

Yellin' at Yellen

Hostile Sexism in the Federal Reserve Congressional Hearings

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Abstract

How prevalent is hostile sexism among U.S. politicians? We analyze the transcripts of every congressional hearing attended by the chair of the U.S. Federal Reserve from 2001 to 2020 using Janet Yellen as a bundled treatment to provide carefully identified evidence of sexism. We find that legislators who interacted with both Yellen and at least one other male Fed chair over this period interrupt Yellen more, and interact with her using more aggressive language. Furthermore, we show that having a daughter reduces a legislator's hostility toward Yellen. These results are not a function of differences in either the content Yellen discusses in these hearings (measured with topic models) or her tone of communication. Our results provide carefully identified evidence of hostile sexism among both male and female legislators when confronted with a female in a novel position of power, supporting a rich literature on gender roles and forms of sexism.

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Introduction

In the United States in 2021, women comprised 40% of city councils, 33% of supreme court justices, 32% of mayors, 31% of state legislators, 30% of statewide elective offices, 27% of Congress, and 22% of governors.¹ A rich body of work examines explanations for this under-representation at different stages of career advancement, starting with the decision to participate in public service (Fox and Lawless, 2010, 2014; Kanthak and Woon, 2015), charting additional challenges confronted by women at different stages in election campaigns (Huddy and Terkildsen, 1993; Sanbonmatsu, 2006; Barber et al., 2016; Holman, Merolla and Zechmeister, 2016; Van der Pas and Aaldering, 2020), and ending with the experiences of office among those who do attain it (Ban et al., 2021; Payson, Fournaies and Hall, 2021).

While different mechanisms bind at each stage of this “leaky pipeline”, in the background is a pervasive gender bias against women in positions of power. A rich body of research spanning the domains of sociology, anthropology, political science, and psychology posits that sexism serves to maintain traditional gender roles in society, and takes one of two forms depending on the context (Glick and Fiske, 1996).² The first – hostile sexism – is what the layperson thinks of when hearing the word “sexism”, and captures hostile behavior toward women who violate traditionally male positions of status and power. The second – benevolent sexism – refers to behaviors that are substantively non-hostile but nevertheless reinforce traditional gender roles. Both forms of sexism combine to maintain the status quo in which men enjoy privileged status in society as leaders, providers, and defenders, and theoretically contribute to the “leaky pipeline” that produces such imbalances in gender representation in American politics.

Yet directly measuring sexism in politics is challenging. Existing evidence focuses on byproducts of sexism, such as the decision on whether to run for office (Fox and Lawless,

¹City council and mayoral statistics in the 100 largest cities in the country. All data from the Center for American Women and Politics: <https://cawp.rutgers.edu/women-elective-office-2021>.

²See Leaper and Ayres (2007a) for a review of the literature.

2010, 2014; Kanthak and Woon, 2015), differences in campaign contributions (Barber et al., 2016; Sorensen and Chen, 2021), media coverage of campaigns (Heldman, Carroll and Olson, 2005; Conroy et al., 2015; Van der Pas and Aaldering, 2020), constituent prejudices (Huddy and Terkildsen, 1993; Lawless, 2009; Bock, Byrd-Craven and Burkley, 2017; Teele, Kalla and Rosenbluth, 2018), and the demands placed on women who attain office despite these barriers (Payson, Fourinaies and Hall, 2021). Causally identified evidence of the latent trait of sexism represents an important gap in the literature.

We use the tenure of Janet Yellen as the first female chair of the Federal Reserve to provide causal evidence of hostile sexism in the U.S. Congress. Despite her exceptional qualifications and distinguished career,³ even progressive senators were hesitant to openly cast their ballot for her.⁴ As a result, rumors emerged that “[...] *people were uncomfortable with her being a woman*” (Langille, 2015, 37). We measure hostile sexism with both interruptions and a text-based measure of aggression. Using a difference-in-differences specification, we show that legislators who interacted with both Yellen and at least one other male Fed chair (Alan Greenspan, Ben Bernanke, or Jerome Powell) were significantly more likely to interrupt Yellen. We test and disconfirm alternative mechanisms that arise due to the bundled nature of our treatment, including which topics Yellen discussed that might differ from her male counterparts, and the tone with which she spoke at these hearings. Finally, we show that the Yellen effect on both interruptions and aggressions differs systematically by whether the legislator has any daughters, an as-good-as-random life experience that has been demonstrated to change the parent’s gender bias in other settings (Washington, 2008; Shafer and Malhotra, 2011; Glynn and Sen, 2014; Borrell-Porta, Costa-Font and Philipp, 2019).

Our findings contribute to several strands of the existing literature. First, we speak to

³“Public Policy Economists’ Open Letter in Support of Janet Yellen as the Next Federal Reserve Chair,” Institute for Women’s Policy Research, August 9, 2013.

⁴The final role call vote for Yellen’s appointment was 56 YEAs, 26 NAYs, and 18 no votes. In comparison, Ben Bernanke received 60 YEAs, 30 NAYs, and 2 no votes for his appointment to a second term in office. Jerome Powell was confirmed with 84 YEAs, 13 NAYs, and 3 no votes.

a rich body of literature on sexism in the U.S. Congress.⁵ Existing work in this field has concentrated on voting behavior (Washington, 2008; Volden, Wiseman and Wittmer, 2016; Swers, 2020; Rolfes-Haase and Swers, 2021), verbal interactions in committee hearings (Kathlene, 1994; Mattei, 1998; Karpowitz and Mendelberg, 2014; Ban et al., 2021), wage gaps among staffers (Calcagno and Montgomery, 2020), and ongoing debates on women in Congressional politics (Krook, 2020). Our findings indicate that legislators reacted to the first female chair of the Fed with hostile sexism, providing further evidence of an existing gender bias in Congressional hearings (Kathlene, 1994; Mattei, 1998; Karpowitz and Mendelberg, 2014; Och, 2020; Ban et al., 2021).

Second, we complement a broader literature on women in central banks. Expanding on existing research on women’s career advancement within central banks (Hospido, Laeven and Lamo, 2019; Carney, 2019), female board representation (Diouf and Pépin, 2017; Charléty, Romelli and Santacreu-Vasut, 2017; Masciandaro, Profeta and Romelli, 2018), and its effect on monetary policy decision-making (Bodea and Kerner, 2021; Bodea et al., 2021),⁶ a key innovation of our contribution is to show that women in leadership roles are subject to greater scrutiny and oversight independent of their professional performance. In the background of this vein of research is the implications of pressures on central banks. While some of these analyses focus on the pressures from the executive (Binder, 2021), our contribution is most related to studies on the interactions between legislators and central banks.⁷ Whereas existing work analyzes how legislators scrutinize central banks’ attainment of their mandates and the role of ideology in these hearings (Fraccaroli, Giovannini and Jamet, 2020; Fraccaroli et al., 2022; Ferrara et al., 2021), we describe an additional source of pressure in the form of sexism. Importantly, our findings uncover

⁵For example, see Kathlene (1994); Mattei (1998); Karpowitz and Mendelberg (2014); Och (2020); Vera and Vidal (2020).

⁶Female FOMC members tend to have more dovish stances on monetary policy (Chappell Jr, Havrilesky and McGregor, 1993; Bodea and Kerner, 2021). For instance, Chappell Jr, Havrilesky and McGregor (1993) show that out of the seven women that served in the FOMC between 1966 and 1996, six of them are ranked among the most dovish members.

⁷Other works that focus on this topic are: Schonhardt-Bailey (2013); Fraccaroli, Giovannini and Jamet (2020); Ferrara et al. (2021); Wischnewsky, Jansen and Neuenkirch (2021)

a neglected deficiency in legislative oversight mechanisms of independent central banks. Although hearings on the Fed’s *Monetary Policy Report* to the Congress should inform legislators about the state of the economy (Binder and Spindel, 2019), these congressional oversight mechanisms appear to function as a catalyst for gender biases.

Finally, our paper makes a carefully identified contribution to the broader literature on gender roles, speaking to a number of theories found across the disparate fields of sociology, psychology, communications, linguistics, and anthropology (Glick and Fiske, 1996; Rudman and Glick, 2021; Eagly and Karau, 2002; Leaper and Ayres, 2007*a*; Brescoll, 2016; Och, 2020; Vera and Vidal, 2020). We construe our results as evidence of hostile sexism in a natural experimental setting, and go to substantial lengths to disconfirm alternative interpretations of our headline finding that legislators interrupted Janet Yellen disproportionately more than either preceding or subsequent chairs of the Federal Reserve, all of whom were male. Specifically, we show that this difference in interruptions occurs within individual legislators who interacted with both Yellen and at least one other (male) Fed chair; that Yellen’s choice of topics and tone of speaking did not differ meaningfully from her male counterparts; and that these differences in proclivity to interrupt the first female Fed chair are not observed among legislators with daughters.

1 Theory

Women in political leadership positions play a vital role. Equipping societies with key advantages, female leaders tend to provide more public goods (Hessami and da Fonseca, 2020), have more inclusive leadership styles (Betz, Fortunato and OBrien, 2021), and weaken stereotypes about gender roles paving the way for the future generation of female leaders (Arvate, Firpo and Pieri, 2021). However, the path to obtaining a leadership position is disproportionately more challenging for women than men (Fox and Lawless, 2010, 2014; Kanthak and Woon, 2015; Huddy and Terkildsen, 1993; Sanbonmatsu, 2006;

Barber et al., 2016; Holman, Merolla and Zechmeister, 2016; Van der Pas and Aaldering, 2020). As a perceived threat to male dominance, women frequently have to overcome extraordinary challenges when pursuing careers, achieving professional success, and obtaining social and political positions of power (Goldin, 2014; Gidengil and Stolle, 2021; Håkansson, 2021). These challenges and barriers have been interpreted as a reflection of “hostile sexism”: a behavioral response to threats to male dominance.⁸ Evidence from various policy areas supports this notion: men behave more aggressively and scrutinizing towards women, independent of a woman’s experience and qualifications (Rudman and Glick, 2021).

A variety of existing theories speak to the prediction that hostile sexism should manifest in situations where women violate gender norms. Specifically, the theory of “role congruity” (Eagly and Karau, 2002) divides shared concepts of gender roles into two categories: descriptive norms and injunctive norms. Descriptive norms capture the stereotypes of gender-specific qualities, such as men being more associated with agency qualities (i.e., assertiveness) and women being more associated with communal qualities. Injunctive norms define what qualities are associated with different societal roles, such as assertiveness and agency in leadership roles (Brescoll, 2016). Women in leadership positions are thus confronted with the challenge of threading the needle of violating one or the other of these norms: pursuit of injunctive norms by being more assertive violates descriptive norms, while pursuit of descriptive norms of communality are punished for failing to adhere to the injunctive norms of leadership.

Norm violations are theorized to elicit social backlash from peers, but the magnitude of this backlash is importantly moderated by a number of factors. For example, humans rely more heavily on stereotypes when interacting with people they do not know (Leaper and

⁸In psychology, Ambivalent Sexism Theory (AST) posits that sexism is comprised of two distinct dimensions: hostility and benevolence (Glick and Fiske, 1996). Benevolent sexism captures positive attitudes and pro-social behaviors towards women that are based on stereotypes of women’s traditional social roles as caregivers and intimacy-providers. “Hostile sexism” refers to an antagonistic response to women who do not conform to traditional gender roles which, in most cultures across the majority of human history, have held less status than the gender roles associated with men.

Ayres, 2007a). Similarly, stereotypically male communication qualities of assertiveness are exaggerated in larger group settings, and in unfamiliar contexts. In addition, sex ratios should moderate the strength of the backlash as well, since women in smaller proportions are more noticeable and therefore activating of biases (Eagly and Karau, 2002). Finally, and importantly, the topic of discourse is a theoretically powerful moderator of backlash, as stereotypically masculine topics can raise the salience of the descriptive and injunctive norms associated with gender.

In the background of this collection of theories is a parsimonious framework for predicting where and when we should observe stronger sexism, which we synthesize as follows. Specifically, let both descriptive and injunctive norms be defined as single points in single-dimensional space.⁹ An individual i has a prior on the appropriate locations of the descriptive δ_i and injunctive ρ_i norms in this space. Perceiving violations of these positions (x_j and y_j , respectively) creates disutility in the form of cognitive dissonance. As individuals react to their discomfort of experiencing norm violations, we posit that they apply pressure to the norm violators in the form of either benevolent or hostile sexism. Formally, we can represent this disutility with utility functions of the form:

$$u_i(\delta_i) = -||\delta_i - x_j||^\alpha$$

$$u_i(\rho_i) = -||\rho_i - y_j||^\gamma$$

where the hyperparameters α and γ govern the shape of the decay in utility as individuals are confronted with increasingly norm-violating observations. A female leader who completely adheres to the individual’s descriptive norms will nevertheless be punished for her violation of the individual’s injunctive norms, while one who fully adheres to the injunctive norms will be similarly punished for failing to adhere to the descriptive norms.

Importantly, let the hyperparameters α and γ be determined by the salience of a

⁹The framework can easily be transported to higher-dimensional space, but doing so only complicates the intuition.

particular setting. For example, the salience of agency and assertiveness, represented by γ , are a function of attributes of the leadership position, such as comparing the leadership positions of school board versus military commander. Similarly, other moderators, such as the gender ratio of a group or the degree of personal familiarity with the female leader, can influence the hyperparameter α .

We plot three examples of these utility concepts in Figure 1. In each of the three examples, female leaders must “thread the needle” between the descriptive norms of gender roles and the injunctive norms of leadership, which becomes increasingly difficult as either the divergence between the norms increases (given by the vertical lines for δ_i and ρ_i) or the decay of the loss function steepens (given by γ and α , representing salience). In the top panel, the descriptive and injunctive norms are separated and the decay of the utility is modest. Female leaders who fully adhere to the injunctive norms of leadership experience sexism in the form of backlash against their violation of descriptive norms of gender roles, and vice versa. The middle panel displays a more extreme setting in which the norms are farther apart and highly salient. Here, even mild deviations from the norm evoke large declines in utility and, as a result, sexist backlash. In this sense, the needle is even harder to thread for female leaders in these contexts. The bottom panel displays a more progressive setting in which the norms are closer together, and less salient. In this context, fully adhering to either the descriptive or the injunctive norms prompts only mild declines in utility, and the presence of sexist backlash is muted.

