Dominated Choices in a Strategically Simple College Admissions Environment

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Abstract

Although many centralized school assignment systems use the strategically simple deferred acceptance mechanism, applicants often make dominated choices. Using administrative data from Hungary, we show that 11 percent of college applicants forgo the free opportunity to receive a tuition waiver. Between 12.3 and 18.7 percent of these dominated choices are consequential, costing 6,600 dollars on average. Our results suggest that dominated choices are more common when their expected utility cost is lower. Since tuition waivers are highly demanded, dominated choices increase the total number applicants assigned to college.

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1 Introduction

Millions of students around the world are assigned to schools through centralized assignment systems. An increasing share of these assignment systems adopt strategically simple mechanisms like deferred acceptance (DA), where ranking alternatives in a way that is inconsistent with one's preferences is a dominated choice.[1] But recent evidence suggests that many applicants make dominated choices when DA is in place. These applicants give up the opportunity to be assigned to alternatives that they prefer, even though this behavior does not benefit them. Despite economists' central role in the practical design and operation of school assignment systems, little is known about the consequences of this behavior and about the characteristics of the applicants who make them.

This paper documents the prevalence and consequences of dominated choices in strategically simple environments and investigates the characteristics of applicants that make them. Detecting dominated choices is a major challenge, as it requires information on preferences that is independent of observed choices. Furthermore, even if information on the preferences is available, search costs, which are hard to measure, may prevent students from applying to certain alternatives.

We overcome this challenge by studying college admissions in Hungary. The Hungarian centralized clearinghouse uses a strategically simple version of the DA to assign approximately 100,000 applicants each year. A special feature of this market is that most study programs are offered both with and without financial aid. These pairs of alternatives have an intrinsic natural ranking, which provides us with information on preferences that is independent of observed choices. Furthermore, as these naturally ranked alternatives are related to the same study programs, search costs cannot rationalize unexpected preferences reports (and, as we discuss below, the user interface makes this explanation particularly unlikely).

Using administrative data, we find that a large fraction of applicants make a *revealed dominated choice*: they submit a Rank-Order List (ROL) that is inconsistent with the natural ranking. These applicants forgo the free opportunity to receive a tuition waiver worth thousands of dollars.[2] During our sample period, more than 11 percent of ROLs are revealed dominated choices. Between 12.3 and 18.7 percent of these revealed dominated choices were costly: the applicant could have received a more desirable assignment had she asked for it. When dominated choices were costly, the average monetary loss was approximately 6,600 dollars. Therefore, the average loss per dominated choice is between 970 and 1,412 dollars, corresponding to an average loss of 129–188 dollars across the entire population.

Revealed dominated choices are a special subset of all dominated choices—those that involve a specific way of foregoing financial aid. The set of revealed dominated choices does not include other dominated choices, such as ones involving the choice of major. Hence, revealed dominated choices can only be detected in "relevant" ROLs (Hassidim et al., 2021)—ones that rank at least

[1] Strategy-proof mechanisms, where participants have a dominant strategy of reporting their true preferences, are viewed to be appealing because of their strategic simplicity. In practice, many clearinghouses do not employ a strategy-proof mechanism, but still choose a strategically simple mechanism, where ranking alternatives in a way that is inconsistent with one's preferences is a dominated strategy (even though the choice of which alternatives to rank may require strategic thinking). Pathak and Sönmez (2013) report on dozens of school-choice systems around the world that implemented strategically simple versions of the deferred acceptance mechanism (DA; Gale and Shapley, 1962), only one of which (Boston Public Schools') was strategy-proof.

[2] The "dominated choice" label is appropriate as under the standard assumptions in the matching market design literature—that agents know the rules of the game and that their utility depends only on their realized assignment—this behavior has no benefit. As we discuss below, there are other possible interpretations, but these fall outside the standard model of matching market design (e.g., Dreyfuss et al., 2022; Meisner and von Wangenheim, 2019), and they imply that DA is not strategyproof.

some self-funded alternatives. Focusing on the subsample of relevant ROLs, the share of revealed dominated choices is 27 percent. For conciseness, hereafter, when there is no risk of confusion, we refer to revealed dominated choices in the Hungarian context simply as dominated choices.[3]

In addition to assessing the private cost of revealed dominated choices, we also evaluate their effect on the market as a whole. To this end, we consider counterfactual markets in which all revealed dominated choices are reverted. We find that revealed dominated choices transfer funding to lower socioeconomic status (SES) applicants, and that they increase the number of students admitted to college. This context-specific result is driven by funding being over-demanded combined with lower rates of revealed dominated choices among lower-SES applicants (as we describe below).

We next turn to the correlates of dominated choices. We find that, all else equal, applicants coming from a higher socioeconomic status (SES) background are more likely to make a revealed dominated choice. Additionally, dominated choices are more common among applicants of lower academic achievement (who have lower chances of admission with state-funding), and when applying to more selective programs (when chances of admission with state-funding are lower).

Our findings suggest that economic incentives affect the prevalence of dominated choices: applicants make more dominated choices when they are less costly. A potential explanation is that applicants expect this behavior to be (approximately) costless and—to explain the large fraction of costly dominated choices—the applicants must hold erroneous beliefs (potentially due to pessimism or overprecision). An alternative explanation is that the standard model of matching market design does not capture important aspects of applicants' preferences, and, as a result, it is not necessarily optimal to rank alternatives truthfully. For example, Dreyfuss et al. (2022) and Meisner and von Wangenheim (2019) show that expectation-based loss aversion can explain the empirical patterns we document. We discuss other alternative explanations, such as information frictions, ego utility, and other-regarding preferences, in Section 6.

Our findings have important implications for the study and design of centralized school assignment systems. First, reported preferences are often used to inform policymakers about the relative desirability of different alternatives (schools, hospital internships, etc.). According to the traditional approach, preferences that are reported to strategically simple mechanisms can be interpreted at face value. But if, for example, agents do not rank desirable options where they expect fiercer competition (as we indeed find), a straightforward interpretation of school-choice data would exaggerate the importance applicants attach to proximity in the common case where individuals have priority in their neighborhood schools (Fack et al., 2019). Artemov et al. (2017) propose an alternative approach to estimating preferences when applicants know their priorities in schools when they submit their ROL (see also Larroucau and Rios, 2020).

Second, understanding the circumstances under which dominated choices in strategically simple environments are more common could inform researchers about the mechanisms underlying this behavior. This, in turn, could lead to new and more predictive classifications of allocation mechanisms according to their "simplicity" (Cason et al., 2006; Li, 2017; Zhang and Levin, 2017; Bó and Hakimov, 2019).

Relation to the literature. This paper is related to studies evaluating dominated-strategy play in strategically simple environments. Our findings on the prevalence of dominated choices are

[3] A potential limitation of our approach, which follows Hassidim et al. (2021), is that the dominated choices we focus on (and the people who make them) are special. Yet, while other dominated choices (e.g., ones involving the choice of major) are likely present as well, detecting them would require strong assumptions or additional information.

consistent with several recent studies that suggest that large fractions of participants in strategically simple environments use dominated strategies.[4] In the laboratory, Chen and Sönmez (2006) find that approximately 30 percent of the participants misrepresented their preferences under DA. Subsequent laboratory experiments that employ numerous variants of their matching environment corroborate this finding.[5] In the field, Gross et al. (2015), Chen and Pereyra (2019), and Rees-Jones (2018) document dominated-strategy play in strategically simple high-stakes environments, using survey evidence.[6] Relying exclusively on observational data, Hassidim et al. (2021) detect revealed dominated choices in the Israeli Psychology Master's Match (IPMM; Hassidim et al., 2017), and Artemov et al. (2017) and Arslan (2018) use their approach to document revealed dominated choices in centralized college admissions markets in Australia and Turkey. In all of the these empirical settings, a limited number of scholarships are offered in a small subset of programs, mechanically imposing a low upper bound on the costs of revealed dominated choices. By contrast, most programs in Hungary are offered both with and without funding and the typical student is assigned with funding, so the corresponding mechanical bound on the cost of revealed dominated choices is substantially higher.

