Leadership, Gender, and Discourse in Monetary Policy: Analyzing Speech Dynamics in the FOMC

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Abstract

Using a novel hand-collected dataset, this paper employs natural language processing and a quasi-experimental approach to investigate the determinants of speech share among members of the Federal Open Market Committee (FOMC). First, given the novelty of the data, I describe key correlations between speech share and FOMC members' gender, education, and tenure status. The second section of the paper uses a difference-in-differences approach to examine whether the appointment of Chair Janet Yellen affected the gender gap in FOMC speech shares. I find that the baseline gender gap of 1.2 percentage points narrows to 0.4 percentage points as a result of Yellen's appointment. Additionally, I find that the expression of opinions in FOMC members' speeches dropped by 7.7 percentage points overall, with female members decreasing by an additional 2.5 percentage points. Despite these changes in discourse style, a significant relationship persists between opinion shares and deviations from the Taylor Rule-implied policy rate, with female members responding more strongly than their male counterparts. This study provides new insights into how leadership and gender influence the internal dynamics of monetary policy discussions within the FOMC.

Keywords: Monetary Policy Communication, Gender Dynamics in Economics, Leadership Impact on Policy Deliberation

JEL Codes: E52, J16, C63

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1 Introduction

The Federal Open Market Committee (FOMC) is central to the formulation of U.S. monetary policy. Understanding the dynamics within the FOMC is crucial for comprehending the mechanisms behind monetary policy decisions and their subsequent communication. This paper examines the determinants of speech shares among FOMC members, providing insights into the internal deliberations, distribution of influence, and the potential impact of leadership transitions, particularly with respect to gender dynamics. By analyzing speech patterns using natural language processing (NLP) techniques, this study sheds light on how individual member characteristics, such as gender, education, tenure, and dissent, shape the discourse within the committee.

Prior research has extensively analyzed market reactions to Federal Reserve communications, transparency initiatives, and the decision-making processes within the FOMC (Thornton 2006 [22]; Meade 2005 [13]; Romer & Romer 2008 [20]; Acosta 2015 [2]; Cannon 2015 [6]; Edison & Carcel 2021 [8]). In particular, Bordo and Istrefi (2023) [4]document how FOMC members' policy preferences are shaped by factors such as educational background and the era in which they were born. Their findings suggest that members with Keynesian training or those exposed to periods of high unemployment tend to be more dovish, prioritizing employment over inflation control. However, while these studies offer insights into policy preferences, less attention has been given to the internal speech dynamics during FOMC meetings, particularly in terms of how leadership and gender influence discourse.

This study builds on the spirit of Bordo and Istrefi (2023) [4]by employing a unique hand-collected dataset that combines detailed information on FOMC members' speeches, educational backgrounds, and personal characteristics. Through the application of natural language processing tools, I extract and analyze speech shares from FOMC meeting transcripts spanning from 2010 to 2018. By leveraging these computational techniques, I investigate how factors such as gender, tenure, and educational background influence the distribution of speech shares among members. Additionally, I examine the content of these

speeches, distinguishing between factual statements and subjective opinions using a fact-vs-opinion classifier.

A central contribution of this paper is the use of a difference-in-differences (Diff-in-Diff) approach to estimate the impact of Janet Yellen's leadership on gender disparities in FOMC speech shares. I find that Yellen's appointment as Chair significantly reduced the gender gap, with female members increasing their share of speech by 0.8 percentage points (pp) on average. Further, my analysis shows a shift in discourse style under Yellen's leadership, as both male and female members exhibited a notable reduction in opinion expression during meetings.

Beyond analyzing speech shares, I extend the inquiry to investigate how these speech dynamics relate to policy outcomes, specifically the gap between the Taylor Rule-implied policy rate and the effective federal funds rate. While previous studies have largely focused on FOMC minutes and statements (Boukus & Rosenberg 2006 [5]; Jegadeesh & Wu 2017 [11]), this study is among the first to link individual speech patterns within meetings to broader monetary policy implications. My finding suggests that female FOMC members will respond with more opinions in the successive meeting than male FOMC members when the deviation of actual Fed funds rate from Taylor rule is larger.

By integrating insights from the monetary policy literature, including the work of Bordo and Istrefi on FOMC member characteristics, and employing natural language processing techniques to assess speech patterns, this paper provides a comprehensive analysis of how diversity in leadership, particularly under Janet Yellen, influences discourse power and decision-making processes within the FOMC. This study thus offers a novel contribution to the literature on monetary policy, leadership, and gender dynamics by focusing on the intersection of leadership, gender, and the internal deliberations of the FOMC.

2 FOMC history & organizational structure

The history of the Federal Open Market Committee (FOMC) dates back to the 1930s. During the Great Depression, the Banking Acts of 1933 and 1935 provided the legislative foundation for the committee (Federal Reserve, 2013 [18]). The FOMC is the body within the Federal Reserve System responsible for setting monetary policy in the United States. Its conduct of open market operations influences the federal funds rate, the Federal Reserve's asset holdings, and its communications with market participants. The FOMC pursues the congressionally mandated goals of maximum employment and price stability (Federal Reserve, 2021).

In the early years of the Federal Reserve System, the twelve regional Federal Reserve Banks operated with a combination of coordination and independence. In 1923, the Open Market Investment Committee was established to coordinate open market operations among the Reserve Banks (Wheelock, D.C., 2000 [24]). Seven years later, in 1930, the Open Market Policy Conference was formed as a successor to the committee (Federal Reserve, 2013 [18]). The concept of the FOMC was first introduced in the Glass-Steagall Act of 1933, but it was not until the Banking Act of 1935 that the committee became fully operational and formalized in its current structure (Federal Reserve, 2013 [18]).

While monetary policies and macroeconomic understanding have evolved significantly over the decades, the FOMC's regular operations have largely remained consistent (Federal Reserve Bank of New York, 2020 [15]).

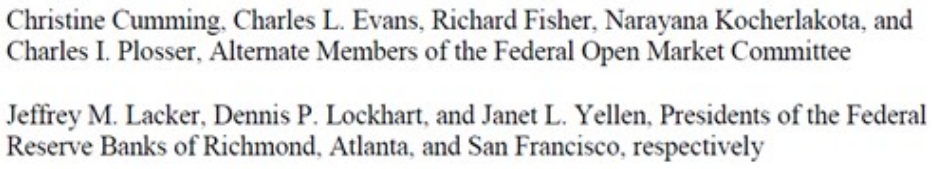
The FOMC is composed of twelve voting members: the seven members of the Board of Governors and five Reserve Bank presidents (Federal Reserve, 2021 [19]). The president of the Federal Reserve Bank of New York holds a permanent voting seat, while the other Reserve Bank presidents serve one-year terms on a rotating basis. The rotating groups are fixed as follows:

One president from Boston, Philadelphia, and Richmond One president from Cleveland and Chicago One president from Atlanta, St. Louis, and Dallas One president from Minneapolis, Kansas City, and San Francisco

By tradition, the Chair of the Board of Governors serves as the Chair of the FOMC, and the president of the Federal Reserve Bank of New York serves as the Vice Chair (Federal Reserve, 2020 [15]). Members of the Board of Governors are nominated by the President of the United States and confirmed by the Senate for fourteen-year terms (Federal Reserve Act, 1913 [1]).

