Meritocracy and Its Discontents:
Evidence from Centralizing and Decentralizing School Admissions

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Abstract

We study the short- and long-run consequences of decentralized versus centralized school admissions in higher education. We analyze the world's first known transition to nationally-centralized admissions and its subsequent reversals during the early 20th century in Imperial Japan. Both in the short- and long-run, we find an equity-efficiency tradeoff between meritocracy and equal regional access to schools. In the short term, in line with theoretical predictions, the centralization led students to apply to the most prestigious school and make more inter-regional applications. This greater regional mobility made the school seat allocation more meritocratic, but also caused high-achieving applicants from urban areas to crowd out rural applicants from their local schools. These impacts were persistent. Four decades later, compared to the decentralized system, the centralized admissions increased the number of high-income earners and elite professionals who were born in urban areas relative to those born in rural areas.

Keywords: Higher Education, Centralized vs Decentralized Admissions, Matching Algorithms, Strategic Behavior, Regional Mobility, Meritocracy, Universal Access, Long-run Effects

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1 Introduction

College and school admission processes vary across time and places. One of the big modern transformations in college admissions is a growing degree of centralization. Today, over 40 countries use regionally- or nationally-integrated, single-application, and single-offer college admissions. At the end of the 19th century, however, no country used such a centralized system. How does the tide of centralization affect students' lives?[1]

This paper studies the short- and long-run consequences of centralizing school admissions. We do so by combining a series of natural experiments in history, newly assembled historical data, and a game-theoretic model. Our theoretical and empirical investigations reveal the pros and cons of centralized admissions, especially an equity-efficiency tradeoff between meritocracy and equal regional access to school.

Our empirical setting is the first known transition from decentralized to nationally-centralized school admissions. At the end of the 19th century, to modernize its higher education system, the Japanese government set up elite national schools that served as an entry point to the most prestigious tertiary education. The acceptance into these schools was merit-based, using annual entrance examinations. Initially, the government let each school run its own exam and admissions, similar to many of today's decentralized K-12 and college admissions. The schools typically ran exams on the same day so that each applicant could apply only for one school. Similar restrictions exist in today's college admissions in Italy, Japan, and the UK.

At the turn of the 20th century, the government introduced a centralized system. In this system, applicants were asked to rank schools in order of their preferences and take a single unified exam. Given their preferences and exam scores, applicants were then assigned to a school based on a well-specified computational algorithm. The algorithm was a mix of the so-called Deferred Acceptance algorithm and the Immediate Acceptance (Boston) algorithm. To the best of our knowledge, this instance is the first recorded nation-wide use of a matching algorithm.[2] Even more remarkably, for reasons detailed below, the government later re-decentralized and re-centralized the system several times, producing multiple natural experiments for studying the consequences of centralization.

We exploit these unique episodes of bidirectional institutional changes to identify the

[1]Despite the rich theoretical literature on this question (Chade et al., 2014; Che and Koh, 2016; Hafalir et al., 2018), the empirical literature is thin due mainly to the scarcity of variations in college admission institutions. Carvalho et al. (2014); Machado and Szerman (2017) are recent exceptions discussed below.

[2]As far as we know, the earliest large-scale use of the Boston algorithm was the assignment of medical residents to hospitals in New York City in the 1920s (Roth, 1990). The oldest national use of the Deferred Acceptance algorithm was the National Resident Matching Program (NRMP) in the 1950s (Roth, 1984). See Abdulkadiroğlu and Sönmez (2003) for the details of these algorithms in school admission contexts.

causal impacts of the centralized admission system.[3] We first use a game-theoretical model to predict the impacts of the centralization on application behavior.[4] Our model predicts that the centralization would cause applicants to apply to more prestigious schools and make more inter-regional applications. These theoretical predictions guide our empirical analysis.

