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LETTER

How Gap Measures Determine Results: The Case of Proportional Systems and the Gender Mobilization Gap

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Abstract

How scholars conceptualize and measure the gender gap in mobilization can have profound consequences for substantive conclusions. Scholars typically refer to a difference between women and men's turnout (difference-in-proportions measure) or a fraction of women voters among all voters (proportion measure). Using the case of proportional representation (PR) reform in Norway, I demonstrate that, in the context of low men's turnout, the proportion measure indicates that PR narrows the gap, while the difference-in-proportion measure indicates that it widens the gap. This is because mobilizing fewer women than men widens the difference between women and men's turnout, but may constitute a greater proportional increase in women's mobilization compared to men when only a few men (and even fewer women) vote. These findings bring together seemingly opposing arguments in the PR-gap debate and have wide implications for the study of 'gaps' within and beyond gender scholarship.

Keywords: gender gap; turnout; electoral systems; measurements; concepts

Can institutions mitigate barriers to voting of underrepresented groups? Using the case of women at the turn of the twentieth century, I reinvestigate the extent to which proportional electoral systems (PR) spur the electoral participation of an underrepresented group that faced severe cultural and structural barriers to voting and, subsequently, representation of that group's interests.

Cutting-edge scholarship suggests that, because PR is typically more competitive, it increases elite incentives to mobilize women (Skorge 2023; Teele 2023). Others question the extent to which we can speak of the unconditionally positive effects of PR. Kittilson and Schwindt-Bayer (2010; 2012) argue that the PR system spurs women's political involvement depending on proportional outcomes, not the system itself. Building on the seminal work of Corder and Wolbrecht (2006; 2016) in the United States, I argue (in 2023) that the overall effects of any electoral system primarily reflect the electoral context in which it operates. In this research, I bring the two perspectives together by shedding light on how scholars define the gender mobilization gap.

Scholars in the PR-gap debate typically measure the mobilization gap either as a difference-in-proportions, which identifies the difference between women's and men's turnout (myself 2023; Teele 2023; Kittilson and Schwindt-Bayer 2010, 2012 on involvement; Carpenter et al. 2018 on social movements), a proportion measure that identifies the share of women among voters (Skorge 2023; Kim 2019 on direct democracy). Despite the central role of concept formation and operationalization in gender scholarship (for example, Goertz and Mazur 2008; Krook 2014; Paxton 2000), there has been little discussion about the conceptualization and operationalization of 'gender gaps'.

Using the case of the traditional gender mobilization gap, I expand upon a theoretical framework I develop elsewhere (2023) to demonstrate different sensitivity of gap measures to the

electoral context. I show that the two measures can produce different insights because one compares women to men using proportions while the other uses differences in proportions. This is especially relevant in low-salience elections where a greater number of men than women is likely to be mobilized by the given phenomenon under study. In this context, the difference-in-proportions measure can indicate a smaller absolute increase in women's votes compared to men's while the proportion measure can indicate a greater proportional increase.

In order to test my argument, I re-examine a highly studied case that recently spurred substantial debates about the effects of PR (namely, myself 2023; Cox, Fiva, and Smith 2016 on turnout; Skorge 2023; Teele 2023 on women). Two Norwegian 1919 PR reforms were implemented in parliamentary (switch from single-member two-round run-off to multimember PR with D'Hondt; see Cox, Fiva, and Smith 2016) and local elections (switch from multimember plurality to multimember PR with Hagenbach-Bischoff, see Skorge 2023). I demonstrate that while both measures indicate that PR narrowed the gap in parliamentary elections with high pre-reform men's turnout, only the proportion measure indicates that the gap narrowed in local elections with low pre-reform men's turnout. Next, I show that the shift in the gap after PR within elections varies with electoral context, as proxied by pre-reform men's turnout. Finally, I build on the methodological advances of Skorge (2023) to provide further evidence within a difference-in-differences framework that complements Skorge's original analysis of local elections.