The FOMC holds eight regularly scheduled meetings each year, approximately every six weeks (Federal Reserve, 2021 [19]. Prior to 1980, FOMC meetings typically lasted one day. However, as financial markets grew more complex, meetings gradually extended to two days during the 1980s and early 2000s. Since 2004, nearly all meetings have been two-day sessions (Board of Governors of the Federal Reserve System, 2005 [14]).

With meetings now typically spanning two days since 2004, the structure of FOMC meetings has evolved to promote comprehensive discussion and effective policymaking. Each meeting begins with detailed briefings from Federal Reserve staff economists on the current state of the economy, financial markets, and international developments. These briefings provide a foundation for the subsequent discussions among the committee members. Following the presentations, each participant—both voting and non-voting members—shares their individual assessments of economic conditions and their views on the appropriate stance of monetary policy in a roundtable format. This collaborative dialogue allows for a diversity of perspectives to be considered. The meeting culminates with the members deliberating on policy decisions, which are determined by a majority vote. The Chair plays a pivotal role in synthesizing the discussion and proposing the policy action to be voted on. After the meeting, the Committee releases a statement summarizing its decisions, and detailed minutes are published three weeks later to enhance transparency and inform the public and markets about its deliberations (Federal Reserve, 2021 [19]).


Christine Cumming, Charles L. Evans, Richard Fisher, Narayana Kocherlakota, and Charles I. Plosser, Alternate Members of the Federal Open Market Committee

Jeffrey M. Lacker, Dennis P. Lockhart, and Janet L. Yellen, Presidents of the Federal Reserve Banks of Richmond, Atlanta, and San Francisco, respectively

Figure 1: Partial Snap shot of attending lists from 2010 January transcript

3 How the FOMC meetings analysis framework is constructed?

In this paper, I utilize the publicly available verbatim transcripts of the Federal Open Market Committee (FOMC) meetings to generate speech share measures for each committee member. As of this writing, I focus on the period from January 2010 to December 2018—the latest publicly available meetings—since these transcripts have a uniform format that enhances computational efficiency. For details on the computational and coding environment, see footnote .

The generation of speech share relies on two key elements: (i) the collection of attending individuals' information for each FOMC meeting, and (ii) the proper separation of conversations using well-designed regular expressions.

For the first element, while Named Entity Recognition (NER) techniques in Natural Language Processing (NLP) are commonly used to extract individuals' names, the complexity of the FOMC transcripts and limitations of NER make it challenging to accurately split names and assign titles (see Figure 1). Therefore, I adopted a manual approach to construct the list of attending members, along with their personal information such as titles, tenure, and education. The personal information for FOMC members was primarily obtained from the Federal Reserve History website ((https://www.federalreservehistory.org/people/), any missing key information needed for subsequent analysis was cross-checked using online sources.

Drawing inspiration from the methodology of Istrefi and Bordo (2023) [4], I collected

detailed information for each FOMC member, including birth date, gender, age, birthplace, date of first attendance as an FOMC member, educational background (degrees earned and institutions attended), degree categories (Economics, Law, Other), and graduate school categories ("Saltwater," "Freshwater," Other). I also generated binary variables indicating whether a member had participated in FOMC meetings for over one year and whether they were regional Federal Reserve Bank presidents. For example, in the case of Janet Yellen, whose initial participation in the FOMC dates back to August 1994, I referred to her first meeting in 1994 rather than the time she became the 11th President of the Federal Reserve Bank of San Francisco.

Table 1 presents summary statistics for male and female FOMC members across key variables. The proportions of Board of Governors members and regional Federal Reserve Bank presidents are relatively balanced between genders, with females equally represented in both roles. Male members, however, show a slightly higher likelihood of holding a Ph.D. in Economics (56% compared to 50% for females) and have a notable presence among graduates of "Saltwater" schools, which account for 57% of male Ph.D. economists compared to 75% for females.

Career backgrounds of FOMC members show notable differences by gender. Males have a more diverse mix of prior roles, with 28% transitioning from academia, 32% from the Federal Reserve, 20% from finance, and 20% from government. In contrast, half of the female members were previously affiliated with the Federal Reserve, while the remaining half were distributed among finance (12.5%), government (25%), and academia (12.5%). This variation highlights potential differences in career trajectories between genders leading up to FOMC appointments.

Regional representation also reveals notable patterns. For females, Missouri stands out as a significant birth region, with 25% of female members born there, while the remaining 75% are distributed across "Other Areas." Male members show a stronger geographic concentration along the coasts, with 12% born on the West Coast (e.g., California) and 36%

on the East Coast (e.g., New York, New Jersey, Massachusetts, Maryland, Virginia, and Washington D.C.).

The academic distinction between "Saltwater" and "Freshwater" schools, first articulated by Hall (1976) [9], remains relevant when examining FOMC members' educational backgrounds. As explained by Istrefi and Bordo (2023) [4], Saltwater schools, such as Harvard and MIT, are traditionally associated with Keynesian economics, emphasizing active fiscal and monetary policies. In contrast, Freshwater schools, including the University of Chicago, emphasize market efficiency, rational expectations, and minimal government intervention. These ideological differences, reflected in the composition of the FOMC, have shaped not only academic debates but also practical policy approaches within the institution.

The second key element in constructing the analysis framework is the proper design and use of regular expressions. FOMC meeting transcripts are provided in PDF format. I relied on the PDF-extracting package pdfplumber (https://github.com/jsvine/pdfplumber) to extract information from the transcripts. The transcripts after January 2010 have a uniform format: the first couple of pages provide information on the meeting date and attendance, followed by the header "Transcript of the Federal Open Market Committee Meeting on [Month] [Day-Day], [Year]," which I used as a separation mark to isolate the main body of the meeting. Each individual's speech is usually prefaced by "CHAIRMAN," "MR.," or "MS." followed by their last name, and then their remarks. I utilized appropriate regular expressions to separate each individual's words and calculated each person's speech share per meeting. For some meetings during Chairman Bernanke's tenure that only lasted one day instead of two, I labeled the Day 2 share as zero.

