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Online Activism and Dyadic Representation: Evidence from the UK E-Petition System

By making it easier for citizens to communicate their preferences, online forms of political participation have the potential to strengthen the representational link between politicians and voters. However, we know little about the effects of online advocacy on politicians' behavior. Using new data from an e-petition system in the United Kingdom, I show that support for a petition among a Member of Parliament's constituents is associated with a substantial increase in the probability that the MP advocates for the petition in parliamentary debate, even when compared to MP behavior in counterfactual non-petition debates which focus on the same policy issues. However, MP responsiveness is conditioned both by party discipline and electoral competition. These findings have important implications for our understanding of dyadic representation in parliamentary systems.

Normative theories of democratic representation suggest that, when viewed as delegates, politicians should advance the preferences of their constituents (Pitkin 1967). In single-member district (SMD) electoral systems, a key concern is whether legislators' actions reflect the specific views of their districts—a concept usually described as “dyadic” representation (Weissberg 1978). Indeed, the idea that SMD-systems incentivize responsiveness to local concerns is commonly cited as one of their central virtues (Carey and Hix 2011; Norris 2001). However, a central dilemma for reelection-seeking politicians is that acquiring information on the preferences of voters can be difficult and costly. This can have pernicious effects, for even when politicians have incentives to adapt their behavior to reflect constituents' preferences, a paucity of information will mean that politicians' knowledge of such preferences may be biased (Broockman and Skovron 2018; Norris and Lovenduski 2004); that responsiveness will be limited (Stimson,

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MacKuen, and Erikson 1995); and that the quality of democratic representation is likely to suffer (Mansbridge 2003, 518). Put bluntly, it is hard to do what the voters want if you do not know what it is that the voters want you to do.

The growth of online political activity therefore represents an important change to the information environment faced by politicians. By lowering the costs of acquiring political knowledge and giving citizens new mechanisms for communicating with their representatives, the Internet has the potential to improve the informational link between politicians and voters. For some scholars, this promises to strengthen representation and “enrich democracy” (Coleman and Blumler 2009, 11). However, despite these claims, we lack empirical evaluations of whether new online forms of political expression have had tangible effects on the quality of dyadic responsiveness. This article helps to fill this gap.

In particular, I investigate the effects on dyadic representation of one popular form of online democratic engagement: government-sponsored electronic petition (e-petition) systems. Taking the United Kingdom as a case study of the effectiveness of these systems, I argue that e-petitions represent a valuable source of information on constituent preferences for reelection-seeking Members of Parliament (MPs). The SMD electoral system used for Westminster elections creates incentives for MPs to cater to their constituents (Cain, Ferejohn, and Fiorina 1984), and although these incentives may be weaker than in some other systems (Carey and Shugart 1995), recent evidence suggests that voters in the United Kingdom are more supportive of MPs who have strong local links with the constituency (Campbell et al. 2019b); who dedicate more time to constituency issues (Vivyan and Wagner 2016); and who demonstrate greater independence from the party line (Campbell et al. 2019a; Vivyan and Wagner 2012). However, due to a paucity of polling information at the local level in the United Kingdom, MPs typically learn about constituent preferences through imperfect signals—emails, letters, face-to-face interaction, social media, and so on—which makes it difficult to form accurate judgments of constituency opinion, and potentially inhibits legislator responsiveness.

The petition data I study, by contrast, provides MPs with useful information for evaluating the strength of constituency opinion across a variety of issues. E-petitions are publicly available on a dedicated government website where anyone can sign by

providing their name, email address, and postcode. The system is popular: UK e-petitions accumulated more than 50 million signatures between 2015 and 2019, and petition signing is the second most popular form of political activity (after voting) in the United Kingdom, with nearly 30% of adults signing e-petitions each year (Hansard Society 2018). Critically, the e-petitions website also presents signature counts for each petition at the level of parliamentary constituencies. Legislators can therefore observe the local strength of support for each petition and use this information to guide their actions in ways that are likely to be electorally rewarding, and in so doing may improve the representation of constituent interests in the policy process.

Politicians in parliamentary systems such as the United Kingdom, even when sufficiently informed about constituent preferences, may be prevented from demonstrating responsiveness to local demands by party leaders who wield strong powers of party discipline and agenda control. As Cain et al. suggest, an inherent tension in SMD parliamentary systems is that “electoral rules create incentives for a personal vote and legislative rules deny representatives the opportunity to establish it” (1987, 217). However, the petition system in the United Kingdom also provides a venue for responding to that information which is generally not subject to control by party leaders: any e-petition that receives more than 100,000 signatures is considered for debate in parliament. MPs’ speeches in the United Kingdom are significantly less constrained by party discipline than their voting decisions, and an MP’s decision to participate in debate—the main dependent variable of interest here—also constitutes an important representative act, as making a speech in a debate of great local interest allows an MP to literally “speak up” for her constituents’ interests. I therefore evaluate the dyadic relationship between UK MPs and constituents by examining patterns of participation in these petition debates.

The expectation I test is straightforward: MPs will be more likely to participate in debates on petitions marked by high levels of local support. However, if an MP already has a strong sense of which issues are important to her constituents, she might participate in a given petition debate even in the absence of the e-petition. An MP from an agricultural constituency, for example, will likely receive many signatures on agricultural petitions, will probably attend the relevant petition debates, but

will probably also attend *non-petition* agricultural debates. In such situations, the relationship between petitions signatures and debate behavior will be confounded. While issues such as these cannot be entirely avoided when using observational data, I describe an empirical strategy which helps to reduce such concerns. Combining statistical topic models with a multilevel random-effects model, I show that MPs' responsiveness to constituent activism in petition debates differs from their behavior in counterfactual non-petition debates that are otherwise very similar in terms of topical content.

My argument and empirical analysis relates specifically to e-petition systems that are formally integrated into the broader political process and so speaks less to non-governmental e-petition systems which have been the focus of study elsewhere (Halpin et al. 2018). Given that both academics and policymakers see e-petitions as a method for strengthening the representational bond between representatives and their constituents (Bochel 2012; Hough 2012; Kennedy Stewart, Cuddy, and Silongan 2013; Procedure Committee 2014), the rapid adoption of these government-sponsored systems in many countries in recent years is perhaps unsurprising.¹ However, the empirical literature on e-petitions has largely been limited to descriptive evidence of the petitioning process, with a focus on documenting the types of people who start (Wright 2015) and sign (Jungherr and Jürgens 2010) e-petitions, the issue agendas petitions promote (Hersh and Schaffner 2018), the rate at which petitions grow (Yasseri, Hale, and Margetts 2017), as well as perceptions of the effectiveness of such systems (Escher and Riehm 2017). What is notably lacking from this literature is an assessment of the effects of these petitions on political representation within legislatures, something that I provide here.

