t-1} < \kappa_1$ and zero otherwise,

where $\alpha_0, \alpha_1, \beta_1, \mu, \kappa_1, \kappa_2, \gamma, \delta, \zeta, \eta, \theta, \iota, \lambda$ and ν are parameters or vectors of parameters, τ is an indicator function as defined in the last line above and $\varepsilon_t | \Gamma_{t-1} = t(v)$, with Γ_{t-1} capturing all the information up to $t-1$ and $t(v)$ a t -distribution with v degrees of freedom. For the \$/€ spot rate, we use an OLS model with the same set of control variables and the same lag structure.

The general specification (1) is an autoregressive-distributed lag model with six lags. The contemporaneous European and other markets' returns are left out to avoid simultaneity problems. This model allows for several special features. First, student- t distributed errors (Bollerslev, 1987) are assumed; these provide a better approximation to residuals that are not normally distributed. Second, the conditional variance enters the main equation (Engle et al., 1987) to account for the potential impact of volatility on market returns. Asymmetric effects of shocks (Engle and Ng, 1993), defined as last-period forecast errors, are included in the model if κ_1 is significantly different from zero. In addition, asymmetry thresholds (Glosten et al., 1993) are captured when κ_2 is not equal to zero.

As a first step, baseline models without any communication dummies are estimated. In a consistent general-to-specific testing-down approach, we are able to exclude the constant term and all other financial markets' control variables throughout all series, as well as (in almost all cases) the lagged endogenous variables. In the equations of three-month and six-month interest rates, lags three, four and five cannot be excluded so, for these maturities, (weak) efficiency is violated. The financial market control variables are (nearly) uncorrelated with the communication dummies, so this approach helps to simplify the model without generating any systematic bias. However, the actual interest rate movements and macroeconomic announcements are not subject to exclusion tests. These variables tend to be

regressions. When the day of the week effects and a 9/11 dummy are included in the variance equation, the estimations did not converge in spite of applying different algorithms.

correlated with the communication dummies, so omitting them ex ante may distort the inferences.

The final baseline model estimation results are listed in Table A2 in the Appendix. In the 3-month and 6-month models, the S&P 500 model asymmetry thresholds cannot be excluded, nor asymmetric shock effects in the 2-year interest rate and the stock market model. Thus, negative last period forecast errors have a larger impact on current volatility than positive ones. The variance term in the mean equation can be excluded in all GARCH series. In the \$/€ model, the null of homoscedasticity is rejected ($F(40,2125) = 2.29^{**}$), so heteroscedasticity-consistent standard errors are used. The residuals in the five GARCH models appear to be closer to a student-t distribution than a normal distribution. Further diagnostic testing shows that non-normality is not removed sufficiently and we therefore use robust standard errors suggested by Bollerslev and Wooldridge (1992).

The Portmanteau statistic indicates serial correlation in the first three series. Since neither including more variables and/or lags nor a richer GARCH(p,q) specification removes this problem, we keep the parsimonious GARCH(1,1) approach. For the 1- and 2-year yields, we cannot rule out an integrated GARCH model ($\text{Chi}^2(1) = 1.95$; $\text{Chi}^2(1) = 2.75$) (see Nelson, 1990), but we ensure stationarity by imposing an a priori restriction.

Specification for volatility estimations

The specification put forward in Equation (1) turns out to be too demanding for estimating the impact of news variables on the conditional variance. Due to the large number of dummy variables in the models, it is difficult to ensure convergence in the estimation procedure. The following simpler specification proves to be robust:

$$(2) \quad \text{returns} = \gamma \cdot \text{FFTR movements} + \delta \cdot \text{Macroeconomic Announcements} \\ + \zeta \cdot 09/11/2001 + \eta \cdot \text{Communication Dummies} + \mu_t$$

$$\text{with: } \mu_t = \varepsilon_t h_t^{1/2},$$

$$h_t = \alpha_0 + \alpha_1 \mu_{t-1}^2 + \beta_1 h_{t-1} + \theta \cdot \text{Macroeconomic Announcements} \\ + \iota \cdot \text{Communication Events},$$

where $\alpha_0, \alpha_1, \beta_1, \mu, \gamma, \delta, \zeta, \eta, \theta$ and ι parameters are, respectively, vectors of parameters and $\varepsilon_t | \Gamma_{t-1} = t(v)$; with Γ_{t-1} capturing all the information up to $t-1$ and $t(v)$ a t -distribution with v degrees of freedom. Some of the control variables used in Equation (1) are omitted and the

macroeconomic announcements are condensed into positive and negative ones throughout all the categories of interest.¹⁴

Due to severe convergence problems, we are not able to include as many different types of communication dummies in the variance equations as in the level estimations. While examining various combinations of dummies in the variance equation, we discovered that all the significant ones show a negative sign. To improve the estimation properties, we impose an equality restriction on these coefficients and concentrate on the occurrence of statements, monetary policy reports, testimonies or speeches rather than on their direction.¹⁵

4. Analyzing the effects on the returns

In this section, we discuss the effect that the announcements have on financial market returns. Our a priori expectations regarding the signs of the particular speech coefficients are given in Table 2.

Table 2: Expected signs of speech dummies

	Bond Market	Stock Market	Foreign Exchange Market
Strong Economic Outlook (EO +)	+	+	-
Weak Economic Outlook (EO -)	-	-	+
Tightening Inclination (MP +)	+	-	-
Easing Inclination (MP -)	-	+	+

Note: The foreign exchange rate series is in price notation, so a negative sign implies an appreciation.

In the case of bonds, we argue that a stronger (weaker) economic outlook will raise (lower) interest rates, as credit demand is likely to increase (decrease). Regarding the stock market, a stronger (weaker) economic outlook will increase (reduce) the expected profits and hence the returns. Speeches indicating a contractionary (expansionary) monetary policy stance should move interest rates up (down), while lowering (raising) stock market returns. On the market for foreign exchange, a strong EO should lead to an appreciation via capital inflows. A tightening inclination should attract further capital inflows because of higher interest rates and cause an appreciation, too.

