Internal Versus Institutional Barriers to Gender Equality: Evidence From British Politics

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Abstract

Weekly lotteries determine which politicians ask the UK Prime Minister a question in front of a male-dominated, noisy chamber. Lottery winners receive 4% higher vote margin in the next election, but women are 12% less likely to submit questions than same-cohort men. The gender gap does not close with lottery-induced experience asking a question, but it closes after a format change, with questions asked to a smaller, quieter audience. The switch differentially draws in women with quieter voices. Our findings support institutional change, rather than experience, as a response to gender gaps in adversarial settings like the UK Parliament.

1 Introduction

High-paid occupations are more male-dominated (Card et al. 2016; Blau and Kahn 2017), and male-dominated workplaces are more competitive and adversarial (Gutek and Cohen 1987; Buser et al. 2014; Flory et al. 2015). Gender gaps in such workplaces may arise because of a gendered mismatch in preferences over workplace rules and norms. For example, women are less competitive, less likely to self-promote, and more likely to avoid public speaking than men (Niederle and Vesterlund 2007; Exley and Kessler 2022; De Paola et al. 2021). Gendered preferences like these can lead to gender gaps in tasks which are more emphasized in male-dominated spaces – like court-room cross-examination, political campaigning, salary negotiations, and golf-oriented networking (Agarwal et al. 2016; Luguri and Eve 2021; Biasi and Sarsons 2022; Biggerstaff et al. 2024).

How can these gender gaps be reduced? We consider two broad types of responses. First, women might adapt to male-dominated workplace norms over time, effectively learning to play by the rules set by men. For example, past UK Prime Minister Margaret Thatcher famously employed a speech coach to help her develop a lower and calmer tone when speaking (Moore 2013). This effort aimed to improve her performance in the domain we study in this paper: public, adversarial debate. If other women strategize like Margaret Thatcher, gender gaps may erode over time, as the preferences and skills of women converge to those of men. In addition, the erosion of gender gaps may be accelerated by policies that temporarily increase female participation, permitting women to learn from experience.

Alternatively, it may be that "leaning out" is an optimal response to the preferences of women (Exley et al. 2020), with these preferences not adapting over time. In this case, the workplace, rather than the women, could adapt – shifting to rules and norms that reduce mismatch. For example, firms could introduce greater flexibility in working hours to better accommodate the constraints of women (Goldin 2021); academic institutions could reduce the combative culture of seminars by introducing new rules, like ten-minute moratoriums on questions (Boustan and Langan 2019; Dupas et al. 2023); firms could introduce networking opportunities that do not revolve around an activity with strong gendered preferences (like golf); and legislatures could organize policy-making around small groups and consensual decision-making, rather than large groups engaging in adversarial debate. In this paper we show evidence for the ineffectiveness of one particular version of women adapting to workplaces, and the effectiveness of one version of workplaces adapting to women. In our setting, the findings are stark: the gender gap is completely unaffected by women gaining experience, while it is almost completely closed by institutional changes.

We study question-asking by national politicians in the UK Parliament, where the share of female Members of Parliament (MPs) rose from 7% in 1990 to 35% in 2023.[1] Each week, MPs

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[1]We treat gender as a binary in this paper, as no politicians in our analysis period are non-binary.

can submit a question to the Prime Minister to be asked in front of a packed legislative chamber. The questions asked at Prime Minister's Questions (PMQs) are high stakes: they are an important means of holding the government accountable for their policies, and they are televised, making PMQs the most visible regular event in the parliamentary calendar. Furthermore, asking questions delivers electoral benefits. Using the lottery-driven variation described below, we find that a single question increases an MP's subsequent vote margin by 4%.

Alongside the high stakes, the atmosphere of PMQs is noisy and aggressive, with peak noise levels akin to the noise from a speeding subway train (ITV 2015, and for an example, see the video here). As a result, the tone of PMQs has been criticized as "masculine, macho, and sexist" (Hazarika and Hamilton 2018, p. 213), and some female MPs have reported opting out of PMQs for precisely these reasons (Mason and Edgington 2014). PMQs is therefore an ideal setting to explore policy approaches to reducing gender gaps in male-dominated, adversarial workplaces.

Two features of PMQs allow us to explore the role of women adapting to the workplace, and the workplace adapting to women. First, weekly lotteries determine which 15 MPs get to ask the Prime Minister a question. These lotteries give exogenous variation in experience, allowing us to test for whether female MPs learn from domain-specific experience, submitting questions more often after experiencing asking a question. Second, the COVID-19 pandemic induced a radical and temporary change to the format of PMQs: MPs could ask questions remotely, to an in-person audience that was over 80% smaller. We explore the impact of this change to the rules on the gender gap in question-asking.

We report five main findings. First, we estimate the gender gap in submitting questions (equivalent to lottery entry) prior to the format change. We use newly-acquired data from 157 lotteries from 2015 to 2020. Eligible male MPs enter 49% of the time, while same-cohort female MPs are 7.1 percentage points (14%, $p < 0.01$) less likely to enter. The gender gap falls to 5.9 percentage points (12%, $p < 0.01$) after adding political party fixed effects. The gap is similar after controlling for vote margin and political positions held, and for a large number of demographic characteristics. Given the concern of over-controlling, the 12% number is our preferred estimate. Using newly-assembled archival data on PMQs lottery winners from 1990 to 2015, we find a similar average gender gap of 15.3%, though we also find suggestive evidence that the gender gap narrowed as the female share of MPs increased.

Importantly for our lottery analysis, the 2015 to 2020 gender gap is only along the intensive margin – in a given parliamentary session, women are no less likely to submit a question at least once; they just submit less often, conditional on ever submitting. If the gender gap was only along the extensive margin, we could not estimate whether the gap closes with experience, since women that never submit do not get experience.

For our second set of results, we use two main approaches to test for whether the gender gap

closes with experience – a test of whether women adapt over time. First, we use the 157 weekly
PMQs lotteries to estimate the causal effects of experience *asking* a question on future question
submission. Second, we use a specification with MP fixed effects to test for whether the gender
gap in question-asking narrows as MPs gain years of parliamentary experience. The first is a test
of the effects of specific task experience; the second a test of the effects of more general political
experience.

Both approaches deliver the same result: experience does not affect the gender gap in question-
asking. Male and female MPs respond similarly to a lottery win: they are somewhat less likely to
submit a question the following week, but behave similarly to lottery losers thereafter. The gen-
der gap in question-asking is therefore unaffected by experience asking questions. Similarly, we
estimate null effects of years of political experience on the gender gap. This second set of find-
ings suggests that experience-based policies – e.g. temporarily mandating more question-asking
opportunities for women – will not reduce the gender gap.[2] In addition, time alone will not narrow
the gap, since the gap is invariant to years of general political experience. However, our results do
not rule out the possibility of closing the gender gap through addressing other internal barriers, for
example, through public speaking training.

Our third finding considers the effects of the shift to the hybrid format. Our preferred estimate
of the gender gap narrowed by 77% during the hybrid period, becoming a statistically insignificant
1.33 percentage points. Several pieces of evidence suggest that this narrowing was caused by the
shift to the new format, rather than other factors confounded with time. In particular, as a placebo
check, we chart the evolution of the gender gap in voting attendance, given that voting procedures
did not substantively change as a result of COVID-19. While women have lower voting attendance
than men, the gap did not change during the period in which PMQs went hybrid. In addition, ruling
out pre-trends, the fall in the question-asking gender gap happened precisely at the time in which
the format changed.

Our fourth set of findings explore the mechanisms by which the format change narrowed the
gender gap. Two main features of the new format might matter: (i) the option to ask questions
remotely, and (ii) the smaller in-person audience, which translated into less noise and heckling,
and saw the frequency of interruptions fall by more than half. Consistent with the latter, we use
new hand-coded data on question-answer exchanges to establish that (i) prior to the hybrid switch,
women were roughly twice as likely as men to be interrupted when asking their question, and
(ii) during the hybrid period, this gender difference disappeared.[3] In addition, we find that pre-

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[2]We do find some evidence of female MPs learning from the experiences of their peers – for each extra question
slot randomly assigned to a female MP, other women are 0.5 percentage points more likely to submit to the next lottery.
But this peer effect channel cannot easily explain the existence of the gender gap in the first place, since female MPs
ask questions every week.

[3]Here we contribute to a literature in political science and law that finds mixed evidence on whether women

hybrid women question-askers are somewhat discouraged from future lottery entry when their question-answer exchange is interrupted, with the opposite effect for male MPs, contributing to the pre-hybrid gender gap.

We then process YouTube videos of PMQs to create an MP-level measure of speaking volume. We find that (i) women ask 0.25σ quieter questions than men, (ii) louder women are more likely to submit questions before the format change, and (iii) louder women are no more likely to submit questions after the format change. This constellation of facts suggests that the hybrid format narrowed the gender gap by drawing in the quieter women that were previously deterred by the noisy and adversarial atmosphere of PMQs.

To isolate the role of the remote questioning option, we explore the evolution of the gender gap in question-asking to ministers other than the Prime Minister. Compared with PMQs, these question periods have one important difference: they were already much less attended (and less noisy) prior to the introduction of the hybrid format. As a result, the effect of the hybrid format on the gender gap for these questions is plausibly due to only one mechanism: the introduction of the remote questioning option. We find no effect of the hybrid format on the gender gap. In addition, we only see suggestive (and statistically insignificant) evidence of female MPs opting for the remote questioning option more than male MPs. Collectively, the evidence suggests that the format change reduced the PMQs gender gap primarily because of the reduction in the adversarial atmosphere, and not because of the flexibility introduced by the remote questioning option.

Our fifth and final finding explores what happened to the gender gap after the hybrid format ended. Remarkably, the narrow gender gap persists after proceedings return to the pre-hybrid format. The narrowing persists for at least four years – as long as we have available data. We consider two possible explanations for the persistent effects of the temporary format. First, it could be that asking questions during the hybrid period (with its less adversarial style) serves as a stepping stone to asking questions with the old format. However, we do not find that women that win the lottery during the hybrid period are more likely to submit questions after the hybrid period ends. Alternatively, it could be that the culture of the hybrid format persists into the post-hybrid era, keeping (quieter) female MPs participating. Consistent with this, we find that gender differences in responses to questions tend to favor women more in the post-hybrid than in the pre-hybrid period – in particular, women are no longer more likely to be interrupted – although on the other hand, the overall frequency of interruptions almost fully rebounds to pre-hybrid levels.

In summary, we document a new gender gap at the highest level of British politics, and show that the gap persisted for at least 30 years, from 1990 to 2020. While this gender gap does not close with experience, it almost completely closes after a shift to a new format – one that is less

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lawyers and politicians are interrupted more than men (Jacobi and Schweers 2017; Patton and Smith 2017; Vallejo Vera and Gómez Vidal 2022; Miller and Sutherland 2023).

adversarial. The gender gap remained negligible after the format reverted, suggesting that even temporary workplace rule changes can persistently reduce gender gaps.

We make three main contributions. First, we rigorously explore the role of one internal barrier and one institutional barrier to gender gaps in the same setting. Recalde and Vesterlund (2022) make a similar distinction, categorizing initiatives to reduce gender differences in negotiation as either "fix-the-women" or "fix-the-institutions" approaches. Using variation across studies, they find the latter class of approaches to be more effective. We reach the same conclusion, though we build on their work by evaluating both types of policies in the same setting, and by studying a different domain: public questioning. Nevertheless, we caveat that our findings need not generalize to other attempts to reduce internal versus institutional barriers, or to other settings. For example, training in public speaking and political communication may be effective (Dal Bó et al. 2024), even in contexts like ours in which domain experience has null effects.

A similar distinction of internal versus institutional barriers is present in prominent lab experiments on gender differences. As one example of the failure of "fix-the-women," Exley et al. (2020) find that a policy that pushes women to negotiate more often makes women worse off. In our natural setting, a lottery win that increases experience with question-asking does not increase future question-asking, suggesting similarly that, by revealed preference, women already "knew when to ask." Both papers then add nuance to popular calls for women to lean in at the workplace (Sandberg 2013). In the realm of "fix-the-institutions," Karpowitz et al. (2012) use a lab experiment to show that changes to institutional rules – unanimous or majority decision rules – can increase the participation of women in deliberation. We study a different aspect of institutional design in a real political setting, finding similarly that rule changes can restore gender equality in voice.

Second, by making use of the UK Parliament's lotteries, we cleanly estimate the effects of task experience on gender gaps in workplace behavior for the first time. Our setting addresses two challenges to estimating such experience effects. First, when behaviors are one-shot or infrequent, like wage negotiations, the effects of experience on the same behaviors in the future are difficult to estimate. Second, experience is usually endogenous – the fact that there is a gender gap means that more women are choosing to opt out of a behavior than men. The women that opt-out likely differ from those that opt-in along unobserved dimensions.

In estimating null effects of experience on the gender gap, our findings complement lab experimental work on the failure of performance feedback to reduce gender gaps (Coffman 2014; Coffman et al. forthcomingb,f). Personal experience of question-asking (and the conversations that follow) can be thought of as a more visceral form of performance feedback (Malmendier 2021); yet even this more visceral feedback does not systematically change future behavior.[4] Otherwise,

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[4]Put another way, we find that exogenous attention does not increase future attention-seeking behavior – politicians do not become attention addicts. In contrast, Srinivasan (2023) finds that Reddit and TikTok content creators create

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our work relates to evidence that women are more hurt by setbacks than men, either through their own behavior (Buser and Yuan 2019; Wasserman 2023) or through the behavior of others (Sarsons 2017). These papers estimate the effects of having a negative experience (e.g. losing a competition) separately for women and men. In contrast, our focus is on estimating effects of having an experience asking a question, which may or may not be considered a negative experience (though we do also find that interrupted exchanges are more demotivating to women than men).

Third, we build on recent work on gender differences in public speaking-related behaviors. Classroom and lab experiments show some evidence, albeit mixed, that women are more averse to public speaking than men (De Paola et al. 2021; Buser and Yuan 2023). In our setting, a format change that retained the need for public speaking almost completely closed the gender gap. This suggests that the historic gender gap in question-asking was not due to gender differences in public speaking aversion per se. Furthermore, we show that the visibility afforded by public speaking yields electoral gains for politicians, a new result that parallels evidence of electoral returns to political advertising (Spenkuch and Toniatti 2018).

Otherwise, Dupas et al. (2023) study question-asking behavior in the context of economics seminars, but with a focus on the gender of the respondent, rather than the gender of the asker. They find that female economists are asked more questions in seminars, and that these questions are more likely to be hostile or patronizing. Their paper is then focused on understanding gender discrimination (or gender disparities), whereas ours is primarily focused on understanding gender differences in preferences and behaviors.[5] In addition, while Dupas et al. (2023) characterize the gendered culture of economics, we complement them by adding two distinct causal tests of adaptation – one on the side of women's behavior and the other on the side of institutional design.[6]

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more content after going viral.

[5]While not a primary contribution, we are the first to rigorously document the gender gap in question-asking at Prime Minister's Questions. Closest to us, several papers explore gender differences in general debate participation (as opposed to PMQs) in the House of Commons. Catalano (2009) studies second reading bill debates during 2005 to 2007, finding that women participate disproportionately in healthcare-related debates. Blumenau (2021) finds that women contribute less to debates during 1997 to 2017 (and that female ministers increase the debate participation of female MPs), but does not study the gender gap for PMQs specifically. Relatedly, Blumenau and Damiani (2021) find that female MPs make fewer speeches in the House of Commons during 1979 to 2019. The only paper we know of that mentions gender differences in participation in PMQs is Franco et al. (2014). This paper finds no gender gap in PMQs participation from 2010 to 2011, but does not control for parliamentary experience, or any other observables. Since female MPs have less experience than men on average, and more experienced MPs participate less often in PMQs, the absence of an experience control biases the gender gap toward zero. Otherwise, several papers have documented gender differences in the *types* of contributions to House of Commons debates. For example, Bird (2005) finds that women are more likely to ask gender-related questions than men, Bates et al. (2014) finds that women are less likely to ask unanswerable questions, Hargrave and Langengen (2021) find that the speeches of women are less adversarial, and Hargrave and Blumenau (2022) find that gender differences in speech style have fallen over time.

[6]Relatedly, Dupas et al. (2023) explore whether gendered treatment differs in seminars with more collegial formats. They report some evidence that seminars with a moratorium on early questions have smaller gender gaps, though they do not go so far as to claim that these effects are causal, writing that "In fact, [moratoriums] may be endogenous to the behavior that we seek to measure. That is, programs may have adopted formal rules in response to concern

2 Asking Questions in the UK Parliament

Parliament. The UK Parliament is formed of two houses – the upper house, the House of Lords, and the lower, elected house, the House of Commons. 650 Members of Parliament (MPs) are elected to sit in the House of Commons through general elections held every five years. The dominant parties are the center-left Labour and center-right Conservative parties. Our main focus is on questions asked by MPs from 2015 to 2023, a period of Conservative government throughout.

Prime Minister's Questions. PMQs is a constitutional convention providing regular opportunities for MPs to hold the sitting government to account. During our period of interest, PMQs was held at noon for roughly 45 minutes every working Wednesday. The Prime Minister stands to answer three types of questions. First, the Leader of the Opposition is permitted to ask up to six questions, and the leader of the second-largest opposition party may ask two questions. Second, other MPs can stand to "catch the eye" of the Speaker of the House, who may then call on them to ask a question. Third, and most relevant to us, 15 MPs selected by lottery can each ask one question.[7]

All MPs are eligible to submit a question for the PMQs lottery, though, by longstanding convention, MPs with a government post (usually a ministerial position) do not enter PMQs.[8] While parties sometimes attempt to orchestrate the questions of their members, these attempts usually fail – as ex-Labour political advisors Ayesha Hazarika and Tom Hamilton write regarding these attempts, "MPs are difficult creatures to herd." (Hazarika and Hamilton 2018, p. 245). Given this, we consider question submission the result of an individual MP's decision, rather than their party's decision. In addition, we include party fixed effects in our main specifications.

The vast majority of MPs submit what is known as an "engagements" question, meaning that they do not have to submit the text of their actual question beforehand. The remaining MPs submit the text of their question upon submission. Prime Ministers then usually do not know the questions they will be asked in advance, though they are heavily prepped for predictable questions.

MPs can submit their question on paper or online with little effort,[9] though they must do so by 12:30 pm on the preceding Thursday. The lottery is held on the same Thursday, with the results sent to MPs on the same day – meaning that lottery winners that submitted an engagements question get six days' notice to prepare their actual question.

While lottery winners are randomly ordered (see Table A1 for balance checks), convention

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about possibly gendered seminar dynamics."

[7]For full videos of PMQs, see https://www.youtube.com/playlist?list=PL40441042C458B62B.

[8]The Table Office manages the weekly lotteries, and they clarified this point over email. If a government minister tries to table a question, the Table Office advises them that the convention is that they do not do such things.

[9]For the exact steps for submitting a question on paper, see https://guidetoprocedure.parliament.uk/articles/Dw0Uwxkh/how-to-submit-a-prime-ministers-question-on-paper. For the steps for submitting online, see https://guidetoprocedure.parliament.uk/articles/GqhMqs58/how-to-submit-a-prime-ministers-question-online.

allows the Speaker of the House to deviate from the order with the aim of alternating between government and opposition questioners. In practice, the order in which lottery-winning MPs speak during PMQs remains highly correlated with the random order determined by the shuffle (Figure A1), and gender does not predict speaking order after controlling for party fixed effects, which we always include in our main analyses of gender differences (Table A2).

Questions and answers are relatively short, averaging 82 and 89 words (we describe our data on questions and answers in Section 3.1). The questions themselves must conform to certain rules. For example, MPs must not ask for information which is readily available, use offensive language, or submit questions that are "trivial, hypothetical, or vague." In practice, such rules still allow for many colorful questions. For example, in February 2013, Anas Sarwar, a Labour MP, asked: "The Prime Minister is rightly shocked by the revelations that many food products contain 100% horse. Does he share my concern that, if tested, many of his answers may contain 100% bull?" In contrast, many questions are policy-oriented. For example, Labour MP Yasmin Qureshi won the lottery in February 2021 and asked Prime Minister Boris Johnson (square brackets added for clarity):

> This Government said that no council would be suffering as a result of the pandemic, and the Chancellor said that he would do everything—"whatever it takes"—to help them. Yet Tory [Conservative]-controlled Bolton Council has just announced £35 million of cuts in towns and an increase in the council tax budget of 3.8%. Can the Prime Minister assure my constituents and my town that that money will be given to them, or will this join a long list of Tory failed promises?

Norms and Atmosphere. Humor is a central feature of the questioning style in PMQs. As Hazarika and Hamilton (2018, p. 165) write, "PMQs without rejoinders and jokes is like a Christmas tree without the baubles, tinsel, coloured lights... they're what makes the whole thing worth looking at." We show in Section 4.6 that women use humor in their questions less often than men. Other than humor, heckling is common, creating an atmosphere in which peak noise levels reach almost 100 decibels, akin to the noise from a pneumatic drill or a speeding subway train (ITV 2015). Anecdotally, heckling at PMQs has targeted women, with one heckler shouting to a female MP "Tell us your age! Where's your birth certificate? Here she comes, Harvey Proctor [her predecessor as MP for her constituency] in drag!" (Hazarika and Hamilton 2018, p. 215). When interviewed about PMQs, ex-Labour leader Harriet Harman replied that PMQs is combative, "as far away from deliberative, seeking consensus, that you could possibly get... a very sort of macho way of doing politics" (Hazarika and Hamilton 2018, p. 214). Opinion polls of the public reveal similar concerns: 47% agree that PMQs is too noisy and aggressive, 33% say that PMQs puts them off politics, and only 16% agree that MPs behave professionally at PMQs (Allen et al. 2014). We test claims of a sexist culture more systematically below.

Questions and Visibility. Questions asked to the Prime Minister serve to increase the visibility of MPs and their policy interests. Gender gaps in participation may then lead to negative career consequences for female MPs, and less accountability for the policies most relevant for women. We report quantitative evidence for positive career effects of question-asking in Section 4.1, while we discuss qualitative details here.

Visibility at PMQs is high given that the chamber of the House of Commons tends to be packed, as referred to by ex-Speaker John Bercow in a 2010 speech (Bercow 2010): "There only ever seem to be a larger number of MPs in the Chamber once a week – for Prime Minister's Questions." In addition, party leaders are almost always present at PMQs, given their responsibility to ask and answer questions. The Prime Minister in particular commits a substantial amount of the working week to preparing for PMQs – eight hours for Margaret Thatcher (PM from 1979 to 1990), and two full days for David Cameron (PM from 2010 to 2016, Hazarika and Hamilton (2018, p. 137-139)). This preparation involves research into the interests of each questioner, in order to better anticipate what question they may ask. Questions then shift the attention of party leaders to the questioner, both during the question time itself, and also in the prior days of preparation. This provides an opportunity for MPs to signal their talents to senior politicians with the power to promote them. As one example of effective signalling, Hazarika and Hamilton (2018, p. 230) describe a question asked by new MP Kevin Brennan in 2002, writing that then-Prime Minister Tony Blair "was impressed enough by this to send Brennan a personal note praising the question: evidence that asking good backbench questions at PMQs can do an MP's prospects plenty of good."

Beyond visibility to party leaders, MPs also use their questions as an opportunity for visibility to the broader public. Among the 1,125 winners of 75 randomly-selected PMQs lotteries, 85% had a Twitter account at the time of winning, and of those, 63% tweeted about their PMQs appearance. Furthermore, PMQs is broadcast live on BBC Two, with a viewership of up to one million (McTernan 2020). As a result, PMQs is the parliamentary event best known to the electorate, with 54% of the public reporting in 2013 that they had seen or heard PMQs in the previous year (Allen et al. 2014).

COVID-19 Arrangements. Two main features of PMQs were changed in response to COVID-19, covering the period April 22, 2020 to July 21, 2021.[10] First, lottery winners could choose to ask their questions in-person or remotely, over Zoom. Second, to ensure social distancing, a maximum of 50 people could be present in the legislative chamber, with the maximum later increased to 64 people. MPs asking questions over Zoom were shown on television monitors placed around the chamber during their turn to speak, while MPs asking questions in-person followed the normal

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[10]See https://www.parliament.uk/about/how/covid-19-proceedings-in-the-house-of-commons/departmental-questions-prime-ministers-questions/ for full details.

protocol of standing to ask a question (Figure A2).

The date of the format switch can be thought of as exogenous with respect to attendance patterns, since the switch was timed to occur after the MPs returned from their Easter recess, the date of which was set prior to knowledge about the severity of COVID-19.[11] The recess period then permitted time for the House of Commons to be retooled for virtual proceedings.[12]

Oral Questions to Other Ministers. On working Mondays to Thursdays, similar question times are held for each government department, with the relevant minister answering questions. The process for submitting oral questions to other ministers is similar to that for PMQs, with questioners again selected by regular lotteries, and de facto ineligible when holding a government post. In addition, the same COVID-19 format changes apply.

For our purposes, there is one key difference between PMQs and oral questions to other ministers. Prior to the pandemic, the latter had roughly one-third of the attendance of PMQs (Figure A3),[13] reducing the noisy and adversarial nature of the questioning. We use this difference to help distinguish between the two main mechanisms through which hybrid proceedings might reduce the gender gap: changing the adversarial environment versus providing an option to ask questions remotely.

3   Data and Empirical Approach

3.1   Data

MP Characteristics. We compile data on Members of Parliament using the online Parliament Members' Names Data API for three purposes. First, we use the data to define the set of current MPs on the day of each lottery. Second, we use the data for various control variables, including gender, political party, and the date the MP was first elected to the House of Commons. We use the date of the first election to assign each MP to a cohort, based on general election timing. For example, one cohort of MPs includes those first elected at or after the 2019 general election, but prior to the 2024 general election (in some cases through by-elections). Third, the data includes a unique ID for each MP, which we use to link MPs across datasets. We also draw from data collected by, and used in, Lamprinakou et al. (2017), Campbell and Hudson (2018), and Butler

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[11]Using the Wayback Machine, we can see that the Easter recess end date as of January 10, 2020 was set to be April 21, 2020 (see here), which is what happened (see here).

[12]During the recess period, "staff across the House Service worked around the clock to transform the virtual and broadcast capability of the Commons" (see here).

[13]In a random sample of 37 PMQs and non-PMQs question times from 2015/16 to the end of February 2020 (i.e. pre-pandemic), we counted an average of 220 visible attendees in screenshots of PMQs versus 78 visible attendees in screenshots of oral questions to other ministers.

et al. (2021), for additional demographic variables covering most of the MPs elected in general elections 2015, 2017, and 2019. We describe additional details on this and other datasets in Online Appendix A.

Political Posts and Elections. We use the Parliament API to download the full set of Government, Opposition, and Parliamentary posts held by MPs. This post-level data includes the ID of the MP that held the post, the name of the post, along with the start and end date. We use this dataset to identify the MPs de facto eligible to submit questions – only those without Government posts – and to include as control variables in some specifications. In addition, we use data held by the Electoral Commission, along with other sources, to perfectly link all PMQs entrants with their pre- and post-lottery vote share and related electoral outcomes.

