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Quota versus Quality? Long-Term Gains from an Unusual Gender Quota[†]

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We evaluate equity-efficiency trade-offs from admissions quotas by examining effects on output once beneficiaries start producing in the relevant industry. We estimate the impact of abolishing a 40 percent quota for male primary school teachers on their pupils' long-run outcomes. We combine this reform with the timing of union-bargained teacher retirements to isolate quasi-random variation in male quota teachers. Pupils exposed to male quota teachers transition more smoothly to postcompulsory education and have higher educational attainment and labor force attachment at age 25. Evidence suggests the quota improved the allocation of talent by mending imperfections in the unconstrained selection process. (*JEL* I21, I23, I28, J16, J24, J45)

Are affirmative action policies, such as quotas, inefficient? While many countries around the world are deliberating quotas to increase the representation of women and underrepresented minorities in business and politics, there is also widespread pushback against such initiatives (United Nations 2019; Long 2019). Universities in the United States and elsewhere face increasing judicial challenges for admissions policies alleged to advantage underrepresented groups (Barnes 2023; Green 2022; BBC 2022). However, we still have a relatively limited understanding of the equity-efficiency trade-offs associated with such policies, largely due to a lack of opportunities to observe their impact on explicit measures of output in real-world contexts.

From a theoretical perspective, the effects of affirmative action and quota policies on output are ambiguous: On one hand, when quotas in educational institutions and workplaces are binding, they require these organizations to "lower the bar" by admitting less

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qualified applicants who would have been rejected otherwise (Welch 1976; Lundberg and Startz 1983; Arcidiacono and Lovenheim 2016). Cast in this light, affirmative action policies may achieve a distributional goal only at the cost of lower productivity.

In contrast to this reasoning, affirmative action policies can raise economic efficiency when evening out unequal opportunities that are unrelated to potential ability (Becker 1957; Coate and Loury 1993; Hsieh et al. 2019). When decision-makers rely on imperfect information of candidates' abilities, differential treatment can be desirable since selection criteria may not account for prior disadvantage. Recent work has found that group-neutral decision rules de facto disadvantage underrepresented groups in domains such as hiring, health, and the criminal justice system (Bohren, Hull, and Imas 2025; Li, Raymond, and Bergman 2026; Rose 2021; Obermeyer et al. 2019). The presence of such selection imperfections raises the prospect that affirmative action policies may actually be output enhancing.

In this paper, we study output under a quota at university admissions that changed the gender composition of an entire occupation. We document that this gender quota—despite the fact that it "lowered the bar" for candidates of the underrepresented group—led to a more efficient allocation of study slots by filling them with eventually more productive workers. Our setting is university admissions for primary school teacher studies, one of the most popular fields of study in Finland. Specifically, we analyze a quota that reserved 40 percent of study slots for men, thus benefiting academically lower-scoring male candidates. We document that these "male quota teachers" perform better on the job relative to marginal female candidates: Pupils who are exposed to more male quota teachers during primary school experience gains in both educational attainment and subsequent labor force attachment. We then show that these productivity gains materialize because the selection criteria disadvantage the underrepresented group and are not related to output. Instead, male teachers in this context exhibit several attributes, namely, career attachment and intrinsic motivation, that may explain their pupils' perseverance regarding their own professional paths.

Our identification strategy isolates exogenous variation in pupils' exposure to male quota teachers with a differences-in-differences instrumental variables (DiD-IV) framework that exploits the sudden termination of the quota. This policy change instantly reduced the share of men among admits to primary school teacher studies from about 40 percent to 20 percent (Uusiautti and Määttä 2013a; Räihä 2010; Izadi 2024). We instrument for the local teacher gender composition that pupils experience in primary school by using the lifting of the quota together with the timing of local demand shocks for new teachers. These demand shocks arise from local teachers reaching the union-bargained teacher retirement age when turning 60. The first stage employs a DiD specification that estimates the differential impact of teacher retirement between the quota and the postquota period on the local share of male teachers. Intuitively, municipalities in which teachers turn 60 while the quota is still in place will hire new teachers from a rookie teacher market with male quota teachers, compared to municipalities whose teachers turn 60 just after the quota was abolished.[1]

[1] We label as "male quota teachers" those male teachers who were only able to enter primary teachers studies because the quota was in place and would not have gotten admitted otherwise. We refer to "marginal female teachers" as those female teachers who were able to be admitted to primary teacher studies once the quota was abolished and would not have gotten admitted otherwise. Throughout the paper, we refer to teachers turning 60 as "retirement."

The exclusion restriction requires that teacher retirements in the postquota period do not *differentially* impact pupil outcomes except via changing the teacher gender composition. Our empirical strategy addresses this by comparing pupils who experience similar exposure to new teachers via retirements but face a different gender composition of those teachers due to the lifting of the quota.

We start by sketching a simple model of statistical discrimination to outline conceptually how group-specific admission thresholds can deliver gains in representation and efficiency. When the test signal is biased against a group of candidates, an unconstrained admissions office sets optimal admission scores that differ by group and correct for the bias. In contrast, requiring admissions to be group blind—that is, abolishing affirmative action, or the quota in the Finnish case—is detrimental both for candidate quality and equal representation when the underrepresented group's lower performance on the test does not map into lower ability.

We then examine the efficiency effects of the male teacher quota empirically. First, we document how the lifting of the quota affected the local gender composition of teachers at the municipal level: Once the primary teacher cohorts that studied without the quota graduate and enter the market for rookie teachers in 1994, each retiring teacher is 20 percentage points less likely to be replaced with a male teacher relative to the quota period. These changes in the local teacher gender composition are accompanied by small, albeit noisily measured, increases in local teachers' average academic scores—consistent with male applicants, who are on average lower scoring, being less likely to be admitted to primary teacher studies once the quota is abolished.

We study how these changes in teacher composition affect pupils, using comprehensive register data from 1988 to 2018 to trace out pupils' education and labor market pathways until age 25. We start by analyzing pupils' application and enrollment behavior when leaving compulsory education three years after finishing primary school. We track pupils' educational trajectory with records from the nationally organized allocation of education slots, for which pupils can put in up to five institution choices. Using the timing of teacher age-based retirements as an instrument for the local teacher gender composition, we show that pupils exposed to a higher share of male teachers via the quota are more likely to directly apply to continued education. As pupils' applications are more aligned with attainable options, they are more likely to obtain one of their top two choices. These patterns translate into higher enrollment rates in postcompulsory education.

Turning to long-term impacts up to early adulthood, we examine pupils' educational attainment, labor market attachment, and field of study by age 25. For pupils who were exposed to a higher share of male quota teachers, we observe a shift toward higher qualifications throughout the educational attainment distribution: For practically oriented vocational degrees, pupils are more likely to have additional advanced qualifications instead of a basic three-year degree. For academic tracks, pupils are more likely to have obtained a university-level BA degree. Consistent with acquiring more education, these pupils have higher attachment to the labor market. At age 25, they are 3 percentage points more likely to be a student or employed for a 1 standard deviation increase in the share of male (quota) teachers, which corresponds to a 4 percent increase over the mean. Using data from degree registers, we further document that exposure to more male quota teachers makes pupils of

both genders more likely to study a STEM (Science, Technology, Engineering, and Mathematics) field. However, neither boys nor girls are more likely to pick an education- or teaching-related field.

Finally, we distinguish between two main avenues through which more equal gender representation may have improved pupils' outcomes. Teacher team performance could have been higher because the quota mended selection imperfections and admitted higher-performing teachers or because diverse teacher teams were more productive due to complementarities.

We document limited scope for complementarities in production between male and female teachers. In the presence of complementarities, the marginal impact of an additional male teacher should be higher in places with a lower share of male teachers at baseline. We show that the benefits of having more male teachers via the quota are similar in magnitude between places with few male teachers and places where the share of men among colleagues is already high. This suggests limited scope for diversity *in itself* being sufficient to augment productivity.

Instead, three complementary pieces of evidence emphasize the presence of imperfect selection in the admission process and shed light on why men's lower performance on the selection criteria did not map into lower performance on the job. First, we show that the admission criteria disadvantaged the underrepresented group. The matriculation exam score attaches a weight of 75 percent to language fields, in which men perform relatively worse, and 25 percent to math and science fields, in which men perform relatively better. Second, we document that this selection criterion is not directly related to productivity on the job. Teachers' performance in the matriculation exam, and in particular in language fields, is not predictive of teacher team performance. We estimate a precise zero, suggesting that the weights of this admission criterion inefficiently disadvantaged men.

Third, we document that the underrepresented group exhibits several attributes that may enhance productivity in this setting. In particular, we show that male teachers display a high degree of dedication to their career as a teacher, which may explain why their pupils are more career oriented themselves. Male teachers are less likely to leave their career as a primary teacher and have higher earnings, which—due to the deterministic nature of the salary scale in this setting—is indicative of taking over additional responsibilities beyond regular teaching hours. These differences between male and female teachers are not fully accounted for by family formation and exist even for teachers without children. We further show evidence that highlights male teachers' intrinsic motivation when pursuing a stereotypically female occupation. Analyzing compensating differentials, we document that among similarly qualified applicants to primary school teacher studies, men face a wage penalty when becoming a primary teacher, whereas women obtain a wage premium. These compensating differentials are indicative of men's intrinsic motivation in the teaching profession, as they forgo higher earnings relative to their outside option. Both of these patterns are consistent with male teachers setting an effective role model for their pupils in terms of career attachment, thus inspiring them to persevere in their own pursuits. This impact is not gender specific, as both boys and girls benefit to a similar extent from exposure to male quota teachers, and it does not operate via improving pupils' grades.

Taken together, our results highlight that men's lower performance on selection criteria does not map into performance gaps on the job, such that the quota raised

both representation and efficiency. While providing a role model in terms of career orientation may explain the underrepresented group's productivity in the context of this study, the particular group-specific characteristics that matter for output will certainly be setting specific.

This paper makes three main contributions. To the best of our knowledge, we are the first study to cleanly document that a quota can have positive effects that extend *beyond* its direct beneficiaries, such that the policy improved output in the relevant sector in the long run. We relate to recent work that has documented benefits from access to selective colleges for candidates admitted under affirmative action relative to their outside option (Bleemer 2022, 2021; Otero, Barahona, and Dobbin 2023; Black, Denning, and Rothstein 2023; Carlana, Miglino, and Tincani 2024). Empirical evidence on how quotas impact output-related measures has almost exclusively focused on mandated representation of women in board rooms, documenting negative or neutral effects on firm performance in the short run (Ahern and Dittmar 2012; Matsa and Miller 2013; Eckbo, Nygaard, and Thorburn 2022; Ferrari et al. 2022).[2]

Second, our work underscores the importance of imperfect selection criteria in creating disparate impacts for underrepresented groups (Bohren, Hull, and Imas 2025). Attention has recently turned to selection criteria in the context of firms' hiring processes (Li, Raymond, and Bergman 2026; Shukla 2025; Chalfin et al. 2016), health (Obermeyer et al. 2019), and the criminal justice system (Rose 2021; Arnold, Dobbie, and Hull 2022). We highlight a general point that extends to settings beyond our specific case study: The selection of candidates based on academic scores and interviews, among the most widely used methods to assess applicants, can miss out on important dimensions of minority talent. Adherence to group-neutral evaluation criteria that discount the talents of the minority group can thus create the false impression of selection on merit (Sethi and Somanathan 2023), to the detriment of equal representation and aggregate productivity.

Third, our paper relates to studies on teacher value added and gender-based role models. A large body of work has documented that teacher value added, rather than teachers' certification or test scores (see Jackson, Rockoff, and Staiger 2014 for a review), drives variation in academic and economic outcomes for pupils (Rivkin, Hanushek, and Kain 2005; Chetty, Friedman, and Rockoff 2014), with recent work emphasizing dimensions of teacher value added that are unrelated to pupils' test scores but matter for long-term outcomes (Jackson 2018; Beuermann et al. 2023; Petek and Pope 2023; Rose, Schellenberg, and Shem-Tov 2022). Several studies have provided evidence that being matched with a same-identity teacher can affect academic performance and choice of field of study (Gershenson et al. 2022; Dee 2007; Lim and Meer 2017, 2020; Carrell, Page, and West 2010), but others fail to find positive impacts (see de Gendre et al. 2023 for a meta-analysis).

While this paper empirically studies the case of a specific quota policy, its features embody inherent trade-offs that are present in any context in which equal representation targets are deliberated as supply exceeds available positions. The "unusual"

[2] Peck (2017) and Cortés, Kasoolu, and Pan (2023) document lower exports and higher firm exit as a consequence of a policy that required firms to hire native workers in Saudi Arabia. Several papers have studied quotas for female politicians but do not take a stance on whether this impacts output (Chattopadhyay and Duflo 2004; Beaman et al. 2009; Besley et al. 2017; Baltrunaite et al. 2014; Bagues and Campa 2021).

feature of our setting, namely, the quota being in favor of a group (i.e., men) that did not suffer from widespread discrimination or stigma, is valuable for isolating the importance of these forces in absence of confounders.[3] The conceptual framework delineates the key variables to consider when applying the insights of this study to any other context in which more equal representation is a policy goal. When an underrepresented group's lower performance on selection criteria does not map into lower performance on the desired outcome a decision-maker aims to maximize, addressing the mismatch between selection criteria and this outcome can be beneficial both for equity and efficiency. In essence, a promising path to more equitable representation lies in carefully considering how different evaluation criteria impact minority representation and actual performance. In academia, with current experimentation on test requirements for US college applications, as well as in the private sector, where companies are starting to use balanced candidate lists across groups, such avenues are increasingly being explored.