Two recurring themes in the literature are the negative correlation of dominated strategy play with cognitive ability and its positive correlation with the expectation of fiercer competition. In practice, applicants' cognitive ability and their competitiveness are positively correlated in the field, making it difficult to disentangle the two components (Hassidim et al., 2021; Rees-Jones, 2018; Artemov et al., 2017). Laboratory experiments find that mistakes under strategically simple mechanisms are more common among lower cognitive ability applicants (Basteck and Mantovani, 2016; Rees-Jones and Skowronek, 2018; Guillen and Hakimov, 2016). Rees-Jones and Skowronek (2018) document a strong causal relationship between applicants' competitiveness and dominated choices in the laboratory. By exploiting within ROL variation in the selectivity of admission, our study is the first to establish this correlation in the field, ruling out cognitive limitations as a sole determinant of dominated choices in high-stakes environments. We also corroborate the correlation between cognitive ability and dominated choices.

There is a growing literature on attention, and suboptimal behavior is a leading measure of inattention (Gabaix, 2019; DellaVigna, 2009). Gabaix (2019) highlights the absence of field evidence on the causes and correlates of inattention. We contribute to this literature by showing the systematic nature of such suboptimal behavior. Our findings are consistent with studies showing that the prevalence of suboptimal behavior is responsive to economic incentives (e.g., Taubinsky and Rees-Jones, 2018; Taubinsky, 2018).

Our work is also related to the large literature on suboptimal behavior in education markets (e.g., Hoxby and Avery, 2012; Hoxby and Turner, 2013; Ajayi, 2011). This literature finds that search frictions with respect to the cost of application, financial aid, and the returns to college attendance, as well as the complexity of the application for financial aid, play an important role, and that low-socioeconomic status (SES) families are particularly affected. We contribute to the literature by studying a long-standing centralized market that is designed to be strategically

[4] Budish and Kessler (2015) investigate a related question of students' ability to express their preferences in the more complex course-scheduling environment.

[5] Examples include Calsamiglia et al. (2010), Chen and Kesten (2011), Ding and Schotter (2015), Ding and Schotter (2016), Featherstone and Niederle (2016), Guillen and Hing (2014), Bó and Hakimov (2019), Klijn et al. (2013), Pais and Pintér (2008), Pais et al. (2011), and Rees-Jones et al. (2019). For a survey see Hakimov and Kübler (2021).

[6] In the context of centralized school choice, numerous studies document evidence of suboptimal play when strategically demanding mechanisms, such as the Immediate Acceptance (i.e., Boston) mechanism, are in place (e.g., De Haan et al., Forthcoming; Kapor et al., 2020).

simple, where information is accessible and abundant, and by focusing on dominated choices that are unlikely to be caused by search frictions. Yet, we find that a substantial fraction of applicants make such dominated choices, and this behavior is more common among urban and high-SES applicants. We conclude that other frictions, such as lack of comprehension of the way the market clears, are also important.

Organization of the paper. The remainder of the paper is organized as follows. Section 2 describes the Hungarian higher-education system, and the admissions process in particular. Section 3 describes our data. Section 4 assesses the prevalence and costs of dominated choices. Section 5 describes the correlation between dominated choices and the characteristics of applicants and programs. Section 6 discusses possible explanations of our findings and concludes.

2 College Admissions in Hungary

Each year, about 100,000 prospective students apply to bachelor's degree programs in Hungary through a centralized clearinghouse, and approximately 72 percent are assigned. Admissions to all higher education programs is controlled centrally by the government since 1985. Starting in 2008, the centralized clearinghouse adopted a variant of student-proposing DA.[7] The mechanism that had been in use previously was based on a similar variant of the program-proposing version of DA. Both mechanisms endow programs with (program-specific) priorities based on a weighted average of several variables (mainly academic performance in the 11th and 12th grades and matriculation exam scores, but also credits for disadvantaged and disabled applicants, as well as for a small number of gifted applicants).

Tuition waivers. Hungarian nationals and citizens of the European Economic Area are eligible to receive up to six years (12 semesters) of free education in the form of a tuition waiver. Nevertheless, the government caps the number of state-funded positions in some majors and in each field of study (business and economics, humanities, etc.). Eligible applicants may apply for a state-funded position, but self-funded positions are also offered. If admitted to a self-funded position, the applicant will not receive a tuition waiver, in spite of her eligibility. On average, 64% of admitted applicants received a tuition waiver in the years 2009–2014.

Tuition varies between programs. In 2013, it ranged from 2,600 to 30,000 dollars for three years, with a median of $3,800 and a mean of $4,500. In comparison, the annual minimum wage in 2013 was approximately $4,000. Besides the monetary benefits, funded positions have other advantages over self-funded ones. Many institutions grant state-funded students priority in access to subsidized housing and other amenities. In some cases, these benefits have substantial monetary value. Moreover, paying students bear the stigma of being thought "not good enough" to be admitted to the traditional funded track (cf. Aygun and Turhan, 2016).[8]

[7] To be precise, the matching system has three rounds. The main round, in which the majority of BA and MA positions are allocated, ends in July; an additional, significantly smaller round at the end of the summer for unfilled self-funded positions; and a winter round for master's programs that start in the spring term (Biró, 2011). We use data only from the main round of the BA match.

[8] A reform in 2012, substantially reduced the availability of state-sponsored (funded) positions in three fields of study: business and economics, legal studies, and social sciences. Additionally, students who benefit from state sponsorship (and did not meet other criteria, such as becoming a parent of two children) were required to work in Hungary for the number of years they spent in college within 20 years of graduation, or else repay the state. Our results continue to hold when restriction attention to the pre-reform period.

Rank-Order Lists. Applicants are allowed to rank any number of *contracts*, i.e., program and funding level combinations, where a program is a specific major–institution pair. For example, they may submit an ROL that includes four contracts with three programs as in Table 1. Submitting an ROL that includes up to 3 programs (which may correspond to up to 6 contracts) only requires paying a fixed application fee of about 40 dollars. This is the case for the ROL in Table 1. However, applicants are charged about 9 dollars for each additional program in their ROL.

Revealed dominated choices. The fact that application fees are determined according to the number of *programs* in the ROL, as opposed to the number of *contracts*, implies that if an applicant ranks a self-funded contract with a certain program, then the marginal (monetary) cost of ranking a state-funded contract with the same program is zero. Search costs are also negligible as the contracts relate to the same program, applicants are well-aware of the state-funded option (which is the norm, and exists in all programs), and the interface makes it nearly impossible to ignore its existence.[9] These features, together with the standard assumption that applicants' preferences depend only on their own allocation, imply that an applicant is using a dominated strategy if she ranks a self-funded contract in some program higher than a state-funded contract in the same program (*revealed flipping*), or if she ranks only a self-funded contract in a program that offers a state-funded contract (*revealed dropping*). We collectively refer to such strategies as *revealed dominated choices* (or simply *dominated choices*, when there is no risk of confusion).

Table 1 presents an ROL that includes four contracts with three programs. This ROL contains both revealed flipping and revealed dropping. First, a self-funded BA in biology at Eötvös Lóránd University is ranked higher than a state-funded contract in the same program (revealed flipping). Second, the applicant ranked only a self-funded BA in applied economics at Corvinus University of Budapest, even though a state-funded contract was offered (revealed dropping).

The fact that we label the behavior we document as dominated is not innocuous. This label relies crucially on the assumption that applicants' utility depends only on the realized assignment, and more specifically only on the applicants' own assignment. While this assumption is standard in the market design literature (e.g., Pathak and Sönmez, 2013), there are other possible interpretations (e.g., other-regarding preferences, self-image concerns).[10] We elaborate on these alternative explanations in Section 6.

Timeline and Information. Applicants submit their ROLs in mid-February. Students in the 12th-grade learn their GPA in April, and complete their matriculation exams in May and June. In early July, applicants report all their grades and exam scores, and they may change the order of their ROL or drop contracts from the list, but they may not add any contracts to the list.

The formulas for priority scores are public. The *priority-score cutoffs*, i.e., the minimum priority score needed to gain admission, are made public shortly after the match. This feature allows

[9] Applicants are required to choose contracts from a dropdown menu in which the state-funded and the self-funded contracts in the same program appear consecutively (screenshots are available in Online Appendix A). Similarly, in the traditional paper-based system, applicants must copy a code corresponding to each contract. These codes appear in an information brochure, which lists state-funded and self-funded contracts in the same program consecutively.

[10] Our view that state-funded positions unambiguously dominate self-funded positions is shared by the popular media. For example, on the day the 2017 match results were made public, a major media outlet published a story with the man-bites-dog title: "*The priority-score cutoff for self-funded medicine exceeds the state-funded cutoff.*" *Source: index.hu;* https://goo.gl/zfxFFw, *accessed: 20/09/2017.* Similarly, in 2012, when some partially funded positions were offered, it was not possible to rank these positions, but they were awarded based on merit to individuals who were assigned a self-funded position (thus, the government implicitly assumed that a state-funded option would be preferred by the applicants, which is consistent with our interpretation).

applicants to verify that they were assigned to the highest-ranked program whose cutoff they surpassed. The clearinghouse website (http://www.felvi.hu) contains detailed statistics about the match in recent years, including quotas, the number of applicants and acceptances, and priority-score cutoffs. Much of this information, in addition to information about all participating programs, is also available in a booklet published by the Ministry of Education yearly. The clearinghouse website also provides decision support in the form of an application fee calculator.

