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The Large Core of College Admission Markets: Theory and Evidence

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In recent years, a growing number of students are being assigned to schools through centralized clearinghouses. The success of such clearinghouses crucially relies on the use of a stable matching mechanism [10, 12]. The matching market design literature finds that a designer who wishes to implement a stable allocation has limited scope for further design. First, the rural hospital theorem determines that the same positions are filled in all stable allocations [7, 9]. Second, the set of stable allocations has the consensus property: all students prefer the outcome of the student-proposing deferred acceptance mechanism (henceforth) to any other stable allocation [4, 8]. Third, empirical and theoretical studies suggest that all students, save for a handful, receive the same assignment in all stable allocations [e.g., 1, 2, 5, 6, 11]. This last finding implies that schools have limited incentive to collect information and to misreport their preferences [3].

The above-mentioned results apply to two-sided matching markets (men and women, students and schools, etc.) where agents' preferences are over potential partners from the other side. However, the environments studied and designed by economists are often more complex. For example, college applicants care not only about the study program they are assigned to, but also about the level of financial aid they receive. In this paper, we ask whether the set of stable allocations continues to be small in these more complex environments.

We study Hungarian college admissions, where colleges offer multiple levels of financial aid. In this environment, we show theoretically and empirically that it is no longer true that almost all students receive the same assignment in all stable allocations. Furthermore, different stable allocations differ in the set of positions filled and in the composition of assigned students, and there is no consensus among students on the most-preferred stable allocation.

Can we expect stable allocations to be meaningfully different in realistically-sized markets? To answer this question, we develop a large market model of Hungarian college admissions markets and study the assumptions required from this model to guarantee that the set of stable allocations is large. Our main theoretical result is that the set of stable allocations is large when students are heterogeneous in their sensitivity to financial terms. By contrast, when students are not heterogeneous in their sensitivity to financial terms—that is, when all students find both contracts with the same college to be nearly perfect substitutes or when all students do not find them to be close substitutes—then the set of stable allocations is small. We also show that both variants of DA allocate funding based on merit and that the set of merit-based allocations is small.

The proof of the main theoretical result and our empirical analysis rely on the *preference flip algorithm*, a novel stable algorithm. The algorithm can be interpreted as allowing colleges to exercise their *local market power* over students who are admitted with state funding, but who have no outside option (a contract at another college or being unassigned) that they prefer to the self-funded contract with the same college.

We next assess the size of the set of stable allocations empirically using administrative data from the Hungarian college admissions system. We document substantial heterogeneity in applicants' sensitivity to financial

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terms. In line with our large market analysis, both variants of DA result in essentially identical allocations, while the outcome of the preference flip algorithm differs for more than 9,000 applicants (approximately 8 percent of the applicants), with slightly more winners than losers. More importantly, the preference flip algorithm increases the number of applicants assigned to college by 1.9 percent (approximately 1,500) with approximately 2,100 unassigned applicants gaining admission and approximately 600 losing their place. Since programs in the capital—which are generally prestigious and highly demanded—typically fill all their positions both under DA and under our alternative, the gains in enrollment mostly accrue to colleges in the periphery.

We analyze the characteristics of those who benefit and lose from the preference flip algorithm. Applicants who prefer the outcome of the preference flip algorithm to the outcome of DA come from a lower socioeconomic background relative to applicants who prefer the outcome of DA. This non-merit-based stable allocation also increases geographic mobility by increasing the number of applicants assigned to a college outside their county of residence.

The full paper is available at <http://rshorner.weebly.com/research.html>

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