The paper is structured as follows: The next section details the Finnish education and teacher training system. We outline a brief conceptual framework in Section II. Section III explains our data sources and sample, followed by the empirical design in Section IV. In Section V, we first examine the effects of the quota on teacher gender composition at the municipal level, before turning to a pupil panel. We turn to mechanisms in Section VI; the final section concludes.

I. Context

A. *Primary School Teachers in Finland*

Finland has been among the top-scoring countries for multiple rounds of international student assessments, leading to considerable international attention paired with efforts to adopt best practices from the Finnish education and teacher training system (Malinen, Väisänen, and Savolainen 2012; Niemi, Toom, and Kallioniemi 2016). Due to being one of the most competitive degrees in university admissions, primary school teachers enjoy high social status (Paronen and Lappi 2018). While salaries are on par with the OECD average, active teaching hours are comparatively low (Sahlberg 2021). Primary school teachers are municipal employees who are hired by local schools and are part of a powerful teachers' union that fixes both salary schedules, and—for the relevant period in this study—a retirement age of 60 in collective bargaining agreements (Kivinen and Rinne 1994; Valtiokonttori 1988). A national curriculum outlines broad learning goals. Under the supervision of municipal education authorities, teachers within and across schools collaborate in designing detailed learning plans (Sahlberg 2021; Sahlberg, Johnson, and Strauss 2019).

In contrast to the United States, primary school teachers are assigned to a cohort as their main classroom teacher, covering all subjects in the respective grade, and may spend several years with that class. However, primary school teachers are also

[3] In the presence of factors such as stigma against the underrepresented group, one would *underestimate* the efficiency effects of more equal representation because that group would likely face additional discriminatory hurdles in the labor market. It would then be unclear if muted impacts of more equal representation were due to lower candidate quality or other confounders. Because of its long historical tradition, the male teacher quota had broad acceptance in Finland (Mankki, Mäkinen, and Räihä 2020).

actively embedded in their work environment through extensive collaboration with their colleagues, both in curriculum design, preparing lessons and school-wide activities, and in active teaching (Sahlberg 2021). Pupils in our setting are thus exposed to and interact regularly with the teacher body of their entire school.

B. *Primary School Teacher Training and the Quota Reform*

Historical Context.—The first teacher training institutes in Finland were founded in the mid-1800s and offered training separately by gender. In 1881, new education decrees allowed for coeducation of children attending municipal primary schools as long as sufficient instruction in handicrafts could be guaranteed, de facto leading to "differentiation between male and female elementary school teachers and a quota system in teacher training," with men constituting about 40 percent of primary school teachers in the first half of the twentieth century (Sysiharju 1987, p. 27). In the context of educational reforms in the 1970s, primary teacher education was transferred to universities and elevated to a master's level degree (Niemi, Toom, and Kallioniemi 2016). With an acceptance rate fluctuating around 10 percent, primary school teaching has been and still is among the most competitive degrees in the country, and applicants often apply multiple years in a row until they are successfully admitted (Tirri 2014; Uusiautti and Määttä 2013a).

Admissions throughout our study period closely followed the main principles established in those reforms, including that "the Ministry of Education has maintained the sex quota system for the training of classroom teachers" (Sysiharju 1987, p. 33): In a first step, applicants were ranked in a centralized system according to their score in the matriculation exam (the nationally graded high school exit exam), with a few additional points given for candidates' extracurricular activities. The highest-ranked candidates were then invited to an in-person second round, in which a faculty board evaluated them on essay tasks, exercises, and interviews, with the exact procedure varying across departments (Izadi 2024; Räihä 2010; Uusiautti and Määttä 2013b). The highest-ranked candidates in the second step were admitted to study primary teacher education according to the number of available study slots.

During the quota period, the Ministry of Education jointly with the education departments ensured that around 40 percent of candidates invited to the second round were men (Liimatainen 2002; Mankki and Räihä 2023). Documentary evidence suggests that universities followed the Ministry of Education's requested gender mix also in the decentralized second step of the selection process by ranking candidates within their specific gender and allocating 40 percent of final slots to men (Sysiharju 1987; Liimatainen 2002). The quota was abolished for the cohort applying to university in the fall of 1989 (thus graduating from primary school teacher studies in 1994), as it was not in compliance with a broad anti-discrimination law passed by Parliament in 1987 (Tasa-Arvovaltuutetu 1987). Since its lifting, politicians and the general public have repeatedly argued for the quota's reinstatement, motivated by the fact that boys are increasingly lagging behind academically and that a growing number of children raised by single mothers may lack a father figure (Etelä Suomen Sanomat 1988; Liiten 2012).

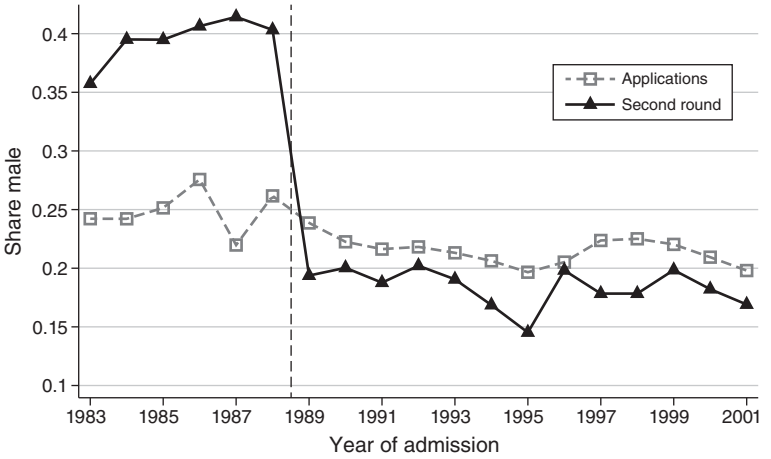

FIGURE 1. SHARE MALE IN APPLICATIONS TO PRIMARY SCHOOL TEACHER STUDIES

Note: Share male among applicants (gray squares) and among invitees (black triangles) to the second round of admissions to primary teacher studies by year of admission.

Source: Liimatainen (2002)

Summary Statistics: *Admissions and Teachers' Characteristics*.—Using aggregate statistics issued by the Ministry of Education, Figure 1 displays the share of men among those applying to primary teacher studies, and among those being invited to the second round of the selection process. While there is a sharp drop from 40 percent to 20 percent for second-round invitees in 1989, the share of men who apply evolves smoothly around the time of the reform.[4] As the quota did not only change the gender composition of incoming teachers but also advantaged academically lower-scoring men, Figure 2 plots future teachers' grade in the matriculation exam for the first attempt of the exam against the last year in which they ever took this exam. While the quota was in place, men on average scored about 0.53 grade points, or a bit more than half a standard deviation lower. Once the quota was lifted, the score gap narrowed to about 0.36 grade points for the cohorts displayed. We will return to the changes in primary teacher gender composition and academic scores more formally in Section VA.

Teacher gender in our setting is correlated with a bundle of other characteristics. Supplemental Appendix Table A1 presents summary statistics on male and female teachers who are active in the profession before the lifting of the quota (i.e., before 1994 as the year in which the first non-quota cohort graduates from teacher studies), and thereafter. In panel A, we can observe that male teachers are somewhat

[4] While the lifting of the quota was widely discussed in policy and media reports at the time, we have found no documentary evidence that either application numbers (see Supplemental Appendix Figure A1) or the composition of applicants would have drastically changed with its lifting. Figure 2 shows no discontinuity in the matriculation exam scores of those admitted postquota.

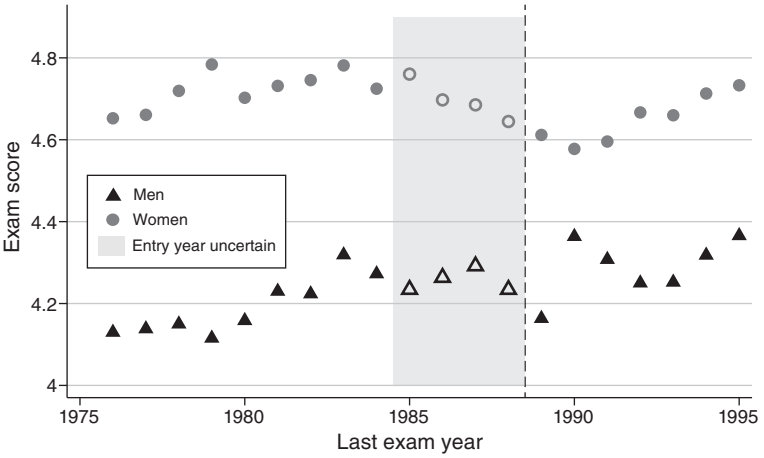

FIGURE 2. MATRICULATION EXAM SCORE AMONG PRIMARY SCHOOL TEACHERS

Notes: Overall score in the matriculation exam among primary school teachers, by gender and the last year in which they took the matriculation exam. The last year of taking the exam serves as a proxy for year of admission to university, which is unobserved. Exam takers in 1989 (dashed gray line) and thereafter will have studied after the quota was abolished, but there is uncertainty with respect to the start date of exam takers in the years prior to 1989. This figure plots the final score obtained in the *first* attempt at the exam in order to get at a measure of cognitive ability that is not influenced by repeated test taking. We plot the exam grade against the date of someone's *last* exam take to most closely approximate the point of entry to university studies.

more likely to come from rural areas and to live in their region and municipality of birth. Regarding educational trajectories in panel B, there is no difference in having obtained a high school degree and being a certified teacher. In panel C, statistics on the matriculation exam show similar pass rates but again illustrate that male teachers have significantly lower exam scores, even when considering the best grades obtained across repeated attempts. High school students had some flexibility to choose either mathematics or a combination of other natural and social sciences ("Reaali") in the matriculation exam. Male teachers are about 9 percentage points more likely to have taken the mathematics exam compared to female teachers and 11 percentage points more likely to have chosen advanced-level mathematics rather than the basic-level exam.

II. Conceptual Framework

In this section, we provide a brief conceptual framework to show that a quota can raise representation without incurring efficiency losses when the test is biased against an underrepresented group of candidates. The intuition mirrors the 1971 landmark Supreme Court case of *Griggs v. Duke Power Co.*, which struck down a promotion rule that was group blind "on paper" but relied on a biased test. For promotion, Duke Power Co. required multiple test-based qualifications that Black employees were substantially less likely to meet and that proved irrelevant for actual on-the-job performance (see also the discussion of this case in Bohren, Hull, and Imas 2025).

A. *Setup*

We set up a simple model of statistical discrimination that encapsulates the key elements of *Griggs v. Duke Power Co* (Aigner and Cain 1977; Phelps 1972; Autor and Scarborough 2008).[5] Our setup incorporates bias in the signal and a capacity constraint. Consider an admissions office that seeks to select a fixed mass of candidates c from a pool of applicants.

Candidates belong to one of two groups g, with $g \in \{M, F\}$ for male and female. The admissions office would like to select teachers with the highest teaching ability a, but it can only observe candidates' scores s with group-specific density $h_g(s)$. The admissions office is required to set score thresholds above which every candidate within a specified group is admitted. Scores are an imperfect measure of ability a due to group-specific bias, b_g, and overall noise e.[6] In particular,

$$s_g = a + e - b_g, \tag{1}$$

$$\text{where } a \sim \mathcal{N}(\mu_a, \sigma_a^2) \quad \text{and} \quad e \sim \mathcal{N}(0, \sigma_e^2)$$

e independent of a; and $b_M > b_W = 0$ a constant.[7] The bias in the test is therefore the only feature that gives rise to average score differences by group. Selection of candidates from each group is from the right-hand tail of the distribution. The expected ability of a candidate from group g given their score s is given by

$$E[a|s,g] = \frac{\sigma_e^2}{\sigma_e^2 + \sigma_a^2}\mu_a + \frac{\sigma_a^2}{\sigma_e^2 + \sigma_a^2}(s + b_g), \tag{2}$$

with $\frac{\sigma_a^2}{\sigma_e^2 + \sigma_a^2}$ equal to the squared correlation coefficient between ability and scores, $\rho^2 \equiv \rho_{a,s}^2$. An unconstrained admissions office sets optimal threshold scores s_g^* such that total expected ability of admits is maximized, subject to a capacity constraint:

$$\max_{s_M, s_F} \int_{s_M} E(a_M|s)\, h_M(s) ds + \int_{s_F} E(a_F|s)\, h_F(s) ds \tag{3}$$

s.t.

$$N_M + N_F = c,$$

[5] The teacher admissions office in our setting is unlikely to practice taste-based discrimination against men by choosing a test that favors women (Becker 1957), as the matriculation exam in Finland is commonly used for university admissions in most fields (Kupiainen, Marjanen, and Ouakrim-Soivio 2018), and teacher education departments themselves campaigned for a reinstatement of the quota after it was abolished (Tasa-Arvovaltuutetu 1992).

[6] We consider a one-stage selection process based on scores (that can be any combination of academic score and evaluator score) to illustrate the main forces at play. In Section VIB, we document that postquota admission probabilities conditional on exam score do not differ by gender in the Finnish context, suggesting that academic scores capture similar dimensions of ability as are evaluated in the second step.