In addition, the vast majority of research on dyadic representation has focused on the presidential system of the United States (Kastellec, Lax, and Phillips 2010; Krimmel, Lax, and Phillips 2016; Miller and Stokes 1963). While recent work suggests that dyadic responsiveness in parliamentary voting in the United Kingdom is nonzero (Hanretty, Lauderdale, and Vivyan 2016), such evidence is mostly limited to non-typical roll-call votes where no whip is imposed or in rare instances where votes cut across party lines. Here, I go beyond roll-call votes and expand the range of activities examined to include MP participation in debates. Further, existing studies of dyadic representation in parliamentary

systems either rely on demographic proxies for measuring constituency opinion (Blidook and Kerby 2011; Hibbing and Marsh 1987; Soroka, Penner, and Blidook 2009), or are limited to evaluating the dyadic relationship on a small number of high-profile issues that are covered in national opinion polls (Hanretty, Lauderdale, and Vivyan 2016). As Stimson et al. argue, “while we, as scholars, rely solely on public opinion polls to do our work, politicians surely do not” (1995, 562), and so an additional value of studying e-petitions is that because petition signature counts are publicly available, they also offer a rare opportunity for researchers to observe the same indicators of constituency-demand as those observed by politicians.

I report three main results in the article. First, MPs are substantially more likely to participate in debates relating to petitions signed by many of their constituents. Second, while this effect is robust to controlling for participation on topically similar non-petition debates, MP responsiveness is clearly conditioned by both party discipline and electoral competitiveness. Finally, MPs not only *participate* more in relevant debates, but they are also more likely to use their speeches to *express agreement* for e-petitions marked by stronger local support. Taken together, these findings suggest that e-democracy initiatives can significantly strengthen representational ties between citizens and politicians, but that the effects of such initiatives are also likely to be mediated by existing political incentives.

Information, Dyadic Representation, and Parliamentary Debate

Positive accounts of representation suggest that reelection-seeking politicians will tailor their behavior to satisfy the wishes of voters, either by taking positions that align with constituents’ preferences or by allocating attention to the most salient constituency-specific issues (Cain, Ferejohn, and Fiorina 1984; Downs 1957; Hall 1996; Mayhew 1974). Information is a central component of these theories (Mansbridge 2003, 516–20), as legislators are expected to infer the preferences of their constituents and use this knowledge to guide their legislative decisions. However, legislators will only occasionally have access to high-quality information to learn about the opinions of their constituents on particular policy issues. More commonly, legislators must rely on heuristics to evaluate the strength of local opinion towards policy: how much correspondence has the legislative office received? How prominent is the

issue in local media? How often do constituents mention the issue “on the doorstep”? It is therefore unsurprising that politicians invest significant resources in gathering information about constituent preferences (Maestas 2003), and that even small changes in this information can translate into meaningful changes in legislative behavior (Bergan and Cole 2015; Butler, Naurin, and Öhberg 2017).

For MPs in the United Kingdom, the value of e-petitions resides in the additional signal they offer about constituents’ preferences. This information is marked by two important properties. First, e-petition signature counts are typically available at low geographic levels of aggregation. Locally disaggregated information allows legislators to respond to the specific preferences of their constituents, which may differ from those of the population at large. Such information is likely to be especially valuable in the United Kingdom, where constituency-specific polls are rare (Johnston et al. 2018; Wring, Mortimore, and Atkinson 2016). Constituency signature counts for each petition are made available on a centralized website, and this information is easy for MPs to access both in terms of the raw data and in the form of an interactive online map.² In addition, for petitions receiving more than one hundred thousand signatures, the parliamentary Petitions Committee also provides this information directly to MPs by emailing them a spreadsheet of the signatures in each constituency (Procedure Committee 2014, 48). MPs clearly access this information, as they frequently refer to specific signature counts in the course of petition debates.³

Second, e-petitions tend to address a diverse set of topics, which contrasts with the limited range of issues considered by national opinion polls, and on which it is unlikely that MPs will always have strong prior understanding of constituent preferences. For instance, the petition calling on the government to “Stop allowing immigrants into the UK”⁴ is typical of the type of issue that might feature in UK election campaigns. By contrast, the petition that lobbied the government to “Give the Meningitis B vaccine to ALL children”⁵ addressed an issue that is not typically central to UK political debate, and where MPs were likely to have weaker intuitions about the importance of the issue to their constituents. E-petitions may therefore also be informative about constituent opinion on issues that have not previously been a part of the political agenda. Moreover, UK e-petitions feature both issues that represent crucial dividing lines in contemporary

British politics⁶ and also “valence” issues on which most voters share a common preference.⁷ For issues that involve high-levels of voter disagreement, local petition signature counts can help MPs to learn about the balance of opinion on that issue among their constituents. For valence issues, signature counts may likewise be informative about the relative importance of the issue in the minds of voters. In either case, being attentive to constituency-specific petition support can help MPs to direct their legislative efforts in ways that are likely to appeal to their voters.

Of course, the people who participate in online political activities may be different from those who participate offline—something that is true of the people who sign e-petitions⁸ and so the number of signatures on a given petition will not enable an MP to accurately judge the absolute level of support for an issue among her constituents. However, MPs can still reasonably draw inferences about constituents’ *relative* issue priorities from petition signatures. On the one hand, an MP could learn about the local salience of an issue by comparing the signature rate on a given petition in their constituency to the signature rate on that petition in other constituencies. Learning from these “across-constituency” comparisons simply requires the belief that petition signers are similarly unrepresentative across different constituencies. On the other hand, an MP could draw inferences by making comparisons between the signature rate in their constituency on one petition to the signature rate in their own constituency on other petitions. That there may be systematic differences between online activists and constituents in general is not problematic for making this type of “within-constituency” comparison, as such biases can be reasonably thought to be constant within constituencies across issues.

Qualitative evidence suggests that MPs do in fact make comparisons both across constituencies and within constituencies across petitions.⁹ For example, in a debate on a high-profile petition in 2017, one MP pointed out that a “higher percentage of constituents from [my constituency] signed the petition than from any other constituency and I am proud to represent them today” (Lucas 2017). Similarly, in a debate in 2018, another MP suggested that “589 of my constituents have signed the petition, which is really high for my constituency” (Hodgson 2018). Overall, although the median petition-signer is unlikely to hold the same views as the median constituent, petitions can nevertheless be used to update legislators’ beliefs about the best ways to allocate their time to different issues. As a consequence, measures of local petition support

are likely to complement the diverse set of heuristics that MPs use to assess the strength of feeling for an issue in their constituency.

However, the informational value that e-petitions have in parliamentary systems may be mitigated by countervailing incentives to toe the party line. The combination of strong powers of party discipline and governmental agenda control means that MPs in parliamentary systems will be less able to use their legislative voting behavior to demonstrate responsiveness to local concerns than is the case for legislators in presidential systems (Carey 2007). In the United Kingdom, for example, although defection in roll-call votes has increased in recent years, the strength of the party whip means that it remains relatively rare (Cowley 2015), and voting records generally reflect partisan divisions rather than information about individual MP behavior (Spirling and McLean 2006). While petitions may strengthen incentives for dyadic behavior, party-discipline constraints in parliamentary systems may mean that MPs are unable to respond to such information.

