A Moveable Benefit? Spillover Effects of Quotas on Women's Numerical Representation[*]

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June 1, 2022
Forthcoming at *Political Research Quarterly*

Abstract
Quotas have helped women achieve greater numerical representation in government around the world. Yet do they have indirect effects on representation elsewhere? We take advantage of plausibly exogenous variation in when and which states enacted legislation mandating 50 percent women's representation in the lowest level of government in India to analyze how quotas affect women's candidacy, vote share, and winning probability at the state level of government. We find that women are more likely to compete and win for the higher political office when women reservation is implemented at the local levels of political governance. This suggests that the gender quotas have spillover effects onto the other levels in politics. As women continue to be under-represented in politics, this paper highlights the role of policy instruments in shaping political careers for women and building inclusive political institutions.
Word Count: (abstract) 137; (manuscript) about 7000
Keywords: women and politics, gender quotas, political representation, India

Introduction

The gender gap in electoral politics has received significant attention from researchers and policymakers. Quotas, or legislation designed to decrease the gap in women's numerical representation in legislatures—often through seat reservations or party-list requirements (Htun 2004; Franceschet and Piscopo 2008; Hughes et al. 2019)—have become popular over the last few decades, with over 130 countries having some form of quota system in place (Hughes et al. 2019).[1] These have led to material gains in the numerical representation of women in politics (Tripp and Kang 2008*a*). Such increases have, in turn, led to certain changes in women's substantive representation, such as budgetary or legislative behavior (Schwindt-Bayer 2010; Bolzendahl 2011; Clayton and Zetterberg 2018; Funk and Philips 2019), and trust in government (Hinojosa, Fridkin and Kittilson 2017). Research also shows that gender quotas and women's representation in politics have spatially (O'Connell 2020; Chen 2010) and temporally (Bhavnani 2009) spilled over to other countries (Tripp and Kang 2008*b*), political parties (Cowell-Meyers 2011), and institutions (Thames and Williams 2013). Yet despite a wealth of research on how quota legislation leads to increased numerical, descriptive, and substantive representation, research has remained limited to examining such outcomes at the level of government for which these quotas were designed.

In this paper, we examine how political instruments such as gender quotas, designed to increase women's representation at one level of government, might also affect representation at *other* levels of government. In other words, is increased women's representation at a higher level of government possible, even if gender quotas take place at lower levels of political office? Building off the literature on supply and demand-side dynamics of political recruitment (Gabaldon et al. 2016; Evans 2008; Escobar-Lemmon and Taylor-Robinson 2005; Kunovich and Paxton 2005), we theorize that such quota "spillover effects" may take place through two potential mechanisms. First, we posit a supply-side explanation, in that women elected at lower levels of government might,

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[1]Reservations may also be enacted voluntarily by political parties themselves in an effort to increase representation, although they are not typically considered a 'quota' (Franceschet and Piscopo 2008).

in turn, run at higher levels of government in the future. Second, from a demand-side perspective, voters themselves may change their views on women politicians as a result of gender quotas at the local level. This may help women garner more votes, become more competitive in elections, and thus win higher level elections. In proposing our theory of quota spillover effects, we contribute to the literature on mechanisms that make women more or less likely to contest—and win—political office (Ladam, Harden and Windett 2018; Thomsen and King 2020; Gangadharan et al. 2016).

The case of India is an ideal test of our theoretical expectations. In 1992, a constitutional amendment formalized a three-tiered form of governance at the village, block, and district levels, along with a 33 percent locally-mandated quota for women, which gave millions of women the opportunity to serve as elected representatives in these governing bodies. Post-2005, some—but not all—states proceeded to move to a 50 percent reservation for women across the local governing bodies. These state-level differences in reserved-seat quotas allow us to examine the influence of women's representation at the local level on women candidates for state assembly elections. Moreover, such a local-to-state career path in politics is not limited to India, as the literature on political decentralization suggests (Myerson 2014); politicians begin their career at the local level, gain prominence, and then aspire to contest for higher office, for instance, by becoming a member of their statewide legislative assembly (MLA) (Ziegfeld 2015; Karekurve-Ramachandra 2020).

We leverage a rich dataset of state legislative assembly elections in India from 1977 to 2018 to analyze if women's representation in state elections improves as a result of reservations for women in local governments. Using a difference-in-differences approach, we find weak support for women's entry into higher-order electoral contests, while we find strong evidence that they are more likely to win these elections post 50 percent gender quotas. In addition, through the use of a panel vector autoregressive model, we also provide suggestive evidence that voters' demand for women politicians drives the supply of women candidates.

We make the following key contributions to the existing literature. First, this paper adds to the small but growing literature on how institutional changes at one level of government can have ripple effects at other levels. Our research compliments the findings of O'Connell (2020) and Karekurve-Ramachandra (2020). O'Connell (2020) investigates the exposure effect of women's leadership at the district level in 10 Indian states due to the 33 percent reservation until 2007, examining women's representation at both the state and parliamentary levels. We extend this by taking into consideration the subsequent proportional shift in the gender quota levels from 33 percent to 50 percent on a larger spatial and temporal scale.[2] Moreover, we focus on the timing of village council-level elections that takes into account exposure to women's leadership at a much broader level. Like our analysis, Karekurve-Ramachandra (2020)'s main focus is also on assessing the shifts in women's representation at the state-level due to local-level gender quotas in the context of India. However, our theory and analysis include a broader set of outcomes in order to assess both supply- and demand-side factors of women's representation in state-level elections. Moreover, we also offer a statistical explanation as to whether supply- or demand-side factors appear to be causing one another.

Second, this paper helps us examine whether there are additional gains to be made when gender quotas extend beyond the critical mass of women's representation. The key argument of supporters of critical mass theory is that women need a certain proportion of numerical representation to make substantive gains in politics. The most commonly accepted critical mass point is about one-third of all available seats (Dahlerup 1988).[3] In line with this argument, much of the research has focused on examining the impact of numerical representation of women on substantive representation (c.f., Park 2017; Childs and Krook 2009). We contribute to this strand of literature by showing that in the presence of parity laws that shift women's representation from one-third to half of the seats at the entry-level political positions, women make numerical gains

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[2]As we describe in the subsequent sections, our analysis is based on 26 states of India from a timeframe of 1977 to 2018.

[3]Though using machine learning methods, Funk, Paul and Philips (2021) show that different critical mass thresholds are at play when it comes to affecting government spending in different sectors.

elsewhere.

The rest of this paper proceeds as follows. We first discuss the role of quotas on both descriptive and substantive representation, as well as review the existing literature on spillover effects. Next we present our theoretical expectations. Then, we brief the institutional context and research design under which we empirically analyze our theoretical question. Last, we present our results and discuss their implications, not only in the Indian context, but also for the field of research in gender and politics more broadly.