¹⁴ As “positive” CPI shocks (e.g. a higher CPI than expected), “positive” PPI shocks and “positive” unemployment rate shocks are negative events for the financial markets’ agents, we code them as negative news in the aggregated macroeconomic announcements. Similarly, we use a positive coding for negative shocks. The FFTR expectations are omitted because a consistent grading of different markets turns out to be exceedingly difficult.

¹⁵ Non-relevant speeches (e.g. those regarding the efficiency of the financial system) are coded as zero. It can be shown that including these speeches in the volatility equation yields non-significant coefficients.

In Table 3, the effects of different types of communication are presented.¹⁶ There are no significant effects of any type of communication on either the stock or the foreign exchange markets. The absolute reactions to the speeches category are the smallest if it is compared with the other respective categories.¹⁷ The statements category seems to bring the largest market reactions if significant, followed by the monetary policy reports and the testimonies. The latter two do not seem to be different in terms of economic significance.

An indication of monetary tightening in a speech brings the two-year bond's yield up by about one basis point. In contrast, one period after a statement, we observe a fall in interest rates throughout all the maturities. Speeches conveying a softer monetary policy stance have the strongest effect on one-year interest rates, which change by three basis points.

Table 3: Impact of different types of communication on interest rates

		3 Months	6 Months	1 Year	2 Years
Statement MP + _{t-1}	(35)	-0.0176**	-0.0168**	-0.0208**	-0.0287*
Statement EO + _t	(24)			0.0214*	
Statement EO + _{t-1}	(24)				0.0279*
Monetary Policy Report EO + _{t+1}	(15)			0.0155*	
Testimony EO + _{t+1}	(17)		0.01*		0.0187*
Testimony EO + _t	(17)	-0.0074*			
Speech MP + _t	(119)				0.009*
Speech MP - _{t+1}	(9)	-0.0093*	-0.0265**	-0.0302*	

Notes: * (**) indicates significance at a 5% (1%) level. The figures in brackets give the frequency of non-zero dummy values. Standard errors are heteroscedasticity-consistent. Only significant coefficients of the variables under examination are reported.

Statements, monetary policy reports and testimonies with a positive EO raise various maturities' yields on different days in the three-day window. The impact is again ascending in the maturity. This is in line with Ehrmann and Fratzscher (2007), who also report a stronger reaction with ascending maturity, in particular for the economic outlook variable. There is an unexpected sign for the influence of testimonies on the three-month yields.

One of the novel aspects of the present study is the consideration of communication activities by the individual members of the Fed. We compare the impact of speeches and testimonies by the members of the Board of Governors with the one by the twelve regional

¹⁶ Any variable under examination with five or fewer non-zero values is excluded. Thus, the negative MP categories of statements, monetary policy reports and testimonies are omitted from the table and the interpretation.

¹⁷ Because of the small coefficient differences and large standard errors, we are not able to validate these patterns statistically, and hence these conclusions are based on point estimates only.

presidents. Our prior is that the “inside” governors should command greater attention from financial market participants and therefore exert a greater influence on the respective returns than the “outside” presidents.¹⁸

Table 4 presents the statistically significant effects for the interest rates at different maturities only. Again, there is no significant reaction on the stock and foreign exchange market on the examined 3-day window and hence the results are not reported for space considerations. Contractionary (expansionary) monetary policy tendencies from BoG members drive the 2-year yield up (down) by 2 basis points (7 points, one day later). Again, the reaction is ascending with the maturity of the securities and with a maximum of 7.8 bps in the 2-year T-note. The results regarding positive EO speeches are mixed. While the 1- and 2-year yields are driven up by the expectation of a positive EO speech, both the 3- and 6-month yields decline.

Table 4: Explaining interest rates with BoG and presidents’ communication

		3 Months	6 Months	1 Year	2 Years
BoG MP + _t	(35)				0.0217*
BoG MP - _{t+1}	(8)	-0.0118**	-0.0331**	-0.0568**	-0.0776**
BoG EO + _{t+1}	(109)			0.007*	0.0126**
BoG EO + _t	(109)	-0.0099**	-0.0061*		

Notes: * (**) indicates significance at a 5% (1%) level. The figures in brackets are the amounts of non-zero dummy values. Standard errors are heteroscedasticity-consistent. Only significant coefficients of the variables under examination are listed.

The most striking result of these regressions is that there is no significant influence of the regional presidents on all the financial markets and for all the maturities of the yields. This finding suggests that agents on financial markets are mainly interested in “inside” information or do not believe that the regional representatives have superior or new information. One characteristic of the Federal Reserve System is that not all regional presidents have voting rights at all points in time. Arguably, financial markets react more strongly to statements from voting than from non-voting presidents. Moreover, announcements by the chairman of the Board of Governors may also generate relatively more public attention. This argument is in accordance with Ehrmann and Fratzscher (2007), who report a similar outcome in their analysis of monetary policy inclinations.

To test these two hypotheses, the BoG announcements are split up into chairman, vice chairman and ordinary members, while the regional presidents’ announcements are divided

¹⁸ Again, we exclude the dummy variables for the Presidents’ “MP -” speeches from the presentation of the results, as they contain only a few observations. The statements and monetary policy reports are included in all the regressions to control for their respective influence.

into a voting and a non-voting group. This disaggregation leads to sometimes few non-zero observations for a category. In Table 5, we include only those dummies that take on more than one non-zero value.