With newly digitalized records of application and enrollment, we first find centralization has large short-run effects on both application behavior and enrollment outcomes. First, consistent with the theoretical predictions, the centralization caused stark strategic responses in application behavior. In particular, strategic incentives in the centralized system led both urban and rural applicants to more frequently rank the most prestigious urban school first. Second, the centralized system caused a greater number of high-ability applicants from urban areas to be admitted to schools in rural areas, often after being rejected by the most prestigious school. As a result, urban high-achievers crowded out rural applicants; the number of entrants to any national elite school coming from the urban area increases by 10% during centralization.[5]

In total, the short-term impacts of the centralization highlight an equity-efficiency tension. On the one hand, the centralization made the school seat allocation more meritocratic, as urban applicants with higher scores were more likely to be admitted to some school even if they failed to enter the most prestigious urban school. On the other hand, this meritocracy comes at the cost of distributional consequences of urban applicants dominating rural applicants, which upsets rural schools and communities (Yoshino, 2001a).

This equity-efficiency tradeoff compelled the government to go back and forth between decentralized and centralized systems, finally settling for a decentralized scheme.[6] Ironically,

[3]This use of bidirectional policy changes echoes other studies with similar identification methods (Niederle and Roth, 2003; Redding and Sturm, 2008; Ahlfeldt et al., 2015; Nakamura and Steinsson, 2018).

[4]Our theoretical analysis is based on the observation that the centralized and decentralized systems can be interpreted as different versions of the same mechanism with different constraints on the number of schools applicants can rank. This interpretation connects our setting to the literature on constrained school choice (Haeringer and Klijn, 2009; Calsamiglia et al., 2010; Pathak and Sönmez, 2013; Chen and Kesten, 2017; Hafalir et al., 2018).

[5]It is also empirically true that the centralized system made rural applicants more often apply to and enter urban schools. The centralized system thus increased regional mobility across the country. But their net effect is such that urban high-achievers crowded out rural applicants.

[6]The government tried to alleviate the distributional consequence by decentralizing admissions and effectively forcing rural schools to favor local students. This attempt appears to share some of the spirit with modern affirmative actions (Arcidiacono and Lovenheim, 2016). This event foreshadows ongoing policy discussions on the distributional effects of meritocratic college admissions. See, for example, discussions in Australia (Marginson, 2011), France ("Derriere l'algorithme de Parcoursup, un choix ideologique," at `https://www.nouvelobs.com/education/20180713.OBS9643/derriere-l-algorithme-de-parcoursup-un-choix-ideologique.html`, retrieved in August 2018), and the US ("How merit-based college admissions became so unfair," at `https://www.washingtonpost.com/opinions/how-merit-based-college-admissions-became-so-unfair/2018/01/10/45a3007e-f569-11e7-b34a-b85626af34ef_story.html?noredirect=on&utm_term=.e8a24d61bd11`,

it is this series of bidirectional reforms that allow us to more precisely identify the effects of centralization than a usual single policy change would permit. These short-run results complement existing empirical studies on the effects of centralization on application behavior, regional mobility, and social welfare (Niederle and Roth, 2003; Abdulkadiroğlu et al., 2006, 2009, 2017b; Carvalho et al., 2014; Hafalir et al., 2018; Machado and Szerman, 2017; Pallais, 2015; Pathak, 2017).

Finally, the centralization had lasting impacts on students' career outcomes. To assess long-term effects, we use data from the Japanese Personnel Inquiry Records in 1939 that provides a list of high-income earners and other distinguished professionals. According to our short-run analysis, urban areas experienced a disproportionate gain in school access relative to rural areas under the centralized admission system. Based on this result, we compare career outcomes of urban- and rural-born cohorts reaching an appropriate application age before and after the admission reforms.

Our differences-in-differences estimates suggest persistent effects of the centralization. Almost four decades later, the centralized system produced a greater number of high-income earners, top managers, and professionals who came from urban areas compared to rural areas. Quantitatively, the number of career elites born in urban areas increased by 10-20% for the cohorts exposed to the centralized admissions. This paper thereby contributes to the literature on the long-term effects of economic mechanism design (Bleakley and Ferrie, 2014) and more generally, the literature that uses historical data to test and refine economic theory (Greif, 1993; Kranton and Swamy, 2008; Börner and Hatfield, 2017).[7]

Section 2 provides historical backgrounds about school admissions in the world and Japan. Section 3 develops theoretical predictions, which we then test in Section 5 using data described in Section 4. Section 5 analyzes short-term impacts of centralizing admissions while Section 6 is about its long-term impacts. Finally, Section 7 summarizes our findings, discusses their limitations, and outlines future directions.

retrieved in August 2018). See also Kamada and Kojima (2015) and Agarwal (2017) among others for discussions about regional inequality in other matching markets. In addition to the distributional concerns, administrative costs of centralization (e.g., coordination and communication among schools) also burdened the government.