Quotas and representation

Seen as a way of 'fast-tracking' women's representation in government (Tripp and Kang 2008*a*), gender quotas come in different forms, but typically consist of voluntary or mandatory party numerical quotas or reserved seat shares in the legislature. Such quotas have improved women's representation by mandating that party leaders strive for gender parity in their recruitment process, and by creating incentives for women to participate in the electoral process. From a purely numerical standpoint, there is clear evidence that quotas increase the representation of women (in some cases even after the withdrawal of quotas, c.f., Bhavnani 2009). For instance, in a cross-national sample, Chen (2010) finds that women's representation in the legislature is about 1.52 times larger than for those countries without a quota in place.

Women's representation and their career progression can vary depending on the quota design and institutional context in which quotas are enforced. For example, institutional differences may affect women's representation, with empirical evidence finding that parliamentary systems generally have higher levels of representation than presidential ones (Norris 1985; Kenworthy and Malami 1999; Kunovich and Paxton 2005). As the names suggest, voluntary party quotas are constituted by parties while mandated party quotas stipulate a required proportion of women candidates to be

nominated in an election contest by law. Reserved seats, on the other hand, ensure the representation of a stipulated proportion of the women in the political office by ensuring the competition only among women on reserved seats. Drawing on a comparative study of 26 countries, Schwindt-Bayer (2009) has noted that institutional factors—such as a minimum stipulated quota threshold, placement mandates, and enforcement mechanisms—affect women's numerical representation.

Though the quota type is not considered a significant predictor of voters' positive attitudes towards women candidates (Allen and Cutts 2018), some studies show that women candidates tend to receive nominations from non-competitive seats in the presence of party quotas, leading to the lower proportion of women winners in these countries (Norris et al. 2004, p. 196). Similarly, a comparative study of reservations in Uganda and Tanzania reports that mechanisms of reservations in Tanzania are more suitable in sustaining women's long-term presence in politics (Wang and Yoon 2018).

In addition to quotas affecting the numeric representation of women, empirical evidence suggests that implementing quotas might also increase women's substantive representation in government. Beaman et al. (2011) find that women politicians in villages with reserved seats for women have different policy preferences than men in ways that improve public goods outcomes for women. Their policy initiatives are more likely to focus on the needs and demands of women voters (Chattopadhyay and Duflo 2004). Political participation of women in deliberative processes improves in the presence of women leaders (Beaman et al. 2009; Deininger, Jin and Nagarajan 2012; Goyal 2020). Greater numbers of women legislators are also associated with a greater number of women-centric issues being introduced and discussed as legislation (Htun, Lacalle and Micozzi 2013; Clayton, Josefsson and Wang 2017).

However, research also points to some mixed effects of quotas on representation (Tripp and Kang 2008*a*). While Franceschet and Piscopo (2008) find that women legislators in Argentina can introduce or coauthor bills related to women's issues, such as violence against women or reproductive rights, this does not necessarily translate into

legislative outcomes. Similar findings were reported by Deininger, Jin and Nagarajan (2012) in that the perceived effectiveness of public services is unlikely to improve with women's reservations. Contrary to the prevalent claim that women leaders may improve distributional benefits to minorities, Bardhan, Mookherjee and Torrado (2010) find the opposite effect on welfare outcomes for ethnic minorities when women were the (reserved seat) heads of a village. When women are selected through quotas, they are perceived as less qualified or inexperienced in holding the position (Franceschet and Piscopo 2008). These biases and stereotypes narrow the scope of women's leadership and limit their presence to merely a symbolic one. Women in political institutions, like in most professions, are also prone to be dominated by the male elite who hold a large share of the power and are unwilling to share with women (Schwindt-Bayer 2018). Such circumstances constrain the performance of women members, and buttress the gendered stereotype that women are not effective political leaders. Consequently, women's participation and their progress for the higher office are unlikely to progress.

Spillover effects of quotas

While we discussed the effects of quotas on numeric and other forms of representation, quotas may affect further changes in women's presence in politics. A small but growing literature focuses on these "spillover effects". Quotas at one level of government may lead to additional quotas being imposed at other levels of government, in the judiciary, or even extend outside government, such as in labor unions or on corporate boards (Franceschet and Piscopo 2013). These have been shown to increase gender representation in fields as diverse as education (Beaman et al. 2012) and entrepreneurship (Ghani, Kerr and O'Connell 2014). They may also make voters more cognizant of gender imbalances in political institutions, as well as elsewhere (Baldez 2006; Tripp and Kang 2008*a*; Clayton 2014).

Cross-nationally, gender quotas in one country may pressure politicians to enact

quotas in other countries, "because they want to appear 'modern' and in tandem with changing international norms" and "because they do not want to appear regressive while neighboring countries make gains in female political representation" (Tripp and Kang 2008*a*, p. 340). Similarly, in the context of party quotas, other parties may feel pressured to adopt gender quotas if a competing party has done so (Cowell-Meyers 2011). At the institutional level, some show that quotas in one institution also make other institutions more diverse. For instance, Thames and Williams (2013) show that quotas improve gender representation in legislatures, which, in turn, can somewhat improve gender representation in the cabinet and judiciary. Similarly, O'brien and Rickne (2016) find in the Swedish context that quotas have an "acceleration effect" as they expand women's opportunities for party leadership positions. Yet, the literature on the geographic spillover effects of women winners in one jurisdiction on neighboring jurisdictions yields mixed results. While some find no spillover effect (Ferreira and Gyourko 2014; Broockman 2014; Bhalotra, Clots-Figueras and Iyer 2013), Gilardi (2015) finds that when women win, more women enter into politics in nearby constituencies.

At the individual level, the increased representation of women set a "legacy effect" leading to more women entering politics (Ladam, Harden and Windett 2018). Kunovich and Paxton (2005) find that the presence of women in party leadership positions leads to an increased number of female candidates competing in elections. For plurality-majority systems, this also translates into them winning more often.[4] In addition, Ladam, Harden and Windett (2018) highlight how women in higher-level political office inspire more women to run for elections at lower levels of government through a 'role-model effect'. All of this suggests that quotas, as well as the women they bring into politics, may—either directly or indirectly—affect women's representation elsewhere.