The UK petition system, however, provides MPs with an alternative mechanism for responding to petitioners' concerns. In particular, any petition that receives over one hundred thousand signatures nationally is considered for debate in parliament. Although the Petitions Committee has some discretion over which debates are scheduled, almost all petitions crossing the one hundred thousand threshold (as well as some slightly below it) have been debated.¹⁰ These debates are attended by members of all political parties as well as the government minister responsible for the relevant department. E-petition debates have become a high-profile part of the parliamentary week, both in the views of MPs themselves¹¹ as well as in terms of the amount of media coverage that is devoted to them.¹²

How might we examine responsiveness in the context of these debates? Politicians may respond to new information about constituent preferences not only by changing their policy positions (as revealed by the votes they cast), but rather by shifting their legislative efforts towards issues that their constituents find most salient. As Hall suggests, constituency influence should not only operate on legislators' voting behavior "but on the intensities that they reveal in their decisions about when and to what extent they will participate in particular matters" (1996, 58). By allocating more of their time to the most pressing local issues, politicians demonstrate their willingness to address constituent concerns. In short,

the decision to participate in a given debate can itself be a representational act.

Legislative debate is a useful arena for pursuing this type of strategy in the United Kingdom. First, parliamentary speeches are publicly visible acts that are widely covered in the UK media and are easy to publicize to constituents. Speaking in parliament is also considered both by voters and MPs to be one of the most important roles that an MP performs (Campbell and Lovenduski 2014). Standing up and making a speech in a debate devoted to a petition which many of your constituents have signed allows the MPs to demonstrate that she has heard local concerns, and has given voice to those concerns in parliament. MPs frequently use parliamentary speeches to draw government attention to issues that are relevant to a certain constituency or to request that a minister takes action relating to the case of a specific constituent. Indeed, the use of constituency-oriented language in parliamentary speech has increased dramatically in the Commons over the past 40 years (Blumenau and Damiani, forthcoming).

In addition, the Petitions Committee provides direct links to both videos and transcripts of petition debates on the e-petition website, making it straightforward for MPs to promote their speeches and to claim credit for responding to petitioner concerns. While MPs cannot directly contact those constituents who signed the petitions—the list of email addresses is not accessible to MPs—they can, and do, report on their activity in petition debates on social media.¹³ That MPs cannot communicate privately with petition signatories also suggests that they cannot use the system as a way of engaging in targeted pandering. Any speech made in a petition debate may reach both supporters and opponents of the petition, and so MPs are only likely to engage with petitions that are supported by a broad coalition of their constituents.¹⁴

Second, and crucially, speechmaking is also less subject to control by party elites than the votes cast in roll calls (Proksch and Slapin 2012). In contrast to other parliamentary systems, the rules governing debate give MPs a great deal of discretion in terms of which the debates to which they contribute, and party leaders have no ability to prevent MPs from speaking on chosen issues. As Soroka et al. suggest, in contexts like the United Kingdom, speechmaking provides a venue “outside the largely party-driven legislative votes, in which dyadic constituency representation may be manifest” (2009, 567). There is no substantive vote at the end of petition debates which suggests that even if strong party discipline

does typically mitigate incentives for dyadic representation in parliamentary systems, MPs may be able to use petition debates to respond to the preferences of their constituents without challenging the party line.

In sum, the UK e-petition system provides MPs with clear information regarding constituent issue priorities and a formal mechanism for responding to that information that is not generally subject to strict party discipline. I therefore expect that MPs will be more likely to participate in debates relating to petitions marked by high levels of local support.

H1: MPs are more likely to participate in debates on petitions signed by many of their constituents than in debates on petitions signed by few of their constituents.

Beyond this central expectation, I also expect the strength of the dyadic link to vary according to electoral and party-discipline incentives. For example, an MP's responsiveness to petitioners' demands is likely to vary as a function of the electoral environment the MP faces. Politicians who win office in constituencies with small electoral margins have greater incentive to respond to constituents than politicians who win office by large margins, and, in the United States, the dyadic connection is indeed stronger for legislators in more competitive districts (Griffin 2006). I expect the same dynamics to operate in the United Kingdom.

H2: The relationship between petition signatures and participation will be stronger for MPs in more electorally competitive constituencies.

Similarly, MPs who have recently entered parliament are also likely to be more eager to establish a dyadic connection with their constituents than their more experienced colleagues. New MPs have had less time to learn about constituent issue priorities or to have established a reputation for standing up for their voters' interests, and so they should be more willing to put on record their support for issues that have attracted significant local support.

H3: The relationship between petition signatures and participation will be stronger for MPs who have recently entered parliament.

By contrast, MPs who hold frontbench positions for either the government or the main opposition party are more likely to be responsive to demands from party leaders than are backbench MPs, as frontbenchers are bound by a hard constraint of collective responsibility (Benedetto and Hix 2007). Similarly, frontbench MPs are formally responsible for attending certain debates in the House (those pertaining to the jurisdiction of their ministries) and so have less freedom to choose which debates to attend.

H4 :The relationship between petition signatures and participation will be weaker for MPs who hold frontbench positions.

Data

I use data on 99 petitions that were granted dedicated debates by the House of Commons Petitions Committee between June 2015 and February 2019.¹⁵ I link information on the number of signatories from each constituency to debate transcripts pertaining to each petition. The Petitions Committee will occasionally group two petitions in the same debate when they address very similar issues, and so the main data of interest come from 76 debates. As discussed below, I also require transcripts for all *non-petition* debates during the same parliamentary term. The total corpus consists of 5,485 debates and close to 350,000 speeches.¹⁶

To construct the independent variable, I take the population normalized *constituency*-level signature counts for a given petition and divide by the population-normalized *national*-level signature counts for that petition.¹⁷ The signature rate for MP i in debate d is given by:

$$\text{Signature rate}_{id} = \frac{\text{Constituency Signatures Per Capita}_{id}}{\text{National Signatures Per Capita}_d} - 1, \quad (1)$$

where I subtract 1 so that for all non-petition debates the signature rate can be set to 0 for all MPs, meaning that the non-petition debates will not contribute to the estimation of coefficients relating to the signature-rate variable.

As discussed above, there are two main types of comparison that MPs make from petition-signature counts. First, MPs may be more likely to participate in a petition debate if their constituency

is high ranked relative to *other constituencies* in terms of signatures on a given petition. Across-constituency comparisons of this sort are clearly reflected in the independent variable described above. That is, Equation (1) directly measures the support for petition d in constituency i relative to the support for petition d in the country as a whole. This suggests that I will only consider an MP to be responsive to increases in petition signatures when those increases are large relative to the support that such petitions receive cross-nationally.