Synthesizing these insights, we formulate the following loss function:

$$L_i(\delta_i; \rho_i) = -\|\delta_i - x_j\|^\alpha - \|\rho_i - y_j\|^\gamma$$

whereas $L_i(\delta_i; \rho_i)$ captures the extent of hostile sexism women encounter based on deviations from descriptive δ_i and injunctive ρ_i norms. Intuitively, this implies that the

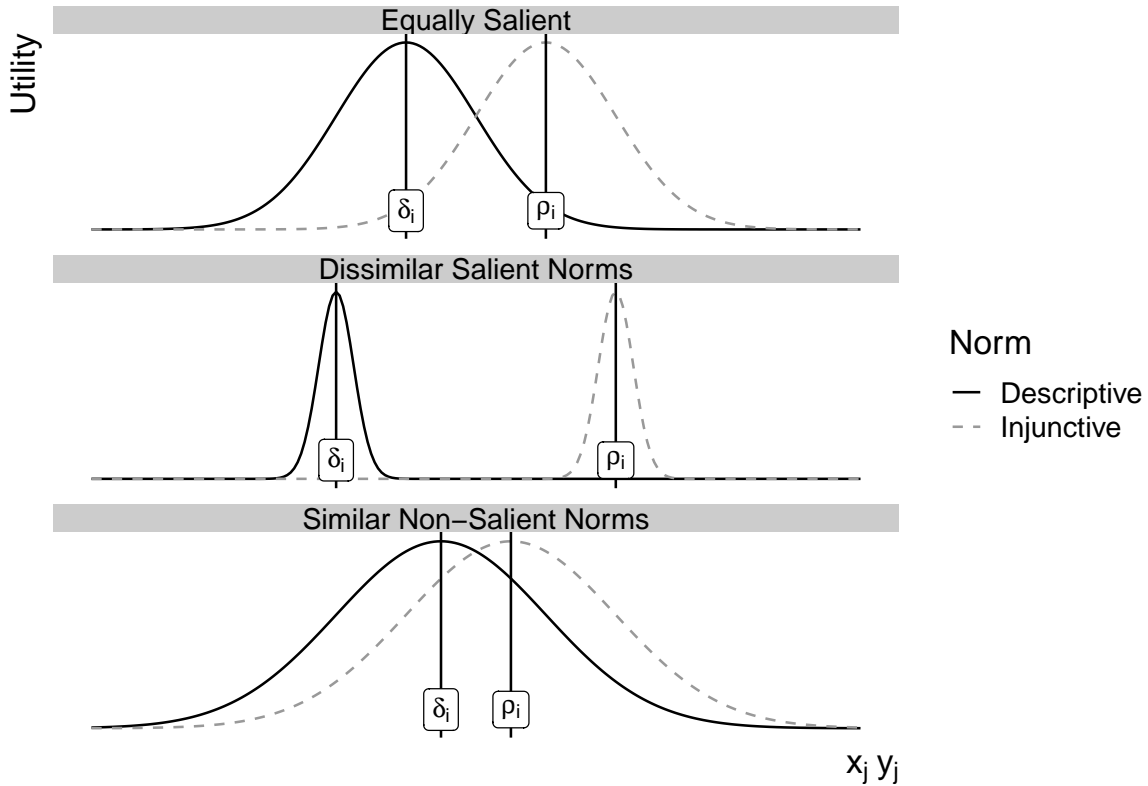


Figure 1: Three examples of role contiguity theory. The top panel displays a situation in which the individual’s descriptive norms (δ_i) and injunctive norms (ρ_i) diverge, and their disutility from observing violations from these norms is modest, theoretically leading to a sexist backlash depending on where the female leader locates herself. The middle panel displays the situation in which the individuals norms are far apart and highly salient, meaning that small deviations from their descriptive norms δ_i yield substantial disutility, as do small deviations from their injunctive norms ρ_i . In this situation, the female leader will likely confront abundant sexism regardless of where she positions herself, either for violating the descriptive norms of gender roles or by violating the injunctive norms of leadership roles. The bottom panel displays the situation in which the individual’s descriptive and injunctive norms are closer together, and are not highly salient. Here, the likelihood of a sexist backlash is minimized as deviations from either the descriptive or injunctive norms do not produce substantial declines in utility.

more salient the descriptive and injunctive norms, the more heavily penalized deviations from these norms will be.

This intuition formalizes three testable expectations about where and when we might observe greater evidence of sexism. First, in situations where the descriptive norms and

injunctive norms diverge, we should observe greater evidence of sexism as the needle women must thread gets narrower. Second, in situations where women are less common and where individuals have less personal relationships, we should observe greater penalties for violating the descriptive norms. Third and relatedly, in situations where the leadership positions are stereotypically more masculine, we should observe greater penalties for violating the injunctive norms.

2 Empirical Context

Based on “*stereotypically male qualities*,”¹⁰ central banking is a policy domain where the salience of both injunctive and descriptive norms is likely to be high. In 2020, only 14 central banks in the world were headed by a woman and one-fifth of central banks had no women in senior positions (Masciandaro, Profeta and Romelli, 2018). Only recently were women appointed to head major central banks such as the Federal Reserve (with Yellen in 2014) and the European Central Bank (with Lagarde in 2019). In theory, these contexts embody the types of situations where hostile sexism should be most pronounced. Specifically, women are still the overwhelming minority, exaggerating the salience of descriptive norms and injunctive norms. Furthermore, as discussed in Glick and Fiske (1996), path-breaking women who represent a threat to traditionally male positions of status and privilege further exacerbate hostile sexist responses.

We concentrate on the tenure of Janet Yellen, the first female chair in the history of the Federal Reserve (Fed).¹¹ Even prior to her appointment in 2014, Ezra Klein of The Washington Post considered what he calls the “whispering campaign”, and in some cases the “shouting campaign” against Yellen becoming the next Fed chair as a result of sexism.¹² In an Op-Ed for the New York Times, Paul Krugman echoed these claims,

¹⁰“Favorite for the Fed.” Pittsburgh Post Gazette, September 19, 2013.

¹¹We do not find similar evidence for Christine Lagarde in the context of ECB oversight hearings, although we posit that this more structured setting is less appropriate a laboratory to empirically investigate our research question (Fraccaroli, Giovannini and Jamet, 2020).

¹²“The subtle, sexist whispering campaign against Janet Yellen.” The Washington Post, June 19, 2013.

arguing that the two “sexism campaigns underway” were in the form of an implicit whisper campaign and the other involving “raw misogyny.”¹³

These early concerns of hostile sexism are supported in the descriptive evidence found in the transcripts of her appearances before both the House and the Senate (see Figure 2). We find a striking and discontinuous increase in the number of times the Fed chair was interrupted that corresponds to Yellen’s tenure. Notably, the increase in interruptions is most pronounced in the House of Representatives, where it is a stark discontinuity. The descriptive evidence in the Senate is more muddled. While Yellen’s tenure captures the period of greatest interruptions of a Fed chair in the data, it caps a secular increase over the preceding 13 years, suggesting that Yellen may have put an end to an increasingly combative tone in Senate hearings. We posit that the greater evidence of a clear difference in the way legislators in the House interact with Yellen and her male counterparts reflects different levels of professionalism in the two chambers.

Consistent with previous research, we posit that interruptions are used to undermine female authority and are consistent with the latent concepts of role ingruity and hostile sexism (Glick and Fiske, 1996; Eagly and Karau, 2002; Och, 2020).¹⁴ We support this interpretation by using Natural Language Processing (NLP) methods to calculate the tone of each interaction, which we use as an alternative measure of hostile sexism.

Our empirical setting is an attractive laboratory to investigate hostile sexism for several reasons. First, by only examining hearings for the Federal Reserve, we hold relatively constant the domain of topics that might be discussed, making it unlikely that our results are driven by topics which might be both differentially inflammatory and differentially discussed by women. Second, the recurring, codified nature of these hearings makes them a relatively challenging test of hostile sexism insofar as this structure limits the possibility of free-flowing conversations where hostility is more likely to arise (Karpowitz and

¹³“Sex, Money and Gravitas”, *New York Times*, August 1, 2013

¹⁴In the Supporting Information we provide an example of text in which we detect interruptions, and discuss and defend our substantive interpretation of this excerpt as evidence of hostile sexism.

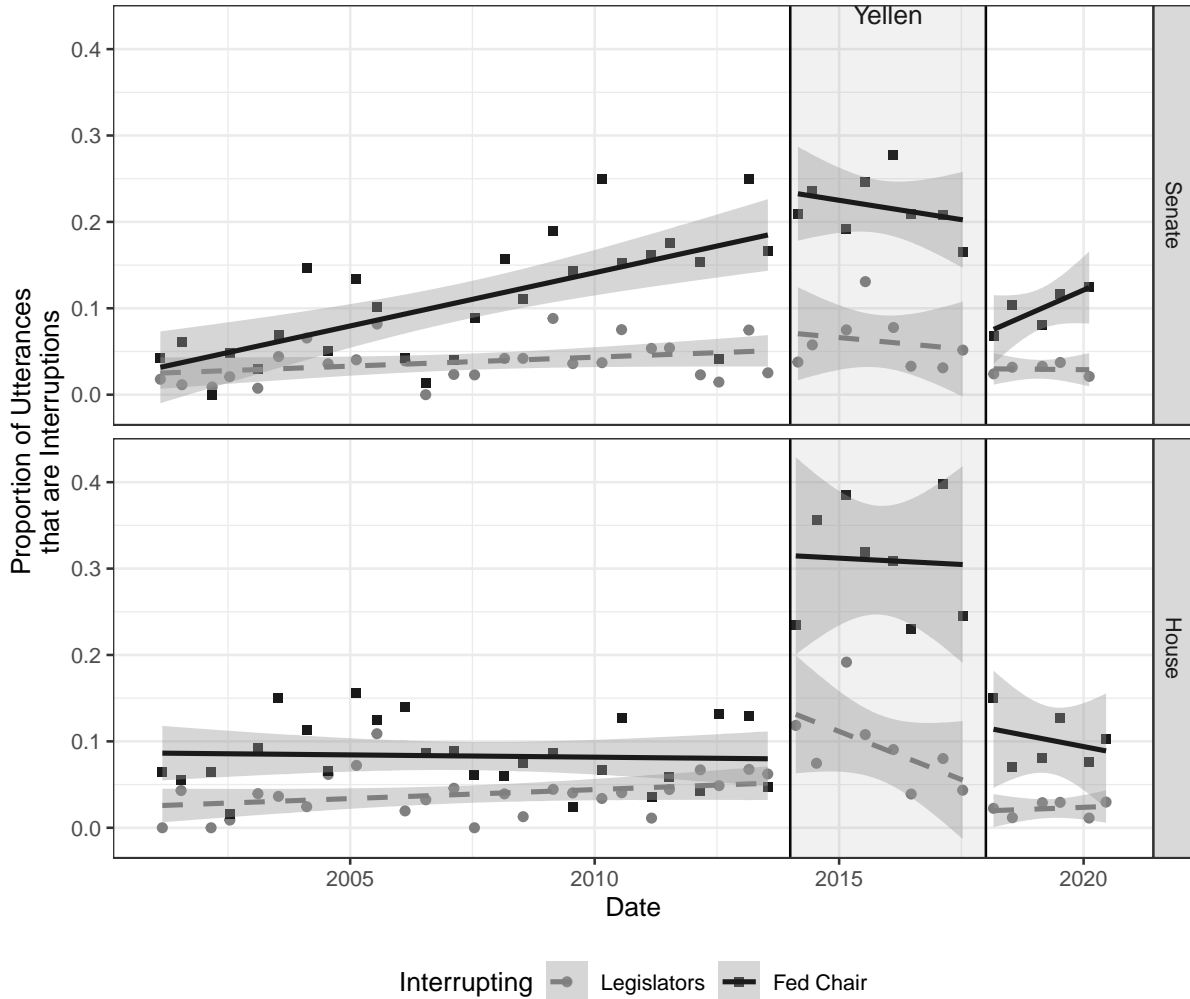


Figure 2: Proportion of utterances that are interruptions over time, separated by House (left panel) and Senate (right panel) hearings, comparing utterances that interrupt a Fed chair to those that interrupt other legislators. The vertical lines denote the mandate of Janet Yellen as chair of the Federal Reserve (February 3, 2014 - February 3, 2018).

Mendelberg, 2014). Third, we focus on interactions with a single individual who occupies the same position throughout: the chair of the Federal Reserve.

However, our narrow focus means that Janet Yellen is a bundled treatment in which her gender is collinear with other aspects of her personality that might also trigger hostility. This poses several challenges to interpreting evidence of increased hostility as evidence of hostile sexism. We describe such challenges in the context of a direct acyclic graph, presented in Figure 3.