Table 1: Summary Statistics by Gender of FOMC Members

	Female		Male		Total
	Count	%	Count	%	Count
Position in FOMC					
Board of Governors	4	50%	9	36%	13
Regional Fed President	4	50%	16	64%	20
Ph.D.					
Econ	4	50%	14	56%	18
Law	1	12.5%	5	20%	6
None/Other	3	37.5%	6	24%	9
Grad School Category (if PhD Econ)					
Saltwater	3	75%	8	57%	11
Freshwater	0	0%	3	21%	3
Other	1	25%	3	21%	4
Last Job before appointed as FOMC member					
Academia	1	12.5%	7	28%	8
Fed	4	50%	8	32%	12
Finance	1	12.5%	5	20%	6
Government	2	25%	5	20%	7
Birth Region Distribution by Gender					
Missouri	2	25.0%	–	–	2
West Coast (e.g., California)	–	–	3	12.0%	3
East Coast (e.g., NY, NJ, MA, MD, VA, DC)	–	–	9	36.0%	9
Other Areas	6	75.0%	13	52.0%	19
Average Age appointed as FOMC member					
		43.4		44.1	
Total	8		25		33

Notes: Summary statistics for 33 members serving in the FOMC during 2010 January to 2018 December. Data on personal information mostly referred to Fed Reserve History. The Birth Region section groups significant areas such as Missouri for females and West/East Coasts for males, with others categorized as "Other Areas."

4 Speech Share Distribution Patterns Among Federal Reserve Chairs: Bernanke, Yellen, and Powell

This section analyzes the average individual share of total FOMC meeting speech by attendees' titles during the tenures of Federal Reserve Chairs Ben Bernanke, Janet Yellen, and Jerome Powell, covering the period from January 2010 to December 2018. Figure 2 indicates

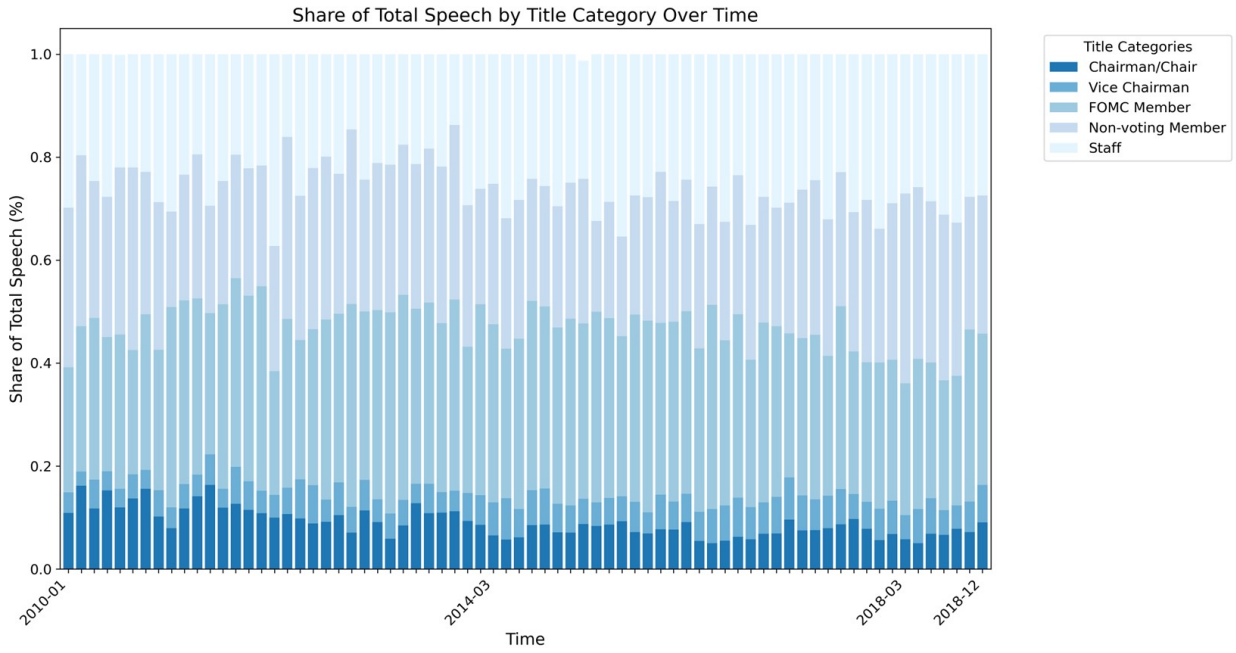


Figure 2: Share of Total Speech by Title Category Over Time

the transition points where leadership changed. Tables **??** and **??** provide a quantitative breakdown.

The data in Table **??** reveal distinct shifts across titles:

- **Chairman/Chair**: The average individual speech share for the Chair decreased notably from 11.1% under Bernanke to 7.4% under Yellen ($p < 0.01$) and further to 6.9% under Powell ($p < 0.10$). This steady decline suggests a shift away from a Chair-centric discussion structure, particularly under Yellen.

- **Vice Chairman**: The Vice Chairman's share of speech rose from 4.9% during Bernanke's tenure to 6.1% under Yellen ($p < 0.01$), before slightly decreasing to 5.8% under Powell, indicating a sustained increase in the Vice Chairman's role post-Bernanke.

- **Board of Governors (Excluding Chair)**: Members of the Board saw a gradual increase in their individual speech shares, rising from 3.7% under Bernanke to 4.5% under Yellen ($p < 0.01$), and further to 5.3% under Powell ($p < 0.05$), underscoring a growing voice for Governors in the discussions.

- **Voting Regional Presidents**: The share of speech by voting Regional Presidents remained steady, ranging between 3.9% under Bernanke to 4.1% and 4.2% under Yellen and Powell, respectively, suggesting a stable role across all tenures.

- **Non-voting Regional Presidents**: Speech shares for non-voting Regional Presidents held steady as well, from 3.7% under Bernanke to 3.4% under Yellen and slightly increased to 3.9% under Powell.

The total share of speech distribution, as shown in Table **??**, highlights the broader shifts:

- **Chairman/Chair**: The Chair's total speech share declined from 11.1% under Bernanke to 7.4% under Yellen ($p < 0.01$), with Powell's tenure observing a further decrease to 6.9% ($p < 0.10$).

- **Vice Chairman**: The Vice Chairman's total speech share increased from 4.9% under Bernanke to 6.1% during Yellen's period ($p < 0.01$), and maintained a slightly lower level at 5.8% under Powell.

- **Board of Governors (Excluding Chair)**: The Board's total share of speech increased notably from 17.2% under Bernanke to 16.7% under Yellen ($p < 0.01$), before slightly decreasing to 12.2% under Powell ($p < 0.01$).

- **Non-voting Regional Presidents**: Total shares for non-voting Regional Presidents also varied, decreasing from 28.1% under Bernanke to 25.3% under Yellen ($p < 0.01$) and rising again to 30.8% under Powell ($p < 0.01$).

- **Staff**: The share of speech by staff increased consistently, from 23.2% during Bernanke's tenure to 28.2% under Yellen ($p < 0.01$) and remained elevated at 28.6% under Powell.

These findings illustrate significant shifts in FOMC participation across different leadership periods. The reduction in the Chair's speech share under Yellen suggests a more distributed discussion format, while the increased speech shares for the Vice Chairman, Board of

Governors, and staff reflect broader engagement across titles. Powell's tenure demonstrates continuity in these trends, further emphasizing evolving participation patterns in response to changes in FOMC leadership.