[7] We assume that the population parameters μ_a, σ_a^2, σ_e^2, and b_g are known to the admission office. In our setting, similar to Autor and Scarborough (2008), the score distributions between groups exhibit a mean shift but similar variance (see also Section VIB). This mirrors group differences in test taking and on-the-job performance in other contexts: In the General Aptitude Test Battery (GATB), a job placement test used for decades by the US Employment Service, minorities' score distribution exhibits a mean shift but similar variance and is equally predictive of job performance (Hartigan and Wigdor 1989).

with N_g the mass of candidates admitted from group g. This results in group-specific cutoff scores given by

$$s_M^* = s_F^* - b_M. \tag{4}$$

The mass of candidates of each group admitted is then given by (see Supplemental Appendix B.2)

$$N_g = 1 - \Phi\left(z_g^*\right), \tag{5}$$

with $\Phi(\cdot)$ the CDF of the standard normal distribution and $z_g^* = \frac{\rho}{\sigma_a}\left(s_g^* - \mu_a + b_g\right)$. The expected ability among admits of each group is

$$E\left[a_g \mid s_g > s_g^*\right] = \mu_a + \sigma_a \rho \lambda\left(z_g^*\right), \tag{6}$$

with $\lambda(\cdot)$ the inverse Mills ratio.

B. *Representation and Efficiency*

We now discuss how allowing versus banning differential treatment by group impacts representation and total expected ability of admits in the context of a biased test.

Unconstrained Admissions.—In the presence of group-specific bias, an unconstrained admissions office is allowed to treat different groups differently and will set group-specific threshold scores that fully offset the bias in the test (equation (4)). Since $z_M^* = z_F^*$, the mass of admitted men and women and their expected ability is the same.

In the Finnish context, the male teacher quota effectively enables the admissions office to set lower entry scores for men. Adding a quota constraint that mandates a minimum share of male admits to the admissions office's optimization problem (equation (3)) is analogous to mandating the implied distance between group-specific threshold scores. If binding, this quota constraint adds a wedge to optimal threshold scores: $s_M^* = s_F^* - b_M - \delta$, with δ the Lagrange multiplier of the quota constraint. Total expected teacher ability declines as the wedge between marginal male and female admission scores grows beyond b_M with the mass of male candidates required by the quota. Importantly, as the test features a bias against men, the quota constraint will only bind if the mass of men required to fulfill it overcompensates for the bias in the test. As long as it does not, the admissions office will be able to implement its optimal, unconstrained allocation.

Group-Blind Admissions.—Group-blind admissions require that the admissions office sets equal cutoff scores for members of both groups ($s^* = s_M^* = s_F^*$) such that $z_M^* > z_F^*$ since the test is biased against the M group. In the Finnish context, teacher admissions are required to be group blind after the quota is abolished. This results in fewer male admits ($N_M = 1 - \Phi\left(z_M^*\right) < 1 - \Phi\left(z_F^*\right) = N_F$) and an efficiency loss. Expected ability of male admits will exceed that of female ones

as higher scoring, but lower–expected ability women are admitted in place of lower-scoring, but higher–expected ability men:

$$E\left[a_M | s_M > s^*\right] = \mu_a + \sigma_a \rho \lambda\left(z_M^*\right) > \mu_a + \sigma_a \rho \lambda\left(z_F^*\right) = E\left[a_F | s_F > s^*\right].$$

Imposing the constraint that the admissions office admits both groups based on the same scores thus lowers both representation and efficiency when the test is biased against one group. We further show in Supplemental Appendix B.1 that imposing group-blind admissions in a setting where the signal is more versus less precise exacerbates representation gaps with ambiguous impacts on efficiency.

In sum, this simple framework highlights that forcing admissions to be group blind is both costly in aggregate and detrimental for equal representation when an underrepresented group's lower performance on evaluation criteria does not reflect ability differences of a similar scope.

III. Data and Sample

Our main data source is register data maintained by Statistics Finland, which span the years 1988–2018 and contain detailed yearly information on all residents in Finland. We compile two main datasets that correspond to the respective parts of the analysis (Schaede and Mankki 2026).

Teachers.—We construct a panel of active primary school teachers from 1990 to 2000 for all individuals whose occupation at any point in time between 1990 and 2005 is classified as a primary school teacher by Statistics Finland's occupation classification system in the employment register (Statistics Finland 2021d). Since occupation categories are first available in 1990 and are not reported in every year, we use a combination of workplace, industry, salary, degree, and career information to infer active teacher status in any given year (Statistics Finland 2020b, 2021d,c). We can match teachers' matriculation exams scores and exam dates for all cohorts born after 1952 (Statistics Finland 2018), but we do not observe university applications in this sample, as these registers were not maintained at the time.

In order to examine future teachers' application success and outside options, we thus rely on a sample of adjacent cohorts. We use data on the universe of all applicants to primary teacher studies for the years 2000–2005, with 2000 as the first year in which data on field of application was collected in the centralized university application system (Statistics Finland 2021a). We link this sample of primary teacher applicants to their performance in the matriculation exam (Statistics Finland 2018), as well as their degree attainment and earnings in the year 2020 (Statistics Finland 2021c, 2022). We use this sample to shed light on compensating differentials in Section VIB.

Pupils.—We observe the universe of children living in Finland who turn 7 years old (and therefore start school in that calendar year) between 1988 and 2000, reaching age 25 until 2018 as the last year of our data in which all outcomes of interest are available. We assign children to a municipality (and teacher gender composition during grades 1–6) based on their place of residence in the year in which they start

school. We further match pupils to their parents, which allows us to observe a rich host of variables related to families' sociodemographic characteristics at age seven (Statistics Finland 2021e). We use a variety of registers, available on a yearly basis after age 16, to measure pupils' outcomes.

Intermediate outcomes: We merge pupils to registers on postcompulsory education applications that occur in the last year of middle school, that is, the year in which pupils turn 16 (Statistics Finland 2020a). This allows us to observe when pupils apply, their preference ranking of up to five degree and institution choices, and which option they are allocated in the centralized admissions process. For the school starting cohorts from 1990 onward, we can additionally observe enrollment in postcompulsory education (Statistics Finland 2020b).

Early adulthood: We measure pupils' labor force status as recorded in the last week of the calendar year in which they turn 25 years old (Statistics Finland 2020b). Regarding educational outcomes, we observe pupils' highest degree achieved, and we construct their field of education using information on their latest or concurrent degree (Statistics Finland 2021c,b). We also link to pupils' matriculation exam grades (Statistics Finland 2018).

We measure all of the treatment variables at the municipal level since data to link pupils and teachers to classrooms or schools do not exist. As our main goal is to estimate the impact of a quota per se, and not the impact of having a teacher of a particular gender, aggregating the data to a level higher than the classroom is consistent with both the research question and a setting in which collegial collaboration is widely practiced both within and across schools in the same municipality (see Section IA). The median population size among the 461 municipalities in 1990 is 2,910 inhabitants, with 450 children and about 24 primary school teachers across the 6 grade levels in primary school.

To comply with data disclosure regulations by Statistics Finland, we exclude municipalities that contain fewer than three teacher observations in a given year from our analysis. Once we move to a pupil-level panel, we restrict the sample to municipality$\times$year cells for which we are able to observe at least six teacher observations (i.e., the teaching staff for grades 1–6).[8]

IV. Empirical Strategy

We want to study whether and how output is affected when the gender composition of teachers changes via a quota. Lifting the quota at the point of university admissions will impact the gender composition among active primary school teachers only gradually over time, but the changes in the flow of incoming teachers are sharp and immediate. In the estimation strategy, we therefore use shocks to the demand for new teachers that arise from idiosyncratic local teacher retirement. Since teacher retirement could respond endogenously to the policy reform itself, we only use variation from teachers reaching the union-bargained retirement age of 60.

[8] Results are qualitatively similar, but more noisily estimated, when keeping the 9,144 pupils for whom we have incomplete teacher composition information in the sample.

We use the term "retirement" exclusively to refer to teachers turning 60 throughout the paper.

An ideal experiment given the aggregation level of our data would consist in randomly removing some teachers from municipalities and deciding with a coin flip whether replacement teachers are drawn either from a pool of male quota teachers or from a pool of marginal female teachers. Our DiD-IV estimation strategy closely approximates this experiment, taking into account that changes in quota teachers materialize via the inflow of rookie teachers and that we cannot directly observe quota male and marginal female teachers in the data. Municipalities in our setting are randomly assigned more quota men—and thus more male teachers in general—via the *timing* of their open positions arising from teacher retirement. We thus estimate a local average treatment effect for complier municipalities, using variation from those municipalities that are induced to hire more versus less quota men among their teachers via the timing of their retirements. This gives the policy-relevant parameter of interest: What happens when we change the composition of an occupation via a quota that operates through the inflow of incoming candidates?

Supplemental Appendix Figure A19 outlines the timeline of the reform: The primary school teacher students who enter university before 1989 are selected via the quota rule. As the time to complete the degree is five years (Nissinen and Välijärvi 2011), the quota and non-quota cohorts of new teachers will leave university around the year 1994 and will be hired by municipalities for their local schools. If municipalities have open positions during the time when quota cohorts enter the teacher market, they will be more likely to hire candidates from a pool with relatively more male rookie teachers compared to municipalities that have to fill open positions once new teacher cohorts selected without the quota are entering the teacher market.

A. *Municipal Level*: *Changes in Teacher Composition*

We first document the first-stage relationship by examining how local retirement interacted with the timing of abolishing the quota changes the gender composition of teachers in a municipality. Consider the following first difference specification that relates changes in the share of male teachers within a municipality to the local share of teachers retiring:

$$\Delta share\ male_{mt} = \pi_0 + \pi_1 share\ 60_{mt} + \pi_2 \mathbf{1}_{t=post} share\ 60_{mt} + X_{mt}\delta + \eta_{rt} + \zeta_{mt}, \tag{7}$$

with $\Delta share\ male_{mt}$ the change in the share of male teachers between t and $t-1$ in municipality m and $share\ 60_{mt}$ the number of teachers who turned 60 years old in that municipality in the year before t over the total number of teachers in t. The indicator function $\mathbf{1}_{t=post}$ switches on once non-quota teacher cohorts graduate and start entering the teacher market in 1994. The coefficient of interest, π_2, measures how teacher retirements in the postquota period trigger changes in the share of local male teachers *relative* to when the quota was still in place. We add region-by-year fixed effects η_{rt} to control for time-varying shocks whose impacts

may vary regionally, with a total of 19 regions comprising on average 24 municipalities. We can also include controls for time-varying municipal characteristics X_{mt}.

While at the municipal level expressing this relationship in flows is intuitive, this is no longer feasible when we evaluate impacts on pupils. This is because their outcomes are observed at fixed points after they have completed primary school (instead of an annual panel). We therefore exploit within-municipality changes in the teacher gender composition across cohorts in a fixed effects design. To more easily bridge between those two parts of the analysis, our preferred first-stage specification at the municipal level is the fixed effects specification that corresponds to equation (7). Equation (8) uses stocks on both sides by regressing the share of male teachers within a municipality on the stock of teacher retirements in the municipality up to that point:

$$(8) \quad share\ male_{mt} = \pi_0 + \pi_1\, total\ share\ 60_{mt} + \pi_2\, \mathbf{1}_{t=post}\, total\ share\ 60_{mt} + X_{mt}\delta + \eta_{rt} + \gamma_{mp} + \zeta_{mt},$$

with $share\ male_{mt}$ the share of male teachers in municipality m in a given year t and $total\ share\ 60_{mt}$ the sum of all teacher retirements that occur in a municipality up to year t. The municipality-by-period fixed effects γ_{mp} "reset" the impact of retirements once the post-period starts in order to separately estimate how retirements affect the local share of male teachers postquota.[9] We report first-stage results for both equations.

B. *Pupil Level*: *Does the Quota Shift in Teacher Gender Affect Outcomes?*

Structural Equation.—We would like to estimate how increasing the share of male teachers via the quota affects pupils' outcomes. As such, we are not interested in the impact of male teachers per se but in the local average treatment effect of swapping quota men for marginal women. This is estimated in a two-stage least squares framework using the timing of local retirement shocks as an instrument for the average share of male teachers in the following structural equation:

$$(9) \quad y_{im,t+x} = \beta_0 + \beta_1\, \overline{share\ male}_{mt} + \beta_2\, \overline{total\ share\ 60}_{mt} + X_i\delta + \gamma_m + \eta_{rt} + u_{imt},$$

with $y_{im,t+x}$ the outcome of interest at time $t + x$ for pupil i who at age seven lived in municipality m, $\overline{share\ male}_{mt}$ the average of the share of male teachers across the years we observe pupils in primary school, and X_i individual level controls.[10] We add municipal fixed effects γ_m as well as region-by-cohort fixed effects η_{rt}.

[9] The municipality-by-period fixed effects are necessary because of the cumulative nature of *total share 60* and ensure that we are using variation that arises from deviations from the municipality-by-treatment-period mean instead of the overall municipal mean.

[10] The controls we include are indicator variables for pupil gender, language (Swedish, Finnish, other), foreign origin, single-parent household, and highest level of education in the household (compulsory, secondary, tertiary, n/a) measured at age seven. Our pupil panel spans 13 cohorts that are starting school in the years 1988–2000 (see Supplemental Appendix Figure A20).

Our empirical strategy isolates variation in the share of male quota teachers from compositional changes in the inflow of recently graduated teachers that is caused by retirements. As rookie teachers may differ from older teachers along various dimensions, we account for pupils' overall exposure to rookie teachers via retirement by controlling for the exposure-weighted share of teachers retiring during a pupils' time in primary school, $\overline{total\ share\ 60}_{mt}$. We discuss this measure in more detail below.