PMQs Lottery Entrants and Winners. The Table Office of the House of Commons has records on the entrants and 15 winners of each PMQs lottery held since May 28, 2015, the start of the 2015/16 parliamentary session. The Table Office shared the PDF records for 264 of the 267 lotteries held from May 28, 2015, until March 30, 2023.[14] These lotteries span three key periods: 157 lotteries during the *pre-hybrid* period until March 19, 2020, 50 lotteries during the *hybrid* period until July 15, 2021, and 57 lotteries during the *post-hybrid* period until March 30, 2023. We use the MP's name and constituency to link our data on lottery entrants perfectly with the MP Characteristics data. Figure A4 visualizes the number of lottery entrants across time, along with the timing of the three general elections during this period, and the period of hybrid PMQs. An average of 287 MPs (52% of eligible MPs) submitted a question for a given PMQs, and 289 female and 546 male MPs entered at least one of the 264 lotteries.

PMQs Questions and Answers. We use question and answer characteristics to test for whether there are gender differences in the types of questions asked, and in the types of reactions received – a test of whether the culture of PMQs differentially hurts women question-askers. We downloaded the written transcripts for all PMQs from May 2015 to April 2023 from the website Hansard, the official record of parliamentary proceedings. We cleaned the raw transcripts, extracting *exchanges* – question-answer pairs, with the question posed by an MP, and the answer given by the Prime Minister. In total, we identify 3,653 exchanges with questions asked by lottery winners across 258 PMQs,[15] including 1,242 questions (34%) asked by female MPs. On average, 14.2 exchanges occur during each PMQs.[16]

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[14]The records for three of the lotteries have been lost. We cannot access records beyond March 30, 2023 due to a change in the Table Office's data-sharing policies.

[15]Transcripts are missing for a small number of PMQs.

[16]Though 15 MPs are chosen by lottery, the number of exchanges may be less than 15 – for example, a lottery-winning MP may be absent, or the Speaker may reject a question due to the question format breaking parliamentary

We manually coded the characteristics of each question and answer, after having stripped the text of references to the gender of the questioner. Each exchange was coded by two coders. Coders recorded the following variables for each question: (i) *Constituency issue*, an indicator equal to one if the question is related to the constituency represented by the MP, (ii) *Request*, an indicator variable equal to one if the question contains a request made by the MP to the Prime Minister, and (iii) *Humor in question*, an indicator variable equal to one if the question contains humor.

In addition, coders assigned each question to one of five categories, adapted from the PMQs text analysis of Zhang et al. (2017): (i) *Issue update/shared concern*: these questions aim to bring awareness to a current event, issue, or policy that is general and non-partisan (e.g. denouncing anti-semitism, supporting veterans), (ii) *Niche concern/narrow factual*: these questions aim to highlight niche issues or concerns, often relevant only for the constituency of the MP (e.g. providing more funding for hospitals in the MP's constituency), (iii) *Concede, accept/condemnatory*: these questions aim to criticize actions, comments, policies or other events that are associated with the Prime Minister or the government; these questions are partisan and aggressive in nature, (iv) *Agreement*: these questions aim to elicit agreement from the Prime Minister and are rhetorical in nature, and (v) *Prompt for comment*: these questions aim to obtain information on events that involve the Prime Minister but are not immediately accessible to MPs (e.g. information on the progress of negotiations for a government contract).

Coders recorded the following variables for each answer: (i) *Answered*, to indicate whether the Prime Minister avoided answering the question, with 0 = no answer, 0.5 = partial answer, and 1 = exact answer, and missing for not applicable, (ii) *Agreed*, to indicate to what extent the Prime Minister expressed agreement with the questioner, with 0 = disagreed, 0.5 = agree and disagree or neither agree nor disagree, and 1 = agree, and (iii) *Humor in response*, an indicator variable equal to one if the answer contains humor.

Lastly, we generate variables without the need of manual coding. Question and answer length are the number of words in each question and answer. For the hybrid period, we record whether the question was asked remotely or in-person. For all periods, we create a measure of extreme interruptions of the MP's question and the PM's response. These are cases where more than two participants are recorded in Hansard as having participated in the question-answer exchange, with the transcript almost always containing the text "[Interruption.]"[17] We find that 1.6% of lottery-winner questions and 1.5% of the PM's answers are interrupted during 2015 to 2023. Lastly, we generate a less restrictive variable that captures the overall rowdiness of a question-answer exchange by looking at whether the text "[Interruption.]" is in the transcript or whether the Speaker

guidelines.

[17]Usually the additional participant is the Speaker of the House, who will interject to quiet the audience by saying "Order." Other potential participants are MPs in the audience who interrupt loudly enough for the transcript to record the interruption.

of the House says "Order," at any point during the exchange. Seven percent of exchanges are rowdy.[18] Background heckling is much more common than the 7% of exchanges classified as rowdy, but is not captured systematically in the transcripts.

YouTube Videos and Twitter. We use the 149 available PMQs YouTube videos for the pre-hybrid period to construct two additional variables. First, we asked research assistants to watch the videos, and code a binary variable equal to one whenever a lottery-winner's question was negatively disrupted. This manual measure complements the Hansard measure described above. Second, we extracted the audio of each video, and used a Short-time Fourier Transformation (STFT) to calculate second-level measures of volume in decibels (dB). We use this data to create two volume measures: (i) the median volume of each lottery-winner's question at PMQs, and (ii) MP-level average volume, equal to the mean of all (i) measures for each MP. For example, if an MP asked two questions pre-hybrid, the MP-level measure is the simple average of the median volume of the first question and the median volume of the second. We use these volume measures to characterize gender differences in loudness, and to test for whether loudness predicts question submission. Furthermore, we use YouTube videos throughout 2015 to 2023 to code up (i) the number of views, (ii) the number of MPs in attendance, and (iii) the female share of the audience.

For an analysis of social media reactions, we randomly selected 25 PMQs from each of the three periods – pre-hybrid, hybrid, and post-hybrid – and manually coded for each lottery winner (i) whether they had a Twitter profile at that time, (ii) whether they posted about their PMQs participation, and (iii) the number of likes, reposts, and replies they received, if they posted.

Earlier and Later PMQs Lottery Winners. For the 968 PMQs lotteries during sessions 1990/91 to 2014/15, and the 76 PMQs lotteries from April 2023 to July 2025, we are able to compile data on lottery winners but not entrants. We use this data to test for gender gaps in question-asking over a longer time period, relying on the fact that lottery winners are representative of lottery entrants, given random assignment. However, with only the winners, we cannot test for causal effects of winning on future entries during these time periods.

Oral Questions to Other Ministers. Similar to the data for the earlier PMQs lotteries, data is available for the lottery winners, but not the entrants, for oral questions to other ministers. We web-scraped this data from daily schedules for the same period as our PMQs data: the start of the 2015/16 session until March 2023. Again relying on the fact that lottery winners are representative

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[18]The number of rowdy exchanges is greater than the sum of exchanges where the MP was interrupted and exchanges where the Prime Minister was interrupted because exchanges can continue after the normal exchange between the lottery-winning MP and Prime Minister. For example, MPs in the audience may heckle or shout unsolicited comments after the Prime Minister has finished speaking.

of lottery entrants, we use this data to explore whether the gender gap in non-PM question-asking changes after the switch to hybrid proceedings.[19]

Voting Attendance. We measure the gender gap in voting attendance to permit a placebo check – given that, unlike PMQs, voting remained in-person throughout all three periods, with the exception of only three dates during the hybrid period, which we exclude from this analysis. We downloaded records for each House of Commons vote held during our core study period, May 2015 to April 2023. The voting records include the ID for each MP, along with their name, party, and their vote. We define the variable $Present_{it}$ as equal to one when MP i is present for at least one vote on date t, and zero otherwise. We set the variable to missing for dates on which there are no votes.

3.2 Econometric Specifications

Effects of Asking Questions. To estimate the effects of question-asking experience on electoral outcomes and future lottery entry, we use the stacked specification:

$$y_{it+k} = \alpha_t + \beta^k \text{Won}_{it} + \varepsilon_{it} \tag{1}$$

The unit of observation is MP-by-date (i-by-t), with 262 lottery dates from 2015 to 2023 for the electoral effects, and 156 lottery dates from 2015 to 2020, for the effects of asking pre-hybrid questions on future lottery entry.[20] In each case, the set of dates are those on which a lottery was held, and the set of MPs on a given date include only those MPs that entered that lottery. We include date fixed effects, α_t, which are equivalent to lottery fixed effects, meaning that our comparisons are between winners and losers of a given lottery.

Won_{it} is a dummy variable equal to one if MP i was a randomly-selected winner in lottery t. Given that 97% of the pre-hybrid lottery winners ultimately asked their question,[21] we estimate Intent-To-Treat (ITT) effects.

For electoral effects, the outcome measures an MP's success (e.g. vote share) in the first general election that follows a given lottery date t (either the 2017, 2019, or 2024 general election). For

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[19]Consistent with random selection of winners, the average female share among PMQs winners is nearly identical to the average female share among PMQs entrants (Figure A5). This helps assure us that the estimated gender difference in winning the lottery is an unbiased, but noisy, proxy for the gender difference in lottery entry. While we do not know the number of entrants for questions to other ministers, the mean and variability of the female share of winners is very similar to that for PMQs (Figure A5), suggesting that many questions are also submitted to other ministers.

[20]Two dates for the 2015 to 2023 period are dropped, with one of these dates during 2015 to 2020. PMQs was cancelled in these two cases, meaning that lottery winners did not get to ask the Prime Minister a question.

[21]We calculated this statistic by web-scraping Hansard (`hansard.parliament.uk`), the official record of parliamentary proceedings. The 3% of lottery winners that did not ask questions either withdrew before the question time (e.g. due to a scheduling clash) or were present but not called on by the Speaker due to time constraints.

the effects on future lottery entry, the outcome is Entered$_{it+k}$, a dummy variable equal to one if MP i entered the kth PMQs lottery after date t. We restrict the sample to observations where the kth lottery is within the same parliamentary session since cross-session learning effects are unlikely, given the breaks between sessions. We use $k \in \{1, 2, 3, 4, 5\}$ to estimate the dynamic effects of winning on future entry, and $k \in \{-5, -4, -3, -2, -1\}$ for balance checks.

Balance tests on other pre-determined variables are consistent with the randomization being carried out properly, whether considering the 2015 to 2020, or 2015 to 2023 periods (Tables A3, A4). In particular, we see no signs of imbalance on previous vote margin (our key electoral outcome), whether for the full sample, or for male and female entrants separately.

We run the stacked specification separately for all MPs, female MPs, and male MPs, as well as a specification with Won$_{it}$ interacted with female to formally test for gender differences in the causal effect of asking questions.

To increase our statistical power to detect effects on future lottery entry, we change the dependent variable to the fraction of the session's remaining PMQs lotteries entered, and whenever $k > 0$, we include the fraction of lotteries entered in the session so far as a control variable. To increase power to detect electoral effects, we control for the lagged dependent variable, or closest predictive parallel (e.g. when the outcome is whether an MP wins the next election, we control for previous vote margin, since whether the MP won previously would be coded as one for all MPs). Given that the specification is stacked, with multiple observations for any MP that enters multiple lotteries, we cluster standard errors at the MP-level.

Gender Differences in Question-Asking. To estimate gender differences in submitting questions, we use another stacked specification:

$$\text{Submitted}_{it} = \alpha_t + \alpha_c + \beta \text{Female}_i + \gamma \mathbf{X}_{it} + \varepsilon_{it} \tag{2}$$

The unit of observation is again MP-by-date, where the set of dates depends on the analysis: 1990 to 2015 for the historic analysis; the pre-hybrid, hybrid, and post-hybrid periods spanning 2015 to 2023 for the core analysis; and 2023 to 2025 for the analysis of longer-term persistence. In each case, the set of dates are those on which a lottery was held, and the set of MPs on a given date are those present in the House of Commons on that date and de facto eligible to submit – those that do not hold any government positions on that date.

For our core PMQs analysis for 2015 to 2023, Submitted$_{it}$ is a dummy variable equal to one if MP i entered the PMQs lottery on date t. For the periods of 1990 to 2015 and 2023 to 2025, the outcome is instead a dummy variable equal to one if MP i was randomly selected as a lottery winner on date t, since data on lottery entrants are not available for these two periods.

Date fixed effects (α_t) restrict our comparisons to be between female and male MPs eligible to submit on the same date. Cohort fixed effects (α_c) restrict our comparisons to be between MPs that entered Parliament during the same term. These fixed effects implicitly control for parliamentary experience. They are important given that more experienced MPs submit questions much less often (Figure A6). Women tend to be less experienced (7.4 years vs. 11.6 years among the PMQs-eligible), as female representation has been increasing in recent years. Without controlling for experience, we would then underestimate what we consider to be the more relevant gender gap: the gap among those with similar years of experience.

Female$_i$ is a dummy variable equal to one if the MP is female and zero if the MP is male. $\mathbf{X}_{it}$ is a vector of covariates that vary depending on the exact specification, including fixed effects for the MP's party as of the last election (Conservative, Labour, Liberal Democrat, Scottish National, Democratic Unionist, or Other[22]), vote margin when last elected, and dummy variables for holding an opposition post (e.g. shadow minister) or a parliamentary post (e.g. vice-chair of the MP's party). We cluster standard errors throughout at the MP-level.

4 Results

4.1 Electoral Effects of Questions

To explore the electoral effects of asking questions at PMQs, we pool all the lotteries for which we know the identities of both entrants and winners (spanning 2015 to 2023), and estimate effects on subsequent general election performance. Since subsequent vote share is not observed for MPs that choose not to run in the next election, we first estimate effects on re-running. Eighty-eight percent of lottery losers run again, and we estimate precise null effects of winning the lottery on re-running, whether for all entrants (95% confidence interval -1.2 to 0.9 percentage points, panel A, column 1, Table 1), or separately for female versus male entrants (panels B and C). These nulls help reduce selection concerns when exploring effects on electoral outcomes for the subset of MPs that ran for the next election.

Winning the lottery increases subsequent vote share by 0.33 percentage points ($p = 0.05$), vote margin by 0.53 percentage points ($p = 0.06$), and the probability of winning the next election by 0.9 percentage points ($p = 0.19$, columns 2 to 4). These are economically meaningful effects given the size of the treatment – less than one minute of visibility delivers a 4% increase in an MP's subsequent vote margin (relative to lottery losers' average vote margin of 14 percentage points).

While we lack power to reject the null hypothesis that the effects are equivalent for male and female entrants, the point estimates are larger for women (see panels B and C, Table 1). This is

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[22]The Other category includes members of minor parties, accounting for only 2.5% of MPs in 2015/16.

most stark for effects on winning the next general election, where we estimate a 1.8 percentage point effect for women ($p = 0.12$), versus a 0.2 percentage point effect for men ($p = 0.84$, and $p = 0.26$ for the test of equal effects for men and women). While this is clearly not definitive evidence that the returns to visibility are higher for women, it is strong evidence against the idea that women might rationally disengage from PMQs due to objectively lower career benefits.[23] And yet, we show in the next section that for several decades prior to the pandemic, female MPs submitted fewer questions to PMQs than similarly-experienced male MPs.

4.2 Gender Differences in Asking Questions to the Prime Minister

Eligible male MPs enter the lottery for PMQs 49% of the time from 2015 to 2020 (Table 2). Same-cohort female MPs are 7.1 percentage points (14%) less likely to enter ($p < 0.01$, column 1). The gender gap falls to 5.9 percentage points (12%) after adding political party fixed effects (column 2) and falls to 5.2 percentage points (11%) after controlling for past vote margin and political positions held (column 3). The gender gap remains similar, at 5.4 percentage points, after adding an array of additional demographic controls, including controls for ethnicity, age, and schooling (column 4). This gender gap with extensive controls remains statistically significant at the 5% level, and shows that the female effect is not picking up differences in (available) observable dimensions between men and women. Part of the reason for this is that, while male and female MPs eligible for a given lottery differ along many observable dimensions (panel A, Table A5), they differ little after controlling for cohort and party fixed effects (panel C). Since vote margin and political positions are mediated by the potentially gendered preferences of voters and party leaders, and since some of the additional controls in column 4 may be downstream of gender, our preferred estimate of the gender gap is 5.9 percentage points or 12%, the gap in column 2 of Table 2.[24]

To explore how much of the gender gap is driven by the extensive margin versus the intensive margin, we collapse the data to the MP-session-level, excluding the short 2019 session, which had only two lotteries. We first replicate the overall gender gap. Men enter 48% of a session's lotteries on average, while women enter 5.3 percentage points fewer (column 5, Table 2). There is no gender gap along the extensive margin: men enter at least one lottery in a session 79% of the time, while women enter a statistically insignificant 1.1 percentage points less (column 6). The gender gap is only along the intensive margin: conditional on entering at least one lottery in a session, men enter 61% of the lotteries, while women enter 5.9 percentage points fewer ($p < 0.01$, column 7). Using data for MPs elected since 2015, we can see that the intensive margin gender gap is present

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[23]Though of course, this leaves the possibility of misperceptions about the benefits reducing participation.

[24]There is a parallel here to the idea of over-controlling when measuring gender wage gaps – for example, by measuring the wage gap conditional on occupation fixed effects (Blau and Kahn 2017).

throughout the distribution (Figure A7). The intensive margin gap is crucial for our analysis of learning from experience: we cannot learn whether the gender gap closes with experience if there is no gender gap among those that get experience.

While women on average engage less than same-cohort men, we explore heterogeneity in engagement among eligible women in Table A6. When including predictors one-by-one, the one statistically significant finding is that ethnic minority women are 9 percentage points less likely to submit questions (column 2, $p = 0.05$). In contrast, ethnic minority status does not predict the question submission of men (Table A7). This suggests that minority women face a double disadvantage, to the extent that asking questions at PMQs has career benefits. Otherwise, we see some evidence that older female MPs are more likely to submit (statistically significant only with controls, column 9, Table A6), which might be consistent with greater confidence driving engagement.

The gender gap in question-asking has persisted since at least 1990 (Figure 1). We estimate that women were 15.3% less likely to submit questions than men from 1990 to 2015, controlling again for the lottery, cohort, and political party fixed effects, along with a dummy variable for being a member of the governing party.[25] Though the estimates are noisy, we find some suggestive evidence that the gender gap fell as the female share of MPs rose from 7% in 1990 to 34% in 2019 (Figure A8). We estimate that a 10 percentage point increase in the share of female MPs is associated with a 5.7 percentage point reduction in the percentage gender gap ($p = 0.05$, weighted OLS with $N = 9$, and weights equal to the inverse of the squared standard error). However, this correlation may be due to other confounds correlated with the passage of time, or compositional effects, rather than a causal effect of female representation on question submission.

4.3   Learning From Own Experience

Next, we use the PMQs lotteries to estimate whether MPs learn from experience, leading them to submit more or less often in future. We first report estimates for the pooled sample, before breaking up effects by gender. As with our analysis of gender differences above, we use only the lotteries from before the switch to hybrid proceedings.

All pre-period coefficients are statistically insignificant – lottery winners are no more or less likely to have entered previous lotteries – consistent with the randomization being carried out correctly (Figure 2). Winners are 3 percentage points ($p = 0.002$) less likely to enter the next lottery, a 4% fall relative to the 76.7% entry rate of lottery losers.[26] This negative effect fades

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[25]We did not include this control in the 2015 to 2020 analysis since the Conservative party governed throughout that period, making this control fully collinear with the political party fixed effects.

[26]To recap the timing: an MP typically learns the lottery result on a Thursday, with this result determining whether they ask a question the following Wednesday. The deadline for the next PMQs is the following Thursday – lottery winners are then 3 percentage points less likely to submit for this deadline. Most MPs enter within a few days of the deadline, allowing the decision-making of most MPs (in terms of whether to submit to the next lottery) to be affected

away quickly, leading to a precisely estimated null effect for entry over the rest of the session – with a 95% confidence interval of -0.9 to 1.2 percentage points.

The pattern in Figure 2 is consistent with some lottery winners taking a temporary respite from entering the lottery to avoid being called on to ask questions in consecutive weeks, perhaps because of the time and energy it takes to craft a good question, or because MPs have a limited pool of relevant questions to ask. The transitory nature of this negative effect suggests that lottery wins are not shifting self-confidence or other self-relevant beliefs in one direction on average. The result may, however, mask heterogeneity, particularly if there are pre-existing gender differences in over- and under-confidence.

Gender Differences in Effects of Experience. The dynamic effects of lottery wins on re-entry are very similar for women and for men (Figure 3). In both cases, we estimate a transitory negative effect of winning on subsequent entry and a precisely estimated null effect on entry throughout the rest of the session. Accordingly, we fail to reject the equality of treatment effects for each post-period (Figure A9). The results are nearly identical when considering the gender gap in treatment effects conditional on cohort and party dummies, making the estimate more comparable with our preferred measure of the gender gap in entry, in column 2 of Table 2 (Figure A10). The results are also similar if we use a stacked panel specification which absorbs MP(-by-lottery) fixed effects (Figure A11).

We do not find a gender gap in the effects of experience among the MPs that entered the lottery. However, this sample is not representative of the full sample of lottery-eligible MPs for which we estimate gender differences in entry – MPs that enter the lottery more often are overweighted when we estimate the effects of lottery wins. To check that this weighting is not driving our results, we reweight our estimates by the inverse probability of lottery entry by MP *i* for the lotteries in the current session, up to the current date, in which that MP was eligible to enter. This reweights our treatment effects to be representative of the MPs that enter the lottery at least once in a session (and the gender gap in entry is driven completely by differential entry conditional on entering at least once, as shown in columns 6 and 7 of Table 2). Our estimates are unchanged after this reweighting (Figure A12).

In principle, our overall null effects on future entry could be consistent with diminishing returns to learning – MPs update their beliefs after asking their first question but update much less after subsequent questions, leading to null results when pooling all lottery wins. To explore this idea, we estimate the same specifications, keeping only those lottery entrants that have not won a PMQs lottery since the 2015/16 session began. While our results for first-time winners are less precise, the pattern is very similar, with again no evidence that women update more positively from experience

by the result of the current lottery.

than men (Figure A13).

While our causal results using the lotteries demonstrate that women do not start submitting more often after one experience of asking a question, it remains possible that women adapt to the questioning style of PMQs more gradually – do women start submitting more often after a year or more of parliamentary experience? To test for this, we explore whether the gender gap in question-asking changes as MPs spend more time in parliament, by adding an interaction term between female and years of experience to specification 2. To exploit only within-MP variation, we also add MP fixed effects, dropping party and cohort fixed effects. We estimate precise null effects of years of experience on the gender gap in question-asking (column 1, Table A8). When focusing on the effects of the first five years of experience (column 2) or the first two years (column 3), we again cannot reject the null of no effect of experience on the gender gap – though if anything, the sign of the coefficient suggests that the gender gap *grows* with experience. Furthermore, we see similar results when considering a third measure of accumulated experience: the number of PMQs lottery wins since 1990, the earliest year for which we have data (Table A9). Multiple approaches then deliver a consistent result: the gender gap in question-asking does not narrow with experience.

Implications. Our results have three implications for experience-based policies. First, a policy that temporarily increases the experience of women – perhaps through mandated lottery entry or additional women-only speaking opportunities – would not close the gender gap in question-asking. In particular, our preferred estimate of the gender gap is 5.9 percentage points (column 2, Table 2), while we can reject an effect of asking one question for women MPs of 1.4 percentage points or more, at the 95% level (panel (a), Figure 3).

Second, a policy that mandates experience for both men and women will also not close the gender gap because the effect of lottery-induced experience for women is no more positive than the effect for men. There is then no evidence that men are initially more overconfident than women and revise their beliefs downward after asking a question.

Third, we cannot rely on gradual adaptation to narrow gender gaps – in this case, the gender gap in question-asking is no smaller after MPs have grown their experience by several years.

Collectively, the evidence is not consistent with a model in which women adapt through experience (although it does not rule out the possibility of women adapting through training). In particular, the gender gap does not appear to be driven by biased beliefs that can be corrected by experience: for example, beliefs about how stressful it is to speak in front of the full chamber, how much the question raises one's visibility internally in the subsequent weeks, and whether the experience leads to other career-relevant opportunities. Instead, female and male MPs either make decisions based on accurate (on average) beliefs or hold biased beliefs that persist in the face of personal experience.

4.4 Learning From Others

While the gender gap in question-asking does not close with personal experience, it is possible that increasing speaking opportunities for women affects the gender gap indirectly through peer effects. In particular, women may learn from the experiences of their peers, submitting questions more often when more women are asking questions. Such reactions may partially reflect role model effects, as found in local politics in India (Beaman et al. 2012). To test this, we use lottery-level variation in the number of questions from female MPs – variation that is random after conditioning on the number of female and male entrants. Specifically, we use the stacked specification:

$$
\begin{aligned}
\text{Entered}_{it+k} = {} & \alpha_{s(t)} + \beta_1^k \text{Number of female winners (exc. } i)_{it} \\
& + \beta_2^k \text{Won}_{it} + \gamma_1^k \text{Number of female entrants (exc. } i)_{it} \\
& + \gamma_2^k \text{Number of male entrants (exc. } i)_{it} + \gamma_3^k \text{Entered}_{it} + \varepsilon_{it}
\end{aligned}
\tag{3}
$$

where $\alpha_{s(t)}$ are session fixed effects, our key regressor is the number of female lottery winners at time t excluding MP i, and we use two-way clustered standard errors by MP and by date (for additional details, see Appendix B).

Consistent with randomization, female and male MPs are no more or less likely to have entered a PMQs lottery prior to a week with more female lottery winners (Figure A14). We find evidence of peer effects for women: in response to an exogenous increase of one additional question from a female MP, female MPs are 0.5 percentage points ($p = 0.02$) more likely to submit to the next PMQs and 0.3 percentage points ($p = 0.09$) more likely to submit to the PMQs after that. These effects are not present for men, nor are the effects negative for men – which would be the case if men were inspired by same-gender questioners.

The magnitude of the female-to-female peer effect is meaningful. While week-to-week variation in the number of female questioners is small (the standard deviation is 1.7, and the number ranges from zero to nine), policies could increase representation more dramatically. For example, assuming linearity, a policy-induced increase of 10 female questioners would increase subsequent female entry to PMQs by 4.1 percentage points – close to the size of the full gender gap. However, these peer effects are short-lived, as we might expect given that each week MPs observe a new set of questioners.

With the caveat that our estimates here are more imprecise, this analysis suggests that mandated opportunities for women might reduce gender gaps indirectly: through peer effects on the behavior of other women. But given that we estimate transitory peer effects, it remains the case that temporary mandated opportunities for women would not have persistent effects on the gender gap – MPs do not appear to have biased beliefs that can be permanently shifted through experience. Given this, we turn to our exploration of the institutional reform of PMQs.

4.5 Going Hybrid

The switch to the hybrid format comprised two main changes. First, attendance in the legislative chamber was capped at 50, whereas previously the chamber was packed. From coding the number of MPs visible in YouTube videos, we estimate a drop in attendance of 82% from the pre-hybrid to the hybrid period, with attendance gradually returning to pre-hybrid levels in the post-hybrid period (Figure A15). Second, MPs were able to ask questions via Zoom or in-person, with the share asking questions virtually varying markedly over time due to seasonal variation in COVID-19 concerns, and resultant policies (Figure A16).

Overall lottery entry during the hybrid period is 10.7 percentage points higher than pre-hybrid, but similar during the post-hybrid period (column 1, Table A10). Even conditioning on cohort, party, and then MP fixed effects, entry is four to five percentage points higher during the hybrid period (columns 2 to 4), more than offsetting the general tendency for more-experienced MPs to submit less often (as shown earlier in Figure A6). Overall engagement is then higher during the hybrid period, but how do these effects differ by gender?