I conclude by proposing that each measure conceptualizes a different aspect of the mobilization gap and, therefore, provides complementing insights. Highlighting the transferability of the analytical tools developed in this paper, I discuss the generalizability of these findings beyond the PR-gap debate.

Two Measures of the Gender Mobilization Gap

Scholars in the PR-gap debate operationalize the gender mobilization gap in two different ways. The defining feature of the two measures is whether women are compared to men using proportions or difference in proportions.[1] Table 1 summarizes the two measures.

The proportion measure is calculated as the number of women voters divided by the number of all voters. Values below 0.5 indicate greater mobilization among men (the traditional gap); values above 0.5 indicate greater mobilization among women. In turn, the difference-in-proportions measure is calculated as the percentage point difference between womens and men's turnout. Negative values indicate that women's turnout is lower than men's (the traditional gap); positive values indicate that women's turnout is higher. In the context of the traditional gap, an increase in either measure indicates a narrowing of the gap.

The two measures can sometimes indicate opposite trends. One such example is presented in Table 2. Imagine that out of 200 eligible women and men, 10 men and 5 women vote. In this case, women's share among voters is 0.334 and the difference in turnout is −5 percentage points (t column). Now, imagine that the number of voters increases to 25 men and 15 women. In this case, women's share among voters *increases* to 0.375, while the difference in turnout *decreases* to −10 percentage points ($t + 1$ column). The two measures indicate an *opposite* trend because the absolute change of voters from one period to the other is lower for women, but the relative change is higher for women. This is because mobilizing fewer women than men can constitute a greater proportional increase for women when there are very few voters.

Theorizing Sensitivity of Gap Measures to Electoral Context

Expanding on my theoretical framework (2023), I theorize that the two measures have different sensitivity to electoral context; that is, the segment of eligibles that are mobilized by a given

[1]The two measures used in the PR-gap debate also differ in whether they account for the size of the eligible electorate, but see robustness to alternative proportion measures in Appendix Section 'Alternative Measures'.

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Table 1. Two Measures in the PR-Gap Debate

Type	Definition	Operalization	
Proportion	Women's share among voters	Proportion of votes cast by women among all voters	$votes_w/(votes_w + votes_m)$
Difference-in-proportions	Difference in turnout	Percentage point difference between women's and men's turnout	$([votes_w/eligibles_w]) \times 100 - ([votes_m/eligibles_m]) \times 100$

***Notes*:** $votes_{w(m)}$refers to the number of votes cast by women(men); $eligibles_{w(m)}$refers to the number of women(men) eligible electorate.

Table 2. Hypothetical Scenario

	t	$t+1$	Absolute change	Relative change
Eligible total	200	200		
Eligible men	100	100		
Eligible women	100	100		
Voters total	15	40		
Men voters	10	25	25–10 = **15**	15/10 = **150%**
Women voters	5	15	15–5 = **10**	10/5 = **200%**
Women's share among voters	5/15 = **0.334**	15/40 = **0.375**		
Gender turnout gap (pp)	5–10 = **−5**	15–25 = **−10**		

phenomenon under study. Reflecting on the multitude of gender-based barriers to voting in the context of a traditional gap, it seems reasonable to assume that there are more men than women with a low cost of voting. In this context, strengthening the incentives to vote and to mobilize among eligibles spurs men's turnout more than women's (*decreasing* the difference-in-proportion measure). However, the weight of women's votes may still increase (*increasing* the proportion measure). This is because, as demonstrated above, mobilizing fewer women than men may constitute a higher proportional increase among women than men.

First, I make assumptions about the distribution of womens and men's propensity to vote, as justified and set out by me (2023, Figure 1a). I assume that there are the same number of women and men eligible and that the distribution of womens and men's cost of voting is normal and of the same shape ($\sigma_m^2 = \sigma_w^2$) except that women's mean cost is slightly to the right of men's ($\mu_m < \mu_w$). This seems plausible in the context of the severe barriers to voting faced by women. While some women may have low voting costs (for example, educated upper-class women), gendered barriers to voting should reduce the number of such women compared to low-cost men. Similarly, while some men may have high voting costs (for example uninformed or non-unionized working-class men), we would expect that there would be fewer such men than women.