Despite knowing the wide and varied effects of gender quotas, we do not yet know how quotas created at the local level of government may affect women's representation in offices higher up the political ladder. The role-model effect (or "ambition

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[4]Though this effect does not occur in proportional representation party list systems.

story") seems inadequate in explaining this phenomenon in particular, since it likely does not explain any bottom-up effects of quotas.[5] Lower-level quota opportunities do not automatically lead other women to get themselves nominated and win higher-level elections because of persisting economic and non-economic barriers at the candidate selection process (Carroll and Sanbonmatsu 2013). The acceleration effect, as explained by O'brien and Rickne (2016), may provide some evidence in support of extending quota spillover effects. But unlike these authors, who study the acceleration effect in the context of quotas improving women's representation on intra-party positions, we focus on women's career progression in politics outside the party (or not specific to any particular party), thus providing a bigger test for such an acceleration effect.

Theoretical framework

Gender quotas in politics emerge as a means to achieve greater gender parity. While some have researched the effect of women in politics on other women entering and contesting in elections (c.f., Kunovich and Paxton 2005; Gilardi 2015; Ladam, Harden and Windett 2018), analyses of how quotas themselves may affect women's representation at other levels of government remains absent from the literature. Can quotas affect women's political fortunes outside the level of government for which they were designed?

Our theoretical framework combines existing research on gender quotas with the newer literature on spillover effects summarized in the previous section. Our basic expectation is that when women's representation improves at lower levels of political institutions—spurred on by enhanced local-level gender quotas—representation at higher levels of political office will also increase. The mechanism by which this happens is driven by two key factors which we elaborate on more below: supply and

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[5]The role-models effect is more suitable in explaining the top-down effects of women leadership such as the shifts in the attitudes, perceptions, and actions in the presence of a successful individual whom people often look up to (Campbell and Wolbrecht 2006; Sweet-Cushman 2018; Haynes and Block 2019; Ladam, Harden and Windett 2018; Beaman et al. 2012).

demand.

Supply side

One core explanation of why a large gender gap persists in higher-level of political positions comes from the pipeline theory, which explains the lack of viable, competent women candidates at entry-level (e.g., local government) positions (Mariani 2008; Thomsen and King 2020). Political aspirants use lower-level political experience as a springboard to pursue opportunities for career progression. Thus, increased women's presence at local levels of politics provides them with exposure to political and public life, while also providing them with the opportunity to strengthen political networks and build an electoral base. An evident implication of the opportunity to contest for or lead a political office is that it may create a pipeline of qualified and experienced women candidates to contest for higher political office (Mariani 2008) since women can signal their competence and competitiveness using their officeholding experience.

Party elites, often dominated by men, traditionally underestimate women candidates and perceive them as a risky proposition.[6] In the context of the US, Crowder-Meyer (2013) finds that party recruiters disproportionately recruit men when they rely on traditional, internal party sources to assess the viability of candidates. As a safeguard against supporting politically inexperienced women, party leaders may end up simply recruiting women from dynastic families (Folke, Rickne and Smith 2018). With an influx of local-level women politicians as a result of a quota, party recruiters may now be able to choose from better-known candidates, or at least have a much wider pool of potential women candidates who could compete in elections for higher levels of government (e.g., at the state or national level). Overall, increased reservation for women at the local level may also reduce party bias towards women candidates (Fox and Lawless 2004; Thomsen and King 2020).

Given our supply-side explanation, we expect to find that the implementation of

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[6]As evidence of this, consider Kunovich and Paxton (2005), who find that women party leaders increase the proportion of women candidates.

local level quotas has an effect on increasing not only the number of women candidates running at higher levels of elected office but also their spread (i.e. women compete in a greater number of constituencies). This forms our first theoretical expectation:

H_1: The number of women candidates running in higher-level elections increases after local-level quotas.

Demand side

Social norms often dictate that women hold stereotypical roles of family life and care-giving. Existing studies highlight that career-ambitious women tend to be penalized and are perceived differently than men (Htun 2005), and that socio-cultural norms are one of the inhibiting factors for women running for elections. As a result, voters tend to devalue women's competence and leadership (Bligh et al. 2012).

Despite these setbacks, there are several ways in which quotas may affect society's attitudes towards women in politics. For one, evidence suggests that as more women are active in electoral politics, voters tend to update their gendered biases (Htun and Piscopo 2010). For instance, Clayton (2014) finds that subnational gender quotas in Lesotho led to a decreased opinion about the role of traditional male chiefs in society. The Korean case of women's representation in local councils also indicates a positive exposure effect, leading to higher chances of women incumbents securing their seats than their men counterparts (Joo and Lee 2018). In addition, voters interact with local women politicians both formally and informally, likely at a greater frequency as compared with politicians at other levels. As a consequence of gender quotas at the local level, voters may be able to perceive women as viable political candidates and shed prevalent gendered stereotypes. In other words, they may become more responsive to the idea of women holding political positions (Gilardi 2015). These changes in attitudes should translate into an improved competitiveness of women candidates at higher levels of office.

To re-emphasize, while the supply-side argument suggests that numerically, more

women candidates will enter races for higher levels of political office after local-level gender quotas, the demand-side argument emphasizes that voters themselves will start to prefer voting for women as a result of local-level gender quotas and therefore, more women will emerge as winners. We therefore put forth the following expectations:

H_2: The vote share of women candidates in higher-level elections increases after lower-level quotas.

H_3: The percentage of women winners as a proportion of all candidates in higher-level elections increase after lower-level quotas.

We are not the first to note the distinction between both supply- and demand-side factors; Kunovich and Paxton (2005) speak of a two-stage 'filter' process whereby in the "first filter, women must be selected by parties in order to *run for* political office. In passing through the second, women must be selected by the electorate in order to *achieve* political office" (p. 507, emphasis theirs). Such a theoretical process is outlined in Figure 1. Nor are we the first to examine how gender quotas at one level of government can affect representation at other levels, although the amount of current research on this is remarkably small (c.f., Bharadwaj 2018; O'Connell 2020; Karekurve-Ramachandra 2020). However, by combining supply- and demand-side arguments into multiple, testable measures, and through our empirical strategy outlined below, we offer a more comprehensive examination into how quotas can have effects on other electoral levels than do previous studies. Moreover, we argue that our theoretical framework and our test case of India is even a bigger test of any supply-and-demand "acceleration effects", since unlike O'brien and Rickne (2016)'s Swedish case, we study the role of gender quotas in the context of higher-level interparty competition.
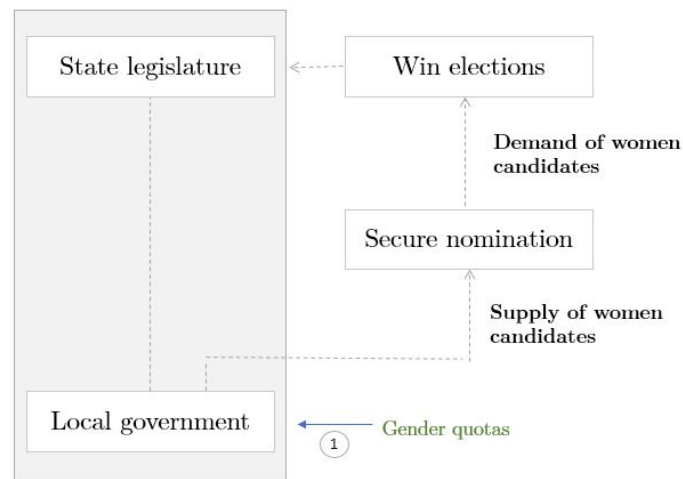
Figure 1: The existing theoretical framework