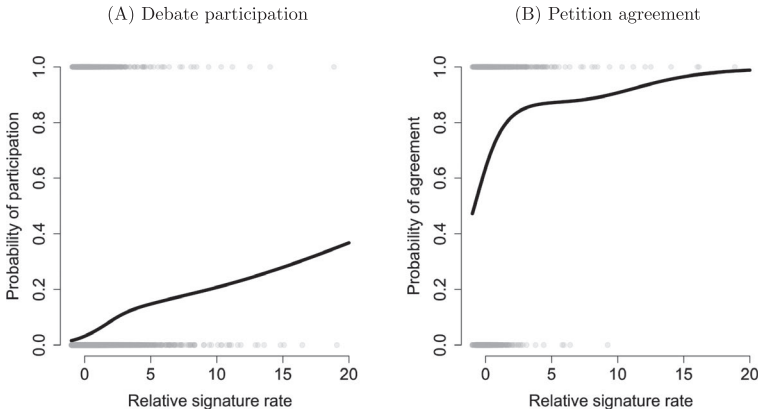
Second, the regression model I describe in the next section includes constituency-specific intercepts, which reflects the intuition that MPs may use within-constituency comparisons across different petitions to inform their debate behavior. The inclusion of these constituency effects means that the key identifying variation in Equation (1) comes from within-constituency changes in the signature rate. This implies that I will only consider an MP to be responsive to petition signatures when the MP is more likely to debate petitions on which Equation (1) is high in comparison to other petitions where Equation (1) is low. Put another way, the model assumes that what matters in determining MP participation decisions is changes in the relative *ranking* of an MP's constituency across petitions.¹⁸

In the main analysis, the dependent variable measures whether MP i participates in debate d or not. An MP is coded as participating when she makes a speech in the debate ($y_{id} = 1$), and zero otherwise. I also consider the effects of signatures on petition *agreement*. Restricting the sample to petition debates, an MP is coded as agreeing with a petition if she expressed overt support for the petition proposal in her speech.¹⁹ Figure 1 shows the probability of debate participation (panel A) and petition agreement (panel B) over the range of the signature rate variable for all petition debates. Gray points are the raw data, and the black lines are a spline fit to the data. The plots illustrate that, in the raw data at least, there is a clear positive relationship between petition signatures and both outcome variables.

Empirical Strategy

Simple comparisons of participation between MPs from constituencies with low and high signature rates are likely to be confounded in a number of ways. First, some constituencies will have higher signature counts, on average, than other constituencies.²⁰

FIGURE 1
Petition Signatures Predict Debate Participation and Petition Agreement



If MPs from these constituencies are also more active in debates *in general* than other MPs, then any association between signatures and participation might reflect these general patterns. To overcome this problem, I estimate MP-specific intercepts that account for fixed tendencies for some MPs to participate in debate more than others. As suggested above, the implication of these intercepts is that identification of the signature rate effect relies only on within-MP variation.

Second, some petitions are clearly more salient than others. For example, the “EU Referendum Rules triggering a 2nd EU Referendum” petition²¹ received more than four million signatures nationally and was subject to extensive media interest. Debates on such popular petitions are likely to be better attended on average than other petition debates, and MPs’ participation is likely due to the high-profile nature of the debate in general, rather than because of the advocacy of their constituents in particular. I account for this concern in two ways. First, as explained above, the signature-rate variable increases only when a constituency provides more signatures for a given petition relative to the total national signature-rate for that petition. Second, I also include debate-specific intercepts in all models that account for common shocks to participation that affect all MPs in a given debate.²²

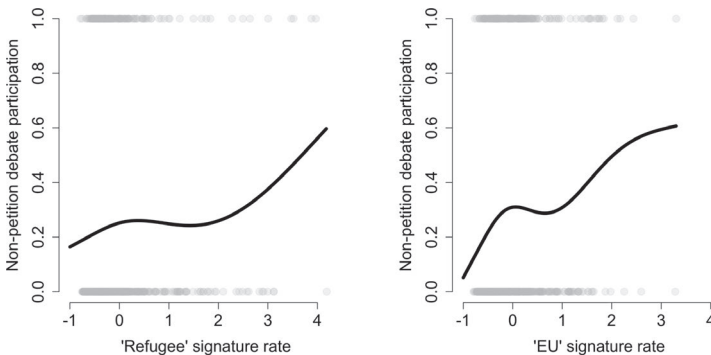
A more subtle inferential concern, however, is that debate participation may not result from constituent activism via e-petitions,

but it may instead reflect MPs' preexisting tendencies to devote attention to the types of issue that attract the attention of their constituents. Consider, for example, the MP for Brighton Pavillion, Caroline Lucas. Brighton Pavillion is one of the most pro-European constituencies in the United Kingdom (Hanretty and Vivyan 2015) and in the "2nd EU Referendum" petition, it ranked 7th (out of 650 constituencies) in terms of the signature-rate variable. Caroline Lucas was an active participant in the debate relating to this petition, but she also contributed to many *other* debates that centred on the topic of the United Kingdom's relationship with the EU even before this particular petition gained traction. Between May 2015 and June 2016, Ms. Lucas mentioned the European Union 77 times in debate: three times as often as the average MP. Even in the absence of the petition, then, it is more likely that Ms. Lucas would contribute to another debate on the issue of the EU than would other MPs.

Figure 2 gives two examples of this type of confounding. In both panels, the x -axis indicates the signature rate for a petition. Panel A depicts a petition calling for the government to increase levels of support for refugees, which was debated in September 2015.²³ Panel B shows a petition which called on the government to prevent the United Kingdom's disorderly exit from the EU, which was debated in November 2018.²⁴ The y -axis measures whether an MP participated in three *non-petition* debates that were closely related to these petitions and which were held *before* the relevant petition was

FIGURE 2
Petition Signatures Predict Participation in Related *Non-Petition* Debates

(A) Participation in nonpetition refugee debates (B) Participation in nonpetition EU debates



discussed in parliament.²⁵ In both cases, petition signatures clearly predict MP participation in prior *non-petition* debates that relate to the same issues as those raised in petitions.

Consequently, MPs will tend to speak frequently about issues which are of concern to their constituents, even in the absence of the information that they glean from the petition. This implies that we should account for an MP's general tendency to participate in debates that relate to the issues of interest that are raised in petitions. In essence, we would like to be able to compare an MP's participation on a given petition debate to a counterfactual debate for which the MP was not provided with petition information. Although we cannot observe this counterfactual, we can make comparisons between petition and non-petition debates that deal with similar underlying topics.

The empirical strategy proceeds in two steps. First, I use statistical topic models to characterize the topics that feature in parliamentary debate and to estimate the proportion of each debate that pertains to each topic. Second, I incorporate these debate-specific topic proportions into the participation model by including coefficients for each MP-topic combination. These effects describe the relative tendency for a given MP to participate on a given topic (for both petition and non-petition debates) and allow me to control for the possibility that some MPs will be more prone than others to discuss certain topics. If an MP tends to participate in many debates about the EU, for example, then that MP will have a large "EU" topic random effect. To the extent that an MP's participation in debates relevant to specific topics correlates with her constituents' signatures of petitions that are also relevant to those topics, this strategy will lead to more conservative estimates of the effects of petition signatures.