Second, I use assumptions made in Figure 1a to predict how the two measures vary with electoral context, proxied by men's turnout (Figures 1b, 1c). I indicate men's turnout with the cumulative distribution function (CDF) of men's cost of voting (converted to percentages). That is, men's cumulative probabilities indicate the proportion of men falling below a particular 'cut-off' cost of voting that separates voters from non-voters. The difference-in-proportion measure is then obtained by subtracting the CDF of women's cost of voting from the CDF of men's cost of voting (converted to a percentage point difference). The proportion measure is obtained by dividing the CDF of women's cost of voting by the CDF of both women and men's cost of voting combined. In this example, the figures predict that the proportion measure increases monotonically with men's turnout. In turn, the difference-in-proportions measure decreases and then increases with men's turnout, reaching its widest point when slightly more than half of men vote.[2]

[2]Of course, these predictions are determined by the assumptions in Figure 1a. Whilst I cannot directly test these assumptions, alternative assumptions are less consistent with my data (see Appendix Section 'Alternative Assumptions' and Appendix Figure A2).

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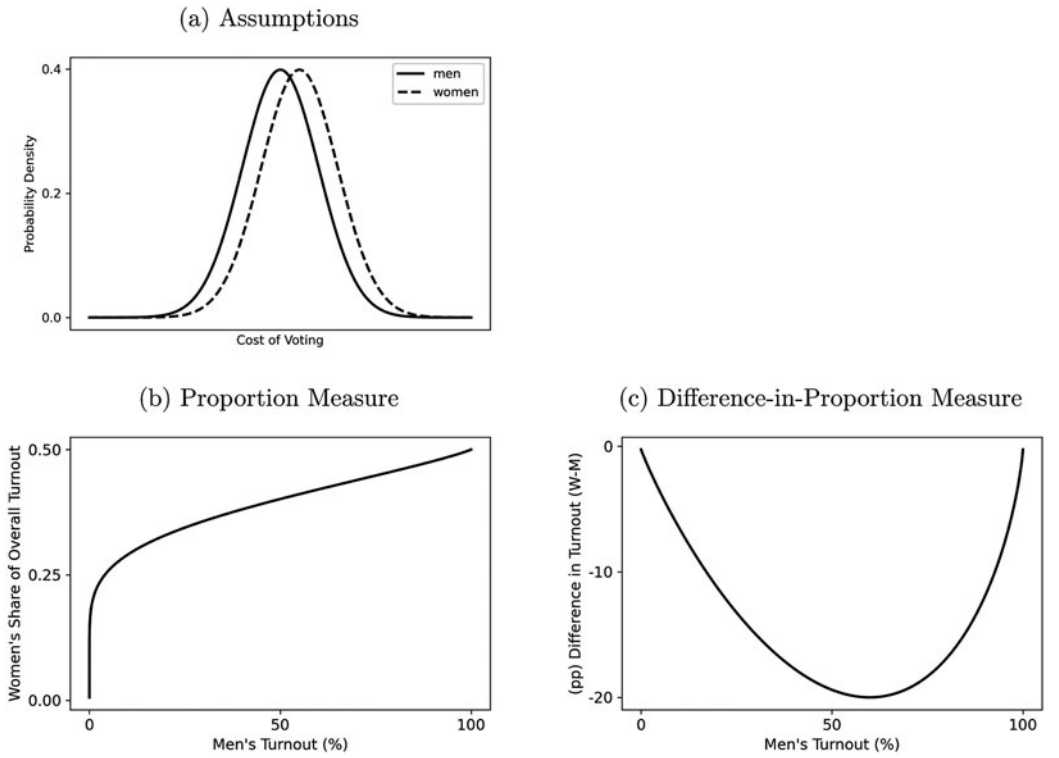

Figure 1. Predicting sensitivity of measures to electoral context: (a) Assumptions, (b) Proportion Measure, (c) Difference-in-Proportion.