Research design

Institutional context: Reservations for women in India

Our theory suggests that as a result of local-level quota implementation, women may enter into politics in greater numbers at higher levels of government (supply-side), as well as become more competitive candidates (demand-side). The case of India is an ideal area in which to test our theoretical expectations. It has a three-tiered federated political structure where voters elect political leaders at the local, state, and national level every five years. With the 73rd constitutional amendment in 1992 (which came into force in 1993 as *The Constitutional (73rd) Amendment Act, 1993*), 33 percent of all seats at the local level (i.e., the *Panchayati Raj* system) comprising governance bodies at the village, block, and district-levels were reserved for women, along with reservations for Scheduled Castes (SC) and Scheduled Tribes (ST), historically disadvantaged social groups.[7] Subsequently, the state governments amended their policies to comply with the constitutional amendment before carrying out local-level elections. After 2005, many states upgraded the percentage of women's reservations from 33 to 50 percent at the local level. However, at the state and the national levels, no such policy

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[7]The caste-based reservations for SCs and STs are proportional to their population in a state.

of women's reservation has come into fruition, despite many attempts to present and pass such bills since 1996. In addition, other than parliamentary elections, all Indian elections occur at different times in different states. This scenario presents an ideal case for a large-scale analysis in isolating the effect of gender quotas by using this identification strategy and difference in timings of implementation on the effects of women candidates in state elections.

Data

We use data on India's assembly (i.e., state legislative) elections from 1977 to 2018 to test our empirical expectations.[8] The data are comprised of the state-wise and the election-wise candidates' information, such as age, gender, caste, party affiliation, vote share percentage, and place in the constituency.[9] Our analysis focuses on 26 states of India.[10]

Dependent variables

We take several approaches to measuring women's representation at the state level to discern whether women are numerically increasing in contesting elections—our supply-side argument outlined above—and whether they are winning the election (the demand-side). We operationalize the concept of women's representation as follows. For supply-side variables we use the following in order to test our first hypothesis:

- The *proportion of women contesting elections* is designed to gauge whether more women are entering into politics. This variable is expressed as a percent of all

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[8]These come from the SHRUG dataset released by Development Data Lab: http://www.devdatalab.org/shrug (Jensenius and Verniers 2017; Asher et al. 2019).

[9]For state elections, the districts are divided into constituencies and voters elect members of legislative assemblies (MLAs) from each constituency.

[10]Meghalaya, Mizoram, and Nagaland are excluded from our analysis as these states are governed under Schedule 6 of the Indian Constitution and do not have women's reservation at the local level. Our sample of 26 states includes Jammu and Kashmir whose status was changed from a state to a union territory in the year 2019. We exclude any bye-elections from our analysis.

candidates (e.g, seven means that seven percent of all candidates in a state election are women).

- The *percentage of races with at least one woman candidate* measures how diffused women are in a race. Lower numbers indicate that women are contesting from few seats.

For our demand-side hypotheses we use the following three variables:

- The *average vote share of women* candidates competing in state elections measures whether women are becoming more successful in races (in terms of votes received) over time. Even though as more women contest elections this measure is likely to decrease, this variable helps establish whether women are becoming more competitive across elections. This is a good measure of hypothesis two.

- The *percentage of women winners from total candidates* is designed to gauge whether women are becoming more successful in state-level elections after the local-level reservation. This variable is expressed as a percentage of all candidates running. We measure hypothesis three using this variable.

- Last, the *percentage of races where a woman won* measures how successful women are at overall representation in the state legislature (i.e., since the winning candidate then goes onto become a member of the legislative assembly). This variable is expressed as a proportion of all available seats in a state election (e.g., 0.3 means that women won three percent of all constituencies). This is a good indicator of assessing the third hypothesis.

Empirical strategy

As explained in the earlier sections, women's reservation in India was implemented in local governments first at the 33% level, and then later at the 50% level. While the 33% reservation was implemented in all states, the 50% reservation was implemented only

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in *some* states. Therefore, we exploit the variation in the proportion of reserved-seat quotas for analyzing the impact of the 50% reservation using a difference-in-differences estimator (DID).[11] Since intervention timings of the 50% reservation varies by state, we cannot use the conventional DID (Cunningham 2021). Instead, our basic framework is as follows:

$$\text{Women's Representation}_{it} = \alpha + \gamma Post50_{it} + \theta_i + \delta_t + \varepsilon_{it} \tag{1}$$

where our various women's representation measures described above are a function of a constant α, a dichotomous variable $Post50_{it}$, which is equal to one if election t is occurring after the post-50% panchayat level reservation in state i (and zero otherwise), θ_i, a series of state fixed effects, δ_t, a series of election fixed effects, and ε_{it} an error term. The election fixed effects account for common changes across all states between elections that may otherwise affect our outcomes of interest, while the state fixed effects account for all time-invariant heterogeneity specific to a given state. The coefficient γ can be interpreted similarly to the conventional DID estimate of interest.

We also adopt a variation of equation 1 for taking into account any trends that may be different in the treatment states implementing 50% reservation:

$$\text{Women's Representation}_{it} = \alpha + \gamma Post50_{it} + + \beta Treated_i \times \delta_t + \theta_i + \varepsilon_{it} \tag{2}$$

where $Treated_i$ is a dichotomous variable equal to one for those states that are "treated" (i.e. any states where the 50 percent threshold for local-level elections was implemented).[12] The key difference between these equations are that in Equation 1 possibly non-linear time effects common to all states are accounted for in the former using the election fixed effects Equations, while in addition to this, in Equation 2 also

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[11]Though we also analyze the effect of the 33% reservation in the robustness section below.

[12]Treatment states include Andhra Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Sikkim, Tripura, Uttarakhand, West Bengal. Control states include Arunachal Pradesh, Goa, Haryana, Punjab, Tamil Nadu, Telangana, Uttar Pradesh, Jammu & Kashmir, and Manipur.

accounts for any treatment-specific (linear) election trends across treated states through the $\beta Treated_i \times \delta_t$ term.

