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College assignment as a large contest

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Abstract

We develop a model of college assignment as a large contest wherein students with heterogeneous learning-costs compete for seats at vertically differentiated colleges through the acquisition of productive human capital. We use a continuum model to approximate the outcomes of a game with large, but finite, sets of colleges and students. The continuum approximation lends tractability to a rich model for studying investment incentives in rank-order competitions. By incorporating two common families of affirmative action mechanisms into our model, admissions preferences and quotas, we can show that (legal) admissions preference schemes and (illegal) quotas have the same sets of equilibria including identical outcomes and investment strategies.

JEL classification: D44; C72; I20; I28; L53

Keywords: Affirmative action; Contests; Approximate equilibrium

1. Introduction

There are many economically salient features of the competition between students for admission to college. An ideal model would include heterogeneity amongst the colleges in terms of quality, allow for differences amongst the students in terms of ex-ante learning costs, and endogenize the decisions students make to compete for admission.[1] For many policy questions, it is also

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[1] The student's private information is about her learning cost. Although we sometimes refer to this as "ability," the learning cost is determined by many factors that are exogenous to the student but under the control of society at large. An example of these factors is access to high quality public education at the primary and secondary level, which varies geographically and based on socioeconomic status of the student's parents.

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necessary to allow for asymmetric admissions policies that grant preferential treatment to the children of alumni (so-called "legacy" status) or students from underrepresented demographic backgrounds (affirmative action). In the latter case, a further complication arises: a primary motivation for policies like affirmative action is the idea of systematic a priori asymmetries between students due to socioeconomic factors (e.g., access to relevant resources like high-quality primary and secondary school education). While many models include one or two of the above factors, providing a tractable model of the market that includes all four features—college heterogeneity, student heterogeneity, a priori cost asymmetry, and asymmetric allocation mechanisms—has proven difficult.

A primary reason for the difficulty is the dual role played by human capital (HC) in college admissions. First, a student's HC is a durable asset which yields a direct economic return, leading to what we call a *productive channel* of investment incentives. This channel is present in the complete-information assortative matching model of Becker (1973). Second, because each student's ex-ante ability is private information, colleges must rely on observable measures of HC production in order to separate high-ability students from their lower-ability counterparts when deciding who will be admitted to each college. Because of this, increasing HC yields an additional, indirect benefit since students who invest more also gain access to higher quality match partners in the college admissions market. The resulting *competitive channel* of incentives resembles the signaling incentives analyzed in the seminal model of Spence (1973).

We model the college admissions market as a contest wherein colleges are rank-ordered and students compete for admission by endogenously choosing the level of HC to accrue prior to a rank-order admissions contest. While this model is difficult to solve when it includes a finite number of students and colleges, we show that a more tractable limit model with a continuum of colleges and students closely approximates the finite model with many agents. More formally, we show that the equilibria of the finite game must approach the unique equilibrium of the limit model as the number of students increases.

To understand why a large market setting might simplify things, consider a student (or a student's parents) that is deciding how much effort to exert in school with an eye toward applying to colleges. If the student wants to ascertain whether she is likely to be admitted to a school with a given GPA and SAT score, she does not need to consider the other students who might also be applying or the strategies they are employing. Instead, she simply consults a college guide that describes the qualifications of previously admitted students. Since the aggregated choices of many market players produces a high degree of predictability in these (endogenous) admissions criteria, she can have confidence if she meets the criterion at a given school that admission is likely.[2]

Our goal is to provide a theoretical model that can serve as a foundation for empirical work as well a tool for market design. In addition, we use our model to prove economically important results about affirmative action and it's role in the market for college admissions. Although we focus on our particular application, we believe that our framework for approximating contests with many agents using a model with a continuum of agents could prove useful. For example, one might imagine that the grant funding process used by government agencies (e.g., the National Science Foundation in the U.S.) might be approximated as a contest with many prizes (grants) that vary in quality (size of the grant) that are competed for by scholars of differing innate ability.

[2] Although this example and our main analysis are focused on college admissions, the basic insight regarding the tractability and applicability of limit games as approximations to real-world contests generalizes far outside the context of college admissions and affirmative action.