In order to empirically assess the predictions in Fig 1b and 1c, I utilize data from pre-reform samples in both parliamentary and local elections. Variable description in Appendix Table A1. Summary statistics and sample descriptions in Appendix Table A2. In order to ease interpretation of the results, I convert proportions (as defined in Table 1) to percentages in all analyses. As theorized, men's turnout has a positive and significant effect ($p < 0.01$) on the proportion measure in both elections (Appendix Table A3, Models 1 and 2; Appendix Figure A2a for adjusted means). In turn, men's turnout has a U-shaped effect on the difference-in-proportions measure. The quadratic term of men's turnout is significant ($p < 0.01$) in local elections – that is, when a substantial number of districts have low men's turnout (Appendix Table A3, Models 3 and 4; Appendix Figure A2b for adjusted means).

The Effect of PR on the Gender Mobilization Gap

The properties of the two measures discussed above have implications for the PR-gap debate. PR typically strengthens the incentives of elites to mobilize, and of voters to vote. I argue that whether PR narrows the gender mobilization gap depends on the gap measure and electoral context. Perhaps the most relevant difference can arise when the segment of eligible electorate mobilized by PR primarily consists of men, as we would expect in the context of a low men's turnout. In this context, the mobilization gap is likely to narrow using the proportion measure, but widen using the difference-in-proportion measure. However, if the segment of the eligible electorate mobilized by PR primarily consists of women, as we would expect in the context of a high men's turnout, both measures are likely to indicate a narrowing of the gap.

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In this section, I provide evidence for this argument in two analyses. In the first analysis, I demonstrate that whether PR is associated with an *overall* shift in the gender mobilization gap varies with the measure used in local elections with low men's turnout. In the second analysis, I demonstrate that the shift in the gap after PR can be explained by pre-reform men's turnout across localities in all elections. Complementing Skorge (2023), I demonstrate that both of these insights hold in a difference-in-differences setting in local elections.

Analysis 1: Documenting a Shift in the Mobilization Gap Before and After PR

Parliamentary elections

Figure 2a plots kernel densities of change in the gender mobilization gap measures between 1918, the last parliamentary election before PR, and 1921, the first parliamentary election after PR. I compare these trends to a control election cycle 1915–1918. The figure shows that the gender gap increased in a majority of pre-reform districts (67.4 per cent and 66.3 per cent using difference-in-proportion and proportion measures, respectively, compared to 35.9 per cent and 38.8 per cent in the control cycle). This is consistent with the expectation that the two measures can indicate the same *overall* effect of PR in elections with high pre-reform men's turnout (see Appendix Figure A3a for pre-reform turnout distribution).

Local elections

Figure 2b plots kernel densities of the change in the gender gap measures between 1916, in the last local election before PR, and 1919, the first local election under PR, in municipalities that introduced PR during this period.[3] I compare these trends to control municipalities that adopted PR before 1916. The figure shows that the proportion measure increased dramatically in municipalities that introduced PR, with the gap narrowing in 84.5 per cent of municipalities (compared to 57 per cent in control municipalities). While the difference-in-proportions measure also narrowed in a majority of municipalities that introduced PR, it *widened* in 41.7 per cent of municipalities (compared to 44.9 per cent in control municipalities). This is consistent with the expectation that the two measures can indicate different *overall* effects of PR in elections with low pre-reform men's turnout (see Appendix Figure A3b for pre-reform turnout distribution).

Difference-in-Differences

I show that the results presented in Figure 2b hold up in a canonical difference-in-differences setting. The causal effect of PR on the mobilization gap in local elections is sizable and statistically significant ($p < 0.01$) when using the proportion measure, but close to zero and not significant at conventional levels using the difference-in-proportion measure (Appendix Table A5, Models 1–2 for the main result, Models 3–4 for robustness; Models 5–6 for pre-treatment placebos; Models 7–8 for replication of Skorge 2023).