Table 2: Average Individual Share of Speech by Title Category

	Bernanke	**Yellen**	**Powell**
Chairman/Chair	0.111	0.074***	0.069
Vice Chairman	0.049	0.061***	0.058
Board of Governors (Excld. Chair)	0.037	0.045***	0.053**
Voting Regional Presidents	0.039	0.041	0.042
Non-voting Regional Presidents	0.037	0.034	0.039
Staff	0.005	0.005	0.005

Notes: For each title's average share, we conducted t-tests between consecutive periods (Bernanke vs. Yellen, Yellen vs. Powell). Significance levels are noted with *.
Source: Author calculations.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Table 3: Average Total Share of Speech by Title Category

	Bernanke	**Yellen**	**Powell**
Chairman/Chair	0.111	0.074***	0.069*
Vice Chairman	0.049	0.061***	0.058
Board of Governors (Excld. Chair)	0.172	0.167***	0.122***
Voting Regional Presidents	0.155	0.162***	0.155
Non-voting Regional Presidents	0.281	0.253***	0.308***
Staff	0.232	0.282***	0.286

Notes: For each title's total share, we conducted t-tests between consecutive periods (Bernanke vs. Yellen, Yellen vs. Powell). Significance levels are noted with *.
Source: Author calculations.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Table 4: Average FOMC member, Individual Share of Speech by Gender and Year (Excld. Chair)

	Female	**Male**	**Total**
2010	0.0294	0.0383	0.0365
2011	0.0278	0.0415	0.0376
2012	0.0258	0.0392	0.0352
2013	0.0266	0.0384	0.0356
2014	0.0271	0.0413	0.0379
2015	0.0329	0.0408	0.0392
2016	0.0362	0.0382	0.0388
2017	0.0418	0.0383	0.0390
2018	0.0451	0.0402	0.0414
Total	0.0313	0.0395	0.0377

Notes: The table presents the average individual share of speech by gender for each year. Calculations are based on author data.
Source: Author calculations.

5 Determinants of FOMC members' speech shares

In this section, I estimate the impact of Federal Open Market Committee (FOMC) members' personal backgrounds—such as tenure, gender, and education—on their speech shares during meetings. I am also interested in whether voting members who dissent have different speech patterns, so I include voting behavior as a binary variable. Voting records are referenced from Thornton and Wheelock (2014) [23] and updated through December 2018.

Given that the total speech share across all members sums to one, it is necessary to control for factors influencing individual shares. I control for the total number of senior Federal Reserve officials present at each meeting, including FOMC members, alternate members, and regional Federal Reserve Bank presidents. Fixed effects for each official's job title are included to account for role-specific speaking patterns. Observations related to the Chair are excluded due to their disproportionately high speech shares and econometric robustness, which could skew the results. The Ordinary Least Squares (OLS) estimates with different specifications are presented in Table 5.

The estimation equation is specified as follows :

$$\begin{aligned}\text{Speech Share}_{ijt} = \text{Dissent}_{ijt} + \text{Joined Over a year}_{ijt} + \text{Gender}_i + \text{Law Degree}_i \\ + \text{Other Grad Degree}_i + \text{FreshWater}_i + \text{Saltwater}_i + \text{Title FE} \\ + \#\text{ of senior officials FE} + \text{Birthyear FE} + \text{Birthplace FE (states)} + \epsilon_{it}\end{aligned} \tag{1}$$

First, I present the gender differences reported in columns 1 and 2. Unconditionally, female members have, on average, a 0.8 % to 1.1 % points lower speech share than their male counterparts. This disparity may reflect broader gender dynamics within high-level professional settings and warrants further investigation into the factors contributing to this gap.

Building on this, I estimate the specifications in columns 3 and 4 by adding variables for graduate school training, experience, and dissent record to the regression. The results suggest that dissenting votes are not significantly associated with differences in speech shares. This indicates that members who dissent do not necessarily speak more or less than those who align with the majority, at least in terms of the proportion of the meeting they occupy.

Experience plays a significant role in speech participation. Members who have been participating in FOMC meetings for less than one year (rookies) have a 0.8 to 1.3 % points lower speech share compared to more experienced members (see columns 3–6). Considering that the average speech share per member is approximately 4% points, this decrease represents a substantial effect size. This finding suggests that familiarity with the committee's processes and increased confidence over time may encourage members to contribute more during meetings.

The impact of educational background is complex due to nonlinear relationships with birth year and birthplace fixed effects. The point estimates vary between columns 3 and 4 and columns 5 and 6, with some variables omitted due to collinearity in columns 5 and 6. In general, the reference group—FOMC members without a PhD or JD degree—appears to

have a slight disadvantage regarding speech share during meetings.

We also examined the impact of career experience before joining the FOMC for each member; please see the results in Appendix A.

Table 5: Determinants of Speech Shares

	(1) Day 1 Share[a]	(2) Day 2 Share	(3) Day 1 Share	(4) Day 2 Share	(5) Day 1 Share	(6) Day 2 Share
Male	0.00826***	0.0108***	0.00707***	0.00675***	0.00907	0.00782
	(0.00109)	(0.00212)	(0.00110)	(0.00218)	(0.00842)	(0.0177)
Dissent			-0.00162	-0.00109	-0.0000452	0.00396
			(0.00203)	(0.00405)	(0.00180)	(0.00379)
FOMC Rookie (< 1 yr)			-0.00900***	-0.0111***	-0.00830***	-0.0129***
			(0.00139)	(0.00278)	(0.00142)	(0.00298)
Law Degree			0.000711	0.00824***	0.0363***	0.0165
			(0.00144)	(0.00287)	(0.0117)	(0.0245)
Econ - Freshwater			0.00662***	0.0116***	0	0
			(0.00154)	(0.00306)	(.)	(.)
Econ - Saltwater			0.00919***	0.0149***	0	0
			(0.00110)	(0.00219)	(.)	(.)
Econ - Other Grad School			0.00667***	0.0211***	0	0
			(0.00147)	(0.00293)	(.)	(.)
Title fixed effects	No	No	No	No	Yes	Yes
# of officials fixed effects	No	No	No	No	Yes	Yes
Birth year fixed effects	No	No	No	No	Yes	Yes
Birth place fixed effects	No	No	No	No	Yes	Yes
N	1130	1130	1130	1130	1129	1129
adj. R^2	0.048	0.021	0.145	0.087	0.429	0.320

Standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Notes: Chair(man) observations are excluded from the analysis.
Source: Author calculations.
a If there is not a second-day meeting, Day 1 share refers to the share of the total meeting.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

6 Dissent and speech frequency: further examination

My exploitative analysis in previous section shows that dissent voting is not significantly correlated with individual speech share, but I do not put into account one factor that might be crucial for opinion expression: speech frequency. In the field of linguistic studies, speech frequencies, the usage of first-person pronouns and changes in pitches are well observed when disagreement happens (Hirsch et. al, 2021 [10], Slapin & Kirkland, 2019 [21]). Thus in this section, I am going to present the result, using dissent voting as the outcome variable, putting speech frequency and speech share measures to the right hand side of the equation.