First Stage.—We instrument for $\overline{share\ male}_{mt}$ with the following first-stage equation at the pupil level that closely mimics the municipal level first stage in equation (8). Since every time period t corresponds to the start of school for a particular cohort, we refer to t as a cohort identifier in the following:

$$\overline{share\ male}_{mt} = \pi_0 + \pi_1 \overline{total\ share\ 60}_{mt} + \pi_2 \mathbf{1}_{t=post} \overline{total\ share\ 60}_{mt} + X_i\delta + \gamma_m + \eta_{rt} + \epsilon_{imt}. \tag{10}$$

Variation in treatment intensity arises from how much teacher retirement different cohorts of pupils across different municipalities experience in the postquota relative to the quota period. π_2 measures how the share of male (quota) teachers a pupil experiences is affected by retirements in the postquota relative to the quota period. By measuring the differential impact of retirements, we compare the causal effect of being exposed to new teachers against the causal effect of being exposed to new teachers with a changed gender composition due to the lifting of the quota. In the two-stage least squares setup, $\hat{\beta}_1$ thus measures how increasing the average share of male teachers via the quota affects pupils' outcomes.

Exposure to Retirement.—We construct a measure of exposure to teacher retirements that reflects that retirements that occur early in (or just prior to) a given pupil's school career will affect them over more time than those that occur later. We therefore take a weighted average over all retirements that a pupil experiences during the six grades g in which they attend primary school:

$$\overline{total\ share\ 60}_{mt} = \frac{1}{6}\sum_{g=1}^{6} R_{mtg}, \tag{11}$$

with $R_g = share\ 60_g + R_{g-1}$ and $R_1 = share\ 60_{-2} + share\ 60_{-1} + share\ 60_1$.[11]

Each retirement is thus weighted by the number of years it affects the teacher gender composition a pupil experiences in school: R_1 sums over the share of teachers retiring just before a pupil enters the first grade and the two years before that. R_2 adds the share of teachers retiring just before a pupil enters second grade to the sum of share retirements experienced up to that point: $R_2 = share\ 60_2 + R_1$, and so forth up to grade 6. In the empirical analysis, we report grade level results for the first stage that directly motivate the construction of this measure.

[11] Subscript mt omitted for better readability in this definition (i.e., $R_{mtg} = R_g$) and in the following paragraph.

C. *Discussion of Identifying Assumptions*

We revisit explicit and implicit identifying assumptions of our setting in more depth. To start with, our identification strategy needs to satisfy the two main IV assumptions. Relevance requires that the relative size of teacher retirements in the postquota period decisively impacts the local share of male teachers, which we can assess directly in the first-stage regressions. The exclusion restriction requires that teacher retirements affect pupils' outcomes only via changes in the share of male teachers, and thus changes in male quota teachers. However, retirements themselves, by triggering teacher turnover, may have a direct effect on pupils. We tackle this by measuring relative changes in outcomes between cohorts that experience similar exposure to retirements, but with different timing. The underlying assumptions here are twofold: First, we need to assume that there are no other policy changes that happen simultaneously with the quota that have effects on students *via the channel of retirements*. To the best of our knowledge, there are no such policies. Secondly, we assume that exiting patterns and hiring practices to replace retiring teachers do not differentially change as a response to the quota. We test for such patterns in Section VE and do not find evidence for differential changes in the postquota period.

Implicit in our empirical design is the further assumption that the local timing of retirements is idiosyncratic and therefore uncorrelated with any other shocks that could affect pupil outcomes. We address such concerns by only using variation arising from teachers turning 60 (instead of actual exits), by controlling for a rich host of pupils' socioeconomic characteristics at age 7, and by including region-by-cohort fixed effects. As such, we are only comparing cohorts in municipalities within the same region and year, with the notion that relevant economic shocks (in the past and currently) will similarly affect neighboring places. Finally, while our regressions are measuring the effect of having more male quota teachers, we see teacher gender not just as a biological distinction but as something that proxies for a bundle of characteristics that may differentiate quota male and marginal female teachers.

V. Main Results

A. *Municipal Level*: *Effects on Teacher Composition*

Teacher Gender.—We start by documenting the effects on teacher gender composition at the municipal level after the quota was lifted. We first examine teacher exit patterns. Figure 3 plots the exit probability by age for all primary school teachers in our panel. We report the probability of a primary teacher not teaching at a given age, conditional on having been an active teacher in the previous year. There is a large spike in exits exactly after teachers turn 60, which is the union-bargained retirement age. In our estimation, we are only using variation from teacher exits that is due to teachers turning 60 years old.[12]

[12] Supplemental Appendix A reports municipal-level statistics on the share of teachers turning 60. In any given year, about 45 percent of municipalities have any retirement. We also examine teachers' likelihood of changing jobs across municipalities in Supplemental Appendix Figure A2. Less than 1 percent of teachers in the age bracket above 55 are changing the location of where they teach across all years of our panel.

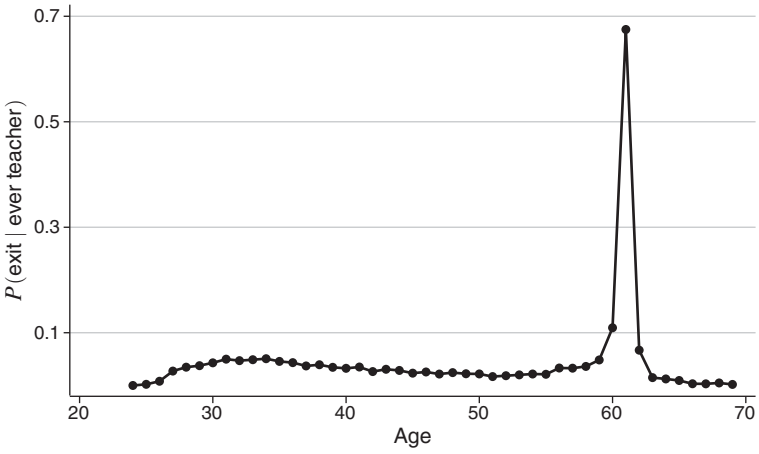

FIGURE 3. PROBABILITY OF TEACHER EXIT BY AGE

Notes: Share of primary school teachers not working as a primary school teacher at a given age, conditional on having worked as a primary school teacher in the previous year. Data for all active primary school teachers in the years 1990–2000. Multiple exits per teacher possible.

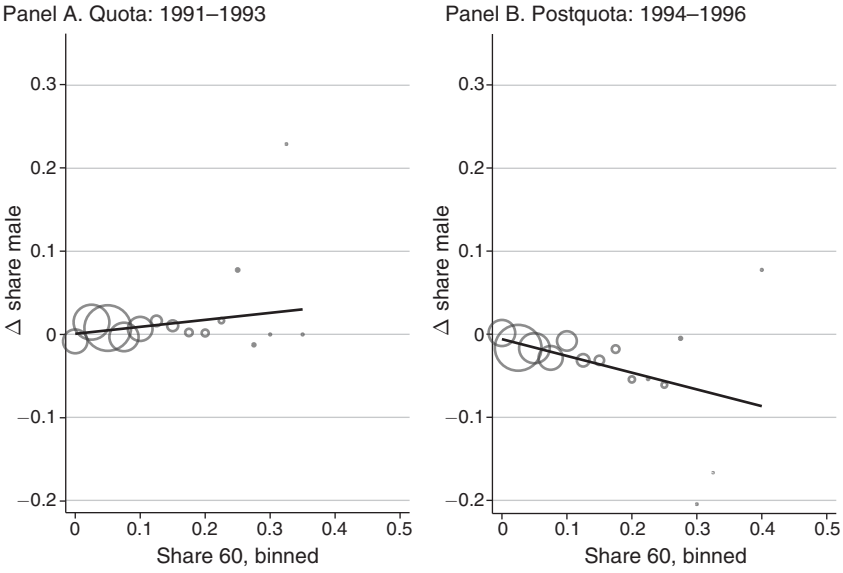

FIGURE 4. FIRST-STAGE INTUITION: CHANGES IN SHARE MALE TEACHERS BY LOCAL RETIREMENTS, RAW DATA

Notes: Municipality-level data, binned: change in the share of male primary school teachers for a period of similar length in the quota (1991–1993) and postquota (1994–1996) period against total share of teachers turning 60. Linear fit, weighted by the number of municipalities per bin.

We start by illustrating the intuition of the first stage using raw data. Figure 4 displays the relationship between teacher retirement in a municipality (on the horizontal axis) and changes in the share of male teachers by separately plotting the period in which quota cohorts enter the teacher market (1991–1993) and a period of similar length in the postquota period (1994–1996). Teacher retirement has a small,

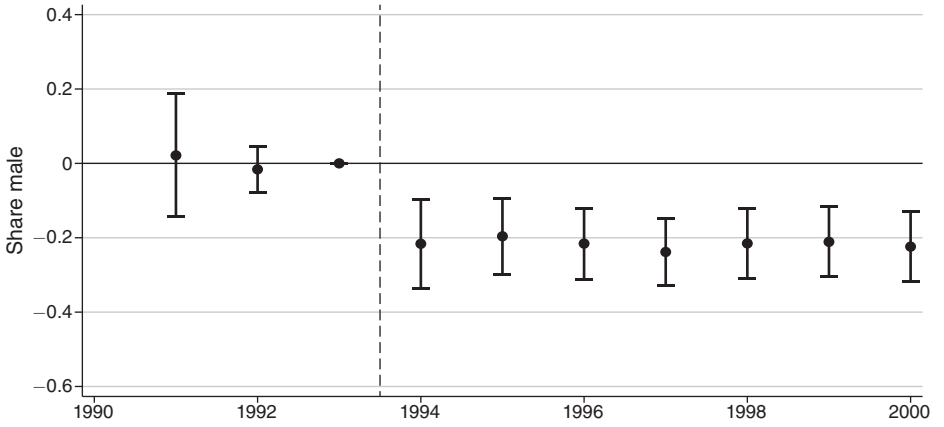

Figure 5. First Stage: Municipal-Level Event Study

Notes: Year-on-year estimates of π_2 for the first-stage equation (8), showing impact of primary teachers turning 60 on the local share of male teachers (relative to 1993 as last year of the quota period). Standard errors clustered at the municipality level. Population weighted.

positive effect on the local share of male teachers in the quota years. In the postquota period, higher shares of teachers retiring are associated with substantial local drops in the share of male teachers.

Figure 5 formalizes this intuition by running the first-stage equation (8) as an event study, estimating separate coefficients year by year, relative to 1993 as the last quota-period year. Teacher retirements in the years in which the quota was still in place do not differentially affect the local share of male teachers relative to the year 1993, while retirements in the postquota period lead to a sizable drop of about 20 percentage points. Table 1 summarizes this result for both the first difference and fixed effects specifications, estimating separate coefficients for the quota and postquota period. Results are quantitatively similar across specifications: While retirements in the pre-period have a small positive effect on the local share of male teachers, the coefficients of interest on retirements in the postquota period are consistently negative.

The magnitude of reported coefficients corresponds to the new steady state and measures the reduction in the share of male teachers if (eventually) all teachers in a municipality retire postquota: In this scenario, the local share of male teachers would drop by between 16 and 20 percentage points relative to the quota period. These magnitudes closely match the drop in incoming male teachers reported by the literature and observed in teacher admissions (Figure 1). For any given postquota retirement, each retiring teacher is 20 percentage points less likely to be replaced by a male teacher.

Teacher Academic Ability.—While the quota targeted the gender composition of incoming primary school teachers, it simultaneously affected overall academic ability among teachers by giving preferential access to men with lower academic scores on average. In Supplemental Appendix Table A3, we report the first stage with the municipal average of teachers' overall matriculation exam grades as the outcome.

Table 1—First Stage at the Municipal Level

	First differences				Fixed effects		
	Δ Share male				Share male		
Share 60 × Postquota	−0.164	−0.169	−0.175	−0.160			
	(0.044)	(0.044)	(0.046)	(0.044)			
Share 60	0.062	0.062	0.070	0.071			
	(0.039)	(0.039)	(0.041)	(0.039)			
Total Share 60 × Postquota					−0.216	−0.242	−0.193
					(0.049)	(0.054)	(0.049)
Total Share 60					0.067	0.098	0.076
					(0.043)	(0.045)	(0.043)
Municipal × Postquota fixed effects					X	X	X
Year fixed effects		X		X	X		X
Region × Year fixed effects			X			X	
Municipal controls				X			X
Adj. R^2	0.017	0.022	0.017	0.025	0.869	0.867	0.869
Observations	4,448	4,448	4,448	4,448	4,443	4,443	4,443
Dep. mean	0.0007	0.0007	0.0007	0.0007	0.3601	0.3601	0.3601

Notes: Estimates for equation (7) (columns 1–4): Year-on-year changes of the share of male teachers ("Δ Share male") on the share of teachers reaching retirement age ("Share 60"), and the corresponding fixed effects specification in equation (8) (columns 5–7) of local share of male teachers on cumulative teacher retirement ("Total Share 60"). Observation counts between specifications change due to municipal consolidation. "Dep. mean" reports mean of the dependent variable in the quota period, that is, before 1994. Standard errors clustered at the municipality level. Regressions weighted by population, means unweighted. Time-varying municipal controls include log population, log household income, share unemployed, share of families in single-parent household, share of adult population with compulsory, secondary, and tertiary education.