Results

We present the results for the 50 percent local-level gender quotas on the percentage of women candidates in state assembly elections in Table 1, Models 1 and 2. All models are shown with standard errors clustered by the state to account for any state-specific heteroskedasticity. Both DID specifications shown (state- and election-fixed effects in Model 1 and state-fixed effects and treatment-specific linear election trends in Model 2) suggest that the percentage of MLA candidates who are women increases by between 0.4 and one percentage point following an increase to a 50 percent women's reservation at local-level of political office, although neither reach conventional levels of statistical significance. This lends some tentative support to our expectation that the supply of women candidates at the state level increase in response to local-level increases in women's representation. However, our second measure of supply-side representation—the percentage of races with at least one woman candidate—shown in Models 3 and 4 in Table 1, suggest that if anything, a *lower* percent of state-level races include at least one woman candidate, although it should be noted that neither of these estimates are statistically significant. In sum, we find relatively weak support for our first hypothesis that local-level gender quotas increase the supply of women candidates.

For our second hypothesis, we measure the vote share of women MLA candidates as a proxy for the demand of women. Models 5 and 6 in Table 2 shows that the vote share of women candidates increases somewhere between 2.7 to nearly four percentage points with the implementation of the 50 percent local-level quota reservation, and this effect is statistically significant. Here, we find support for our second hypothesis; MLA women candidates in states with greater levels of women's representation at the local level appear to perform better in elections, something that we argue is suggestive of a

Table 1: Weak evidence of local-level 50% reservation's effect on state-level supply-side factors

	% Women candidates		% Races with at least one woman candidate	
	(1)	(2)	(3)	(4)
50% reservation	0.406	1.007*	-2.542	-0.574
	(0.478)	(0.557)	(3.380)	(3.979)
State FE	Y	Y	Y	Y
Election FE	Y	Y	Y	Y
Treated state x Election trend		Y		Y
Observations	194	194	194	194
R^2	0.968	0.972	0.967	0.969
Adjusted R^2	0.961	0.963	0.959	0.960

Dependent variable:

Note: Standard errors clustered by state are given in parentheses. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$.

greater demand for women candidates.

Table 2: Strong evidence of local-level 50% reservation's effect on state-level demand-side factors

	Vote share		% Women winners		% Races with women winners	
	(5)	(6)	(7)	(8)	(9)	(10)
50% reservation	2.695*	3.990***	0.216**	0.280**	1.512	2.248*
	(1.483)	(1.430)	(0.100)	(0.132)	(0.972)	(1.248)
State FE	Y	Y	Y	Y	Y	Y
Election FE	Y	Y	Y	Y	Y	Y
Treated state x Election trend		Y		Y		Y
Observations	194	194	194	194	194	194
R^2	0.933	0.939	0.834	0.841	0.890	0.898
Adjusted R^2	0.918	0.921	0.797	0.793	0.865	0.867

Dependent variable:

Note: Standard errors clustered by state are given in parentheses. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$.

Finally, do these local-level quota policies make women more likely to win elections to the state legislative assembly? As shown in Table 2, the enactment of a 50 percent local-level gender quota has a positive and statistically significant effect on improving women's winnability in state-level elections. Substantively, this increase is modest as the percentage of women winners increases only by 0.22 to 0.28 percentage points. In measuring our third hypothesis, we also assess the percentage of races where a woman candidate wins. We find that the percentage of races where women winners emerge

increases by between 1.51 (in Model 9) and 2.25 percentage points (Model 10), although only the latter is weakly statistically significant. Overall, given the results in Models 7 through 10 we have relatively consistent support for our third hypothesis.

Robustness, identification and sensitivity tests

There are several key assumptions to verify with respect to our findings. One important identifying assumption underlying DID approaches is that the treatment (in our case, the 50 percent quota) is plausibly randomly assigned to a given state. This assumption would not be valid if states that adopted the 50 percent reservation hold a progressive approach towards women, for instance. We test this by comparing gender-based indicators for the treatment and control group using the National Family Health Survey (2005-06). The states began adopting the 50 percent women reservation after 2005. Therefore, NFHS data appropriately provides a baseline picture of gender-based indicators, while avoiding any post-treatment comparisons. We find no systematic differences between treatment and control groups using difference of means tests, as shown in Table 3; none of the differences are statistically significant.

Table 3: No difference between treated and control states before quota implementation

	Treated Average	Control Average	Difference (Treated - Control)
Total Fertility Rate	2.49	2.54	-0.05 [-0.67 0.56]
Infant Mortality Rate	51.60	42.11	9.49 [-6.72 25.70]
Sex-Ratio	930.59	902.25	28.34 [-61.12 117.80]
"Prefer Sons Over Daughters" Among Women	21.44	20.98	0.46 [-8.41 9.33]
Educated Women (High School and Above)	23.93	29.43	-5.50 [-15.95 4.96]
Employment Among Married Women	43.62	42.98	0.64 [-15.70 16.99]

Note: 17 treated and 8 control states. $*\, p < 0.05$. 95% confidence intervals in square brackets. Two-sided tests. The differences may differ due to rounding off.

Another assumption is that of "parallel trends"; in our research design, this involves testing whether states that did enact a 50 percent reservation had similar pre-reservation outcomes to states that never enacted such reforms. Were we to find differing pre-treatment outcomes, it would suggest that factors other than women's reservation may be affecting supply- and demand-side variables, and also make using untreated states a poor empirical counterfactual to the outcomes of treated states would have had, had they never been treated. Since the year in which state-level reservations took place differs by state, we estimate a two-way fixed effects model, where in place of $Post50_{it}$ we substitute dichotomous variables equal to one for elections taking place before and after the reservation (Cerulli and Ventura 2019; Cunningham 2021). Using joint F-tests, we fail to reject the null hypothesis that all pre-treatment coefficients are equal to zero, which suggests that the parallel trends assumption is satisfied. These tests and plots are available in the Supplemental Information (SI).

We also investigate whether there are post-treatment effects—in other words, whether our estimates above grow larger or smaller as state elections continue to be held in states that passed the 50 percent local election reservation. As shown in the SI, there is some evidence that the magnitude of the effects grow stronger as more elections are held post-reservation.

An additional concern is that, because the overall DID estimate comes from weighted sums of average treatment effects for each unit, some of these weights may end up being negative if there is heterogeneity in the treatment effects (De Chaisemartin and d'Haultfoeuille 2020). At the extreme, these negative weights may result in a negative average treatment effect, even though all individual effects may be positive, for example. As shown in the SI, using the procedure outlined by De Chaisemartin and d'Haultfoeuille (2020) we find that none of the individual treatment effects ever receive a negative weight.