3 Data and Summary Statistics

In this section, we describe the data that we use in our empirical analysis. We begin, in Section 3.1, by presenting our data sources and defining our sample. In Section 3.2, we present summary statistics.

3.1 Data Sources

Our main data source is an administrative dataset that contains information about the bachelor's degree admissions process between 2009 and 2014 in Hungary. In particular, we observe each applicant's complete ROL and program-specific priority scores,[11] as well as the list of existing programs with their realized priority-score cutoff. For each applicant we also observe gender, age, postal code, and a high-school identifier. Additionally, the data include all the information that is required to (re)calculate the applicant's priority score in each program she applied to. This information includes grades in various subjects in the final two years of high school (11th and 12th grades), performance in the matriculation exams, and the number of points the applicant received for claiming a disadvantaged background.[12] This dataset also includes applicants' assignment.

Our analysis uses three additional data sources that we merged based on demographic information. The first data source is the T-STAR dataset of the Hungarian Central Statistics Office. We use it to obtain settlement-level annual information on collected income taxes.[13] In particular, we calculate the per capita gross annual income for all 3,164 settlements for each year between 2009 and 2014. The second data source is the microregional-level annual unemployment rates published by the National Employment Service in 2008, one year before the start of our sample period.[14] The territorial breakdown consists of 174 units. To calculate the cost of ex post costly dominated choices, we collected data on the 2013 and 2014 tuition costs of each program and their length (in semesters) from the centralized admission system website.[15]

Our full dataset consists of 721,674 ROLs submitted between 2009 and 2014. We restrict our sample to the *eligible sample*: ROLs that can potentially exhibit dominated choices. These ROLs must meet two criteria. First, the applicant must be eligible for a tuition waiver. As our data

[11] Our data report up to 7 contracts from each ROL: the first 6 contracts and the contract to which the applicant is assigned. The dataset also reports the number of contracts in each ROL. We observe the complete ROL for 92.9 percent of applicants and 94.3 percent of all ranked contracts.

[12] To be eligible for disadvantaged status, an applicant must have a per capita household income that is lower than 130 percent of the minimum pension (approximately $1,900 a year). Students with disadvantaged status receive regular cash transfers and are eligible for free textbooks during high school.

[13] For further information visit https://goo.gl/EqSgaU, accessed: 05/03/2018.

[14] Source: https://goo.gl/9xiVPz, accessed: 16/11/2016. For more information on the territorial units see https://goo.gl/FffwkT, accessed: 16/11/2016.

[15] To convert the tuition costs to dollar terms, we used the official HUF/USD exchange rates of the Central Bank of Hungary (1USD = 223HUF in 2013 and 1USD = 232HUF in 2014).

do not contain direct information on tuition-waiver eligibility, we rely on indirect information: we restrict the sample to ROLs submitted by citizens of the European Economic Area who did not report being ineligible. Second, we focus on ROLs that include at least one contract with a bachelors-degree-granting program that offers both state-funded and self-funded contracts. The eligible sample includes 528,172 ROLs.

We sometimes refer to the subsample of *high-school senior applicants*. These are the 269,932 eligible applicants who, at the time, were younger than 22 and had completed their matriculation exam in the same year when they applied.[16] We also refer occasionally to *relevant* ROLs. These are ROLs that include at least one self-funded contract. Revealed dominated choices can only be detected in relevant ROLs.

3.2 Summary Statistics

Table 2 summarizes the means and standard deviations of the background characteristics of eligible applicants. Applicants were 21.92 years old on average, with 55 percent being female. The majority (63 percent) of the applicants attended secondary grammar schools, whose declared purpose is to prepare students for higher education. Approximately 19 percent of the applicants lived in Budapest, 20 percent lived in one of the 18 county capitals, 32 percent resided in towns, and the remainder lived in villages. About 7 percent of the applicants claimed points for disadvantaged status. The share of high-school senior applicants was 51 percent.[17] Eligible applicants' GPAs were three percent of a standard deviation higher than all applicants' GPAs.

The lower panel of Table 2 presents statistics on the number and types of contracts that ROLs include. The average ROL length was 3.8 contracts, which corresponds to 3.05 programs. Applicants' ROLs include only funded contracts frequently (59 percent) and only self-funded contracts rarely (7 percent). Among applicants who listed both state-funded and self-funded contracts in their ROL, 77.4 percent ranked each state-funded contract above *all* self-funded contracts. Taken together, these figures suggest that funding plays an important role in applicants' choices between alternatives.

4 The Prevalence and Costs of Dominated Choices

In this Section, we document the prevalence and cost of dominated choices. We begin, in Section 4.2, by reporting the share of applicants making dominated choices. In Section 4.2, we assess the private costs of dominated choices. Finally, in Section 4.3, we study the effect of dominated choices on the market as whole.

4.1 The Prevalence of Dominated Choices

Out of 528,172 ROLs in the eligible sample, 58,178 (11 percent) contain a dominated choice (Table 3). The majority of these ROLs (54,185) include a revealed dropping. Only 5,150 ROLs

[16] Focusing on high-school seniors eliminates the potential concern that some ineligible applicants do not rank any state-funded contract, but fail to report their ineligibility.

[17] High-school senior applicants were younger (on average 19.05 years old), more likely to be female (56.5%) and to be a graduate of a secondary grammar school (69.9%), and less likely to reside in the capital (16.4%). Their 11th-grade GPA is 28.4 percent of a standard deviations above the mean in the entire applicant population. High-school seniors had longer ROLs (on average, 4.34 contracts with 3.43), and were more likely to rank state-funded contracts exclusively (65%).

include a revealed flipping.

Revealed dominated choices can only be detected in relevant ROLs, i.e., ROLs that rank at least one self-funded contract. So, for some purposes, it may be more informative to consider the fraction of dominated choices from this subsample. The share of relevant ROLs in the eligible sample is 41 percent (see Table 2), so, for example, the share of relevant ROLs with a dominated choice is 27 percent (=11%/41%).

The prevalence of dominated choices among high-school seniors is lower. About 5.8 percent of all ROLs contain a dominated choice (16.6 percent of relevant high-school seniors' ROLs). Revealed dropping (5.0 percent) is substantially more common than revealed flipping (1.1 percent).

4.2 The Private Cost of Dominated Choices

According to our interpretation, dominated choices correspond to weakly dominated strategies. Rational applicants that understand the admissions process use dominated strategies only when they are certain that this behavior is not costly.[18] In this section, we assess the private cost of dominated choices, i.e., the cost of dominated choices to the agents that make them under the prevailing market conditions.

Table 3 reports that the number of ROLS with an ex post costly revealed dominated choice is between 7,177 and 10,808 (between 6,563 and 10,168 when correcting only revealed dropping, and between 614 and 724 when correcting only revealed flipping). In other words, the share of ex post costly dominated choices is between 12.3 and 18.7 percent of all dominated choices (among high-school seniors, the share is between 4.3 and 9.6 percent). To derive these bounds, we compare the assignment of the applicant to her assignment if she reported the counterfactual ROL that ranks the funded contracts that were dropped or flipped on the top of her ROL (for the upper bound) or directly above the self-funded contract (for the lower bound), holding the ROLs of all other applicants fixed. Equivalently, the upper bound is the number of applicants who met the priority-score cutoff for the state-funded seat in a program whose state-funded contract they dropped or ranked below its self-funded version, and the lower bound corresponds to the subset of these ROLs in which the applicant was not assigned a contract she ranked higher than the self-funded seat with respect to which she made a dominated choice.