The regression is expressed as follows:

$$Dissent_{it} = \text{Day 1 Speech Share}_{it} + \text{Day 2 Speech Share}_{it} + X_{it} + \epsilon_{it} \tag{2}$$

Where X_{it} is a vector of person characteristic variables as used in previous section, the results is presented in the following Table 6.

The findings reveal several notable patterns. First, speech frequency, measured by the total number of contributions during the meeting, is positively and significantly associated with dissent voting. Specifically, a one-unit increase in speech count increases the probability of dissent by 0.0028 (significant at the 1 percent level). This suggests that individuals who speak more frequently are more likely to express dissent, aligning with previous research highlighting the role of vocal expression in signaling disagreement.

Second, the analysis of speech shares on each day reveals mixed results. While the share of speech on Day 1 is negatively associated with dissent and statistically significant at the 5 percent level, the share of speech on Day 2 shows no significant relationship. This distinction may reflect the dynamic nature of discussions across multi-day meetings, where the tone and focus often shift.

Third, individual characteristics also play a crucial role in explaining dissent. Gender differences emerge, with male members significantly less likely to dissent, consistent with

prior studies suggesting gendered dynamics in decision-making environments. Additionally, members with economics backgrounds from "freshwater" schools and those with "other" economics specializations are significantly less likely to dissent, suggesting that educational training may influence voting behavior.

The results underscore the importance of incorporating speech frequency and individual characteristics into the analysis of dissent behavior. This contributes to a more nuanced understanding of the interplay between speech dynamics and voting outcomes in committee settings.

Table 6: Dissent & Speech frequency

	Dissent voting
Speech Count	0.0028***
	(0.0011)
Day 1 speech share	-1.1092*
	(0.5622)
Day 2 speech share	0.2559
	(0.3027)
Male	-0.0385**
	(0.0184)
Board Member	-0.0257
	(0.2194)
President	0.0641
	(0.2194)
Vice Chairman	-0.0250
	(0.2209)
FOMC Rookie	-0.0373*
	(0.0217)
Law Degree	0.0216
	(0.0290)
Econ-Freshwater	-0.0459*
	(0.0232)
Econ-Other	-0.0543**
	(0.0224)
Econ-Saltwater	-0.0253
	(0.0186)
Constant	0.0074
	(0.2187)
Meeting fixed effect	Yes
Observations	1,130
Adjusted R^2	0.0376

Notes: The table presents regression results using HDFE estimators, absorbing the time variable. Standard errors are reported in parentheses.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

7 Yellen's effect on female FOMC members: a Diff-in-Diff design

In previous section, I found female members are at a natural disadvantage in terms of discourse power. (See Table 4 for detailed summary statistics by gender and year) In management literature like Gould et al. (2018) [12], female leaders can create a trickle-down effect affecting executive gender diversity. Blackmon (2020) [3]addressed the impact on IMF operation and gender representation following the appointment of Christine Lagarde as IMF's first female managing director. So here I follow the spirit and implement the Diff-in-Diff identification to estimate the impact on female members from Yellen's leadership in the FOMC. Before proceeding with the analysis, I first plot the average speech shares by gender from Jan 2010 to Dec 2018. Figure 3 & 4 presented the trends by gender, I label the first time Yellen becoming chair with the golden line. Despite the bumpy observations in the late Bernanke era, I see a clear convergence in the two trends in both figures. Another pieces of evidence is shown in Figure 5 & 6, where I showed the distribution of average speech share at each meeting by each FOMC member and year, the blue colored males are always at the top of the distribution. Yet we noticed a significant increase for female members who joined after 2014, even Esther George who used to be at the bottom of the distribution, increased her speech share gradually in later years.

To quantify the Yellen effect, we run the estimation equation as:

$$\begin{aligned}\text{Speech share}_{it} = \beta_0 + \beta_1 \text{Post}_t + \beta_2 \text{Treatment}_i + \beta_3 \text{Treatment}_i * \text{Post}_t \\ + \#\text{ of senior officials FE} + \epsilon_{it}\end{aligned} \tag{3}$$

Where speech share is the individual level speech share each meeting (day 1 & 2 separately), Post is a 0/1 binary indicating Yellen's leadership, Treatment is a binary gender dummy (= 1 if female), Treatment * Post is the actual parameter of interest, number of senior officials is controlled for the properties of speech share. We will present the results in

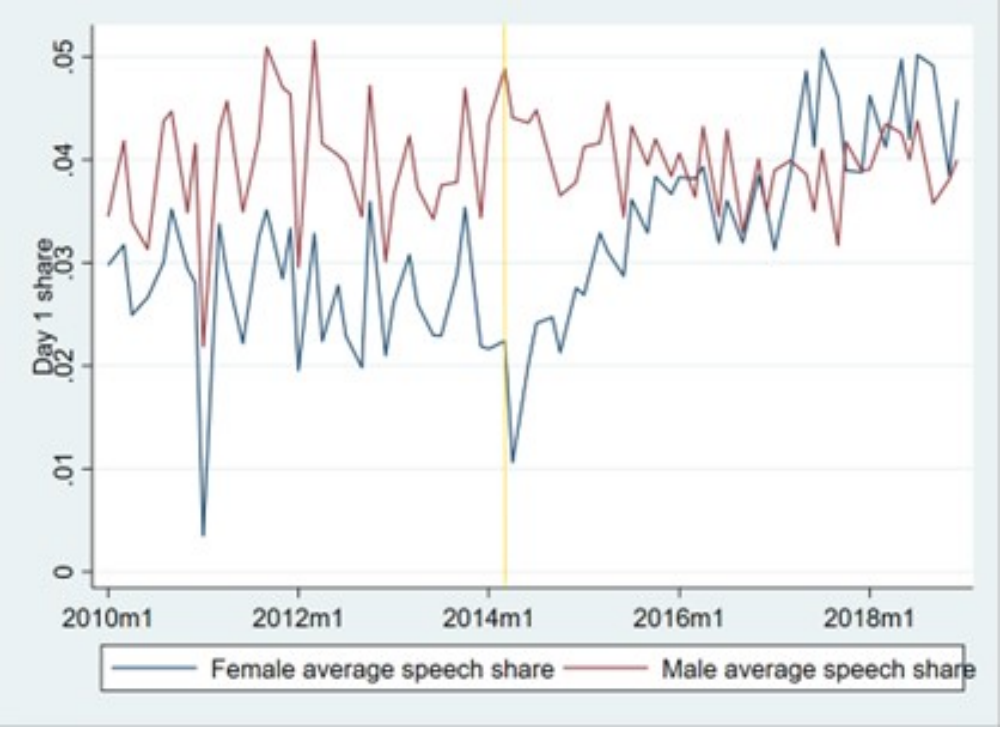


Figure 3: Day 1 average speech share by gender

Table 7. For Day 1 and Day 2 estimates, female average speech share increased by roughly 0.8 pp and 0.6 pp significantly. The significance of Treatment indicates the natural disadvantage of female members. Yellen's leadership significantly vanished the gap between different genders. For Post estimates, in theory it is not supposed to be significant. However, in our dataset, for the period of 2010 to 2012, there are a lot of vacancies for Day 2 speech share, leading to the post estimates being significant. In summary, Yellen's leadership significantly increased female FOMC member's discourse power.