Our preferred estimate of the gender gap is 5.86 percentage points during the 2015 to 2020 pre-hybrid period (left panel of Figure 4, $p < 0.01$, replicating column 2 of Table 2). The gender gap narrowed by 77% during the hybrid period, becoming a statistically insignificant 1.33 percentage points (middle-panel, $p = 0.65$). Despite the return to in-person-only proceedings, the gender gap remained narrower during the post-hybrid period, at 0.68 percentage points ($p = 0.81$). We reject the null hypothesis that the pre-hybrid gender gap is equivalent to the hybrid-onward gender gap ($p = 0.05$). These core patterns can also be seen visually when using monthly data on PMQs entry by gender (Figure 5), and they are not explained by concurrent gendered changes in eligibility to enter (Figure A17). In short, a gender gap that had persisted for at least three decades almost completely closed following the introduction of hybrid proceedings.

Six pieces of evidence suggest that the narrowing of the gender gap was due to the introduction of the hybrid format, rather than confounding factors. First, and most importantly, the narrowing of the gender gap is not driven by compositional changes induced by the December 2019 general election (recall Figure A4 for the timeline), which brought in 140 new MPs. Column 1 of Table 3 replicates the result from Figure 4. Column 2 includes MP fixed effects – fully shutting down any compositional channels. The results are if anything slightly stronger.

Second, and also important, we estimate the gender gap in voting attendance as a placebo check. Unlike Prime Minister's Questions, remote voting was only permitted for a handful of days in May 2020. After dropping these days, we can then chart the evolution of the gender gap in voting attendance before and after the hybrid PMQs period. If the gender gap in question-asking narrows due to confounding changes over time – for example, female MPs becoming more enthusiastic about political participation because of COVID-19-related policy-making – rather than the hybrid

format, we would expect to see a similar evolution in the gender gap in voting attendance. In reality, the gender gap in voting attendance is stable throughout the pre-hybrid, hybrid, and post-hybrid periods (Figure 6).[27] Another confounding change over time is the shock of COVID-19 restrictions to the time MPs have available for work, with this shock potentially affecting men and women differently. The lack of an impact on the gender gap in voting attendance also helps to rule out this channel. However, even without this voting null result, reasonable priors would likely be that the COVID-19 shock would negatively impact the time for work more for women than for men, given gender norms in childcare responsibilities.

Third, one concern is that the switch to the hybrid format is collinear with an increase in the importance of health as a topic for questioning. If female MPs are more interested in health policy than male MPs, the gender gap in questioning might narrow as a result of the growing importance of health policy, as opposed to the format change. To test for this, we require a measure of the importance of health-related questions at each weekly PMQs, and we require this measure to not be mechanically correlated with the participation of women. We use the share of health-related words used in question-answer exchanges involving the *male* lottery winners and the Prime Minister. We calculate the share after removing stopwords and trimming the remaining words using the Porter Stemming Algorithm. We use the following common health-related trimmed keywords: health, nh (as in NHS, the National Health Service), hospit, cancer, and covid. We then repeat the regressions shown in Table 3, but with an additional interaction term between Female and the measure of the health-related word share (Table A11). A related concern would be that the confound is COVID-19 questioning specifically, rather than health in general. To that extent, we additionally look at using the word share of only COVID-19 related topics (Table A12).[28] For both word shares, our results are similar, suggesting that the gender gap did not narrow because health-related questioning became more common.[29]

Fourth, ruling out pre-trends, the narrowing of the gender gap in question-asking occurs precisely at the point at which the format shifted to hybrid (top-left panel, Figure 7, $p = 0.03$ from

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[27]One concern with this test is that the voting attendance rate is substantially higher than the question-asking rate, limiting the possibility of increased engagement by women. This would push us towards a mechanical null on this placebo check. We introduce additional placebo checks that address this issue in Section 4.6. In particular, we show that the switch to hybrid did not affect gender gaps in question-asking to other ministers. Since these question periods were not adversarial to begin with, we argue that this evidence speaks against the treatment effect being driven by the option to ask questions remotely.

[28]We also find that in general, not accounting for gender, COVID-19-related topics during PMQs are uncorrelated with PMQs entry (Table A13), suggesting that the general connection between COVID-19 topics and PMQ participation is weak.

[29]As a third check, in Section 4.6 we show that the gender gap in questions to the Health Secretary did not change after the switch to hybrid. This result jointly speaks against two stories: (i) that COVID-19 questions differentially attracted women (since these questions became especially important in the context of questions to the Health Secretary), and (ii) that the remote questioning option was the key mechanism narrowing the gender gap. We flesh out the argument for (ii) in Section 4.6.

testing for equality of the gender gap before and after). This evidence is weaker, with $p = 0.17$ for the test of equality, if we exclude the lottery immediately before the hybrid change, where we cannot rule out the possibility that the large gender gap is due to gendered COVID-19-related aversion to attending in-person. However, the hybrid-induced change still amounts to a complete closure of the gender gap, albeit noisily estimated (with a 95% confidence interval for the effect on the gender gap of -1.9 to 10.8 percentage points).

Fifth, while the shift to hybrid coincides with the UK's first national lockdown, the gender gap in question-asking is stable upon the introduction of the UK's second national lockdown (top-right panel, Figure 7). Sixth, while the shift to hybrid coincides with the return of MPs from the 2020 easter break, we see no similar jumps in the gender gap in question-asking around the easter breaks of 2019 and 2018 (bottom panels, Figure 7). Similarly, in a specification in which we address calendar effects by fully interacting MP fixed effects with the calendar week (from one to 52), the results actually strengthen (column 3, Table 3). Our results are then not picking up regular seasonal variation in the gender gap.

Collectively, our findings suggest that the switch to the hybrid format causally reduced the gender gap in question-asking. Two main mechanisms might drive such an effect: first, it could be that women were more deterred than men by the culture of noise and heckling – features that almost disappeared during the hybrid period. Second, it could be that women benefited from the flexibility of remote questioning more than men. We explore the noise and heckling channel first.

4.6 Mechanisms: Noise Versus Flexibility

Pre-Hybrid PMQs. To explore the possibility that the pre-hybrid style of PMQs differentially affects women, we estimate gender differences in the characteristics of pre-hybrid questions and answers. We then ask the same question of the hybrid and post-hybrid periods. We use the following specification:

$$\text{Characteristic}_{itr} = \alpha_t + \alpha_c + \alpha_p + \alpha_r + \beta \text{Female}_i + \varepsilon_{it} \tag{4}$$

where $\text{Characteristic}_{itr}$ is some feature of the question-answer exchange involving MP i during PMQs week t, manually coded by coder r, with two coders per exchange. α_t, α_c, α_p, and α_r are week, cohort, political party, and coder fixed effects. Other than the coder fixed effects, these fixed effects parallel our preferred specification for the gender gap in question-asking. Female$_i$ is a dummy variable equal to one when the MP in exchange i is female. We cluster standard errors at the MP-level.

In the pre-hybrid period, men and women ask questions of similar length, though the Prime Minister gives answers that are roughly 5% longer to women, whether we control for question

characteristics, including question length, or not (Figure A18). The types of questions that men and women ask are similar, with one main exception: while men use humor in 6% of their questions, women use humor 2.2 percentage points or 37% less often ($p = 0.01$, panel (a), Figure 8). Perhaps surprisingly, women are no less likely to ask condemnatory questions during the pre-hybrid period.

Having characterized questions, we turn to the issue of whether the pre-hybrid questions of women are treated differently than those from men. While we have shown that the Prime Minister gives longer answers to women, the PM is no more likely to give a complete answer to (as opposed to dodging the question), or to express agreement with, women (panel (b), Figure 8). The PM is however 1.5 percentage points (40%) less likely to use humor in response ($p = 0.02$). This fact, together with the fact that female MPs use humor less often, may contribute to a feeling of being out of the "old boys' club." Though whether this fact deters women from asking questions is a separate matter, which we return to below.

Beyond the response of the PM, does the crowd of attending MPs treat women questioners differently? While noise and heckling are common, only extreme cases lead the Speaker of the House to intervene, leading to parliamentary transcripts recording "[Interruption]." We consider gender differences in these rare interruptions as informative about how audience noise more generally affects women. The pre-hybrid questions of female MPs are 1.5 percentage points more likely to be interrupted ($p = 0.03$) – over twice as likely as men, who are interrupted 1.4% of the time (panel (b), Figure 8). The Prime Minister is no more likely to be interrupted after a question from a female MP, suggesting that the gender difference in interruptions is not just because women ask questions in more provocative topic areas. In addition, the gender gap in interruptions is similar after controlling for question characteristics (Figure A19).

The transcript-derived measure of interruptions is limited as a lower bound on the total number of interruptions during an exchange as it only captures the most negative instances of interruptions where the speaking MP must pause before continuing.[30] To address this limitation, we turn to an alternative measure of negative disruptions: we tasked research assistants to watch all pre-hybrid PMQs YouTube videos, and to record when questions faced negative disruptions. Using this approach, we unearth roughly double the number of interruptions than the number recorded in Hansard – 3.3% of questions are coded as having faced a negative interruption, while 1.8% of questions are transcribed with "[Interruption]" in Hansard. Women face 67% more manually-coded negative disruptions than men (Table A14), consistent with our finding using transcript-reported interruptions.

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[30]This misses audience disruptions in which MPs continue to speak without pausing. Positive interruptions are also recorded in the transcripts through other texts such as "[Applause]", "[Laughter]", and "[Hon. Members: "Here, here!"]". There are only 14 total instances of positive interruptions to MPs in our data, and so we do not analyze these cases.

Hybrid PMQs and Beyond. The switch to hybrid PMQs softened the adversarial style of PMQs: the size of the in-person audience fell by more than three-quarters (Figure A15), and interruptions fell by more than half (Figure A20). The fall in attendance plausibly caused the fall in interruptions. Consistent with this, using attendance data from the non-hybrid periods, we find suggestive evidence that a higher audience size predicts a higher share of interrupted questions (Table A15).[31]

Gender gaps in question and answer characteristics also changed during the hybrid period. The gender gap in the use of humor disappeared (panel (a), Figure 8), largely due to men using humor less often. A natural interpretation is that the returns to humor are lower with a smaller in-person audience, and since men use humor more often, a drop in the returns to humor serves to narrow the gender gap.

Responses tend to shift in favor of women during the hybrid period (panel (b), Figure 8). Most importantly, the gender gap in interruptions disappears, while the Prime Minister is more likely to agree with and respond with humor to female questioners. These shifts are similar when controlling for question characteristics (Figure A19).

In summary, the style of PMQs appears to have shifted in favor of women during the hybrid period. Did this change in style cause the gender gap in question-asking to narrow?

Noise Versus Flexibility. The shift to hybrid arrangements conflates two main factors: the change to the questioning style and audience antics of PMQs, as discussed above, and the availability of a remote questioning option. We now turn to two pieces of evidence in favor of the noise and rowdiness channel.

First, if the rowdiness-reduction of hybrid proceedings plays a role in closing the gender gap, we may expect rowdy question-asking experiences to cause female MPs to disengage more than male MPs in the pre-hybrid period. To test this, we use Hansard transcripts for the questions asked by lottery winners in the pre-hybrid period, and code up an indicator variable *Rowdy Exchange*, equal to one if the lottery winner's exchange with the Prime Minister experienced any type of interruption (8% of exchanges are coded as rowdy).[32] Armed with this measure, we can explore whether experiencing a rowdy exchange predicts lower future entry, and whether this differs by MP gender. We caveat that a causal interpretation is not guaranteed, given that the rowdiness of an exchange is not randomly assigned.

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[31]As attendance records are not collected officially, we count attendance using YouTube screenshots of the full chamber as shown in Figure A3. We additionally count the number of female MPs present using the same screenshot, though we do not reject the null hypothesis of no effect of the female share on interruptions (Table A15). To explore this further, we used YouTube screenshots from 25 randomly-selected pre-hybrid PMQs to code which individual MPs contribute to rowdiness by either talking, laughing, or shouting. Consistent with the null effect above, though surprising to us, we do not detect a gender difference (Table A16).

[32]This is a broader measure than our earlier measure of whether the MP or PM is interrupted, which gives us a larger sample of events, increasing our power to detect effects on future PMQs entry.

Rowdy exchanges tend to deter female MPs from future question-asking, while motivating male MPs (Table 4). The p-value for a test of a differential effect of rowdiness by gender falls from 0.12 to 0.04 after adding a control for past PMQs entry (column 2), which helps to alleviate the endogeneity concern that female MPs that experience rowdy exchanges are those that tended to enter less already (and vice versa for male MPs). The p-value falls further to 0.02 when we estimate the gender gap in effects of rowdiness conditional on cohort and political party (column 3), in line with our preferred estimates of the gender gap in question-asking. The key coefficients are large: taking the estimates in column 3 as causal, rowdy exchanges serve to increase the subsequent (conditional) gender gap in entry by 18 percentage points.

Second, if noise and heckling deter women from submitting questions, we might hypothesize that this channel deters women more than men because women have, on average, quieter speaking voices. If this is the case, we might expect that speaking volume predicts question entry during the pre-hybrid period, and less so afterwards. We find exactly this, using the volume data extracted from YouTube videos.

Lottery-winning women ask questions 0.8 dB more quietly than men (column 1, Table 5), or roughly one-quarter of the standard deviation of volume for men.[33] In columns 2 to 5, we explore whether speaking volume predicts question submission. First, we replicate the gender gap in question submission using only the sample of MPs for which we have a measure of volume – those that asked at least one question covered by the YouTube videos (column 2). Next, using the same sample of pre-hybrid PMQs, we explore whether MP-level speaking volume predicts question submission, separately for women and for men. As hypothesized, louder women are more likely to enter than quieter women ($p < 0.05$), while volume is not predictive for men (with $p = 0.13$ for the test of equality of effects for women and men). The magnitude is meaningful: women that are 0.8 dB louder (the size of the gender gap in loudness) submit questions 1.5 (0.8*1.9) percentage points more often – or roughly one-quarter of the gender gap.

In contrast, volume does not predict question submission during the hybrid or post-hybrid periods, for women or for men (columns 4 and 5). It follows that the hybrid format draws in the quieter women more than the louder women, and these quieter women remained engaged after the format changed back (we return to the point of persistent effects in Section 4.7). This evidence, along with our evidence from rowdy exchanges, is consistent with the idea that the hybrid format narrowed the gender gap at least partly because the new format was quieter and less adversarial.

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[33]The gender gap in volume is unlikely to be explained by distance to a microphone given that (i) many hanging microphones are distributed throughout the chamber, (ii) while seating is clustered by political party and seniority (frontbencher versus backbencher), the gender gap is estimated conditional on political party fixed effects, and the estimate and standard error are identical to two decimal places after adding fixed effects for holding an opposition post or a parliamentary post (those with government posts are ineligible for PMQs and thus already excluded from the regression), and (iii) through manual coding of the YouTube videos for ten randomly-selected pre-hybrid PMQs, we do not detect a gender difference in the proximity of speakers to a microphone (Table A17).

Flexibility. To isolate the role of flexibility, we use the data on oral questions asked to other minis-ters. These questions were still affected by the remote questioning option. But in contrast to PMQs, these question periods were much less well-attended (recall Figure A3), and as a consequence, less noisy, even prior to the introduction of hybrid proceedings. As a result, only one of the two mech-anisms (of noise and flexibility) is operative when the format changes for the non-Prime Minister questions – flexibility. If the gender gap for non-Prime Minister questions evolved similarly to that of the PMQs gender gap, this would suggest that it is flexibility that narrows the PMQs gender gap. In contrast, if the gender gap for non-Prime Minister questions was similar before and after the hybrid change, this suggests that the key mechanism is the change in the noisy environment.[34]

We find evidence for the latter story. We focus first on the gender gap in questions asked to the Health Secretary (Figure A21). By focusing on Health, we have a domain that became more salient and important during the pandemic, in the same way that questions to the Prime Minister became more important. Like with PMQs, health-questioning participation increased during the hybrid period. Unlike PMQs, the gender gap in question-asking did not change during the hybrid period – remaining statistically insignificant throughout.[35] Turning to questions to all other ministers (excluding Health and the Prime Minister), we find a similar result (Figure A22). Though participation increases during the hybrid period, the gender gap does not change.

As a complementary test, we explore whether female lottery winners are more likely than men to choose to ask their question remotely when given the option. Women are four to five percentage points more likely to choose the remote option (Table A18), though we cannot reject the null hypothesis of no gender difference at conventional levels. The one statistically significant predictor of remote questioning is age (column 4), presumably reflecting the greater COVID-19-related health concerns of older MPs.

Together, these findings suggest that the remote questioning option is unlikely to be a key mech-anism through which the switch to the hybrid format narrowed the gender gap in question-asking at PMQs. Instead, the evidence speaks more strongly in favor of the change to the adversarial nature of the questioning as the key mechanism.

External Visibility. Lastly, an alternative explanation for the narrowed gender gap might be changes to the visibility of MPs to the broader public.[36] For example, visibility to the public might fall if

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[34]Implicitly, we are using a triple-difference approach to isolate the effects of changing adversarial norms, where the differences are (i) men versus women, (ii) before versus after the format change, and (iii) Prime Minister versus non-Prime Minister questions.

[35]As we signalled in a footnote above, this result also speaks against the confound of the importance of COVID-19 questions. These questions became more common during the hybrid period. But if this increased focus on COVID-19 differentially selected in women, we would also expect the gender gap in questions to the Health Secretary to change over time (in this case, becoming the opposite gap, with women asking more questions than men).

[36]Internal visibility to MPs may also have changed as a result of the hybrid proceedings. However, we cannot easily speak to this given data limitations: while we know that physical attendance was lower in the hybrid era, no

the hybrid style is less engaging. However, proxying visibility with YouTube viewership numbers, we do not see any evidence for the hybrid format changing the overall visibility of questioners (Figure A23). This hints that the adversarial style of PMQs can be reduced without sacrificing voter engagement.

While viewership did not change, gendered reactions to MPs' social media posts might have differed during the hybrid era. We explore this by coding the PMQs-related Twitter posts of lottery winners from 75 randomly selected PMQs, and then exploring gender differences using our preferred specification – i.e. conditional on cohort and political party fixed effects. Eighty-five percent of lottery winners had a Twitter profile at the time of their lottery, and of these, 63% tweeted about their PMQs participation. We find only weak evidence of gender differences in having a Twitter profile or posting (columns 1 and 2, Table A19). While we do not find gender differences in reactions pre-hybrid (likes, reposts, and replies, panel A, columns 3 to 5), we find strong evidence of more positive reactions to the posts of female MPs during the hybrid era (panel B), which turn negative, if anything, in the post-hybrid period (panel C). These findings suggest that the effects of the format change on the atmosphere inside the chamber also spilled out to the atmosphere outside the chamber. To the extent that PMQs entrants were aware of these external changes, this may have also played a role in narrowing the gender gap in question-asking.

4.7   Persistence

The hybrid-era narrowing of the gender gap persisted following the return in September 2021 to pre-hybrid proceedings, until April 2023 (Figure 4) – the gender gap was 1.33 percentage points during the hybrid period, and 0.68 percentage points during the post-hybrid period. The gender gap remains closed during April 2023 to July 2025 – a period for which we have data on lottery winners, but not lottery entrants (Table A20), making the 2023 to 2025 estimated gender gap roughly 40% noisier than that of 2021 to 2023. Nevertheless, the four-year continuation of a narrowed gender gap suggests that the gap may not return in future.

Reverting to the 2015 to 2023 period, we use kernel density plots in Figure A24 to identify which parts of the distribution drive the persistence. For both male and female MPs, the shift to hybrid proceedings shifts the distribution of entry rates to the right – both male and female MPs are far more likely to submit to at least 80% of PMQs during the hybrid period relative to the pre-hybrid period.

For male MPs, the post-hybrid return to the regular PMQs format leads to a leftward shift of the distribution of entry. Most notably, the new distribution of entry almost exactly tracks that of

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data exists on attendance over Zoom. As a result, we cannot determine whether lottery-winner visibility to MP peers rose or fell during the hybrid period. We might even guess that it rose, given that overall PMQs lottery participation was substantially higher during the hybrid period (Table A10).

the pre-hybrid distribution. The hybrid-induced additional entry then does not appear to have any persistent effects for men – they return completely to their pre-hybrid patterns of behavior.

For female MPs, the return to regular proceedings leads again to a leftward shift of the distribution, but this time the shift is only partway toward the pre-hybrid distribution. Relative to pre-hybrid behaviors, fewer women are submitting 20 to 60% of the time, and more women are submitting 80% of the time or more. The hybrid shift had a legacy once removed: female MPs continued to be more likely to submit questions regularly.

Why did the narrowing of the gender gap persist? One possibility is that the less-adversarial questioning style served as a stepping stone to participation in the more-adversarial questioning style – once a female MP had experience with the former, she would feel more prepared to participate in the latter. We do not find evidence for this – hybrid-era lottery-winners are no more likely than lottery-losers to submit questions after the end of hybrid proceedings, and if anything, female winners are slightly *less* likely to do so (Table A21).[37] We also find that hybrid-era lottery winners are less likely to submit to subsequent lotteries, now without the restriction that these be in the post-hybrid era (Figure A25), although this negative effect is not significantly different for male versus female MPs.

An alternative explanation is that the demise of the adversarial style induced by hybrid proceedings persisted into the post-hybrid period, encouraging female MPs to keep submitting regularly. We find some suggestive evidence for this. In particular, while the gender gap in questions using humor re-emerged in the post-hybrid period (panel (a), Figure 8), gender gaps in post-hybrid responses almost all favor women, with the Prime Minister more likely to answer and agree with the questions of women, similarly likely to use humor in response, and with women slightly less likely to be interrupted (panel (b)). However, the general level of interruptions almost fully recovered to pre-hybrid levels (Figure A20). In this sense, there is suggestive, but mixed, evidence in favor of MPs learning to adopt a less adversarial style of questioning, rather than female MPs learning from leaning in.

5   Conclusion

While many male-dominated occupations are diversifying, these occupations often feature a legacy of workplace norms and rules set by men. Given gender differences in preferences, this can lead to mismatch, with women being less comfortable with prevailing work norms than men. On the one hand, women might adapt through experience, with mismatch eroding over time. We do not

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[37]Another possibility is that the narrow gender gap persists because women selected in by the hybrid format build habits of submitting questions – they learn from submitting, but not from asking. We find this explanation plausible, though we do not know of a feasible empirical test for habit formation in this setting. Future work might adapt the approach of Hussam et al. (2022) to test for whether habit formation can be leveraged to narrow gender gaps.

see this in the setting of the UK Parliament: gender gaps in question-asking are unaffected by experience asking questions, and by additional years of general experience working in Parliament. On the other hand, organizations could reform institutions to reduce mismatch. In the case of the UK Parliament, reforms were accidental – though introduced to allow social distancing during the pandemic, they had the unintended consequence of almost completely closing the gender gap in question-asking, a gender gap that had persisted for decades.

Our paper leaves four main avenues for future research. First, we study only one type of internal barrier, a lack of experience. Could alternative policies, like training, reduce gender gaps without the need for institutional changes? Second, what other light-touch organizational reforms can reduce gender gaps? For example, we lack causal evidence on the attempts of economists to make seminar culture more collegial (Dupas et al. 2023). Third, what factors drive and block such organizational adaptation to the needs of a newly diverse workforce? In the case of British Parliament, reform happened only because of the pandemic. In light of the long-running negative view of the public around the professionalism of PMQs, why did reform not happen anyway? One answer would be that since male MPs remain in the majority, their preferences remain catered to (the "median voter" is a man). Fourth, what are the downstream career effects of organizational reforms that reduce gender gaps in visibility?

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Figures and Tables

Table 1: Lottery Winners Receive Higher Vote Shares in the Next Election

	Ran for Next GE (1)	Vote Share at Next GE (%) (2)	Vote Margin at Next GE (%) (3)	Won Next GE (4)
	Panel A: All Entrants			
Won PMQs Lottery	-0.001	0.326**	0.528*	0.009
	(0.005)	(0.166)	(0.284)	(0.007)
	Panel B: Female Entrants			
Won PMQs Lottery	0.003	0.391	0.807*	0.018
	(0.008)	(0.261)	(0.475)	(0.012)
	Panel C: Male Entrants			
Won PMQs Lottery	-0.004	0.229	0.255	0.002
	(0.007)	(0.207)	(0.349)	(0.009)
All Entrants Observations	75,299	66,274	66,274	66,274
Number of MPs	835	771	771	771
Lottery Losers Outcome Mean	.88	45.8	14	.719
Previous Vote Margin	Yes	No	Yes	Yes
Previous Vote Share	No	Yes	No	No
p(Female Effect = Male Effect)	0.47	0.63	0.35	0.26

Notes: The data includes the full set of lottery entrants for the 264 lotteries from 2015 to 2023, excluding two lotteries for which the associated PMQs were cancelled. Outcome variables are: (1) dummy variable for whether the MP ran for the next general election (in years 2017, 2019, and 2024), (2) vote share at the next general election (%), (3) vote margin at the next general election, which is the percentage of votes won by, and is negative for losers, and (4) dummy variable for whether the MP won at the next general election. Outcomes in columns 2 to 4 are missing if the MP did not run in the next general election. Standard errors are clustered at the MP-level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 2: Women Are Less Likely to Submit Questions to the Prime Minister

|	Entered				Entry Percentage	Ever Entered	Entry Percentage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Female	-7.12***	-5.86***	-5.22**	-5.42**	-5.31**	-1.13	-5.94***
	(2.19)	(2.23)	(2.18)	(2.18)	(2.11)	(2.37)	(1.76)
Observations	87,137	87,137	87,137	87,137	2,373	2,373	1,927
Number of MPs	890	890	890	890	890	890	791
Sample	All	All	All	All	All	All	Entered$\geq$1
Male Outcome Mean	49.4	49.4	49.4	49.4	48	79	61
Lottery FE	Yes	Yes	Yes	Yes	No	No	No
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Party FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Margin and Posts	No	No	Yes	Yes	No	No	No
Additional Controls	No	No	No	Yes	No	No	No
Session FE	No	No	No	No	Yes	Yes	Yes

Notes: The unit of observation is MP-lottery for the stacked specification in columns 1 to 4, with 157 lotteries from 2015 to 2020 (the pre-hybrid era). The unit of observation is MP-session in columns 5 to 7. We exclude the short 2019 session for the MP-session-level analysis given that it only had two lotteries. The sample in columns 1 to 4 includes only those MPs eligible to enter each lottery (those without a government position). The sample in columns 5 to 7 includes MPs eligible to enter at least one lottery for each given session. Column 7 includes only the MPs that entered at least one lottery that session. Entered is a variable equal to 100 if the MP entered the PMQs lottery and zero otherwise. Coefficients can then be interpreted as percentage point effects. Entry Percentage is the percentage of lotteries an MP entered that session. Ever Entered is a variable equal to 100 if the MP entered at least one lottery that session, and zero otherwise. Margin and Posts denote controls for the MP's vote margin at their last election, and dummy variables for holding an opposition post (e.g. shadow minister) or a parliamentary post (e.g. vice-chair of the MP's party). Additional Controls include age, number of parliamentary elections lost prior to first joining the House of Commons, dummy for Black and minority ethnic, dummy for attended state school, dummy for attended university, dummy for studied at Oxford or Cambridge university, dummy for politics-adjacent job prior to entering the House of Commons, dummy for born abroad, and dummy for born outside England, along with dummies for missing, as these variables are missing for some of the MPs in our sample. Standard errors are clustered at the MP-level throughout. *** p<0.01, ** p<0.05, * p<0.1.