To implement the topic-control strategy, I estimate statistical topic models using the texts of all speeches during the study period. I concatenate all speeches within each debate into a common text and then estimate Correlated Topic Models (Blei and Lafferty 2005) models for all D parliamentary debates, including petition debates.²⁶ Like all topic models, the CTM assumes that the frequency with which terms co-occur within different debates gives information about the "topics" that feature in those debates. The key output of the model is λ , which is a $K \times D$ matrix, where λ_d describes a given debate as a vector of topic proportions, and λ_{kd} gives the proportion of debate d devoted to topic k . Note that I use the texts of *all* debates—both petition-related and non-petition-related—to

estimate the topic models. This is essential, as the resulting λ matrices therefore provide a common topic space which we can use to compare petition debates to regular debates.

The CTM requires that we choose a number of topics, K , to estimate from the data. Because there is no a priori reason to prefer any particular value for K , I estimate several different models, while varying the number of topics: $K \in 5, 10, \dots, 100$. I present results from all 20 topic model specifications in Figure S3 in the online supporting information, but Appendix S5 in the online supporting information shows that the model with 60 topics best predicts MP debate participation, and I focus on the results from this model.

The validity of the control strategy rests on the assumption that we can approximate the topics of petition debates in the full sample of non-petition debates. To investigate this assumption, in Table S6 in the online supporting information, I present for each petition debate in the data, the titles of the three closest matching *non-petition* debates according to the cosine similarity between the λ_d vectors. The results are reassuring, as petition debates are matched with non-petition debates that deal with very similar policy areas. For example, the petition debate on “Student Loan Agreements” is matched to non-petition debates on “University Tuition Fees,” “Student Maintenance Grants,” and “Higher Education Funding.” Similarly, the petition debate on “Fur Trade” is matched to non-petition debates on “Animal Welfare,” “Welfare of Young Dogs,” and “Puppy Smuggling.” Across all debates in the sample, the topic model clearly clusters petition debates with non-petition debates that share a similar substantive focus.²⁷

With the topic estimates in hand, for individuals i, \dots, N , debates d, \dots, D , and topics k, \dots, K , I model debate participation in a hierarchical logistic regression of the following form:

$$\text{logit}(y_{id}) = \alpha_0 + \alpha_i + \delta_d + \sum_{k=1}^K \beta_{ik} \lambda_{kd} + \gamma_{i,t} * \text{Signature rate}_{id}, \quad (2)$$

where y_{id} measures whether an MP participated in a given debate, and $\text{Signature rate}_{id}$ is defined in Equation (1). α_i and δ_d are intercepts for MPs and debates, respectively, α_0 is a grand-intercept term, and β is a matrix of MP-topic coefficients. Finally, γ is a vector of MP-signature coefficients.

The primary quantities of interest are the $\gamma_{i,t}$ coefficients, which describe the relationship between the signature rate and

debate participation for each MP in each parliamentary session for which they appear in the data.²⁸ As these coefficients are estimated for each MP, I use only within-MP variation in debate participation to identify the effect of petition signatures. Recall also that as $\text{Signature rate}_{i,t} = 0$ for all non-petition debates, it is only petition debates that contribute to the likelihood function via the γ parameters.

As outlined above, I also expect the effect of signatures to vary across different MP-types, and I model the γ coefficients in a second-level model of the following form:

$$\begin{aligned} \gamma_{i,t} \sim & N(\varphi_0 + \varphi_{\text{New MP}} \cdot \text{New MP}_i \\ & + \varphi_{\text{Frontbench}} \cdot \text{Frontbench}_{i,t} \\ & + \varphi_{\text{Margin}} \cdot \text{Margin}_{i,t} \\ & + \sum_p^P \varphi_{\text{Party}_p} \cdot \text{Party}_{i,p}, \sigma_\gamma^2), \end{aligned} \quad (3)$$

where $\text{Frontbench}_{i,t}$ is a binary variable for whether a given MP held a frontbench position for either the government or the main opposition party (Labour) during a given parliamentary session, $\text{New MP}_{i,t}$ is an indicator for whether the MP was new to the House in the parliamentary session t , and $\text{Margin}_{i,t}$ is the electoral margin of victory for MP i in the election preceding time period t . I also control for the party of MP i via the $\text{Party}_{i,p}$ dummy variables, though the results are not sensitive to this choice.²⁹ The coefficients associated with these second-level variables will tell us how (on the logit scale) the $\gamma_{i,t}$ coefficients vary, on average, according to the attributes of the MP.

The model provides two major benefits. First, it represents a conservative strategy for estimating the effect of signatures on participation. MP-specific intercepts rule out omitted variable bias that stems from MP characteristics that are time invariant; debate-specific intercepts control for confounding factors that relate to the aggregate popularity of each debate; and the MP-topic coefficients account for any factors that might drive MP and constituent attention to particular topics. Second, it provides a rich framework for evaluating how the effects of e-petitions vary as a function of MP-level characteristics.³⁰

Estimation is complicated by the fact that we have lots of data (≈ 3.5 million observations), lots of models ($K \in 5, 10, \dots, 100$), and lots of parameters per model.³¹ Traditional Bayesian inference

approaches such as Gibbs sampling would be computationally impossible here, and so I instead use a variational inference approach (Kucukelbir et al. 2017) to approximate the posterior distribution, which I implement in Stan (Carpenter et al. 2016).³²

Results

Table 1 presents median estimates and associated 95% posterior intervals for the second-level logit coefficients described in Equation (3).³³ Model 1 includes only the γ parameters from Equation (2), and the associated second-level parameters from Equation (3). Models 2 and 3 include intercepts for MPs (α) and debates (δ), respectively, and both sets of intercepts are included in model 4. Model 5 additionally includes the MP-topic coefficients (β). Although there are some small differences across models, conditioning on MP effects, debate effects, and MP-topic effects makes little substantive difference to the estimated effects of petition signatures.

Consider the baseline signature effect in each model, φ_0 , which represents the effect of the petition signature rate for a Conservative MP in a perfectly competitive constituency (where Margin = 0), who is not new to the House and who does not hold a frontbench position. Across all specifications, this baseline effect is positive, and precisely estimated. Based on model 5, increasing the signature rate by one unit is associated with a 36% [22%, 51%] increase in the odds of debate participation for an MP of this type.