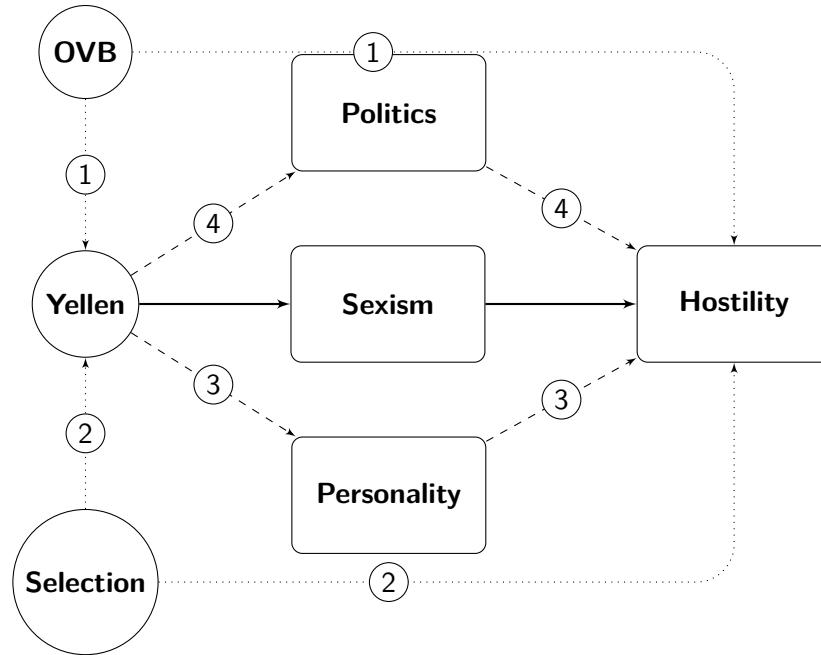


Figure 3: Causal DAG illustrating alternative pathways (dashed lines through “Personality” and “Politics”), omitted variable bias (dotted lines from “OVB”), and selection bias (dotted lines from “Selection”). Omitted variable bias (OVB) occurs if Yellen’s tenure as chair of the Fed co-occurred with an increase in hostility toward the Fed. Selection bias occurs if the legislators attending the Congressional Hearings differentially decided to attend based on pre-existing hostility toward Yellen that is unrelated to her gender. An alternative interpretation of our findings might be that there is something else unique about Janet Yellen besides her gender (i.e., her personality, style of speaking, etc.) that causes increased hostility. Alternatively, Yellen is not only the first female chair of the Federal Reserve, but she is also the only Fed chair appointed by a Democrat president in our data, and holds different policy views on the appropriate role of the Fed. If these qualities engender greater hostility among Republicans or conservatives, and these groups are also more likely to express this hostility than Democrats or liberals, our interpretation would mis-attribute this hostility to sexism.

We use solid black arrows to outline our theorized pathway of interest, attributing hostile behavior towards Janet Yellen due to hostile sexism. The first two alternate pathways represent threats to causally identifying a Yellen effect if 1) Congress simply grew more hostile over time (“OVB”), or 2) the legislators who attended Yellen’s hearings were more hostile, independent of her gender (“Selection”). The second two alternate pathways represent alternative mechanisms by which Yellen causally influences hostility: such as her policy preferences (“Politics”) or differences in her personality.

To rule out the threats to causally identifying the bundled effect of Yellen’s tenure, we implement the following tests. First, omitted variable bias (OVB) occurs if Yellen’s tenure as chair of the Fed co-occurred with an increase in hostility toward the Fed. We narrow the window of analysis to just prior to her arrival, and just after her departure, to demonstrate that the effect we identify is specific to Yellen. Second, selection bias occurs if the legislators attending the Congressional Hearings differentially decided to attend based on pre-existing hostility toward Yellen that is unrelated to her gender. We implement interlocutor fixed effects to identify the increase in hostility toward Yellen that occurs among legislators who attended hearings with both her and at least one other male Fed chair. By estimating a battery of regressions in which we calculate legislator-specific increases in interruptions, focusing only on the last year of Bernanke and the first year of Yellen (or the last year of Yellen and the first year of Powell), we argue that neither the OVB nor selection concerns are substantiated. The same legislator who interrupted Bernanke in 2013 is 14 percentage points more likely to interrupt Yellen in 2014, and 18 percentage points less likely to interrupt Powell in 2018 than they were to interrupt Yellen in 2017. For these patterns to be unrelated to Yellen, it would have to be that the precise start and end of her tenure coincides with broader shifts in sentiment toward the Federal Reserve within individual legislators who attended hearings over this period.

Even with these methods that close the first and second pathways (indicated with dotted lines in Figure 3), an alternative interpretation of our findings is that there might be something else unique about Janet Yellen besides her gender that causes increased hostility, such as, for instance, her personality or style of speaking. We use NLP to evaluate whether Yellen speaks differently from other Fed chairs, either in the topics she focuses on or in the tone of her speech. Using topic models estimated via Latent Dirichlet Allocation (Blei, Ng and Jordan, 2003), as well as machine learning predictions of unpleasant tone (using Google’s Perspective API), we find no descriptive support for the third alternative pathway indicated by the dashed line through “personality” in Figure 3.

If anything, we show that Yellen was disproportionately interrupted more for every topic in our model, and that the tone of the utterances that interrupt Yellen are more attacking than the tone of the interactions between the same legislators and male Fed chairs. In addition, we control for both the topic loadings as well as the predicted probability of different aspects of tone in our main regressions, demonstrating that even when Yellen talks about the same topics in the same tone as her male counterparts, she is interrupted more.

Finally, Yellen is not only the first female chair of the Federal Reserve, but she is also the only Fed chair appointed by a Democrat president in our data (even if the other Fed chairs were re-appointed by Democrat presidents). If these qualities engender greater hostility among Republicans or conservatives, and these groups are also more likely to express this hostility than Democrats or liberals, our interpretation would misattribute this hostility to sexism. We confirm that, while Republicans and conservatives are significantly more likely than Democrats and liberals to interrupt Yellen, both groups are disproportionately more likely to interrupt her than other Fed chairs. This finding suggests that our results cannot be attributed solely to the fourth alternative pathway, indicated by the dashed line through “politics” in Figure 3.

As a final test, we appeal to existing research that demonstrates a causal relationship between having a daughter and declining attachment to gender roles among men (Shafer and Malhotra, 2011; Borrell-Porta, Costa-Font and Philipp, 2019), greater legislative support for female-centered public policy (Washington, 2008), and greater legal support on gender issues (Glynn and Sen, 2014). According to this work, the experience of parenting a daughter reduces a father’s attachment to gender roles, theoretically reducing the salience of the descriptive norms described above, if not the location of said norms.¹⁵ Consistent

¹⁵There is an open debate whether these measures accurately reflect the concepts of hostile versus benevolent sexism in Ambivalent Sexism Theory. While a decline in self-reported attachment to gender roles is theoretically consistent with a decline in sexism overall, these survey self-reports might mask benevolent sexism, as might the legal and legislative outcomes summarized in Washington (2008) and Glynn and Sen (2014). We leave the resolution of this debate to future work, and underscore that the as-good-as-random assignment to daughters should reduce hostile sexism among legislators, allowing us

with our expectations, legislators with daughters were significantly less likely to interrupt Yellen more frequently than her male counterparts. We argue that this analysis recovers a causally identified, conceptually valid estimate of hostile sexism among legislators in the United States Congress.

3 Data and Research Design

Pursuant of the Federal Reserve Reform Act,¹⁶ the chair of the Board of Governors of the Federal Reserve appears twice each year before the Senate Committee on Banking, Housing and Urban Affairs, and twice before the House Committee on Financial Services. The hearings begin with an opening remark by the Fed chair, followed by a Q&A session, in which members of Congress debate monetary policy issues with the Fed chair.¹⁷ After these lengthier opening statements have finished, the proper conversation begins, with the chair of the committee beginning the sequence of questions for the Fed chair, followed by other members of the committee. The Fed chair replies to these questions, which may be followed up on by the original interlocutor, or by a different committee member.

These hearings are a matter of public record and their transcripts are stored on *govinfo*, a website maintained by the US Government Publishing Office.¹⁸ The transcripts capture the sequential conversational flow indicating changes in who is speaking with a new paragraph that begins with the title and last name of the current speaker. We treat each segment of text as the core unit of analysis, which we refer to as an utterance.¹⁹

We process the textual data into a single data frame with rows indexing the speaker-

to confirm the theorized pathway in our data via heterogeneous effect analysis.

¹⁶The Federal Reserve Reform Act is accessible at the following link (last accessed in November 2021): <https://www.govinfo.gov/content/pkg/STATUTE-91/pdf/STATUTE-91-Pg1387.pdf>.

¹⁷Each committee is composed of a chairman, who is generally the majority party member with the greatest seniority; a Vice-chairman; and a Ranking Member. For more details, see: <https://www.senate.gov/artandhistory/history/common/briefing/Committees.htm>.

¹⁸The data can be accessed at the following link (last accessed on September 2021): <https://www.govinfo.gov/app/collection/chrq>.

¹⁹A snapshot of one of these transcripts as well as the distribution of utterances in the data is provided in the Supporting Information.

utterance-hearing. We identify interruptions based on the notation used in the original transcripts: a series of two or more hyphens (--) to end an utterance. We rely on the sequential structure of the data to not only identify who is being interrupted, but also who is doing the interrupting.

Our dataset covers the period from February 13th, 2001 to June 17th, 2020, consisting of 23,119 total utterances, 79 total hearings (40 in the House of Representatives and 39 in the Senate) attended by 242 unique legislators, 8 speaking experts, and 4 chairs of the Federal Reserve (Greenspan, Bernanke, Yellen, and Powell).

The Fed chairs in the period under analysis experienced different financial eras, each characterized by different challenges and policy stances.²⁰ Overall, each Fed chair encountered some forms of political pressure or resistance.

Alan Greenspan's term was a period of moderate inflation and economic growth coupled with sporadic and short episodes of financial instability, such as the dot-com crisis, the Mexican peso crisis, and financial woes surrounding the 9/11 attacks. Appointed by President Reagan in 1987 to which he had close ties, Alan Greenspan defended his restrictive monetary policy stance and publicly warned the administration to stop pressuring the Fed to lower rates and expand the money supply during his first term in office (Smith and Boettke, 2015).²¹ Greenspan's term ended with lower rates that favored the emergence of the housing bubble (Smith and Boettke, 2015; Rajan, 2010). From a political perspective, he faced similar challenges under the Bush and Clinton administrations (Havrilesky, 1995).

Ben Bernanke chaired the Fed during the Great Financial Crisis: under his tenure, monetary policy was particularly expansive, and the Fed acted as a lender of last resort to rescue troubled financial institutions. However, Bernanke faced substantial public scrutiny

²⁰For a recent and detailed overview of the chairmanship and their policies, see Hess and Shelton (2016); Bauer and Faseruk (2020); Bernanke (2022).

²¹The Washington Post 'Greenspan Tells Administration to Stop Pressure', February 25, 1988. <https://www.washingtonpost.com/archive/business/1988/02/25/greenspan-tells-administration-to-stop-pressure/b17e1c67-6846-455f-b7b2-3709812577cf/>

concerning the Fed’s inability to predict the Great Financial Crisis and its handling (Bauer and Faseruk, 2020). Roger Lowenstein of the New York Times, commenting on Bernanke’s handling of the financial crisis, concluded that “*Bernanke has gotten close acting like a fool in the shower fumbling with first the hot water and then the cold.*”²² And indeed, Bernanke faced considerable political backlash for his efforts to rescue an ailing banking sector. Congress initially rejected recapitalizing banks even after Lehman’s collapse, as rescuing banks was considered politically costly.²³ In Bernanke’s own words, during his tenure as chair, “the Fed has come under sustained political fire, especially from Congress, for its regulatory failures before the crisis, for the bailouts of failing financial firms and other extraordinary actions during the crisis, and for its use of quantitative easing and other new monetary tools” (Bernanke, 2022, page 223).

Following Bernanke as chairman of the Federal Reserve, Janet Yellen inherited a similar political climate. Despite her exceptional credentials and qualifications, commentators were initially skeptical about her being a woman and “wondered whether she could handle the inevitable fights with Congress”.²⁴ Janet Yellen took over during a recovery period accompanied by the decline of the unemployment rate. As labor market conditions tightened, she gradually hiked interest rates and reduced the size of the Fed’s balance sheet. Although she received substantial public praise for her leadership and even managed to lift the public’s confidence in the Federal Reserve from its all-time lows (Bauer and Faseruk, 2020),²⁵ her tenure can be described as a time of “pretty much constant harassment from politicians on all sides.”²⁶

In particular, President Trump repeatedly attacked the Fed chair (Bianchi, Kind and Kung, 2019; Tillmann, 2020) and appointed Jerome Powell as Fed chair. To express his

²²‘The Education of Ben Bernanke’ The New York Times, January, 20, 2008.

²³In particular, the \$700 billion recapitalization bill known as the Troubled Asset Relief Program (TARP) was initially rejected by the US Congress. As economic and financial conditions deteriorated, Congress later approved the TARP legislation (Bernanke, 2022).

²⁴“The subtle, sexist whispering campaign against Janet Yellen” The Washington Post, July 19, 2013.

²⁵‘Confidence in U.S. Economic Leaders Flagging’ Gallup Press Release, May 2nd, 2022.

²⁶“Toughest job in Washington?” Politico, December 1, 2014.

anger that his appointee to lead the Federal Reserve would not bend to his will, President Trump even went as far to ask: “Who is our bigger enemy, Jay Powell or Chairman Xi?”²⁷ Although Powell followed Yellen’s policy path, including moderate rate increases and a longer period of unchanged policy, he faced constant political pressure from all sides of the political aisle. This policy persisted up until the Covid-19 crisis, when the period of our analysis ends.

Figure 4 plots the total utterances and total interrupted utterances by each speaker in our data who spoke more than 100 times.²⁸ As illustrated, the chairs of the Fed have the most utterances in our data, followed by the acting committee chairs. Janet Yellen is among the speakers who is interrupted the most, measured as the proportion of her utterances that are interrupted, and is interrupted almost twice as frequently as the next (Mr. Garrett). Our empirical analysis attempts to draw two conclusions from this powerful descriptive result: first, that these differences in interruptions are causally attributable to Janet Yellen, and second that they reflect sexism among her interlocutors.

²⁷“Trump asks who is bigger enemy, Fed Chair Powell or China’s Xi?” Reuters, August 23, 2019.

²⁸We reproduce these figures with a lower threshold for inclusion in the Supporting Information.