It might also be the case that our results may be driven by the temporal effects of women's reservation starting back at the 33 percent reserved-seat quotas at the local

level, although recall that this affected *all* Indian states. Still, to rule out this alternative argument, we use three different specifications that are available in the SI. First, we control for the implementation of the 33 percent reservation in our models. Second, we also add a lagged dependent variable of each outcome in order to account for any dependence in each of our women's representation variables. Third, we remove two states—Karnataka and Andhra Pradesh—from our analysis; these states had provisions for women's reservations prior to the 73rd Amendment (since 1987 and 1991, respectively). Our results remain consistent through these specifications.

A final concern could be that these results are driven by the emergence of non-competitive women candidates. Therefore, we also take into consideration the percentage of women candidates who lose their security amount deposited with the Election Commission of India (ECI). In Indian elections, all candidates are mandated to submit a security deposit with the ECI, which is forfeited if candidates do not receive at least one-sixth of the total vote share in a constituency. This is designed to dissuade candidates from entering an election race who are unlikely to be serious contenders. We measure this variable as a percentage of all women candidates. As shown in the SI, the share of women candidates who lose their security deposit decline between 5.8 to 9.2 percentage points, indicating that the proportion of competitive women candidates in MLA elections increases with the introduction of a 50 percent reservation at the local level.

Does the supply of women candidates drive demand for them, or vice-versa?

As discussed above, the extant literature suggests that the supply of candidates comes first, then the demand for women candidates by voters (c.f., Kunovich and Paxton 2005). Our findings suggest that both state level demand- and supply-side outcomes were affected by local level quota implementation (with more evidence for the former),

but it does not answer the question of whether supply-side factors drive demand for women candidates, or if the increased demand for women candidates goes on to increase the supply of candidates. To address this, we employ a panel Vector Autoregressive Model, or pVAR (Holtz-Eakin, Newey and Rosen 1988), which leverages our use of multiple demand- and supply-side factors measured over time and across many states. pVARs allow us to not only let each of our five factors be possibly endogenous to one another, it also allows us to test which factors may cause each another, as well as examine how these changes take place over time. In other words, it allows us to parse out whether an increased supply of women candidates is driving demand-side factors, or vice-versa.

We follow the suggestion of Abrigo and Love (2016), who propose estimating a pVAR using generalized method of moments in order to remove time-invariant heterogeneity specific to each state, as well as the well-known Nickell bias common in models with a small number of time points, lagged dependent variables, and unit fixed effects. Since these models are estimated as a rather unwieldy set of simultaneous equations, we offer a fuller discussion of our pVAR setup and present the full table of results in the SI. In brief, we let each of our five supply and demand factors be a function of their own one-period lag as well as the lag of all other factors. We also include the 50 percent reservation treatment indicator (as well as its lag) as an exogenous variable, remove cross-sectional means to account for cross-sectional dependence, and cluster our standard errors by state. Despite the complex parameterization of pVAR models, we can examine the impacts of each of our five supply- and demand-side factors using two relatively straightforward interpretation approaches, described below.

In order to answer which factors drive one another, we first perform a series of exogeneity tests. Granger causality—a form of causality in time series—can be established if we find that, after conditioning on the past history of variable *a* (as well as all other supply- and demand-side factors), past values of *b* are still statistically significant predictors of current values of *a*. In other words, rejecting the null hypothesis of joint Wald tests of variable *b* on *a* suggests that variable *b* "Granger-causes" *a*. A simplified

form of these results are shown in Table 4, although interested readers may consult the SI for actual χ^2 values from these tests. A "*yes*" box in Table 4 indicates that row *b* Granger-causes column *a* at $p < 0.05$ using a Wald test (and "*weak*" if $p < 0.10$). There is very little evidence that any of the supply-side factors—the percentage of women candidates and the percentage of races with at least one woman candidate—cause either one another or any of the demand-side factors; if anything, having more races with at least one woman candidate is a weak cause of the vote share of women candidates. In contrast, two of our demand-side factors, the percentage of women winners and the percentage of races with women winners, appear to cause not only the two supply-side factors, but also the other demand-side factor (vote share) as well as cause one another. To summarize Table 4, in contrast to much of the extant literature we find that, if anything, more *demand* for women candidates causes the supply of women candidates to increase, not the other way around.

Table 4: Granger-causality tests suggest that demand causes supply

	Supply-Side		Demand-Side		
b ⇓ "Granger-Causes" a ⇒	% Women candidates	% Races with at least one woman candidate	Vote share	% Women winners	% Races with women winners
% Women candidates	*n/a*				
% Races with at least one woman candidate		*n/a*	*weak*		
Vote share			*n/a*		
% Women winners	*yes*	*yes*	*weak*	*n/a*	*yes*
% Races with women winners	*yes*	*yes*	*weak*	*yes*	*n/a*

Note: Individual exogeneity tests show whether row *b* Granger-causes column *a*, using Wald tests from the estimated pVAR. H_0 : the excluded *b* does not Granger-cause equation variable *a*. *yes*: $p < 0.05$; *weak*: $p < 0.10$. Actual χ^2 values for all tests are available in the SI.

While Table 4 helps establish which factors might be causing one another, we still do not know the direction of this relationship. To better visualize this, we estimate a se-

ries of impulse response functions (IRFs) based on our estimated pVAR model. These show the effect of a plus one standard deviation shock (an assumed-exogenous "impulse") to one of the five variables at a given time point, and plots the corresponding response in each of these variables for up to four elections into the future. Based off the Granger-causality results and to avoid interpreting all 25 plots (the same as the number of entries in Table 4), we only show impulses of two strongest factors that appear to drive the others: the percentage of women winners as well as the percentage of races with women winners. All other IRFs are available in the SI.

In Figure 2, we show the effect of a one standard deviation (all variables shown are standardized) impulse in the percentage of women winners at the 0th election, and plot the response across the next four election periods. While this shock completely dissipates from the percentage of women winners after one election period, it has several statistically significant negative effects on the two supply-side variables. In response to a greater percentage of women winners, the percentage of women candidates declines, as does the percentage of races with at least one woman competing in the next election cycle. Turning to demand-side variables, while the vote share of women is not affected, the percentage of races with women winners also experiences a decline of nearly half a standard deviation in the next election cycle. Across all variables however, the effects caused by an increase in the percentage of women winners appears to be temporary, since none of the responses are statistically significant after the first election period after the shock. To summarize, increasing the demand-side factor of the percentage of women winners causes decline in the supply of women (as well as the percentage of races with women winners), albeit temporarily.