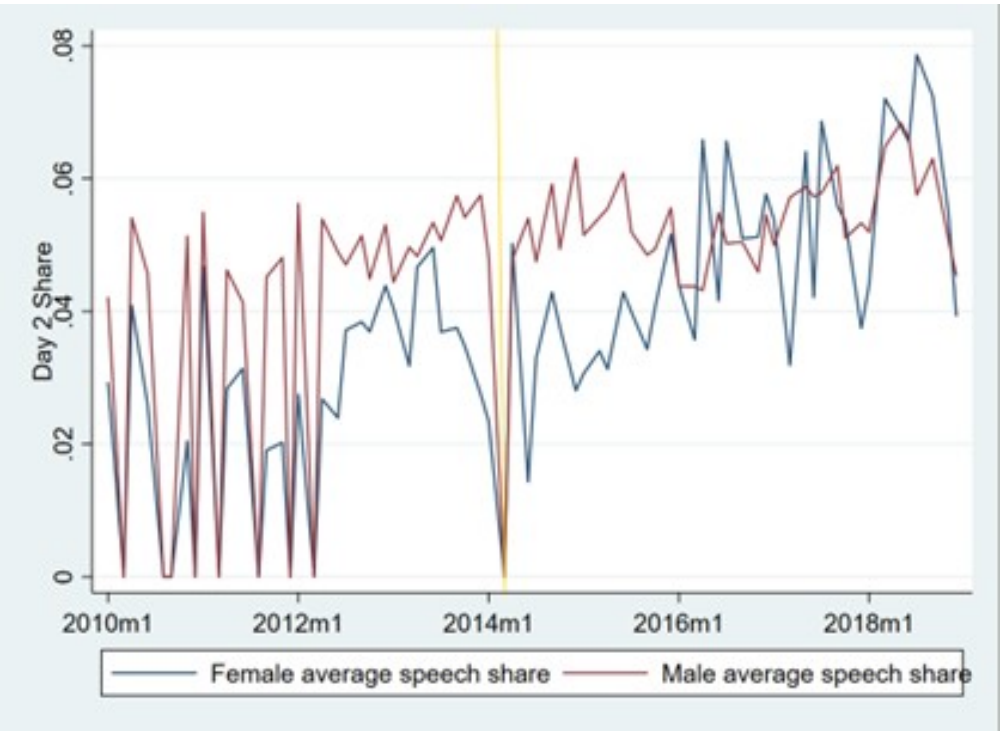


Figure 4: Day 2 average speech share by gender

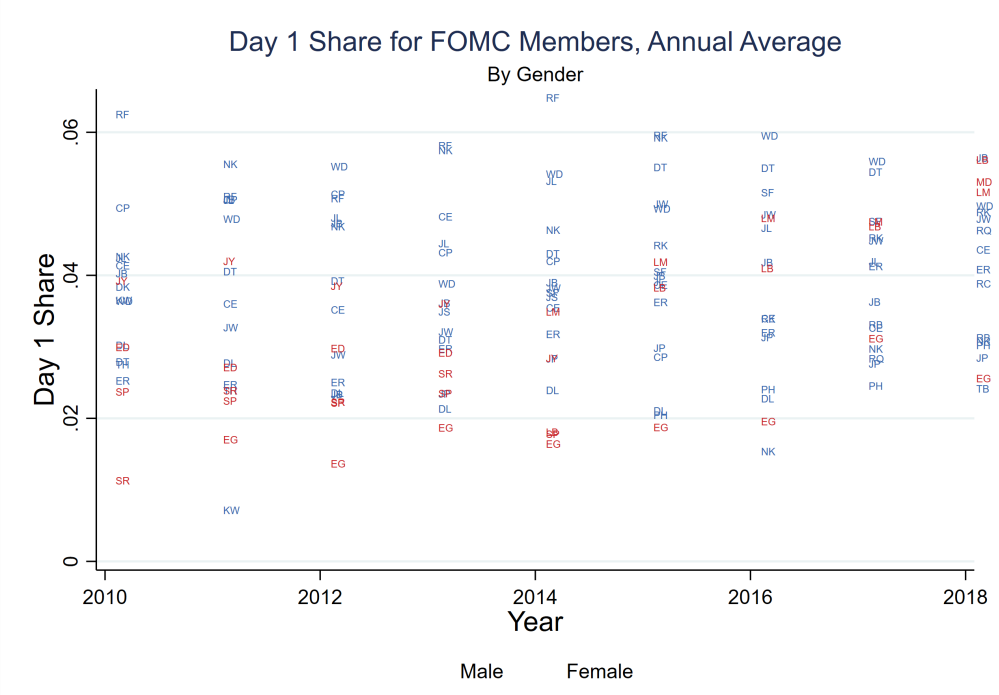


Figure 5: Day 1 average speech share by gender, yearly

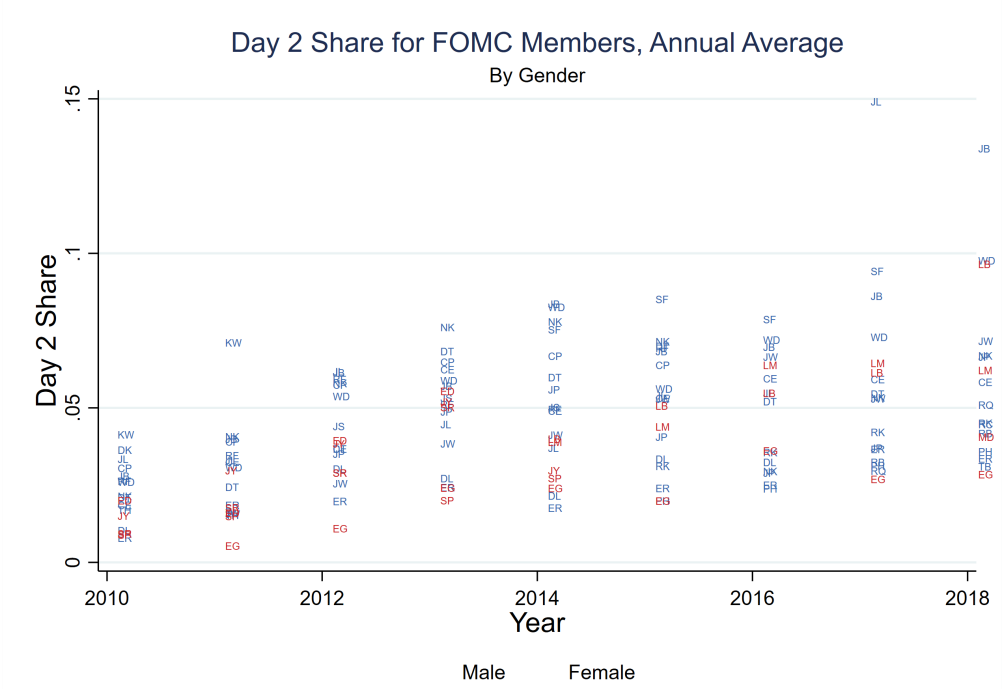


Figure 6: Day 2 average speech share by gender, yearly

Table 7: Diff-in-Diff Results

	Day 1 Share[a]	**Day 2 Share[b]**
Post (=1 if > 2014 Mar)	-0.00123	0.01817***
	(0.00161)	(0.00531)
Treatment (= 1 if Female)	-0.0123***	-0.01299***
	(0.00679)	(0.00184)
Post * Treatment (Yellen effect)	0.00890***	0.00633**
	(0.00169)	(0.00297)
# of officials FE	Yes	Yes
N	1130	1130
Adj. R^2	0.074	0.150

Notes: Chair(man) observations are excluded from the analysis.
Source: Author calculations.
[a] If there is not a second day meeting, day 1 share refers to the share of the total meeting.
[b] If the second day meeting is not presented, day 2 share equals 0.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

8 Yellen's effect on speech content

Building on the specification strategy outlined in earlier sections, we extend our analysis to the contents of the FOMC meetings. While previous studies have primarily concentrated on FOMC minutes and statements (e.g., Boukus & Rosenberg, 2006 [5]; Jegadeesh & Wu, 2017 [11]), there has been relatively little attention paid to the discussions within the meetings themselves and the specific contributions of individual FOMC members to these discussions.

To address this gap, we employed a fact-vs-opinion binary classifier from Hugging Face (Papadopoulos, 2022 [17]). The classifier assigns labels to each sentence from the original FOMC transcript, where a label of 0 denotes an opinion, and 1 denotes a fact. For each FOMC member, we calculated the proportion of sentences classified as opinions and facts in each meeting.

The classifier model used in this analysis is based on the XLM-RoBERTa architecture, initially developed by a team at Facebook (Conneau et al., 2019 [7]). The model was trained on 2.5TB of filtered CommonCrawl data, and the version utilized in our study was fine-tuned using an annotated corpus of approximately 9,000 English sentences. To validate the reliability of our calculated opinion shares, we compared our classification results with those obtained using the state-of-the-art open-source model, Llama 3.1. For Jan 2010 