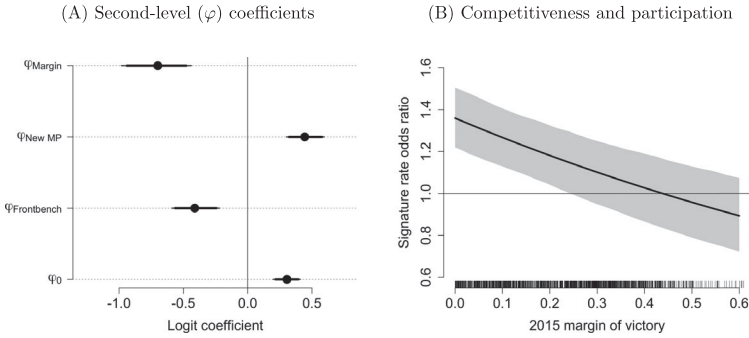
To further explore the heterogeneity in these effects, I plot the second-level φ coefficients for model 5, with associated 90 and 95% posterior intervals, in panel A of Figure 3. The plot reveals important interaction effects between MP characteristics and the signature rate. For example, in line with Hypothesis 4, the estimated $\varphi_{\text{Frontbench}}$ coefficient is negative and implies that there is essentially no effect of petition signatures for MPs who hold government or opposition frontbench positions. Similarly, and consistent with Hypothesis 3, the φ_{NewMP} coefficient is positive: MPs who are new to the house, and therefore have had less time to establish a reputation for constituency service, are significantly more responsive to petition signatures than are more experienced MPs.

The negative coefficient for φ_{Margin} also provides support for Hypothesis 2 and suggests that the effect of petition signatures is larger for MPs from more competitive constituencies. Panel B of Figure 3 depicts the effects of the signature rate on participation

TABLE 1
Second-Level φ Effects (debate participation)

	Model 1	Model 2	Model 3	Model 4	Model 5
φ_{Margin}	-0.53 (-0.78, -0.3)	-0.26 (-0.48, -0.02)	-0.48 (-0.81, -0.18)	-0.44 (-0.64, -0.24)	-0.7 (-0.98, -0.44)
$\varphi_{\text{Frontbench}}$	-0.15 (-0.34, 0.06)	-0.25 (-0.51, 0)	-0.18 (-0.39, 0.05)	-0.17 (-0.37, 0.02)	-0.41 (-0.59, -0.22)
φ_{NewMP}	0.34 (0.2, 0.47)	0.45 (0.31, 0.58)	0.35 (0.2, 0.53)	0.52 (0.41, 0.63)	0.44 (0.3, 0.6)
φ_0	0.25 (0.19, 0.31)	0.09 (0.02, 0.14)	0.21 (0.13, 0.29)	0.16 (0.09, 0.23)	0.31 (0.2, 0.41)
φ Party dummies	✓	✓	✓	✓	✓
MP random effects	×	✓	×	✓	✓
Debate random effects	×	×	✓	×	✓
MP-topic random effects	×	×	×	×	✓
N parameters	1279	2555	6767	8043	51843
DIC	885867.3	837270.5	842447.2	789726.6	722455.1

FIGURE 3
Effects of Signature Rate on Debate Participation



(as an odds ratio) across the range of the Margin variable. The figure shows that the effect of petition signatures is strongest for MPs in competitive constituencies and weakest for MPs in very safe seats. The substantive magnitude of this effect is nontrivial. Increasing the signature rate in a competitive constituency (where the MP won the election by 1 percentage point over the nearest challenger) from half of the national rate to five times the national rate leads to a 28 percentage point increase in the probability of participating in debate,³⁴ relative to a baseline probability of just 3%. However, the same increase in the signature rate for uncompetitive constituencies (where the MP won the election by 40 points) results in no increase in participation probability.

It is worth reemphasizing that the results in model 5 represent conservative estimates of the effect of petition signatures. The model accounts for any omitted variable bias that is related to fixed tendencies of some MPs to participate in debate more than others; for the aggregate popularity of different debates; and for any factor that might drive particular MPs to participate in parliamentary debates that are devoted to specific topics. The model does not, of course, provide a complete solution to the ubiquitous problem of identifying causal effects from non-experimental data, as there may be other sources of confounding that I do not account for here.³⁵ However, the fact that the estimates of the signature-rate effects differ little after the inclusion of these controls is reassuring and increases our confidence in the inferences drawn here.

In sum, the results suggest that MPs are clearly responsive to constituent activism as expressed through e-petitions and that

this responsiveness is conditioned by considerations of collective responsibility for frontbench MPs and by the electoral incentives an MP faces. Overall, however, by encouraging legislators to engage with the issues that their constituents find most salient, e-petitions appear to have positive and non-trivial effects on dyadic representation.

Petition Agreement

For those MPs who do participate in petition debates, is there also a relationship between signatures and petition *agreement*? I investigate this question by focusing on the subset of 581 MPs who participated in any of the petition debates in the sample. An MP is coded as being in agreement with a petition if she expressed overt support for the proposal given in the petition text.³⁶ In this section, the dependent variable therefore measures whether an MP expressed agreement with a given e-petition ($y_{id} = 1$) or not ($y_{id} = 0$).

As with the previous analysis, I model MP agreement using a hierarchical logit model which includes MP-specific signature effects (γ_i), MP intercepts (α_i), and debate intercepts (δ_d) at the first level. Here, the MP effects capture the tendency for MPs to agree with petitions in general, and the debate effects capture whether some petitions are more agreeable to all MPs than others. Predictors at the second level of the model are identical to those given in Equation (3): I model the MP-signature effects (γ_i) as a function of whether the MP is new to the House, whether the MP held a frontbench position, and the electoral margin of the MP.³⁷

In contrast to the analysis above, I am unable to estimate the MP-topic random effects (β_{ik}) here. To do so would require coding each MP's *position*, rather than merely their participation, on each of the non-petition debates discussed in parliament. Manual coding of this sort is infeasible for such a large number of debates. Accordingly, because this secondary analysis is potentially prone to MP-specific topic confounding, the results should be considered as illustrative.

Results

The estimates for the second-level φ coefficients from the approval analysis are presented in Table 2. As before, the estimates are relatively stable across the different specifications, although due to the much smaller sample size, they are also somewhat noisier.

TABLE 2
Second-Level φ Effects (petition approval)

	Model 1	Model 2	Model 3	Model 4
φ_{Margin}	0.29 (-0.27, 0.8)	0.41 (-0.21, 1.04)	0.82 (-0.03, 1.61)	0.21 (-0.45, 0.89)
$\varphi_{\text{Frontbench}}$	-0.05 (-0.78, 0.79)	-0.37 (-1.15, 0.4)	0.12 (-0.86, 1.14)	0.09 (-1, 1.11)
φ_{NewMP}	0.05 (-0.17, 0.27)	0.09 (-0.1, 0.29)	0.45 (0.21, 0.71)	0.51 (0.22, 0.8)
φ_0	0.95 (0.75, 1.14)	1.02 (0.83, 1.21)	0.58 (0.35, 0.8)	0.99 (0.79, 1.2)
φ Party dummies	✓	✓	✓	✓
MP random effects	×	✓	×	✓
Debate random effects	×	×	✓	✓
N parameters	796	1589	882	1675
DIC	4046.1	3636.3	2672.4	2692.3

In general, this analysis suggests that in addition to the effects on debate participation, petition signatures also matter for MP approval. The baseline signature-effect parameter, φ_0 , is positive and significantly different from zero in all model specifications. Based on the estimates in model 4, for a non-frontbench Conservative MP who is not new to the house, and has the mean level of electoral competitiveness, increasing the signature rate from half of the national rate to five times the national rate is associated with a 63 percentage point increase in the probability of petition approval. Conditional on participating in petition debate, MPs are therefore substantially more likely to express support for a petition in their speeches when many of their constituents have signed that petition.

