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POLITICAL SOLUTIONS TO DISCRIMINATORY BEHAVIOR

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Abstract

Discriminatory treatment of minorities by public authorities remains a serious challenge and breaks with the central principles of impartiality. However, little research examines how discrimination can be reduced through political means. This article argues that discrimination occurs when the perceived marginal cost of serving a minority citizen exceeds the funding per user and/or when excess of demand forces the provider to prioritize which citizens to serve. This also suggests that increasing the funding per user and increasing supply to meet demand might reduce differential treatment. These predictions are tested in a high school enrollment system where the funding is linked to the number of students enrolled. Unique, fine-grained administrative data shows that minority applicants are 9 percentage points less likely to be enrolled in their preferred high school. More importantly, an administrative reform shows how increasing the supply side flexibility and pay-per-user cuts the difference in half.

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Political Solutions to Discriminatory Behavior

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Discriminatory treatment of minorities by public authorities remains a serious challenge and breaks with the central principles of impartiality. However, little research examines how discrimination can be reduced through political means. This article argues that discrimination occurs when the perceived marginal cost of serving a minority citizen exceeds the funding per user and/or when excess of demand forces the provider to prioritize which citizens to serve. This also suggests that increasing the funding per user and increasing supply to meet demand might reduce differential treatment. These predictions are tested in a high school enrollment system where the funding is linked to the number of students enrolled. Unique, fine-grained administrative data shows that minority applicants are 9 percentage points less likely to be enrolled in their preferred high school. More importantly, an administrative reform shows how increasing the supply side flexibility and pay-per-user cuts the difference in half.

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INTRODUCTION

According to Weber, a fundamental advantage of modern bureaucracy is that "Everyone is subject to formal equality of treatment; that is, everyone in the same empirical situation." (Weber 1947, p. 340). In fact, equality concerns are often a key argument for the choice of public provision of a service because the private market solution would be deemed too unfair (Le Grand 1991). However, recently, differential treatment of minorities by public authorities has received increased attention throughout the Western world (e.g. Reny and Newman 2021). Thus, even though central principles of impartiality are widely approved and anti-discrimination laws are broadly set in motion (Schram et al. 2009, p. 401), discriminatory treatment of minorities remains a serious challenge. In addition, numerous studies employing survey experimental (e.g. Schram et al. 2009; Pedersen et al. 2018) as well as field experimental (e.g. White et al. 2015; Einstein and

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Glick 2017; Hemker and Rink 2017; Olsen et al. 2020; Dinesen et al. 2021) approaches confirm that minority citizens are, indeed, treated differently from majority citizens by public authorities. Apart from the detrimental effects for minority citizens and the fact that discrimination breaks with the central principles of impartiality, research has also shown adverse effects on political trust, efficacy, and participation (Schneider and Ingram 1993; Soss 1999; Ziller and Helbling 2019).

Though discrimination prevails in various encounters with public authorities and is undesirable for several reasons, precious little research examines how such discrimination can be reduced by political means. More generally, reviews across disciplines agree that "the literature does not reveal whether, when, and why interventions reduce prejudice in the world" (Paluck and Green 2009, p. 360; see also Bertrand and Duflo 2016, p. 85; Paluck et al. 2019, p. 133). The lack of evidence might reflect the fact that studying sustainable methods of reducing discrimination at the hands of public authorities with political means proves to be an incredibly difficult task for at least three reasons.

The first reason relates to the challenge of identifying policies that actually reduce discrimination. Ample psychological literature provides evidence on debiasing interventions in the lab (Bertrand and Duflo 2016). However, researchers have called for caution while applying findings from the lab in the real world (Spencer et al. 2016). The situations in the lab are rarely similar to what you face in the field, and the identified interventions are not easily controllable by political means (ibid.).

The second reason relates to causally identifying the effects of such policies. Policies are often implemented either globally treating all units, which makes it difficult to generate a valid control group, or locally as a response to specific organizational performance or behavior, making the policy endogenous to the outcome of interest.

The third reason relates to the challenge of detecting discrimination at all. Existing studies often categorize the explanations of discrimination as based on taste (Becker 1957), statistical associations between minorities and specific traits (Phelps 1972), or implicit biases (Bertrand et al. 2005). Following the first and second explanation, discrimination might reflect a conscious decision. But since discrimination is outlawed throughout the Western world and impartiality is particularly articulated as a virtue of modern bureaucracy, explicitly acknowledging differential treatment is unlikely. If discrimination is caused by implicit biases that work outside the discriminator's conscious, people

might not even be aware of discriminatory behavior though they might be willing to admit it.

To identify relevant policies, this study builds a theoretical model that suggests that discrimination occurs due to two simple premises often shaping the provision of public services. The first relates to a perception of minority citizens as being more costly to serve. The second premise is that the funding scheme for the provider is related to the number of users they serve. This is a typical way of funding public services and covers various funding systems including quasi-markets, voucher systems, and contracting out. The model predicts that discrimination is likely to occur if the perceived marginal cost of serving a minority citizen exceeds the pay-per-user and/or excess of demand for a provider forces the provider to prioritize which citizens to serve – a common situation since no price mechanism limits the demand for popular providers (Lipsky 2010). As a consequence, the model also suggests that increasing the funding per user and increasing supply to meet excess of demand might reduce differential treatment.

To examine the validity of the model, this study focuses on a highly important context: high school enrollment. High schools differ substantially in terms of the quality of teaching, ability of peers, and level of segregation seen in them. Being admitted to the high school of your choice might also highly affect your engagement and commitment to the program. Also, being admitted to a service of your choice increases the match between individual preferences for services with the provided service – a key argument for offering citizens in a democracy a choice between different providers (Tiebout 1956). Finally, public schooling is provided around the world and is one of the largest public providers of service in many countries. More specifically, this study focuses on high school allocation in Denmark where the funding has been determined by free school choice and the number of enrolled students but with little supply side flexibility since 2007. Thus, the providers had an incentive to be selective in their enrollment practices. In addition, previous studies have found that minority citizens (specifically non-Western citizens) are more likely to be referred to another class or school than their majority citizen peers (Andersen and Guul 2019; Olsen et al. 2020) in a Danish context, indicating that minority status is, indeed, perceived as costly in this setting.

Most importantly, an administrative reform in 2010 increased the supply side flexibility and increased the pay per student. The reform let the providers buy their own buildings (instead of using them for free), thereby increasing the ability to determine the high school capacity locally. In exchange, the providers got an 11 per cent increase in the pay per student. For the full population of high school applicants (more than 115,000 applications) in Denmark from 2009 to 2012, highly detailed register data from the enrollment process makes it possible to observe applicants, which high school they apply for, whether they are enrolled in the prioritized high school as well as detailed individual characteristics including measures of academic abilities (GPA from middle school) and minority status (non-Western applicant or not), and link them through unique personal identifiers. This allows this study to meet the third challenge (detecting discrimination) by modelling the enrollment process extremely accurately and detect whether minority and majority applicants in the same empirical situation are evenly admitted to their preferred high school.

This data and a difference-in-difference design comparing the difference in enrollment in preferred high schools between non-Western and Western applicants before and after the reform make it possible to meet the second challenge and identify whether these policy changes have indeed induced public providers to discriminate less. Pre-reform fixed effects estimates within receiving first priority high schools and sender middle schools show that non-Western applicants are 9 percentage points less likely to get enrolled in their preferred high school as compared to Western applicants. The reform effectively eliminates half of the difference in first priority enrollment rate between Western and non-Western applicants. Various robustness checks and a placebo test support the conclusions. Particularly interestingly and in accordance with expectations, the reduction in discriminatory treatment of non-Western applicants appears to be driven by oversubscribed providers. The findings implicate that redesigning the economic incentives in public service delivery makes it possible to reduce differential treatment through politically controllable means.

The next section introduces the theoretical explanations of discrimination and their potential political solutions; it also reviews the sparse evidence found on policies that reduce discriminatory treatment. The second section develops the theoretical model and derives its empirical implications. The third section presents the empirical setting before the estimation strategy, data, and measurement

are discussed. The descriptive statistics and results follow. The findings are further discussed in relation to other possible political means for reducing discrimination and potential mechanisms.

THEORY AND EXISTING EVIDENCE

Discrimination and Political Solutions

There are at least three theoretical explanations for why discrimination occurs which also apply to discrimination by public authorities. First, discrimination might be a result of racism and a distaste for minority citizens (Becker 1957). Second, it might occur because people make decisions based on statistical associations between minorities and specific traits (Phelps 1972). Finally, discrimination might occur because of implicit biases that people unintentionally rely on in decision making (Bertrand et al. 2005). While the first and third explanation arguably reflects irrational and biased decision processes and the second a more rational and potentially unbiased response from the perspective of the minority citizen the outcome is the same: you are treated according to your minority status instead of based on your specific situation.

Previous studies have looked into interventions that might reduce exclusionary attitudes among ordinary voters. For instance, Kalla and Broockman (2020) finds that non-judgmentally exchanging narratives in interpersonal conversations can facilitate durable reductions in exclusionary attitudes. Similarly, a recent review by Paluck et al. (2019) has examined the support for the contact hypothesis but concludes that "(...) the jury is still out regarding the contact hypothesis and its efficacy as a policy tool" (ibid. p. 133). Further, it remains an open question whether these types of interventions can reduce exclusionary attitudes and ultimately transform into less discriminatory behavior by public authorities.

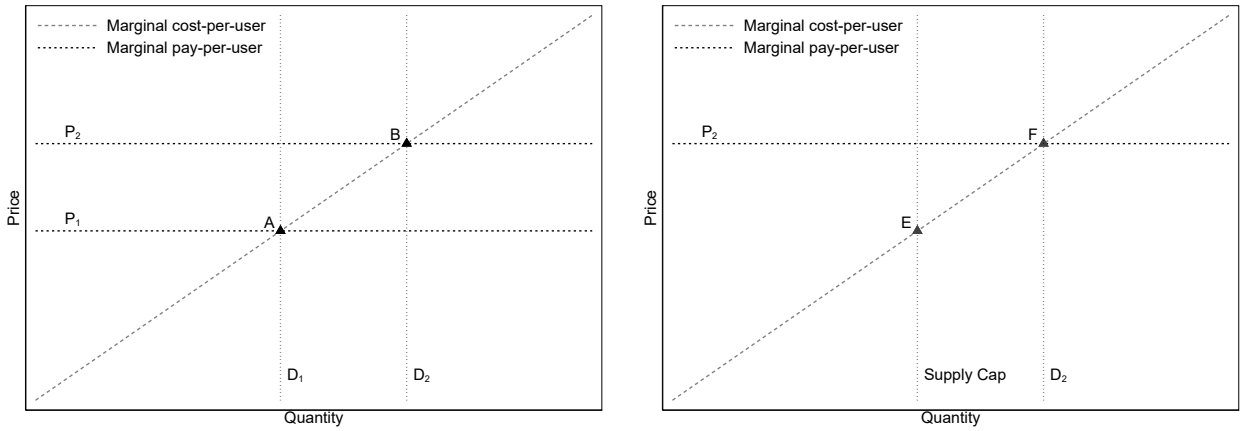
Few studies have examined political solutions to discrimination by public authorities. Generally speaking there are three main political solutions to societal problems: 1) regulatory, 2) informational, and 3) economic (Vedung 2011). However, pure regulation appears ineffective since anti-discrimination laws are already set in motion in many countries (e.g. the Civil Rights Act of 1964 in the US). Concerning informational solutions Fang et al. (2018) examine in a field experiment whether government information

can deter landlords from discriminating their potential tenants through their responses to them. However, the results are inconclusive, and the authors suggest that this might be explained by the fact that they need to estimate the interaction between minority status and the policy in question to determine the policy's effect, which requires additional power (ibid.). Further, the examined policy targets private providers, and the same tools might not be effective for public providers. In relation to economic solutions a further distinction between providing economic resources and creating economic incentives can be made (Vedung 2011). Concerning the first, a recent study finds that the random provision of resources that reduces the workload for a sample of public school teachers also reduces discriminatory responses in a survey experiment afterwards (Andersen and Guul 2019). Though the authors conclude that whether the reduction in discriminatory responses might be temporary remains an open question, this suggests that economic instruments might be a key to reducing differential treatment. Concerning economic incentives, less is known. However, the use of economic incentives in relation to the provision of public service is exactly what signifies market-based reforms that introduce user choice and competition. Therefore, the next section develops a model for how such market-based reforms might affect discriminatory behavior by public authorities

Theoretical Model for Public Service Discrimination and Reduction

Market-based reforms have gained popularity across the globe in various service areas such as education, health care, social services and nursing home services (Blöchliger 2008). These types of reforms might be popular because it makes it possible to balance two often conflicting goals. On the one hand, a key rationale behind the decision to provide a service in the public rather than the private domain is that the results would be too unequal in the private domain (Le Grand 1991). On the other hand, a common critique of public service provision is that it makes the provider responsive to the political leadership rather than the users of the service (Chubb and Moe 1988). To compensate for the latter without compromising the first, a widespread response by political authorities is to introduce elements of choice and competition. The main idea involves two elements: 1) giving the users a choice between at least two providers of the service in question, and 2) paying the provider a fixed price per user for their service. The specific setup varies empirically in many ways. Thus, a system can be created with

FIGURE 1. Theoretical models for the relationship between user demand, pay-per-user, cost-per-user, and quantity of provided units of service under a choice and competition funding system



Note: The y-axis indicates price and the x-axis indicates quantity. D_1 and D_2 indicate different levels of fixed demand. P_1 and P_2 indicate fixed levels of pay-per-user. "Supply Cap" indicates a fixed cap for the supply quantity. The diagonal line illustrates the increasing marginal cost-per-user. Panel A depicts a situation with complete supply side flexibility, while Panel B depicts a situation where a supply cap is introduced.

only public providers, only private providers, or both as long as the government pays a fixed price for the provision of the service. In practice, such systems are known as quasi-markets, voucher systems, or agreements to contracting out (Blöchliger 2008).