FOMC meeting, the Llama 3.1–8B model classified an average opinion share of 42.3%, whereas the XLM-RoBERTa model yielded an average of 51.6%. Upon reviewing the results, we found that the XLM-RoBERTa model was more adept at capturing questions posed by FOMC members, which we believe is crucial for understanding the potential impact of leadership changes on FOMC deliberations and overall policy formulation.

Figure 7 illustrates a significant decline in the share of opinions expressed after Janet Yellen assumed the role of Federal Reserve Chair. FOMC members, regardless of gender, exhibited a decrease in the relative amount of opinions or questions articulated during these meetings. To quantify the gender-specific impact of the leadership transition, a difference-in-differences (DID) model is estimated.

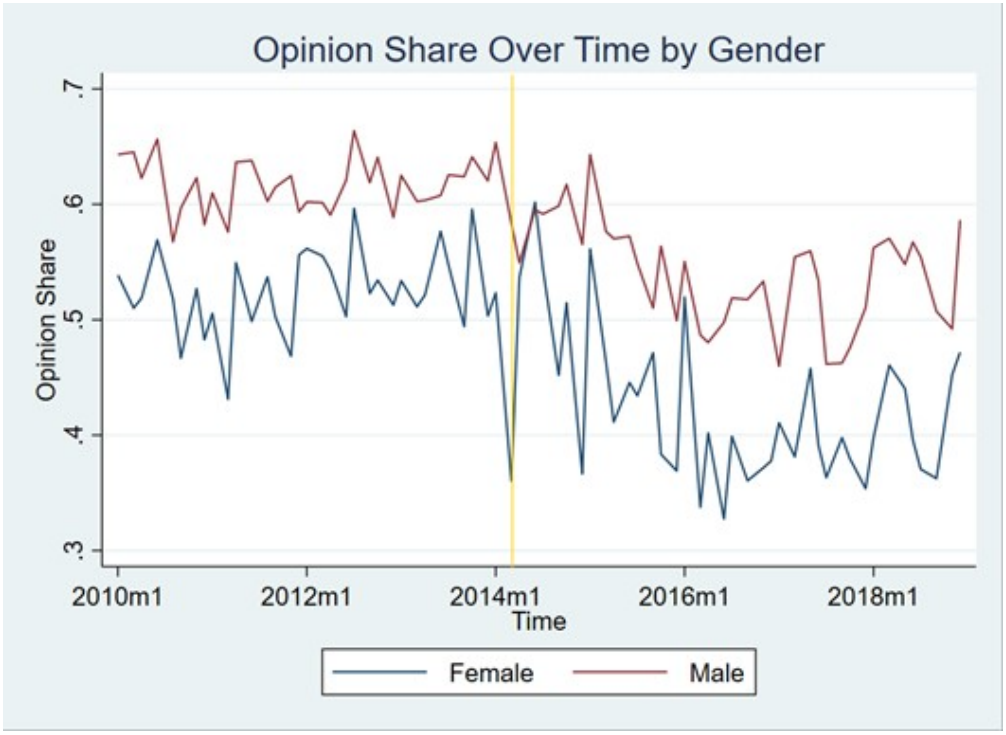


Figure 7: Average opinion shares of FOMC members by meeting and gender

$$\text{Opinion share}_{it} = \beta_0 + \beta_1 \text{Post}_t + \beta_2 \text{Treatment}_i + \beta_3 \text{Treatment}_i * \text{Post}_t + \epsilon_{it} \tag{4}$$

The results, presented in Table 8, indicate that FOMC members as a whole experienced a general decline of 7.7 pp in their opinion share post-leadership change. Moreover, female members exhibited an additional 2.5 pp reduction in the share of opinions expressed during FOMC meetings. This suggests that the leadership transition led to a marked shift in the discussion dynamics, with a notable reduction in the extent of opinions voiced, particularly among female members.

Table 8: Diff-in-Diff Results: Opinion Share

	Opinion Share
Post (=1 if > 2014 Mar)	-0.077***
	(0.0057)
Treatment (= 1 if Female)	-0.092***
	(0.0083)
Post * Treatment (Yellen effect)	-0.025***
	(0.0120)
N	1130
Adj. R^2	0.3246

*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

9 Policy rate gap and opinion share measure

To assess the validity of the opinion share measure, we analyze the relationship between the policy rate gap, defined as the difference between the actual federal funds rate and the Taylor Rule implied rate and the gender specific opinion shares at each successive Federal Open Market Committee (FOMC) meeting. Specifically, our analysis focuses on meetings following the quarterly data releases in February, May, August, and November.