Table 5: Explaining returns with different grades of formal importance

		3 Months	6 Months	1 Year	2 Years	S&P 500	\$/€
Chairman MP - _{t+1}	(3)		-0.0296*	-0.058**	-0.0899*	-0.0104*	
Chairman MP - _t	(3)	0.0362**	0.0385*	0.05**	0.055*		
Chairman MP - _{t-1}	(3)	0.0272**					
Chairman EO + _t	(31)	-0.0088*	-0.013**				
Chairman EO - _t	(11)			0.0244*	0.0342*		-0.0059**
Chairman EO - _{t-1}	(11)		-0.0138*				
Vice Chairman MP + _{t+1}	(4)				-0.0298**	0.0074*	
Vice Chairman MP + _{t-1}	(4)						-0.006*
Vice Chairman MP - _{t+1}	(3)		-0.0192*	-0.0432*			
Vice Chairman MP - _t	(3)		-0.0249*	-0.0665*		-0.0206*	
Vice Chairman EO + _{t+1}	(22)	0.0097**			0.016*		
Vice Chairman EO + _t	(22)	-0.0134**					
Vice Chairman EO - _{t+1}	(5)	-0.0478**	-0.0358**	-0.0497**		0.0074**	-0.0032*
Vice Chairman EO - _t	(5)	-0.0231**		0.0195**	0.0365**	0.0114**	
Vice Chairman EO - _{t-1}	(5)	-0.0179**	-0.0447**	-0.0414**			
BoG Members MP + _t	(24)				0.0228*		
BoG Members MP - _{t+1}	(2)		-0.0323**				
BoG Members MP - _t	(2)			-0.045*	-0.11**		0.0035**
BoG Members MP - _{t-1}	(2)			-0.0663**			
BoG Members EO + _t	(56)	-0.0076**					
Voting Presidents MP + _{t+1}	(32)		0.0121*			-0.0034*	
Voting Presidents MP + _{t-1}	(32)						
Voting Presidents MP - _{t+1}	(2)		-0.0382**				
Voting Presidents MP - _t	(2)	0.0124**	-0.0481*	-0.0392*		-0.0051**	
Voting Presidents MP - _{t-1}	(2)		0.0153**				-0.006**
Voting Presidents EO + _{t+1}	(105)					0.0023*	
Voting Presidents EO - _{t-1}	(23)			-0.0173*			
Non-Voting Presidents EO - _{t-1}	(37)						-0.0017*

Notes: * (**) indicates significance at a 5% (1%) level. The figures in brackets are the number of non-zero dummy values. Standard errors are heteroscedasticity-consistent. Only significant coefficients of the variables under examination are listed.

Looking at the source of the news, we first discover supporting evidence for the voting/non-voting presidents' hypothesis. The former influence all the financial markets except the two-year maturities. Only the lagged negative EO speeches by non-voters are significant in the foreign exchange market but with an unexpected sign. Secondly, the BoG

has a more profound impact on financial markets than the regional presidents, both with regard to mean effects as well as temporary dynamics. Thirdly, within the BoG, we do not find sufficient evidence to support the hypothesis of descending coefficients with a diminishing degree of formal importance. However, in the majority of significant cases, the chairman and the vice chairman have a larger absolute impact on the returns than the individual members.

Switching to the behavior of different financial markets, we find rather unexpected signs for the stock market. Only the expectation of hiking speeches by voting presidents (the S&P 500 goes down by 0.34 percentage points) as well as the expectation of a bright economic outlook speeches by the same group (the S&P 500 goes up by 0.23 percentage points) drive the returns in the expected way. All other significant tightening or easing tendencies as well as the negative economic outlook yield unexpected signs.

An explanation for the unexpected signs could be due to an interdependence of monetary policy and economic outlook expectations. Agents will assume that a rate cut (increase) is typically based on a negative (positive) economic outlook and a negative (positive) economic outlook will suggest future rate cuts. If we do not control perfectly for the occurrence of these types of news then sign reversals of the relevant coefficients can come about, in particular on the stock market.

The resulting coefficients on the foreign exchange market are also mixed. Only comments by the BoG members indicating looser monetary policy and the lagged influence of speeches with “MP +” content by the vice chairman lead to the expected signs, namely a depreciation by 0.35 percent and an appreciation by 0.6 percent, respectively. Again, there could be a rationale for these unexpected signs as a brighter economic outlook will not only bring capital inflows but also larger imports of goods and services. If the latter case dominates, there will be depreciation in contrast to our expectation of an appreciation.

Support for the hypothesis that the reaction to speeches is ascending with the maturity of the respective asset is found for bond markets. We also find evidence of the asymmetry hypothesis as negative speeches move the rate more than positive ones. Good examples are the differences between the vice chairman’s positive and negative economic outlook speeches or the voting presidents’ monetary policy speeches. As in the case of the other financial markets, we encounter unexpected signs in the bond market, in particular related to the economic outlook. We further return to the issue of unexpected signs in the robustness analysis presented in section 6.

Finally, in terms of financial market impact, the coefficient estimates presented above for different forms of monetary policy communication are slightly misleading, in so much as speeches occur far more often than all the other forms of communication considered in our sample. Table 6 reports the impact of an inclination of tighter monetary policy on bond markets measured as cumulative returns over three-day windows based on the number of actual events in our sample. Target rate hikes are used as a reference category.

Table 6: Cumulative returns during a three-day communication window

	# of Events	3 Months	6 Months	1 Year	2 Years
Target Rate Hikes	24	-0.69	-0.21	-0.01	0.17
Chairman MP +	7	0.09	0.02	0.08	0.04
Vice Chairman MP +	4	0.26	0.29	0.19	0.13
BoG Members MP +	24	0.47	0.37	0.43	0.64
Voting Presidents MP +	32	0.97	0.70	0.60	0.52
Non-Voting Presidents MP +	56	0.85	0.59	0.76	0.52

We find that the impact is positive and economically meaningful throughout all the forms of communication and across all the bond markets. Thus, in spite of their relatively small coefficients, speeches, which are the least formal method of communication in our study, in particular by voting and non-voting presidents, do play a noticeable role in bond markets due to their relatively high frequency of occurrence.

5. Analyzing the effects on volatility

To assess whether financial markets are affected by the different types of communication of the FOMC members in terms of trading activity, we use the parsimonious GARCH(1,1) equation presented in (2), which allows us to examine the effects of communication on volatility. We concentrate on the events of communication and do not differentiate according to different news contents. Estimation of the conditional variance in the presence of many dummy variables is difficult, and one might easily end up with a local optimum (see Doornik and Ooms, 2008). Thus, we only report those results where we achieved robust convergence.

The results of the examination of the different types of formal communication are summarized in Table 7. The communication events have no effect on the one- and two-year securities. Interestingly, one conclusion for the level effect here is reversed: the effect on volatility is diminishing with ascending maturities. Moreover, now there are effects on the stock market, too. Except for the statements in the three-month regression, there is a

unanimous and consistent ranking of the different types through all the markets:¹⁹ Statements have a greater impact on trading activity than monetary policy reports and testimonies. Less important are speeches by BoG members and presidents.