In contrast to Figure 2, there appear to be *positive* supply- and demand-side effects caused by a one standard deviation increase in the percentage of races where a woman won, as shown in Figure 3. The number of women candidates increase by nearly half a standard deviation in the next election, with similarly-sized increases (although only weakly statistically significant) in both the percentage of women winners and the percentages of races with at least one woman running. This suggests that the supply
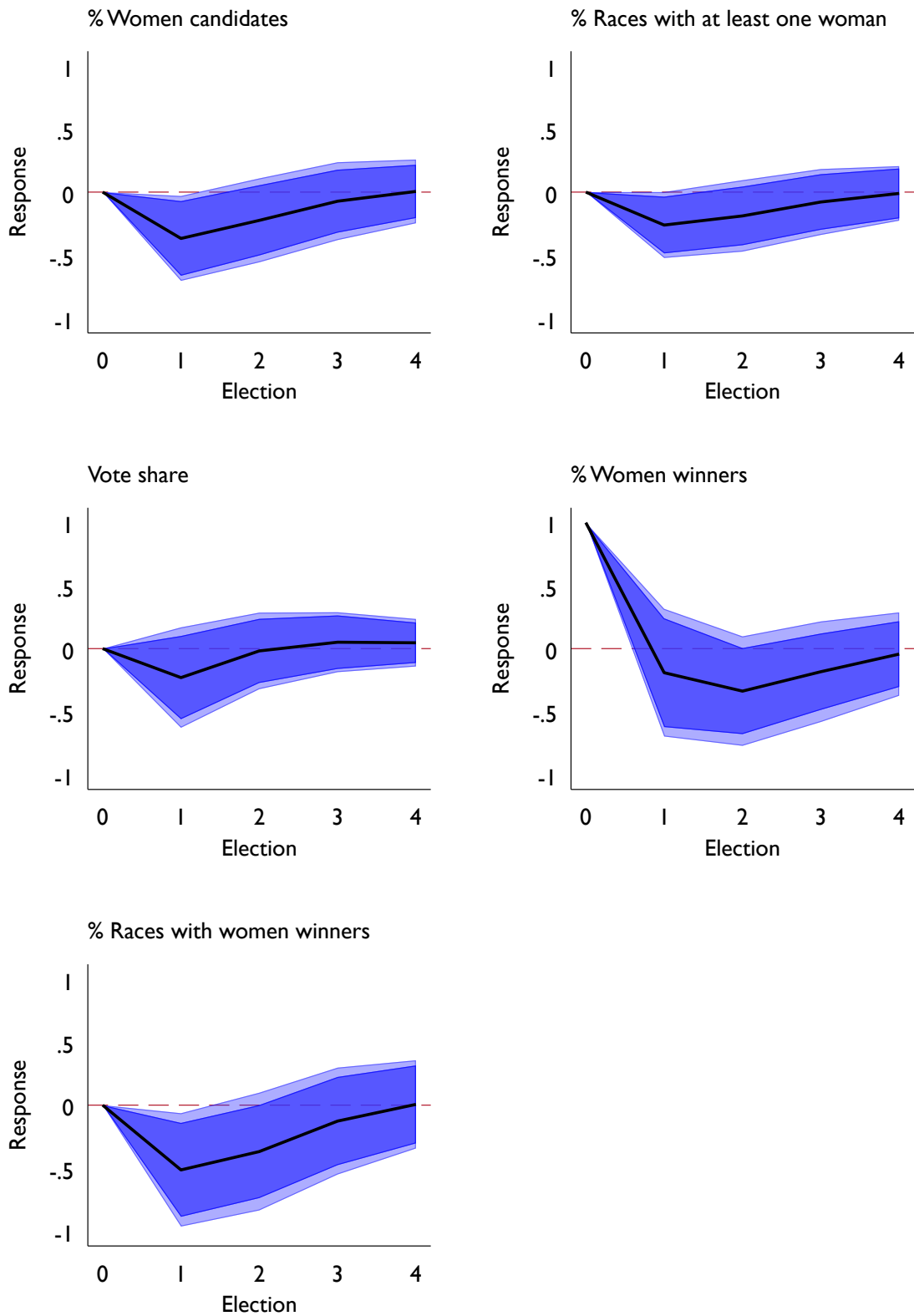
Figure 2: Effect of a +1 standard deviation impulse of the percentage of women winners on all supply- and demand-side outcomes

Note: Estimated response along with 90% (dark blue) and 95% (light blue) bootstrapped confidence intervals shown. All variables standardized.

of women candidates appears to increase once women start winning in a larger percentages of races. We also find that increases in the percentage of races with women winners tends to persist over time (losing statistical significance only in the second election held post-shock), which suggests that women candidates continue to remain competitive once they begin to win in state-level elections.

Discussion and conclusion

Women have played an increasing role in politics in recent years, often through quotas designed to increase their numerical representation. In this paper we have found that such quotas have potential effects on representation beyond the level of government for which they were designed. Though in terms of percentage points these gains might look small, considering that these positive effects are being observed at the assembly level of elections within one to two election cycles after the proportional shift from 33 to 50 percent gender quotas at the local level, these represent substantial effects. Moreover, considering recent trends in Indian elections, we expect that these effects will grow in magnitude in future.[13]

We find that the mechanisms by which this effect occurs seem to be both demand-side—voters may start to favor women candidates—as well as supply-side—successful women may run for other higher positions in government. On the supply-side, even though our data limit our ability to further investigate the causal mechanisms driving our results, we pose two main explanations. One, entry-level gender quotas can