Analysis 2: Explaining the Shift in the Mobilization Gap with Men's Turnout

Proportion measure

I regress the change in the proportion measure before and after the reform on pre-reform men's turnout. The proportion measure *decreases* with men's turnout in both local and parliamentary elections. The coefficients on men's turnout are negative and statistically significant at a 5 per cent level (Models 1 and 2 in Appendix Table A4). Plotting adjusted means in Figure 3a, we can see that the proportion measure indicates the narrowing of the gender

[3]Treated municipalities include few municipalities with one party list that were not required to adopt PR (see Skorge 2023).

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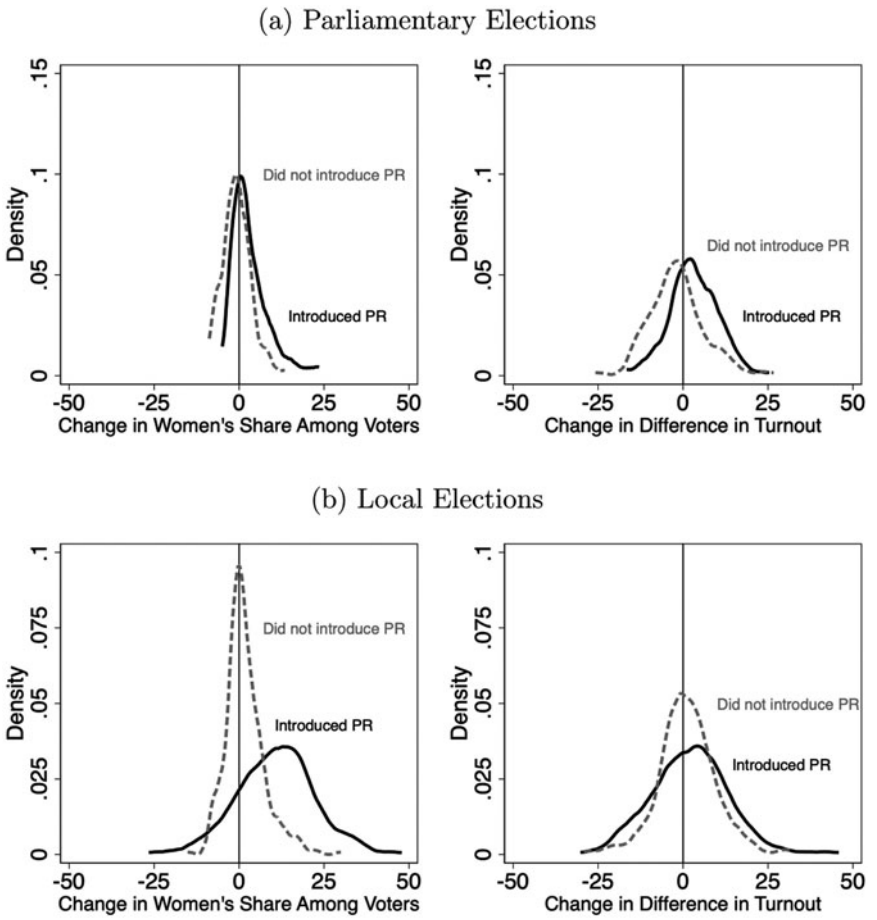

Figure 2. Kernel densities of change in gender mobilization gap. (a) Parliamentary elections. (b) Local elections.
Notes: Sub-figure a) plots kernel density of change in gender gap measures in parliamentary elections; solid (dash) line refers to treated election cycle 1918–1921 (control cycle 1915–1918); unit of analysis is pre-reform district. Sub-figure b) plots kernel density of change in gap measures in local elections 1916–1919; solid (dash) line refers to treated municipalities that introduced PR in 1919 (control municipalities that introduced PR prior to 1919); unit of analysis is a municipality. Redistricted localities between relevant elections excluded.

mobilization gap at most levels of men's turnout. The negative sign reflects the fact that the incentives to mobilize cannot strengthen any further if pre-reform men's turnout is very high (ceiling effects), and may even decrease. This is consistent with the expectation that the proportion measure can indicate the narrowing of the gap after PR as long as pre-reform men's turnout was not already very high.