A system of choice and competition resembles a pure private solution but with several differences. One important difference is that the user demand for a specific provider becomes unrelated to the price of the service, since it is the same for all providers (typically zero from the user's perspective). Thus, the demand for a specific service has other determinants. For simplicity, I consider the demand exogenous in the current model. Thus, I treat the demand for a specific provider as fixed. The marginal cost function for the providers, on the other hand, is expected to be closely tied to the quantity of the service provided. This is expected for at least two reasons. First, production costs are, in general, expected to increase at a certain point due to diseconomies of scale (Boyne 1995). The second and more important element in the cost function is specifically linked to the marginal cost of providing service for specific users since we would expect some users to be more demanding or rewarding to serve than others due to individual user characteristics. One such factor might be minority status. Thus, some users might be perceived as high-cost users and others as low-cost users. While discriminatory perceptions have given

several different explanations (as described above) for the purpose of the model, we can be agnostic about whether the cost assessments are accurate or biased. Nonetheless, two experimental studies from the educational context show what can be viewed as discriminatory behavior and thereby support that public authorities indeed have negative perceptions of minority citizens in this context. Thus, minority fathers are faced with more administrative burdens when they ask if it is possible to move their children to a new school in Denmark (Olsen et al. 2020) and (Pfaff et al. 2021) show in the context of the US, that whether or not a parent receives a response to a request for a meeting with a possible school for their child depends on their religious affiliation.

When the pay-per-user is fixed and the marginal cost of increasing supply grows with the number of users served, we would expect the providers to increase the supply of their service as long as the marginal cost of providing another unit of the service is below the fixed pay-per-user. Note that since the pay-per-user is fixed the marginal pay-per-user is constant and that the marginal pay-per-user is equivalent to the marginal revenue.

This simple model for the provision of service is depicted for a specific provider in Figure 1, Panel A. Thus, if the user demand for the service is fixed at D_1 and the marginal cost of providing the service for the costliest user is below the pay-per-user P_1, we would expect to end up in situation A where all users with a preference for a specific provider are served by this provider. However, if the marginal cost of providing the service exceeds the pay-per-user and the demand for the service is fixed at D_2 and thus above this threshold, we would expect the providers to choose not to enroll a number of users. Additionally and specifically, we would expect them to decline the users they find most costly to enroll in the program. As mentioned, if minority status enters this cost assessment, one implication of such an excess of demand would be that minority users would be rejected and thus receive differential treatment (with all else being equal).

Studies from the educational policy literature on school choice supports that schools are selective in their intake of students. Lubienski et al. (2009) show that schools across three different school choice programs in the US use a variety of exclusionary strategies. Similar results are found in the context of the UK by Burgess et al. (2007), who suggest that the combination of school choice policies and limited supply side flexibility ultimately forces the schools to introduce criteria for a selective intake of

students. Parallel patterns are found after the introduction of school choice in New Zealand where oversubscribed schools implemented enrollment schemes and minority and disadvantaged students became disproportionately concentrated in specific schools (Ladd and Fiske 2001).

Instead of changing the perceived costs, one simple solution to this type of discrimination would be to increase the pay-per-user to make it more profitable to increase supply to meet demand. Thus, if politicians changed the pay-per-user from P_1 to P_2, we would end up in situation B where all users preferring the specific provider are served by this provider.

An important assumption for this to be true is supply side flexibility. Thus, the providers must be able to increase the units of the service supplied. Panel B depicts a situation where the supply is capped at a fixed quantity. If the demand for the service is above the supply cap (as depicted by D_2 in Panel B), we would expect the same as described above, namely that the providers decline the service for some users based on their perceived costs even though the marginal cost of increasing the supply is below the pay-per-user (depicted by P_2 in Panel B). Again, we would expect that removing such a limitation would increase the supply to meet demand and potentially reduce discriminatory decline decisions. Further, it would make it possible to end up in situation F instead of E. Importantly, this argument is robust even if we relax the fixed demand assumption. Thus, we would expect a similar result even if the demand is affected by changes in the quantity of the service provided as long as the change in demand is smaller than the change in quantity.

To sum up, when minority status enters the providers' cost assessment in a choice and competition funding system, we would expect discrimination to occur in situations where demand exceeds the marginal cost of increasing supply or with limited supply side flexibility and increasing the pay-per-user and/or the supply side flexibility would reduce discriminatory treatment. To test these propositions I need to study a service area governed by choice and competition where some providers experience an excess of demand. But most importantly I need exogenous changes in the pay-per-user and/or supply side flexibility. A reform within the Danish public high school program in 2010 constitutes an excellent case with reference to all these subjects, and the next section describes this empirical setting in more detail.

RESEARCH DESIGN

Empirical Setting

The Danish educational system consists of 10 years of compulsory schooling: preschool class and grade 1 to 9 (equivalent to elementary and middle school in the US). Roughly 80 per cent of Danish students attend a public school. After 9^{th} grade, students can attend the voluntary 10^{th} grade, apply for further education, or enter the labor market. If the student chooses to apply for further education, they can continue on to high school or enter vocational training. The largest high school program is the General Upper Secondary Education Program (STX) which generally prepares the students for further college education (roughly 38 per cent of the cohort enrolled in this program in 2009).[1] Contrary to the compulsory schooling, almost all students attend a public high school (approximately 96 per cent of all STX students in the studied period). The high schools have been run as self-governing institutions with local boards organized under the national Ministry of Education since 2007. Denmark has a multi-tier government system with a national, regional, and municipal level, and regional governments (five in total) have a formal role in coordinating the overall upper secondary educational capacity in the region. Within each region all high schools take part in allocation committees in their local area that are formed based on geographical proximity. If a high school is oversubscribed, the school is legally supposed to pass on all applications to the allocation committee that will then allocate the applicants.

Legal documents describe the enrollment process further but several key steps are informally determined. The high schools are obliged to report their student capacity to the regional government the following school year in November. The regional government approves the reported capacity in January. In March, the applicants fill out a prioritized list of high schools they would like to attend. The application is sent to their current middle school, which makes sure that information concerning the applicant's academic abilities (final GPA or teacher-assessed GPA) as well as personal information concerning their address and name are attached. Then, the current middle school passes the application

[1]The students can also choose to apply for two more specialized high school programs focused on either business and economics or technology and science. These programs function under slightly different government regimes, and since the reform in question did not affect these programs, the focus is on the general program (STX).

on to the high school with the highest priority on the applicant's list. The relevant high school is then responsible for assessing whether the applicant is eligible for high school.[2] If the applicant is deemed eligible and the number of first priority applications do not surpass the capacity, the applicant will be offered the chance to attend the high school the following school year, without further ado. If the school is oversubscribed, it needs to be determined who among the eligible applicants should be enrolled in the preferred high school.

In the application process, the high schools can observe several things about the applicants. As mentioned they directly observe the applicant's academic abilities (GPA), the applicant's current middle school (the sender of the application) and what grade they currently attend (9^{th} grade or the voluntary 10^{th} grade). Based on the applicant's name, it is also possible to determine the gender (male or female) as well as the minority status of the applicant (non-Western or Western) – a common way of observing these attributes. The specific address of the applicants might also implicitly signal their socioeconomic status. High schools might be aware of where the applicants with higher educated parents tend to live in their local area. Also, high schools can take travel distance into consideration when determining which applicants to enroll.

Though the allocation committees are supposed to handle the allocation process in the case of oversubscribed high schools, their power to do so remains limited for several reasons. The legal work sets up a few guidelines for the allocation mechanism. The committee should seek to meet all applicants' first priority before starting applicant redistribution steps, and they are supposed to take travel patterns into account. However, the committees consist of principals from relevant local high schools, and the distribution of applicants can be viewed as an unequal bargaining process where the oversubscribed high schools have a better bargaining position than the high schools with too few first priority applicants. Whether this is true is of course an empirical question. However, if the allocation committees to some extent reduce selective enrollment behavior among oversubscribed schools it would only make the estimates of any remaining selectivity in enrollment behavior more conservative, as compared to a situation without allocation committees. In fact, several anonymous principals reported that the oversubscribed high schools could pick and choose which applicants to accept in an assessment

[2]The middle school or high school can also ask the student to sit for an academic test before it makes a decision.

of the allocation committees in the studied time period (Pluss 2012). For instance, a principal stated: "It is very much up to the schools who they choose to pass on, and it is no secret that the school that passes the students on makes the decision and that it might seem a bit nontransparent how things end up the way they do" (Principal, Capital Region) (ibid.). On top of that, some regions explicitly allowed their high schools to file a list of applicants they would like to admit.

The high schools' funding consists primarily of activity-based grants related to the number of students enrolled and those who graduate from high school. Before the 2010 reform, the central government owned the high school buildings and the high school providers were allowed to use the buildings free of charge. However, that also meant that attempts to increase the capacity needed permission from central government authorities. The reform made it possible for the schools to buy their buildings at a favorable price based on an assessment of their ability to pay, making it markedly easier for the high schools to increase capacity. In addition, if the schools chose to buy the buildings, the pay per enrolled student would increase dramatically. Thus, the reform made it a lot easier for the high schools to increase the capacity and intake of students, and in addition, it increased the incentive to do so since the pay per student increased. The Finance Committee in the Danish parliament made the decision. The official background for the decision was that decentralized responsibility would give providers an increased economic incentive to optimize resources based on local conditions (ft.dk 2009). Within 10 months, 91 per cent of the high schools had accepted the offer with more to come.[3] More specifically, the high schools receive five activity-based grants relative to the number of students enrolled. The exact numbers are shown in Table 1. The activity-based grants are divided into several parts called taximeter grants. The largest is a grant intended to cover costs related to teaching activities. The second largest is a grant given for each student who graduates from the specific high school. Finally, three different grants are related to other costs such as administration, buildings, and maintenance. As mentioned earlier, of particular interest here is a new grant introduced in 2010 intended to cover building costs as a consequence of the providers taking over the ownership. Ultimately, the reform increased the pay-per-user by roughly 11 per cent.

[3]A few schools were specifically not allowed to buy their buildings until ongoing construction or renovation work was finished.

TABLE 1. Pay-per-user in high school in 2009–2010

	Pre-reform 2009	Post-reform 2010
Teaching taximeter	54,200	55,300
Completion taximeter	14,000	14,100
Collective expenses taximeter	8,300	7,500
Maintenance taximeter	1,200	0
Building taximeter	0	8,700
Total pay-per-user per year (with 1/3 of completion grant)	68,367	76,200

Note: All numbers are in nominal Danish kroner 6.15 DKK ~1 $. This data is obtained from the yearly governmental financial bills in 2009 and 2010. Further, 1/3 of the completion grant is calculated as part of the total pay-per-user since it usually takes three years to complete the high school program.