Table 7: Explaining volatility by different types of communication

		3 Months	6 Months	S&P 500
FOMC Statements	(57)	-0.00111*	-0.00024*	-0.000131**
Monetary Policy Reports	(20)	-0.00164**		-0.000067*
FOMC Testimonies	(20)	-0.00163**		
BoG Speeches	(127)	-0.00068**		-0.00004**
Presidents' Speeches	(368)	-0.00052**		-0.000031**

Notes: * (**) indicates significance at a 5% (1%) level. The figures in brackets are the number of non-zero dummy values. Standard errors are heteroscedasticity-consistent. Only significant coefficients of the variables under examination are listed.

Next, we assess the impact of speeches only but differentiate between the various groups of speakers. We find some significant effects only for the three-month t-bills and the S&P 500 index (see Table 8).²⁰ In the first case, influence diminishes with decreasing formal importance. On the stock market, the chairman's speeches exert no influence on volatility and the impact of other speakers cannot be directly linked to their formal importance.

Table 8: Explaining volatility by different speakers

		3 Months	S&P 500
Chairman	(43)	-0.00135**	
Vice Chairman	(28)	-0.00101**	-0.000051*
BoG Members	(76)	-0.00064**	-0.000032*
Voting Presidents	(154)	-0.00064**	-0.000036*
Non-Voting Presidents	(214)	-0.00058**	-0.000038*

Notes: * (**) indicates significance at a 5% (1%) level. The figures in brackets are the number of non-zero dummy values. Standard errors are heteroscedasticity-consistent. Only significant coefficients of the variables under examination are listed.

Finally, the coefficients in Tables 7 and 8 indicate that, when announcements have a statistically significant effect on conditional volatility, it is always negative. Ehrmann and Fratzscher (2008) report a dampening effect of FOMC communication on the volatility of short-term interest rates outside the periods close to and after meetings. We interpret this as an indication of the role of central bankers as financial market “psychologists.” By communicating with the public, they can calm down markets. This finding can be explained in various ways. First, perhaps central bankers do not bring in new or surprising information and instead signal traders that their portfolios are adequately structured. This would be in line

¹⁹ Again, these conclusions are based on point estimates only.

²⁰ Statements and monetary policy reports are included as control variables.

with our small number of significant coefficients in the level examinations. Second, traders may limit their activities because they want to wait and see whether there is new information in the speech. When speeches contain no new information, there is no incentive to increase trading activities afterwards.

We explore the dynamics of the volatility effect using a three-day data window, as it could be the case that less activity on the day of the announcement is accompanied by more trading before or after the event. To achieve robust convergence of the variance equation, we have to condense all the different forms of communication into one dummy variable. However, the regression results show no significant influence on the day before and after the announcement, which implies that the dampened activity of central bank communication is not offset by more ex-ante or ex-post trading.

Finally, Rigobon and Sack (2004) identify monetary policy shocks by taking advantage of the conditional volatility in financial market returns. They assume that communications related to FOMC meetings and semi-annual monetary policy testimonies to Congress contain a greater amount of news about monetary policy than is available on other days. Based on our estimates, we cannot support this conjecture. We find that market volatility is also significantly affected on days when other forms of FOMC communication occur and this result raises some doubts that their method can truly identify monetary policy shocks.

6. Alternative specifications and further robustness checks

We now explore extensively the robustness of our findings. First, omitting the MP dummies does not noticeably affect the coefficients of the Economic Outlook indicators. This is a rough approach to assessing potential collinearity between the two variables based on the interdependence sketched above.

Second, we omit the EO dummies, which do not differ from the last GDP Consensus Forecast or the last monetary policy report. These speeches are not news for market participants; therefore, they should not have affected the coefficients for the dummy variables. In contrast, the remaining speeches should trigger larger reactions because they are more likely to be news. As the results do not change significantly, we keep the broader approach used above.

Third, we interact the dummies with a novelty and a repetition index. The first index is created to catch the degree of novelty of the news while comparing it with the speeches

delivered and other news that occurred over the last twenty business days.²¹ The novelty approach can be seen as a procedure to extract the surprise component of a speech. The second index is based on interacting the speeches with an index capturing the repetition of announcements. It is used to test whether insisting on and repeating the same view of the economy leaves a stronger impression on financial markets. Again, these adjustments had only a negligible impact on the outcome of the estimations.

Fourth, to capture the periods of extraordinarily good or bad yields, we regress the respective day's excess returns over the average returns of the past twenty business days against the speeches and the control variables. The purpose here is to eliminate abnormal times that may bias the results. This approach, as well as splitting the sample and estimating the results for different sub-samples down to one-year segments, do not change the core results.

Fifth, we create an index to control for days with extraordinary capital inflows using growth rates of the broad dollar index as a proxy, which could help to explain days with falling bond yields and rising stock market indices.²² Two separate dummies for extraordinary net capital inflows and outflows are created and interacted with the speeches dummies. As before, there is little impact on the outcome of the reported regression results.

Sixth, following the approach by Edmonds and Kutan (2002), we code all the speeches by Chairmen Greenspan and Bernanke in a separate dummy. Speeches regarding the economic outlook continue to have unexpected signs on the bond markets in the majority of cases (thirty-three out of forty-four).

Seventh, we also examine the impact of each FOMC member as a person on financial markets. However, the majority of dummy coefficients are based on a small number of observations and it turned out that no interpretable results could be obtained.

Eighth, we extend our volatility analysis to differentiate between central bank communication around the time of FOMC meetings and during "normal" times. Ehrmann and Fratzscher (2008) conclude in an analysis using media data that financial market volatility is positively affected by central bank communication around the time of policy meetings. Using our data set for an examination of the impact on market volatility during these "purdah" periods around central bank meetings, we confirm our earlier findings: in contrast to Ehrmann and Fratzscher (2008), our news dummies in the conditional variance equations are either insignificant or remain negative.

²¹ Other horizons are also used, but they do not bring different results.

²² The broad index is a weighted average of the foreign exchange values of the U.S. dollar against the currencies of a large group of major U.S. trading partners.