Figure 1: Gender Differences in Question-Asking Have Persisted Since 1990
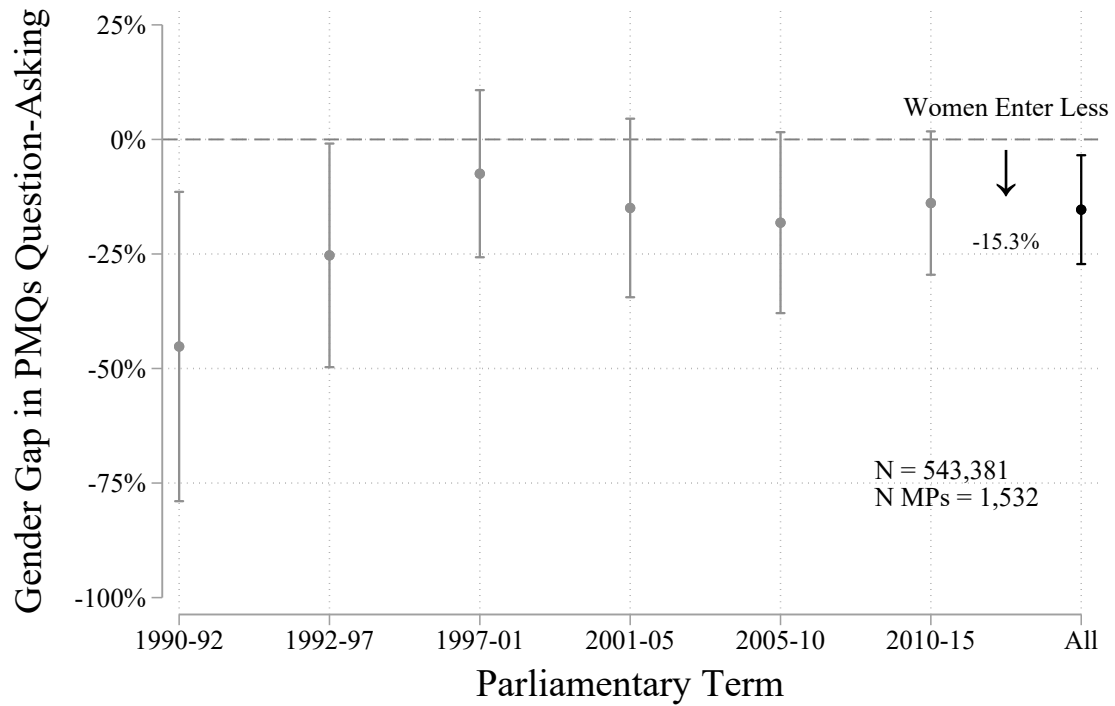
Notes: The figure shows the gender gap in winning the PMQs lottery separately for each parliamentary term from 1990-92 to 2010-15, and for all terms pooled. The estimates use specification 2 with lottery, cohort, and political party fixed effects, and a dummy variable for being a member of the governing party (this dummy is fully collinear with political party fixed effects during 2015 to 2020, given that the Conservative party was in government throughout). The observation numbers in the bottom-right refer to the pooled specification. 95% confidence intervals are shown.

Figure 2: Question-Asking Experience Does Not Increase Future Question-Asking
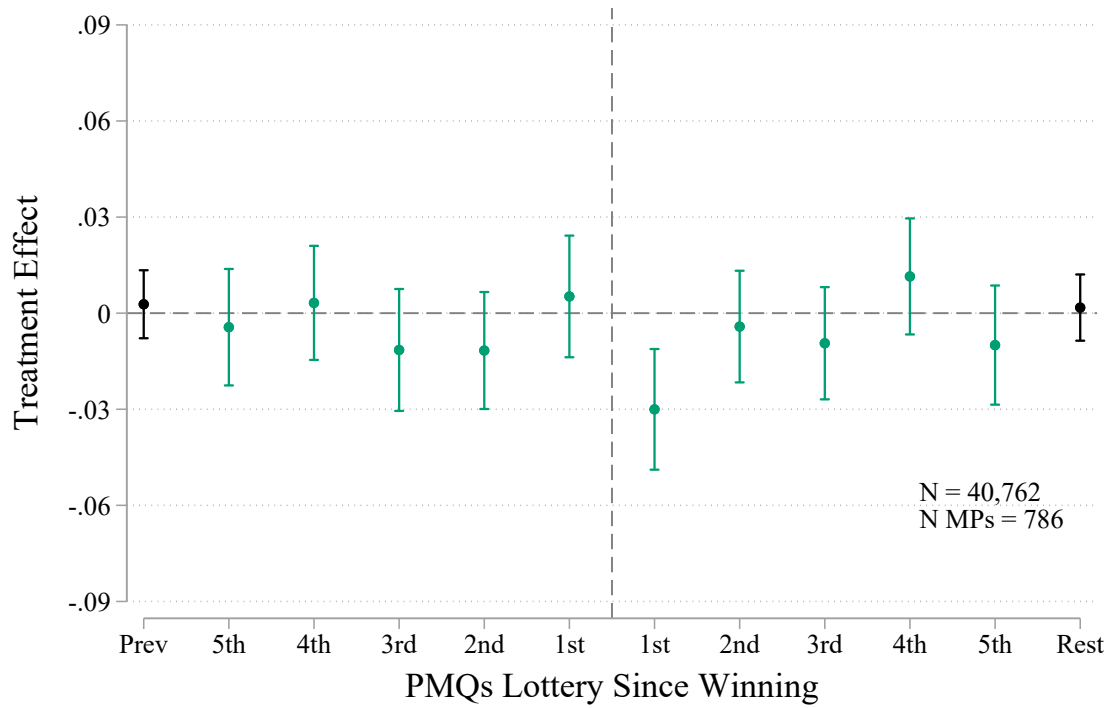
Notes: The figure plots the causal effect of winning the PMQs lottery on re-entry for all MPs, using stacked specification 1. The sample includes all entrants for 156 PMQs lotteries from 2015 to 2020. Each marker is from a separate regression. The green markers to the right of the dashed line show the effect on entering each of the next five lotteries. The green markers to the left denote balance checks, testing for whether winners of the current lottery were more or less likely to enter the previous five lotteries. The black markers show the effect on the proportion of lotteries entered the rest of the current session (Rest) and the proportion entered in the session so far (Prev, a placebo check). The observation numbers in the bottom-right refer to the far-right Rest effect. All six coefficients to the right of the dashed line come from a stacked regression which includes a control for the proportion of lotteries entered in the session so far to increase precision. 95% confidence intervals are shown.

Figure 3: Experience Does Not Affect the Gender Gap in Question-Asking

(a) Female MPs

(b) Male MPs
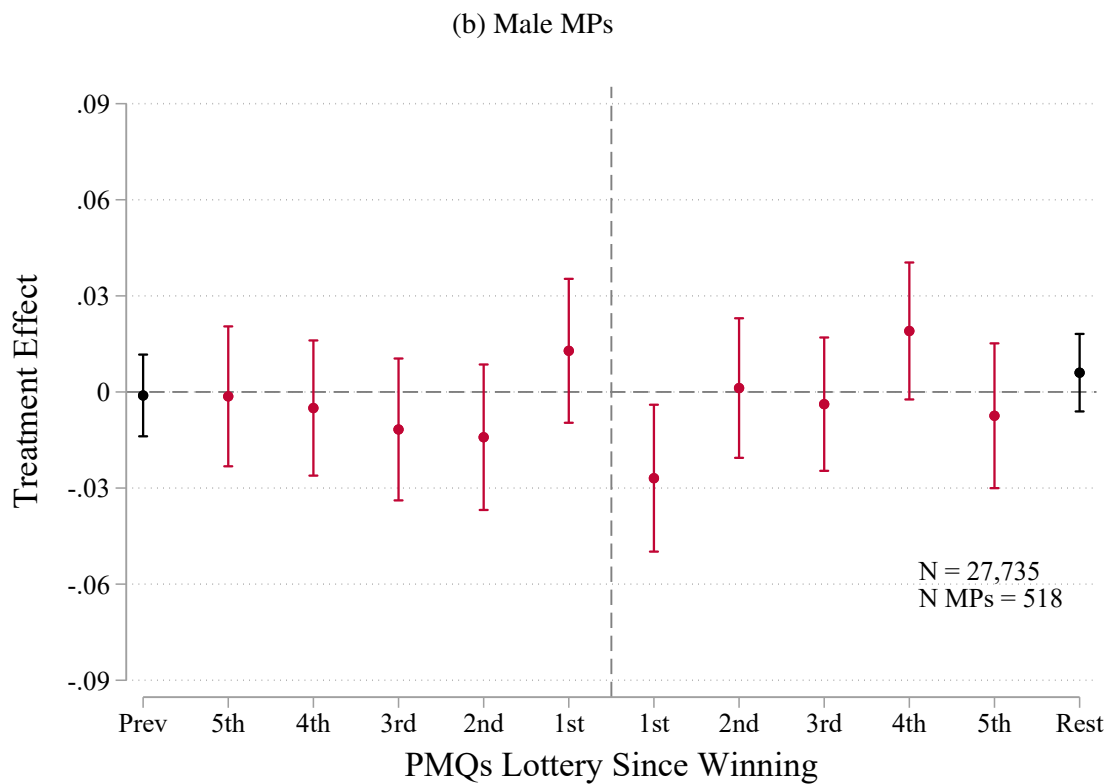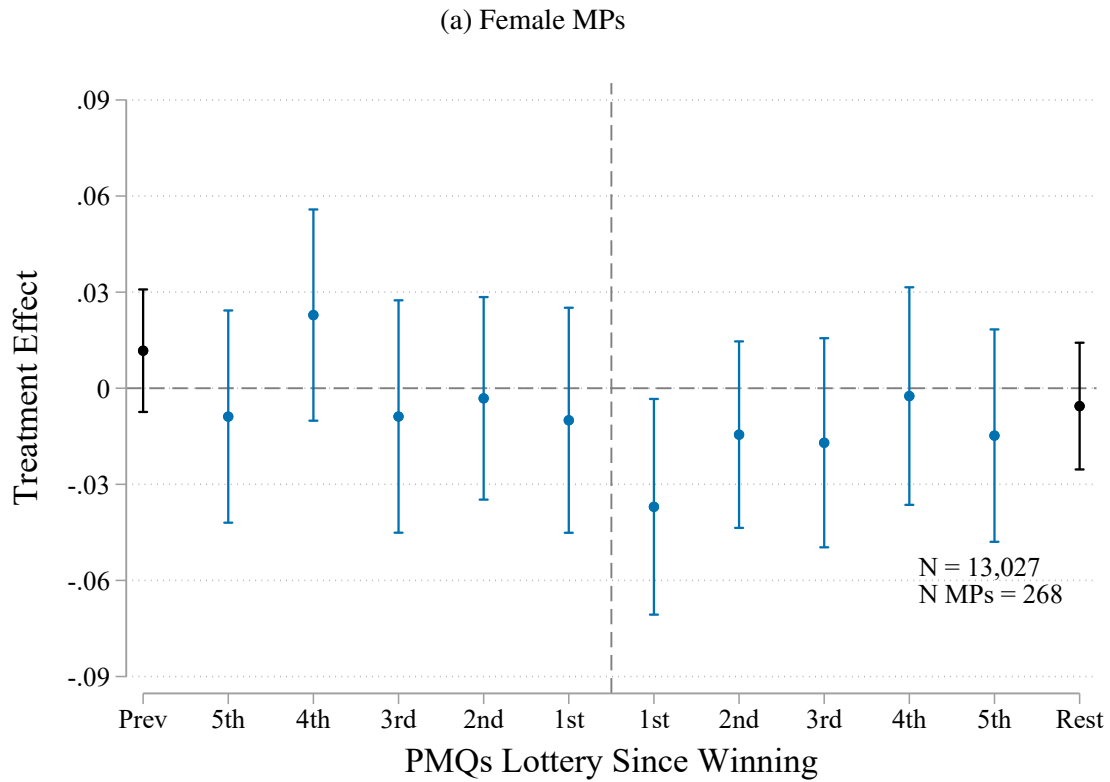
Notes: Panels (a) and (b) replicate the previous figure, but for female and male entrants separately.

Figure 4: The Gender Gap Almost Completely Closed After the Switch to Hybrid Proceedings
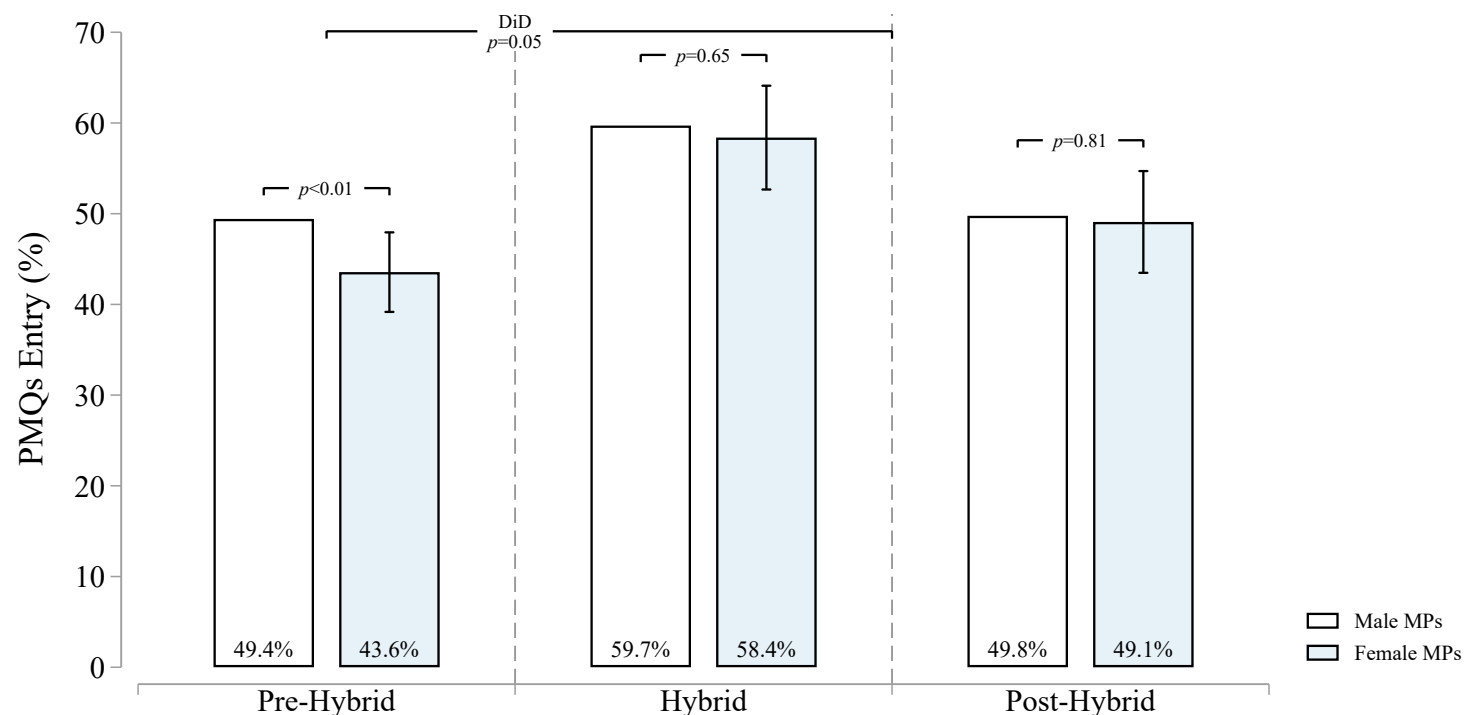
Notes: The white bars show the raw PMQs entry rate for eligible male MPs during three periods: before hybrid proceedings (June 2015 to March 2020), during hybrid (April 2020 to July 2021), and after the return to the in-person-only format (September 2021 to April 2023). The blue bars show the entry rate for eligible women, derived from our preferred specification with lottery, cohort, and political party fixed effects (following column 2 of Table 2). Three p-values reflect tests of the null hypothesis that the gender gap in entry in a given period is zero, while the DiD p-value reflects a test of the null hypothesis that the gender gap pre-hybrid is equal to the one from the hybrid periods onwards. The number of female/male MPs included in each period is: 293/597 for pre-hybrid, 197/370 for hybrid, and 217/407 for post-hybrid.

Figure 5: PMQs Entry by Gender and Month
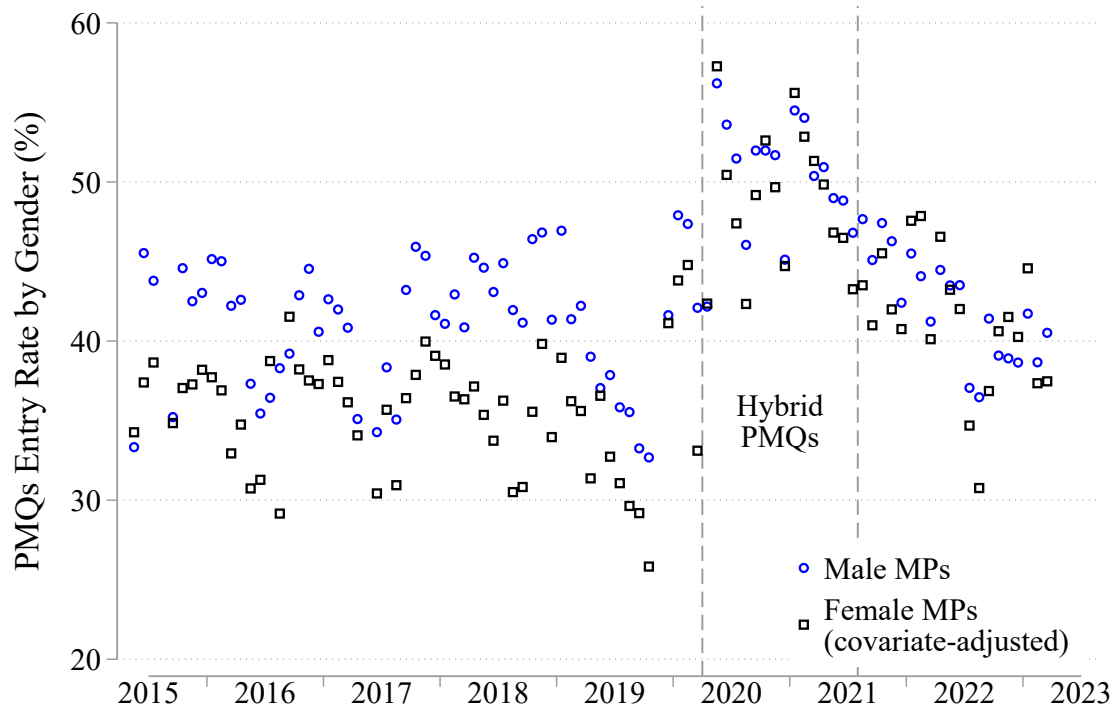
Notes: The figure shows the fraction of PMQs-eligible male MPs that submitted questions each month, and the equivalent covariate-adjusted fraction for eligible female MPs: from adding on the female coefficient in a regression with cohort and political party fixed effects (in line with our preferred specification, column 2 of Table 2).

Table 3: The Closing Of The Gender Gap Is Not Due To Compositional Or Calendar Effects

	Entered		
	(1)	(2)	(3)
Female	-5.86***		
	(2.23)		
Female × Hybrid	4.53*	4.81*	5.55*
	(2.67)	(2.75)	(2.87)
Female × Post-Hybrid	5.18*	5.46*	5.66*
	(2.77)	(2.85)	(2.92)
Observations	146,205	146,199	138,671
Male Outcome Mean	51.4	51.4	51.6
Lottery FE	Yes	Yes	Yes
Cohort-Period FE	Yes	Yes	Yes
Party-Period FE	Yes	Yes	Yes
MP FE	No	Yes	Yes
MP-Calendar Week FE	No	No	Yes
p(Pre-Hybrid Gap = Hybrid and After Gap)	0.05	0.05	0.04

Notes: The unit of observation is MP-lottery, including 264 lotteries from 2015 to 2023. The sample includes only those MPs eligible to enter each lottery (those without a government position). Entered is a variable equal to 100 if the MP entered the PMQs lottery and zero otherwise. Coefficients can then be interpreted as percentage point effects. Cohort-Period FE are cohort fixed effects fully interacted with dummy variables for the pre-hybrid, hybrid, and post-hybrid periods (similar for Party-Period FE). The p-value in the bottom row reflects a test of the null hypothesis that the gender gap pre-hybrid is equal to the one from the hybrid period onwards. This comes from a separate regression in which Female × Hybrid and Female × Post-Hybrid are replaced with Female × Hybrid and After. Standard errors are clustered at the MP-level throughout. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Figure 6: The Gender Gap in Voting Attendance Was Not Affected
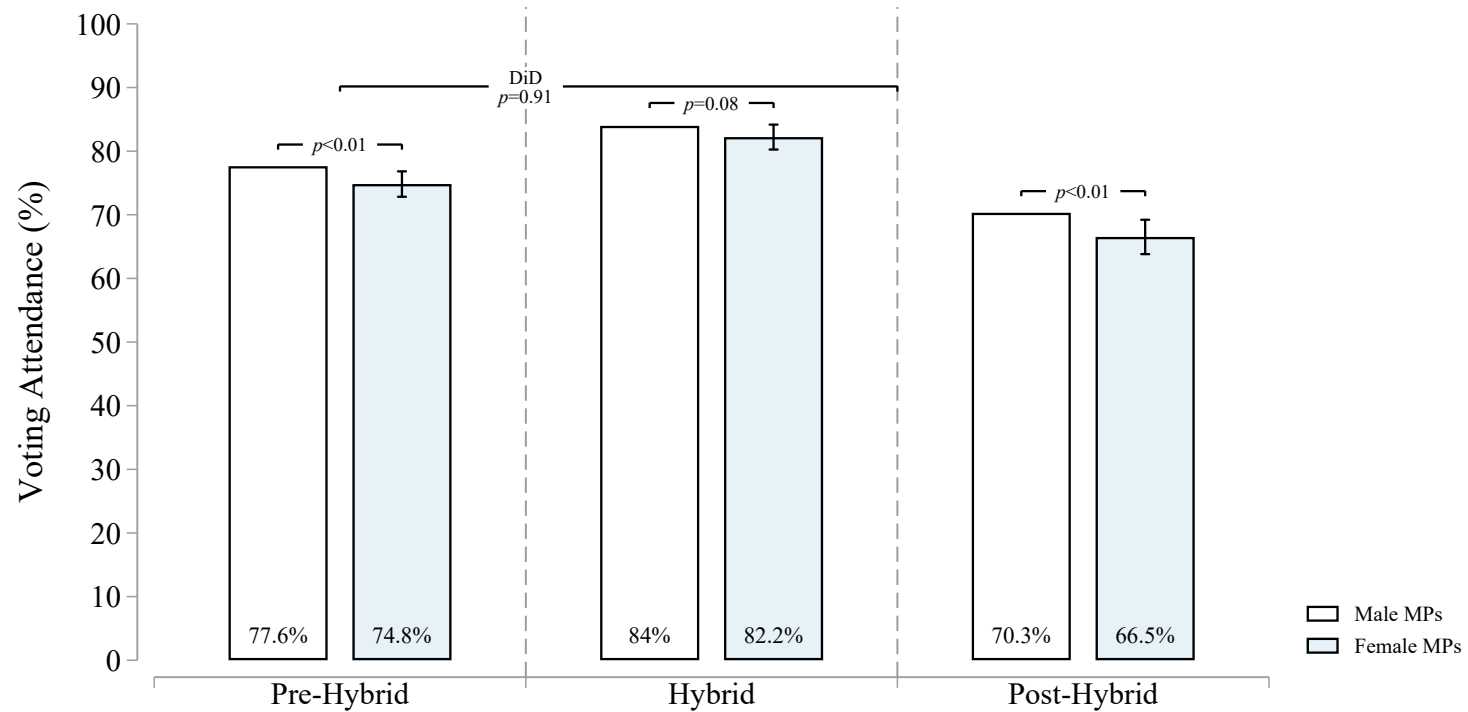
Notes: The white bars show the raw voting attendance rate for PMQs-eligible male MPs during three periods: before hybrid PMQs proceedings (June 2015 to March 2020), during hybrid (April 2020 to July 2021), and after the return to the in-person-only PMQs format (September 2021 to April 2023). We exclude the three dates in which remote voting was permitted (May 12, 13, and 14, 2020), leaving only dates where voting was in-person. The blue bars show the voting attendance rate for eligible women, derived from our preferred specification with date, cohort, and political party fixed effects (following column 2 of Table 2). Three p-values reflect tests of the null hypothesis that the gender gap in attendance in a given period is zero, while the DiD p-value reflects a test of the null hypothesis that the gender gap pre-hybrid is equal to the one from the hybrid period onwards. The number of female/male MPs included in each period is: 292/591 for pre-hybrid, 197/372 for hybrid, and 217/407 for post-hybrid.

Figure 7: The Gender Gap in Question-Asking Around Different Events
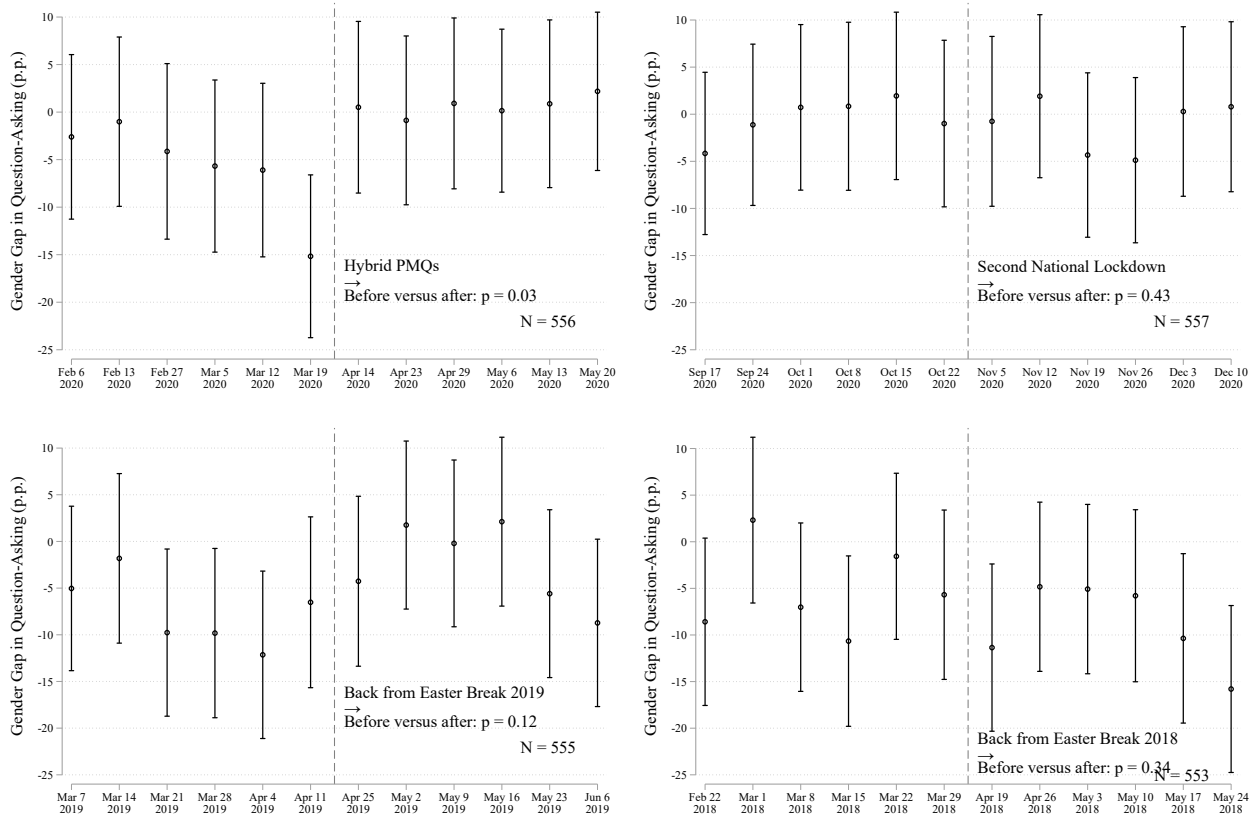
Notes: The figure shows the gender gap in PMQs lottery entry lottery-by-lottery for the six PMQs before and after different events. In each case, we include cohort and party fixed effects, as in our preferred specification in column 2 of Table 2. The number of observations (equivalent to the number of MPs) in the bottom-right refers to the specification for the right-most lottery date. 95% confidence intervals are shown, derived from MP-clustered standard errors.