Empirical Strategy

As mentioned initially, studying policies that reduce discrimination is challenging. Policies that might reduce discrimination rarely randomly generate valid control and treatment groups. Policies are either implemented globally leaving no one unaffected or locally as a response to performance or organizational behavior that makes the policy endogenous to the outcome of interest. To be fair, it might be possible to handle some policy solutions in a randomized control trial – for instance, the information campaign examined in Fang et al. (2018). However, many relevant policy instruments (such as changing the incentive scheme in the public sector) are difficult to manipulate by the researcher. In addition, as the authors of the former study mention, statistical power becomes an issue in this type of study.

While the policy reform described above was implemented nationally, it is possible to gain leverage from the fact that we would expect the policy to affect specific groups of applicants differently according to their perceived cost. Thus, we would expect the policy to increase the enrollment rate particularly for non-Western applicants since the increase in the pay per student would make it beneficial to include students who would have previously exceeded the perceived costs. This makes it possible to use a difference-in-difference design to estimate whether the policy increased the enrollment in preferred high schools more for non-Western applicants than for Western applicants. Importantly, while the increase in the pay per student could affect the enrollment of Western students as well, this would only make the difference-in-difference estimate of the policy effect more conservative. The validity of the

difference-in-difference design relies on the common trend assumption. While it is impossible to test the assumption, if the assumption holds, it is both possible to take time-invariant factors as well as potential time trends into account.

In addition, you need to get a reliable measure of whether discrimination takes place. A frequently used approach is to use name cues – either in a survey or field experimental setup to isolate the effect of minority status from other potential (and legitimate) reasons for differential treatment. However, it might not be feasible to combine this approach with relevant policy changes as described above (Fang et al. 2018).

Therefore, this study takes another approach and relies on unique detailed administrative data to get an estimate of potential discriminatory treatment that makes it possible to model the decision process with high precision. Thus, it becomes possible to estimate whether applicants with different minority statuses have a different probability of getting enrolled in their preferred high school using high school fixed effects and middle school fixed effects, with controls for gender, GPA, grade at the time of application (9^{th} or 10^{th} grade), and parental educational background. These data make it possible to observe applicant characteristics directly with a few exemptions. First, it might be possible for the providers to gather further information (e.g. by contacting the school that the applicant currently attends or by looking into other qualitative data sources), but gathering such additional information is a costly process – especially because the high schools, on average, enroll more than 200 students per year. Second, applicant address is not observed. If the non-Western applicants systematically live further away from the school that they prioritize than their majority peers, that could be a legitimate concern in the system under investigation. However, the middle school fixed effects handle these issues to a large extent, because only applicants from the same school districts are compared in these models. School districts are geographically rather small; thus, travel time between students seldom differ markedly, and we would expect socioeconomic differences might also be reduced if students with similar backgrounds are selected into the same school district. Further, if this is the case the middle school fixed effects also take into account if applicants from less affluent school districts apply less strategically. In addition to account for socioeconomic signals from applicant address, I include controls for parental education in the analysis.

Furthermore, while the assumption behind the detection of discrimination in this setup is that all empirical differences observable by the high schools are measured, the difference-in-difference assumptions are more relaxed. I can, thus, validly estimate the effect of the reform even if the estimate of discrimination is biased as long as the estimation bias is time-invariant. This implicates that the reform estimate would be valid even though the providers gather unobserved additional information, as long as they do it to the same extent in the pre- and post-reform periods. Similarly, even if the providers use residential patterns to select applicants, it does not affect the validity of the difference-in-difference estimate as long as these patterns are constant over time. Due to the relatively limited time perspective, it seems unlikely that such patterns would change dramatically in the studied time period. Since not all high schools accepted the offer to buy their buildings and thereby also received the increase in the pay-per-user, we can consider the difference-in-difference estimate as an intention-to-treat estimate. The primary outcome is whether applicants are enrolled in their preferred high school. More formally, the primary outcome variable, Y, is an indicator variable taking the values:

$$Y = \begin{cases} 1, & \text{student enrollment in } 1^{\text{st}} \text{ priority high school} \\ 0, & \text{otherwise} \end{cases} \tag{1}$$

The full model can be written as follows:

$$Y_{ihm} = \alpha + \beta_1 G_i + \beta_2 T + \beta_3 G_i T + \mathbf{x_i} + \theta_h + \lambda_m + \varepsilon_{ihm} \tag{2}$$

where Y_{ihm} signifies enrollment in preferred high school, for applicant i applying for enrollment in high school h from middle school m. G_i is an indicator of whether student i is of non-Western descent. T is a time dummy taking the value 0 for the pre-reform year 2009 and 1 for the post-reform years 2010–2012. $\mathbf{x}_i$ is a vector of applicant level covariates. θ_h and λ_m are high school and middle school fixed effects, respectively.

All models are estimated with ordinary least squares (OLS), and since the outcome is binary, they are interpreted as linear probability models (Wooldridge 2010, p. 562). Robustness analysis based on logistic regressions produces similar results.[4] Abadie et al. (2017) argue that you should

[4]Table A.2 in the supplemental materials shows the coefficients based on logistic regression (Model 1) and with

cluster standard errors at the level of treatment. Since the enrollment decision is largely determined at individual high schools and the reform specifically changed the incentives that individual high schools received, the standard errors are clustered at the high school level. However, clustering at the level of middle schools or the allocation committee also produces significant results (see Table A.4 in the supplemental materials for the exact p-values.[5])

To summarize, most importantly, the reform allows us to examine whether changing the theoretically relevant determinants of differential treatment can effectively reduce discrimination. The described approach makes it possible to determine the enrollment rate for Western and non-Western applicants in the same empirical situation. Thus, this study relies on a difference-in-difference design based on observing the enrollment of Western and non-Western applicants before and after the implementation of the reform.

Data and Measurement

The study capitalizes on detailed administrative data on the admission process (see Table A.15 in the supplemental materials for an overview of the administrative data sources). As mentioned above, the regular application process for high school involves filling out an online application formula with a prioritized list of schools for further education. This study is based on records of all first priority

covariates (Model 2), estimated as a conditional logistic model with fixed effects at the high school level (Model 3) and at the middle school level (Model 4). All coefficients are significant and in the same direction as they are in the linear probability models. However, taking fixed effects into account in a logistic regression framework is challenging, since the size of the fixed effects is unknown and assumptions need to be made about their size to obtain partial marginal effects (Wooldridge 2010, p. 622). Also, it is not possible to estimate the effects with both levels of fixed effects and covariates.

[5]When clustering at the middle school level, all main variables across all model specifications are significant at the 0.001 level. Clustering at the allocation committee level also provides results that are significant across models though the difference-in-difference estimate in the most restricted Models 5 and 6 are only significant at the 0.10 per cent level.

applications for a public high school from 2009 to 2012.[6] As a matter of fact, 2009 is the oldest entry of the application data. In 2012 a flexible class size cap was introduced that could have affected the results, and therefore 2012 is the endpoint of the analysis. However, changing the post-reform period does not change the results substantially (see Table A.13 in the supplemental materials).

To measure whether the applicants are enrolled in their preferred high school, both measures of the preferred high school and actual enrollment are needed. For each applicant, I can directly observe the high school that the applicant would prefer. Whenever a person enrolls in an educational program, it is also reported to a central register. Unique personal identifiers make it possible to link the information and create a measure of enrollment in the preferred high school. Ideally, I would like to observe the offer of enrollment, because applicants with different backgrounds could accept it to different extents; however, as long as such tendencies do not change with the reform, the difference-in-difference also takes that into account. In a Danish setting, minority status relates to whether you are of non-Western or Western descent.[7] The public political debate of immigration in Denmark has focused on non-Western origins (Green-Pedersen and Krogstrup 2008, p. 611); official statistics are telling about the concentration of non-Western immigrants, and policies are based on it (ft.dk 2010). Finally, previous Danish (e.g. Villadsen and Wulff 2017; Dinesen and Sønderskov 2015) as well as European studies (Schneider 2008) have used non-Western origins as the basis for empirical analysis on the role of ethnicity and minority status.[8] Place of birth of the applicant and their parents are also directly observable in central registers and used to construct the measure of minority status. The applicant's gender is measured as a simple indicator of whether the applicant is female

[6]The raw data contains 116,108 first priority applications for a specific high school. A total of 670 observations are dropped due to missing information on which school they apply from. Another 62 observations are dropped because they lack background information. In total, missing observations constitute less than 1 per cent of the population. No further data restrictions are imposed. Table A.1 in the supplemental materials summarizes the attrition.

[7]Non-Western descent refers to people not originating from the 27 EU countries, Great Britain, Iceland, Norway, Switzerland, the European micro-states, Canada, USA, Australia, or New Zealand.

[8]However, using the distinction between Danish and non-Danish applicants produces similar results (see Table A.14 in the supplemental materials)

or male based on biological sex at birth. Their GPA is measured as a simple average of their middle school grades in all exams as well as classroom grades assessed by their teachers if they apply after the voluntary 10^{th} grade or as a simple average of their classroom grades if the they apply from 9^{th} grade since the exam grades are usually not available when the application is submitted in March. The GPA is standardized within each cohort of 9^{th} grade students (standard deviation=1, mean=0). Finally, parental background is measured with a set of indicator variables for highest educational attainment for each parent (MA or PhD level, BA level, academy level, below academy level, and missing).

Descriptives and the Common Trend Assumption

Table 2 shows descriptive statistics for the sample before and after the reform. The reform slightly decreased the share of applicants that did not enroll in their preferred high school. This would also be expected since the reform made it easier for the providers to increase supply and thus meet surplus in demand. The share of females, non-Western, 10^{th} grade applications, and applicants with missing GPAs did not change markedly. However, the standardized GPA decreased slightly, indicating that applicants performing slightly more poorly within their cohort applied for a high school. Both before and after the reform, the applicants performed above the cohort mean (set to 0).

Figure 2 shows additional descriptive statistics of enrollment patterns. Panel A shows the raw rates of enrollment in the preferred high school by minority status from 2009 to 2012. The figure clearly shows the initial difference in enrollment rates between non-Western and Western applicants, that the enrollment rate changes markedly for the non-Western applicants after the reform, and that the enrollment rates are relatively stable in the post-reform period. Panel B shows the average number of students enrolled per provider in the period 2007 (first year under the described funding system) to 2012. Thus, it is possible to examine the changes in enrollment across years in both the pre- and post-reform periods. The graph shows that the average number of students per provider has been slowly increasing since 2007, but the average enrollment took a huge jump in the year after the reform, indicating that the reform induced the providers to increase intake (grey line, right y-axis). At the same time, the share of non-Western students enrolled is fairly constant throughout the period (black line, left y-axis).

TABLE 2. Descriptive statistics pre-reform and post-reform

	Pre-reform		Post-reform	
	Mean	SD	Mean	SD
Enrolled in the preferred high school	0.81		0.85	
Female applicant	0.62		0.61	
Non-Western applicant	0.09		0.09	
GPA standardized within the cohort	0.63	0.74	0.57	0.76
GPA missing	0.02		0.01	
10^{th} grade application	0.38		0.39	
Number of observations	26,382		88,994	

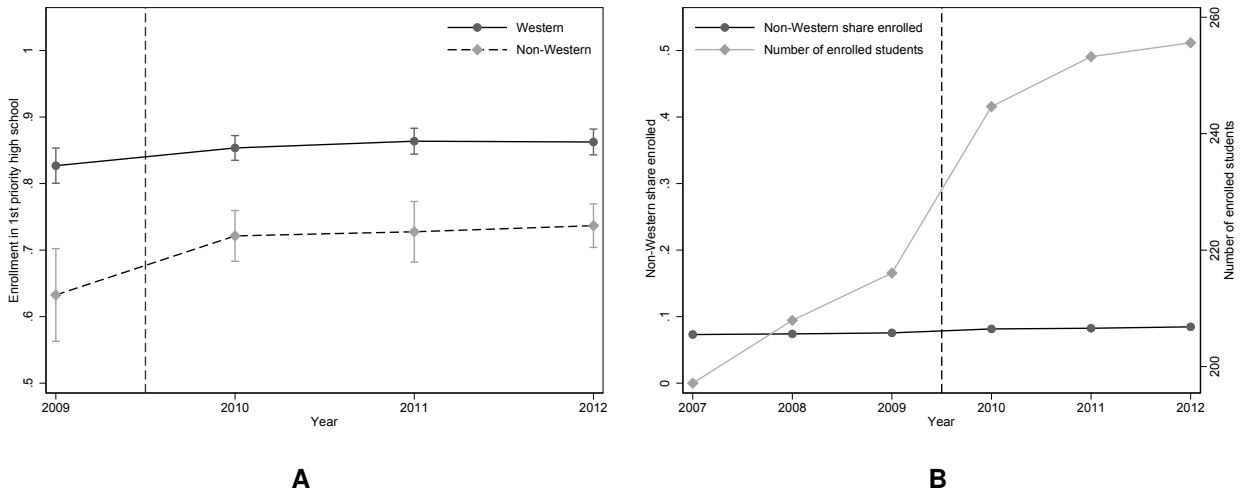
Note: All variables except the GPA standardized are indicator variables. The GPA is calculated by taking the mean of all exam grades and classroom-assessed grades for 10^{th} grade students and all classroom assessed grades for 9^{th} grade students. The GPA has been standardized within each full cohort of 9^{th} grade students. Further, 2009 constitutes the pre-reform period, and 2010–2012 the post-reform period.