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[13]In the Indian context, there have been growing attempts of opening up political spaces for women. For instance, advocacy organizations such as *Shakti* and the Indian School of Democracy are making concerted efforts in strengthening women's representation in politics. Some parties are committing to fielding a certain percentage of women in assembly elections. For instance, the incumbent party Janata Dal (United) in Bihar nominated 19 percent of women in the 2020 assembly-level elections. Similarly, Indian National Congress (INC) nominated 38.5 percent of women candidates in the Uttar Pradesh assembly elections in 2022. Party efforts such as these not only work as peer pressure for other parties to narrow the gender gap in candidate nomination, but also represent opportunities for local women leaders party workers to progress upwards in their political careers. For instance, In the Bihar assembly elections of 2022, women candidates such as Susmalata Khushwaha and Ritu Jaiswal began their political careers from the grassroots and won local level elections in the year 2016. Similarly, many women candidates in the Uttar Pradesh assembly elections of 2022 had a history of contesting and winning local body elections(Verniers and Mirchandani 2022).
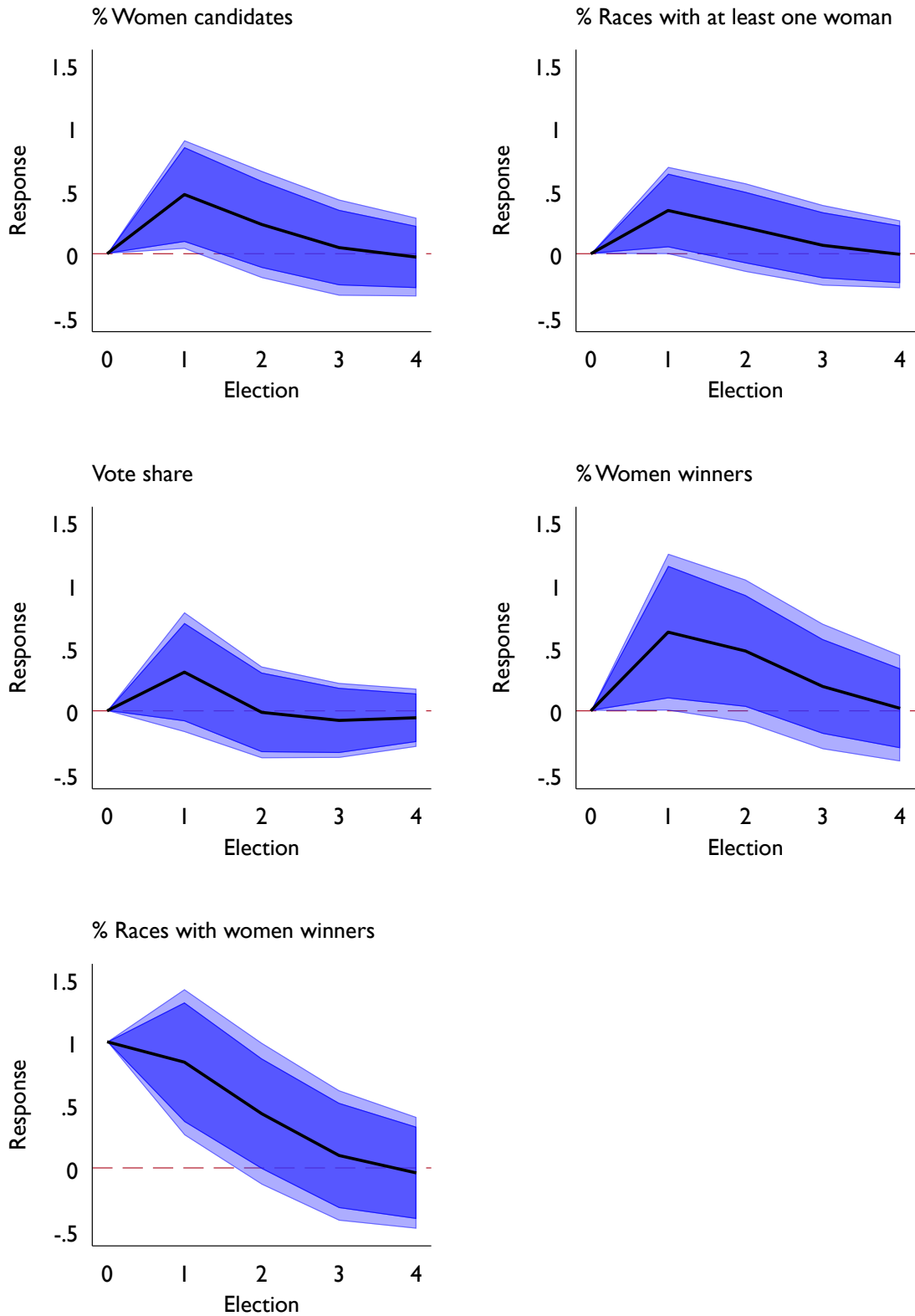
Figure 3: Effect of a +1 standard deviation impulse of the percentage of races where woman won on all supply- and demand-side outcomes

Note: Estimated response along with 90% (dark blue) and 95% (light blue) bootstrapped confidence intervals shown. All variables standardized.

prompt local women incumbents to secure a nomination and then go on to contest state-level elections. Second, considering that quotas can shift voters' attitudes favorably towards women, new women entrants can emerge as contestants and possibly win state-level elections. Though existing work finds some support for the former possibility (Karekurve-Ramachandra 2020), future work should examine the perceived effect of being a quota beneficiary in the career progression of women.

The demand-side factors present encouraging results that not only does state-level women candidates' competitiveness improve as a result of local-level quotas, they also obtain more seats in the legislative assembly. These results indicate that women's entry into the political arena through quotas may address the issue of a 'leaky pipeline' to power at the highest levels of government. Moreover, our results also contribute to the literature on critical mass that suggests that women make more gains when quota reforms achieve parity (i.e., the 50 percent reservation), moving beyond the minimum conventional threshold of 30 percent for women's representation.

Our results are also relevant beyond the Indian context. Our findings contrast somewhat with existing studies that show no spillover effect of women's reservations to neighboring geographic areas (Bhalotra, Clots-Figueras and Iyer 2013), or that the quota effect may actually limit the upward mobility of women (Kerevel 2019; Lassébie 2020). However, our results are consistent with studies that show that quotas induce an 'acceleration effect' in widening the viable pool of women candidates (O'brien and Rickne 2016), the likelihood of women being re-elected increases even in the absence of quotas (Bhavnani 2009; O'Connell 2020), and that voter acceptance improves towards women politicians (Beaman et al. 2009).

Through the use of our pVAR models, our analysis also provides suggestive evidence that demand-side factors drive supply-side factors (as well as driving other demand-side factors), not the other way around. This indicates that parties may take into consideration voters' responsiveness affecting women's winning potential. A further investigation into directionality of these effects presents a complicated picture. We

find that when women win elections in higher proportions, their performance dips in the next two elections on all five variables, indicating a temporary backlash effect. On the other hand, a higher proportion of legislative races where women win has not only a temporary uplifting effect across the variables under consideration, these positive effects appear to last for a longer period than the backlash effects discussed above. These contrasting findings may also be driven by how the geographical spread of women's representation is perceived by voters and party recruiters in comparison to overall pool of women representatives.

Taken together, our findings open up further research questions. For instance, we do not yet know what individual-level and party-level factors affect women's nomination for the state-level elections, since these are more competitive and expensive than local-level elections. There could also be differential outcomes for different subgroups of women (e.g., women from minority ethnic or social groups). Future work might also examine the conditions under which entry-level gender quotas help or hurt women in their career progression. Finally, we examine our research question in the context of reservations. The comparative effectiveness of different quota designs in facilitating the career path of women remains to be examined.

While the existing research has already established that improving gender representation has meaningful gains for electoral politics and society, women still constitute a minuscule proportion of Indian electoral politics. Based on our results, gender quotas at the state and the national level may be a way forward to bridge the gender gap in politics.

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