Difference-in-proportions measure

I regress the change in the difference-in-proportions measure before and after the reform on pre-reform men's turnout. In order to account for ceiling effects as above, I add squared pre-reform men's turnout (Models 3 and 4 in Appendix Table A4). The difference-in-proportions measure *increases* with men's turnout in both parliamentary and local elections, and this increase slows at high levels of men's turnout. The estimated coefficients on men's turnout are significant at a 5 per cent level in local elections but lack significance in parliamentary elections where men's turnout was rarely low. Plotting adjusted means in Figure 3b, we can see that the difference-in-proportions measure indicates a widening of the gap when men's turnout is low and a narrowing

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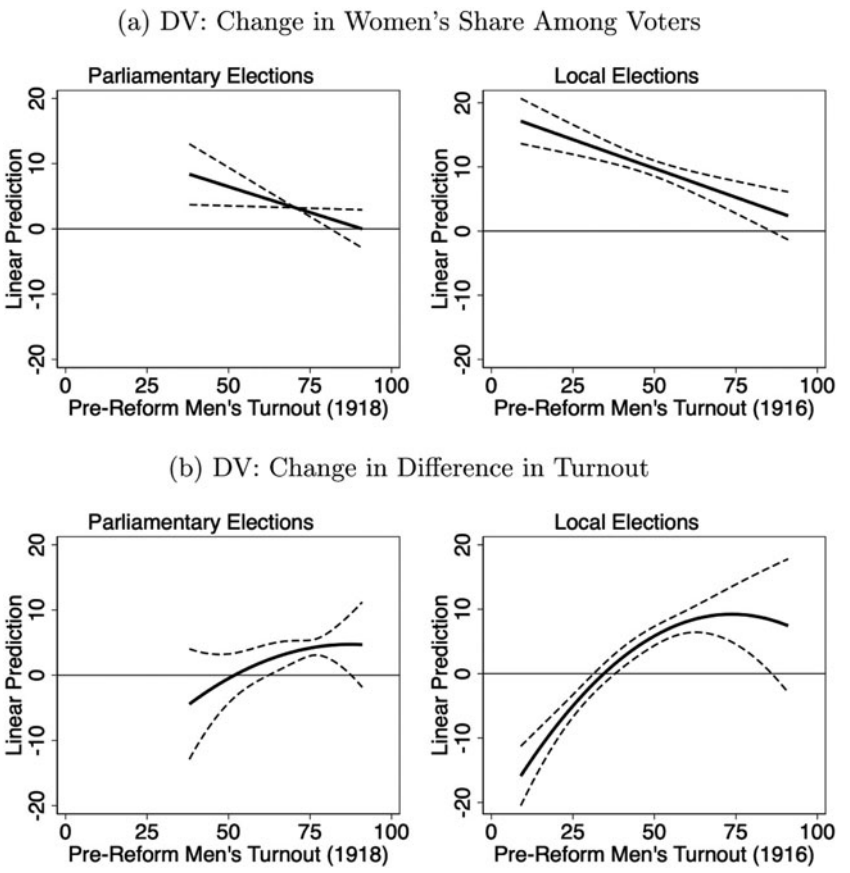

Figure 3. Plotting adjusted means of the change in gender mobilization gap before and after PR by pre-reform men's turnout. (a) DV: Change in women's share among voters. (b) DV: Change in difference in turnout.
***Notes*:** Full models in Appendix Table A4; 95 per cent CIs.

of the gap when men's turnout is high, but not too high. This is consistent with the expectation that, whether the difference-in-proportions measure indicates narrowing or widening of the gap, depends on context. While PR can spur incentives for women to vote, it may not narrow the difference between womens and men's turnout, and may sometimes even widen it.