Unfortunately, it is not possible to assess the trend in 1^{st} priority high school enrollment in the pre-reform period, which could support the validity of the common trend assumption, since the application data necessary to create the measure is only available for one year before the reform. A potential violation to the common trend assumption would be if the share of non-Western applicants took a dramatic drop in the post-reform period. However, as Table 2 shows, this is not the case.

Another potential threat to the design would be if the non-Western applicants started submitting applications more strategically following the reform. One way to test this is to examine whether non-Western applicants are less likely to apply for oversubscribed high schools than Western applicants in the post-reform period compared to the pre-reform period. However, a supplementary analysis shows that this does not seem to be the case (see Table A.5 in the supplemental materials). There appears to be slightly fewer applicants for oversubscribed schools in the post-reform period, but this is not significantly lower for non-Western applicants.[9] In summary, though it is not possible to examine the pre-reform trends, the available evidence supports that the common trend assumption appears to be valid.

[9]The slightly fewer applicants for oversubscribed schools also show that the increased enrollment was not met by a larger increase in demand, which would lead to different expectations, as argued in the theory section.

FIGURE 2. Descriptives for 1st priority enrollment rates and enrolled students



Note: Panel A represents raw rates of enrollment in first priority high schools by the minority status in the period 2009–2012. The vertical lines represent 95% confidence intervals. Panel B depicts the average number of students enrolled in high schools in the period 2007–2012 (gray line, right y-axis) and share of non-Western students enrolled (black line, left y-axis). The vertical dashed line indicates the timing of the reform.

RESULTS

Impact of the Reform on Differential Treatment

Table 3 shows the results (see Table A.3 in the supplemental materials for the full model results). All reported coefficients are significant at the 5 per cent level or lower. Model 1 shows that non-Western students were 19 percentage points less likely to be enrolled in their preferred high school in the pre-reform period. The coefficient drops by taking differences in background characteristics and high school fixed effects into account to a difference of 10 percentage points (Model 4). Thus, observable empirical differences explain approximately half of the difference in enrollment rates between the non-Western and Western applicants and the high school to which they apply. Introducing middle school fixed effects does only reduce the difference marginally (Model 6). Thus, under the assumption of no unobserved confounders, non-Western applicants in the same empirical situation were 9 percentage points less likely to be enrolled in their preferred high school. The reform coefficients represent the difference in enrollment rate before and after the reform for Western applicants. Thus, the reform increased enrollment in preferred high schools by approximately 3.5 percentage points for Western applicants. The coefficient does not change markedly across specifications indicating that slightly

TABLE 3. Enrolled in 1st Priority High School, Non-Western Applicant and Reform

	(1)	(2)	(3)	(4)	(5)	(6)
Non-Western appl.	-0.194***	-0.129***	-0.162***	-0.101***	-0.142***	-0.093***
	(0.030)	(0.028)	(0.020)	(0.019)	(0.019)	(0.018)
Reform	0.033**	0.036**	0.033**	0.036**	0.032**	0.036**
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Non-Western appl. x reform	0.063**	0.060**	0.054**	0.052**	0.049*	0.047*
	(0.021)	(0.020)	(0.020)	(0.019)	(0.019)	(0.019)
Constant	0.827***	0.752***	0.825***	0.744***	0.930***	0.866***
	(0.013)	(0.013)	(0.009)	(0.010)	(0.060)	(0.060)
Covariates	No	Yes	No	Yes	No	Yes
High school FE	No	No	Yes	Yes	Yes	Yes
Middle school FE	No	No	No	No	Yes	Yes
Adjusted r^2	0.02	0.05	0.01	0.05	0.03	0.06
Observations	115,376	115,376	115,376	115,376	115,376	115,376

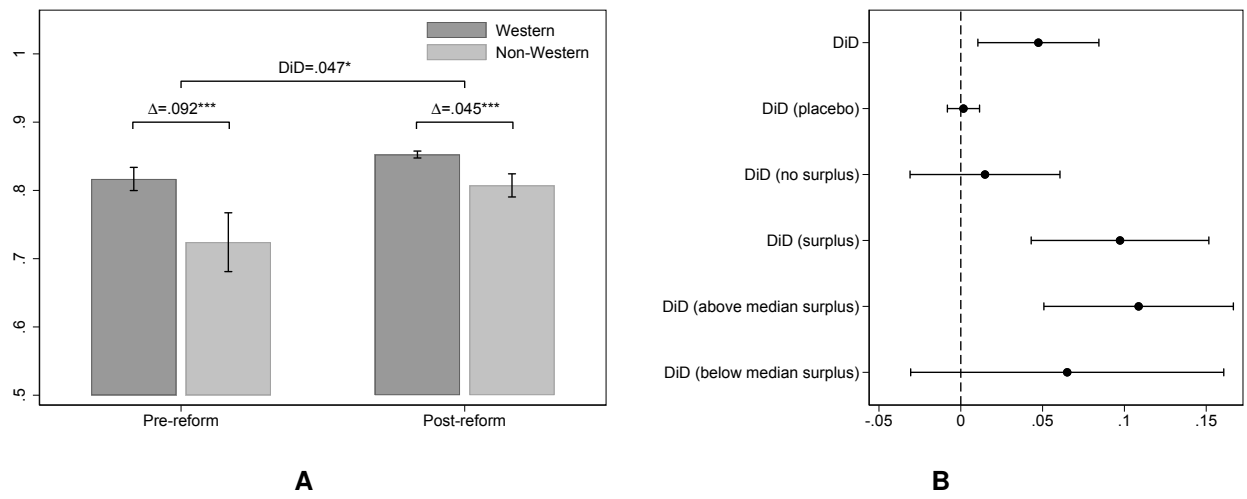
Note: Coefficients from linear probability models (OLS). Standard errors clustered at high school level in parentheses. All reported variables are indicator variables. Covariates included are standardized GPA and GPA missing indicator, indicators for parental education as well as indicators for female applicant and grade of application (9th or 10th grade). See Table A.3 in the supplemental materials for the full model results. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

more applicants were enrolled in their preferred high school in the post-reform period. Finally, the interaction term between non-Western applicant and reform constitutes the difference-in-difference estimate. The coefficient in Model 1 indicates that the reform reduced the difference in enrollment rate between non-Western and Western applicants by approximately 6 percentage points. Including covariates, high school fixed effects and middle school fixed effects only slightly change the estimates (still roughly 5 percentage points in Model 6). This suggests that the reform eliminated half of the difference between Western and non-Western applicants' enrollment rates in preferred high schools, indicating a substantial reduction in the differential treatment of non-Western applicants.

Additional Robustness Analysis and Possible Mechanisms

Figure 3, Panel A shows more detailed results by plotting the predicted enrollment rates in preferred high schools for Western and non-Western applicants before and after the reform based on Model 6 in Table 3 – the most conservative estimates. Importantly, while the difference in the enrollment rate between Western and non-Western students drops from 9 percentage points in the pre-reform period to

FIGURE 3. Predicted enrollment rates by minority status pre-reform and post-reform and difference-in-difference estimates.



Note: Panel A shows predicted enrollment rates by minority status pre-reform and post-reform based on Table 3, Model 6. Differences and difference-in-difference estimates are above the horizontal bracket. The vertical lines represent 95% confidence intervals. Panel B shows difference-in-difference estimates for different specifications based on Model 6 in Table 3 above and Model 6 in Tables A.6, A.7, A.8, A.9, and A.10 in the supplemental materials. The horizontal lines represent 95% confidence intervals. All estimates are based on standard errors clustered at the high school level. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

4.5 percentage points in the post-reform period, the difference is still significant, indicating that the reform did not completely eliminate differential treatment.

Figure 3, Panel B summarizes several alternative difference-in-difference specifications that support the expected mechanisms linking the increase in the pay per student to the reduction in differential treatment. The first estimate corresponds directly to the estimate from Table 3, Model 6 for comparison. A potential concern relates to whether the reduction in differential treatment is actually caused by differences in perceived cost or other mechanic changes in enrollment caused by the reform. One way to test this is to conduct a placebo test and calculate the difference-in-difference estimate based on an observable characteristic which might not be perceived as costly by the provider. The gender of the applicants constitutes such a characteristic. Thus, if it is the costly assessment of minority status that drives the results, I would expect the difference-in-difference estimate for a non-costly characteristic to be insignificant. Since gender balance is much closer to 50 per cent (approximately 60 per cent are females), the coefficient based on gender can be estimated with higher precision than the coefficient based on minority status (only 10 per cent of the applicants are non-Western). Still the

difference-in-difference estimate (the second estimate in Panel B) in the placebo test is insignificant and zero in practical terms. The reported estimate is based on the same specification as Model 6 in Table 3; however, the estimate is very stable across specifications (see Table A.6 in the supplemental materials).

Another observable implication of the proposed theoretical model is that I would expect the level of demand for the specific provider to affect their response to the reform (as shown in Figure 1, Panel A). Thus, I would only expect the difference in enrollment rate to change for providers with a surplus of demand. One way to test this proposition is by grouping the providers based on whether or not the number of first priority applications exceeded the number of enrolled applicants in the pre-reform period – in other words, whether the individual high school initially had to refer some applicants to other high schools or whether they received some students who had prioritized other schools as their first priority. The third and fourth difference-in-difference estimate in Figure 3, Panel B shows the difference-in-difference estimate for providers of initially undersubscribed and oversubscribed high schools in the pre-reform period, respectively. The results show that virtually all of the reduction in differential treatment can be attributed to the providers with an excess of demand with an estimated reduction of almost 10 percentage points. Contrary to this, the difference-in-difference estimate is insignificant for the providers with an excess of supply and close to zero (see Table A.7 and A.8 in the supplemental materials for the full models). This indicates that the reduction is, indeed, driven by increased intake in schools that previously experienced an excess of demand.[10]

A further observable implication is that I would expect the largest reduction in discriminatory intake among the providers that experienced the largest surplus of demand before the reform. The last two difference-in-difference estimates in Figure 3, Panel B shows the effects among the surplus schools that experienced above and below the median level of over-subscription in the pre-reform period (see also Tables A.9 and A.10 in the supplemental materials). The difference-in-difference estimate is 11 percentage points among the schools with the largest surplus and only 7 percentage points among the

[10]Interestingly the difference between non-Western and Western applicants' non-enrollment rate in the post-reform period is reduced to approximately 2-3 percentage points among the providers with excess of demand but closer to 6-7 percentage points among the providers with excess of surplus. While these numbers are estimated relatively inaccurately, they indicate that the remaining differential treatment in the post-reform period can be attributed to the providers who previously had an excess of supply. See Tables A.7 and A.8 in the supplemental materials.