While coefficients are noisily estimated due to exam grades only being available for teacher cohorts born after 1952, retirements in the post-period lead to an increase of about 0.09 grade points in the local teacher body, relative to the quota period (column 1). This magnitude is consistent with replacing approximately 20 percent of teachers with an on average 0.36 grade point higher score when admitting more women and fewer men postquota (see Figure 2) and corresponds to about a 0.1 standard deviation increase in local teacher teams' exam grades. We next turn to examine how these changes affect pupils.

B. *Pupil Level*: *First Stage*

Our pupil-level panel spans the cohorts that enter primary school between the years 1988 and 2000. We start by documenting the first-stage relationship: Are children who experience more teacher retirement postquota exposed to fewer male quota teachers? As we observe pupils at fixed points in time after having completed primary education, we would like to relate pupils' overall exposure measure to male teachers—that is, the average share of male teachers across the six years a pupil spends in primary school—to their overall exposure to teacher retirements.

We begin by documenting grade-level patterns to trace the dose-response function between exposure to male (quota) teachers and retirements. Figure 6, panel A shows the first-stage results if we regress the average share of male teachers on the share of retirements pupils experience just before they start each grade level, starting up

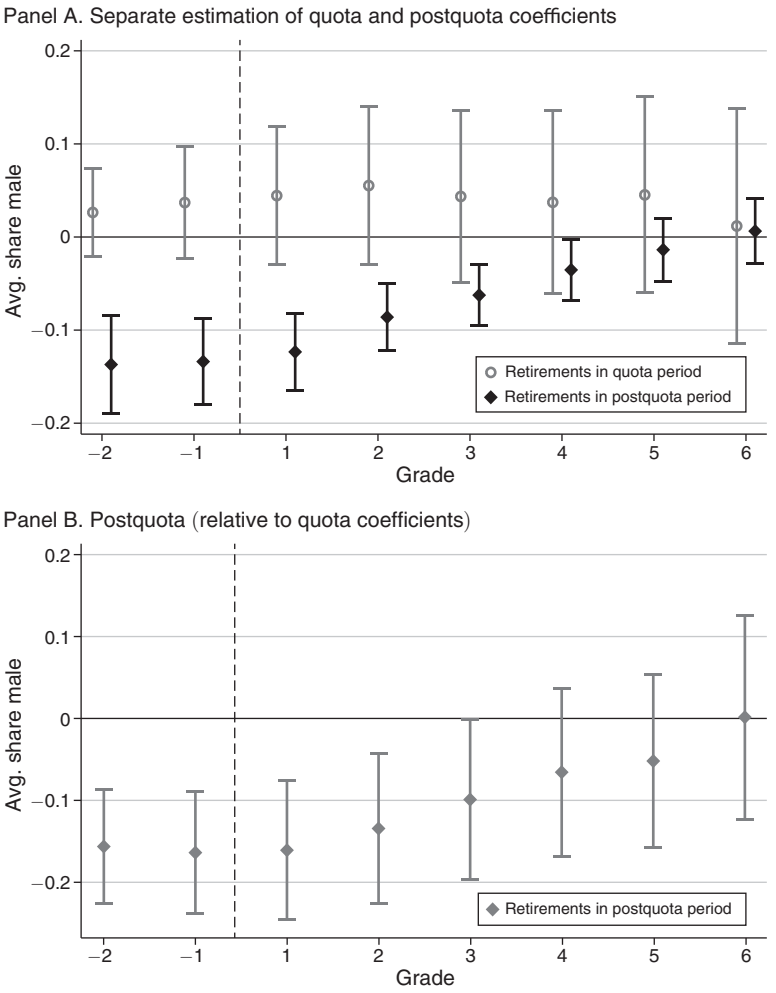

FIGURE 6. FIRST STAGE BY GRADE: AVERAGE SHARE MALE TEACHERS

Notes: Grade-level estimation of pupil-level first stage (equation (10)). Outcome is the average share of male teachers a pupil is exposed to during their time in primary school (grades 1–6), regressed on the share of teachers turning 60 just before a pupil enters the respective grade in school (grades 1–6), starting 2 years prior to a pupil entering school (grades −2 and −1). Panel A estimates absolute coefficients for effect of retirement pupils experience by grade in the quota and the postquota period. Panel B depicts coefficients for the postquota period *relative* to the quota period (i.e., it shows the difference between quota and postquota estimates depicted in panel A). All specifications include region-by-cohort and municipality fixed effects as well as individual-level controls measured at age 7: gender, language (Swedish/Finnish/other), foreign origin, single-parent household, highest level of education in household. Standard errors clustered at the municipality level.

to two years before they enter school and until grade six. Figure 6, panel A depicts coefficients separately for the quota period (gray) and the postquota period (black), while Figure 6, panel B shows the effect of retirements in the postquota period *relative* to the quota period. Teacher retirements in the early grades postquota have a large negative and significant impact on the average share of male teachers pupils experience during their time in primary school. At higher grade levels, this effect gradually peters out. This pattern clearly shows that retirements in early grades, which affect the teacher composition during the entire six years a pupil spends in

Table 2—First Stage, Reduced Form, and IV: Applications for Postcompulsory Education

	First stage			RF			IV		
	Avg share male			Apply			Apply		
Avg share male							0.546	0.698	0.418
							(0.203)	(0.236)	(0.195)
Total Share 60 ×	−0.176	−0.176	−0.169	−0.096	−0.096	−0.058			
Post	(0.042)	(0.042)	(0.043)	(0.026)	(0.026)	(0.027)			
Total Share 60	0.033	0.033	0.044	0.049	0.049	0.019	0.031	0.025	−0.001
	(0.036)	(0.036)	(0.037)	(0.020)	(0.020)	(0.021)	(0.025)	(0.027)	(0.020)
Municipal FE	X	X	X	X	X	X	X	X	X
Cohort FE	X	X		X	X		X	X	
Region × Cohort FE			X			X			X
Ind. controls		X	X		X	X		X	X
MOP F^{eff}							17.57	17.54	15.35
Adj. R^2	0.916	0.916	0.922	0.038	0.038	0.038			
Observations	825,095	825,095	825,095	825,095	825,095	825,095	825,095	825,095	825,095
Dep mean	0.313	0.313	0.313	0.911	0.911	0.911	0.911	0.911	0.911

Notes: Columns 1–3 show estimates for equation (10) with the average share male teachers pupils are exposed to during primary school as the outcome. Columns 4–6 show reduced-form estimates (corresponding to equation (10)), and columns 7–9 show IV estimates of equation (9), with a pupil applying directly in the spring of the year they turn 16 (i.e., the last year of middle school) as the outcome. Individual-level controls measured at age 7: gender, language (Swedish/Finnish/other), foreign origin, single-parent household, highest level of education in household. Standard errors clustered at the municipality level. MOP F^{eff} is Olea and Pflueger (2013) effective F-statistic.

primary school, contribute more to explaining the average share of male teachers a pupil faces across their entire time in primary school. Similarly, retirements that happen just before a pupil enters grade six will only impact the share of male teachers for one year and therefore contribute less to moving the average share of male teachers over all six years. This pattern, as described in Section IVB, informs our construction of the instrument when measuring a pupil's exposure across all grades. We define a pupil's exposure to retirements as the average cumulative share of teachers retiring in each grade level, which weighs retirements proportional to the number of grades they impact the teacher composition that a pupil experiences. In Table 2, the first three columns report results for the pupil-level first stage. The postquota interaction with retirements measures by how much the average share of male (quota) teachers changes relative to the quota period if all teachers were to retire just before a pupil starts school. The magnitudes closely match the municipal-level regressions and the drop in the share of men in admissions to primary teacher studies (Figure 1).

C. *Intermediate Outcomes*: *Applications and Enrollment for Postcompulsory Education*

Turning to outcomes, we start by tracking pupils' application choices to higher education options that take place after compulsory schooling at age 16. After primary school (grades 1–6) and middle school (grades 7–9), pupils in Finland have the option to apply to upper secondary education, which typically takes three years to complete, is provided free of charge, and is divided into vocational and academic

tracks. In grade nine, the final year of middle school, pupils apply for their desired institution, and in the case of the vocational track, also their desired field. While further education is not mandatory after age 16, raising completion rates of upper secondary education is a policy priority, as a postcompulsory degree is deemed crucial for labor force attachment: Finns with only compulsory education have significantly lower employment rates in adulthood and are four times more likely to be out of the labor force altogether (Virtanen 2016; Niemi, Toom, and Kallioniemi 2016).[13] In the centrally organized application process, each pupil can submit up to five choices for institution (and field), and a student-proposed deferred acceptance (DA) algorithm allocates available study slots. As applications take place before pupils obtain their final grades that are used to allocate slots, and with the popularity of institutions and fields varying over the years, students face uncertainty. The number of available slots per degree is centrally regulated, and about 4 percent of a cohort end up without a study slot in the fall after finishing middle school.

We start by examining the dose-response function of the reduced form: How do retirements affect application decisions? Rather than establishing results for impacts at particular grade levels, the goal of this exercise lies in examining the similarity of dose-response patterns between the first stage and the reduced form. Figure 7 shows the grade-level reduced form for whether pupils apply to postcompulsory education directly in their last year of middle school, with the upper panel reporting separate coefficients for the quota and postquota period, and the lower panel showing the relative difference. As documented in the upper panel, exposure to new teachers via teacher retirements during the quota period has small positive but insignificant impacts on pupils' likelihood of applying. Postquota retirements in the earlier grades of pupils' primary school attendance have larger and negative impacts on applications, similar to the patterns observed in the first stage (Figure 6). As factors other than male quota teachers may impact application decisions, the grade-level coefficients in the reduced form are more noisily estimated than the mechanical relationship in the first stage, with idiosyncrasies present in particular grade levels. Overall, however, the patterns between first stage and reduced form are reassuringly synchronous.

Considering pupils' exposure to male (quota) teachers and retirements over their entire time in primary school, Table 2 reports the first stage, reduced form and IV for the main outcome for this section, gradually adding controls. Our preferred specification includes region-by-cohort fixed effects, thus comparing pupil cohorts in close-by municipalities, and we subsequently report results for this specification choice. While teacher retirements that pupils experience during the quota period have a small positive but insignificant impact on the share of male (quota) teachers (column 3) and their application likelihood (column 6), there is a significant negative impact of retirements in the postquota period on their exposure to male (quota) teachers and applications to postcompulsory education. Column 9 reports

[13] Virtually everyone (99.7 percent of a cohort) successfully graduates from compulsory education (Virtanen 2016). Prior research with Finnish data has shown that slot allocations in upper secondary education matter for degree completion: With an RDD design, Virtanen (2016) shows that failing to obtain a higher-ranked choice or a study slot at all results in a lower probability of graduation. Huttunen et al. (2023) document that admission to any postsecondary education reduces crime among young men.

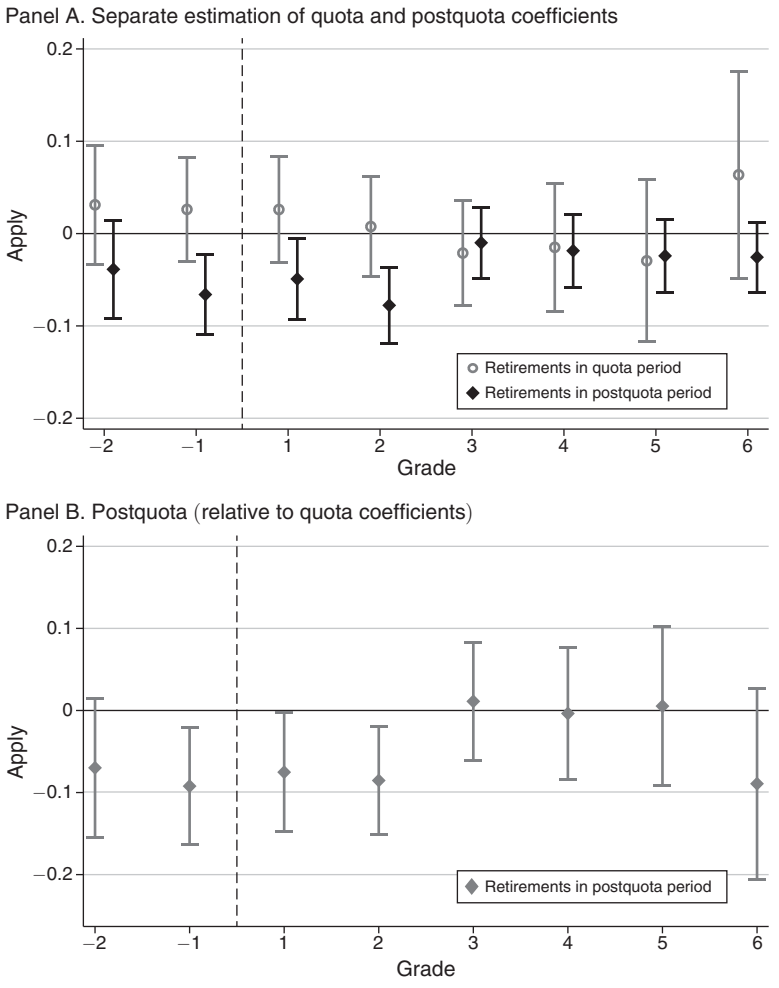

FIGURE 7. REDUCED FORM BY GRADE: APPLICATIONS FOR POSTCOMPULSORY EDUCATION

Notes: Grade-level estimation of pupil-level reduced form (equation (10)). Outcome is binary indicator for pupils applying to postcompulsory education directly after middle school, regressed on the share of teachers turning 60 just before a pupil enters the respective grade in school (grades 1–6), starting 2 years prior to a pupil entering school (grades −2 and −1). Panel A estimates absolute coefficients for effect of retirements pupils experience in the quota and the postquota period. Panel B depicts coefficients for the postquota period *relative* to the quota period (i.e., it shows the difference between quota and postquota estimates depicted in panel A). All specifications include region-by-cohort and municipality fixed effects, as well as individual-level controls measured at age 7: gender, language (Swedish/Finnish/other), foreign origin, single-parent household, highest level of education in household. Standard errors clustered at the municipality level.

the corresponding IV estimates. Being exposed to more male teachers via the quota results in higher likelihood of pupils applying to postcompulsory education. The coefficients report the effect size associated with an increase from zero to all of the teaching staff being male quota teachers. When scaling effect sizes by a 1 standard deviation increase in the share of male (quota) teachers (0.064), pupils have a 2.7 percentage point higher likelihood of applying, corresponding to a 3 percent increase over the mean of the dependent variable.