Ostapenko (2020) [16] employed Bayesian Lasso methods to demonstrate that changes in the federal funds rate are influenced by uncertainty sentiment measures on various topics. Building upon this work, the current analysis extends the examination by utilizing transformer architectures to dissect monetary policy discussions, providing a more nuanced understanding of the factors influencing policy decisions.

The Federal Reserve Bank of Atlanta offers a Taylor Rule Utility tool (`https://www.atlantafed.org/cqer/research/taylor-rule#Tab3`), which provides historical data for three specifications of the Taylor Rule. The original Taylor Rule, as proposed by Taylor (1993), is expressed as:

$$\hat{FFRt} = \rho FFRt - 1 + (1-\rho)\left[(r_t^* + \pi_t) + 1.5(\pi_t - \pi_t^*) + \beta \min gap_t, \theta\right] \tag{5}$$

where $\hat{FFR}_t$ is the estimated federal funds rate at time t, ρ is the smoothing parameter, r_t is the real equilibrium interest rate, π_t is the actual inflation rate (measured by PCE), π_t^* is the inflation target, and gap_t is the output gap.

The three specifications from the Atlanta Fed, Taylor93GDP, FOMCTaylor93UR, and FOMCTaylor99UR, differ in their inputs for the real interest rate and output gap. For example, Taylor93GDP uses the Laubach-Williams (LW) model's one-sided measure for the real interest rate and the Congressional Budget Office's estimate of potential output. In contrast, FOMCTaylor93UR and FOMCTaylor99UR employ FOMC participants' longer-run projections for the federal funds rate and inflation under appropriate monetary policy. Given the complexity and potential discrepancies among these measures, as highlighted by Yellen (2015) [25], this analysis tests how FOMC members respond to different estimations, with a particular focus on gender differences.

The policy rate deviation is calculated as:

$$\text{Policy Rate Deviation}_t = \text{Average Actual Fed Funds Rate}_t - \text{Taylor Rule Predicted Rate}_t. \tag{6}$$

Using this deviation, we analyze its impact on the average male and female opinion shares of FOMC members (excluding the Chair) at the subsequent meeting following the data release. The regression model is specified as:

$$\text{Average Male/Female Opinion Share}_t = \beta_0 + \beta_1 \text{Policy Rate Deviation}_t + \epsilon_t. \tag{7}$$

The Ordinary Least Squares (OLS) estimates are presented in Table 9.

The regression results in Table 8 demonstrate a statistically significant relationship between policy rate deviations and FOMC members' opinion shares, with notable differences by gender. The coefficient on the Taylor93GDP gap is positive and significant at the 5% level for both male and female members, suggesting that larger deviations from the Taylor93GDP

Table 9: Regression Results for Male and Female Opinion Shares

	Male Opinion Share			Female Opinion Share		
	(1)	(2)	(3)	(4)	(5)	(6)
Taylor93GDP gap	0.0432***			0.0693***		
	(0.0156)			(0.0251)		
FOMCTaylor93UR gap		0.0313			0.0622	
		(0.0201)			(0.0316)	
FOMCTaylor99UR gap			0.0251***			0.0404***
			(0.00518)			(0.00833)
Observations	28	28	28	28	28	28

Note: For the time series in the original data, we miss the value before 2012. Thus finally we can only have 28 observations.
t statistics in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

rule are associated with increased opinion expression in the subsequent FOMC meeting. This finding holds for both genders, though the magnitude of the response is somewhat larger for female members.

For the FOMCTaylor93UR gap, the relationship is positive but statistically insignificant for both male members and female members.

The FOMCTaylor99UR gap exhibits the strongest association, with positive and highly significant coefficients at the 0.1% level for both male and female members. These results suggest that larger deviations from this rule lead to more frequent opinion contributions in subsequent meetings, with a slightly larger effect for female members.

Overall, these results underscore the importance of policy rate deviations from Taylor Rule benchmarks in shaping the dynamics of opinion expression during FOMC meetings. The variation in coefficients across the three Taylor Rule specifications highlights the sensitivity of the opinion share measure to different monetary policy estimates. The gender differences observed suggest that male and female FOMC members may weigh policy deviations differently, potentially reflecting differing risk assessments or economic priorities. The statistically significant relationships across all specifications lend support to the validity of the opinion share measure as a meaningful indicator of FOMC deliberation dynamics.

10 Conclusion

This paper contributes to the literature on monetary policy decision-making by offering an in-depth analysis of speech dynamics within the FOMC, particularly under Janet Yellen's leadership. We find that gender, tenure, and education play a significant role in determining speech contributions, with Yellen's appointment reducing the gender gap in speech shares by an average of 0.8 percentage points. This finding underscores how leadership transitions can create opportunities for greater gender equity in high-level discussions.

Beyond speech shares, our analysis of opinion content reveals that Yellen's leadership prompted a marked reduction in the proportion of opinions expressed during meetings, with female members experiencing an additional 2.5 percentage point decline compared to their male counterparts. This shift in discourse style highlights the broader influence leadership can exert on the dynamics of policy deliberation.

Our investigation into policy rate deviations provides further insights into how these speech patterns align with monetary policy. We find a significant relationship between policy rate deviations from the Taylor Rule and the share of opinions expressed, particularly among female members, who showed a stronger response to deviations than their male colleagues. This suggests that gender dynamics may influence how FOMC members react to monetary policy conditions, with female members possibly exhibiting heightened sensitivity to deviations from policy norms.

These findings highlight the intricate relationship between leadership, gender, and policy deliberation within the FOMC. Future research should delve further into how different leadership styles and individual characteristics shape decision-making processes and policy outcomes. This work provides a stepping stone for understanding how diversity and leadership intersect to influence the conduct of monetary policy in practice.

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Appendix A. Determinants of Speech Shares (with past work experience)

Table 10: Determinants of Speech Shares

	Day 1 Share	**Day 2 Share**
Dissent	-0.0000452	0.00396
	(0.00180)	(0.00379)
FOMC Rookie (< 1 yr)	-0.00830***	-0.0129***
	(0.00142)	(0.00298)
Male	0.0507***	0.0495*
	(0.0124)	(0.0260)
Last job before FOMC: Fed	-0.00597	0.0119
	(0.00701)	(0.0147)
Last job before FOMC: Fnance	0.00766	-0.00329
	(0.00754)	(0.0158)
Last job before FOMC: Government	-0.0151	0.0308
	(0.00944)	(0.0198)
Title fixed effects	Yes	Yes
# of officials fixed effects	Yes	Yes
Birth year fixed effects	Yes	Yes
Birth place fixed effects	Yes	Yes
Degree effects	Yes	Yes
N	1130	1130
adj. R^2	0.429	0.320

Notes: Chair(man) observations are excluded from the analysis.
Source: Author calculations.
a If there is not a second day meeting, day 1 share refers to the share of total meeting.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.