TABLE 4. High school completion for enrolled students

	(1)	(2)	(3)	(4)
Non-Western student	-0.104***			-0.028*
	(0.015)			(0.014)
Female student		0.030***		0.019***
		(0.005)		(0.005)
GPA standardized within the cohort			0.152***	0.149***
			(0.004)	(0.004)
GPA missing			-0.046*	-0.047*
			(0.020)	(0.020)
Constant	0.808***	0.782***	0.698***	0.690***
	(0.009)	(0.009)	(0.010)	(0.009)
Adjusted r^2	0.00	0.00	0.07	0.07
Observations	49,805	49,805	49,805	49,805

Note: Coefficients from linear probability model (OLS). Standard errors clustered at high school level in parentheses. All reported variables are indicator variables except for the standardized GPA. The completion rate is measured for all students enrolled in the pre-reform yeasr 2007 and 2008. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

low surplus schools. Further, in the pre-reform period non-Western applicants are 13 percentage points less likely to be enrolled in their preferred schools among the schools with the largest surplus compared to 9 percentage points among the schools with the smaller surplus (see Tables A.9 and A.10) in the supplemental materials.[11]

Finally, while the differential treatment of minority applicants have detrimental effects for the individual and break with the principles of impartiality, it is interesting to examine whether the perceived costs are actually observable by the providers. One way to examine this is to analyze whether different groups of applicants have different probabilities of finishing high school. More specifically, I can examine this by regressing completion rates[12] on observable characteristics. Table 4 shows

[11]Another way to test this is by looking at the effects for the surplus schools that gained most additional seats by the reform. However, this analysis might be affected by post-treatment bias since the decision to increase the number of seats was taken after the reform. Still Tables A.11 and A.12 in the supplemental materials show the effects among the surplus schools that gained above and below the median number of seats in the first year after the reform.

[12]Completion is defined as graduating from high school of enrollment three years after enrollment. Dropping out, not graduating on time, or graduating from another high school counts as non-completion. The analysis is

that non-Western students have 11 percentage points lower completion rates. Similarly, females have 2 percentage points higher completion rates than males. However, the most important predictor of completion rate is GPA from middle school, which directly measures academic abilities (and explains 7 per cent of the variation in the completion rate). Interestingly, when I include all characteristics in one model, non-Western students only have 3 percentage points lower completion rates than Western students which is quite close to the difference between male and female students indicating that most of the difference in completion rates is explained by differences in GPA. The fact that the reform did increase the enrollment of non-Western applicants in their preferred high school (main analysis above) but not the enrollment of male applicants (the placebo test) indicates the differential treatment might reflect more than an assessment of the applicants' propensity to complete high school.[13]

DISCUSSION OF POLITICAL SOLUTIONS AND DISCRIMINATION

The findings above indicate that discrimination happens in predictable ways and that adjusting the pay-per-user can reduce discriminatory behavior. These findings have several interesting implications. First, the findings show promise in relation to how discrimination can be reduced. Importantly, the reform did not increase the average cost per high school student; it merely changed the funding so that an increased share of the funding was based on the pay-per-user (because of the introduction of the building taximeter) and less funding was fixed (as a result of the free use of the buildings). Thus, the reform only muddled around with the money that was already in the system. However, the results also show that increasing the pay-per-user might not be a perfect political solution to discrimination. First, when you consider the intake of minority applicants across high schools throughout the studied period, the share is relatively constant indicating that increased pay per student might not increase the providers' willingness to enroll minority students but only increases the overall intake. Thus, though the outcome might have improved for minority applicants, the providers might discriminate to the same extent as before. In addition, the results show that the reform reduced discrimination but did not

restricted to students enrolled in 2007 and 2008 (the years before the reform).

[13] Another possible mechanism could be through differential use of academic tests before making the enrollment decision after the reform. However, the data needed to examine this was not available.

eliminate it. This makes it relevant to consider other possible solutions to discriminatory behavior.

One alternative mean to reduce discrimination could be to increase the pay-per-user for specific groups of applicants (e.g. with minority backgrounds). However, this could easily cause new problems with stigma associated with belonging to a specific group of citizens. Also, it could foster new types of strategic behavior such as selection within the group of applicants that would imply additional pay-per-user (e.g. the preferred group of minority applicants or those with the best academic track records). Another related alternative would be to use quotas and thereby force the providers to enroll a certain proportion of minority applicants. However, that could cause the same types of strategic behavior as described above since oversubscribed high schools would still have to refer some (minority) students to other providers.

Another widespread funding model is fixed funding that is unrelated to the number of users. However, this could arguably even increase discrimination since it would give the providers an incentive to avoid all applicants they would perceive as costly. These considerations could indicate that a funding system with increased dependence on pay-per-user could indeed be the best possible political solution. However, there are at least two other alternatives that are worth considering as well. One alternative would be to let an independent agency determine which applicants should be enrolled in which schools. In fact, that was supposed to be the point of the allocation committees in the system under investigation. However, this case also stresses that the agency needs to have actual power to decide on the distribution of applicants to be effective. Another possibility might be to setup clear and unbendable criteria for the distribution of applications. Both responses would reduce discretion at the high school level, which could be a more viable solution. However, setting up these rules and simultaneously keeping some extent of choice for the applications is difficult. If authorities, for instance, sort applicants based on grades, they might end up with highly segregated schools in terms of academic abilities. Another possibility is to use travel distance but that will de facto remove the possibility of free choice. The discussion shows the importance of carefully considering the consequences of different modes for the provision of service for discriminatory behavior, but it ultimately remains a political question as to how to balance these concerns.

Further, though it is not the purpose of the analysis above to determine the type of discrimination

at play, the analysis shed some light on possible explanations. Even though it is possible for some unobserved confounder to explain the differential enrollment of non-Western applicants, the fact that this difference remains substantial using high school fixed effects and middle school fixed effects, with controls for gender, GPA, grade of application (9^{th} or 10^{th} grade), and parental educational background suggests that this difference can indeed be attributed to minority status. The fact that minority students are less likely to graduate on average in the pre-treatment period (as shown in Table 4) could indicate that the differential treatment of non-Western applicants constitute a case of statistical discrimination. However, the placebo-test with female applicants shows they are less likely to get enrolled in their preferred high school both in the pre-reform and the post-reform period (see Table A.6 in the supplemental materials) even though they are more likely to graduate; this fact indicates that there is something else apart from pure rational motives at stake. Another possible explanation within the rational explanatory framework relates to the almost constant share of non-Western students across the studied period which could indicate that the providers are concerned about getting too large a proportion of non-Western students and therefore consciously seek to control the share throughout the studied period. If the differential enrollment was purely based on tast, why the economic incentives should affect the enrollment pattern is less straightforward. The pattern we see, however, could also be consistent with implicit biases that simply become less dominant when the number of available seats increases. However, more research focusing on the different explanations is needed to answer this question with larger certainty.

CONCLUSION

While the reasons to look for political solutions to discriminatory behavior are abundant, little research empirically examines how to do so. This study argues that the pay-per-user funding that is widely used might be both a potential source for discrimination and a possible solution. If minority users are perceived as more costly than majority users, simply increasing the pay-per-user as well as supply side flexibility might prove to be easy tools that reduce discrimination by public authorities.

The analysis in the current study relies on rich data, but as discussed in the methodology section, the conclusions are only valid under two important assumptions. The first one relates to whether I

observe all relevant empirical differences between Western and non-Western applicants. While this seems plausible, even if the estimate of differential treatment is biased, I can validly estimate the effect of the reform because of the difference-in-difference design as long as this potential bias is constant in the studied time period. Furthermore, in relation to the latter, various validity checks including a placebo test and test for differences in application patterns' support that the common trend assumption is valid in the current setup though it is not possible to examine pre-reform trends.

Obviously, equal treatment and allowing all applicants to enroll in their preferred high school are not the only goals to achieve in public service delivery. The introduction of funding based on the number of users also introduces incentives to unintended behavior by the providers such as focusing on quantity rather than quality in the educational production. We would only expect the incentives for such behavior to increase with increased reliance on pay-per-user funding, and these potential adverse effects, which might be substantial, should, of course, be kept in mind. In addition, it might, for example, also be important to ensure a geographical spread and a diverse composition of users across providers. Balancing these considerations also ultimately remains a political question.

Whether the political solution to discrimination will be feasible in other settings is of course an empirical question. Importantly, the study covers the full population of applicants for a public high school in the studied period, and the conclusions, therefore, seem safe within this context. Even though the proposed theoretical model is based on few assumptions, the question of whether we will see similar patterns in other settings where pay-per-user funding is applied and minority users are perceived as more costly to serve remains to be answered by future research. The examined mode of funding has been used across various areas of service (schools, high schools, colleges, hospitals, and elder care to name a few). Therefore, the number of settings in which this question can be examined is high. Importantly, while many different services are provided based on such funding schemes, it is rarely (if ever) the case for important services, such as the police, and obviously not in areas of society where the solutions are completely based on the market. Also, an important extension of the proposed model would be to include determinants of demand for specific providers in a choice and competition system, since the impact of changing the incentives differs markedly under excess of supply rather than excess of demand. Further, the reform did not completely root out the differential intake rate, suggesting that

other measures might be needed. This calls for future studies seeking to replicate whether similar effects can be found in other countries and service areas; it also calls for future studies looking into other policy instruments that might root out discriminatory behavior where other funding systems are applied. The present study supports the idea of looking for ways to root out discriminatory behavior rather than the biases that cause the behavior (Spencer et al. 2016). Thus, the task is to look for potentially sustainable ways of avoiding discriminatory behavior rather than remove its roots.

ON HUMAN SUBJECTS

The author affirms this research did not involve human subjects.

ON ETHICS & CONFLICT OF INTEREST

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ON DATA TRANSPARENCY

Research documentation that support the findings of this study are openly available in the APSR Dataverse at https://doi.org/10.7910/DVN/TNQ7EI. Limitations on data availability are discussed in the supplemental materials.

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SUPPLEMENTAL MATERIALS FOR POLITICAL SOLUTIONS TO DISCRIMINATORY BEHAVIOR

Thorbjørn Sejr Guul

May 12, 2022

ON DATA TRANSPARENCY

The analyses of this paper are based on administrative registers maintained by Statistics Denmark. Analysis of these data can only be conducted on servers hosted by Statistics Denmark. Statistics Denmark guidelines as well as current legislation entail that these data cannot be made publicly available. The author of the paper will ensure that the analysis data sets as well as any programs needed to replicate the results of this paper are archived for at least five years following the date of publication. In the interest of scientific validation and replication of the analyses of this paper, the Department of Economics and Business Eco-nomics, Aarhus University, will assist researchers who are interested in validating the re-sults of the paper. Statistics Denmark must approve any researcher who is to have access to the data and data access can be obtained from Aarhus only. Replication requests should be directed to the ECONAU data management team at datamanager@econ.au.dk.

The analyses of this paper have specifically been conducted on the NCRR8 server, project number 707810. All calculations were carried out with the software Stata MP version 16.1. Once access is granted to the data in project 707810, the Stata do-file "replication dofile - Political Solutions to Discriminatory Behavior.do" – which is available in the APSR Dataverse at https://doi.org/10.7910/DVN/TNQ7EI – will load all relevant data sets and run all procedures necessary to reproduce all results presented in the paper as well as in the supplemental materials.

ADDITIONAL DESCRIPTIVES AND RESULTS

TABLE A.1. Sample Selection

	Number of Applicants
All 1st priority public high school applications 2009–2012	116,108
Missing middle school ID	-670
Missing background information	-62
Analysis sample	115,376

TABLE A.2. Not enrolled in 1st priority high school, non-Western applicant and reform. Logistic regression.

	(1)	(2)	(3)	(4)
Non-western appl.	1.021***	0.563***	0.876***	0.734***
	(0.125)	(0.125)	(0.082)	(0.061)
Reform	-0.252**	-0.287***	-0.262**	-0.245***
	(0.081)	(0.084)	(0.084)	(0.029)
Non-Western appl. X reform	-0.193*	-0.189*	-0.157†	-0.166*
	(0.084)	(0.083)	(0.085)	(0.067)
Female appl.		0.151***		
		(0.029)		
GPA std. within cohort		-0.679***		
		(0.041)		
GPA missing		0.457**		
		(0.150)		
10th grade appl.		-0.544***		
		(0.060)		
Maternal education				
-Below academy level (m)		ref.		
-Academy level (m)		-0.089***		
		(0.021)		
-BA level (m)		-0.002		
		(0.028)		
-MA or PhD level (m)		0.159***		
		(0.030)		
-Missing (m)		0.172***		
		(0.041)		
Paternal education				
-Below academy level (p)		ref.		
-Academy level (p)		-0.107***		
		(0.028)		
-BA level (p)		0.039		
		(0.033)		
-MA or PhD level (p)		0.046		
		(0.039)		
-Missing (p)		0.133***		
		(0.034)		
Constant	-1.564***	-1.048***		
	(0.093)	(0.085)		
High School FE	No	No	Yes	No
Middle School FE	No	No	No	Yes
Observations	115,376	115,376	115,376	114,403

Note: Coefficients from logistic regression (model 1 and 2) and conditional logistic regression (model 3 and 4). Standard errors clustered at high school level (model 1-3) and middle school level (model 4). All reported variables are indicator variables except standardized GPA. (m) and (p) are short for maternal and paternal respectively. For technical computational reasons the outcome was reversed in the calculations. 973 observations are dropped in model 4 because of all positive or all negative outcomes within middle school. $^{\dagger}\ p < 0.1$, $^{*}\ p < 0.05$, $^{**}\ p < 0.01$, $^{***}\ p < 0.001$.