Finally, estimating all the models without any control variables does not yield more expected signs. To check the robustness of our control model, we use the dummies constructed by Ehrmann and Fratzscher (2007), which shortens our baseline model to May 1999–May 2004. Throughout almost all the financial markets and maturities, their speeches dummies reveal the right signs if significant.

7. Central bank communication and its representation in the media

This raises the question of why our speech dummies yield unexpected coefficients for the Economic Outlook variables, while the outcome in the Ehrmann and Fratzscher (2007) study is so much in line with a priori expectations. To address this question, we employ the data set from Ehrmann and Fratzscher (E&F) and conduct several experiments. First, we have to make our data comparable by shortening the observation period, coding our variables using E&F's procedure in +1/0/-1 dummies – thereby excluding possible asymmetries in the reaction – and concentrating on a 1-day window only. In their data set, E&F differentiate between three sources of communication: chairman (Alan Greenspan), members of the BoG, and regional presidents. Following E&F, we add the monetary policy reports and testimonies to Alan Greenspan's speeches as well as testimonies held by BoG members to their speeches.²³

Second, we compare the outcome of estimating models explaining financial market returns using both our news variables as well as those compiled by E&F. The upper part of Table 9 gives the significant news variable from our approach, the middle part the E&F results and the bottom part shows a regression including both sets of news indicators.

There is no column for exchange rates, as we did not find significant coefficients of our news variables as well as those of E&F in the foreign exchange market. Using our news data, we find one significant variable only, Economic Outlook by a BoG member, with a wrong sign. The regression with E&F's news variables leads to a large number of significant influences throughout all the markets, which, moreover, are fully in line with a priori expectations. Combining both sets of news variables in one regression reveals that they appear to be almost orthogonal to each other, as all the results from the previous two tables carry over (plus an additional effect of the E&F Greenspan EO in the one-year bond market, which is again in line with our expectations). To investigate the relationship between the two data sets further, in Table 10, we try to match our speech dummies relating to the original

²³ Note that, while the monetary policy reports are typically delivered by the chairman, they are arguably more an outcome of the discussions at the Board of Governors than the personal view of the chairman.

source with their newswire dummies for Greenspan, other BoG members and regional Fed presidents.

Table 9: Explaining returns: this paper's approach versus Ehrmann and Fratzscher (2007)

Using news variables from our approach only:

	3 Months	6 Months	1 Year	2 Years	S&P 500
BoG Members EO	-0.0077**				

Using news variables from Ehrmann and Fratzscher (2007) only:

	3 Months	6 Months	1 Year	2 Years	S&P 500
E&F Greenspan MP	0.0142**	0.0149**	0.0181*	0.0234**	-0.0063**
E&F Greenspan EO				0.0219*	0.0063**
E&F Presidents EO					0.0043*

Using both sets of news:

	3 Months	6 Months	1 Year	2 Years	S&P 500
BoG Members EO	-0.0073**				
E&F Greenspan MP	0.0149**	0.0144*	0.0174*	0.0237**	-0.0065**
E&F Greenspan EO			0.0131*	0.0297**	0.0059**
E&F Presidents EO					0.0044*

Notes: * (**) indicates significance at a 5% (1%) level. Standard errors are heteroscedasticity-consistent. Only significant coefficients of the variables under examination are listed.

The first row in the three sub-tables gives the absolute number of news in the E&F and our approach, the second row the share of matches between E&F's event variables and ours on the day the speech was delivered and the third row gives the share when including the subsequent day.

Table 10: Coding news: this paper's approach versus that of Ehrmann and Fratzscher (2007)

Alan Greenspan

	MP	E&F MP	EO	E&F EO
Number of news occurrences	9	56	35	38
% matched on the same day		44.4%		51.4%
% matched on the same and subsequent day		100.0%		65.7%

BoG Members

	MP	E&F MP	EO	E&F EO
Number of news occurrences	12	10	52	15
% matched on the same day		8.3%		9.6%
% matched on the same and subsequent day		16.7%		19.2%

Presidents

	MP	E&F MP	EO	E&F EO
Number of news occurrences	23	20	154	12
% matched on the same day		4.3%		1.3%
% matched on the same and subsequent day		21.7%		5.2%

Speeches conveying information about the economic outlook seem to be of particular interest to the media when they are delivered by Alan Greenspan, as the number of newswire reports and our indicators are roughly the same. Two-thirds of our news events coincide with E&Fs indicators either on the same or the subsequent day. Only about 20 percent of our BoG speeches correspond with E&F, and statements about the economic outlook by regional presidents are almost completely ignored by the media.

Turning to the monetary policy inclinations, this time we find a huge gap between the absolute number of Greenspan-related events covered by the media and those recorded in our data set, with the former being much larger than the latter. The match between the two variables is fairly large on the first day and perfect when including another day. When assessing news generated by BoG members and regional presidents, there is a deceptive similarity in absolute numbers between the two different ways of coding the events. It turns out, however, that the matching between written speeches and media coverage is in fact quite poor.

Our finding that there is much more Greenspan news in the media than delivered in official speeches and congressional hearings can be explained by two factors: first, the newswire variables also include informal interviews as well as information from the question and answer sessions often taking place after the formal communications; second, newswire reports may not be precise in stating who actually spoke on behalf of the Fed, particularly in the case of monetary policy reports, and thereby over-represent the chairman in their attempt to “sell” news to the market. Third, additional ambiguity about the course of monetary policy may also be created by the news agencies themselves. For example, five tightening inclinations by Alan Greenspan are reported in 2001. In our data, we find no reflections of these inclinations nor do we observe any actual target rate cuts throughout this year.

All of our monetary policy speeches coincide with E&F media news on the same or on the subsequent day. We explore this timing issue by adjusting the dates of all the Greenspan speeches according to their appearances in newswire reports. Table 11 shows the outcome of including the time-adjusted news in the regressions explaining financial market returns.