Figure 8: Gender Differences in Questions and Responses
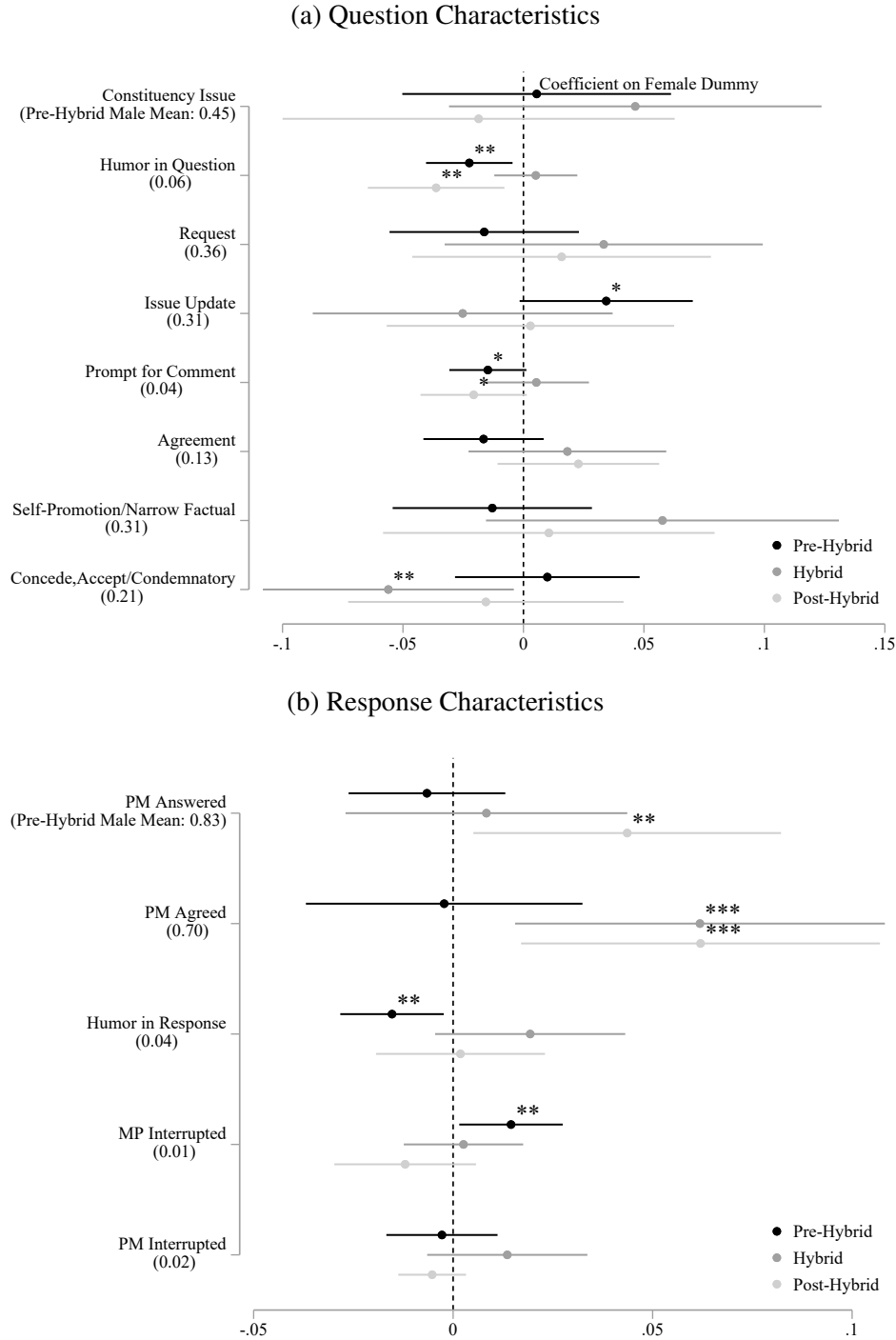
(a) Question Characteristics

(b) Response Characteristics

Notes: The figure shows the coefficient on the female indicator variable from specification 4, separately for question and response characteristics, and for three different periods: pre-hybrid PMQs (2,236 exchanges), hybrid PMQs (677 exchanges), and post-hybrid PMQs (740 exchanges). In each regression, we include cohort, week, and coder fixed effects, and party fixed effects for the party of the MP asking the question. Constituency issue, humor in question, request, humor in response, MP interrupted, and PM interrupted are indicator variables. Issue update, prompt for comment, agreement, self-promotion/narrow factual, and conceded, accept/condemnatory are indicator variables that are mutually exclusive. PM answered and PM agreed take values 0, 0.5, and 1, increasing in the degree to which the PM answered/agreed with the question asked. 95% confidence intervals are shown. *** p<0.01, ** p<0.05, * p<0.1.

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Table 4: Rowdy Exchanges Deter Female Questioners From Future Entry More Than Men

| | Entered Next Week | | |
	(1)	(2)	(3)
Female × Rowdy Exchange	-5.96	-7.42	-10.55*
	(5.55)	(5.71)	(5.89)
Male × Rowdy Exchange	4.80	7.03*	7.16*
	(4.15)	(3.93)	(4.19)
Observations	2,159	2,085	2,085
Male Outcome Mean	75.3	75.5	75.5
Female Dummy	Yes	Yes	Yes
PMQs Week FE	Yes	Yes	Yes
Past Entry	No	Yes	Yes
Cohort-by-Rowdy Exchange FE	No	No	Yes
Party-by-Rowdy Exchange FE	No	No	Yes
p(Female × Rowdy = Male × Rowdy)	0.12	0.04	0.02

Notes: The unit of observation is at the PMQs exchange-level. The sample includes all MPs who won the lottery during the pre-hybrid era, asked their question, and remained eligible to enter the lottery in the following (pre-hybrid) week. We require Hansard transcripts to measure rowdiness, which limits us to 150 of the 157 pre-hybrid PMQs. Rowdy Exchange is an indicator variable equal to one if an interruption occurred during the exchange between the MP and the PM in the current week, and zero otherwise. 8% of the exchanges in the sample for column 1 are classified as rowdy. Entered Next Week is a variable equal to 100 if the MP entered the PMQs lottery the following week, and zero otherwise. Coefficients can then be interpreted as percentage point effects. Past Entry is an indicator variable equal to one if the MP entered the PMQs lottery in the prior week, and zero otherwise. Cohort-by-Rowdy Exchange and Party-by-Rowdy Exchange FEs include the full set of fixed effects, and their interactions with Rowdy Exchange, to allow for differential effects of rowdiness by cohort and political party. In column 3, we demean the party and cohort variables added as interactions with Rowdy Exchange, ensuring that the coefficients on Male × Rowdy Exchange and Female × Rowdy Exchange are still easily interpretable, as the effects for an MP taking the mean values for cohort and party. The p-value in the bottom row reflects a test of the null hypothesis that the coefficient on Female × Rowdy Exchange is equal to the coefficient on Male × Rowdy Exchange. Standard errors are clustered at the MP-level throughout. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 5: Louder Women Submit Questions More Often Pre-Hybrid, But Not After Hybrid

	Volume	Entered			
	(1)	(2)	(3)	(4)	(5)
Female	-0.79***	-5.59***	39.29	0.45	26.77
	(0.12)	(2.13)	(28.76)	(44.09)	(46.79)
Speaking Volume × Female			1.88**	-0.01	-0.01
			(0.76)	(1.20)	(1.29)
Speaking Volume × Male			0.29	-0.07	-0.93
			(0.71)	(1.01)	(1.07)
Observations	2,141	66,031	66,031	17,861	19,655
Sample	Pre-Hybrid	Pre-Hybrid	Pre-Hybrid	Hybrid	Post-Hybrid
Male Outcome Mean	-27.2	62.7	62.7	65.7	55.0
p(Vol × Fem = Vol × Male)			0.13	0.97	0.58
Date FE	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes
Party FE	Yes	Yes	Yes	Yes	Yes

Notes: The unit of observation is MP-date. The sample for column 1 includes the lottery-winner questions asked at pre-hybrid PMQs with available YouTube videos. The sample for the remaining columns includes the MPs eligible to enter each lottery, for pre-hybrid PMQs lotteries, only for the sample of 578 MPs for which Speaking Volume is non-missing. Entered is a variable equal to 100 if the MP entered the PMQs lottery and zero otherwise. Coefficients can then be interpreted as percentage point effects. Volume is our MP-date YouTube-derived measure of question volume in decibels (median volume during an MP's question). Speaking Volume is our MP-level YouTube-derived measure of speaker volume (mean of MP-date measures). We measure volume using only the videos for PMQs held prior to the hybrid period. Both volume measures are weakly below zero, as zero decibels reflects the maximum sound level in a video that can be processed without distortion. Standard errors are clustered at the MP-level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Online Appendix

"Internal Versus Institutional Barriers to Gender Equality: Evidence From British Politics"

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Table A1: Balance Test for Lottery Speaking Order (2015 to 2023)

	Male (1)	Age (2)	Years Experience (3)	Voter Turnout (4)	Vote Margin (5)	Labour (6)	Conservative (7)	Number Of Wins (8)
				Panel A: All Entrants				
Lottery Order	0.001	-0.038	-0.011	-0.007	0.053	-0.002	0.001	0.000
	(0.002)	(0.045)	(0.035)	(0.023)	(0.066)	(0.002)	(0.002)	(0.004)
				Panel B: Female Entrants				
Lottery Order		-0.070	-0.017	-0.014	0.055	-0.001	0.000	-0.001
		(0.076)	(0.044)	(0.051)	(0.117)	(0.004)	(0.003)	(0.007)
				Panel C: Male Entrants				
Lottery Order		-0.039	-0.018	-0.016	0.004	-0.001	-0.000	0.001
		(0.058)	(0.048)	(0.026)	(0.085)	(0.002)	(0.003)	(0.005)
All Winners Observations	3,652	3,652	3,652	3,652	3,652	3,652	3,652	3,652
Outcome Mean	.66	51	8	67	22	.36	.47	.93
Lottery FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The data includes all lottery winners for the 258 lotteries with available Hansard transcripts (used to measure actual speaking order) from May 2015 to March 2023. Lottery order is the random speaking order among lottery winners (which the Speaker can deviate from). Outcome variables are: (1) dummy variable for male, (2) age when entered this lottery, (3) years since first entering the House of Commons, (4) voter turnout when last elected to Parliament, (5) vote margin when last elected to Parliament, (6) dummy variable for elected as Labour MP, (7) dummy variable for elected as Conservative MP, and (8) number of PMQs lottery wins since this session started. Standard errors are clustered at the MP-level. *** p<0.01, ** p<0.05, * p<0.1.

Figure A1: Speaking Order Versus Lottery Order
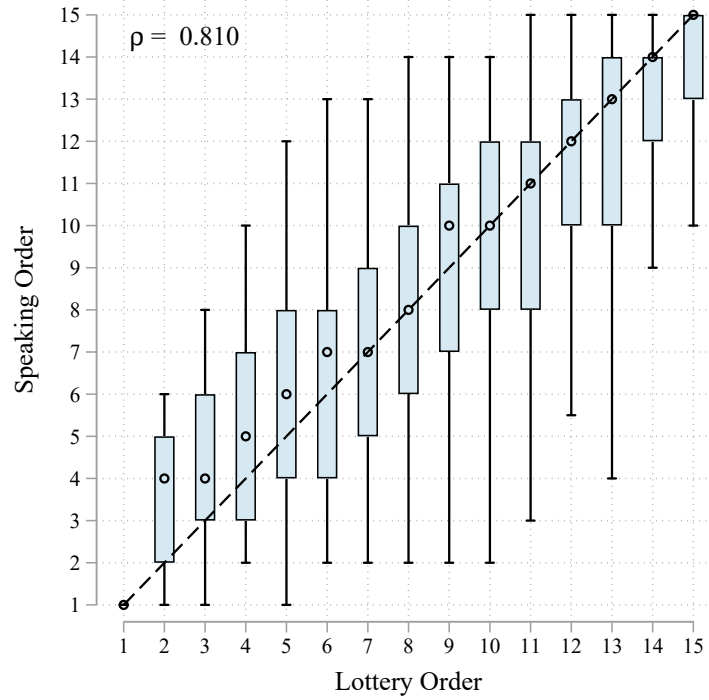
Notes: This figure shows the box plot of actual speaking order by random lottery order values, for the 258 PMQs lotteries with available Hansard transcripts (used to measure actual speaking order) from May 2015 to March 2023. Circles represent the median, and the blue boxes represent the interquartile range. The whiskers are defined by the interval $[q_1 - 1.5iqr, q_3 + 1.5iqr]$ where q_1 and q_3 are the 1st and 3rd quartiles respectively and iqr is the interquartile range. The correlation coefficient between speaking order and lottery order is shown in the top-left corner.

Table A2: Gender Does Not Predict Speaking Order Conditional on Controls

	Speaking Order			
	(1)	(2)	(3)	(4)
Lottery Order	0.808***	0.810***	0.809***	0.809***
	(0.010)	(0.008)	(0.008)	(0.008)
Female	0.876***	-0.010	-0.013	-0.001
	(0.163)	(0.064)	(0.064)	(0.067)
Conservative		-3.537***		
		(0.077)		
Observations	3,652	3,652	3,652	3,652
Lottery FE	Yes	Yes	Yes	Yes
Party FE	No	No	Yes	Yes
Cohort FE	No	No	No	Yes

Notes: The unit of observation is MP-lottery, including 258 lotteries with available Hansard transcripts from 2015 to 2023. The sample includes only lottery winners. Speaking Order is the actual order in which MPs speak during the PMQs, ranging from 1 to 15. Lottery Order is the order in which MPs are randomly drawn from the weekly lottery, ranging from 1 to 15. Conservative is a dummy variable equal to one if the MP is a member of the Conservative party. Standard errors are clustered at the MP-level throughout. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Figure A2: Prime Minister's Questions Hybrid Proceedings

Notes: The screenshot shows an example of PMQs during COVID-19, when attendance switched to a hybrid format (maximum 50 MPs allowed in the chamber). This specific PMQs, which took place on April 22nd 2020, can be found on YouTube at this link.

Figure A3: Non-Prime Minister's Questions Times Are Less Well-Attended

Notes: The screenshots show attendance at PMQs (top) and Cabinet Office questions (bottom) on the same date, April 27, 2016. We count visible attendance as 241 for PMQs and 72 for questions to the Cabinet Office. These numbers are similar to what we estimate for random samples of pre-pandemic question times (220 vs. 78).

Figure A4: Timeline and Number of Lottery Entrants
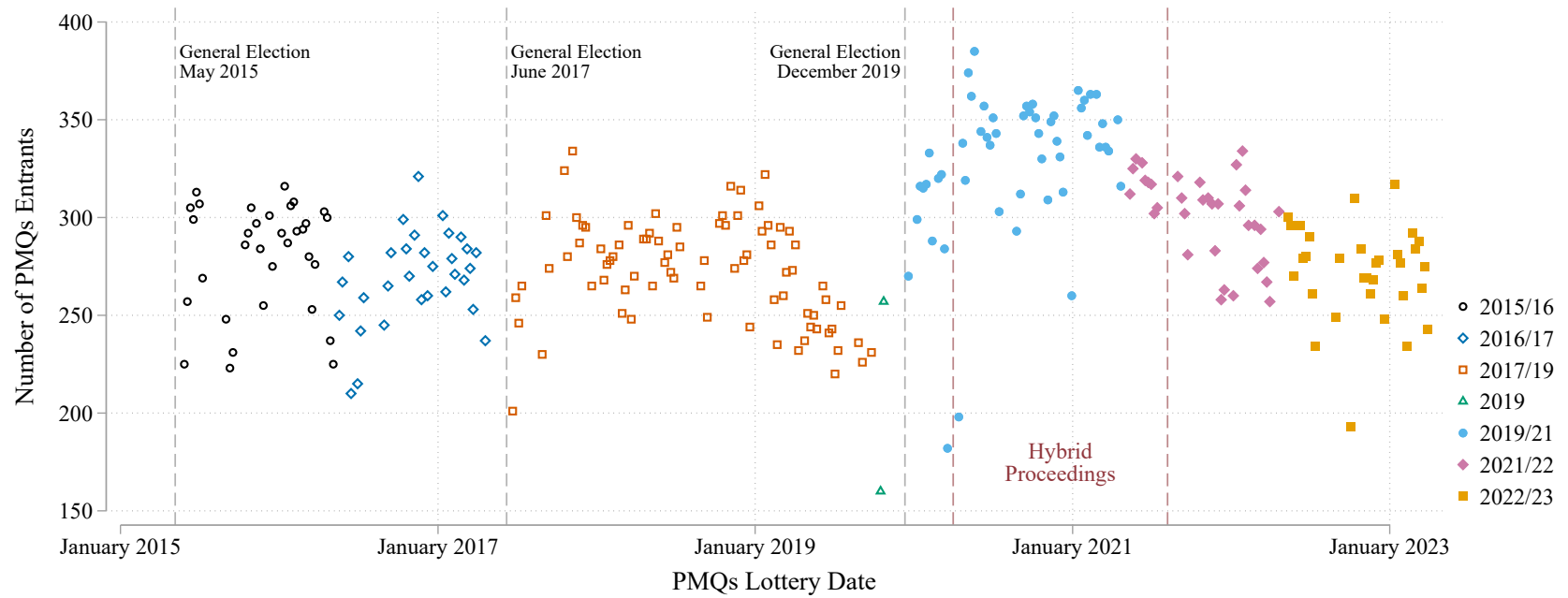
Notes: The figure shows the number of entrants for each of the 264 PMQs lotteries in our data. The colors differ by parliamentary session. The vertical dashed lines denote the three general elections during this period, and the period in which PMQs followed hybrid proceedings.

Figure A5: Extrapolating From the Female Share of Winners to the Female Share of Entrants
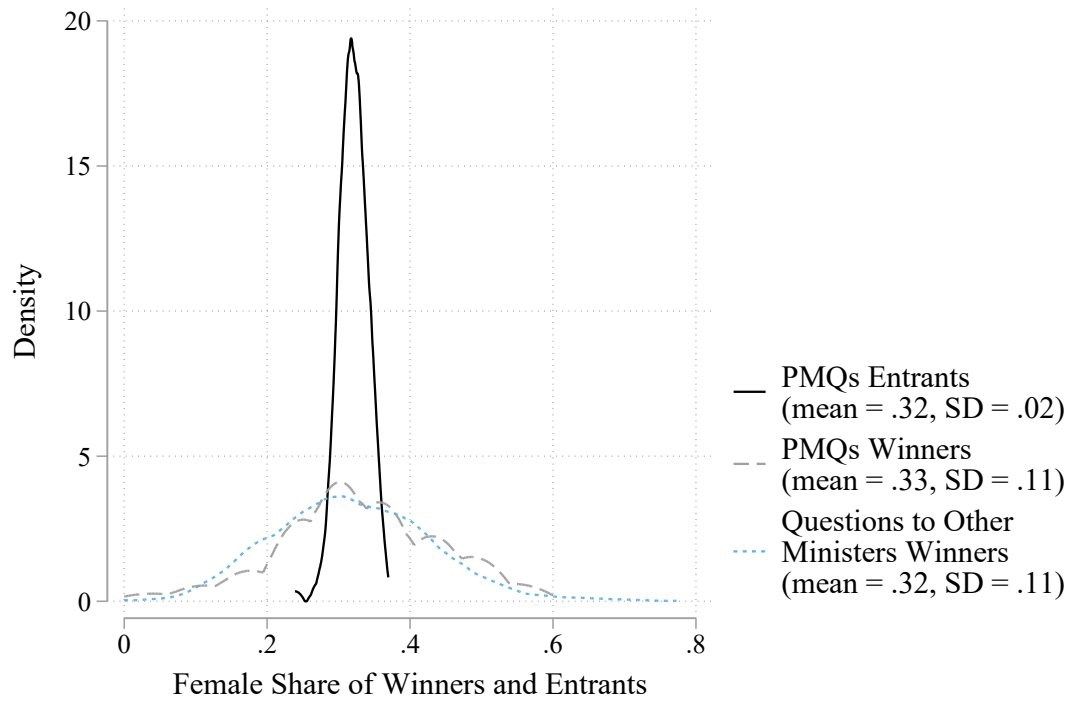
Notes: This figure shows probability density functions for the female share of pre-hybrid (i) PMQs lottery entrants, (ii) PMQs lottery winners, and (iii) Questions to Other Ministers lottery winners.

Table A3: Balance Test for Winning the PMQs Lottery (2015 to 2020)

	Male (1)	Age (2)	Years Experience (3)	Voter Turnout (4)	Vote Margin (5)	Labour (6)	Conservative (7)	Number Of Wins (8)
				Panel A: All Entrants				
Won PMQs Lottery	-0.009	-0.180	-0.078	-0.063	0.188	0.005	-0.009	-0.010
	(0.010)	(0.237)	(0.189)	(0.108)	(0.318)	(0.011)	(0.010)	(0.023)
				Panel B: Female Entrants				
Won PMQs Lottery		-0.153	0.315	0.110	-0.333	0.011	-0.014	0.038
		(0.431)	(0.256)	(0.210)	(0.597)	(0.019)	(0.016)	(0.039)
				Panel C: Male Entrants				
Won PMQs Lottery		-0.171	-0.218	-0.131	0.436	-0.001	-0.004	-0.033
		(0.279)	(0.241)	(0.125)	(0.375)	(0.012)	(0.013)	(0.028)
All Entrants Observations	43,044	43,044	43,044	43,044	43,044	43,044	43,044	43,044
Full Sample Outcome Mean	.68	51	7.9	67	21	.4	.44	1
Lottery FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The data includes the full set of lottery entrants for the 157 lotteries from 2015/16 until the switch to hybrid proceedings in April 2020. Outcome variables are: (1) dummy variable for male, (2) age when entered this lottery, (3) years since first entering the House of Commons, (4) voter turnout when last elected to Parliament, (5) vote margin when last elected to Parliament, (6) dummy variable for elected as Labour MP, (7) dummy variable for elected as Conservative MP, and (8) number of PMQs lottery wins since this session started. Standard errors are clustered at the MP-level. *** p<0.01, ** p<0.05, * p<0.1.

Table A4: Balance Test for Winning the PMQs Lottery (2015 to 2023)

	Male (1)	Age (2)	Years Experience (3)	Voter Turnout (4)	Vote Margin (5)	Labour (6)	Conservative (7)	Number Of Wins (8)
				Panel A: All Entrants				
Won PMQs Lottery	-0.009	-0.088	-0.093	0.174*	-0.130	-0.004	-0.008	0.004
	(0.008)	(0.183)	(0.140)	(0.091)	(0.241)	(0.008)	(0.008)	(0.019)
				Panel B: Female Entrants				
Won PMQs Lottery		-0.019	0.131	0.492***	-0.633	-0.002	-0.011	0.013
		(0.301)	(0.165)	(0.189)	(0.454)	(0.014)	(0.013)	(0.025)
				Panel C: Male Entrants				
Won PMQs Lottery		-0.088	-0.154	0.032	0.135	-0.008	-0.003	-0.000
		(0.228)	(0.188)	(0.099)	(0.282)	(0.009)	(0.010)	(0.025)
All Entrants Observations	75,804	75,804	75,804	75,804	75,804	75,804	75,804	75,804
Full Sample Outcome Mean	.66	51	8.1	67	22	.36	.47	.91
Lottery FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The data includes the full set of lottery entrants for the 264 lotteries from 2015/16 to 2022/23. Outcome variables are: (1) dummy variable for male, (2) age when entered this lottery, (3) years since first entering the House of Commons, (4) voter turnout when last elected to Parliament, (5) vote margin when last elected to Parliament, (6) dummy variable for elected as Labour MP, (7) dummy variable for elected as Conservative MP, and (8) number of PMQs lottery wins since this session started. Standard errors are clustered at the MP-level. *** p<0.01, ** p<0.05, * p<0.1.

Figure A6: Experienced MPs Are Less Likely to Submit Questions
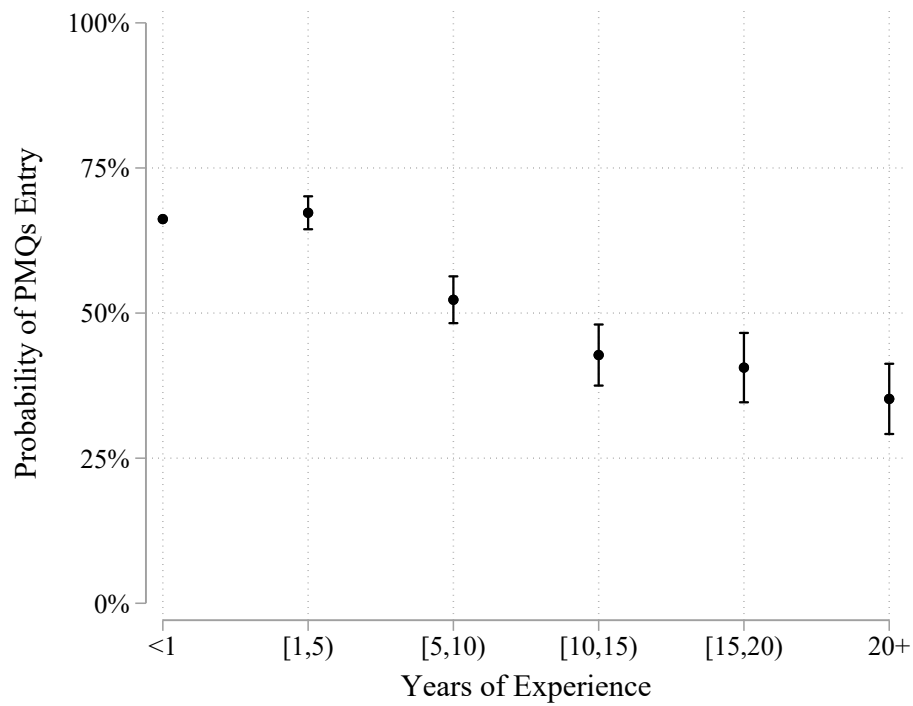
Notes: The figure shows the coefficients and confidence intervals from a regression of PMQs lottery entry from 2015 to 2023 on dummy variables for different levels of experience and lottery fixed effects. The effects are shown relative to the raw mean for PMQs-eligible MPs with less than one year of experience. Standard errors are clustered at MP-level.

Table A5: How Do Characteristics of Male and Female MPs Differ?