There is, however, less evidence of heterogeneity here. Consistent both with Hypothesis 3 and the participation results presented above, the coefficients on the New MP variable imply that MPs who have recently joined the house are more sensitive to increases in the petition signature rate than are more experienced MPs. However, these results are only significantly different from zero in two out of four specifications. Similarly, there is no predictable variation in the effect of petitions signatures on petition agreement either as a function of electoral margin, or whether an MP holds a frontbench position. The estimates of these second-level coefficients are varying in sign and also considerably less precise than in the participation analysis.

What accounts for these differences between the participation and agreement analyses? One key point is that the baseline

level of petition agreement is very high. Of the 1,994 speeches in the raw data, 1,302 expressed agreement with the aims of the petition. Furthermore, as is clearly visible in panel B of Figure 1, even MPs from constituencies with low signature counts are—conditional on participating—more likely than not to express agreement with the petitions in debate. These patterns suggest that the main representational decision from an MP's perspective is whether or not to participate in certain debates, rather than which position to take in the debates in which they do participate.

Conclusion

In 2017, MPs debated a petition calling on the government to “Prevent Donald Trump from making a State Visit to the United Kingdom” which received nearly two million signatures. The debate was very well attended, so much so that the sitting was extended to accommodate the increased demand for floor time. Although the government opposed the petition's aims, MPs from across the political spectrum spoke in favor of canceling the state visit. In the final speech of the debate, Paul Flynn MP concluded: “This has been an extraordinary event... We are expressing the voice of the people and a thunderous voice it has been... It is a good day Parliament” (Flynn 2017). The findings in this article suggest that this is more than simple hyperbole. In general, when constituent opinion as expressed via an e-petition is strong, MPs are more likely to lend their voice to the articulation of that opinion in parliamentary debates. These results are therefore encouraging, as they suggest that providing voters with new mechanisms for communicating their political preferences can lead to stronger representational ties between citizens and politicians.

The conditional nature of these effects should, however, highlight the limits of policy innovations of this type. Notably, the representational benefits of e-petitions are clearly stronger for some types of MPs. Perhaps unsurprisingly, e-petitions have essentially no effect on Frontbench MPs, for whom party discipline binds most strongly. The effectiveness of online activism is also clearly conditioned by incentives created by the electoral system. New MPs and MPs from marginal seats are most sensitive to variation in constituent issue priorities. Accordingly, while some see the Internet as a force which has the potential to dramatically alter representational relationships in politics (Coleman and Blumler 2009), the findings here suggest that online political activism is

more likely to shape political behavior at the margins and will likely be constrained by existing political incentives.

Dyadic representation in parliamentary systems is more complicated than in other settings. The combination of an SMD electoral system and a parliamentary government creates countervailing incentives for MPs: be a loyal party member and improve the party brand, or respond faithfully to constituent demands and increase electoral security by building a strong personal vote. While party discipline is clearly a primary determinant of MPs' *voting* decisions in these systems, the results here highlight that responsiveness to voter preferences via other forms of legislative behavior is nonzero. Whether they navigate the party-voter trade-off by making use of roll-call votes that are not subject to party discipline (Hanretty, Lauderdale, and Vivyan 2016), by internal lobbying of party leaders (Butler, Naurin, and Öhberg 2017), or, as demonstrated here, through the strategic use of parliamentary speech (Blidook and Kerby 2011; Soroka, Penner, and Blidook 2009), it is clear that MPs are aware of and respond to constituent preferences with many different types of legislative behavior.

There are, of course, many other dimensions on which we might want to evaluate the effectiveness of online activism. A common criticism of e-petition systems, for example, is that even popular petitions have little tangible impact on the policymaking process. For instance, despite the vocal opposition of many MPs in the Trump debate, the US President did indeed visit the United Kingdom in mid-2018. More work is therefore needed to assess what (if any) downstream consequences the behavioral effects documented here have for policymaking. Future research might also address whether e-petitions help cultivate further interest in and understanding of politics and whether they encourage signatories to participate in politics in other ways.

Finally, I have presented evidence from the UK system, but similar e-petition initiatives now exist at both the national and sub-national level in several countries. The key features of the UK system that facilitate the analysis in this article are the fact that petition signature counts are made available at the constituency level and that petitions are formally integrated within existing parliamentary processes. To extend the analysis here to other contexts would require identifying systems that share similar features. While the UK system is unusual in the fact that it directly links petitions above the one hundred thousand signature threshold with specific parliamentary debates, other systems also provide formal mechanisms for

politicians to respond to the concerns of petitioners. For instance, in both the Scottish Parliament and the German Bundestag, e-petitions are linked to committee meetings and public consultations held in parliament. However, data on local signature counts is not currently publicly available for these systems. Interested scholars might therefore consider working with parliamentary authorities to secure such data and to investigate whether the representational benefits demonstrated in the UK generalize elsewhere.

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NOTES

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1. E-petition schemes have been introduced in the United Kingdom (<https://petition.parliament.uk>), the United States (<https://petitions.whitehouse.gov>), Germany (<https://epetitionen.bundestag.de>), Canada (<https://petitions.ourcommons.ca>), Australia (https://www.aph.gov.au/Parliamentary_Business/Petitions), the Ukraine (<https://petitions.com.ua>), as well as in the European Parliament (<https://petiport.secure.europarl.europa.eu/petitions>) and in many local government settings (Hough 2012).

2. See Appendix S1 in the online supporting information for an example.

3. See Appendix S10 in the online supporting information for examples.

4. <https://petition.parliament.uk/archived/petitions/106477>.

5. <https://petition.parliament.uk/archived/petitions/108072>.

6. See, for example, the petition on “EU Referendum Rules triggering a 2nd EU Referendum” at <https://petition.parliament.uk/archived/petitions/131215>.

7. See, for example, the petition entitled “Prevent avoidable deaths by making autism/learning disability training mandatory” at <https://petition.parliament.uk/petitions/221033>.

8. See Appendix S3 in the online supporting information.

9. I report further examples in Appendix S10 in the online supporting information.

10. Table S4 in the online supporting information lists all 99 petitions debated between June 2015 and February 2019.

11. As one MP puts it, “These Monday afternoon debates are becoming something of a showpiece, and a bit box-office” (Grady 2019).

12. See, for example, “Article 50: MPs debate six-million signature petition,” *BBC News*, April 1, 2019; and “MPs debate bid to make it illegal to force women to wear high heels at work,” *Daily Express*, March 6, 2017.