[18] A potential explanation for the prevalence of dominated choices is that applicants do not understand the application fee structure. Specifically, applicants may not understand that the application fee is charged per program, not per contract. To assess this theory, we concentrate on the subsample of applicants who ranked four or more contracts, with three or fewer programs. These applicants must have learned the pricing scheme, because they had to pay only the fixed application fee. We find that the share of applicants with dominated choices is 6.8 percent in this subsample. Moreover, if applicants have rational expectations, this explanation requires implausibly high levels of risk aversion, loss aversion, or hyperbolic discounting. As an illustration of this claim, we conservatively consider lower bound on the share of costly dominated choices in the population of high-school seniors (which is substantially lower than the bound in the eligible sample). The lottery $[6,600, 0.043; -9, 0.957]$ mimics the trade-off that this theory suggests (4.3% is the lower bound on the share of costly dominated choice, 6,600 dollars is the average tuition cost, and 9 dollars is the marginal cost of application). This lottery is accepted by all agents with absolute risk aversion levels below $4 \cdot 10^{-3}$—substantially higher than the range suggested by Cabrales et al. (2017) as reasonable (below $5 \cdot 10^{-4}$). The positive correlation between dominated choices and SES also requires that wealthier individuals are more risk averse, counter to the conventional view (Hart, 2011; Dohmen et al., 2011). Similarly, this lottery is accepted by all loss averse (and otherwise risk neutral) agents with a loss aversion coefficient lower than 32 – substantially higher than 5, the highest estimate reported in Abdellaoui et al. (2008). The associated payoff stream is accepted for future discounting coefficients higher than 0.03 (in the absence of further discounting or risk or loss aversion)—Gabaix (2019) suggests the substantially higher 0.7 as a portable, already estimated parameter (DellaVigna and Malmendier, 2006).

The monetary loss associated with each ex post costly dominated choice is approximately 6,600 dollars. Thus, the average monetary loss as the result of dominated choices is between 970 and 1,410 dollars.

4.3 The Aggregate Effect of Dominated Choices

In Section 4.2, we study the direct effect of dominated choices over the applicants who make them. By definition, this effect must be non-positive. But one man's loss may be another man's gain. In this section, we consider the aggregate effect of dominated choices. To do this, we re-calculate the entire assignment after "undoing" *all* dominated choices. We do this using both of the approaches that we used above (i.e., ranking the state-funded just above the self-funded contract or at the top or the ROL).[19]

Table 4 reports our findings. In Column 2, we summarize the results with respect to the "state-funded above self-funded" approach. In this scenario, 2.2 percent of the applicants would have received a different assignment: 1.2 percent would have benefited (by being admitted to the same program under better financial terms, or by being admitted to a different program that they prefer), and 1.0 percent of the applicants would have lost. The results for the "state-funded on top" approach are summarized in Column 3. In this scenario, 3.1 percent of the applicants would have been affected, with 1.7 percent benefiting and 1.4 percent losing. In both scenarios, it is much more common for a loser to become unassigned than it is for a winner to become assigned, and so dominated choices *increase* the total number of admitted applicants.

In Table 5 we compare the characteristics of those who benefit from the change to those who lose. Losers are more likely to be high-school seniors and to be disadvantaged. They are also more than 2 years younger on average. These differences are consistent with the relative prevalence of dominated choices in the respective groups (we elaborate on differences in prevalence in Section 5).

Interestingly, only 1 percent of winners rank state-funded contracts exclusively, while the respective fraction among losers is 64 percent. This difference is explained by two factors. First, many of the winners directly benefit from their dominated choice being corrected. By the definition of revealed dominated choices, these applicants rank at least one self-funded contract. Second, when we correct a costly revealed dominated choice, the immediate effect is often displacing an applicant from the state-funded contract in the corresponding program while freeing up a seat at the self-funded contract. In these cases, the first circle of affected applicants includes a winner that gets a self-funded contract (and therefore ranks some self-funded contract), and a loser that gets displaced from a state-funded contract (potentially, an applicant that ranked only state-funded contracts).

Finally, we assess the aggregate effect of dominated choices on the private cost of each individual dominated choice. To do this, we repeat the analysis from Section 4.2, but calculate the cost in a counterfactual market that is free of all other dominated choices (we use both of the approaches described above). We find that the share of dominated choices that are costly ex post is between 11 and 17 percent in the "state-funded above self-funded" scenario and between 10 and 16 percent in the "state-funded on top" scenario. Intuitively, correcting dominate choices increases the competition over state-funded seats, which increases the priority-score cutoff for admission with state-funding and thus reduces the number of costly dominated choices (since a necessary condition for a dominated choice to be costly is that the applicant's priority score is above the

[19] When there are multiple state-funded contracts to rank at the top, we order them in the same order that the self-funded contracts are ranked.

priority-score cutoff). The fractions for "state-funded on top" are lower since this counterfactual increases the competition over state-funded seats even further.

5 The Correlates of Dominated Choices

This section examines the correlates of dominated choices. In Section 5.1 we report the characteristics of applicants who made dominated choices, and in Section 5.2 we consider the characteristics of programs where dominated choices are more common.

5.1 Applicant Characteristics

To summarize the characteristics of applicants who made dominated choices, we regress an indicator for dominated choices on applicant-level demographic variables, proxies of socioeconomic status, academic achievement, and year fixed effects. It is important to note that these regressions provide descriptive evidence on the characteristics of applicants who submitted ROLs with dominated choices, but we cannot attribute a causal interpretation to the estimated coefficients.

Table 6 summarizes our findings. Applicants of a higher SES make more dominated choices on average. In columns (1)–(3) we corroborate this correlation using an array of proxies for SES (microregional-level unemployment rate, settlement-level gross annual per capita income, and indicator for claiming priority points for disadvantaged background). Furthermore, the fraction of dominated choices is increasing in the size of the settlement where the applicants resides.

Applicants of low socioeconomic status were less likely to apply for self-funded positions, a necessary condition for detecting a dominated choice. We argue that this channel does not drive the positive relationship between proxies for SES and dominated choices. In Appendix Table B1 we restrict attention to ROLs that include at least one self-funded contract (relevant ROLs), and repeat the same analysis. The results continue to hold.

We also find that applicants with a higher GPA make fewer dominated choices. A one standard deviation increase in the 11th-grade GPA is associated with a 4.2 percentage points (38 percent) decline in the probability of making dominated choices. Additionally, female applicants were 3 percentage point (27 percent) more likely to make a dominated choice.

Appendix Table B2 repeats this analysis restricting attention to high-school seniors and finds similar results. Additionally, regressions for each characteristic separately yield similar results (see Appendix Table B3).

5.2 Program Characteristics

In this section, we show that applicants make more dominated choices with respect to study programs where they are less likely to be admitted with state-funding. To this end, our unit of observation in this section is an *application* – a program that appears in at least one contract in an ROL. We begin with column (1) of Table 7, which presents the results of a simple linear regression of an indicator of dominated choice on the (standardized) priority-score cutoff of the corresponding state-funded contract. We interpret the state-funded priority-score cutoffs as a measure of admission selectivity. We find that, conditional on appearing in an ROL, dominated choices are more common in applications to programs with higher state-funded priority-score cutoffs. Specifically, a one standard deviation increase in the state-funded priority-score cutoff is associated with a 3.4 percentage point increase in the prevalence of a dominated choice.

Columns (2)–(5) repeat this analysis for other program characteristics. We find that the share of dominated choices in applications to rural colleges is about 2.5 percentage points higher. Additionally, the share of dominated choices is 12 percentage points higher in applications to evening programs. The share of dominated choices is particularly high in the fields of law, business and economics, and social science.[20] The lowest shares are in the fields of healthcare and art.

We cannot attribute a causal interpretation to the results of these regressions for several reasons. First, applicants sort into programs based on their personal characteristics, such as ability. So, for example, since academic ability and dominated choices are negatively correlated, it is reasonable to assume that failing to control for ability results in understating the correlation between admission selectivity and dominated choices. Second, programs differ along multiple dimensions, which confounds the relationship between any specific program characteristic and dominated choices. To address these concerns, we perform a linear regression that includes ROL fixed effects (to address sorting) and controls for an array of program characteristics.

Column (7) of Table 7 presents the results of this regression (for comparability, column (6) reports the results without ROL fixed effects). The correlations with fields of study are generally attenuated (but not eliminated). The correlation with admission selectivity persists, but slightly attenuated. Finally, the coefficient of evening programs shrinks from -0.12 to -0.03.

Intuitively, the inclusion of ROL fixed effects means that we identify the slopes from ROLs that include multiple programs with distinct characteristics. The sharp decrease in the coefficient of evening programs stems from the fact that the share of dominated choices in ROLs that include only evening programs is high (26.4 percent of 94,098 ROLs that include only evening programs compared to 7.7 percent of other 434,074 ROLs). Assuming that applicants that are interested in evening programs are typically active in the labor market, this correlation, and the higher rates of dominated choices among non-high-school-senior applicants, suggest that information frictions (potentially due to the lack of access to advising in school) may be an important factor driving the dominated choices we observe.