TABLE A.3. Enrolled in 1st priority high school, non-Western applicant and reform. Full model results.

	(1)	(2)	(3)	(4)	(5)	(6)
Non-western appl.	-0.194***	-0.129***	-0.162***	-0.101***	-0.142***	-0.093***
	(0.030)	(0.028)	(0.020)	(0.019)	(0.019)	(0.018)
Reform	0.033**	0.036**	0.033**	0.036**	0.032**	0.036**
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Non-Western appl. X reform	0.063**	0.060**	0.054**	0.052**	0.049*	0.047*
	(0.021)	(0.020)	(0.020)	(0.019)	(0.019)	(0.019)
Female appl.		-0.020***		-0.018***		-0.017***
		(0.004)		(0.004)		(0.004)
GPA std. within cohort		0.089***		0.094***		0.094***
		(0.004)		(0.004)		(0.004)
GPA missing		-0.073*		-0.078**		-0.097***
		(0.029)		(0.027)		(0.026)
10th grade appl.		0.066***		0.069***		0.071***
		(0.005)		(0.004)		(0.004)
Maternal education						
-Below academy level (m)		ref.		ref.		ref.
-Academy level (m)		0.013***		0.007*		0.008**
		(0.003)		(0.003)		(0.003)
-BA level (m)		0.001		0.002		0.001
		(0.004)		(0.003)		(0.003)
-MA or PhD level (m)		-0.020***		0.001		-0.003
		(0.004)		(0.005)		(0.004)
-Missing (m)		-0.026***		-0.021**		-0.018**
		(0.007)		(0.006)		(0.006)
Paternal education						
-Below academy level (p)		ref.		ref.		ref.
-Academy level (p)		0.014***		0.005		0.006†
		(0.004)		(0.004)		(0.003)
-BA level (p)		-0.005		0.001		0.000
		(0.004)		(0.004)		(0.004)
-MA or PhD level (p)		-0.006		0.007†		0.004
		(0.005)		(0.004)		(0.004)
-Missing (p)		-0.021***		-0.017**		-0.015**
		(0.005)		(0.005)		(0.005)
Constant	0.827***	0.752***	0.825***	0.744***	0.930***	0.866***
	(0.013)	(0.013)	(0.009)	(0.010)	(0.060)	(0.060)
High school FE	No	No	Yes	Yes	Yes	Yes
Middle school FE	No	No	No	No	Yes	Yes
Adjusted r^2	0.02	0.05	0.01	0.05	0.03	0.06
Observations	115,376	115,376	115,376	115,376	115,376	115,376

Note: Coefficients from linear probability models (OLS). Standard errors clustered at high school level in parentheses. All reported variables are indicator variables except standardized GPA. (m) and (p) are short for maternal and paternal respectively. $^{\dagger}\ p < 0.1, {}^{*}\ p < 0.05, {}^{**}\ p < 0.01, {}^{***}\ p < 0.001$.

TABLE A.4. Enrolled in 1st priority high school, non-Western applicant and reform. P-values based on clustering standard errors at different levels. Part A.

	(1)	(2)	(3)	(4)	(5)	(6)
Non-Western appl.	-0.194	-0.129	-0.162	-0.101	-0.142	-0.093
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
	[<0.001]	[<0.001]	[<0.001]	[<0.001]	[<0.001]	[<0.001]
	{<0.001}	{0.002}	{<0.001}	{0.001}	{<0.001}	{0.002}
Reform	0.033	0.036	0.033	0.036	0.032	0.036
	(0.004)	(0.002)	(0.004)	(0.001)	(0.004)	(0.001)
	[<0.001]	[<0.001]	[<0.001]	[<0.001]	[<0.001]	[<0.001]
	{0.007}	{0.002}	{0.007}	{0.002}	{0.007}	{0.002}
Non-Western appl. x reform	0.063	0.060	0.054	0.052	0.049	0.047
	(0.004)	(0.004)	(0.008)	(0.007)	(0.013)	(0.012)
	[<0.001]	[<0.001]	[<0.001]	[<0.001]	[<0.001]	[<0.001]
	{0.029}	{0.023}	{0.039}	{0.031}	{0.070}	{0.060}
Female appl.		-0.020		-0.018		-0.017
		(<0.001)		(<0.001)		(<0.001)
		[<0.001]		[<0.001]		[<0.001]
		{0.008}		{0.004}		{0.003}
GPA std. within cohort		0.089		0.094		0.094
		(<0.001)		(<0.001)		(<0.001)
		[<0.001]		[<0.001]		[<0.001]
		{<0.001}		{<0.001}		{<0.001}
GPA missing		-0.073		-0.078		-0.097
		(0.014)		(0.004)		(<0.001)
		[0.001]		[<0.001]		[<0.001]
		{0.029}		{0.015}		{0.003}
10th grade appl.		0.066		0.069		0.071
		(<0.001)		(<0.001)		(<0.001)
		[<0.001]		[<0.001]		[<0.001]
		{<0.001}		{<0.001}		{<0.001}
High school FE	No	No	Yes	Yes	Yes	Yes
Middle school FE	No	No	No	No	Yes	Yes
Observations	115,376	115,376	115,376	115,376	115,376	115,376

Note: Continues on next page.

TABLE A.4. Enrolled in 1st priority high school, non-Western applicant and reform. P-values based on clustering standard errors at different levels. Part B.

	(1)	(2)	(3)	(4)	(5)	(6)
Maternal education						
-Below academy level (m)		ref.		ref.		ref.
-Academy level (m)		0.013		0.007		0.008
		(<0.001)		(0.023)		(0.009)
		[<0.001]		[0.021]		[0.013]
		{<0.001}		{0.091}		{0.061}
-BA level (m)		0.001		0.002		0.001
		(0.867)		(0.504)		(0.727)
		[0.855]		[0.523]		[0.734]
		{0.836}		{0.306}		{0.648}
-MA or PhD level (m)		-0.020		0.001		-0.003
		(<0.001)		(0.812)		(0.525)
		[<0.001]		[0.791]		[0.522]
		{<0.001}		{0.832}		{0.522}
-Missing (m)		-0.026		-0.021		-0.018
		(<0.001)		(0.001)		(0.003)
		[<0.001]		[0.004]		[0.009]
		{0.001}		{0.011}		{0.024}
Paternal education						
-Below academy level (p)		ref.		ref.		ref.
-Academy level (p)		0.014		0.005		0.006
		(<0.001)		(0.145)		(0.092)
		[<0.001]		[0.093]		[0.057]
		{<0.001}		{0.154}		{0.061}
-BA level (p)		-0.005		0.001		0.000
		(0.253)		(0.810)		(0.912)
		[0.210]		[0.800]		[0.909]
		{0.278}		{0.816}		{0.908}
-MA or PhD level (p)		-0.006		0.007		0.004
		(0.213)		(0.094)		(0.335)
		[0.141]		[0.098]		[0.348]
		{0.160}		{0.084}		{0.309}
-Missing (p)		-0.021		-0.017		-0.015
		(<0.001)		(0.001)		(0.003)
		[<0.001]		[<0.001]		[0.001]
		{<0.001}		{0.001}		{0.001}
High school FE	No	No	Yes	Yes	Yes	Yes
Middle school FE	No	No	No	No	Yes	Yes
Observations	115,376	115,376	115,376	115,376	115,376	115,376

Note: Coefficients from linear probability models (OLS). P-values based on standard errors clustered at high school level in (parentheses). P-values based on standard errors clustered at middle school level in [brackets]. P-values based on standard errors clustered at allocation committee level in {braces}. All reported variables are indicator variables. Covariates included are standardized GPA and GPA missing indicator, indicators for parental education as well as indicators for female applicant and grade of application (9th or 10th grade).

TABLE A.5. Applying for oversubscribed high schools.

	(1)	(2)
Non-western appl.	-0.032	-0.006
	(0.057)	(0.052)
Reform	-0.018**	-0.016*
	(0.007)	(0.007)
Non-Western appl. X reform	0.001	0.000
	(0.018)	(0.018)
Female appl.		-0.002
		(0.009)
GPA std. within cohort		0.031**
		(0.010)
GPA missing		-0.022
		(0.054)
10^{th} grade appl.		0.012
		(0.024)
Maternal education		
-Below academy level (m)		ref.
-Academy level (m)		-0.019*
		(0.009)
-BA level (m)		-0.002
		(0.011)
-MA or PhD level (m)		0.067**
		(0.022)
-Missing (m)		0.020†
		(0.010)
Paternal education		
-Below academy level (p)		ref.
-Academy level (p)		-0.031**
		(0.011)
-BA level (p)		0.029*
		(0.012)
-MA or PhD level (p)		0.047*
		(0.023)
-Missing (p)		0.008
		(0.010)
Constant	0.452***	0.424***
	(0.051)	(0.054)
Adjusted r^2	0.00	0.01
Observations	115,376	115,376

Note: Coefficients from linear probability models (OLS). Standard errors clustered at high school level in parentheses. All reported variables are indicator variables except standardized GPA. (m) and (p) are short for maternal and paternal respectively. $^{\dagger}\ p < 0.1, {}^{*}\ p < 0.05, {}^{**}\ p < 0.01, {}^{***}\ p < 0.001.$

TABLE A.6. Enrolled in 1st priority high school, placebo test using female applicant and reform as main variables.

	(1)	(2)	(3)	(4)	(5)	(6)
Female appl.	-0.009	-0.022**	-0.010	-0.021**	-0.008	-0.018**
	(0.007)	(0.007)	(0.006)	(0.007)	(0.006)	(0.006)
Reform	0.037**	0.040**	0.035**	0.039**	0.035**	0.039**
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Female appl. X reform	0.002	0.002	0.003	0.003	0.001	0.002
	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Non-western appl.		-0.082***		-0.060***		-0.056***
		(0.016)		(0.009)		(0.008)
GPA std. within cohort		0.089***		0.094***		0.094***
		(0.004)		(0.004)		(0.004)
GPA missing		-0.073*		-0.077**		-0.096***
		(0.029)		(0.027)		(0.026)
10th grade appl.		0.066***		0.068***		0.070***
		(0.005)		(0.004)		(0.004)
Maternal education						
-Below academy level (m)		ref.		ref.		ref.
-Academy level (m)		0.013***		0.007*		0.008*
		(0.003)		(0.003)		(0.003)
-BA level (m)		0.001		0.002		0.001
		(0.004)		(0.003)		(0.003)
-MA or PhD level (m)		-0.020***		0.001		-0.003
		(0.004)		(0.005)		(0.004)
-Missing (m)		-0.027***		-0.021***		-0.019**
		(0.007)		(0.006)		(0.006)
Paternal education						
-Below academy level (p)		ref.		ref.		ref.
-Academy level (p)		0.014***		0.005		0.006†
		(0.004)		(0.004)		(0.003)
-BA level (p)		-0.005		0.001		0.000
		(0.004)		(0.004)		(0.004)
-MA or PhD level (p)		-0.006		0.007†		0.004
		(0.005)		(0.004)		(0.004)
-Missing (p)		-0.021***		-0.017**		-0.016**
		(0.005)		(0.005)		(0.005)
Constant	0.816***	0.749***	0.817***	0.742***	0.924***	0.864***
	(0.014)	(0.014)	(0.011)	(0.012)	(0.059)	(0.060)
High school FE	No	No	Yes	Yes	Yes	Yes
Middle school FE	No	No	No	No	Yes	Yes
Adjusted r^2	0.00	0.05	0.00	0.05	0.03	0.06
Observations	115,376	115,376	115,376	115,376	115,376	115,376

Note: Coefficients from linear probability model (OLS). Standard errors clustered at high school level in parentheses. All reported variables are indicator variables except standardized GPA. (m) and (p) are short for maternal and paternal respectively. $^{\dagger}\ p < 0.1, {}^{*}\ p < 0.05, {}^{**}\ p < 0.01, {}^{***}\ p < 0.001$.