The upper half of this table shows that our time-adjusted monetary policy inclinations by Greenspan become highly significant throughout all bond maturities with the correct sign. Still in line with our findings in Section 4, the absolute influence is increasing with ascending maturity. We would interpret these results as clear evidence that, at least with regard to communications originating from central banks, financial markets do not absorb news by themselves. Rather, financial market actors, instead of perceiving information when it

becomes available from the original source, rely on media reports delivered via news agencies. Put differently, we find evidence that news agencies perform the role of a noticeable filter even when the chairman of the FOMC is talking. Although speeches have been given during trading hours, financial markets react with a time lag. They rely on news agency reports, which tend to come in the evening hours on the same day after market closure or on the subsequent day.

Table 11: Explaining returns: adjusted timing for Greenspan MP news

Using adjusted news variables from our approach only

	3 Months	6 Months	1 Year	2 Years	S&P 500
Greenspan MP	0.02958**	0.03672**	0.04585**	0.04927**	

Using both sets of news variables

	3 Months	6 Months	1 Year	2 Years	S&P 500
Greenspan MP			0.03025**		
E&F Greenspan MP	0.01267**	0.01184**		0.01970**	-0.00735**

Notes: * (**) indicates significance at a 5% (1%) level. Standard errors are heteroscedasticity-consistent. Only significant coefficients of the variables under examination are listed.

The bottom half of Table 11 indicates that, if we include our time-adjusted variables together with the E&F variables, the latter dominate (except for the one-year horizon). Thus, in spite of the collinearity between the two series of news variables, the E&F media-based indicator remains significant. This shows that markets react to news conveyed via the news agencies, even if there are no formal central bank communications as covered by our data set. Comparing the coefficients of the variables based on formal communications in the upper part of the table with those that contain speeches and other forms of informal communication in the lower part reveals that the absolute effects on financial market returns are larger in the former case.²⁴ We interpret this finding as evidence that news originating from speeches and conveyed by the media drive financial markets more than media reports of question and answer sessions and interviews.

In general, by taking into account only those statements that generate headlines, the effects are going to be larger and are less subject to other non-controlled influences. This holds especially for our adjusted Greenspan monetary policy variables, which can be shown to be a sub-selection of newswire reports. Headlines and financial market reactions should be viewed as reinforcing as a headline may derive from a post-speech reaction while a headline can also be the cause of such a reaction. Our in-depth analysis of the speeches also reveals

²⁴ However, statistical testing indicates a statistically larger impact only in the case of 6-month and 1-year bonds ($t = 1.95$, $t = 2.35^*$). Regarding the other maturities, we have to rely on point estimates.

that headlines, which can be viewed as the filtered representations, are sometimes difficult to reconcile with the original source.

We also discover that newswire services are quite selective in their reporting, thus not covering all speeches, typically ignoring the lesser-known presidents or delaying the reporting for a few days. The newswire services take the questions and answers occurring after a speech into account. Presumably, journalists ask questions that are of particular interest to financial analysts and the answers cause market reactions.

The issue of central bank communication and news creation has not been the subject of many studies. In the European context, Berger et al. (2006) analyze the coverage that ECB central bank decisions receive in the print media. They find, among other things, that the way the print media report news depends on ECB communication, in particular its press conferences after meetings of the Governing Board. Regarding our question of interest, these findings can be interpreted as an indication that the central bank chooses the recipients of its messages non-randomly. Apparently, important news is transported actively via the main press channels, while information that is perceived as less important may not be launched specifically and thus is taken up, if at all, by a variety of press channels.

8. Conclusions

In this paper, we study the effects of FOMC communication, in particular speeches, on financial markets' returns and volatility over the period 1998 to 2006. Using a GARCH model and a new comprehensive data set, we analyze the influence of speeches, post-meeting statements, monetary policy reports and testimonies. We concentrate our analysis on five research questions:

First, do speeches have an effect on financial markets' returns as a result of traders adjusting their behavior in the light of the contents of these communications? We show that central bank communication has a significant impact on financial market returns, in particular on bond markets and much less so on stock and foreign exchange markets, which are affected rather unsystematically. In addition, we found some evidence of asymmetry, negative news causing larger reactions than positive news on the bond markets.

Second, is the magnitude of such effects big enough to be of economic importance? The absolute sizes of the statistically significant effects are not large. The absolute size effects on bond markets are such that interest rates increase with the maturity of the security. The outcome of our coefficient estimates suggests that central bank communication does not drive financial markets more than macroeconomic announcements.

Third, we study whether there are quantitative differences between the sizes of the impact across different types of communications. Our point estimates suggest that the reaction is relatively larger – in terms of both returns and conditional variances – the more formal the type of communication is. This corresponds with findings put forward by Ehrmann and Fratzscher (2007).

Fourth, we investigate whether the position of the speaker within the Federal Reserve System might explain financial markets' reactions. We conclude that members of the Board of Governors (BoG) have a larger influence than the regional presidents. Within the BoG, the chairman and vice chairman exert a larger influence than normal members. Furthermore, speeches by voting presidents cause larger reactions than those by non-voting presidents. However, when we take into account the frequency with which certain forms of FOMC communication occur and consider their cumulated effects over our sample period, we discover that speeches by less prominent Fed members have a noticeable and theoretically consistent impact on bond markets.

Fifth, we analyze whether these communications are able to calm down the financial markets. During days of announcements, there is a decline in volatility in the case of three- and six-month T-bills on bond markets. On stock markets, the volatility is also muted after an announcement. Thus, central bank communication seems to be working effectively with regard to lowering price volatility. In addition, our findings raise some doubts regarding the general superiority of identification through heteroscedasticity compared with other approaches when trying to estimate the effects of monetary policy shocks.

Compared with our a priori beliefs, we discover a smaller number of significant relationships and quite a number of unexpected signs of coefficients, in particular related to the economic outlook. We showed that this outcome is not due to misspecification of the empirical models. Instead, we conclude that Fed speeches by themselves are not always important events for financial markets. For instance, question and answer sessions after speeches could be more important conveyors of news. Furthermore, news agencies perform the role of a noticeable filter. If journalists consider news as worth reporting, it will have a much stronger impact on markets than otherwise.