There are several possible explanations for the negative correlation that remains after the inclusion of fixed effects. First, state-funding is relatively scarce in evening programs, and so the correlation may represent the response to expectation of selectivity. Second, some applicants may think that only full-time applicants "deserve" to be funded (although the funding they forgo will be allocated to another applicant to an evening program).

5.2.1 Heterogeneity

We next examine whether the associations between study program characteristics and dominated choices are heterogeneous across various subgroups. Table 8 further refines the analysis of Column (7) of Table 7 by separately estimating regressions for disadvantaged and non-disadvantaged applicants (measured by claiming points for disadvantaged status), as well as for low-achieving and high-achieving applicants (measured by having below/above average 11th-grade GPA). We find that the association between state-funded priority-score cutoffs and dominated choices is weaker for low-SES applicants. Additionally, the strength of the association is weaker for applicants of high academic achievement.

[20] The 2012 reform substantially reduced the availability of stat-funding in these fields, making state-funded seats substantially more selective. Focusing on the pre-reform period, this correlation is attenuated, but continues to exist.

6 Discussion

We find that a large fraction of applicants make dominated choices, and a non-negligible share of these dominated choices is costly. It is difficult to explain dominated choices, especially costly ones, using standard models of matching markets. Which behavioral models may generate such empirical patterns?

Submitting an ROL that is inconsistent with the applicant's true preferences is only weakly dominated. In particular, if an applicant assigns zero probability to the event that she will be admitted to a more-preferred alternative, she is indifferent between truthful reporting and making a dominated choice with respect to this alternative, and if the probability of admission is very low she is nearly indifferent. Our findings that applicants make more dominated choices when their expected cost is lower are consistent with applicants choosing dominated strategies that they believe are (approximately) optimal. However, the high share of costly dominated choices requires the presence of overly pessimistic beliefs about the likelihood of admission to the state-funded contract for this explanation to drive our results.

Another possibility is that applicants are not aware of the optimal strategy. Such lack of awareness may arise for several reasons. First, applicants may not understand that ranking inconsistently with their preferences is suboptimal under deferred acceptance. This possibility is consistent with the higher rates of dominated choices among two groups of applicants who presumably have less access to advising: non-high-school-senior applicants and applicants to evening programs. We note, however, that for applicants to believe that revealed dominated choices are beneficial, they must believe in their ability to influence the the priority-score cutoffs in a substantial way (or that their influence may be small but they are very likely to be marginal).[21] Second, applicants may not be aware of the availability of state-funded position. As we discuss above, we find this explanation highly unlikely, since state-funded seats are the historical norm and account for most college seats, and since the user interface makes them nearly impossible to ignore. Lastly, applicants may mistrust the explanations provided to them by the mechanism. This can arise from skepticism regarding the accuracy of the information they receive about the mechanism or from skepticism regarding the policymaker's commitment to use the stated mechanism. We do not think that lack of trust drives our results since, in the Hungarian context, the match has a long history, is governed by legislation, and is operated by the central government. Moreover, since priority-score cutoffs become public shortly after the match, applicants can verify that their assignment is indeed the option they ranked highest among those whose cutoff they surpassed.

An alternative theory that is consistent with our findings is that the standard model ignores an important aspect of applicants' preferences, and as a result truthfulness is not always optimal. For example, applicants may have *ego utility*, and may distort their choices to avoid receiving information about their priority as this may hurt their self-image (Kőszegi, 2006). In the context of self-image concerns, it is worth mentioning that applicants learn their priority score, and that the priority-score cutoffs are public information. Thus, applicants have access to the same information about their priority no matter what ranking they submit. On the other hand, the strategies we classify as dominated choices make this information less salient and easier to ignore. Recently, Dreyfuss et al. (2022) and Meisner and von Wangenheim (2019) show that expectation-based loss aversion can explain the patterns we document.

Another possibility is that applicants have "non-standard" preferences that do not exclusively

[21] Applicants may falsely believe that they influence the likelihood of certain probability events that are, in fact, independent of their actions ("magical thinking"). Arad (2014) finds evidence of individuals avoiding "greedy" decisions under uncertainty out of fear that they will be "magically" punished by the universe.

depend on their own allocation. Since there is over-demand for funding, altruistic motives are consistent with many of the patterns we document (Fehr and Fischbacher, 2002; Charness and Rabin, 2002). However, the share of dominated choices among low-SES applicants is substantial. Moreover, the fact that 7 percent of the applicants are deemed disadvantaged by the government, which raises their priority score substantially, reduces the plausibility of this explanation, especially in light of the fact that many applicants drop the funded positions only in some programs. Finally, applicants who are admitted with funding have full control over the money they receive and can redistribute it to raise their utility even more.

The patterns we documented suggest that dominated choices are more common when their expected cost is lower. Future research should provide evidence on the causes of dominated choices, allowing to further narrow down on specific behavioral models. This will improve our ability to design effective marketplaces and to interpret choice data.

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Tables and Figures

Table 1: A rank-order list with dominated choices

Rank	Program		Funding
	Institution	Major	
1.	Eötvös Lóránd University	BA in Biology	Self-funded
2.	Corvinus University of Budapest	BA in Applied Economics	Self-funded
3.	Eötvös Lóránd University	BA in Biology	State-funded
4.	Eötvös Lóránd University	BA in Mathematics	State-funded

Notes: The table presents a rank-order list that includes four contracts with three programs.

Table 2: Applicant-level summary statistics

	Mean (1)	St. dev. (2)
Female	0.55	(0.50)
Age (yrs)	21.92	(5.51)
High school		
- secondary grammar school	0.63	(0.48)
- vocational school	0.32	(0.47)
Residence		
- capital	0.19	(0.39)
- county capital	0.20	(0.40)
- town	0.32	(0.47)
- village	0.29	(0.45)
11th-grade GPA	3.68	(0.87)
11th-grade GPA (standardized)	0.04	(0.99)
11th-grade GPA - missing	0.18	(0.38)
Disadvantaged status	0.07	(0.25)
High-school senior applicant	0.51	(0.50)
Number of contracts on ROL	3.80	(2.03)
Number of contracts on ROL (data)	3.58	(1.44)
Number of programs on ROL (data)	3.05	(1.14)
ROL by funding type		
- only state-funded contracts	0.59	(0.49)
- state- and self-funded contracts	0.34	(0.48)
- only self-funded contracts	0.07	(0.25)
Number of applicants	528,172	

Notes: The table reports mean values of applicant characteristics, with standard deviations in parentheses. Disadvantaged status is an indicator for claiming priority points for disadvantaged status. GPA is the average grades in mathematics and Hungarian grammar and literature. GPA is measured on a scale of 1 to 5. Applicants whose high-school GPA is low relative to their matriculation exam scores have no incentive to report their GPA, as it has no effect on their priority score. As a result, 11th-grade GPA is missing for 18 percent of applicants. The correlation between missing GPA and matriculation exam scores in our data is negative and strong. The number of contracts on the ROL is reported administratively, whereas we calculate the number of programs based on the contracts observed in the dataset (see Footnote 11).

Table 3: The Prevalence and Private Cost of Dominated Choices

	Dominated choice		Ex post costly dominated choice			
			Lower bound		Upper bound	
	(1)		(2)		(3)	
Revealed dropping	54,185	(10.3%)	6,563	(12.1%)	10,168	(18.8%)
Revealed flipping	5,150	(1.0%)	614	(11.9%)	724	(14.1%)
Revealed dropping or flipping	58,178	(11.0%)	7,177	(12.3%)	10,808	(18.7%)

Notes: The table presents the prevalence and cost of revealed flipping, revealed dropping and all revealed dominated choices among eligible applicants ($N = 528,172$). Column (1) reports the number (share) of ROLs with a dominated choice. Columns (2) and (3) report the lower and upper bounds on the number of ROLs with an ex post costly dominated choice and their share of ROLs with the same type of dominated choice in parenthesis.

Table 4: The aggregate effect of dominated choices

	Benchmark	State-funded above self-funded	State-funded on top
	(1)	(2)	(3)
A. *Admitted applicants*			
- admitted applicants	71.9	71.7	71.6
- admitted applicants with state-funding	50.6	50.8	50.8
- admitted applicants with self-funding	21.4	21.0	20.8
B. *Winners*		1.2	1.7
- newly admitted applicants		0.1	0.2
- applicants admitted to the same program		0.9	0.8
- applicants admitted to a different program		0.2	0.7
C. *Losers*		1.0	1.4
- newly rejected applicants		0.3	0.5
- applicants admitted to the same program		0.2	0.3
- applicants admitted to a different program		0.5	0.6

Notes: The table compares the realized allocation (benchmark, column (1)) to two counterfactual allocations corresponding to the two ways of "undoing" dominated choices (columns (2) and (3)). A winner is an applicant that prefers (based on the corrected ROL) the counterfactual allocation to the benchmark. Losers are defined analogously. The numbers represent percentages of the entire applicant population over the sample period.