TABLE A.7. Enrolled in 1st priority high school, non-Western applicant and reform. Surplus of demand.

	(1)	(2)	(3)	(4)	(5)	(6)
Non-western appl.	-0.224***	-0.164***	-0.191***	-0.133***	-0.166***	-0.119***
	(0.042)	(0.038)	(0.028)	(0.027)	(0.028)	(0.027)
Reform	0.065**	0.068**	0.066**	0.070**	0.065**	0.069**
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
Non-Western appl. X reform	0.112***	0.112***	0.102***	0.102***	0.097***	0.097***
	(0.027)	(0.027)	(0.026)	(0.027)	(0.027)	(0.027)
Female appl.		-0.037***		-0.033***		-0.027***
		(0.008)		(0.007)		(0.007)
GPA std. within cohort		0.099***		0.103***		0.105***
		(0.007)		(0.007)		(0.007)
GPA missing		-0.076		-0.082		-0.092†
		(0.060)		(0.055)		(0.049)
10th grade appl.		0.066***		0.063***		0.069***
		(0.011)		(0.006)		(0.007)
Maternal education						
-Below academy level (m)		ref.		ref.		ref.
-Academy level (m)		0.009		0.002		0.005
		(0.006)		(0.006)		(0.006)
-BA level (m)		-0.005		-0.001		-0.002
		(0.007)		(0.006)		(0.006)
-MA or PhD level (m)		-0.013†		0.007		-0.001
		(0.006)		(0.007)		(0.007)
-Missing (m)		-0.026*		-0.021*		-0.017†
		(0.011)		(0.010)		(0.010)
Paternal education						
-Below academy level (p)		ref.		ref.		ref.
-Academy level (p)		0.007		-0.003		-0.000
		(0.007)		(0.007)		(0.007)
-BA level (p)		-0.003		-0.000		-0.001
		(0.006)		(0.007)		(0.006)
-MA or PhD level (p)		0.008		0.017**		0.012†
		(0.007)		(0.006)		(0.006)
-Missing (p)		-0.037***		-0.031***		-0.030***
		(0.008)		(0.009)		(0.008)
Constant	0.741***	0.669***	0.738***	0.662***	0.828***	0.783***
	(0.024)	(0.023)	(0.018)	(0.021)	(0.095)	(0.088)
High school FE	No	No	Yes	Yes	Yes	Yes
Middle school FE	No	No	No	No	Yes	Yes
Adjusted r^2	0.02	0.05	0.01	0.05	0.05	0.08
Observations	50,207	50,207	50,207	50,207	50,207	50,207

Note: Coefficients from linear probability model (OLS). Standard errors clustered at high school level in parentheses. All reported variables are indicator variables except standardized GPA. (m) and (p) are short for maternal and paternal respectively. $^{\dagger}\ p < 0.1, {}^{*}\ p < 0.05, {}^{**}\ p < 0.01, {}^{***}\ p < 0.001$.

TABLE A.8. Enrolled in 1st priority high school, non-Western applicant and reform. No surplus of demand.

	(1)	(2)	(3)	(4)	(5)	(6)
Non-western appl.	-0.182***	-0.109***	-0.144***	-0.082***	-0.126***	-0.076***
	(0.034)	(0.029)	(0.026)	(0.024)	(0.024)	(0.022)
Reform	0.004	0.007	0.005	0.009	0.004	0.009
	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)
Non-Western appl. X reform	0.032	0.028	0.023	0.020	0.017	0.015
	(0.028)	(0.025)	(0.025)	(0.023)	(0.025)	(0.023)
Female appl.		-0.008*		-0.007*		-0.005
		(0.003)		(0.003)		(0.003)
GPA std. within cohort		0.087***		0.087***		0.086***
		(0.005)		(0.005)		(0.005)
GPA missing		-0.076**		-0.075**		-0.094***
		(0.024)		(0.024)		(0.026)
10th grade appl.		0.069***		0.072***		0.072***
		(0.004)		(0.004)		(0.005)
Maternal education						
-Below academy level (m)		ref.		ref.		ref.
-Academy level (m)		0.013***		0.012**		0.010**
		(0.003)		(0.003)		(0.003)
-BA level (m)		0.005†		0.005†		0.005
		(0.003)		(0.003)		(0.003)
-MA or PhD level (m)		-0.013**		-0.007		-0.008
		(0.005)		(0.005)		(0.005)
-Missing (m)		-0.022**		-0.020*		-0.018*
		(0.008)		(0.008)		(0.007)
Paternal education						
-Below academy level (p)		ref.		ref.		ref.
-Academy level (p)		0.013***		0.011**		0.009*
		(0.004)		(0.004)		(0.004)
-BA level (p)		-0.000		0.002		0.002
		(0.005)		(0.005)		(0.005)
-MA or PhD level (p)		-0.011†		-0.005		-0.005
		(0.006)		(0.005)		(0.005)
-Missing (p)		-0.007		-0.006		-0.004
		(0.005)		(0.005)		(0.005)
Constant	0.898***	0.813***	0.894***	0.808***	0.967***	0.878***
	(0.005)	(0.008)	(0.005)	(0.006)	(0.025)	(0.023)
High school FE	No	No	Yes	Yes	Yes	Yes
Middle school FE	No	No	No	No	Yes	Yes
Adjusted r^2	0.02	0.06	0.01	0.05	0.04	0.07
Observations	65,169	65,169	65,169	65,169	65,169	65,169

Note: Coefficients from linear probability model (OLS). Standard errors clustered at high school level in parentheses. All reported variables are indicator variables except standardized GPA. (m) and (p) are short for maternal and paternal respectively. $^{\dagger}\ p < 0.1, {}^{*}\ p < 0.05, {}^{**}\ p < 0.01, {}^{***}\ p < 0.001$.

TABLE A.9. Enrolled in 1st priority high school, non-Western applicant and reform. Above median surplus of demand.

	(1)	(2)	(3)	(4)	(5)	(6)
Non-western appl.	-0.236***	-0.174***	-0.204***	-0.148***	-0.180***	-0.133***
	(0.044)	(0.037)	(0.031)	(0.030)	(0.030)	(0.028)
Reform	0.087*	0.090*	0.090*	0.094*	0.092*	0.095*
	(0.039)	(0.039)	(0.038)	(0.038)	(0.038)	(0.038)
Non-Western appl. X reform	0.123***	0.121***	0.113***	0.112***	0.109***	0.109***
	(0.025)	(0.026)	(0.027)	(0.028)	(0.026)	(0.028)
Female appl.		-0.048***		-0.042**		-0.034**
		(0.011)		(0.011)		(0.011)
GPA std. within cohort		0.103***		0.108***		0.112***
		(0.011)		(0.011)		(0.011)
GPA missing		-0.168†		-0.161†		-0.174*
		(0.083)		(0.088)		(0.068)
10th grade appl.		0.054**		0.056***		0.064***
		(0.016)		(0.009)		(0.011)
Maternal education						
-Below academy level (m)		ref.		ref.		ref.
-Academy level (m)		0.006		-0.003		0.000
		(0.009)		(0.010)		(0.009)
-BA level (m)		-0.003		0.000		-0.003
		(0.010)		(0.009)		(0.010)
-MA or PhD level (m)		-0.008		0.007		-0.005
		(0.010)		(0.010)		(0.009)
-Missing (m)		-0.026†		-0.021		-0.020
		(0.015)		(0.014)		(0.014)
Paternal education						
-Below academy level (p)		ref.		ref.		ref.
-Academy level (p)		-0.005		-0.012		-0.008
		(0.010)		(0.009)		(0.008)
-BA level (p)		-0.009		-0.008		-0.007
		(0.010)		(0.009)		(0.008)
-MA or PhD level (p)		0.007		0.015†		0.011
		(0.009)		(0.008)		(0.008)
-Missing (p)		-0.041**		-0.038**		-0.039**
		(0.012)		(0.011)		(0.010)
Constant	0.681***	0.624***	0.676***	0.611***	0.697***	0.667***
	(0.036)	(0.035)	(0.029)	(0.034)	(0.130)	(0.119)
High School FE	No	No	Yes	Yes	Yes	Yes
Middle School FE	No	No	No	No	Yes	Yes
Adjusted r^2	0.02	0.05	0.02	0.05	0.07	0.10
Observations	29,083	29,083	29,083	29,083	29,083	29,083

Note: Coefficients from linear probability model (OLS). Standard errors clustered at high school level in parentheses. All reported variables are indicator variables except standardized GPA. (m) and (p) are short for maternal and paternal respectively. $^{\dagger}\ p < 0.1, ^{*}\ p < 0.05, ^{**}\ p < 0.01, ^{***}\ p < 0.001.$

TABLE A.10. Enrolled in 1st priority high school, non-Western applicant and reform. Below median surplus of demand.

	(1)	(2)	(3)	(4)	(5)	(6)
Non-western appl.	-0.145**	-0.087†	-0.147**	-0.086*	-0.132*	-0.087†
	(0.044)	(0.042)	(0.041)	(0.040)	(0.047)	(0.045)
Reform	0.031†	0.035*	0.033*	0.037*	0.029†	0.033*
	(0.016)	(0.016)	(0.015)	(0.015)	(0.015)	(0.015)
Non-Western appl. X reform	0.065	0.069	0.058	0.062	0.063	0.065
	(0.044)	(0.043)	(0.045)	(0.044)	(0.048)	(0.046)
Female appl.		-0.024**		-0.020**		-0.015*
		(0.008)		(0.007)		(0.007)
GPA std. within cohort		0.097***		0.096***		0.095***
		(0.008)		(0.006)		(0.007)
GPA missing		-0.009		-0.008		-0.012
		(0.031)		(0.028)		(0.028)
10th grade appl.		0.071***		0.074***		0.079***
		(0.008)		(0.008)		(0.007)
Maternal education						
-Below academy level (m)		ref.		ref.		ref.
-Academy level (m)		0.012†		0.007		0.009
		(0.007)		(0.005)		(0.005)
-BA level (m)		-0.008		-0.003		-0.001
		(0.007)		(0.006)		(0.007)
-MA or PhD level (m)		-0.015†		0.004		0.001
		(0.008)		(0.011)		(0.011)
-Missing (m)		-0.021		-0.019		-0.011
		(0.013)		(0.013)		(0.016)
Paternal education						
-Below academy level (p)		ref.		ref.		ref.
-Academy level (p)		0.019†		0.010		0.010
		(0.009)		(0.009)		(0.010)
-BA level (p)		0.009		0.010		0.007
		(0.008)		(0.010)		(0.009)
-MA or PhD level (p)		0.013		0.019†		0.012
		(0.009)		(0.010)		(0.010)
-Missing (p)		-0.029*		-0.020		-0.022
		(0.013)		(0.014)		(0.013)
Constant	0.824***	0.737***	0.823***	0.731***	0.999***	0.936***
	(0.012)	(0.018)	(0.012)	(0.020)	(0.103)	(0.099)
High School FE	No	No	Yes	Yes	Yes	Yes
Middle School FE	No	No	No	No	Yes	Yes
Adjusted r^2	0.01	0.04	0.01	0.04	0.05	0.08
Observations	21,124	21,124	21,124	21,124	21,124	21,124

Note: Coefficients from linear probability model (OLS). Standard errors clustered at high school level in parentheses. All reported variables are indicator variables except standardized GPA. (m) and (p) are short for maternal and paternal respectively. $^{\dagger}\ p < 0.1, ^{*}\ p < 0.05, ^{**}\ p < 0.01, ^{***}\ p < 0.001$.

TABLE A.11. Enrolled in 1st priority high school, non-Western applicant and reform. Surplus of demand. Above median gain in seats.