13. See, for example:

1. Margaret Ferrier MP: “I spoke yesterday during the South Korea dog meat trade debate—thanks to the public petitioners for securing it. <https://t.co/ZstsqOJkc9>”, 13 September 2016, 10.00 a.m., Tweet.

2. Thangam Debbonaire MP: “Here’s my speech in yesterday’s Westminster Hall debate on the e-petition for a second EU referendum https://www.debbonaire.co.uk/e_petition_about_a_second_eu_referendum”, 6 September 2016, 5.58 p.m., Tweet.

14. I thank one of the anonymous reviewers for pointing this out.

15. A small number of further petitions were also “tagged” to existing parliamentary debates. I examine these debates in Appendix S8 in the online supporting information.

16. Petition data was collected from www.petition.parliament.uk and speech data from www.theyworkforyou.com.

17. When more than one petition is discussed in a debate, I sum the constituency signature counts across the petitions.

18. I show that the main results are robust to alternative specifications in Appendix S6 in the online supporting information.

19. Full details are given below.

20. See Appendix S3 in the online supporting information.

21. <https://petition.parliament.uk/archived/petitions/131215>.

22. An alternative approach would be to use the numerator of Equation (1) as the independent variable and rely on the debate intercepts to account for differences in average debate- and petition-level popularity. However, as I show in Appendix S7 in the online supporting information, as petition signatures exhibit higher variance across constituencies for more popular petitions, including the unnormalized version of the signature-rate variable will lead the regression model to implicitly put much higher weight on debates related to popular petitions than to other petitions (Aronow and Samii 2016). The specification in Equation (1) largely avoids this problem.

23. <https://petition.parliament.uk/archived/petitions/105991>.

24. <https://petition.parliament.uk/petitions/219905>.

25. I describe the procedure for selecting the three closest matching debates to each petition debate in Appendix S5 in the online supporting information.

26. I remove all punctuation and numbers from the texts, reduce words to their stems, and remove any tokens that appear in fewer than 2.5% of all texts.

27. In Appendix S5, I provide additional validation of the topic-control strategy. In particular, I show that this approach improves our ability to predict MP debate participation in general and also associates MPs to topics in ways that are consistent with intuitions about British politics.

28. I include separate coefficients for each MP in each term (2015–17 and 2017–Present) because I model these signature effects as a function of covariates that change between parliamentary terms.

29. See Table S11 in the online supporting information.

30. The model is completed with prior distributions over the $\alpha_{i,t}$, δ_d , $\beta_{i,k}$ and variance parameters:

$$\begin{aligned}
 \alpha_{i,t} &\sim N(\mu_0 + \mu_{\text{NewMP}} * \text{New MP}_{i,t} \\
 &\quad + \mu_{\text{Frontbench}} * \text{Frontbench}_{i,t} \\
 &\quad + \mu_{\text{Margin}} * \text{Margin}_{i,t} \\
 &\quad + \sum_p^P \mu_{\text{Party}_p} \text{Party}_{i,p}, \sigma_\alpha^2) \\
 \delta_d &\sim N(\phi_0 + \phi_{\text{Petition Debate}} * \text{Petition Debate}_d, \sigma_\delta^2) \\
 \beta_{i,k} &\sim N(0, \sigma_{\beta_k}^2) \\
 \sigma_\alpha, \sigma_\delta, \sigma_\gamma, \sigma_{\beta_k} &\sim N(0, 2).
 \end{aligned} \tag{4}$$

31. For example, a model with 60 topics includes over 50,000 parameters.

32. Variational inference is orders of magnitude faster than state-of-the-art MCMC algorithms and is guaranteed to provide the correct expected values of parameters. However, it will also sometimes understate the variability in the posterior implying that in some cases the estimated standard errors may be too small. In Appendix S11 in the online supporting information, I discuss the likely severity of this problem, and provide comparisons to a more traditional MCMC approach. This analysis shows that none of the substantive results presented in the article are sensitive to the use of VI.

33. Estimates of the additional coefficients described in Equation (4) are given in Table S9 in the online supporting information. In addition to the heterogeneity I highlight here, Conservative MPs are somewhat less responsive to petition signatures than Labour MPs and somewhat more responsive than LibDem MPs.

34. This is based on newly elected Conservative MPs who do not hold a frontbench position.

35. One potential concern, for example, is that e-petitions may be used by legislators to mobilize public support for their own favored projects. However, in contrast to traditional petitions in the Commons, e-petitions do not require the support or “sponsorship” of an MP before they are considered for debate. In addition, the vast majority of traffic to the website that hosts e-petitions comes via social media (Yasseri, Hale, and Margetts 2017, 11). If MPs encourage their constituents to sign particular petitions, this should be obvious from their activity on social media platforms. In Appendix S9 in the online supporting information, I show that very few MPs use social media to promote e-petitions, making it unlikely that the results below are attributable to MP activism.

36. The author and an RA read all 1,384 petition debate speeches and coded whether each MP was “For” or “Against” the motion in the petition. In cases where more than one petition was discussed in a given debate, coding was based on agreement with the largest petition. Coders agreed in 90% of cases.

37. Again, I also control for the party of the MP, and I include the same predictors in the second-level model for the α_i parameters (Table S10 in the online supporting information).

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web site:

Appendix

S1 Petition website

Figure S1 Map of petition signatures

S2 Summary statistics

Table S1 Summary statistics

Table S2 Summary statistics

S3 Descriptive analysis of petition signatures

Table S3 Constituency-level determinants of signature rates

S4 Debated petitions

Table S4 Debated e-petitions

S5 Topic control strategy validation

Figure S2 DIC by topic

Table S5 MPs with highest β_{ik} coefficients by topic

Table S6 Closest matching debates

Table S7

Figure S3 Participation results are insensitive to topic-model specification The figure depicts the main second-level coefficients of interest (φ_0 , $\varphi_{\text{Frontbench}}$, φ_{NewMP} and φ_{Margin}) from Equation (3) for each of the topic models I estimate. The x -axis of each sub-panel gives the number of topics, and the y -axis gives the value of the relevant coefficient. Regardless of the number of topics estimated in the CTM model, the results are very similar.

S6 Alternative independent variable specifications

Table S8 Bivariate logit—Participation

S7 Regression weights for alternative specifications of the signature rate

Figure S4 Conditional variance of signature rate variable specifications

S8. ‘Tagged’ petition debates

Figure S5 Effects of signature rate on debate participation—“Tagged” debates While there is no relationship between petition signatures and participation in debates in the Commons Chamber (black points), there is a positive relationship between signatures and participation for debates in Westminster Hall (blue points).

S9. MP promotion of e-petitions via Twitter

Table S9 Second-level predictors (debate participation)

Table S10 Second-level predictors (petition approval)

Table S11 Second-level φ effects (debate participation)—without party control

S10. Qualitative evidence on MPs’ knowledge of petition signatures

S11. Variational inference/HMC comparison

Figure S6 Variational inference vs HMC coefficients