[7]Our analysis provides evidence about the impacts of different admission systems, thus complementing the literature on the effects of different schools conditional on a particular admission system (Dale and Krueger, 2002; Altonji et al., 2012; Dobbie and Fryer, 2013; Hastings et al., 2013; Pop-Eleches and Urquiola, 2013; Deming et al., 2014; Kirkeboen et al., 2016; Abdulkadiroğlu et al., 2017a; Zimmerman, forthcoming). Our results also relate to empirical studies of the long-term effects of educational institutions and resources (Duflo, 2001; Meghir and Palme, 2005; Oreopoulos, 2006; Pischke and Von Wachter, 2008). These studies focus on the effects of quantitative expansions of resources (such as school constructions and compulsory schooling extensions) while we investigate the effects of qualitatively different resource allocation mechanisms conditional on a pool of resources.

2 Background

2.1 College Admissions around the World

College and school admission institutions vary across time and places. Today, over 40 countries use regionally- or nationally-integrated, single-application, and single-offer college admissions. Figure 1 depicts countries that adopt some centralized college admissions in dark red and countries without any centralized college admissions in light yellow, showing that centralized college admissions are used in all continents except North America.

At the same time, the centralization of college admissions is a relatively new phenomenon in history. At the end of the 19th century, no country used such a centralized system. Even today, many countries like the US and Canada keep using decentralized systems. Similar points apply to K-12 school admissions as well. How does the centralization of college and school admissions affect students' application behavior, enrollment results, and future careers? Understanding the costs and benefits of centralization will have important implications for policy designs.

2.2 Centralizing Admissions in Imperial Japan

To evaluate the impacts of centralized school admissions, we go back to the world's first known implementation of a centralized system at the turn of the 20th century in Imperial Japan. After the Meiji Restoration of 1868, education reforms were a central part of modernization efforts by the Japanese government. In 1894, the government launched a new set of higher education institutions consisting of one Imperial University and five national Higher Schools. By 1908, it was expanded to four Imperial Universities (Tokyo, Kyoto, Tohoku, and Kyushu) and eight national Higher Schools (First in Tokyo, Second in Sendai, Third in Kyoto, Fourth in Kanazawa, Fifth in Kumamoto, Sixth in Okayama, Seventh in Kagoshima, and Eighth in Nagoya, named after the order in which they were established) in key locations across Japan as shown in Figure 2a. Hereafter we refer to the eight national schools as Schools 1-8 for short.[8]

These schools served effectively as an entry point to Imperial Universities (the most prestigious tertiary education) as virtually all graduates of Schools 1-8 were admitted to these universities without further selection until 1918 if not later. Furthermore, Imperial University

[8]Schools 1-5 were established in 1894 and Schools 6, 7, and 8 were established in 1900, 1901, and 1908, respectively. Despite the growing demand for higher education, due to fiscal constraints, the number of national schools remained constant until 1917. In addition to Schools 1-8, there was a quasi-national school, Yamaguchi Higher School, which was established in 1894, discontinued in 1904, and re-established in 1918. The number of higher education institutions increased after 1918, as the government permitted not only national but also local public and private high schools and universities.

graduates were partially or wholly exempted from the Higher Civil Service Examinations and other highly selective national qualification exams (Amano, 2007). As a result, entering Schools 1-8 was considered an equivalent to obtaining a passport into the elite class in Imperial Japan. To apply to these schools, one must be male aged 17 or older and have completed a middle school. As Schools 1-8 admitted only about two thousand students each year, they constituted less than 0.5% of the cohort of male aged 17.

The admissions to Schools 1-8 were merit-based and determined by annual entrance examinations. Initially, the government let each school administer its own exam and admissions, and the schools typically ran their exams on the same day so that each applicant could apply to only one school. We call this system "decentralized admissions," "decentralized applications," or Dapp for short.