	(1)	(2)	(3)	(4)	(5)	(6)
Non-western appl.	-0.259***	-0.198***	-0.208***	-0.156***	-0.185***	-0.141***
	(0.046)	(0.041)	(0.026)	(0.026)	(0.031)	(0.028)
Reform	0.120*	0.122*	0.120*	0.122*	0.118*	0.120*
	(0.047)	(0.047)	(0.046)	(0.046)	(0.047)	(0.047)
Non-Western appl.X reform	0.113**	0.114**	0.102**	0.104**	0.106**	0.106**
	(0.031)	(0.031)	(0.029)	(0.031)	(0.029)	(0.030)
Female appl.		-0.037**		-0.036*		-0.027*
		(0.013)		(0.013)		(0.012)
GPA std. within cohort		0.099***		0.101***		0.102***
		(0.010)		(0.011)		(0.012)
GPA missing		-0.056		-0.056		-0.057
		(0.038)		(0.036)		(0.044)
10th grade appl.		0.077***		0.060***		0.070***
		(0.010)		(0.009)		(0.007)
Maternal education						
-Below academy level (m)		ref.		ref.		ref.
-Academy level (m)		0.009		0.001		0.005
		(0.007)		(0.009)		(0.008)
-BA level (m)		-0.007		-0.008		-0.008
		(0.010)		(0.009)		(0.008)
-MA or PhD level (m)		-0.021*		0.004		-0.006
		(0.009)		(0.011)		(0.010)
-Missing (m)		-0.008		-0.003		-0.004
		(0.016)		(0.014)		(0.016)
Paternal education						
-Below academy level (p)		ref.		ref.		ref.
-Academy level (p)		0.001		-0.015		-0.012
		(0.010)		(0.009)		(0.009)
-BA level (p)		-0.007		-0.007		-0.005
		(0.008)		(0.006)		(0.006)
-MA or PhD level (p)		0.003		0.015†		0.011
		(0.012)		(0.009)		(0.009)
-Missing (p)		-0.048***		-0.045***		-0.044**
		(0.010)		(0.011)		(0.013)
Constant	0.699***	0.632***	0.695***	0.637***	0.779***	0.750***
	(0.044)	(0.044)	(0.036)	(0.042)	(0.120)	(0.113)
High School FE	No	No	Yes	Yes	Yes	Yes
Middle School FE	No	No	No	No	Yes	Yes
Adjusted r^2	0.03	0.06	0.03	0.06	0.07	0.10
Observations	24,049	24,049	24,049	24,049	24,049	24,049

Note: Coefficients from linear probability model (OLS). Standard errors clustered at high school level in parentheses. All reported variables are indicator variables except standardized GPA. (m) and (p) are short for maternal and paternal respectively. $^{\dagger}\ p < 0.1, {}^{*}\ p < 0.05, {}^{**}\ p < 0.01, {}^{***}\ p < 0.001$.

TABLE A.12. Enrolled in 1st priority high school, non-Western applicant and reform. Surplus of demand. Below median gain in seats.

	(1)	(2)	(3)	(4)	(5)	(6)
Non-western appl.	-0.143***	-0.086*	-0.142**	-0.080†	-0.127**	-0.080†
	(0.036)	(0.037)	(0.040)	(0.040)	(0.038)	(0.039)
Reform	0.018	0.022	0.020	0.025†	0.019	0.024†
	(0.014)	(0.014)	(0.013)	(0.013)	(0.013)	(0.013)
Non-Western appl. X reform	0.077*	0.075*	0.070†	0.067†	0.070	0.069
	(0.035)	(0.035)	(0.037)	(0.037)	(0.041)	(0.042)
Female appl.		-0.037***		-0.031***		-0.026**
		(0.009)		(0.007)		(0.007)
GPA std. within cohort		0.099***		0.105***		0.106***
		(0.010)		(0.008)		(0.009)
GPA missing		-0.084		-0.092		-0.093
		(0.087)		(0.079)		(0.067)
10th grade appl.		0.054**		0.065***		0.073***
		(0.019)		(0.009)		(0.012)
Maternal education						
-Below academy level (m)		ref.		ref.		ref.
-Academy level (m)		0.009		0.003		0.009
		(0.009)		(0.008)		(0.008)
-BA level (m)		-0.003		0.006		0.004
		(0.009)		(0.008)		(0.008)
-MA or PhD level (m)		-0.006		0.010		0.007
		(0.009)		(0.010)		(0.010)
-Missing (m)		-0.044**		-0.038*		-0.028†
		(0.013)		(0.013)		(0.014)
Paternal education						
-Below academy level (p)		ref.		ref.		ref.
-Academy level (p)		0.012		0.008		0.009
		(0.009)		(0.008)		(0.008)
-BA level (p)		0.001		0.006		0.002
		(0.010)		(0.011)		(0.010)
-MA or PhD level (p)		0.013		0.020*		0.013
		(0.009)		(0.009)		(0.010)
-Missing (p)		-0.026†		-0.018		-0.017
		(0.013)		(0.013)		(0.010)
Constant	0.776***	0.702***	0.774***	0.683***	0.865***	0.801***
	(0.020)	(0.020)	(0.010)	(0.019)	(0.154)	(0.142)
High School FE	No	No	Yes	Yes	Yes	Yes
Middle School FE	No	No	No	No	Yes	Yes
Adjusted r^2	0.00	0.03	0.00	0.04	0.06	0.09
Observations	26,158	26,158	26,158	26,158	26,158	26,158

Note: Coefficients from linear probability model (OLS). Standard errors clustered at high school level in parentheses. All reported variables are indicator variables except standardized GPA. (m) and (p) are short for maternal and paternal respectively. $^{\dagger}\ p < 0.1, ^{*}\ p < 0.05, ^{**}\ p < 0.01, ^{***}\ p < 0.001$.

TABLE A.13. Enrolled in 1st priority high school, non-Western applicant and reform. Robustness to changes in the study period.

	(1) 2009-2014	(2) 2009-2013	(3) 2009-2012	(4) 2009-2011	(5) 2009-2010
Non-western appl.	-0.097***	-0.095***	-0.093***	-0.091***	-0.081***
	(0.020)	(0.020)	(0.018)	(0.018)	(0.018)
Reform	0.038***	0.038***	0.036**	0.033**	0.026*
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Non-Western appl. X reform	0.055**	0.051*	0.047*	0.048*	0.049*
	(0.020)	(0.020)	(0.019)	(0.020)	(0.023)
Female appl.	-0.019***	-0.017***	-0.017***	-0.013**	-0.011*
	(0.003)	(0.003)	(0.004)	(0.004)	(0.005)
GPA std. within cohort	0.088***	0.091***	0.094***	0.095***	0.105***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.006)
GPA missing	-0.097***	-0.104***	-0.097***	-0.101**	-0.112***
	(0.024)	(0.026)	(0.026)	(0.031)	(0.033)
10th grade appl.	0.072***	0.071***	0.071***	0.068***	0.071***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.006)
Maternal education					
-Below academy level (m)	ref.	ref.	ref.	ref.	ref.
-Academy level (m)	0.005†	0.006*	0.008**	0.008*	0.008*
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
-BA level (m)	0.001	0.001	0.001	0.002	0.005
	(0.003)	(0.003)	(0.003)	(0.004)	(0.005)
-MA or PhD level (m)	-0.003	-0.001	-0.003	-0.003	-0.004
	(0.004)	(0.004)	(0.004)	(0.005)	(0.007)
-Missing (m)	-0.016**	-0.018**	-0.018**	-0.019**	-0.018†
	(0.005)	(0.006)	(0.006)	(0.007)	(0.010)
Paternal education					
-Below academy level (p)	ref.	ref.	ref.	ref.	ref.
-Academy level (p)	0.006*	0.007*	0.006†	0.005	0.007
	(0.003)	(0.003)	(0.003)	(0.004)	(0.005)
-BA level (p)	0.000	0.001	0.000	0.002	0.005
	(0.003)	(0.003)	(0.004)	(0.004)	(0.006)
-MA or PhD level (p)	-0.002	0.002	0.004	0.003	0.007
	(0.004)	(0.003)	(0.004)	(0.005)	(0.006)
-Missing (p)	-0.015***	-0.012**	-0.015**	-0.018**	-0.013†
	(0.004)	(0.004)	(0.005)	(0.006)	(0.007)
Constant	0.898***	0.872***	0.866***	0.900***	0.863***
	(0.046)	(0.046)	(0.060)	(0.065)	(0.080)
High School FE	Yes	Yes	Yes	Yes	Yes
Middle School FE	Yes	Yes	Yes	Yes	Yes
Adjusted r^2	0.06	0.06	0.06	0.07	0.07
Observations	176,466	146,589	115,376	85,042	54,892

Note: Coefficients from linear probability model (OLS). Standard errors clustered at high school level in parentheses. All reported variables are indicator variables except standardized GPA. (m) and (p) are short for maternal and paternal respectively. $^{\dagger}\ p < 0.1, {}^{*}\ p < 0.05, {}^{**}\ p < 0.01, {}^{***}\ p < 0.001.$

TABLE A.14. Enrolled in 1st priority high school, non-Danish applicant and reform.

	(1)	(2)	(3)	(4)	(5)	(6)
Non-Danish appl.	-0.184***	-0.122***	-0.153***	-0.095***	-0.132***	-0.085***
	(0.028)	(0.026)	(0.018)	(0.018)	(0.018)	(0.017)
Reform	0.033**	0.036**	0.033**	0.036**	0.032**	0.036**
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Non-Danish appl. X reform	0.057**	0.055**	0.049**	0.048**	0.043*	0.042*
	(0.019)	(0.019)	(0.018)	(0.017)	(0.018)	(0.017)
Female appl.		-0.020***		-0.018***		-0.017***
		(0.004)		(0.004)		(0.004)
GPA std. within cohort		0.089***		0.094***		0.094***
		(0.004)		(0.004)		(0.004)
GPA missing		-0.071*		-0.076**		-0.095***
		(0.029)		(0.026)		(0.026)
10th grade appl.		0.066***		0.069***		0.071***
		(0.005)		(0.004)		(0.004)
Maternal education						
-Below academy level (m)		ref.		ref.		ref.
-Academy level (m)		0.014***		0.008*		0.008**
		(0.003)		(0.003)		(0.003)
-BA level (m)		0.001		0.003		0.002
		(0.004)		(0.003)		(0.003)
-MA or PhD level (m)		-0.019***		0.002		-0.002
		(0.004)		(0.005)		(0.004)
-Missing (m)		-0.024***		-0.019**		-0.017**
		(0.007)		(0.006)		(0.006)
Paternal education						
-Below academy level (p)		ref.		ref.		ref.
-Academy level (p)		0.014***		0.005		0.006†
		(0.004)		(0.004)		(0.003)
-BA level (p)		-0.005		0.001		0.001
		(0.004)		(0.004)		(0.004)
-MA or PhD level (p)		-0.006		0.007†		0.004
		(0.005)		(0.004)		(0.004)
-Missing (p)		-0.018***		-0.015**		-0.014**
		(0.005)		(0.005)		(0.005)
Constant	0.828***	0.751***	0.826***	0.743***	0.933***	0.867***
	(0.013)	(0.013)	(0.009)	(0.010)	(0.060)	(0.060)
High School FE	No	No	Yes	Yes	Yes	Yes
Middle School FE	No	No	No	No	Yes	Yes
Adjusted r^2	0.02	0.05	0.01	0.05	0.03	0.06
Observations	115,376	115,376	115,376	115,376	115,376	115,376

Note: Coefficients from linear probability model (OLS). Standard errors clustered at high school level in parentheses. All reported variables are indicator variables except standardized GPA. (m) and (p) are short for maternal and paternal respectively. $^{\dagger}\ p < 0.1, {}^{*}\ p < 0.05, {}^{**}\ p < 0.01, {}^{***}\ p < 0.001$.

TABLE A.15. Overview of data sets

Data source: National Agency for It and Learning		
Name (English)	Name (Danish)	Variables
Joint application for upper secondary education[1]	Fælles Tilmelding til Ungdomsuddanelserne (FTU)	1st priority high school, middle school ID, 10th grade appl.
Data source: Statistics Denmark Registries		
Name (English)	Name (Danish)	Variables
Middle School Grades[2]	Grundskolekarakterer (UDFK)	GPA
The Population[3]	Befolkningen (BEF)	Female, Non-Western, parental ID
Educations[4]	Uddannelser (UDDA)	Maternal education, Paternal Education
Condensed Student Register[5]	Komprimeret elevregister (KOTRE)	High school enrollment, High school completion

Note: Statistics Denmark hosts de-identified micro data sets that can be linked through unique personal identifiers. This table provides an overview of the various data sources and variables that were linked to conduct the analysis in this article. A short description of each data set follows below:

[1] Includes data on applications for upper secondary education.

[2] Includes data on all grades given in the end of middle school.

[3] Includes data on general demographic characteristics including gender, ethnic origin as well as parental ID.

[4] Includes data on highest completed level of education.

[5] Includes data on educational enrollment and completion.