	Age (1)	Elections Lost (2)	Years Experience (3)	Vote Margin (4)	Labour (5)	Conservative (6)	BAME (7)	State School (8)	University (9)	Oxbridge (10)	Politics Job (11)	Born Abroad (12)	Born Outside England (13)
							Panel A: Lottery FEs						
Female	-2.48***	-0.29***	-4.45***	0.16	0.26***	-0.25***	0.08***	0.13***	0.07**	-0.04	0.02	0.05*	0.04
	(0.93)	(0.06)	(0.72)	(1.24)	(0.04)	(0.04)	(0.03)	(0.04)	(0.03)	(0.03)	(0.04)	(0.02)	(0.04)
							Panel B: Lottery and Cohort FEs						
Female	1.07	-0.23***	-0.04	2.06*	0.31***	-0.27***	0.07***	0.08*	0.07**	-0.02	0.02	0.05**	0.02
	(0.77)	(0.06)	(0.05)	(1.19)	(0.04)	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)	(0.04)	(0.02)	(0.04)
							Panel C: Lottery, Cohort, and Party FEs						
Female	1.05	-0.09	0.04	1.05			0.05*	-0.01	0.07**	-0.00	-0.05	0.05**	0.03
	(0.80)	(0.06)	(0.06)	(1.20)			(0.03)	(0.04)	(0.03)	(0.04)	(0.04)	(0.02)	(0.04)
Observations	87,137	87,137	87,137	87,137	87,137	87,137	86,616	79,933	85,673	85,726	83,143	69,381	69,381
Number of MPs	890	890	890	890	890	890	876	760	843	840	841	687	687
Male Mean	53	.67	12	24	.36	.5	.052	.46	.8	.24	.38	.038	.26

Notes: The data includes the full set of eligible MPs for the 157 lotteries from 2015/16 until the switch to hybrid proceedings in April 2020. Each panel includes a different set of fixed effects. Outcome variables are: (1) age when entered this lottery, (2) number of parliamentary elections lost prior to first entering the House of Commons, (3) years since first entering the House of Commons, (4) vote margin when last elected to Parliament, (5) dummy variable for elected as Labour MP, (6) dummy variable for elected as Conservative MP, (7) dummy variable for Black, Asian or Minority Ethnic, (8) dummy variable for educated in a comprehensive/academy/state-funded non-selective school, (9) dummy variable for having graduated from university, (10) dummy variable for having attended Oxford or Cambridge university, (11) dummy variable for having had a politics-adjacent job prior to entering the House of Commons, (12) dummy variable for being born outside of the UK, and (13) dummy variable for being born outside of England. Standard errors are clustered at the MP-level. *** p<0.01, ** p<0.05, * p<0.1.

Figure A7: Cumulative Distribution Function of Percentage of PMQs Lotteries Entered
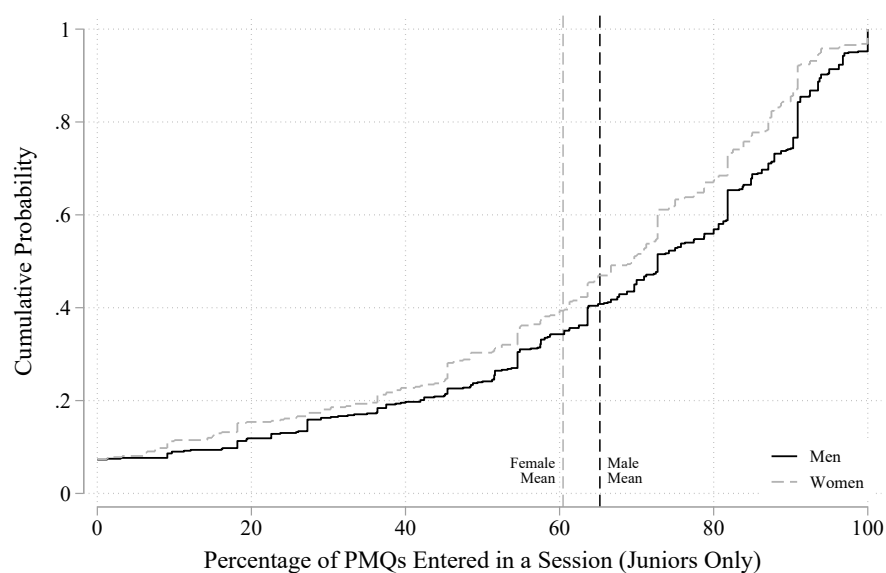
Notes: The figure shows the cumulative distribution function of the percentage of PMQs lotteries entered when eligible to, using the pre-hybrid 2015 to 2020 data collapsed to the MP-session-level, and only MPs that joined the House of Commons since the 2015 general election. We exclude the 2019 session in which there were only two PMQs lotteries. The CDF is plotted separately for female and male MPs. The data includes 181 females and 238 males (409 female-session and 523 male-session observations).

Table A6: What Types of Women Are More Likely to Submit Questions?

|	Entered (Female MPs)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Age	0.25								0.38**
	(0.16)								(0.17)
Black, Asian or Minority Ethnic		-9.00**							-7.46
		(4.52)							(4.56)
State-Schooled			-5.41						-4.36
			(3.95)						(3.84)
University Degree				-2.87					-1.98
				(4.94)					(4.87)
Attended Oxbridge					0.04				3.14
					(4.22)				(4.40)
Politics-Related Previous Job						-1.61			-0.60
						(3.41)			(3.30)
Born Outside of the UK							-9.82		-8.51
							(6.68)		(8.35)
Born Outside of England								-5.66	-0.96
								(5.19)	(6.06)
Observations	28,045	27,877	24,230	27,296	27,278	26,987	22,286	22,286	28,045
Number of MPs	293	287	231	272	270	276	224	224	293
Lottery FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Party FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The unit of observation is MP-lottery (i.e. the stacked specification), with 157 lotteries from 2015 to 2020 (the pre-hybrid era). The sample includes female MPs eligible to enter each lottery (those without a government position). Entered is a variable equal to 100 if the MP entered the PMQs lottery and zero otherwise. Coefficients can then be interpreted as percentage point effects. All control variables shown are dummy variables, with the exception of Age, which is in years. To avoid losing observations due to missinginess, column 9 additionally includes dummy variables for each control being missing, and each control is set to -99 when missing. Standard errors are clustered at the MP-level throughout. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A7: What Types of Men Are More Likely to Submit Questions?

| | Entered (Male MPs) | | | | | | | | |
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Age	0.24								0.24
	(0.16)								(0.17)
Black, Asian or Minority Ethnic		-0.04							-0.96
		(5.10)							(5.31)
State-Schooled			2.96						2.70
			(3.10)						(3.14)
University Degree				-0.32					3.11
				(3.60)					(3.70)
Attended Oxbridge					-7.18**				-7.26**
					(3.46)				(3.53)
Politics-Related Previous Job						-5.02*			-5.17*
						(2.80)			(2.78)
Born Outside of the UK							4.18		-1.87
							(7.26)		(8.58)
Born Outside of England								3.76	4.15
								(3.68)	(3.90)
Observations	59,092	58,739	55,703	58,377	58,448	56,156	47,095	47,095	59,092
Number of MPs	597	589	529	571	570	565	463	463	597
Lottery FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Party FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The unit of observation is MP-lottery (i.e. the stacked specification), with 157 lotteries from 2015 to 2020 (the pre-hybrid era). The sample includes male MPs eligible to enter each lottery (those without a government position). Entered is a variable equal to 100 if the MP entered the PMQs lottery and zero otherwise. Coefficients can then be interpreted as percentage point effects. All control variables shown are dummy variables, with the exception of Age, which is in years. To avoid losing observations due to missinginess, column 9 additionally includes dummy variables for each control being missing, and each control is set to -99 when missing. Standard errors are clustered at the MP-level throughout. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Figure A8: Gender Gap Versus Female Representation in Parliament
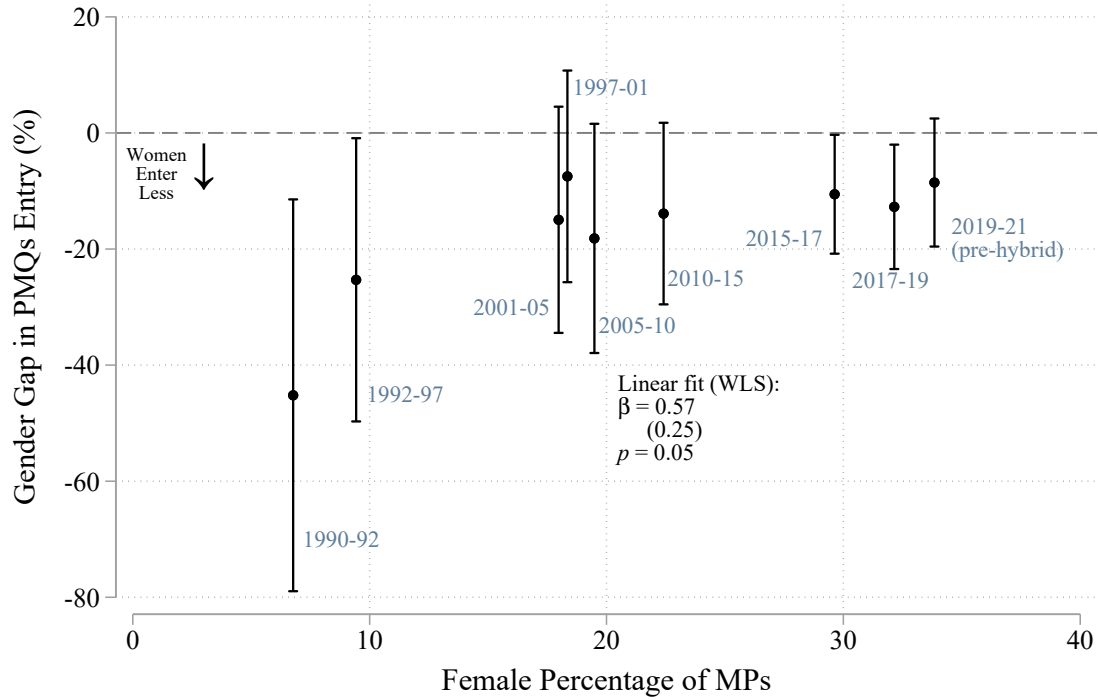

Notes: The figure plots the term-level (nine terms from 1990-92 to 2019-21) PMQs gender gap and 95% confidence intervals against the average female percentage of sitting MPs during that term. The 2019-21 term keeps only pre-hybrid lotteries. The last three terms use the specification in column 2 of Table 2, while the earlier terms use that of Figure 1 (and these earlier terms have less precision given that we only observe lottery winners rather than entrants). The linear fit referenced in the figure comes from an $N = 9$ weighted OLS regression of the estimated gender gap (point estimate) on the female percentage of MPs, with the inverse of the squared standard error as weights, and robust standard errors.

Figure A9: Gender Heterogeneity in the Effect of Lottery Wins
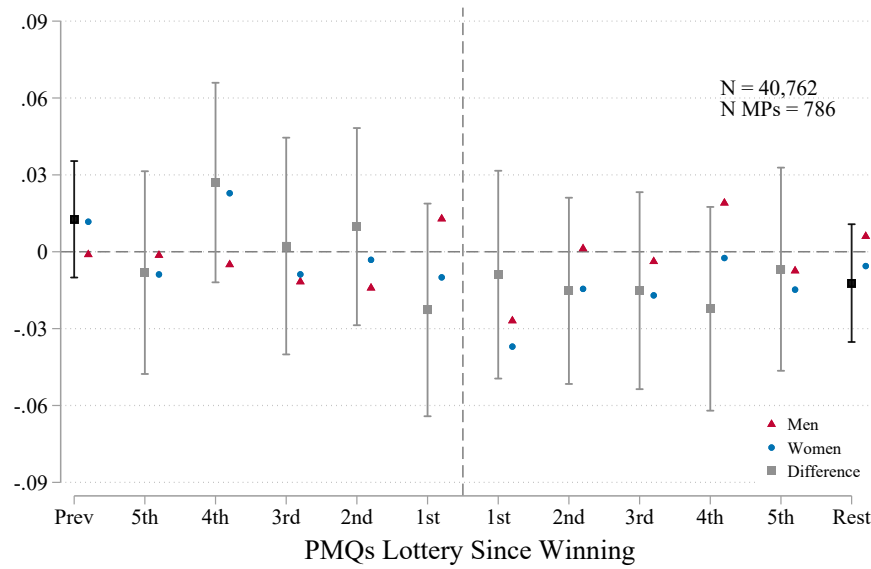
Notes: The figure plots the gender difference in the effect of winning on previous and subsequent entries, i.e. the coefficient on the interaction between female and treatment dummies in the stacked specification. The point estimates from the stacked specification run separately for women and men (identical to those in Figure 3) are plotted in blue and red.

Figure A10: Gender Heterogeneity in the Effect of Lottery Wins, Conditional on Cohort and Party
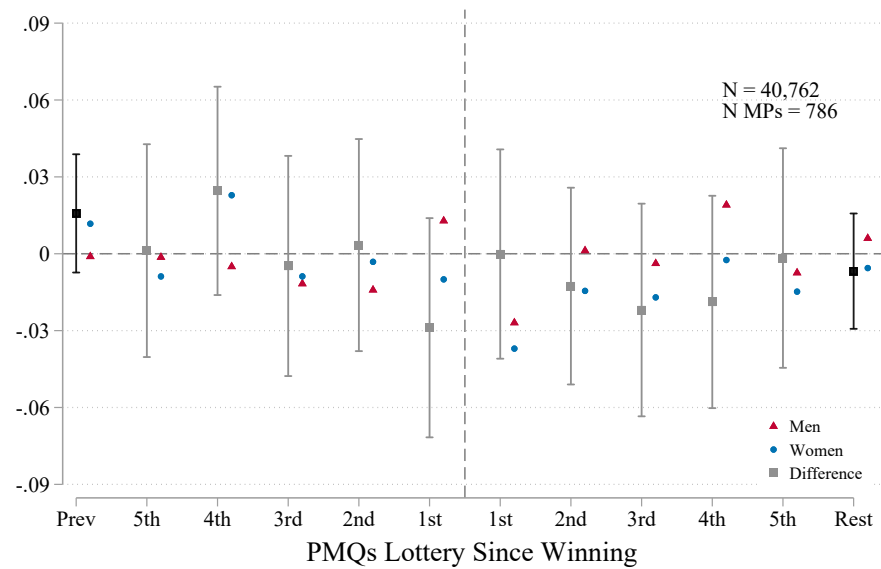

Notes: The figure plots the gender difference in the effect of winning on previous and subsequent entries (i.e. the coefficient on the interaction between female and treatment dummies in the stacked specification), conditional on cohort and political party (i.e. the regression includes the full set of interactions between winning and cohort dummies, and between winning and party dummies). The point estimates from the stacked specification run separately for women and men (identical to those in Figure 3) are plotted in blue and red.

Figure A11: Effects of Question-Asking On Future Question-Asking: Stacked Panel Robustness

(a) All MPs
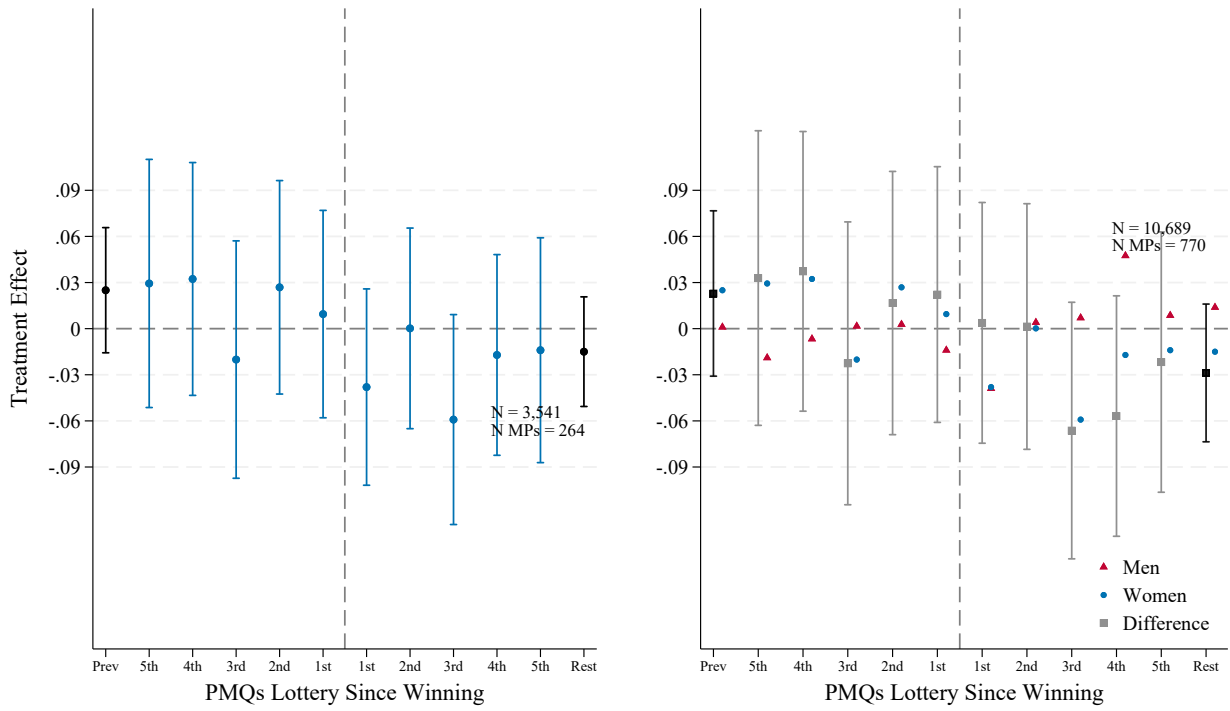

(b) Female MPs

(c) Male MPs
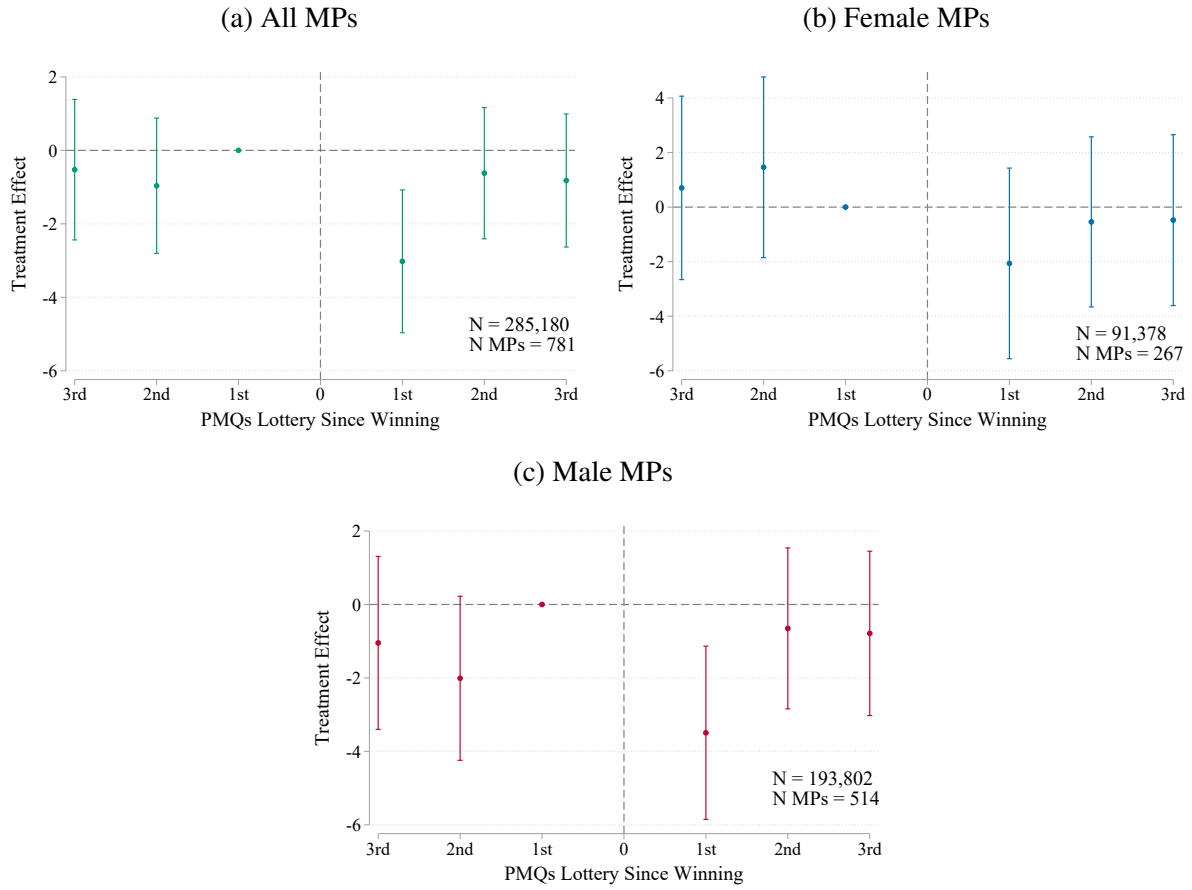
Notes: The figure shows the effects of winning the PMQs lottery on entry into future PMQs lotteries. The balanced panel sample includes entrants to lotteries from 2015 to 2020. The estimates derive from a stacked panel specification, with MP-by-lottery and relative week-by-lottery fixed effects, and interactions between winning and relative week. Standard errors are clustered at the MP-level, and 95% confidence intervals are shown.

Figure A12: Gender Heterogeneity in the Effect of Lottery Wins After Reweighting
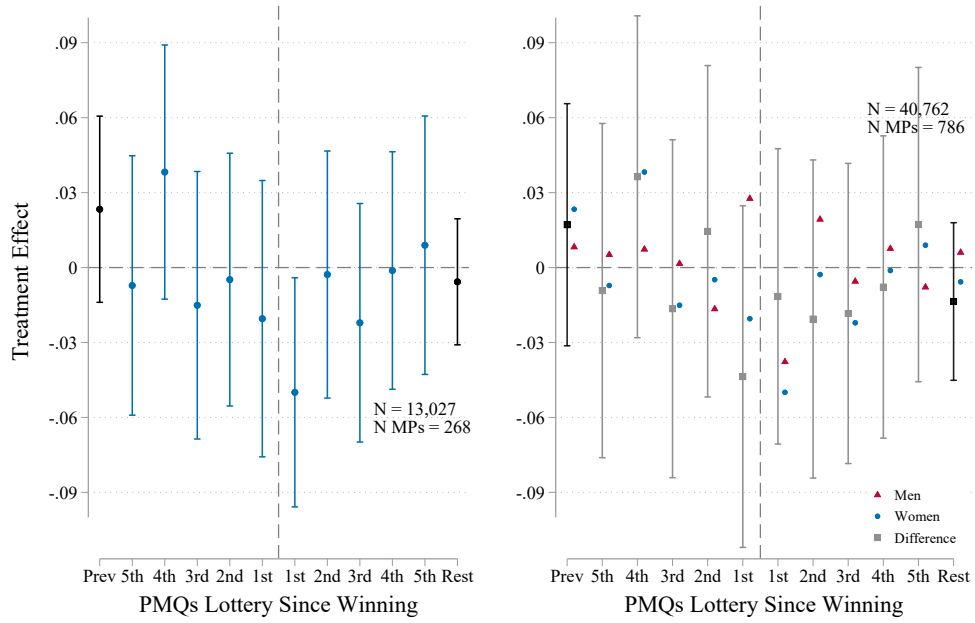
Notes: The left-hand-side panel plots the effects of PMQs' lottery wins for female MPs, with reweighting by the inverse probability of prior lottery entry that session. The right-hand-side panel plots the difference in the effect between female and male winners, with the same reweighting.

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Figure A13: The Effect of Lottery Wins for Not-Yet Winners

Notes: The left-hand-side panel plots the effects of PMQs' lottery wins for female MPs that had not won the lottery since the 2015/16 session began. The right-hand-side panel plots the difference in the effect between female first-time winners and male first-time winners.

Table A8: The Gender Gap in Question-Asking Does Not Close With Parliamentary Experience

|	Entered (1)	Entered (2)	Entered (3)
Female $\times$ Years of Experience	-0.03	-1.05	-2.42
	(0.86)	(1.47)	(2.51)
Observations	87,129	34,698	19,757
Sample	All	Exper$\leq$5	Exper$\leq$2
Number of MPs	882	434	422
Outcome Mean	49.3	63.9	63.6
Lottery FE	Yes	Yes	Yes
MP FE	Yes	Yes	Yes

Notes: Stacked specification where the unit of observation is MP-lottery, including the 157 lotteries from 2015 to 2020 (the pre-hybrid era). The sample includes only those MPs eligible to enter each lottery (those without a government position). Column 2 includes only those with Years of Experience less than or equal to five years. Column 3 includes those with experience less than or equal to two years. Entered is a variable equal to 100 if the MP entered the PMQs lottery and zero otherwise. Coefficients can then be interpreted as percentage point effects. Years of Experience is the number of years since the MP was first elected to the House of Commons (until the date of the PMQs lottery). Note that there is no Female dummy, as it is fully collinear with the MP fixed effects, and similarly there is no Years of Experience level variable, as it is fully collinear with the lottery fixed effects (which are equivalent to date fixed effects) after absorbing the MP fixed effects. Standard errors are clustered at the MP-level throughout. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A9: The Gender Gap in Question-Asking Does Not Close With Accumulated PMQs Experience

|	Entered		
	(1)	(2)	(3)
Female × No. of Wins Since 1990/91	0.50	0.53	-1.41
	(0.63)	(0.81)	(1.46)
Observations	87,129	34,698	19,757
Sample	All	Exper≤5	Exper≤2
Number of MPs	882	434	422
Outcome Mean	49.3	63.9	63.6
No. of Wins Since 1990/91 Control	Yes	Yes	Yes
Lottery FE	Yes	Yes	Yes
MP FE	Yes	Yes	Yes

Notes: Stacked specification where the unit of observation is MP-lottery, including the 157 lotteries from 2015 to 2020 (the pre-hybrid era). The sample includes only those MPs eligible to enter each lottery (those without a government position). Column 2 includes only those with Years of Experience less than or equal to five years. Column 3 includes those with experience less than or equal to two years. Entered is a variable equal to 100 if the MP entered the PMQs lottery and zero otherwise. Coefficients can then be interpreted as percentage point effects. Years of Experience is the number of years since the MP was first elected to the House of Commons (until the date of the PMQs lottery). Note that there is no Female dummy, as it is fully collinear with the MP fixed effects. Standard errors are clustered at the MP-level throughout. *** p<0.01, ** p<0.05, * p<0.1.