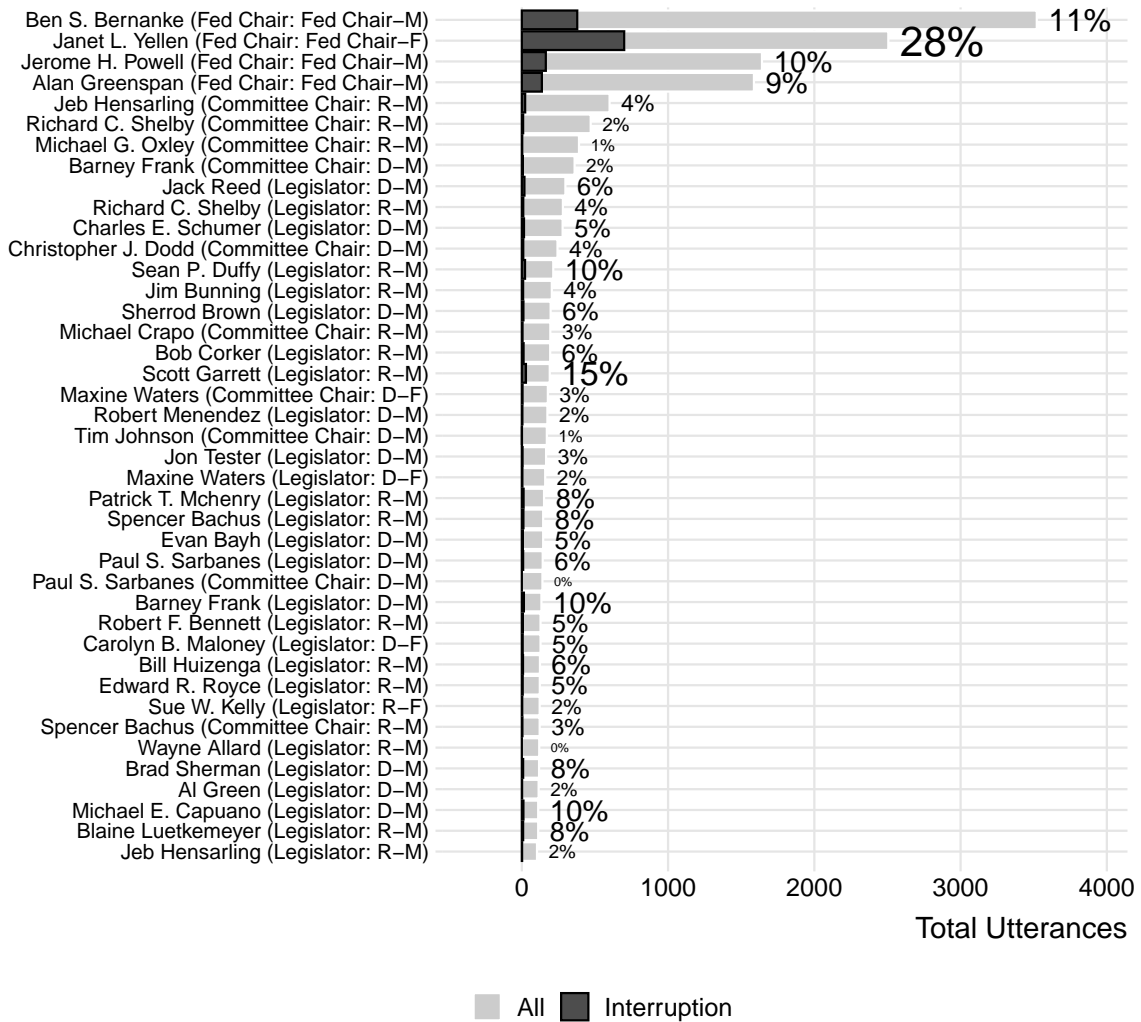


Figure 4: Total utterances by most talkative speakers (light grey bars), along with total interruptions (dark grey bars in the left panel) and total utterances that interrupt another speaker (dark grey bars in the right panel).

3.1 Specifications

To investigate whether Janet Yellen is interrupted more than others, we estimate four different regressions. The first is a simple correlational regression of whether an utterance is interrupted as a function of the speaker’s identity. We compare the fixed effects intercept for Janet Yellen to all other speakers to confirm that she is interrupted disproportionately more, even after controlling for a number of speaker and utterance-level factors.

Formally,

$$\text{Interrupted}/\text{ing}_{u,i,t} = \alpha_i + \delta_t + \gamma \mathbf{U}_u + \lambda \mathbf{X}_{i,t} + \varepsilon_{u,i,t} \quad (1)$$

where $\text{Interrupted}/\text{ing}_{u,i,t}$ is a binary measure of whether utterance u by speaker i in time t is interrupted (or interrupts someone else); α_i are fixed effects for each speaker who is being interrupted, relative to Bernanke; δ_t are date fixed effects (equivalent to hearing fixed effects, since there is never an instance in which two hearings are held on the same day); and $\mathbf{X}_{i,t}$ are controls measured at the speaker level (total utterances by that speaker in that hearing, incumbent vote share, gender, seniority, age, party affiliation, and ideology).²⁹ Table 1 provides summary statistics for each of these measures. We direct interested readers to SI Section 2.1 where we explore the marginal effects across each dimension in more detail.

Of particular importance is \mathbf{U}_u , which is a vector of controls measured at the utterance level, including the logged number of characters, an indicator for whether the utterance itself interrupts / is interrupted by the preceding, and two vectors of NLP measures. The first NLP measure predicts the tone of each utterance based on Google’s Perspective API,³⁰ which was designed to measure the tone of online comments or posts along several dimensions. This tool combines a powerful transformer machine learning algorithm with millions of annotated training data to predict whether a small chunk of text is toxic,

²⁹We rely on Poole and Rosenthal (2017)’s DW-NOMINATE measure for ideology.

³⁰See the SI for a detailed discussion of this algorithm and the applicability of it to our empirical setting.

Table 1: Summary Statistics

Variable	N	Mean	Std. Dev.	Min	Pctl. 25	Pctl. 75	Max
chamber: House							
party	212						
... D	92	43.4%					
... Expert	8	3.8%					
... Fed Chair	4	1.9%					
... I	1	0.5%					
... R	107	50.5%					
gender	212						
... F	41	19.3%					
... M	171	80.7%					
nominate_dim1	212	0.085	0.42	-0.792	-0.313	0.465	0.863
oversight	212	0.071	0.257	0	0	0	1
yellen_vote	212	0.009	0.097	0	0	0	1
nKids	212	1.843	1.721	0	0	3	7
nDaughters	212	0.907	1.045	0	0	1.194	4
nSons	212	0.927	1.113	0	0	2	6
age	212	54.478	10.479	27	46.375	62.5	82
seniority	212	6.327	6.912	0	1	8.725	32.2
votepct	212	0.65	0.14	0.437	0.548	0.72	1
chamber: Senate							
party	71						
... D	31	43.7%					
... Expert	1	1.4%					
... Fed Chair	4	5.6%					
... I	0	0%					
... R	35	49.3%					
gender	71						
... F	10	14.1%					
... M	61	85.9%					
nominate_dim1	71	0.099	0.4	-0.756	-0.285	0.454	0.782
oversight	71	0.056	0.232	0	0	0	1
yellen_vote	71	0.113	0.318	0	0	0	1
nKids	71	2.07	1.713	0	0.25	3	9
nDaughters	71	1.113	1.217	0	0	2	5
nSons	71	0.958	0.975	0	0	2	4
age	71	60.058	8.431	41	55	65.25	84.429
seniority	71	10.663	9.087	0	3.417	17.35	32.5
votepct	71	0.608	0.148	0.268	0.506	0.656	1

sexist, aggressive, attacking, and a number of other dimensions of unpleasant speech. We control for these predicted probabilities in our main specifications to hold constant the alternative pathway that Yellen’s experiences are driven by *how* she speaks.³¹

Our second NLP-based measure estimates the topics each speaker talks about. Specifically, we estimate a topic model via Latent Dirichlet Allocation (LDA, Blei, Ng and Jordan 2003) with 100 topics on the utterances, treating each utterance as its own document.³² The resulting model predicts the probability that each utterance is about each of the 100 topics. We include these predicted probabilities in our main specifications to control for the alternative pathway that Yellen’s interruptions are driven by *what she talks about*.

Our main specification organizes the data dyadically and predicts whether a speaker is disproportionately more likely to interrupt Yellen than others. Formally, for ego i responding to alter j during a hearing held in time t , we estimate:

$$\text{Interrupting}_{u,i,j,t} = \alpha_i + \rho_j + \delta_t + \gamma \mathbf{U}_u + \varepsilon_{i,j,t} \quad (2)$$

We are interested in exploring whether speakers are more likely to interrupt Yellen than they are to interrupt others, which is achieved with the twin fixed effects (α_i and ρ_j). Here, the identifying variation comes from within a member of Congress who interacts with both Yellen and at least one other Fed chair.

Finally, our fourth specification uses a difference-in-differences design in which we compare the difference in how often a Fed chair is interrupted relative to a non-Fed chair,

³¹Note that this approach is distinct from research by Dietrich, Hayes and O'Brien (2019), who analyzes the audio recordings of speeches on the floor of Congress with specific attention to pitch to measure emotional states. Our method relies on the choice of words and their arrangement to predict the probability that an utterance would be interpreted as toxic, aggressive, flirtatious, and a host of other labels by a human interlocutor. For more information, please refer to the SI.

³²We examine the coherence of different choices of the number of topics k , and settle on a 100-topic model. See the SI for more details.

before and after Yellen’s tenure. Formally:

$$\begin{aligned} \text{Interrupting}_{u,i,\text{Fed},t} &= \beta_1 \mathbb{I}\text{Fed}_t + \beta_2 \mathbb{I}\text{Yellen Tenure}_{i,t} \\ &+ \beta_3 \mathbb{I}\text{Fed}_t * \mathbb{I}\text{Yellen Tenure}_{i,t} \\ &+ \alpha_i + \gamma \mathbf{U}_u + \varepsilon_{i,j,t} \end{aligned} \tag{3}$$

Under the assumption that the parallel trends between utterances that respond to a Fed chair and those that respond to another legislator holds across periods, we can treat the difference between interruptions of a male Fed chair and another legislator as a valid counterfactual against which we compare the difference between interruptions of Yellen and another legislator. All specifications implement two-way cluster robust standard errors at the speaker-hearing level.

To support our interpretation of the causal effect of Yellen as evidence of sexism, we appeal to a well-documented empirical pattern: parents of daughters are less likely to hold sexist stances across a variety of settings. These results are found both among the general public, where the outcomes are measured by beliefs and opinions measured via survey data (Shafer and Malhotra, 2011; Borrell-Porta, Costa-Font and Philipp, 2019); among US Courts of Appeals judges, where the outcomes are measured by votes on gender issues (Glynn and Sen, 2014); as well as among legislators, where the outcomes are measured by support for feminist legislation (Washington, 2008). Based on this literature, we posit that legislators with daughters are less likely to treat Yellen with hostility due to her gender, which we interpret as evidence consistent with our theorized mechanism of hostile sexism.

Specifically, we interact the transition from Bernanke to Yellen, and from Yellen to Powell, with a binary indicator, *Daughter*, which equals one if the legislator has at least one daughter, and zero otherwise. This specification is a difference-in-differences estimator where we compare the difference in the proportion of times legislators with and without daughters interrupt Bernanke (or Powell), with the difference in the proportion of times

those with and without daughters interrupt Yellen. Under the parallel trends assumption that those with daughters represent how those without daughters would have behaved were it not for their sexism, we argue that this confirms our theorized mechanism of interest: hostile sexism. Formally:

$$\begin{aligned} \text{Interrupting}_{i,\text{Fed},t} &= \beta_1 \mathbb{I} \text{Yellen}_t + \beta_2 \mathbb{I} \text{Daughter}_{i,t} \\ &+ \beta_3 \mathbb{I} \text{Yellen}_t * \mathbb{I} \text{Daughter}_{i,t} + \lambda \mathbf{X}_{i,t} + \varepsilon_{i,j,t} \end{aligned} \tag{4}$$

β_3 captures the difference in the degree to which legislators with and without daughters increased the proportion of times they interrupted the Fed chair during Yellen’s tenure versus either Bernanke or Powell. We expect $\beta_3 < 0$, as having daughters should attenuate the likelihood of a sexist reaction against the first female chair of the Federal Reserve. For this analysis, we collapse our data to the speaker-hearing level, meaning that the outcome is measured as the proportion of times a speaker interrupts a Fed chair and precluding our use of controls for utterance-level covariates. However, we confirm our findings are robust to the utterance-level analysis in the SI. Furthermore, as there are only a tiny fraction of legislators whose number of children change over the period of analysis, we are prevented from using speaker fixed effects, instead relying on the battery of speaker-level covariates contains in $\mathbf{X}_{i,t}$.