In addition, speeches are often a portmanteau of well-known facts that change only slightly over prolonged periods of time. Thus, the news component may be very small at times. Reading the speeches and comparing them with market expressions suggests that the expectations of the financial market agents – in particular with regard to the economic outlook – appear to be relatively more extreme. Assuming that the agents correct for central bankers'

“conservatism” or “dampening attempts,” their reaction may just be the opposite to what one would expect a priori. For example, this phenomenon is evident in the often-stated “disappointment” of financial market participants after a speech or after an interest rate decision: while the fundamentals are sound, the market participants are disappointed when they hear about (minor) risks. Thus, this effect may explain some of the unexpected coefficients found in our analysis.

Finally, our results suggest that financial market news is not necessarily created at the time when the information becomes available, but comes into existence only after it goes through a filtering process by the media. It is therefore not realistic to view markets as “automatic information processing entities.” Instead, individual news recipients, i.e. financial market participants, depend on information filters to cope with the flood of daily information. It is remarkable that this observation can be made for U.S. markets, which are typically regarded as efficient. We were able to substantiate this conjecture by informal discussions with a small group of bond traders. They state that they usually read monetary policy statements and listen to speeches by Greenspan (Bernanke) themselves. Other types of communications are rather neglected and the traders tend to rely on newswire information. Moreover, our finding that headlines can noticeably depart from a neutral reading of the contents of a speech suggests that journalists may impose specific value judgments when reporting the contents of central bank announcements. In our view, these observations open up interesting avenues for further research.

References

- Andersson, M., Dillén, H. and Sellin, P. (2006), Monetary Policy Signaling and Movements in the Term Structure of Interest Rates, *Journal of Monetary Economics* 53, 1815–1855.
- Berger, H., Ehrmann, M. and Fratzscher, M. (2006), Monetary Policy in the Media, ECB Working Paper No. 679.
- Blinder, A., Ehrmann, M., Fratzscher, M., de Haan, J. and Jansen, D.-J. (2008), Central Bank Communication and Monetary Policy: A Survey of the Evidence, DNB Working Paper No. 170.
- Bollerslev, T. (1986), Generalized Autoregressive Conditional Heteroscedasticity, *Journal of Econometrics* 31, 307–327.
- Bollerslev, T. (1987), A Conditional Heteroscedastic Model for Speculative Prices and Rates of Return, *Review of Economics and Statistics* 69, 542–547.
- Bollerslev, T. and Wooldridge, J.M. (1992), Quasi-Maximum Likelihood Estimation and Inference in Dynamic Models with Time Varying Covariances, *Econometric Reviews* 11, 143–172.
- Carlson, J.B., Craig, B., Higgins, P. and Melick, W.R. (2006), FOMC Communications and the Predictability of Near-Term Policy Decisions, Federal Reserve Bank of Cleveland Commentary, June 2006.
- Chirinko, R.S. and Curran, C. (2005), Greenspan Shrugs: Formal Pronouncements, Bond Market Volatility, and Central Bank Communication, Paper for Presentation at the American Economic Association Meetings on January 8, 2006.
- Connolly, E. and Kohler, M. (2004), News and Interest Rate Expectations: A Study of Six Central Banks, RBA Annual Conference Volume, Reserve Bank of Australia, 108–134.
- De Haan, J. (2008), The Effect of ECB Communication on Interest Rates: An Assessment, *Review of International Organizations* 3, 375–398.
- Doornik, J.A. and Ooms, M. (2008), Multimodality in the GARCH Regression Model, *International Journal of Forecasting* 24, 432–448.
- Edmonds, R. and Kutan, A.M. (2002), Is the Public Information Really Irrelevant in Asset Markets? *Economics Letters* 76, 223–229.
- Ehrmann, M. and Fratzscher, M. (2007), Communication by Central Bank Committee Members: Different Strategies, Same Effectiveness? *Journal of Money, Credit and Banking* 39, 509–541.
- Ehrmann, M. and Fratzscher, M. (2008), Purdah: On the Rationale for Central Bank Silence Around Policy Meetings, ECB Working Paper No. 868, February 2008.
- Engle, R.F. (1982), Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation, *Econometrica* 50, 987–1008.

Engle, R.F., Lilién, D.M. and Robbins, R.P. (1987), Estimating Time-Varying Risk Premia in the Term Structure: The ARCH-M Model, *Econometrica* 55, 391–407.

Engle, R.F. and Ng, V.K. (1993), Measuring and Testing the Impact of News on Volatility, *Journal of Finance* 48, 1749–1778.

Glosten, L.R., Jagannathan, R. and Runkle, D.E. (1993), On the Relation Between the Expected Value and the Volatility of the Nominal Excess Return on Stocks, *Journal of Finance* 48, 1779–1801.

Hayo, B. and Kutan, A.M. (2005a), IMF-related News and Emerging Financial Markets, *Journal of International Money and Finance* 24, 1126–1142.

Hayo, B. and Kutan, A.M. (2005b), The Impact of News, Oil Prices, and Global Market Developments on Russian Financial Markets, *Economics of Transition* 13, 373–393.

Ielpo, F. and Guégan, D. (2007), Further Evidence on the Impact of Economic News on Interest Rates, MPRA Paper No. 3425.

Jansen, D.-J. and de Haan, J. (2005), Talking Heads: The Effects of ECB Statements on the Euro-Dollar Exchange Rate, *Journal of International Money and Finance* 24, 343–361.

Kohn, D.L. and Sack, B.P. (2004), Central Bank Talk: Does it Matter and Why? *Macroeconomics, Monetary Policy, and Financial Stability*, Bank of Canada, Ottawa, 175–206.

Nelson, D. (1990), Stationarity and Persistence in the GARCH(1,1) Model, *Econometric Theory* 6, 318–334.

Nelson, D. (1991), Conditional Heteroscedasticity in Asset Pricing: A New Approach, *Econometrica* 59, 347–370.

Poole, W. (2005), How Predictable Is Fed Policy? Manuscript of speech delivered on Oct 4, 2005, http://www.stlouisfed.org/news/speeches/2005/10_04_05.htm.

Reeves, R. and Sawicki, M. (2007), Do Financial Markets React to Bank of England Communication? *European Journal of Political Economy* 23, 207–227.

Reinhart, V. and Sack, B.P. (2005), Grading the Federal Open Market Committee's Communications, unpublished manuscript.