Figure A14: Effects of Questions From Women on the Entry of Others

(a) Female MPs
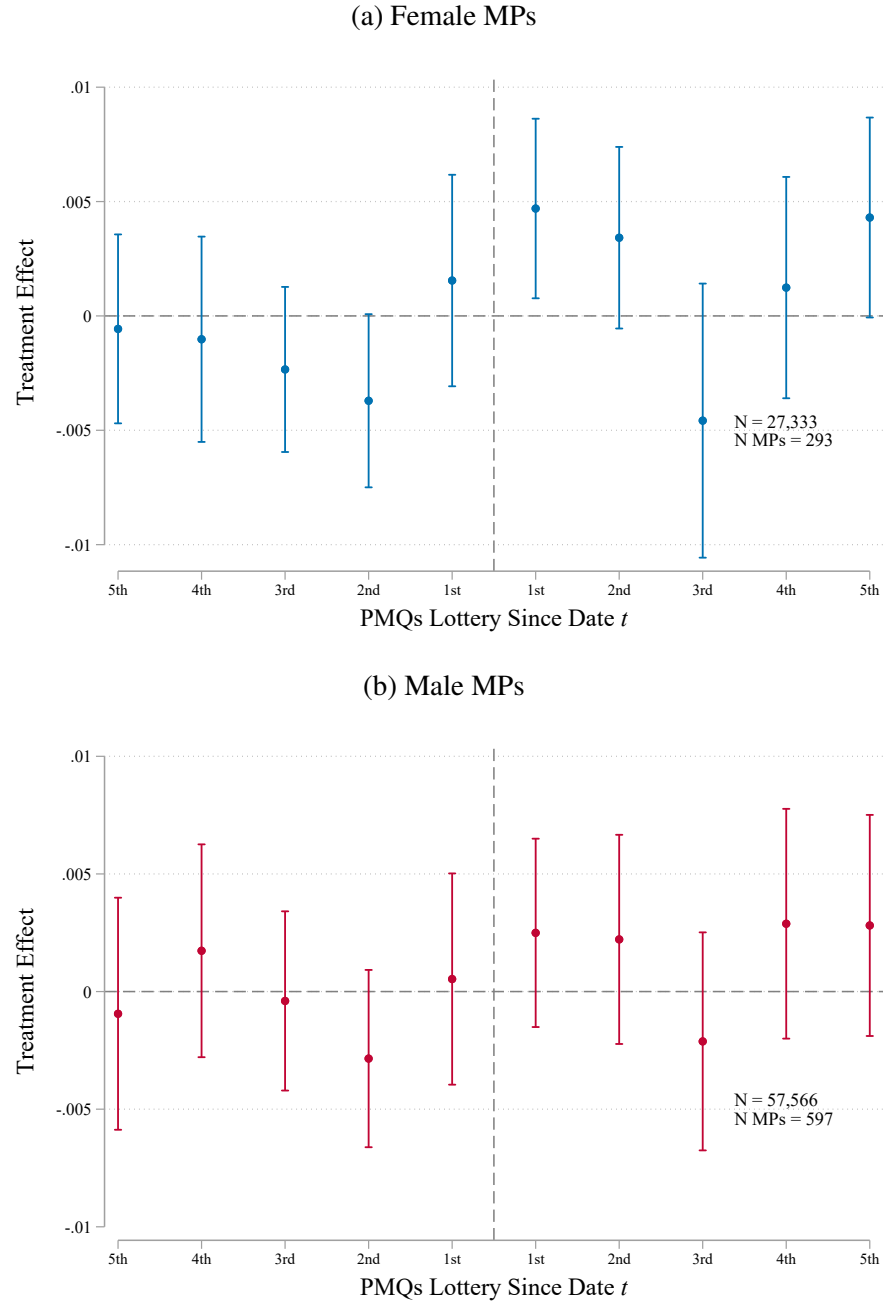
(b) Male MPs



Notes: The figure plots the causal effect of an additional female (other than MP *i*) winning for female and male MPs separately, using stacked specification 3. Each marker is from a separate regression. The markers to the right of the dashed line show the effect on entering the next five lotteries. The markers to the left denote balance checks, showing that an additional female winner in the current lottery does not predict decisions to enter the previous five lotteries. The observation numbers in the bottom-right refer to the effect on the 1st lottery since date *t*. The sample includes all time *t* lottery-eligible MPs, for the 156 PMQs lotteries from 2015 to 2020. 95% confidence intervals are shown.

Figure A15: PMQs Attendance Over Time
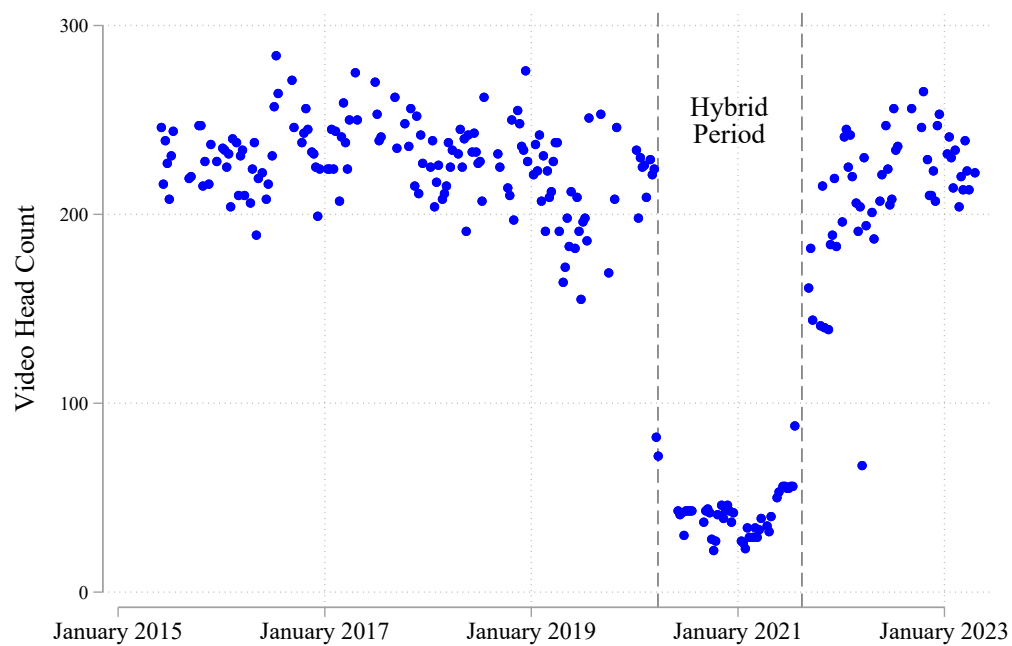
Notes: The figure plots the estimated number of people physically present in the House of Commons for Prime Minister's Questions across time. The estimates are made by observing YouTube videos of each PMQs, pausing the video at the point that the camera shows the full room.

# Figure A16: Virtual Question Share Over Time
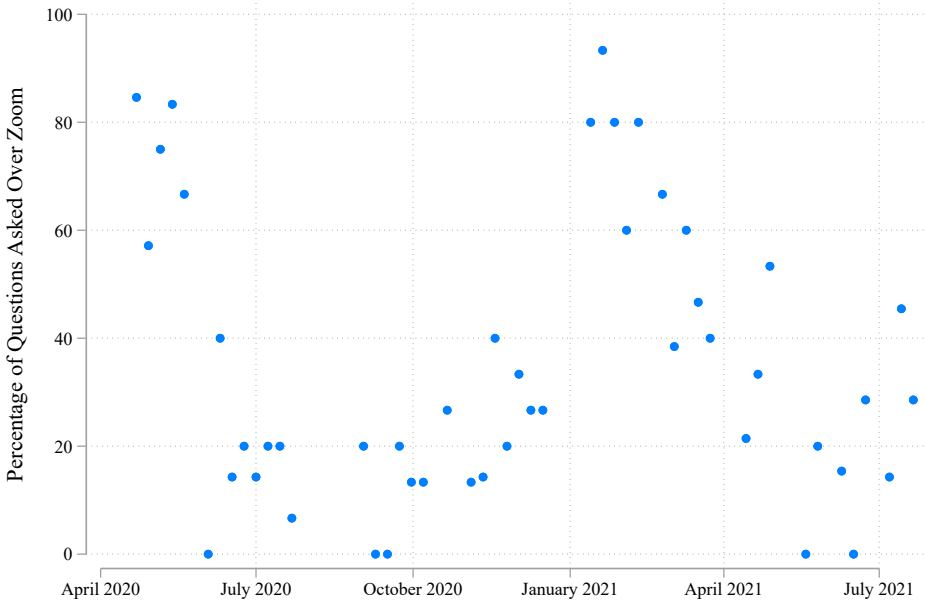
Notes: The figure plots the percentage of PMQs lottery-selected questions that were asked over Zoom (as opposed to in-person) during the period of hybrid proceedings.

Table A10: Lottery Entry Is Higher During the Hybrid Era

	Entered			
	(1)	(2)	(3)	(4)
Hybrid Period	10.70***	4.73***	4.51***	4.24***
	(1.36)	(1.38)	(1.38)	(1.29)
Post-Hybrid Period	1.66	-4.29***	-4.52***	-4.34***
	(1.36)	(1.37)	(1.37)	(1.30)
Observations	146,205	146,205	146,205	146,199
Number of MPs	909	909	909	903
Pre-Hybrid Outcome Mean	49.3	49.3	49.3	49.3
Cohort FE	No	Yes	Yes	Yes
Party FE	No	No	Yes	Yes
MP FE	No	No	No	Yes
p(Hybrid Period = Post-Hybrid Period)	<0.001	<0.001	<0.001	<0.001

Notes: The unit of observation is MP-lottery, including 264 lotteries from 2015 to 2023. The sample includes only those MPs eligible to enter each lottery (those without a government position). Entered is a variable equal to 100 if the MP entered the PMQs lottery and zero otherwise. Coefficients can then be interpreted as percentage point effects. Hybrid and Post-Hybrid Period are dummy variables indicating lotteries held during the hybrid and post-hybrid eras. Standard errors are clustered at the MP-level throughout. *** p<0.01, ** p<0.05, * p<0.1.

Figure A17: PMQs Eligibility by Gender and Month
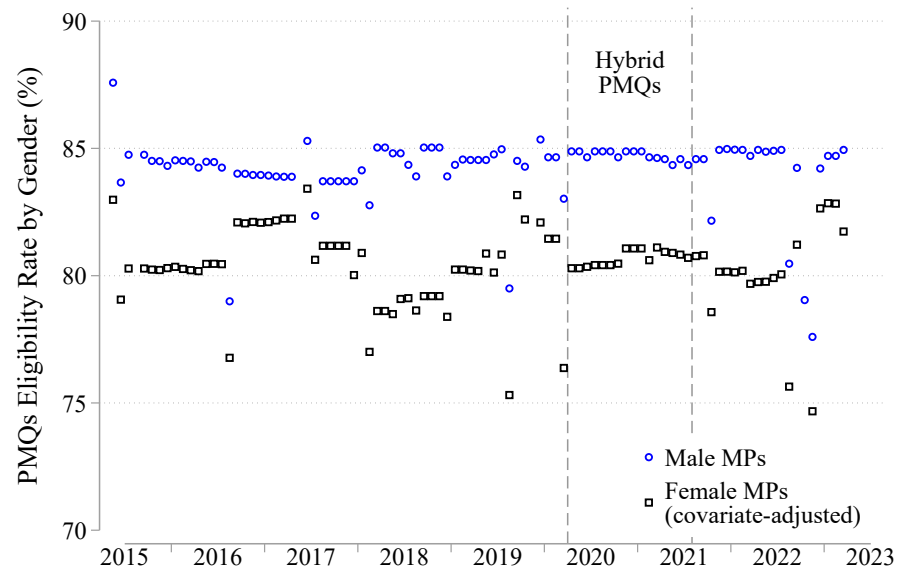
Notes: The figure shows the fraction of male MPs that are eligible for PMQs each month, and the equivalent covariate-adjusted fraction for female MPs: from adding on the female coefficient from a regression with cohort and political party fixed effects (in line with our preferred specification, column 2 of Table 2). Female MPs have lower eligibility rates as they are more likely to hold government positions.

Table A11: The Closing Of The Gender Gap Is Not Due To Health Questions Becoming More Important

	Entered		
	(1)	(2)	(3)
Female	-5.95***		
	(2.27)		
Female × Hybrid	4.30	4.54*	5.21*
	(2.66)	(2.76)	(2.88)
Female × Post-Hybrid	5.12*	5.42*	5.62*
	(2.78)	(2.86)	(2.93)
Female × Health Topic Share	45.96	65.90	41.62
	(70.29)	(68.66)	(75.85)
Observations	142,887	142,881	135,209
Male Outcome Mean	51.4	51.4	51.6
Lottery FE	Yes	Yes	Yes
Cohort-Period FE	Yes	Yes	Yes
Party-Period FE	Yes	Yes	Yes
MP FE	No	Yes	Yes
MP-Calendar Week FE	No	No	Yes
p(Pre-Hybrid Gap = Hybrid and After Gap)	0.06	0.06	0.04

Notes: The unit of observation is MP-lottery, including 258 lotteries from 2015 to 2023 (we lose 6 lotteries due to missing transcripts, with these transcripts required for the Health Topic Share variable). The sample includes only those MPs eligible to enter each lottery (those without a government position). Entered is a variable equal to 100 if the MP entered the PMQs lottery and zero otherwise. Coefficients can then be interpreted as percentage point effects. Health Topic Share is the week-level share of health-related words in exchanges between male lottery winners and the Prime Minister. Cohort-Period FE are cohort fixed effects fully interacted with dummy variables for the pre-hybrid, hybrid, and post-hybrid periods (similar for Party-Period FE). The p-value in the bottom row reflects a test of the null hypothesis that the gender gap pre-hybrid is equal to the one from the hybrid period onwards. This comes from a separate regression in which Female × Hybrid and Female × Post-Hybrid are replaced with Female × Hybrid and After. Standard errors are clustered at the MP-level throughout. *** p<0.01, ** p<0.05, * p<0.1.

Table A12: The Closing Of The Gender Gap Is Not Due To COVID-19-Related Questions Becoming More Important

|	Entered		
	(1)	(2)	(3)
Female	-5.79***		
	(2.24)		
Female × Hybrid	4.54*	4.65*	5.06*
	(2.66)	(2.76)	(2.89)
Female × Post-Hybrid	5.25*	5.50*	5.61*
	(2.80)	(2.88)	(2.93)
Female × COVID-19 Topic Share	-86.11	10.42	129.04
	(299.82)	(295.83)	(350.61)
Observations	142,887	142,881	135,209
Male Outcome Mean	51.4	51.4	51.6
Lottery FE	Yes	Yes	Yes
Cohort-Period FE	Yes	Yes	Yes
Party-Period FE	Yes	Yes	Yes
MP FE	No	Yes	Yes
MP-Calendar Week FE	No	No	Yes
p(Pre-Hybrid Gap = Hybrid and After Gap)	0.04	0.04	0.04

Notes: The unit of observation is MP-lottery, including 258 lotteries from 2015 to 2023 (we lose 6 lotteries due to missing transcripts, with these transcripts required for the COVID-19 Topic Share variable). The sample includes only those MPs eligible to enter each lottery (those without a government position). Entered is a variable equal to 100 if the MP entered the PMQs lottery and zero otherwise. Coefficients can then be interpreted as percentage point effects. COVID-19 Topic Share is the week-level share of COVID-19-related words in exchanges between male lottery winners and the Prime Minister. Cohort-Period FE are cohort fixed effects fully interacted with dummy variables for the pre-hybrid, hybrid, and post-hybrid periods (similar for Party-Period FE). The p-value in the bottom row reflects a test of the null hypothesis that the gender gap pre-hybrid is equal to the one from the hybrid period onwards. This comes from a separate regression in which Female × Hybrid and Female × Post-Hybrid are replaced with Female × Hybrid and After. Standard errors are clustered at the MP-level throughout. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A13: COVID-19-Related Topics During PMQs Do Not Predict Entry

|	Entered		
	(1)	(2)	(3)
COVID-19 Topic Share	-0.32	-0.21	-0.48
	(0.61)	(0.92)	(1.05)
Exchange	PM-vs-Opp	PM-vs-MP	All
Observations	111	111	111
Outcome Mean	55	55	55
Month-Period FE	Yes	Yes	Yes

Notes: The unit of observation is at the lottery level. We include all lotteries from the first week when COVID-19 was mentioned during the PMQs to the last week when COVID-19 was mentioned. Entered is the percentage of MPs that entered the PMQs lottery, calculated using only those MPs eligible to enter each lottery (those without a government position). COVID-19 Topic Share is the standardized week-level share of COVID-19-related words in exchanges. The row Exchange indicates how COVID-19 Topic Share is calculated: using exchanges between the PM and the leader of the opposition, between the PM and the MPs who won the lottery that week, or all exchanges. Month-Period FE are month fixed effects fully interacted with dummy variables for the pre-hybrid, hybrid, and post-hybrid periods. Robust standard errors are reported throughout. *** p<0.01, ** p<0.05, * p<0.1.

Figure A18: Gender Differences in Question and Response Length
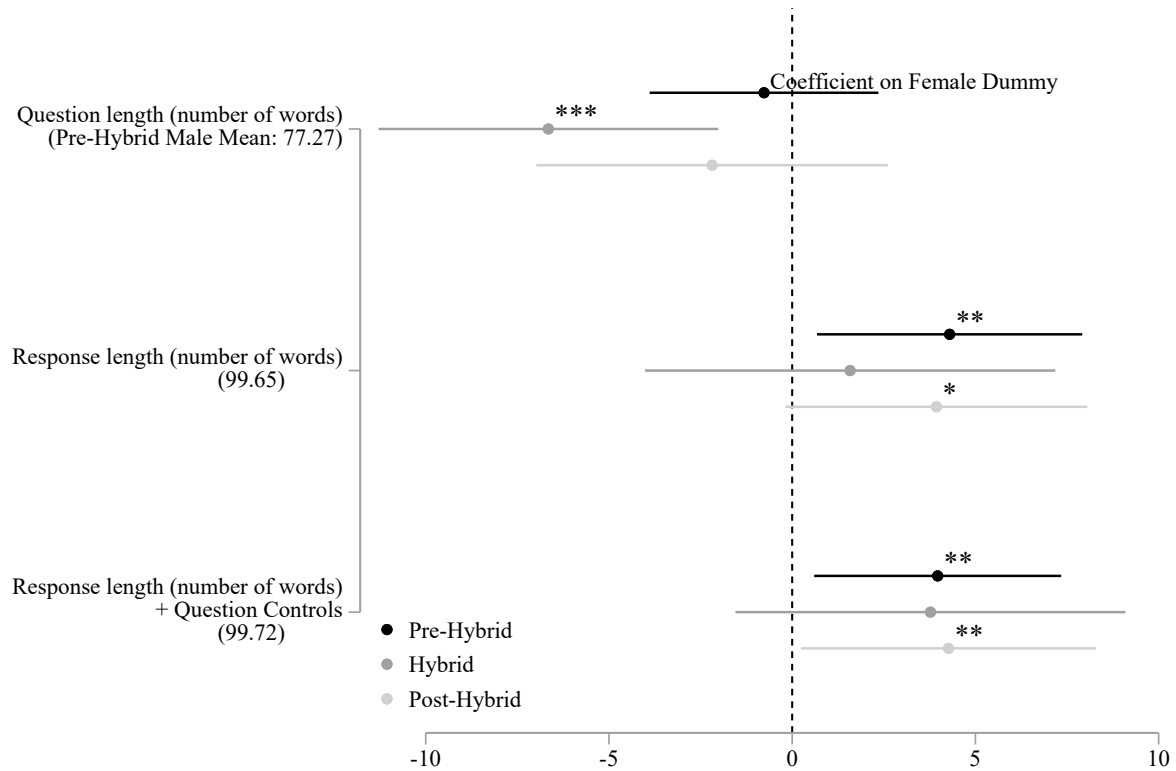
Notes: The figure shows the coefficient on the female indicator variable from specification 4, for three different periods: pre-hybrid PMQs (2,236 exchanges), hybrid PMQs (677 exchanges), and post-hybrid PMQs (740 exchanges). In each regression, we include cohort, week, and coder fixed effects, and party fixed effects for the party of the MP asking the question. For the "+ Question Controls" regressions, we additionally control for question characteristics: Question Length, as well as the following indicator variables: Constituency Issue, Humor in Question, Request, Issue Update, Prompt for Comment, Agreement, Self-Promotion/Narrow Factual, and Concede-accept/condemnatory. 95% confidence intervals are shown. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Figure A19: Gender Differences in Responses Controlling for Question Characteristics
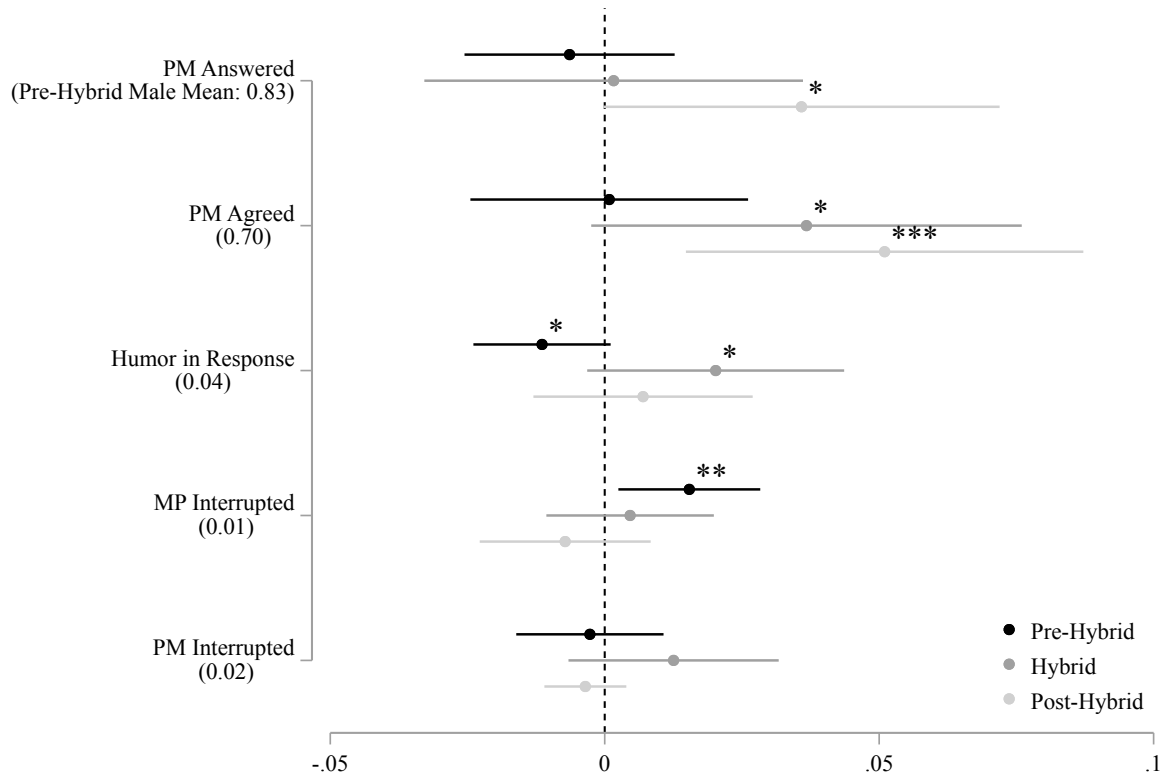

Notes: The figure shows the coefficient on the female indicator variable from specification 4, for three different periods: pre-hybrid PMQs (2,236 exchanges), hybrid PMQs (677 exchanges), and post-hybrid PMQs (740 exchanges). In each regression, we include cohort, week, and coder fixed effects, and party fixed effects for the party of the MP asking the question. In addition, we control for question characteristics: Question Length, and the following indicator variables: Constituency Issue, Humor in Question, Request, Issue Update, Prompt for Comment, Agreement, Self-Promotion/Narrow Factual, and Concede-accept/condemnatory. 95% confidence intervals are shown. *** p<0.01, ** p<0.05, * p<0.1.

Table A14: Female Questioners Face More Negative Disruptions

	Disruption	
	(1)	(2)
Female	1.89**	1.88**
	(0.91)	(0.91)
Observations	2,141	2,141
Male Outcome Mean	2.84	2.84
Date FE	Yes	Yes
Cohort FE	Yes	Yes
Party FE	Yes	Yes
Margin and Posts	No	Yes

Notes: The unit of observation is MP-date, using stacked specification 2. The sample covers questions from the lottery winners for the 149 PMQs from 2015 to 2020 (the pre-hybrid era) with available YouTube videos. Disruption is equal to 100 if the MP's question was negatively disrupted, and zero otherwise, as coded manually from watching YouTube videos of PMQs. Coefficients can then be interpreted as percentage point effects. Margin and Posts denote controls for the MP's vote margin at their last election, and dummy variables for holding an opposition post (e.g. shadow minister) or a parliamentary post (e.g. vice-chair of the MP's party). Standard errors are clustered at the MP-level. *** p<0.01, ** p<0.05, * p<0.1.

Figure A20: Rowdy Exchanges Were Less Common During the Hybrid Era
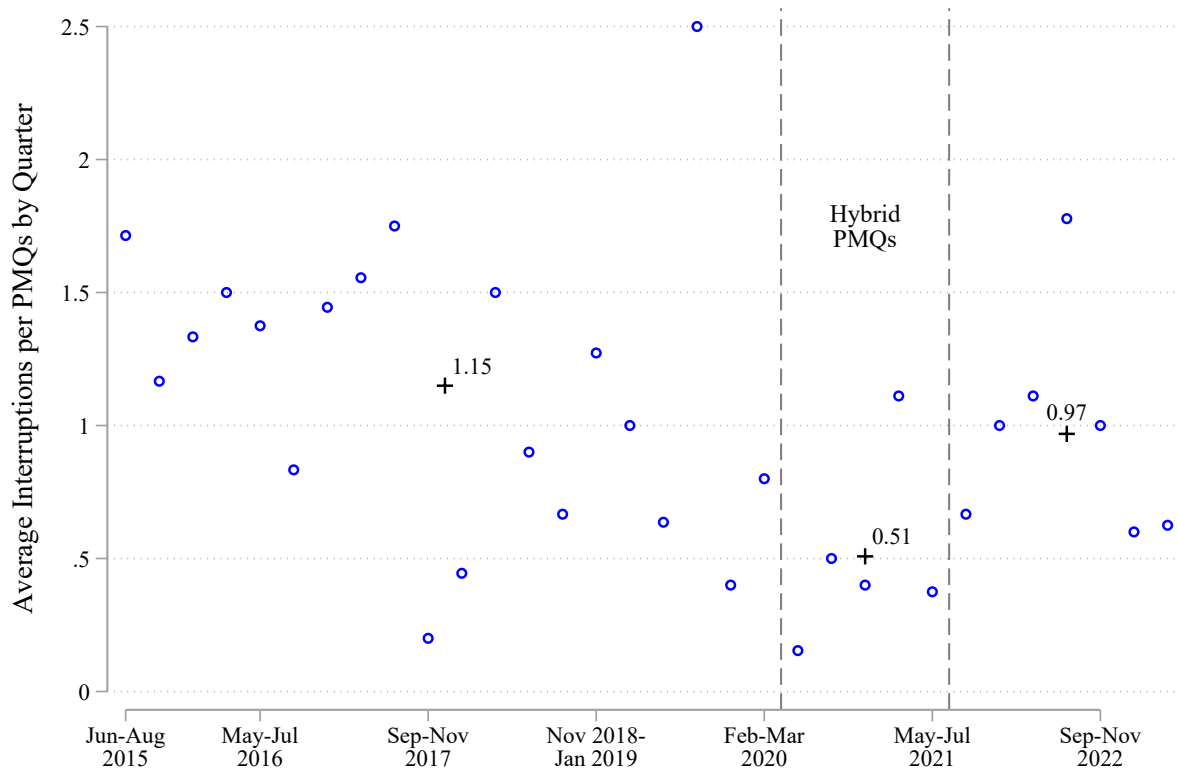
Notes: The figure shows the average number of interrupted exchanges per PMQs (recorded in parliamentary transcripts, used elsewhere as the exchange-level variable *Rowdy Exchange*) against time. The blue circles denote the averages by quarter. The black crosses denote the averages for the three key periods: pre-hybrid, hybrid, and post-hybrid.