4 Results

We begin by confirming the descriptive results summarized above in Figure 4 – namely that Yellen is interrupted disproportionately more than others. Figure 5 plots the fixed effects for a subset of speakers who spoke 100 or more times in the data. Positive estimates indicate that these speakers were interrupted more than Bernanke was, while negative coefficients indicate they were interrupted less. As illustrated, Yellen was interrupted significantly more frequently than *any* other speaker in our dataset who spoke 100 or

more times, even after controlling for what she talked about and how she talked.³³

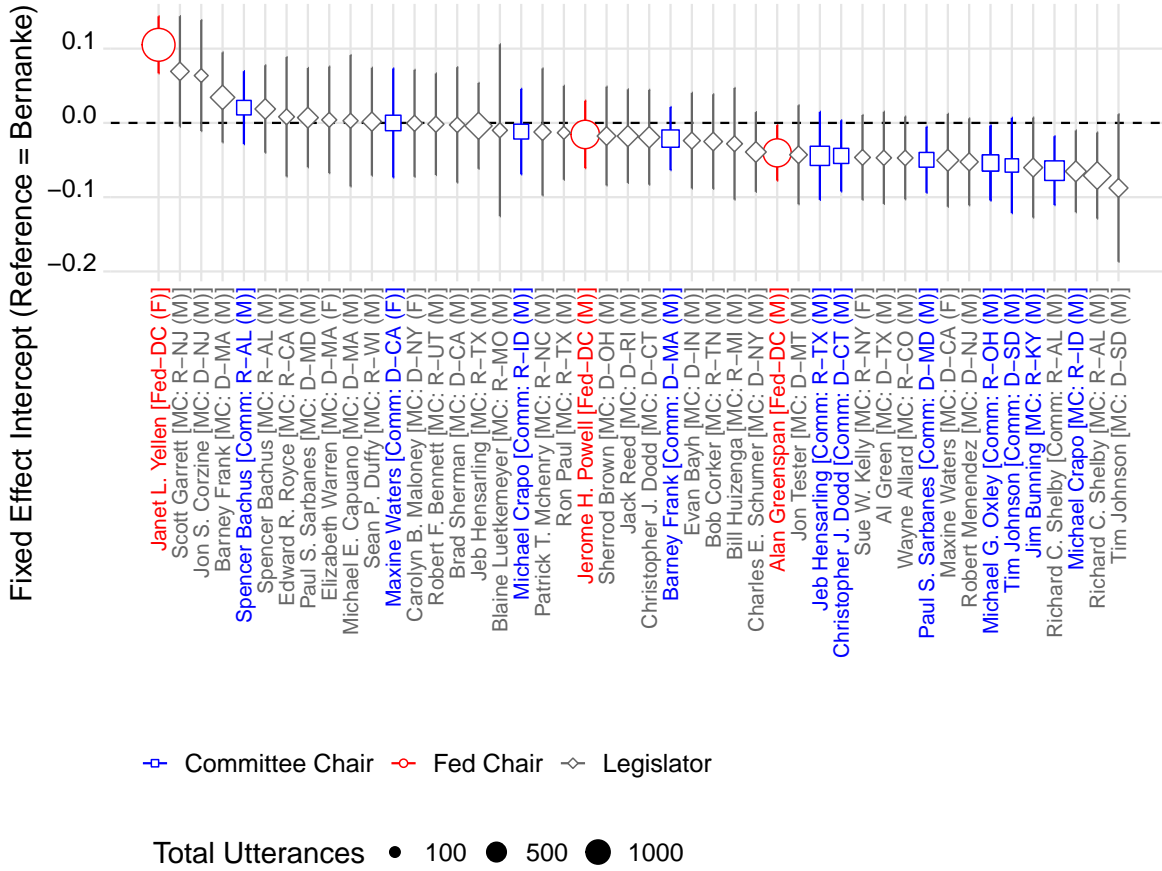


Figure 5: Coefficient plot summarizing the difference between Bernanke’s propensity to be interrupted and a subset of other speakers (filtered to those who have 100 or more utterances in total). Points are sized by the total number of utterances for each speaker. The associated regression table is included in the Supporting Information.

³³We lower the threshold for inclusion to 20 or more utterances in the Supporting Information, confirming these results.

We can look at heterogeneities in these results in two ways.³⁴ First, we subset our data to the House and the Senate to see if these patterns are stronger among one group of politicians than the other. As illustrated in the left panel of Figure 6, our findings are significantly stronger in the House than in the Senate, potentially reflecting the stronger norms of decorum in the latter chamber due to longer term limits (Kousser, 2005).³⁵

Second, we investigate whether Fed chairs themselves are interrupting others, and whether Yellen differs systematically from her peers in this regard. As illustrated in the right panel of Figure 6, Yellen is no more likely to interrupt others than Ben Bernanke. If anything, she was *less* likely to be the interruptor in House hearings compared to Bernanke, whereas none of the other male Fed chairs differed from each other.

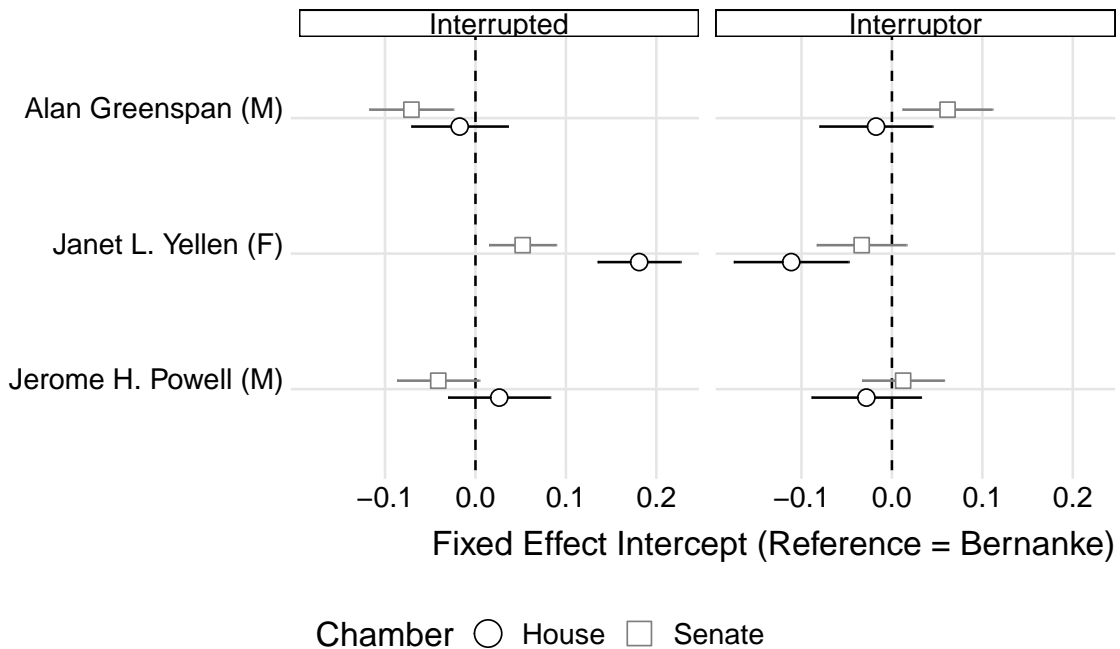


Figure 6: Coefficient plot summarizing the difference between Bernanke’s propensity to be interrupted (left panel) and to interrupt someone else (right panel), and the other Fed Chairs, disaggregating to hearings in front of the House Committee on Financial Services (black circles) and hearings in front of the Senate Finance Committee (grey squares).

³⁴We present a battery of heterogeneous effects by interlocutor characteristics, including gender, party, seniority, and ideology in the Supporting Information.

³⁵We believe this difference in chambers of Congress is striking and worthy of further investigation, beyond the scope of this paper.

These results confirm the descriptive evidence that Janet Yellen alone experienced a spike in interruptions, disconfirming the concern that our results simply reflect a secular increase in hostility over time. Nevertheless, it is possible that Yellen’s tenure happened to co-occur precisely with an increase in hostility that is unrelated to her (i.e., the omitted variable bias problem we described in Section 2). To test for this possibility, we look for changes in behavior within legislators. Figure 7 indicates that those who interacted with Yellen and other chairs of the Fed were consistently more likely to interrupt Yellen. While this does not preclude the possibility that speakers simply became more hostile in 2014, it does mean that this shift would have had to occur *within* legislators, instead of reflecting an incoming class of more hostile interlocutors.

Second, we support this descriptive evidence with the dyadic regression described in Equation 2. Table 2 summarizes these results. Yellen is indeed consistently more likely to be interrupted than Bernanke. These results are robust to the inclusion of controls measured at both the speaker and hearing level. The most rigorous specification is presented in column 5 where we add speaker fixed effects, meaning that the estimate captures the degree to which an individual legislator interrupted Yellen more than they interrupted Bernanke. Substantively, the estimate of 0.16 corresponds to a given legislator being 16 percentage points more likely to interrupt Janet Yellen than they were to interrupt Bernanke who had a base rate of roughly 1 out of every 10 utterances being interrupted.³⁶

To further confirm our causal interpretation of these patterns, we turn to the difference-in-differences specification described in Equation 3. We plot the marginal effect of interrupting a Fed chair across periods, isolating only the within-legislator changes via legislator fixed effects. As displayed in Figure 8, we again find evidence consistent with a Yellen-specific effect of approximately 0.16, or 16 additional interruptions per 100 utterances compared to the male Fed chairs.

³⁶We examine heterogeneous effects by politician characteristics in our Supporting Information Figure 7, finding that – while Republicans and conservatives are significantly more likely to increase their interruptions of the Fed chair during Yellen’s tenure – the general pattern of Yellen being interrupted more than others holds across all ranges of all moderators.

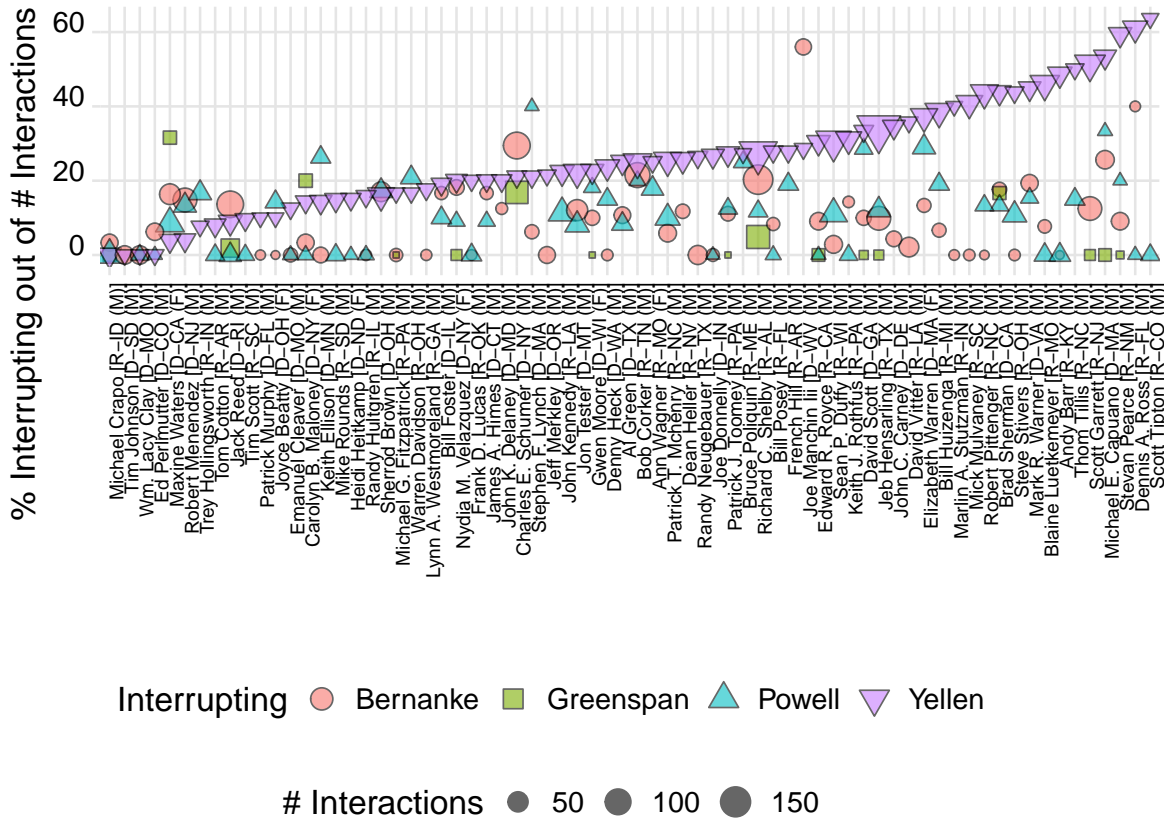


Figure 7: Points represent the share of total possible interactions (size) between a politician (x-axis) and one of the four Fed chairs that were interruptions. Red bars highlight legislators who interrupted male Fed chairs more than they interrupted Yellen while purple bars highlight those who interrupted Yellen more than they interrupted male Fed chairs. Data are subset to those who interacted with Yellen and at least one other Fed chair at least 10 times.