Table 5: Characteristics of winners and losers

	State-funded above self-funded			State-funded on top		
	Winners	Losers	p-values: (1)=(2)	Winners	Losers	p-values: (4)=(5)
	(1)	(2)	(3)	(4)	(5)	(6)
Female	0.50	0.55	0.000	0.51	0.55	0.000
Age (yrs)	26.16	23.37	0.000	25.69	23.64	0.000
High school						
- secondary grammar school	0.69	0.63	0.000	0.68	0.62	0.000
- vocational school	0.26	0.32	0.000	0.26	0.34	0.000
Residence						
- capital	0.28	0.21	0.000	0.28	0.21	0.000
- county capital	0.21	0.19	0.001	0.20	0.19	0.005
- town	0.29	0.32	0.000	0.29	0.32	0.000
- village	0.22	0.28	0.000	0.23	0.28	0.000
11th-grade GPA	3.79	3.65	0.000	3.82	3.64	0.000
11th-grade GPA - missing	0.20	0.14	0.000	0.19	0.14	0.000
Disadvantaged status	0.01	0.06	0.000	0.02	0.05	0.000
High-school senior applicant	0.18	0.39	0.000	0.21	0.37	0.000
Number of contracts on ROL	3.18	3.87	0.000	3.45	3.86	0.000
Number of contracts on ROL (data)	3.01	3.64	0.000	3.25	3.64	0.000
Number of programs on ROL (data)	2.46	3.09	0.000	2.70	3.07	0.000
ROL by funding type						
- only state-funded contracts	0.01	0.64	0.000	0.02	0.64	0.000
- state- and self-funded contracts	0.34	0.35	0.014	0.38	0.36	0.192
- only self-funded contracts	0.65	0.00	0.000	0.60	0.00	0.000
Number of applicants	8,589	7,126		12,515	9,903	

Notes: The table compares the characteristics of applicants that benefit or lose as a result of dominated choices (directly and indirectly). We consider two counterfactual allocations corresponding to the two ways of "undoing" dominated choices that we describe the text. A winner is an applicant that prefers (based on the corrected ROL) the counterfactual allocation to the benchmark. Losers are defined analogously. Columns (3) and (6) present p-values for the equality of mean characteristics of winners and losers.

Table 6: Demographics, socioeconomic status, academic achievement and dominated choices

Dependent variable	Dominated choice		
	(1)	(2)	(3)
Unemployment rate in 2008 (%)	−0.002***		
	(0.000)		
Gross annual per capita income (1000 USD)		0.008***	
		(0.000)	
Disadvantaged status			−0.068***
			(0.001)
11th-grade GPA (standardized)	−0.042***	−0.042***	−0.042***
	(0.001)	(0.001)	(0.001)
Vocational school	0.004***	0.005***	0.004***
	(0.001)	(0.001)	(0.001)
Other school	0.023***	0.024***	0.019***
	(0.004)	(0.004)	(0.003)
County capital	−0.034***	−0.016***	−0.036***
	(0.002)	(0.002)	(0.002)
Town	−0.038***	−0.016***	−0.042***
	(0.002)	(0.002)	(0.001)
Village	−0.046***	−0.019***	−0.048***
	(0.002)	(0.002)	(0.001)
Female	0.030***	0.031***	0.032***
	(0.001)	(0.001)	(0.001)
Year FE	Yes	Yes	Yes
R-squared	.027	.028	.03

***: p<0.01, **: p<0.05, *: p<0.1.

Notes: The table presents the results of a linear regression of an indicator for dominated choices on demographics, academic achievement, and measures of socioeconomic status. The regression coefficients are conditional on year fixed effects. Robust standard errors are in parentheses. We restrict the sample to eligible applicants (N = 528,172). The share of dominated choices is 11.0% in this sample. Eleventh-grade GPA is missing for 17.9% of the sample. We include an indicator of those missing observations in our regressions. The omitted residence is the capital. The omitted school type is secondary grammar school.

Table 7: Program characteristics and dominated choices

Dependent variable	Dominated choice						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Priority-score cutoff (state-funded, standardized)	0.0342***					0.0271***	0.0232***
	(0.0002)					(0.0003)	(0.0003)
Bachelor program		−0.0071***				0.0144***	0.0059***
		(0.0007)				(0.0008)	(0.0010)
Full-time program			−0.1174***			−0.1368***	−0.0321***
			(0.0007)			(0.0008)	(0.0014)
Program location: capital				−0.0243***		−0.0200***	−0.0232***
				(0.0008)		(0.0009)	(0.0008)
Program location: county capital				−0.0267***		−0.0075***	−0.0016**
				(0.0008)		(0.0008)	(0.0007)
Agriculture					−0.0131***	0.0082***	0.0068***
					(0.0014)	(0.0014)	(0.0018)
Arts					−0.0438***	−0.0127***	−0.0079***
					(0.0014)	(0.0014)	(0.0023)
Business and Economics					0.0467***	0.0537***	0.0270***
					(0.0013)	(0.0013)	(0.0018)
Computer Science					−0.0372***	0.0051***	0.0028
					(0.0013)	(0.0013)	(0.0019)
Engineering					−0.0380***	0.0018	0.0065***
					(0.0012)	(0.0012)	(0.0018)
Healthcare					−0.0481***	−0.0308***	−0.0075***
					(0.0012)	(0.0013)	(0.0018)
Humanities					0.0161***	0.0195***	0.0159***
					(0.0013)	(0.0013)	(0.0017)
Law and Administration					0.1193***	0.1068***	0.0406***
					(0.0020)	(0.0020)	(0.0024)
Media					−0.0376***	−0.0184***	−0.0053*
					(0.0019)	(0.0019)	(0.0028)
Natural Sciences					−0.0377***	0.0106***	0.0201***
					(0.0013)	(0.0013)	(0.0018)
Pedagogy					0.0032**	0.0082***	0.0127***
					(0.0015)	(0.0015)	(0.0018)
Security					−0.0345***	−0.0283***	−0.0062***
					(0.0013)	(0.0013)	(0.0019)
Social Sciences					0.0512***	0.0479***	0.0299***
					(0.0015)	(0.0014)	(0.0018)
R-squared	.023	.0041	.036	.0049	.035	.081	.76
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ROL FE	No	No	No	No	No	No	Yes

***: p<0.01, **: p<0.05, *: p<0.1.

Notes: The table presents the results of a linear regression of an indicator of dominated choices on program characteristics, such as the state-funded priority-score cutoff, program type (omitted: BA-MA program), program schedule (omitted: evening program), program location (omitted: town), and field of study (omitted: sport). Robust standard errors are in parentheses. The sample covers the period between 2009 and 2014. The number of applications is 1,521,644, which corresponds to 528,172 ROLs. The share of dominated choices (on the application-level) is 6.64 percent in this sample. All specifications include year fixed effects, and the specification presented in column (7) includes ROL fixed effects as well.