Table 3—IV Estimates: Applications and Enrollment for Postcompulsory Education

	Apply directly	Apply late	Apply never	Top choice	Enrolled at 16	Enrolled ever
Avg share male	0.418	−0.343	−0.075	0.528	0.606	0.124
	(0.195)	(0.175)	(0.073)	(0.244)	(0.307)	(0.073)
MOP F^{eff}	15.35	15.35	15.35	15.35	13.06	13.06
Observations	825,095	825,095	825,095	825,095	695,341	695,341
Dep. mean	0.911	0.066	0.023	0.858	0.861	0.98
Std effect	0.093	−0.088	−0.032	0.096	0.109	0.055

Notes: IV estimate of equation (9). Applications: Outcomes in columns 1–3 are mutually exclusive categories of applications to upper secondary education: Pupils apply directly in spring of the year in which they turn 16 ("Apply directly"), they apply up to four years after they have turned 16 ("Apply late"), or they apply never or later than five years after having turned 16 ("Apply never"). Allocation: (column 4) Pupils obtain one of their first two choices in the application ("Top choice"). Enrollment: (columns 5–6) Pupils are enrolled in upper secondary education in the fall of the year in which they turn 16 ("Enrolled at 16"), and ever enrolled in upper secondary education up to age 25 ("Enrolled ever"). Data on enrollment available for cohorts starting school in 1990 and after (see Section III). All specifications include region-by-cohort and municipality fixed effects, as well as individual-level controls measured at age 7: gender, language (Swedish/Finnish/other), foreign origin, single-parent household, highest level of education in household. Standard errors clustered at the municipality level.

Table 3 reports IV results on the full set of outcomes regarding pupils' application timing and choices after compulsory schooling.[14] Having more male quota teachers makes pupils more likely to apply directly in their final year of middle school and less likely to postpone applying to up to five years later. When considering the allocation of slots, pupils are more likely to get one of their top two choices. These patterns translate into higher enrollment rates in upper secondary education. Why are pupils who are exposed to more male quota teachers more successful in obtaining their top choices? In Supplemental Appendix Table A7, we document that having more male quota teachers makes pupils apply more in line with attainable options. Specifically, we check whether pupils are more sophisticated in their applications, with effects reported directly by pupil gender. Male pupils are more likely to include any vocational training option among their choices (column 2) while refraining from applying exclusively to academic high schools (column 3). For girls, the effect goes in the opposite direction. When examining which track pupils obtain, the margin for boys shifts from no slot (column 4) toward a vocational spot (column 5), while girls are more likely to obtain an academic rather than a vocational spot (column 6). As such, boys adjust their aspirations downward, which prevents them from ending up without a slot, and girls correctly have high aspirations as they get into academic high schools.

[14] We provide multiple sensitivity checks: Supplemental Appendix Table A4 reports IV estimates for the main application outcomes in this section with cohort instead of region-by-cohort fixed effects, documenting that results are not sensitive to this choice. Supplemental Appendix F.1 reports the full set of corresponding reduced-form results, and Supplemental Appendix F.2 displays grade-level reduced-form estimates. Results for the full set of mutually exclusive categories regarding which slot pupils obtain are reported in Supplemental Appendix Table A6.

D. *Long-Term Outcomes*: *Labor Force Attachment*, *Educational Attainment*, *and Field of Study*

Higher exposure to male quota teachers has positive impacts on pupils' continuation of education beyond compulsory schooling at age 16, but do these patterns translate into longer-term gains? This section explores the impacts of male quota teachers for outcomes in young adulthood. We examine whether positive impacts on applications and enrollment translate into higher human capital and labor market attachment. As obtaining postcompulsory education in Finland is considered a prerequisite to prevent social exclusion and to successfully transition into the labor market (Virtanen 2016; Niemi, Toom, and Kallioniemi 2016), these are relevant outcomes from a policy perspective.

Educational Attainment.—As pupils show a higher attachment to education after middle school, we first trace whether pupils have obtained more human capital as young adults. After compulsory education, the Finnish education system has two tracks: vocational and academic. Standard three-year vocational degrees offer training in occupation-specific skills but can be augmented with an additional year for further specialization or academic high school course work ("vocational plus"). The typical study path for the tertiary level is at polytechnics. The academic path leads from a three-year high school degree to a bachelor's (three years) and master's degree (two years) at university.

Table 4 presents IV results for educational attainment by examining the highest degree achieved by age 25 using mutually exclusive education categories.[15] We observe a shift toward higher attainment both in vocationally oriented as well as in academic education paths. As such, we observe a shift away from remaining with compulsory education or a standard three-year vocational degree only, toward a "vocational plus degree." Turning to academically oriented degrees, we similarly observe a shift away from high school degrees toward having completed a university bachelor-level degree.

Labor Market Attachment.—We next examine pupils' labor market attachment at age 25. As many youths are still studying at this age but are classified as employed due to part-time work, we combine the categories of being a student and being employed into one measure that reflects not sitting idle. For this age group, this metric is considered relevant to measure the propensity to successfully integrate into the labor market (Eurostat 2021; OECD 2021).

Table 5 reports effects for mutually exclusive labor market status categories. Being exposed to more male quota teachers results in higher likelihood of being either employed or a student at age 25. For a 1 standard deviation increase in the share of male (quota) teachers, pupils have a 3.2 percentage point higher likelihood

[15] Supplemental Appendix Table A5 shows the first-stage, reduced-form, and IV results for gradually adding in controls for the main outcome (employed/student) of this section. Reduced-form results for long-run outcomes are reported in Supplemental Appendix F. Supplemental Appendix Figure A7 shows the reduced form for the main long-term outcomes grade by grade. As longer-term outcomes are increasingly impacted by a variety of factors other than male quota teachers, the estimated coefficients are noisier when compared to patterns at age 16, but patterns generally mirror the first-stage dose-response function.

Table 4—IV Estimates: Highest Degree Achieved at Age 25

	Compulsory schooling	Vocational			Academic		
		Sec	Sec plus	Tert	Sec	Tert: BA	Tert: MA
Avg share male	−0.169	−0.053	0.424	−0.079	−0.436	0.384	−0.070
	(0.154)	(0.259)	(0.207)	(0.210)	(0.227)	(0.145)	(0.092)
MOP F^{eff}	15.43	15.43	15.43	15.43	15.43	15.43	15.43
Observations	810,066	810,066	810,066	810,066	810,066	810,066	810,066
Dep mean	0.127	0.316	0.108	0.146	0.211	0.054	0.038
Std effect	−0.032	−0.007	0.087	−0.014	−0.068	0.108	−0.023

Notes: IV estimates of equation (9). Outcomes are mutually exclusive categories of pupils' highest degree achieved at age 25, from left to right: Compulsory education only. Vocational track: Basic three-year secondary degree ("Sec"), additional qualifications or high school coursework beyond a basic degree ("Sec plus"), tertiary degree from a polytechnic ("Tert"). Academic track: Three-year high school degree ("Sec"), university BA degree ("Tert: BA"), university MA degree ("Tert: MA") or higher. 1,327 observations have no degree information. All specifications include region-by-cohort and municipality fixed effects as well as individual-level controls measured at age 7: gender, language (Swedish/Finnish/other), foreign origin, single-parent household, highest level of education in household. Standard errors clustered at the municipality level.

Table 5—IV Estimates: Labor Market Attachment at Age 25

	Employed/student	Unemployed	DI/pension	Other out of LF
Avg share male	0.510	−0.038	−0.124	−0.326
	(0.242)	(0.152)	(0.075)	(0.137)
MOP F^{eff}	15.44	15.44	15.44	15.44
Observations	811,393	811,393	811,393	811,393
Dep mean	0.842	0.086	0.017	0.053
Std effect	0.089	−0.009	−0.061	−0.093

Notes: IV estimates of equation (9). Outcomes are mutually exclusive categories of pupils' labor market status measured at age 25: Being in employment or a student, unemployed, on disability insurance (DI) or receiving pension payments, or being out of the labor force for other reasons. This table and all other labor market attachment results at age 25 do not report estimates for the separate category of "conscripts/community service," which contains a total of 1,185 observations. All specifications include region-by-cohort and municipality fixed effects as well as individual-level controls measured at age 7: gender, language (Swedish/Finnish/other), foreign origin, single-parent household, highest level of education in household. Standard errors clustered at the municipality level.

of working or studying, which corresponds to a 4 percent increase over the mean. While we observe no effect on unemployment, pupils are somewhat less likely to be on a disability pension and significantly less likely to be out of the labor force for reasons other than disability.

Field Choice.—We next turn to study whether exposure to more male quota teachers inspires pupils to pursue different fields of education. Male teachers could be setting an important example of men working in an occupation that is otherwise female dominated. As such, they may inspire primarily boy pupils to pursue a teaching-related field. On the other hand, male teachers could also more broadly motivate pupils to pursue different education fields.

Table 6—IV Estimates: Field of Education at Age 25

	Male	Neutral	Female	STEM	STEM-M	Education/teacher	Primary teacher
Avg share male	0.301	−0.497	0.196	0.593	0.704	−0.013	0.063
	(0.228)	(0.285)	(0.190)	(0.272)	(0.321)	(0.073)	(0.049)
MOP F^{eff}	15.44	15.44	15.44	15.44	15.44	15.44	15.44
Observations	811,393	811,393	811,393	811,393	811,393	811,393	811,393
Dep mean	0.303	0.433	0.264	0.264	0.379	0.023	0.011
Std effect	0.042	−0.064	0.028	0.086	0.092	−0.005	0.039

Notes: IV estimates of equation (9). Outcomes from left to right: Field is "Male" dominated (> 70% male), (gender) "Neutral," or "Female" dominated (> 70% female), based on previous generation. Field is STEM or STEM + Medicine (STEM-M). Field is Education Science or Teacher. Field is Primary School Teacher. All specifications include region-by-cohort and municipality fixed effects, as well as individual-level controls measured at age 7: gender, language (Swedish/Finnish/other), foreign origin, single-parent household, highest level of education in household. Standard errors clustered at the municipality level.

We measure pupils' choice of educational field at age 25. We classify their career choices via their field of education rather than their occupation because many youths at this age are still studying. For each pupil in our sample, we pick the field of the highest degree acquired if they are no longer a student and the field of their current degree if they are still studying. We define fields as primarily female or male dominated based on the generation prior to our sample, that is, the 13 cohorts who are 7 years old during the years 1975–1987. If a group constitutes more than 70 percent within a field and degree-level cell, we define the field as male or female leaning, and gender-neutral otherwise. This results in 30 percent of pupils being in "Male" fields, 43 percent in gender-neutral, and 26 percent in "Female" fields. We also report results on STEM and STEM-M (STEM plus Medical) fields as well as teaching-related fields in general and primary school teacher in particular.[16]

Table 6 reports results on the choice of education field. We observe a somewhat noisy shift away from gender-neutral toward both more male- and female-dominated fields. Turning to STEM and STEM-M, pupils are significantly more likely to take up such fields when exposed to more male quota teachers, with effect sizes corresponding to a 0.086 and 0.092 standard deviation increase for a 1 standard deviation increase in the share of male quota teachers, respectively. In Supplemental Appendix Table A11, the STEM shift is similarly pronounced for both pupil genders.[17] Regarding teaching fields overall and primary teacher education specifically, we fail to reject a null effect. In summary, we find limited scope for the quota having

[16] That is, we define share female based separately for a vocational degree in business versus an academic degree in business. For the group that has never finished a degree beyond compulsory education and is currently not a student (9.8 percent of the sample), we assign the gender share of compulsory education, which is categorized as a gender-neutral field based on the previous generation. STEM fields are defined based on the three-digit classification of Statistics Finland in one of the following fields: Agricultural Sciences (including Forestry and Fishery), Biology, Engineering, Environmental Sciences, ICT, Mathematics and Statistics, Physical Sciences, Veterinary Science, and the four-digit category related to Materials Sciences (glass, paper, plastic, and wood). STEM-M in addition includes the three-digit field Health.

[17] In all of the regressions on field choices, we do not estimate joint fixed effects for both genders but report seemingly unrelated regressions. We do this since the assumption that shocks would affect boys and girls similarly does not seem justified for field choice (i.e., a shock that raises demand for health care workers is likely to have quite different effects on young women versus young men).

been able to diversify teaching occupations for the next generation, but the shift toward STEM fields is consistent with pupils aiming for higher-earning fields in the labor market.