Finally, to investigate the degree to which these findings are driven by a secular increase in interruptions, we subset the data to the union of all hearings attended by Yellen and either Bernanke or Powell, the hearings specific to a single presidential administration (Obama’s terms for Bernanke to Yellen, Trump’s term for Yellen to Powell), and to the final year of one chair and the first year of the following. While narrowing the window of comparison in this fashion reduces the number of observations, it gives us a tighter comparison between Yellen and a male Fed chair in both the beginning and the end of her tenure. Figure 9 plots the estimates from a fixed effects regression run on data collapsed to the speaker-hearing level. As illustrated, the move from Bernanke to Yellen in 2015 saw

Table 2: Dyadic Interruptions

	Vanilla (1)	Speaker Ctrls (2)	Utterance Ctrls (3)	Hearing FEs (4)	Speaker FEs (5)	-Nay/NV (6)
Yellen (ref. Bernanke)	0.169*** (0.012)	0.160*** (0.016)	0.158*** (0.018)	0.123*** (0.022)	0.158*** (0.027)	0.157*** (0.030)
Powell (ref. Bernanke)	-0.013* (0.006)	-0.016† (0.008)	-0.011 (0.012)	0.007 (0.016)	0.019 (0.027)	0.027 (0.027)
Greenspan (ref. Bernanke)	-0.026 (0.019)	-0.024 (0.022)	-0.026 (0.020)	-0.001 (0.023)	-0.014 (0.024)	-0.016 (0.025)
Age		0.009 (0.006)	0.007 (0.006)	0.011 (0.007)		
Vote Share		-0.004 (0.006)	-0.004 (0.006)	-0.001 (0.007)		
Ideology		0.004 (0.012)	0.003 (0.013)	0.002 (0.015)		
Republican (ref. Democrat)		-0.010 (0.037)	-0.005 (0.038)	-0.010 (0.040)		
Senate (ref. House)		-0.011 (0.039)	-0.010 (0.038)	(0.000)		
Male (ref. Female)		-0.012 (0.016)	-0.006 (0.015)	0.010 (0.015)		
Seniority		-0.006 (0.009)	-0.004 (0.009)	-0.010 (0.010)		
Fed Oversight Sponsor		0.007 (0.006)	0.006 (0.006)	0.007 (0.005)		
Oppose Yellen Conf.		-0.013 (0.019)	-0.011 (0.022)	-0.003 (0.024)		
Interrupted			0.093** (0.033)	0.078* (0.031)	0.070* (0.027)	0.065** (0.024)
100 LDA Topic Loadings	N	N	Y	Y	Y	Y
Tone Probabilities	N	N	Y	Y	Y	Y
Hearing FE	N	N	N	Y	Y	Y
Speaker FE	N	N	N	N	Y	Y
Observations	20,151	20,151	20,151	20,151	20,151	18,981
R ²	0.078	0.085	0.099	0.113	0.135	0.135

Notes: Dyadic regressions predicting whether Greenspan, Powell, and Yellen were interrupted more than Bernanke. Column 2 (‘vanilla’) includes speaker covariates only, including the total number of utterances of the interrupting politician during the hearing. Column 3 controls for the total number of characters (logged) in the interrupted utterance, utterance-topic probabilities from a 100-topic model, predicted probabilities of tone, and an indicator of whether the interruption itself was interrupted. Column 4 adds hearing fixed effects. Column 5 adds interruptor fixed effects. Column 6 drops all senators who either voted against Yellen’s confirmation or abstained. Two-way standard errors are clustered at the speaker-hearing level to account for correlated errors within interlocutors as well as correlated errors within each hearing. † $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

a statistically significant increase in interruptions in the House of Representatives, but a null result in the Senate (left panel). Conversely, the transition from Yellen to Powell saw

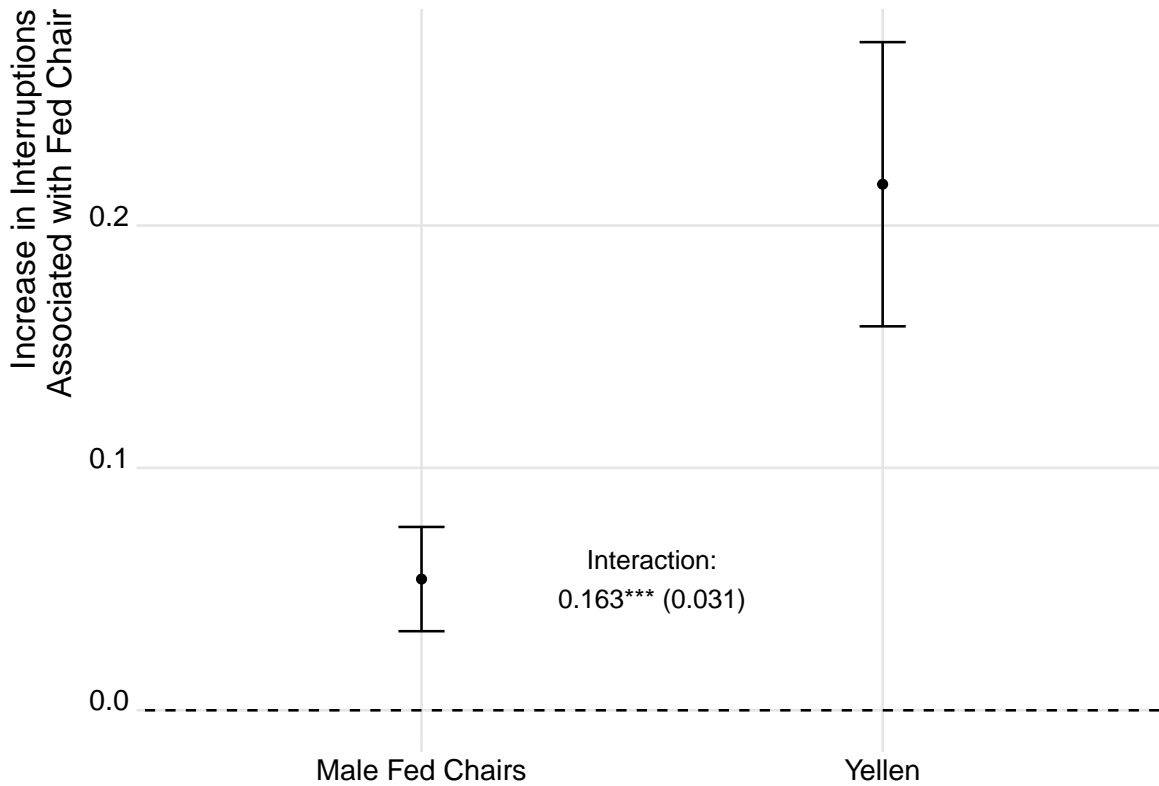


Figure 8: Difference-in-differences marginal effects comparing increase in interruptions of the Fed chair during Yellen’s tenure among those who attended hearings with her and at least one other male Fed chair.

a statistically significant decline in interruptions in both chambers.³⁷

4.1 Mechanisms: Sexism and Daughters

The preceding results confirm that Janet Yellen was interrupted significantly more than the male chairs of the Fed. However, these findings do not confirm that we are capturing a sexist response. In our empirical setting, Janet Yellen is a bundled treatment whose gender is only one dimension among many characteristics that might explain why she is

³⁷The tightest identification subset – the comparison between the final year of an outgoing chair and the first year of an incoming chair – is also the one we have substantive reason to suspect should work against our findings. Specifically, the final hearings for an outgoing chair and the initial hearings for an incoming chair are those most likely to be more polite, as the outgoing chair is thanked for their service, and the incoming chair is welcomed.

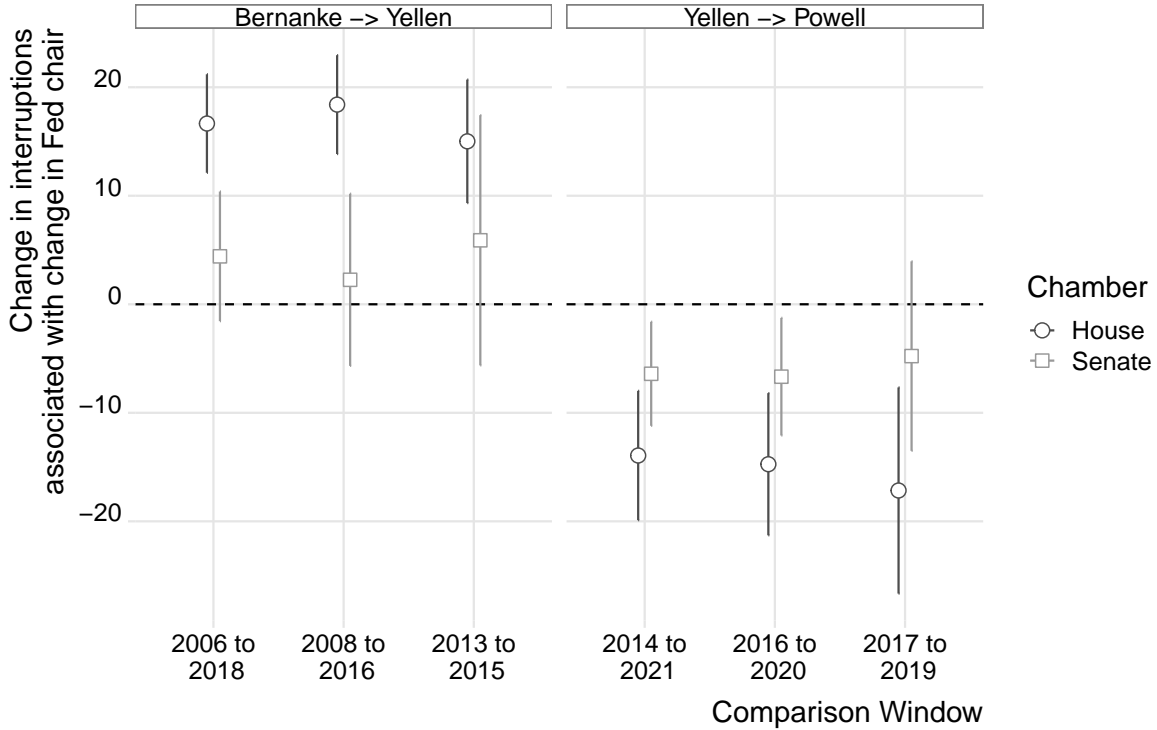


Figure 9: Coefficient estimates capturing the increase in the probability the speaker interrupts the Fed chair when the role shifts from Bernanke to Yellen (left panel) and when it shifts from Yellen to Powell (right panel). Points are shaded by whether the regression is run on hearings in the House of Representatives or in the Senate. The x-axis describes the subset of the data that is being used.

interrupted more than other Fed chairs during Congressional hearings.

To identify whether sexism is the driver of interruptions, we turn to the interacted regression we defined in Equation 4. In this specification, we predict interruptions as a result of the interaction between Yellen’s tenure (vis-à-vis the tenure of either Bernanke or Powell) and whether the interacting legislator has any daughters.³⁸ Our results, summarized in Figure 10, indicate that legislators with daughters in the House of Representatives are significantly less likely to interrupt the chair of the Fed when it switches from Bernanke to Yellen. Conversely, there is no such evidence of a role played by sexism in the interrup-

³⁸We confirm our results are robust to using proportion of children that are daughters, as well as to re-estimating these results on the utterance-level data, allowing us to control for the topics, tone, and other utterance-level covariates described above. We are unable to include legislator-fixed effects in these specifications, as there are only a handful of interlocutors whose first daughter is born within the period of analysis.

tions in the Senate. The overall patterns are stronger in the transition from Bernanke to Yellen than they are in the transition from Yellen to Powell, although we highlight that the interaction term is of similar magnitude and sign, only more noisily estimated.

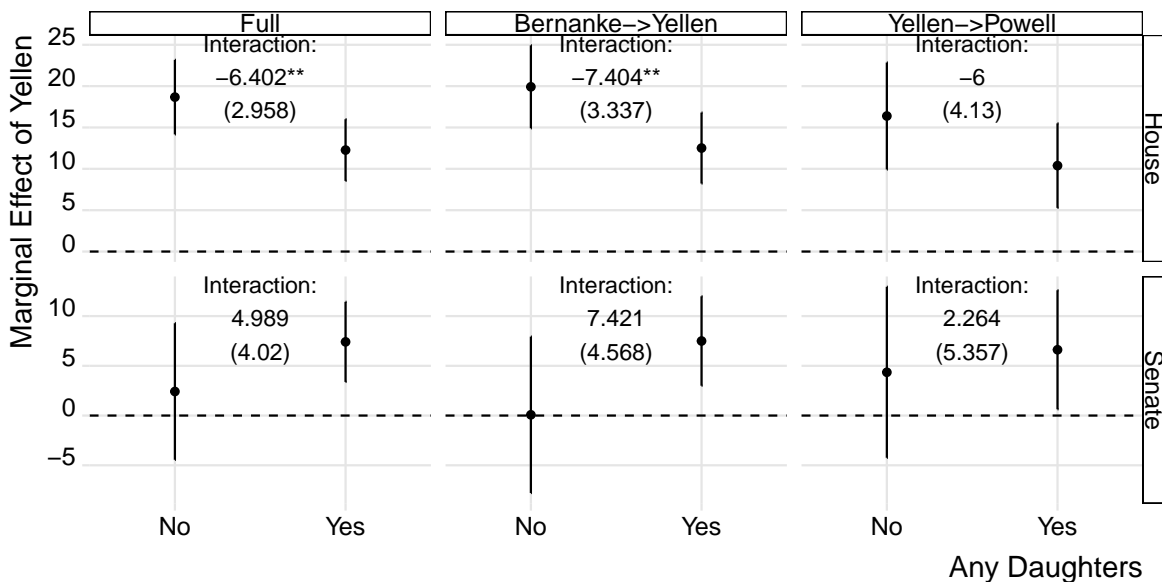


Figure 10: Marginal effect of Yellen taking over as chair of the Fed on whether legislators attending hearings interrupted the chair of the Fed, interacted with whether the legislators had any daughters.

4.2 Alternative Mechanisms: Topic and Tone

Evidence of the attenuating effect of daughters notwithstanding, it may be that Yellen is simply a more interruptable interlocutor. She might speak more slowly, might be more cagey or unsatisfying in her responses, or might simply do more to avoid answering difficult questions. While it is unlikely that these styles of speech bias the previous results by triggering stronger responses among those without daughters, we nevertheless perform several tests to disconfirm this alternative mechanism.

First, we exploit the topic models that were previously used as a control to examine whether Yellen differs systematically from other Fed chairs in what she speaks about. We investigate this question in two ways. For one, we calculate the probability of a topic

conditional on its utterance being interrupted or not, and then investigate whether Yellen chooses topics that are more heavily associated with interruptions than other Fed chairs.³⁹ Figure 11 shows these quantities of interest. It displays the difference in topic used by Yellen relative to the other male Fed chairs on the x-axis, and the difference in the same topics associated with interrupted and uninterrupted utterances on the y-axis.

As illustrated, there is strong evidence that some topics are more likely to be associated with an interrupted utterance (toward the top of the plot) and others are less likely to be associated with an interrupted utterance (toward the bottom of the plot). The highest-scoring terms associated with these topics provide an intuitive understanding of which types of speech are more or less likely to be interrupted. Specifically, speculative or imprecise language (“think”, “look”, “thing”) is most likely to be interrupted, while polite formalities (“thank”, “gentleman”, “recognize”) are least likely to be interrupted. However, we show that Yellen does not discuss interruptable topics more than other Fed chairs, as indicated by a local linear smoother.⁴⁰

Alternatively, we can assign the highest scoring topic to every utterance, aggregate them by speaker, and inspect whether the utterance was interrupted. Figure 12 plots the topics on the y-axis, and the proportion of utterances associated with this topic for each group of speakers that were interrupted on the x-axis. We sort the results by how heavily they are associated with the probability of Janet Yellen being interrupted. As illustrated, Yellen is more likely to be interrupted across almost all topics compared to the other male chairs of the Fed. These results indicate that the systematic evidence of an interruption bias against Janet Yellen is unlikely to be driven by her focus on specific topics compared

³⁹When calculating this per-topic probability, we drop all of Yellen’s own utterances. We do so to purge the measure of potential confounding factors driven by the fact that Yellen is more likely to be interrupted due to factors unrelated to the semantic content of the topic itself (i.e., sexism).