Difference-in-differences

The results presented in Figure 3b hold up in a difference-in-differences specification with a treatment-covariate interaction. The interaction between the treatment effect and pre-reform men's turnout in local elections is statistically significant ($p = 0.001$) (Appendix Table A6, Model 1). Including a squared men's turnout to account for ceiling effects is not significant at conventional levels ($p = 0.113$), but returns results consistent with the predictions. Plotting heterogeneous treatment effects in Appendix Figure A4 (Model 1), we can see that PR had a *positive* effect on the difference-in-proportion measure in municipalities with pre-reform men's turnout of over 36–37 per cent, and a *negative* effect otherwise. Looking closely at the estimated confidence intervals (CIs), these effects are statistically significant for municipalities with men's turnout above 48 per cent and below 14 per cent. In the model that accounts for ceiling effects (Appendix Figure A4, Model 2), the positive effect of PR is significant when men's turnout is between about 42 per cent and 75 per cent.

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Making Sense of the PR-Gap Debate

The one question that looms large is whether one measure is the 'right one'. I propose that it is more helpful to think of the two measures as providing complementing information. In line with Adcock and Collier's (2001) distinction between background and systematized concepts, scholars in the PR-gap debate may be understood as sharing the same background concept (what I call the mobilization gap), but conceptualize it in two different ways. In fact, Skorge (2023) refers to inequality in voting, while I (2023) and Teele (2023) refer to the turnout gap. Consistent with this argument is the observation that the two measures are *not* correlated *when* women's share among voters is low and men's turnout is also likely to be low (see Appendix Section 'Discriminant Validation').

If the two measures conceptualize a different aspect of the same background concept, it is easier to make sense of the conflicting results in the PR-gap debate. Given that the weight of women's votes is likely to be less dependent on context, using a proportion measure is likely to suggest that PR has an overall 'positive' effect on women's mobilization. Using a difference-in-proportions measure, on the other hand, is likely to suggest that the 'positive' effects of PR are context-dependent. Given that PR incentivizes elites to mobilize women, these insights suggest that elites may undermobilize women compared to men in PR to an even greater extent than before the reform. That is, even if PR spurs a greater proportional increase in women's mobilization, it may widen the difference between women's and men's turnout. Only when the two measures are explored in tandem, can we uncover this previously overlooked insight.

Discussion

Through a study of a historical PR reform, this paper demonstrates that while PR increases women's turnout, whether or not it also advances gender equality may depend on how we measure women's mobilization relative to men's. Whilst increasing women's turnout is an important precursor to gender equality, the extent of women's participation vis-à-vis men's seems especially relevant in determining the extent of politicians' incentives to mobilize women and, therefore, women's substantive representation. As women's turnout continues to lag behind men's in a wide variety of contexts (Desposato and Norrander 2009 on Latin America; Robinson and Gottlieb 2021 on Africa; Dassonneville and Kostelka 2021 on secondary elections in the West), the papers' key insights seem relevant for the study of women today.

This paper has implications beyond the PR-gap debate on both substantive and methodological levels. On a substantive level, this paper demonstrates the effects of institutions that increase mobilization of underrepresented groups (for gender, Córdova and Rangel 2017 on compulsory voting; Corder and Wolbrecht 2006; Corder and Wolbrecht 2016 on registration; Kim 2019 on direct democracy) may either fail to deliver or even increase the groups' underrepresentation. Even if institutions secure a proportional increase in the groups' mobilization, they may inadvertently increase the difference in mobilization between the groups.

On a methodological level, this paper offers analytical tools that can guide theoretical considerations of how mobilization gaps are conceptualized and operationalized. Beyond women's mobilization, these tools seem relevant for the study of other under-mobilized groups that face greater costs of voting. Similarly, these tools seem relevant for our understanding of gaps beyond mobilization. For example, difference-in-proportion gaps in party preferences would also appear to depend on the underlying assumptions about the distribution of party preferences, and, therefore, the electoral context. The analysis beyond gender mobilization gaps, however, is left for future research.

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/S0007123424000139.

Data availability statement. Replication data for this article can be found in Harvard Dataverse at: https://doi.org/10.7910/DVN/5INAYT.

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