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

Romer, C. and Romer, D. (2000), Federal Reserve Information and the Behavior of Interest Rates, *American Economic Review* 90, 429–457.

Sims, C. (2002), The Role of Models and Probabilities in the Monetary Policy Process, *Brookings Papers on Economic Activity* 2, 1–62.

Appendix

Examples of speeches and their coding

Remarks by Chairman Alan Greenspan “Economic Developments” before the Economic Club of New York, New York (May 24, 2001)

[...] Moreover, with inflation low and likely to be contained, the main threat to satisfactory economic performance appeared to come from *excessive weakness in activity*. So we took out the restraint inherent in our previous policy stance and have moved policy to a more accommodative posture to counter the effects of the downshift in demand. [...] The period of sub-par economic growth is not yet over, and we are *not free of the risk that economic weakness will be greater than currently anticipated, requiring further policy response*. [...]

Coding:

Speech Alan Greenspan Economic Outlook Negative and
Speech Alan Greenspan Monetary Policy Easing

Testimony of Chairman Alan Greenspan “The Economic Outlook” before the Joint Economic Committee, U.S. Senate (April 21, 2004)

[...] The economy appears to have emerged around the middle of last year from an extended stretch of subpar growth and entered a period of more vigorous expansion. After having risen at an annual rate of 2-1/2 percent in the first half of last year, real GDP increased at an annual pace of more than 6 percent in the second half. [...] Although real GDP is not likely to continue advancing at the same pace as in the second half of 2003, recent data indicate that *growth of activity has remained robust* thus far this year. [...] As I have noted previously, *the federal funds rate must rise at some point* to prevent pressures on price inflation from eventually emerging. [...]

Coding:

Testimony Alan Greenspan Economic Outlook Positive and
Testimony Alan Greenspan Monetary Policy Tightening

Table A1: Descriptive statistics of daily returns

	3 Months	6 Months	1 Year	2 Years	S&P 500	\$/€
Mean	-0.0001	-0.0001	-0.0002	-0.0003	0.0002	0.0001
Maximum	0.48	0.17	0.22	0.28	0.0557	0.0271
Minimum	-0.67	-0.61	-0.59	-0.57	-0.0703	-0.0247
Std Dev.	0.0465	0.0409	0.0458	0.0599	0.0117	0.0061
Skewness	-2.02	-2.36	-1.43	-0.3248	0.0089	0.0883
Excess Kurtosis	39	30.6	16.7	5.2	2.67	0.8313

Table A2: Results of the baseline estimations

	3 Months	6 Months	1 Year	2 Years	S&P 500	\$/€
α_0	0.00002**	0.00003*	0	0	0	---
α_1	0.0977**	0.0709**	0.0721*	0.0413**	-0.0153	---
β_1	0.8525**	0.8693**	0.9029**	0.9497**	0.9383**	---
Student-t Degrees of Freedom	4	4.5	5.8	7	21.9	---
Asymmetry	---	---	---	0.0213	0.0021	---
Threshold	0.1144*	0.0958*	---	---	0.1149*	---
Dummy 09/11/2001	-0.4927**	-0.4533**	-0.4341**	-0.4909**	-0.0942**	0.018**
Bond Return _{t-3}	-0.0519**	-0.0641**	---	---	---	---
Bond Return _{t-4}	0.0806**	0.0723**	---	---	---	---
Bond Return _{t-5}	0.1417**	0.15**	---	---	---	---
FFTR Hike	-0.0103**					
FFTR Cut	-0.0341**	-0.04**				0.0016*
FFTR Inter-Meeting Cut	-0.0593**				0.024**	
CF GDP Current	0.0013**	0.0017**	0.0029**	0.0029*		
CF CPI Current	0.0016*					
Industrial Production Positive				0.0197*		
Industrial Production Negative						
Trade Balance Positive						
Trade Balance Negative		-0.0064*	-0.0099**			
Consumer Confidence Positive						
Consumer Confidence Negative	-0.0083**	-0.0131**	-0.0175**	-0.0245**		0.0021**
ISM Positive		0.0147**	0.0257**	0.0322**	0.0030*	
ISM Negative					0.0043**	0.0028**
Retail Sales Positive		0.0147**	0.0275**	0.0385**		-0.0018*
Retail Sales Negative	-0.0085**	-0.008*	-0.0124*			
Housing Starts Positive	-0.0062**	-0.0095**	-0.0114**			
Housing Starts Negative		-0.0105*			0.0029*	
Non-Farm Payroll Positive			0.0218*			-0.0041**
Non-Farm Payroll Negative		-0.0241**	-0.0399**	-0.0625**		0.0027*
Unemployment Rate Positive						
Unemployment Rate Negative			0.023*	0.0418**	-0.0043*	
CPI Positive						
CPI Negative		-0.0087**	-0.0098*			
PPI Positive			-0.0103*	-0.0186*		
PPI Negative						
FFTR Positive Surprise	-0.0259**				0.0046**	
FFTR Negative Surprise	-0.1006**			0.0379*		
Number of Observations	2198	2198	2198	2198	2198	2198
Log-Likelihood	4596.1	4590.2	4076.6	3339.4	7046.1	8123
Normality Test: Chi ² (2)	547**	236.8**	229.6**	117.5**	25.8**	56.2**
AR 1-2 Test: F(2,2164)	---	---	---	---	---	0.2129
ARCH 1-1 Test: F(1,2164)	---	---	---	---	---	0.0007
ARCH 1-2 Test: F(2,2154), F(2,2156)	0.7742	1.4	1.66	1.08	2.96	---
Portmanteau Test: Chi ² (43), Chi ² (46)	191.2**	143.5**	76.5**	55.7	52.5	---
RESET Test: F(1,2165)	---	---	---	---	---	0.0112

Notes: * (**) indicates significance at a 5% (1%) level. Standard errors are heteroscedasticity-consistent. Besides the GARCH terms, only significant coefficients are listed. "Positive" or "negative" implies the direction of the shock, i.e. a positive CPI shock means a higher CPI than expected. The one year ahead Consensus Forecasts and the Advance GDP releases are omitted due to no significant values. The F(2,2154) and Chi²(43) statistics are for the first two series; the F(2,2156) and Chi²(46) for the remaining three.