Table A15: Attendance, Gender Composition, and Adversarial Atmosphere

	MP Interrupted Share			Rowdy Exchange Share		
	(1)	(2)	(3)	(4)	(5)	(6)
Attendance (z-score)	0.005**	0.005**	0.003	0.007	0.008	0.009
	(0.002)	(0.002)	(0.003)	(0.005)	(0.005)	(0.006)
Female Share (z-score)	-0.001	-0.001	0.000	-0.008	-0.007	-0.003
	(0.002)	(0.003)	(0.004)	(0.005)	(0.005)	(0.008)
Observations	209	209	209	209	209	209
Outcome Mean	0.018	0.018	0.018	0.078	0.078	0.078
Month FE	No	Yes	No	No	Yes	No
Quarter-Specific Linear Time Trend	No	No	Yes	No	No	Yes

Notes: The unit of observation is the PMQs date. The sample includes all lotteries in the pre- and post-hybrid period. MP Interrupted is the share of PMQs questions that were severely interrupted, requiring the Speaker to intervene. Rowdy Exchange Share is the share of PMQs question-answer exchanges that faced any interruption. Attendance (z-score) is the standardized total number of MPs in attendance (SD = 28.83). Female Share (z-score) is the standardized share of attending MPs that are female (SD = 0.06). Quarter-Specific Linear Time Trend is a set of quarter dummies fully interacted with the PMQs date to allow for differential linear time trends by quarter. Robust standard errors are reported throughout. *** p<0.01, ** p<0.05, * p<0.1.

Table A16: Female MPs Are No More Likely to Contribute to Rowdiness Than Male MPs

	Talking, Laughing, or Shouting (1)	Shouting (2)
Female	-0.013	0.016
	(0.040)	(0.014)
Observations	593	593
Male Outcome Mean	0.377	0.013
Lottery FE	Yes	Yes

Notes: The sample consists of MPs from 25 randomly selected PMQs in the pre-hybrid period. Information on the MPs are recorded visually from a YouTube clip of the PMQs livestream in which the chamber is rowdy. Talking, Laughing, or Shouting is an indicator variable equal to one if the MP is visibly talking, laughing, or shouting during the clip, and zero otherwise. Shouting is an indicator variable equal to one if the MP is visibly shouting during the clip, and zero otherwise. Standard errors are robust. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A17: Female Questioners Are Not Detectably Further From Microphones

|	Microphone Visible	
	(1)	(2)
Female	-0.09	-0.06
	(0.10)	(0.11)
Observations	138	133
Male Mean	0.67	0.66
Party FE	No	Yes
Cohort FE	No	Yes

Notes: The sample includes the PMQs lottery winners that went on to actually ask a question, from 10 randomly selected lotteries from the pre-hybrid period. The unit of observation is at the MP-lottery level. Microphone Visible is a dummy variable equal to one if a microphone head is visible in the YouTube screenshot of the MP asking their question, zero otherwise. Standard errors are clustered at the MP-level. *** p<0.01, ** p<0.05, * p<0.1.

Figure A21: The Gender Gap in Questions to the Health Secretary Was Not Affected
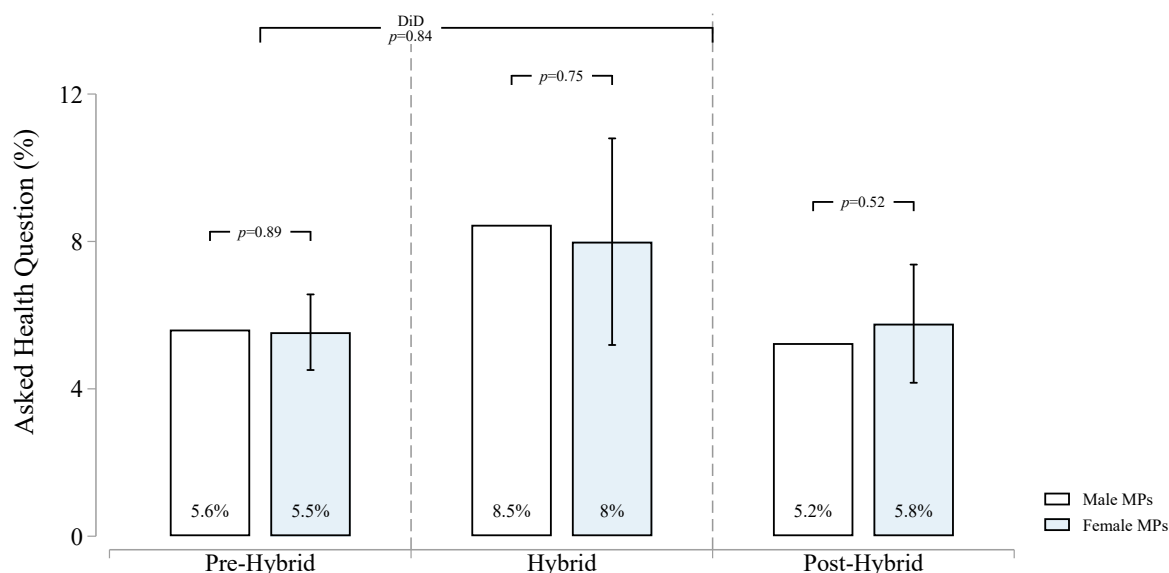
Notes: For questions to the Prime Minister we have data on the names of all MPs that submitted a question; for questions to the other ministers, we only have data on those randomly selected to ask a question (from among those that submitted). The white bars show the raw percentage of eligible male MPs that asked an oral question to the Health Secretary during three periods: before hybrid proceedings (June 2015 to March 2020), during hybrid (April 2020 to July 2021), and after the return to the in-person-only format (September 2021 to April 2023). The blue bars show the percentage for eligible women, derived from our preferred specification with lottery, cohort, and political party fixed effects (following column 2 of Table 2). Three p-values reflect tests of the null hypothesis that the gender gap in entry in a given period is zero, while the DiD p-value reflects a test of the null hypothesis that the gender gap pre-hybrid is equal to the one from the hybrid periods onwards.

Figure A22: The Gender Gap in Questions to Other Ministers Was Not Affected
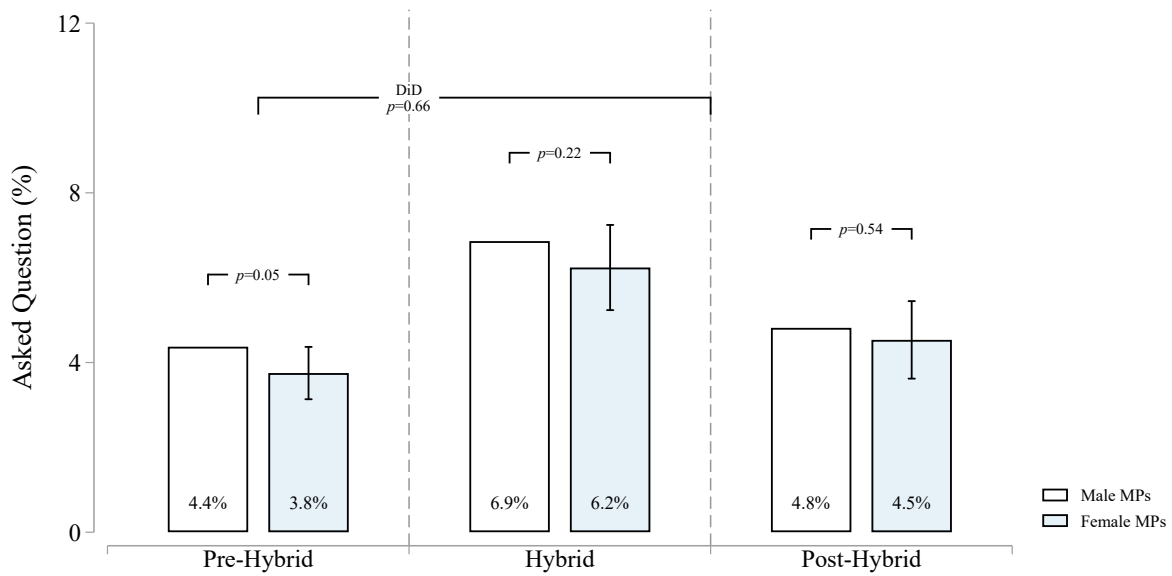
Notes: For questions to the Prime Minister we have data on the names of all MPs that submitted a question; for questions to the other ministers, we only have data on those randomly selected to ask a question (from among those that submitted). The white bars show the raw percentage of eligible male MPs that asked an oral question to other ministers (excluding Health) during three periods: before hybrid proceedings (June 2015 to March 2020), during hybrid (April 2020 to July 2021), and after the return to the in-person-only format (September 2021 to April 2023). The blue bars show the percentage for eligible women, derived from our preferred specification with lottery, cohort, and political party fixed effects (following column 2 of Table 2). Three p-values reflect tests of the null hypothesis that the gender gap in entry in a given period is zero, while the DiD p-value reflects a test of the null hypothesis that the gender gap pre-hybrid is equal to the one from the hybrid periods onwards.

Table A18: Are Female MPs More Likely to Ask Questions Remotely?

	Asked Remotely			
	(1)	(2)	(3)	(4)
Female	5.37	4.79	4.66	4.15
	(3.99)	(4.07)	(4.10)	(4.41)
Previous Vote Margin (%)			0.03	-0.02
			(0.13)	(0.13)
Holds Opposition Post			-5.02	-2.14
			(7.98)	(8.20)
Holds Parliamentary Post			10.54	10.31
			(12.99)	(14.44)
Age (Years)				0.49**
				(0.21)
Elections Lost				0.21
				(2.10)
Black, Asian or Minority Ethnic				-1.13
				(7.01)
State-Schooled				-4.12
				(4.83)
University Degree				-3.64
				(5.72)
Attended Oxbridge				-0.89
				(4.62)
Politics-Related Previous Job				1.77
				(4.25)
Born Outside of the UK				4.63
				(11.57)
Born Outside of England				-1.45
				(5.96)
Observations	676	676	676	676
Number of MPs	341	341	341	341
Male Outcome Mean	32.7	32.7	32.7	32.7
Lottery FE	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
Party FE	No	Yes	Yes	Yes

Notes: The sample includes PMQs lottery winners during the hybrid era, and the unit of observation is MP-lottery. Asked Remotely is a variable equal to 100 if the MP chose to ask their question over Zoom, rather than in-person. Coefficients can then be interpreted as percentage point effects. Previous Vote Margin and Posts controls denote the MP's vote margin at their last election, and dummy variables for holding an opposition post (e.g. shadow minister) or a parliamentary post (e.g. vice-chair of the MP's party). Additional Controls include age, number of parliamentary elections lost prior to first joining the House of Commons, dummy for Black and minority ethnic, dummy for attended state school, dummy for attended university, dummy for studied at Oxford or Cambridge university, dummy for politics-adjacent job prior to entering the House of Commons, dummy for born abroad, and dummy for born outside England, along with dummies for missing (not shown), as these variables are missing for some of the MPs in our sample. Standard errors are clustered at the MP-level throughout. *** p<0.01, ** p<0.05, * p<0.1.

Figure A23: The Hybrid Format Change Does Not Affect YouTube Viewership
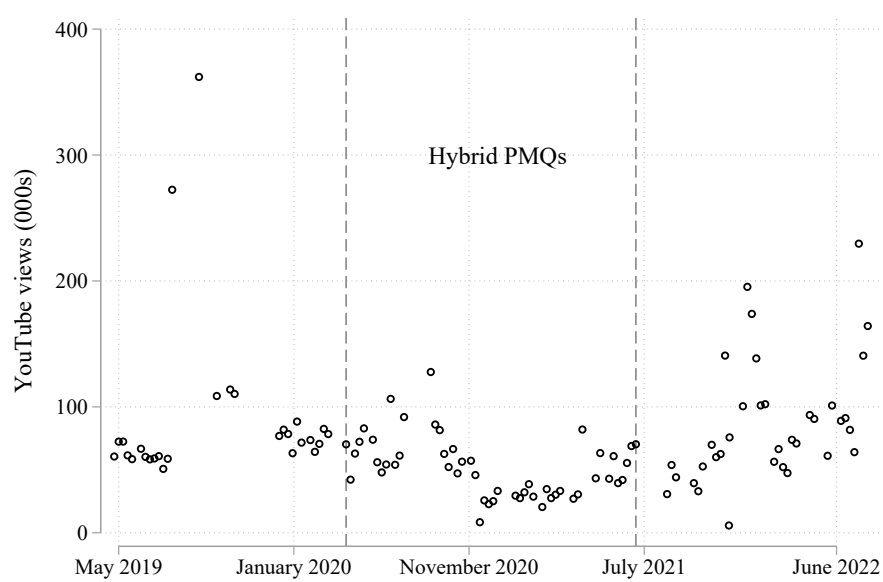
Notes: This figure shows the total YouTube views that each PMQs received on the video posted to the official UK Parliament YouTube channel as of July 15, 2025.

Table A19: Gender Differences in Reactions to PMQs Posts on Twitter

|	Twitter Profile (1)	Posted on Twitter (2)	Number of Likes (3)	Number of Reposts (4)	Number of Replies (5)
	Panel A: Pre-Hybrid Period				
Female	0.04	0.11*	24.85	0.05	2.44
	(0.03)	(0.06)	(20.92)	(10.25)	(2.62)
	Panel B: Hybrid Period				
Female	-0.11	-0.05	85.09***	31.46***	9.37***
	(0.07)	(0.07)	(28.78)	(10.86)	(3.45)
	Panel C: Post-Hybrid Period				
Female	-0.11*	0.00	-75.55	-28.60	-5.52
	(0.06)	(0.07)	(57.76)	(19.95)	(4.53)
Full Sample Observations	1,124	959	607	607	607
Full Sample Outcome Mean	.85	.63	114	47	13
Lottery FE	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes
Party FE	Yes	Yes	Yes	Yes	Yes

Notes: The sample includes the PMQs lottery winners from 75 randomly selected lotteries: 25 during the pre-hybrid period, 25 during the hybrid period, and 25 during the post-hybrid period. We collect information on each MP's engagement on Twitter about the PMQs they participated in. The outcome variables are: (1) whether an MP had a Twitter profile as of the lottery, (2) whether the MP posted about the PMQs on Twitter conditional on having a profile, (3) number of likes of the post, (4) number of reposts of the post, and (5) number of replies to the post. Outcome in column 2 is set to missing if the MP did not have a Twitter profile as of the lottery date. Outcomes in columns 3 to 5 are set to missing if the MP did not make a post about their question. Further, they are also winsorized at the 95th percentile to reduce the influence of outliers. *** p<0.01, ** p<0.05, * p<0.1.

Table A20: The Gender Gap Remains Closed During 2023 to 2025

	Entered and Won		
	(1)	(2)	(3)
Female	-0.05	-0.02	-0.04
	(0.20)	(0.20)	(0.20)
Observations	42,255	42,255	42,255
Male Outcome Mean	2.54	2.54	2.54
Lottery FE	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes
Party FE	No	Yes	Yes
Margin and Posts	No	No	Yes

Notes: The unit of observation is MP-lottery (i.e. the stacked specification), with 76 lotteries from April 2023 to July 2025. The sample includes only those MPs eligible to enter each lottery (those without a government position). The outcome variable is equal to 100 if the MP won the PMQs lottery and zero otherwise (for this time period we do not have data on which MPs entered the lottery, we only know which MPs won, as these MPs are listed on publicly available Order Papers). Coefficients can then be interpreted as percentage point effects. Margin and Posts denote controls for the MP's vote margin at their last election, and dummy variables for holding an opposition post (e.g. shadow minister) or a parliamentary post (e.g. vice-chair of the MP's party). Standard errors are clustered at the MP-level throughout. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Figure A24: Women Continue to Ask More Often After Hybrid Ends, Men Do Not
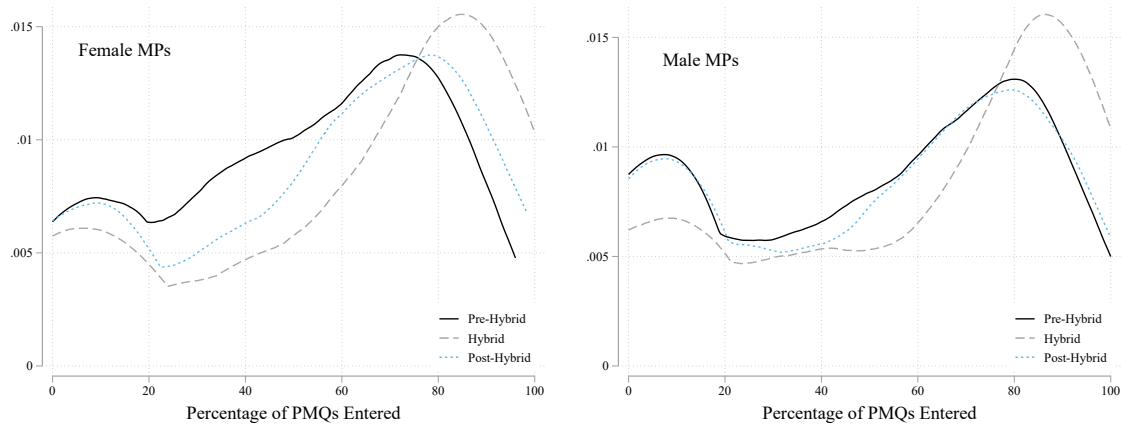
Notes: The figure plots kernel densities of the PMQs entry rate separately for men and women, and separately for the pre-hybrid, hybrid, and post-hybrid periods. For a given MP and period, the entry rate is calculated as the percentage of PMQs lotteries entered, only among the lotteries for which they were eligible to enter. We keep only the MP-period observations for which an MP was eligible to enter at least 20 lotteries.
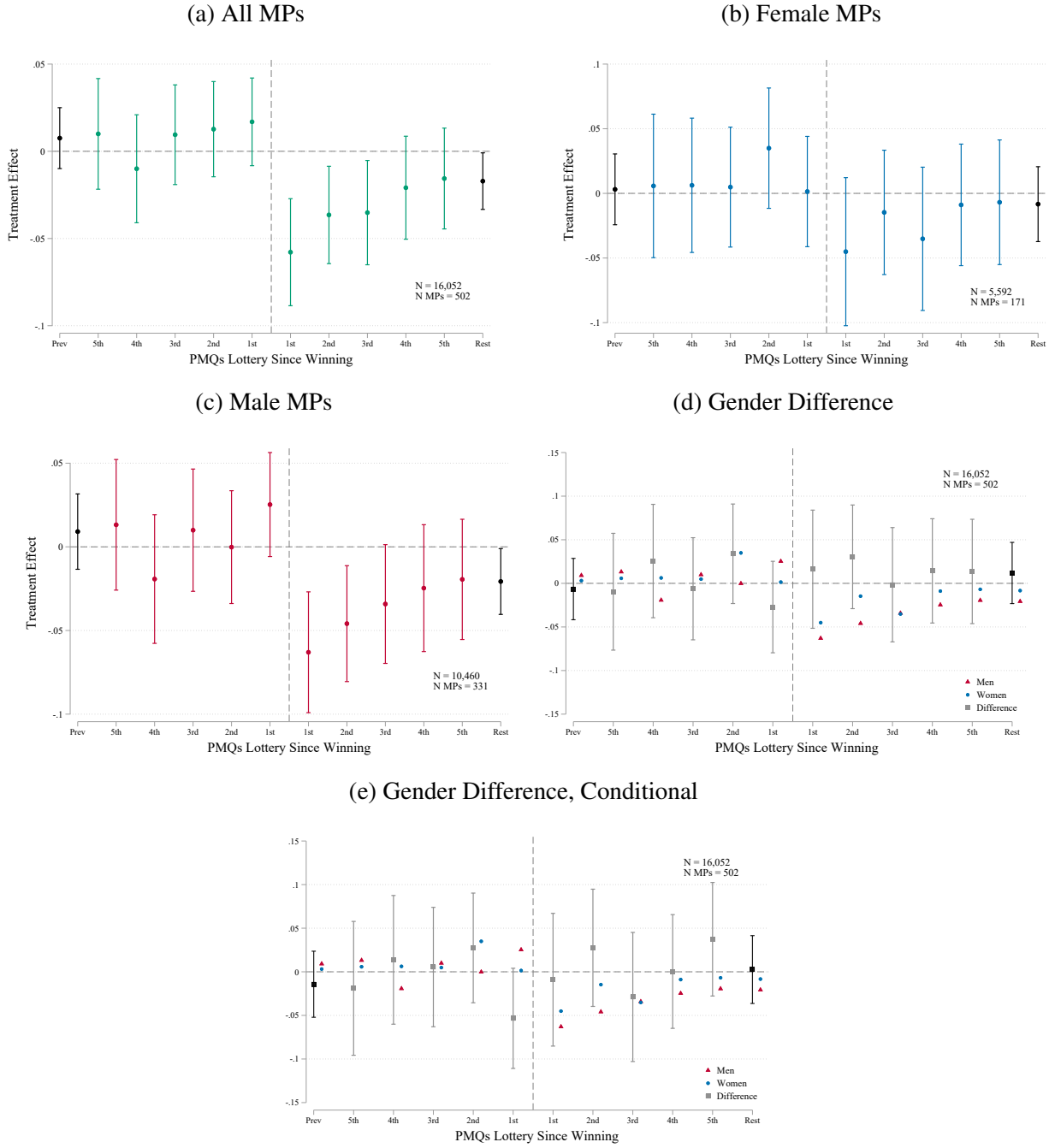
Table A21: Hybrid Lottery Winners Are No More Likely To Ask Questions Post-Hybrid

	Post-Hybrid Entry (%)		
	(1)	(2)	(3)
Won	-0.45	-1.63	0.20
	(0.93)	(1.59)	(1.15)
Observations	16,368	5,702	10,666
Gender Sample	All	Female	Male
Lottery Sample		Hybrid Lotteries Only	
Male Outcome Mean	62.3	62.3	62.3
Lottery FE	Yes	Yes	Yes
Lagged Control	Yes	Yes	Yes

Notes: Stacked specification where the unit of observation is MP-lottery, including only lotteries during the hybrid era, and only MPs that entered each lottery. The outcome is the percentage of post-hybrid PMQs lotteries entered. Won is a dummy variable equal to one for those MPs that won the lottery. Lagged Control is the proportion of PMQs lotteries entered since the current session began. Standard errors are clustered at the MP-level throughout. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Figure A25: Effects of Hybrid Questions on Future Entry

(a) All MPs

(b) Female MPs

(c) Male MPs

(d) Gender Difference

(e) Gender Difference, Conditional

Notes: The figure shows the effect of winning a hybrid-era PMQs lottery on future lottery entry. See Figures 3, A9, and A10 for full details.

A Data Appendix

MP Characteristics. Further to the description in Section 3.1, we use the Parliament Members' Names Data API to find the date of birth for each MP in our sample, allowing us to calculate an MP's age on the date of each PMQs lottery. We fill in some missing dates of birth through online sources (predominantly Wikipedia and news articles), and in some cases we have slight measurement error, where only the year or year and month is known.

From the API we also construct a variable *Elections Lost*, which is the number of parliamentary elections a given MP had lost prior to first entering the House of Commons. This variable serves as a proxy for the circuitous-ness of an MP's route into national politics.

Chris Butler and Rosie Campbell kindly shared additional MP-level data, collected for MPs elected in general elections 2015, 2017, and 2019. This data has varying missingness depending on the exact variable, though still covers a large fraction of the 890 unique MPs that were eligible for at least one of the pre-hybrid lotteries. From their data we construct the following variables:

- *BAME* ($N = 876$): dummy variable equal to one if the MP is Black, Asian or Minority Ethnic.

- *State School* ($N = 760$): dummy variable equal to one if the MP was educated in a comprehensive, academy, or state-funded non-selective school.

- *University* ($N = 843$): dummy variable equal to one for having graduated from university.

- *Oxbridge* ($N = 840$): dummy variable equal to one for having attended Oxford or Cambridge University.

- *Politics Job* ($N = 841$): dummy variable equal to one for having had a politics-adjacent job prior to entering the House of Commons (e.g. other elected office, special advisor (a temporary civil servant that assists a government minister)).

- *Born Abroad* ($N = 687$): dummy variable equal to one for being born outside of the United Kingdom.

- *Born Outside England* ($N = 687$): dummy variable equal to one for being born outside of England.

Election Data. For general elections prior to 2005, we use data hosted by www.politicsresources. net, while for general elections from 2005 to 2024, we use data held by the Electoral Commission, along with House of Commons research briefings compiled by the House of Commons Library. For by-elections, we use additional research briefings.

Earlier and Later PMQs Lottery Winners. From 1990/91 to 1996/97, the lottery winners are listed on daily schedules that are available in bound journals in the parliamentary archives. We scanned and digitized these schedules. For 1997/98 to 2014/15, we web-scraped schedules available on the UK Parliament website. For 2023 to 2025, we manually assembled the lists from Order Papers on https://commonsbusiness.parliament.uk/.

Voting Attendance. See https://www.parliament.uk/about/how/covid-19-proceedings-in-the-house/remote-voting/ for full details on voting procedures during COVID-19. The voting data can be found at https://hansard.parliament.uk/search/Divisions?startDate=2015-05-27&endDate=2023-06-13&house=Commons&includeCommitteeDivisions=True&partial=False&sortOrder=0. We code MPs as present or not for each vote. An MP is present for a vote whenever (i) they are recorded as having voted aye or no or both (those that vote both are "actively abstaining"), and not through assigning a proxy voter to vote on their behalf, or (ii) they were assigned the role of "teller" (and so responsible for counting the votes). Other than voting both aye and no, MPs can also abstain by continuing to occupy their seats during a vote. In this case, although they are present in the House of Commons, we would miscode them as not present, unless they satisfied (i) or (ii) for at least one other vote on the same day.

B Learning From Others Specification Details

The key regression equation for our learning from others analysis is:

$$\text{Entered}_{it+k} = \alpha_{s(t)} + \beta_1^k \text{Number of female winners (exc. } i)_{it}$$
$$+ \beta_2^k \text{Won}_{it} + \gamma_1^k \text{Number of female entrants (exc. } i)_{it} \tag{5}$$
$$+ \gamma_2^k \text{Number of male entrants (exc. } i)_{it} + \gamma_3^k \text{Entered}_{it} + \varepsilon_{it}$$

The unit of observation and outcome are the same as those used in specification 1. The sample includes all MPs eligible to enter the lottery at t. Since the identifying variation is now at the lottery-level, we no longer include date fixed effects. Instead, we include session fixed effects ($\alpha_{s(t)}$), which are not needed for identification but can increase power.

Our key regressor is the number of female lottery winners at time t excluding MP i, meaning that we again estimate ITT effects. This variable is only exogenous conditional on the number of female and male entrants excluding MP i (in particular, conditioning only on the number of female entrants, we would systematically have more female winners in weeks where there are fewer male entrants, given that there are 15 winners each week). In the same regression, we include a dummy variable for whether MP i entered lottery t, and one for whether they won lottery t. It follows that β_2^k captures the effect of MP i winning lottery t on whether they enter lottery $t+k$, while β_1^k captures the effect of an additional female (other than i) winning lottery t on whether MP i enters lottery $t+k$. The γs are coefficients on nuisance controls – they are not of direct interest, nor are they interpretable as causal. As with the learning from own experience analysis, we run the regression separately for female MPs and male MPs.

We again use $k \in \{1,2,3,4,5\}$ to estimate the dynamic effects of winning on future entry, and $k \in \{-5,-4,-3,-2,-1\}$ for balance checks. We use two-way clustered standard errors by MP and by date, given that the level of treatment is now the lottery-date rather than the MP.