E. *Robustness*

We provide a detailed analysis and description of robustness checks for our main results in Supplemental Appendix H. First, we show in Supplemental Appendix H.1 that schools do not change their hiring (or teacher exit) practices as a consequence of the quota reform. We find no evidence that schools would differentially try to retain teachers reaching age 60 or hire laterally following teacher retirement postquota. Second, lifting the quota implies recruiting more young female teachers to schools, who may have more absences or turnover due to maternity leave. We show that this is unlikely to explain our main results, as pupils exposed to more female teachers having a newborn child do not generally face worse outcomes (Supplemental Appendix H.2). Third, we run placebo checks and document that there are no reduced-form treatment effects of teacher retirements for pupils who have already left school (Supplemental Appendix Section H.3). Fourth, in Supplemental Appendix H.4 we show that our results are not sensitive to the choice of sample or specification, and unlikely to be explained by general macroeconomic shocks during our study period. We also probe whether our municipal-level aggregation of exposure variables is sensible by showing that the impacts of male (quota) teachers are plausibly linearly additive. Finally, we document that potential bias arising from heterogeneous treatment effects in two-way fixed effects designs is unlikely to be a concern in our setting (Supplemental Appendix H.5).

VI. Mechanisms

Our results indicate that teacher teams with more male quota teachers performed better, analogous to having had higher "value added": Conditional on socioeconomic background, pupils who experienced a higher share of male teachers via the quota have better outcomes. Turning to mechanisms, we differentiate between two potential ways in which selection without the quota may fail to capture benefits from a more diverse teacher workforce.

First, gains from diversity may arise when selection criteria do not properly account for a candidate's (teaching) ability at an individual level. Selection on scores unconditional of gender can miss out on high-quality male teachers if men's lower scores do not map into equally lower teaching ability, as illustrated in the conceptual framework in Section II. Second, if there are complementarities in production between male and female teachers, that is, through specialization according to comparative advantage, overall teacher quality may be lower when fewer men are in the pool of available teachers.

In the following, we document limited scope for complementarities and present three pieces of evidence that underscore the presence of imperfect selection of talent as a driving force. We first document that the admission criteria disadvantage the underrepresented group, as the composite score of the matriculation exam attaches considerably less weight to mathematics and natural science fields, in which men

perform relatively better. We then show that scores are not directly related to productivity on the job. Teacher team performance on the exam is not predictive of pupil outcomes, suggesting that the score criterion inefficiently disadvantages men. Third, we shed light on the particular attributes that may explain the disadvantaged group's productivity in the context of this setting: Male teachers may serve as a role model for pupils in terms of their own career attachment and intrinsic motivation for their job—two factors that may inspire pupils to be more ambitious in their own pursuits, that is, by continuing education, being more attached to the labor market, and choosing fields with higher earnings.

We show that these role model effects are not gender specific, as both girls and boys benefit similarly from exposure to male quota teachers. We further rule out that our main effects are driven by male quota teachers merely increasing pupils' grades. While providing a role model in terms of career attachment may explain higher performance among marginal candidates of the underrepresented group in the context of this study, the particular characteristics that determine output will be specific across different contexts for which policymakers consider more equal representation.

A. *Complementarities in Production*

We test for the presence of complementarities in production by assessing marginal returns to male quota teachers along the distribution of the share of male teachers at baseline (i.e., in 1990). If male and female teachers are complements, adding an additional male teacher at a place with mostly female teachers should have larger marginal returns compared to adding an additional male teacher in an environment that is close to gender parity. We split the sample by the median share of male teachers in a municipality. The first group has initially a lower share of male teachers (mean: 28 percent), and the second group a relatively higher share of male teachers (mean: 44 percent). Supplemental Appendix Table A17 shows the reduced form for the main outcomes. The magnitude of coefficients across places with high and low share of male teachers is qualitatively similar, and we cannot reject that they are the same. These patterns suggest limited scope for complementarities in production driving the positive impacts of the quota.[18]

B. *Imperfect Selection of Individual Talent*

Admission Criteria Disadvantage the Underrepresented Group.—During the time of our study, applicants to primary school teaching were ranked based on their average performance across the four mandatory fields of the matriculation exam. These four fields consisted of a test in the mother tongue (Finnish or Swedish), the respective second national language, a foreign language, and the student's choice of either a mathematics exam or a science exam ("Reaali"), the latter containing a test battery in both natural and social sciences (Kupiainen, Marjanen, and Ouakrim-Soivio

[18] This interpretation presumes that the gender composition in schools within the same municipality corresponds to the average municipal gender composition. We examine this assumption in Supplemental Appendix H.4. We focus on the reduced form here since splitting the sample across municipalities renders relatively noisy IV estimates due to loss of power in the first stage, but similar conclusions (Supplemental Appendix Table A18).

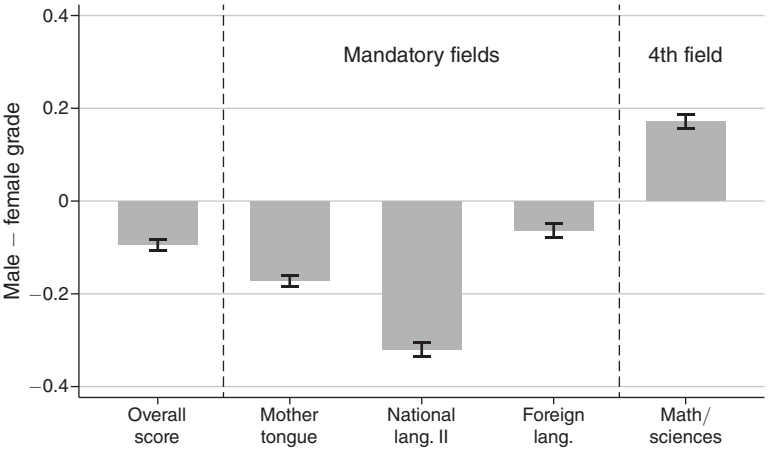

Figure 8. Performance Differences by Gender on Matriculation Exam by Field, Full Population

Notes: Performance differences in the matriculation exam by gender for the full population of exam takers. Gender difference in score ("Overall score") and in each of the exam fields that count toward the overall score. Each displayed field receives equal weight of 25 percent in the calculation of overall score. The score for "Math/sciences" is based on the best grade received if an exam taker chose both fields. Sample based on the full population of first-time matriculation exam takers in the high school track (lukion opiskelija) under age 22 for the years 1983–1985. Grades are assigned on a curve and range from 2–6, with 6 being the highest grade and 0 assigned for a failing exam (Kupiainen, Marjanen, and Ouakrim-Soivio 2018).

2018). The score that was used to rank primary school teacher applicants in the first admission step thus put a weight of 75 percent on language fields, and a weight of 25 percent on either mathematics or sciences. As women perform markedly better in languages, the relative importance of language performance in determining university admissions across a vast number of fields has been a source of criticism (Kupiainen, Marjanen, and Ouakrim-Soivio 2018).

We examine gender differences in performance across exam fields during the quota period in Figure 8, which displays the difference in average test scores by field for the full population of exam takers for three cohorts in the mid-1980s. The overall exam score is composed of the average across the four mandatory fields, with men scoring about 0.1 grade points lower relative to a 4.3 grade point average for women. In the full population of exam takers, men score substantially lower on all three language fields compared to women but higher both in absolute and relative (0.36 grade points) terms on mathematics and sciences.

While we do not observe applicants to primary school teachers studies for this time window, we can repeat the analysis for those who eventually become teachers in Supplemental Appendix Figure A8. Among primary teachers, men perform worse on all fields compared to women, but the relative patterns are similar to the overall population: The gender score gap in mathematics and sciences is 0.25 grade points lower relative to the gap in languages.

The weighting of fields in the matriculation exam score thus discounted fields in which men performed relatively better when ranking primary teacher applicants. This score served as a main criterion for primary teacher admissions, and we show in Section VIB that the second-round interview did not overcome this misalignment. However, the differential weighting of fields could be justified and even desirable if

Table 7—Teacher Team Performance and Teacher Exam Scores

	Apply				Employed/student			
Overall GPA	−0.0040				0.0012			
	(0.0061)				(0.0082)			
Language		−0.0074	−0.0085			−0.0056	−0.0060	
		(0.0063)	(0.0068)			(0.0080)	(0.0084)	
Math or science		0.0044				0.0080		
		(0.0053)				(0.0060)		
Math			0.0028				0.0005	
			(0.0032)				(0.0035)	
Science			0.0026				0.0065	
			(0.0052)				(0.0057)	
Math background				0.0017				0.0234
				(0.0152)				(0.0157)
Adj. R^2	0.070	0.070	0.070	0.070	0.025	0.025	0.025	0.025
Observations	825,033	825,033	825,033	825,033	811,332	811,332	811,332	811,332
Dep. mean	0.911	0.911	0.911	0.911	0.842	0.842	0.842	0.842

Notes: Estimates of pupil outcomes on teachers' exam scores in the matriculation exam. Outcomes are pupils' application likelihood and employment status (see Tables 3 and 5). The score for "Language" is comprised of the grade for Mother Tongue, Second National Language and Foreign Language. "Math or science" is based on the best grade received if an exam taker chose both fields. "Math background" measures the share of teachers who have taken mathematics in their matriculation exam. All specifications include region-by-cohort and municipality fixed effects as well as individual-level controls measured at age 7: gender, language (Swedish/Finnish/other), foreign origin, single-parent household, highest level of education in household. Standard errors clustered at the municipality level.

teacher performance on languages is paramount for pupil outcomes. We therefore continue by examining the relationship between pupil outcomes and teacher test performance across the different fields of the matriculation exam.

Impact of Admission Criteria on Productivity.—In Table 7 we examine the relationship between teachers' matriculation exam scores and "teacher team value added" at the cohort-by-municipality level, exploiting variation in teacher team test performance that different pupil cohorts within the same municipality are exposed to. We estimate a precise zero for the impact of teachers' matriculation exam score on pupils' outcomes. For a 1 standard deviation increase in a teacher team's overall score (0.18), we can rule out effects on pupils' application likelihood that are larger than 0.003 (or 0.3 of a percent over the mean) as the upper and smaller than −0.001 (or −0.2 of a percent over the mean) as the lower bound. Splitting the overall exam score by grades in language and math or sciences in columns 2 and 3 shows similarly negligible impacts for any field. Teacher test scores not explaining teacher (team) value added is not unique to our setting, with many studies having documented similarly negligible relationships between teacher test performance and pupil outcomes (Kane, Rockoff, and Staiger 2008; Angrist and Guryan 2008; Harris and Sass 2011; Jackson, Rockoff, and Staiger 2014; Hanushek and Rivkin 2006). Since teacher's matriculation exam score is not informative of teacher team value added, candidate selection on these scores thus inefficiently constrains the pool of male teachers, who on average, perform considerably lower on the

Table 8—Career Attachment

	Exit	Exit (birth)	Leave	Leave (birth)	Sick leave
Male	−0.0071	−0.0041	−0.0169	−0.0147	−0.0006
	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)
Adj. R^2	0.013	0.003	0.010	0.008	0.002
Observations	21,484	21,484	186,621	186,621	105,239
Dep. mean	0.037	0.008	0.041	0.015	0.016
Dep. mean men	0.032	0.005	0.029	0.004	0.016
Dep. mean women	0.039	0.01	0.047	0.019	0.016

Notes: Regressions of outcomes related to leave-taking for the panel of active primary teachers (ages 26–55), on an indicator for being "Male." Outcomes from left to right: "Exit": Defined as switching from being an active teacher to not being a teacher in the next year at any point within the first five years of the panel, and not returning as an active teacher until the end of the panel. "Exit (birth)": Exit for which either the year just before or the first year of leave coincides with the birth of a child. "Leave": Defined as switching from being an active teacher to not being a teacher in the next year in any given year. "Leave (birth)": Leave for which either the year just before or the first year of leave coincides with the birth of a child. "Sick leave": Receiving payments for sick leave in any given year, data available for 1995–2000 only. All specifications include year and municipality fixed effects.

language sections of this exam. In other words, a reweighting of exam fields with more emphasis on math and sciences would diversify the pool of admits without detrimental impacts on output.

Why Are Male (Quota) Teachers More Productive?—

Career Attachment: We examine two proxies of career attachment for teachers, using our main panel of active primary school teachers from 1990 to 2000: gender differences in career exit and compensation for additional responsibilities beyond regular teaching hours. Table 8 documents gender differences in exit and leave-taking among active teachers, restricting the sample to teachers below age 55 to not conflate career exits with retirement. Male teachers are less likely to exit the teaching career, defined as not returning to teaching from a leave that occurs in the first 5 years of the panel until the end of the 10-year period (column 1). This differential dropout is not explained merely via channels of family formation, as only a bit more than half of the gender difference in exits from the teaching career is accounted for by exits that are initiated following the birth of a child (column 2). Overall, male teachers are about 20 percent less likely to more permanently leave teaching as a career compared to women. Columns 3 and 4 show that male teachers are also less likely to go on leave in any given year, defined as switching from being an active teacher to not working as a teacher in the following year. However, this gender difference is almost entirely explained by female teachers being absent following a birth. We show in Supplemental Appendix H.2 that female teachers giving birth per se does not lead to worse student outcomes, pointing to team teaching structures being able to absorb such shocks. Instead, these leave and exit patterns are indicative of differential attachment to the profession, with male teachers having a more sustained presence in their pupils' schools. We do not observe any gender differences in taking sick leave (column 5).