⁴⁰In the Supporting Information, we recreate these plots using a structural topic model (STM, Roberts et al. (2014)) to calculate the difference in topic use by Yellen relative to each other Fed chair (x-axes) and compare these coefficients with topic-specific intercepts (y-axes) from a model that predicts whether an utterance is interrupted, conditional on speaker fixed effects, hearing fixed effects, and continuous measures of rhetorical hostility. Our results confirm the lack of a systematic relationship between the topics differentially used by Yellen and the likelihood she is interrupted.

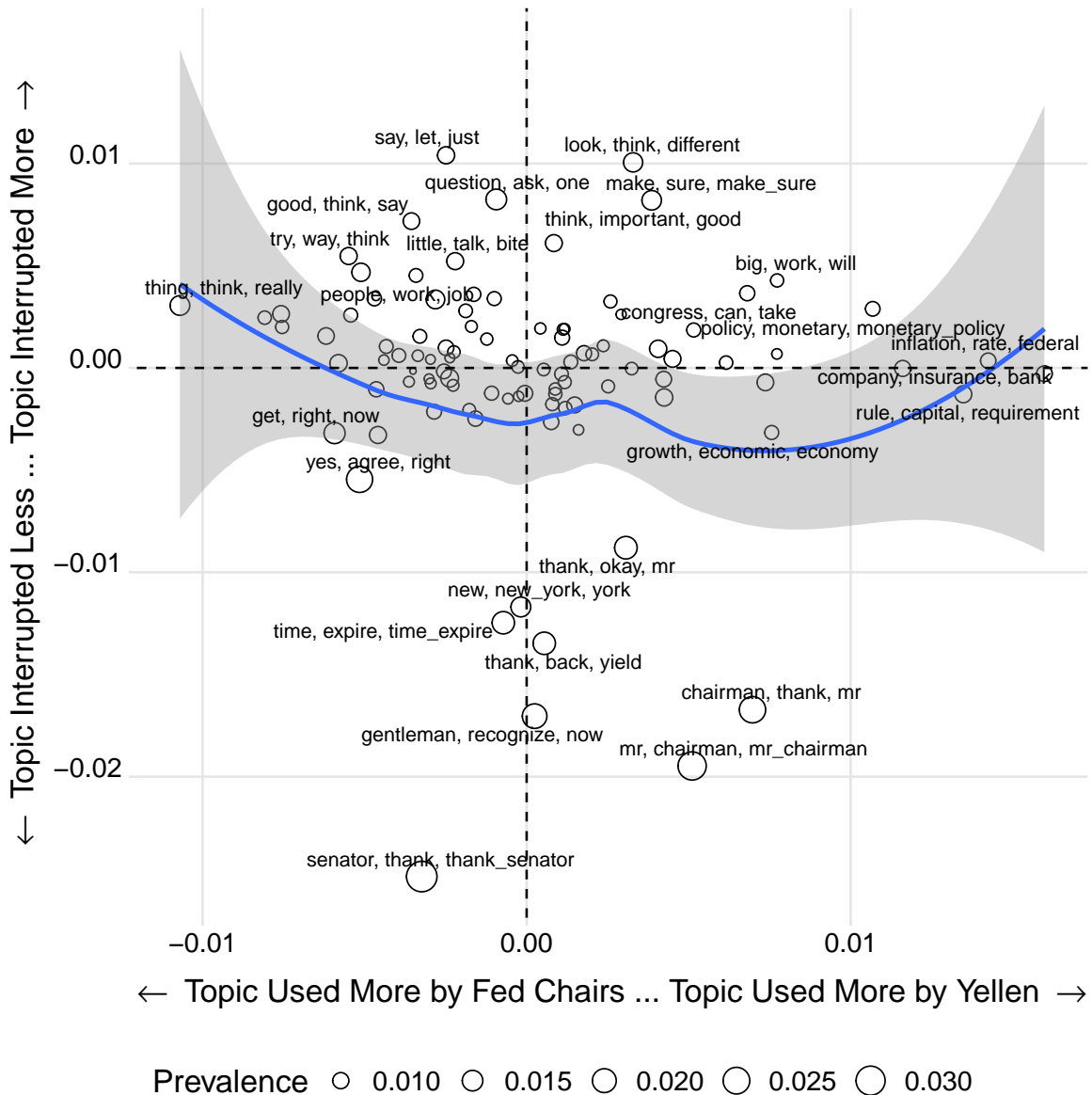


Figure 11: Scatter plot of topics by whether they were used more by Yellen or male Fed Chairs (x-axis) and whether they were more or less interrupted (y-axis).

to other Fed chairs.

However, topic models can only capture *what* was said, not *how* it was communicated. If Yellen talks about the same things as other Fed chairs, but does so in a more frustrating tone, the causal effect we attribute to sexism might instead be due to the way she speaks. To address this issue, we run a regression similar to those described above in equation 1, except that we replace the indicator for whether an utterance is interrupted with the con-

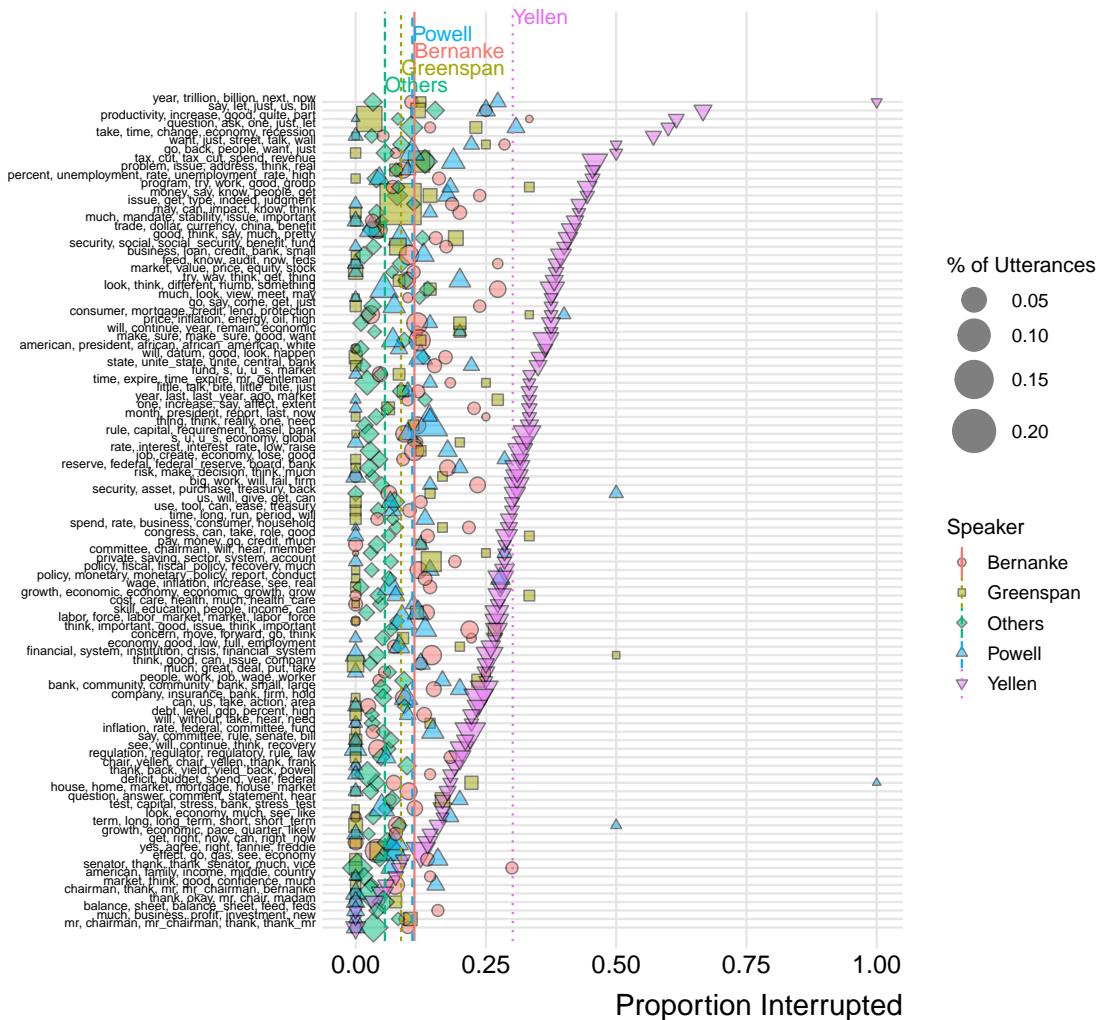


Figure 12: Each utterance is assigned to its highest-scored topic (y-axis) and then aggregated to the speaker. The x-axis indicate the proportion of each speaker’s utterances that is interrupted, broken out by the utterance’s highest scoring topic. Points are sized by the proportion of all utterances that are assigned to each topic.

tinuous measure of the utterance’s toxicity, aggression, or incoherence. These measures are produced by a sophisticated machine learning algorithm developed by Google for the purpose of online content moderation (*Using machine learning to reduce toxicity online*, 2021). Substantively, the algorithm is fed vector representations of chunks of text known as ‘word embeddings’ and generates a predicted score for a number of different dimensions of tone, including attack, identity attack, threat, insult, unsubstantial, incoherent,

inflammatory, toxicity, sexually explicit, profanity, obscene, or flirtation. The algorithm is trained on a rich corpus of textual data, in which chunks of text were manually labeled by humans. The algorithm’s resulting score on a text can be understood as the predicted probabilities that a human would label that text as belonging to one of the aforementioned dimensions. We refer to these measures as capturing the “tone” of each utterance in our data.⁴¹

In addition, we subset the data to only those utterances made by one of the chairs of the Federal Reserve, and focus attention on an indicator for Janet Yellen. Formally:

$$\text{Tone}_{u,i,j,t} = \mathbb{I}Yellen_t + \rho_j + \text{poly}_{t,3} + \gamma \mathbf{U}_u + \varepsilon_{i,j,t} \quad (5)$$

where $\text{poly}_{t,3}$ is a cubic polynomial for time, ρ_j are fixed effects for who the speaker is responding to, and \mathbf{U}_u are the same utterance-level controls as described above. By controlling for the tone of the utterance to which the speaker is responding, along with the topic loadings, we isolate the component of Yellen’s rhetoric that is independent of the broader conversation in which she is participating. The results are summarized in Figure 13, illustrating that Janet Yellen’s tone is not significantly different from male Fed chairs at the 95% level of confidence with the exception of flirtation, on which she scores significantly lower than her male counterparts.⁴² In sum, we find little evidence to support the alternative hypothesis that Yellen is interrupted more because of what she talks about, or how she talks.

⁴¹Against this backdrop, we underscore that our use of the term “tone” differs from related work by Dietrich, Hayes and O’Brien (2019), which relies on audio data to measure divergences in pitch to capture emotional tones.

⁴²There is suggestive evidence that her utterances are more unsubstantial than those of Bernanke, Greenspan, and Powell, although this doesn’t exceed the threshold for statistical significance.

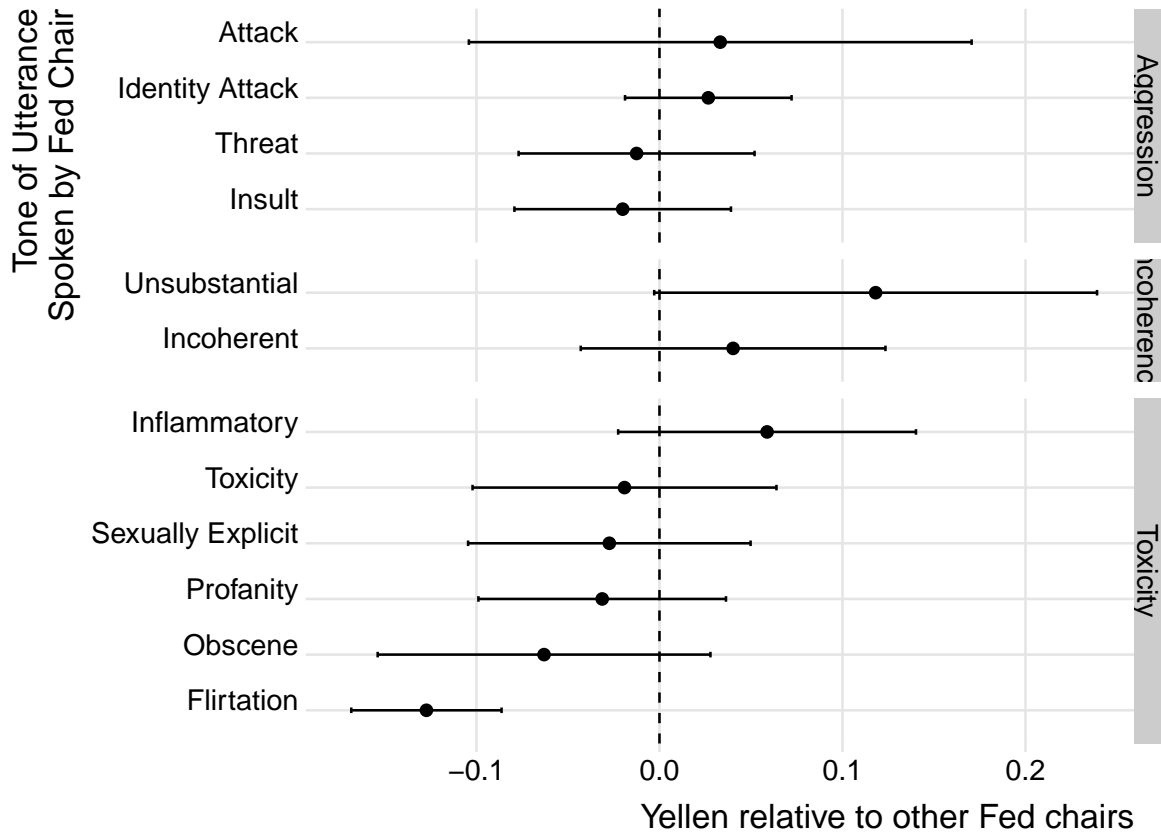


Figure 13: Coefficients capturing the difference in tone between utterances by Janet Yellen and the other three male Fed chairs.