Table 8: Program characteristics and dominated choices: heterogeneity

Dependent variable	Dominated choice			
	Disadvantaged	Non-disadvantaged	Low 11th-grade GPA	High 11th-grade GPA
	(1)	(2)	(3)	(4)
Priority-score cutoff (state-funded, standardized)	0.0114***	0.0240***	0.0355***	0.0133***
	(0.0008)	(0.0003)	(0.0006)	(0.0004)
Bachelor program	−0.0015	0.0066***	−0.0015	0.0051***
	(0.0028)	(0.0010)	(0.0025)	(0.0010)
Full-time program	−0.0350***	−0.0322***	−0.0404***	−0.0174***
	(0.0052)	(0.0015)	(0.0021)	(0.0022)
Program location: capital	−0.0070***	−0.0239***	−0.0295***	−0.0131***
	(0.0019)	(0.0008)	(0.0013)	(0.0009)
Program location: county capital	0.0029*	−0.0017**	−0.0011	−0.0003
	(0.0017)	(0.0008)	(0.0012)	(0.0009)
Agriculture	0.0035	0.0070***	0.0129***	0.0034
	(0.0036)	(0.0020)	(0.0030)	(0.0024)
Arts	−0.0102*	−0.0074***	−0.0278***	0.0036
	(0.0058)	(0.0024)	(0.0041)	(0.0030)
Business and Economics	0.0131***	0.0282***	0.0225***	0.0317***
	(0.0038)	(0.0019)	(0.0030)	(0.0024)
Computer Science	0.0027	0.0026	0.0081**	0.0041
	(0.0039)	(0.0020)	(0.0031)	(0.0025)
Engineering	0.0056	0.0064***	0.0116***	0.0066***
	(0.0036)	(0.0019)	(0.0030)	(0.0024)
Healthcare	−0.0004	−0.0086***	−0.0049	−0.0041*
	(0.0035)	(0.0019)	(0.0031)	(0.0024)
Humanities	0.0103***	0.0163***	0.0219***	0.0134***
	(0.0035)	(0.0019)	(0.0029)	(0.0024)
Law and Administration	0.0271***	0.0423***	0.0427***	0.0397***
	(0.0056)	(0.0026)	(0.0046)	(0.0030)
Media	−0.0177***	−0.0040	−0.0227***	0.0068*
	(0.0067)	(0.0029)	(0.0046)	(0.0039)
Natural Sciences	0.0121***	0.0202***	0.0276***	0.0160***
	(0.0037)	(0.0019)	(0.0031)	(0.0024)
Pedagogy	0.0061*	0.0131***	0.0188***	0.0104***
	(0.0037)	(0.0020)	(0.0030)	(0.0025)
Security	−0.0030	−0.0069***	−0.0136***	0.0070***
	(0.0039)	(0.0021)	(0.0032)	(0.0026)
Social Sciences	0.0129***	0.0316***	0.0341***	0.0282***
	(0.0037)	(0.0019)	(0.0029)	(0.0025)
Year FE	Yes	Yes	Yes	Yes
R-squared	0.69	0.76	0.76	0.74

***: p<0.01, **: p<0.05, *: p<0.1.

Notes: The table presents the results of a linear regression of an indicator of dominated choices on program characteristics, such as the state-funded priority-score cutoff (standardized), program type (omitted: BA-MA program), program schedule (omitted: evening program), program location (omitted: town), and field of study (omitted: sport). Robust standard errors are in parentheses. The sample covers the period between 2009 and 2014. The number of applications is 1,521,644, which corresponds to 528,172 ROLs. The share of dominated choices (on the application-level) is 6.64 percent in this sample. All specifications include year and ROL fixed effects.

Supplemental Material (for Online Publication)

A The Application Interface

This Appendix presents screenshots from the online application interface.

Figure A1 presents an example of an ROL. This ROL includes three programs with six contracts. A contract is a combination of the institution (e.g., ELTE), faculty (e.g., TÁTK), major (e.g., szociológia – sociology), degree (A – Bachelors), schedule (N – full time), and state-funding (A – state-funded, K – self-funded).

Figure A1: An Example of an ROL

Notes: Source: https://goo.gl/KQGPvD, accessed: 11/12/2018.

Adding a contract to an ROL involves the following three steps:

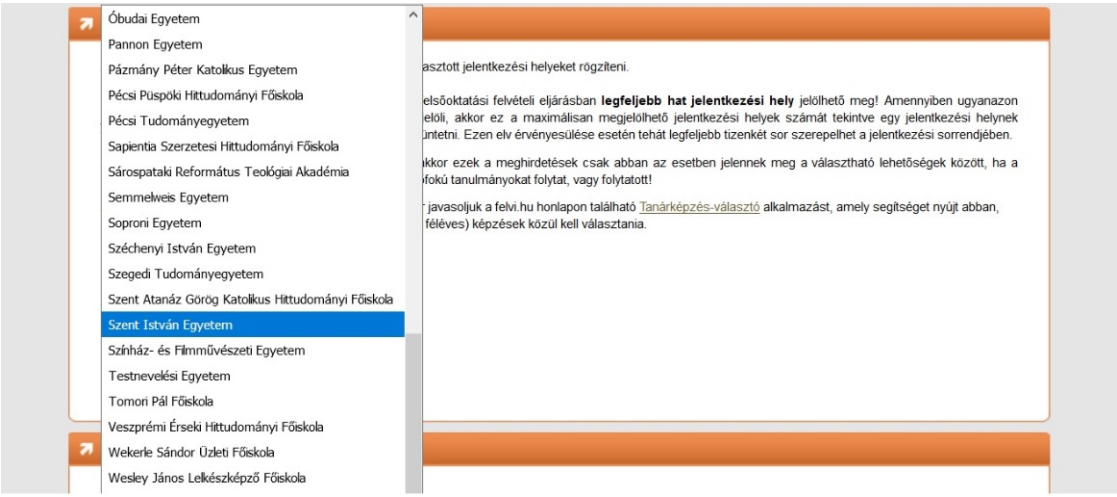
Step 1: Selecting an institution, e.g., Szent István Egyetem (Figure A2).

Step 2: Selecting a faculty, e.g., SZIE–ÉTK (Figure A3).

Step 3: Selecting a contract (i.e., a major – degree – schedule – funding combination), e.g., Építőmérnöki ANA – Civil engineering, Bachelors, full time, funded (Figure A4).

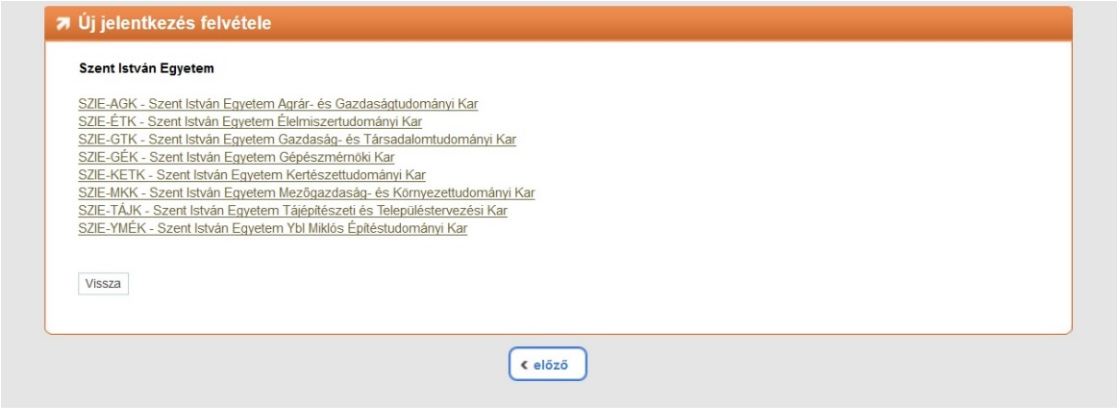
Of note, contracts that differ only in the level of funding appear consecutively in the dropdown menu in Step 3.

Figure A2: Step 1: Institution selection



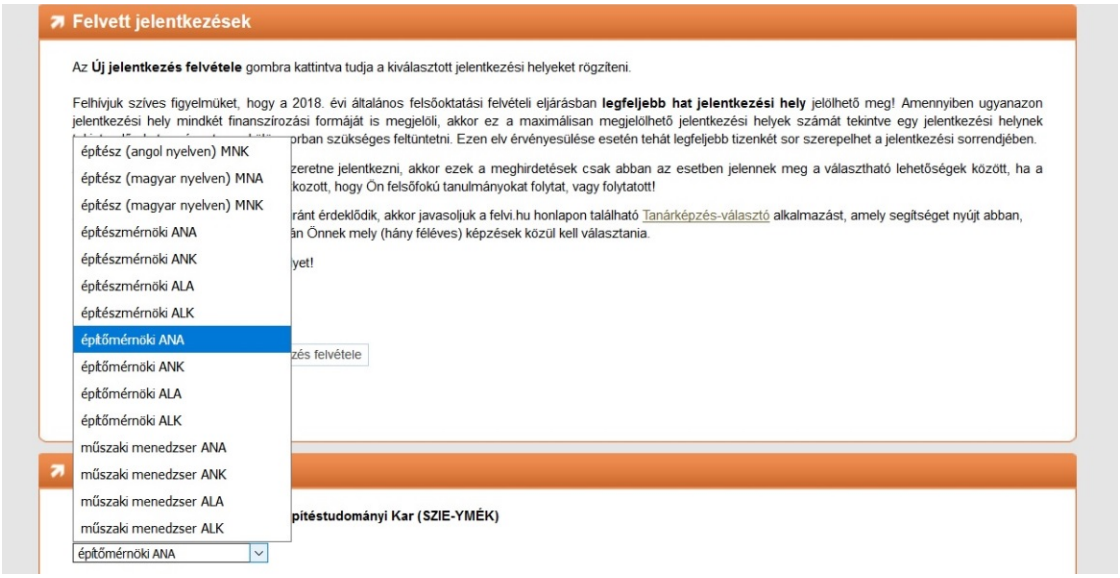
Notes: Source: https://goo.gl/PyV4mc, accessed: 11/12/2018.