We next turn to examine residual earnings as a second proxy for career attachment. The salary scale of teachers is strictly deterministic, and overtime and additional responsibilities are compensated with supplemental payments above the regular payroll according to a fixed key (Statistics Finland 1995; OAJ 2023). We can thus examine gender differences in residual wage earnings that likely reflect differential engagement at schools in activities beyond regular teaching hours. We start by plotting the evolution of (raw) teacher earnings by age and gender in Supplemental Appendix Figure A9, separately depicting women who never have children. Initially, the earnings profile of men and women who never have children evolve similarly, while women with children have a somewhat lower level (likely due to these being childbearing years). However, by age 40, the earnings of women who never have children fully converge with those of women with children, while male teachers' compensation levels are higher. Supplemental Appendix Table A19 confirms these patterns, highlighting that male teachers' earnings are higher even when accounting for differential impacts of children or leave-taking: Controlling for year and municipality fixed effects, male teachers on average earn about €3,000 (approximately $3,000) more (column 1), but there is no gender-specific return to experience defined as time since degree (column 2). This earnings gap persists even when restricting the sample to teachers who do not receive any government transfers (sick pay or parental leave pay) in a given year (column 3). Comparing only teachers who never have children in column 4, the gender gap in salary becomes smaller but does not disappear and corresponds to men without children being compensated an additional 4.5 percent over their female counterparts. Men are more likely to become principal (column 5), but promotions may not be free of potential gender bias. Importantly, though, the salary gap is not explained by men being more likely to be promoted (column 6). Taken together, these patterns in teacher salary and teacher exit are suggestive of male teachers picking up additional responsibilities at school and being more attached to their profession, thus providing a role model for pupils in terms of their own career attachment and commitment to their profession.

Intrinsic Motivation: We next assess a proxy for male and female teachers' intrinsic motivation for this profession by analyzing compensating differentials in the labor market across marginal candidates. For this exercise, we compare similarly scoring applicants for primary school teacher studies by gender in order to understand the outside options of admits. Our sample contains the universe of *applicants* to primary school teacher studies in the years 2000–2005 (i.e., postquota, with the pool of male applicants containing men who would have been accepted during the quota), linked to candidates' performance on the matriculation exam, as well as their adult wage earnings and degree obtained by 2020.[19]

We start by documenting the relationship between matriculation exam score and the likelihood of obtaining a primary teaching degree by gender in Supplemental

[19] University study slots in Finland are allocated in a centralized university application system by deferred acceptance. The year 2000 is the first time that data on application fields in the national application system are available. On average, about 9 percent of the full population of applicants apply to primary school teacher education in a given year. Since actual admissions are unobserved, we use information on whether applicants ever obtain a primary teaching degree by 2020. Completion rates for primary teaching are at 90 percent (Nissinen and Välijärvi 2011). Data on field choice for 2003 are missing, and we exclude applicants in this year from the analysis.

Appendix Figure A10. For both male and female applicants, the likelihood of obtaining a primary teaching degree is increasing in score. Supplemental Appendix Table A20 formalizes these patterns and confirms that there is not differential score premium by gender after the quota is abolished: Conditional on exam score, men and women face similar application success. This clearly shows that men no longer obtain a score premium postquota. In addition, these patterns highlight that the selection criteria in the second admissions step do not differentially reverse the impact of exam scores for men.[20]

We measure compensating differentials by comparing labor market earnings among similarly qualified applicants within gender:

$$(12) \quad Wage_i = \beta_0 + \beta_1 Teacher_i + \beta_2 Male_i \times Teacher_i + \beta_3 Male_i + X_i + u_i,$$

with $Wage_i$ yearly wage earnings, $Teacher_i$ an indicator for having obtained a primary teaching degree, $Male_i$ an indicator for being male, and X_i a vector of controls for exam score, application year, age and experience. Table 9 documents wage premia, with women who got rejected from primary teaching as the omitted group. Women who obtain a primary teaching degree earn a wage premium of €3,400 (approximately $3,400) relative to their female counterparts who got rejected. For men, the teaching degree comes with a wage penalty, both in relative and absolute terms. Male degree holders have a €5,000 penalty relative to women's premium and an absolute penalty of €1,600 when compared to men who do not become a primary teacher.[21] These wage penalties are more pronounced when restricting the sample to applicants who ever obtain a university degree in columns 3 and 4. In Supplemental Appendix Figures A11 and A12, we document men and women's outside options that underpin this result. When examining alternative fields that male and female primary teacher applicants apply to, close to 60 percent of women's alternative applications go to other education fields compared to 35 percent for men. Men are instead more likely to pick higher-earning fields, such as natural sciences and business administration or law. This maps into alternative fields obtained by 2020. As men are not accepted into primary teaching, they thus obtain fields with higher earnings as their next-best alternative. Taken together, these patterns suggest that among similarly scoring applicants, men possess skills that the labor market values but that do not seem to receive sufficient consideration in the teacher admission process. At the same time, men who become primary teachers are willing to accept a wage penalty, highlighting their intrinsic motivation when choosing this stereotypically female profession.

Role Model Impacts by Pupil Gender: Do male quota teachers serve as a role model primarily for boys? While the main effects clearly demonstrate that the overall impact of male quota teachers was positive, this could mask heterogeneous effects by pupil gender. Figure 9 and Supplemental Appendix Table A8 report

[20] That is, the interview round does not disproportionally recognize or make up for skills of male applicants that exam scores may not fully account for.

[21] In Supplemental Appendix Figure A13, we show that these wage penalties are present throughout the exam score distribution.

Table 9—Wage Premia for Primary Teaching Degree Holders by Gender

	(1)	(2)	(3)	(4)
Teaching degree	3,397	3,381	2,739	2,719
	(304)	(305)	(300)	(300)
Male × Teaching degree	−4,972	−4,887	−6,779	−6,659
	(646)	(654)	(652)	(657)
Male	11,213	12,379	13,010	15,244
	(336)	(1,420)	(376)	(1,573)
Score	1,362	1,418	978	1,074
	(134)	(149)	(141)	(156)
Male × Score		−279		−525
		(330)		(359)
Adj. R^2	0.098	0.098	0.102	0.102
Observations	20,430	20,430	17,857	17,857
Dep. mean	40,224	40,224	41,456	41,456

Notes: Outcome is total wage earnings in the year 2020. In columns 3 and 4, sample is restricted to applicants who ever obtain any university degree. Controls for age, experience (time since degree), and application year. Sample contains all applicants to primary teacher education in the years 2000–2005 (data for 2003 missing) and considers all degrees obtained by the year 2020. If an applicant applies multiple years in a row during this time period, only the last application is considered. Exam score based on best performance if applicant had multiple takes.

heterogeneity by pupil gender for the main application outcomes at age 16. We run our main specification (equation (9)) with separate treatment effects for boys and girls while estimating controls and fixed effects jointly.[22] Girls' outcomes are not negatively impacted from exposure to male quota teachers. We test whether boys benefited more from male quota teachers, with *p*-values reported in the bottom row of Supplemental Appendix Table A8: For educational outcomes at age 16, we cannot reject the null hypothesis of the coefficients being the same for boys and girls for any outcome at the 5 percent level. We report impacts on long-run outcomes by gender in Supplemental Appendix E. While some coefficients for highest degree achieved differ, these are the ones where boys are not benefiting as much as girls. There are significant differences by pupil gender for labor market outcomes at age 25, but the gendered pattern is sensitive to the choice of whether to estimate fixed effects jointly or separately. We cannot reject that coefficients by gender are the same for specifications estimated with separate controls and fixed effects in Supplemental Appendix E.2. Taken together, we do not detect main effects that differ systematically and significantly by pupil gender, in particular when considering the main educational achievement outcomes.[23]

[22] When estimating these fixed effects jointly, the underlying assumption is that time-varying region-specific economic shocks affect, e.g., the choice of whether to apply for boys and girls to a similar extent.

[23] This finding suggests that simply recruiting more men to primary schools may have limited potential to allow boys lagging behind to catch up—possibly so because same-gender role model effects may be more limited in scope when the matched group is not in a minority role. In line with this notion are studies that do not find evidence for same-gender match effects across a range of OECD countries (de Gendre et al. 2023; Cho 2012; Holmlund and Sund 2008).

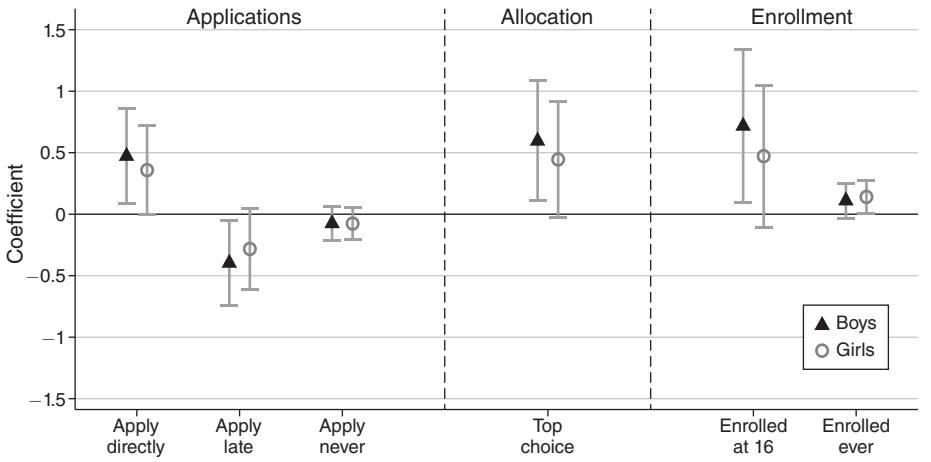

FIGURE 9. IV ESTIMATES: APPLICATIONS AND ENROLLMENT FOR POSTCOMPULSORY EDUCATION BY PUPIL GENDER

Notes: IV estimate of equation (9). Applications: Outcomes in columns 1–3 are mutually exclusive categories of applications to upper secondary education: Pupils apply directly in spring of the year in which they turn 16 ("Apply directly"), they apply up to four years after they have turned 16 ("Apply late"), or they apply never or later than five years after having turned 16 ("Apply never"). Allocation: (column 4) Pupils obtain one of their first two choices in the application ("Top choice"). Enrollment: (columns 5–6) Pupils are enrolled in upper secondary education in the fall of the year in which they turn 16 ("Enrolled at 16"), and ever enrolled in upper secondary education up to age 25 ("Enrolled ever"). All specifications include region-by-cohort and municipality fixed effects, as well as individual-level controls measured at age 7: gender, language (Swedish/Finnish/other), foreign origin, single-parent household, highest level of education in household. Standard errors clustered at the municipality level.

Do Male Quota Teachers Increase Pupils' Grades? We finally document limited evidence that male quota teachers increase their pupils' grades. This further strengthens the interpretation that effects operate through male (quota) teachers providing a more general role model of career attachment rather than opening up additional opportunities to pupils by increasing scores. We use two sources of pupil grades: final grades obtained in middle school that determine which slot applicants obtain in their applications to postcompulsory education and grades obtained in the nationally standardized matriculation exam. We observe GPA for 97 percent of the full sample of pupils and restrict the analysis of grades to those who apply to postcompulsory education. Field-specific grades for mathematics and languages (the average of mother tongue and second national language) are available for all pupil cohorts except the last two (i.e., starting school before 1999). Grades for the matriculation exam are available for all cohorts, but we can only observe those 49 percent of the full sample who sat this exam.

Supplemental Appendix Table A21 documents male quota teachers' impact on pupil grades, with coefficients consistently indistinguishable from zero, albeit imprecisely estimated. For middle school grades, we observe a noisy and negative impact on GPA across all subjects (column 1), with estimates for languages fields negative and estimates for mathematics closer to zero. Column 5 shows that exposure to male quota teachers increases the likelihood of observing middle school grades. For matriculation exam grades, the observed patterns are quite similar, with impacts on overall GPA noisy and negative and impacts on the likelihood of observing a pupil's exam positive. Across both exams, these patterns suggest

that—if anything—male quota teachers pull in pupils at the margin of the grade distribution to apply to postcompulsory education or sit the matriculation exam, with no discernible improvements in pupils' grades. Supplemental Appendix Table A22 further documents precisely estimated null effects of teacher's own matriculation exam performance on their pupils' grades in both middle school and the matriculation exam, consistent with results in Section VIB.

VII. Conclusion

In this paper, we document that a quota that advantaged academically lower-scoring men to obtain a study slot for primary teacher education has positive effects on output as measured by their pupils' intermediate and long-run educational and labor market outcomes. Using comprehensive register data, we show that male quota teachers impact consequential application patterns to postcompulsory education: Pupils are more likely to apply to continue education directly after middle school, to obtain the study slots on top of their list, and to enroll. We find that pupils who were exposed to a higher share of male quota teachers during their time in primary school are more likely to be either employed or studying at age 25, have higher educational attainment as measured by their highest degree achieved, and are more likely to pursue education fields in STEM subjects.

Multiple pieces of evidence suggest that the quota in our setting reduced selection imperfections by allowing group-specific admission thresholds. While selection criteria in absence of the quota were group neutral "on paper," in practice, they discounted productivity-relevant attributes of male applicants. The quota thus helped to offset such discounting.

Our study evaluates the effects of a quota policy with fixed parameters and does therefore not aim to take a stance on whether a binding representation target is an optimal policy. However, the main trade-offs highlighted in this paper generalize to any setting in which more equitable representation is a policy goal. When a key criterion for choosing candidates discounts the abilities of an underrepresented group, conscious reweighting of selection criteria can help to overcome such misalignment irrespective of the chosen policy instrument. Our results suggest that this may pay off not only in terms of achieving more equitable representation but also in terms of economic efficiency.

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