4.3 Hostility

Not all interruptions are hostile. Positive interruptions are a form of expressed support, which has been shown to strengthen norms of “niceness” in groups (Leaper and Ayres, 2007*b*; Karpowitz and Mendelberg, 2014). Conversely, negative interruptions are a power play in which the interruptor expresses opposition or deprecation toward the interrupted. These types of interruptions are used to silence speakers and suppress communication, both specifically – i.e., by talking over and disrupting a particular statement – and generally – i.e., by fostering a hostile communication setting that dissuades others from speaking up. These patterns can be particularly detrimental to women’s participation: Beck (2001) shows that female council members are more likely than their male counterparts to “hold back” their views in response to hostility.

To confirm that the greater frequency of interruptions experienced by Yellen reflects a more hostile hearing, we investigate whether the way she is spoken to is more aggressive than the tone confronted by male Fed chairs. To calculate this measure of rhetorical aggression, we again rely on Google’s Perspective API. We show in Figure 14 that (1) there is descriptive evidence of an increase in aggression among those responding to Fed chairs when Yellen takes over; (2) a legislator fixed effect specification (of the form described in Equation 2) confirms this conclusion, particularly for the “attack” dimension; but (3) a difference-in-differences specification (of the form described in Equation 3) finds no systematic difference in hostility when comparing the gap between the tone in utterances responding to legislators and utterances responding to Fed chairs. The one exception to this result is when looking at the transition from Yellen to Powell in 2018, where we see a decline in the aggression index among utterances responding to the Fed chair, but no corresponding shift in the tone of those utterances responding to other legislators.

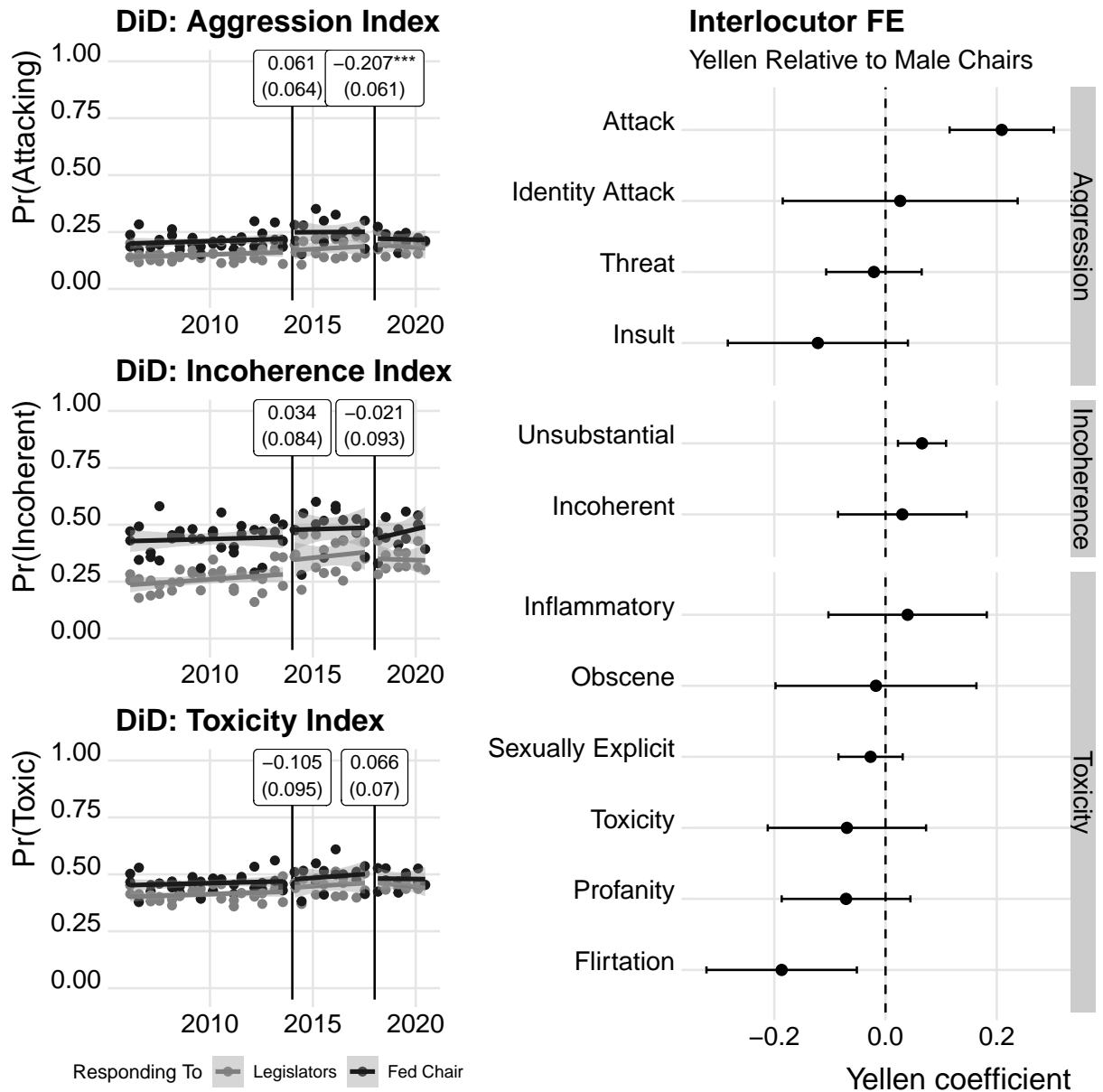


Figure 14: *Left column:* Difference-in-differences estimates (labels) capturing the difference in tone (top: aggression; middle: incoherence; bottom: toxicity) between utterances responding to legislators (grey) and those responding to Fed chairs (black), between Bernanke and Yellen’s tenures (left vertical line) and between Yellen and Powell’s tenures (right vertical line). Estimates based on Equation 3. † $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. *Right column:* coefficients (points) and two standard deviations (bars) capturing the difference in tone (y-axis) of utterances responding to Yellen and all other male Fed chairs, estimated as the change in tone within legislators who interacted with Yellen and at least one other Fed chair, as per Equation 2.

The lack of evidence when using a diff-in-diff design on tone likely reflects the organic nature of human conversation, in which language is a function of both individual and group-level influences (Leaper and Ayres, 2007b; Danescu-Niculescu-Mizil et al., 2013; Rossiter, 2021). As such, when hostility increased during Yellen’s tenure, it influenced the tone not only of those utterances responding to her, but also all other utterances we observe. Substantively, our results suggest that sexism affected not only Yellen’s ability to testify, but also the broader tone of all conversations at these hearings.

In addition, we compare the difference in tone among those with and without daughters who interact with each Fed chair relative to Bernanke, demonstrating that the increase in hostility associated with Yellen is attenuated among those with daughters (see Figure 15). Importantly, these systematic differences only obtain for Yellen.

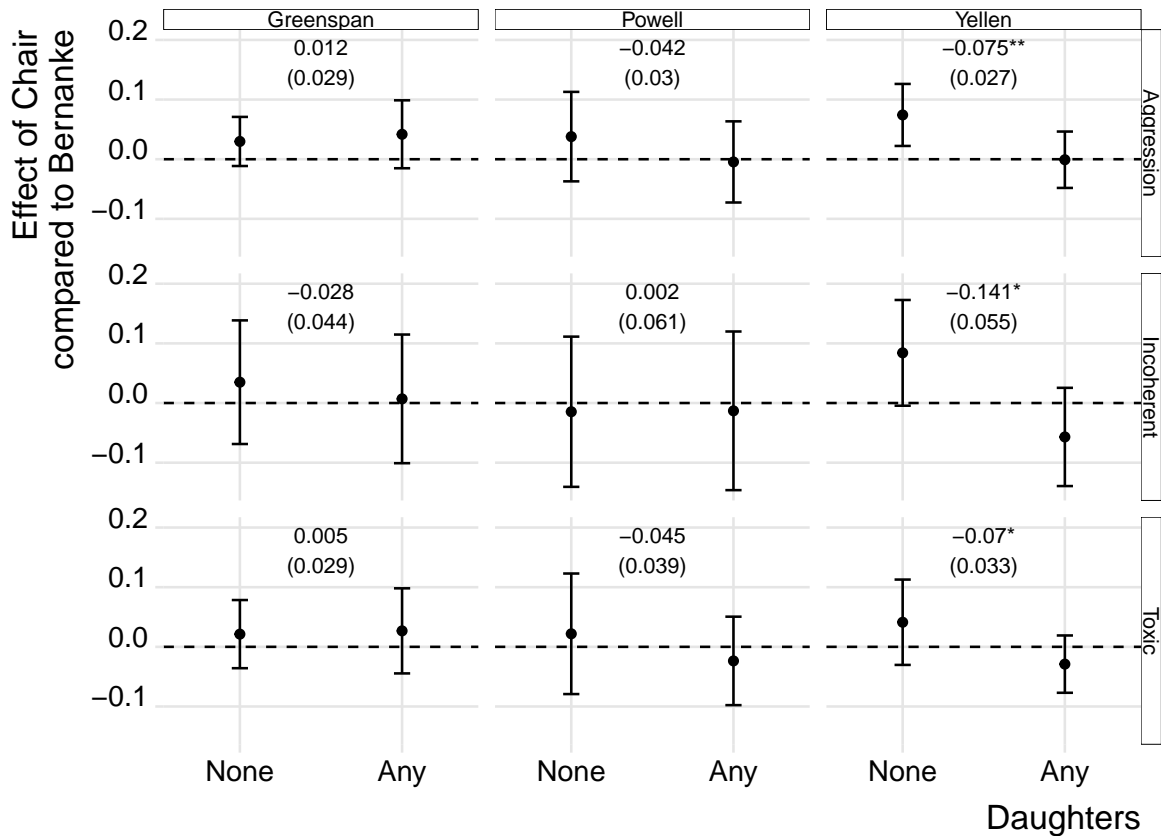


Figure 15: Marginal effects comparing increase in tone of utterances (rows) responding to Yellen relative to Bernanke (y-axes), among those with and without daughters (x-axes).

5 Discussion

Legislators attending congressional oversight hearings with the Chair of the Federal Reserve interrupted Janet Yellen – the first female chair – more than they interrupted her male predecessors and male successor. Yellen did not interrupt others more than her male counterparts (if anything, she interrupted them less), nor did she talk about different topics or use different language in her communication. Furthermore, the increase in interruptions persists after controlling for the gender, seniority, ideology, age, partisanship, chamber, and incumbent vote margin, as well as indicators for whether the legislator sponsored legislation to augment Congress’s oversight on the Fed and for whether the legislator opposed or abstained Yellen’s confirmation.⁴³ Finally, we show that legislators without daughters increased their interruptions more than those with daughters, although we emphasize that both groups interrupted Yellen more than her male counterparts.

The skeptical reader might be left convinced that Janet Yellen was treated differently than her male counterparts chairing the Federal Reserve Bank due to sexism, but they might be concerned about the generalizability of our findings. It is, after all, a single Fed chair whose experiences we document. We respond to this skepticism statistically and substantively.

Statistically, we emphasize that in our empirical framework Janet Yellen is better understood as a bundled treatment rather than an outcome. Her tenure as chair of the Fed is the variation in gender that we exploit to document systematic evidence of sexism among elected officials. We go beyond the mere comparison between her tenure and those of her counterparts, and identify the sexist content of these interruptions. We do so by showing that legislators without daughters are more likely to engage in hostile sexism and that Yellen’s tone and topic per se are not more likely to be interrupted. This evidence supports the view that the origin of these interruptions is a pre-existing gender bias among

⁴³We explore these controls in SI Section 2.1, showing that men, Republicans, and conservatives were significantly more likely to increase their interruptions, but that women, Democrats, and liberals nevertheless exhibited statistically significant increases in interruptions during Yellen’s tenure.

legislators and that does not depend on Yellen specifically. Future work that can apply our empirical strategy to other Congressional settings would be helpful to characterize the generalizability of our results.

Substantively, we show that Janet Yellen’s ‘grilling’ in Congressional hearings is an alarming example how gender bias and sexism can creep into political oversight and threaten the credibility of vital democratic accountability mechanisms. Even if we limit our contribution to documenting sexism experienced by Janet Yellen, we argue that this is a non-trivial finding as sexism undermines the purpose of these hearings. These hearings are a crucial mechanism of democratic accountability on the performance of the chair of the Federal Reserve (Binder and Spindel, 2019). Yellen’s exposure to sexism-based aggression during her tenure undermines the accountability mechanism of these hearings.

Nevertheless, we posit that our findings generalize beyond the specific context. Our results are consistent with a rich theoretical literature on sexism, spanning the fields of sociology, anthropology, education, feminist studies, and political science. By demonstrating the presence of hostile sexism in a setting where traditionally male positions of status are being threatened, we provide carefully identified empirical evidence in support of Ambivalent Sexism Theory (AST, Glick and Fiske 1996) and role congruity theory (Eagly and Karau, 2002). And by demonstrating the attenuating influence of parenting daughters, we contribute to a growing literature on how socially and politically relevant attitudes can be shaped by events occurring later in life (Shafer and Malhotra, 2011; Washington, 2008).

From a practical or policy perspective, our contribution is an urgent call to recognize and remove the subtle layers of a political glass ceiling on women to create a more equitable policy environment benefiting the greater public good.

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