Figure A3: Step 2: Faculty selection



Notes: Source: https://goo.gl/PyV4mc, accessed: 11/12/2018.

Figure A4: Step 3: Contract selection



Notes: Építőmérnöki – ANA refers to the contract "Civil engineering – Bachelors (A), Full-time (N), Funded (A)." Építőmérnöki – ANK refers to the contract "Civil engineering – Bachelors (A), Full-time (N), Self-funded (K)." Source: https://goo.gl/PyV4mc, accessed: 11/12/2018.

B Additional Results

Table B1: Demographics, socioeconomic status, academic achievement and dominated choices: Relevant applicants

Dependent variable	Dominated choice		
	(1)	(2)	(3)
Unemployment rate in 2008 (%)	−0.000		
	(0.000)		
Gross annual per capita income (1000 USD)		0.003***	
		(0.001)	
Disadvantaged status			−0.083***
			(0.005)
11th-grade GPA (standardized)	−0.052***	−0.052***	−0.052***
	(0.001)	(0.001)	(0.001)
Vocational school	0.017***	0.018***	0.017***
	(0.002)	(0.002)	(0.002)
Other school	0.020***	0.021***	0.014**
	(0.006)	(0.006)	(0.006)
County capital	−0.023***	−0.014***	−0.023***
	(0.003)	(0.004)	(0.003)
Town	−0.024***	−0.012***	−0.022***
	(0.003)	(0.004)	(0.003)
Village	−0.026***	−0.012***	−0.024***
	(0.003)	(0.004)	(0.003)
Female	0.036***	0.037***	0.038***
	(0.002)	(0.002)	(0.002)
Year FE	Yes	Yes	Yes
R-squared	.023	.023	.024

***: p<0.01, **: p<0.05, *:p<0.1.

Notes: The table presents the results of a linear regression of an indicator for dominated choices on demographics, measures of academic achievement, and measures of socioeconomic status. The regression coefficients are conditional on year fixed effects. Robust standard errors are in parentheses. The share of dominated choices is 26.6 percent in the relevant subsample. Eleventh-grade GPA is missing for 18.7 percent of the sample. We include an indicator for those missing observations in our regressions. The sample includes 218,502 ROLs. The omitted residence is the capital. The omitted school type is secondary grammar school.

Table B2: Demographics, socioeconomic status, academic achievement and dominated choices: High-school senior applicants

Dependent variable	Dominated choices		
	(1)	(2)	(3)
Unemployment rate in 2008 (%)	−0.002***		
	(0.000)		
Gross annual per capita income (1000 USD)		0.007***	
		(0.000)	
Disadvantaged status			−0.030***
			(0.001)
11th-grade GPA (standardized)	−0.030***	−0.030***	−0.030***
	(0.001)	(0.001)	(0.001)
Vocational school	−0.006***	−0.005***	−0.005***
	(0.001)	(0.001)	(0.001)
Other school	0.005	0.005	0.002
	(0.005)	(0.005)	(0.004)
County capital	−0.027***	−0.011***	−0.030***
	(0.002)	(0.002)	(0.002)
Town	−0.032***	−0.014***	−0.038***
	(0.002)	(0.002)	(0.002)
Village	−0.041***	−0.018***	−0.046***
	(0.002)	(0.002)	(0.002)
Female	0.018***	0.018***	0.019***
	(0.001)	(0.001)	(0.001)
Year FE	Yes	Yes	Yes
R-squared	.036	.037	.037

***: p<0.01, **: p<0.05, *:p<0.1.

Notes: The table presents the results of a linear regression of an indicator for dominated choices on demographics, academic achievement, and measures of socioeconomic status. The regression coefficients are conditional on year fixed effects. Robust standard errors are in parentheses. The share of dominated choices is 5.8 percent. Eleventh-grade GPA is missing for 17.8 percent of the sample. We include an indicator for those missing observations in our regressions. The sample includes 269,932 ROLs. The omitted residence is the capital. The omitted school type is secondary grammar school.

Table B3: Demographics, socioeconomic status, academic achievement and dominated choices

Dependent variable	Dominated choice						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Unemployment rate in 2008 (%)	−0.003***						
	(0.000)						
Gross annual per capita income (1000 USD)		0.010***					
		(0.000)					
Disadvantaged status			−0.078***				
			(0.001)				
11th-grade GPA (standardized)				−0.040***			
				(0.000)			
Vocational school					0.019***		
					(0.001)		
Other school					0.018***		
					(0.002)		
County capital						−0.041***	
						(0.001)	
Town						−0.048***	
						(0.001)	
Village						−0.058***	
						(0.001)	
Female							0.011***
							(0.001)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.0062	.0091	.0077	.021	.0046	.008	.0041

***: p<0.01, **: p<0.05, *:p<0.1.

Notes: The table presents the results of linear regressions of an indicator for dominated choices on demographics, measures of academic achievement, and measures of socioeconomic status. The regression coefficients are conditional on year fixed effects. Robust standard errors are in parentheses. The share of dominated choices is 11.0 percent. The sample includes 528,172 ROLs. The omitted school type is secondary grammar school (column (5)). The omitted residence is the capital (column (6)).

Table B4: Program characteristics and dominated choices: 2009–2011

Dependent variable	Dominated choice						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Priority-score cutoff (state-funded, standardized)	0.0221***					0.0164***	0.0173***
	(0.0002)					(0.0003)	(0.0004)
Bachelor program		−0.0114***				0.0009	0.0107***
		(0.0010)				(0.0011)	(0.0013)
Full-time program			−0.1350***			−0.1574***	−0.0426***
			(0.0009)			(0.0011)	(0.0019)
Program location: capital				−0.0319***		−0.0107***	−0.0181***
				(0.0010)		(0.0011)	(0.0009)
Program location: county capital				−0.0272***		−0.0045***	−0.0022**
				(0.0010)		(0.0010)	(0.0009)
Agriculture					−0.0106***	0.0050***	0.0004
					(0.0020)	(0.0019)	(0.0023)
Arts					−0.0419***	−0.0111***	−0.0073**
					(0.0019)	(0.0018)	(0.0029)
Business and Economics					0.0145***	0.0201***	0.0044**
					(0.0017)	(0.0017)	(0.0022)
Computer Science					−0.0408***	−0.0039**	−0.0045*
					(0.0017)	(0.0017)	(0.0024)
Engineering					−0.0398***	−0.0053***	−0.0020
					(0.0017)	(0.0016)	(0.0023)
Healthcare					−0.0462***	−0.0339***	−0.0113***
					(0.0017)	(0.0017)	(0.0023)
Humanities					0.0115***	0.0163***	0.0071***
					(0.0018)	(0.0017)	(0.0022)
Law and Administration					0.0814***	0.0645***	0.0221***
					(0.0024)	(0.0025)	(0.0029)
Media					−0.0365***	−0.0174***	−0.0136***
					(0.0025)	(0.0025)	(0.0034)
Natural Sciences					−0.0410***	0.0020	0.0125***
					(0.0018)	(0.0018)	(0.0023)
Pedagogy					0.0249***	0.0148***	0.0063**
					(0.0022)	(0.0021)	(0.0025)
Security					−0.0263***	−0.0220***	−0.0075***
					(0.0019)	(0.0018)	(0.0024)
Social Sciences					0.0358***	0.0291***	0.0131***
					(0.0019)	(0.0018)	(0.0022)
R-squared	.012	.0026	.052	.0039	.022	.082	.77
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ROL FE	No	No	No	No	No	No	Yes

***: p<0.01, **: p<0.05, *: p<0.1.

Notes: The table presents the results of a linear regression of an indicator of dominated choices on program characteristics, such as the state-funded priority-score cutoff, program type (omitted: BA-MA program), program schedule (omitted: evening program), program location (omitted: town), and field of study (omitted: sport). Robust standard errors are in parentheses. The sample covers the period between 2009 and 2014. The number of applications is 887,051, which corresponds to 306,926 ROLs. The mean outcome in the sample is 6.0 percent. All specifications include year fixed effects, and the specification presented in column (7) includes ROL fixed effects as well.