All schools were not created equal, however. Among the eight schools, School 1 in Tokyo was considered by far the most prestigious due to its capital location and close ties with Tokyo Imperial University. The next most prestigious was School 3 in Kyoto. By contrast, located in a remote southwest region, School 5 and School 7 were considered the least prestigious among all. Consequently, the schools differed substantially in their popularity and selectiveness. For example, in 1901, the rate of acceptance (i.e., the share of admitted applicants in all applicants) was 23% in School 1 (Tokyo), compared to 51% in School 5. In fact, many highly talented students who applied to School 1 (Tokyo) were rejected and had to give up or retake the exam in the subsequent year, while less popular schools were admitting not so talented students. For the government whose goal was to select the best and brightest and send them to higher education, the decentralized system seemed inefficient.

To remedy this problem, in 1902, the government instituted a centralized system in which applicants were asked to select multiple schools they would like to enter, rank them in order of their preferences, and take a single unified entrance exam at the nearest school from their residence. Applicants were then assigned to a school (or no school if unsuccessful) according to their exam scores and school preferences, based on a well-specified centralized algorithm announced ex ante. To the best of our knowledge, this is the world's first recorded large-scale use of a matching algorithm. We call this system "centralized admissions," "centralized applications," or Capp for short. In proposing this system, the Higher Education Committee explained its purpose as to enroll "students of superior academic talents," placing a clear emphasis on meritocracy (Yoshino, 2001a, p.53).

This institutional innovation, however, was short-lived. Partly in response to the oppositions by school principals as discussed later, the government switched back to Dapp (with a modification of using a unified exam) in 1908. The government continued to oscillate between decentralization and centralization, however, reintroducing Capp (with a slight

modification) in 1917, moving back to Dapp (with a unified exam) in 1919, reinstituting Capp (with major modifications) in 1926, finally settling down to Dapp (returning to its most decentralized form) in 1928.

In other words, in a space of thirty years, there were three periods of centralized admissions: first in 1902-07, next in 1917-18, and finally in 1926-27. We exploit this series of bidirectional policy changes to identify the causal impacts of centralization on the selection of students and their career outcomes.[9] According to historical studies, these repeated policy changes were the result of tugs- of- war between the Ministry of Education who pushed for centralization and meritocracy and the Association of School Principals who preferred decentralization and regional autonomy (Amano, 2017; Takeuchi, 2011). In the following empirical analysis, we take the timing of reform as exogenous, namely, we assume that every year there was a positive probability that the current system could change, but exactly when it happens was determined largely by external conditions that affect relative bargaining power of the two opposing parties.[10]

To understand the centralized system and how it operated, we briefly describe the algorithm and assignment results in 1917 (only year in which such data are available; note that the 1917-18 algorithm is only slightly different from the 1902-07 algorithm). New application procedures were announced in April, three months before the exam, as a public notice published in Government Gazette. The assignment rules were as follows (see Appendix Figure A.2 for a reprint of the original notice in Japanese).

(1) First, select the same number of applicants as the sum of each school capacity in descending order of exam score. If the score is tied, decide by lottery.

(2) Second, for applicants selected in (1), in descending order of exam score, assign each applicant to the school of his first choice until the school capacity is filled. If the score is tied, decide by lottery.

(3) Third, for those applicants who are selected in (1) and not assigned to any school in (2), in descending order of exam score, assign each applicant to a school of their second choice until the school capacity is filled. If the score is tied, decide by lottery.

[9]These historical episodes are well known among historians of the Japanese education, who provide detailed institutional accounts (e.g., Yoshino, 2001a,b; Takeuchi, 2011; Amano, 2007, 2017). The preceding studies, however, are mostly descriptive and qualitative. In this study, we combine a formal model and quasi-experimental empirical methods to analyze the causal effects of centralizing school admissions.

[10]For example, the second and third introduction of Capp was implemented by the same person who was named the Minister of Education in 1916 and again in 1924 under the different Cabinets (Amano, 2017, Chapter 6).

(4) Finally, for those applicants who are selected in (1) and not assigned to any school in (2) and (3), in descending order of exam score, assign each applicant to a school of their third choice or below that has an unfilled seat. If the score is tied, decide by the school preference order. If both the score and the preference order are the same, decide by lottery.

Written more than a century ago, the rules were described clearly and precisely in an almost mathematical manner. Observe that the above method imposes meritocracy up front in which only top-scoring applicants were considered for admission regardless of their school preference order (Step (1)). Then these applicants are assigned to one of Schools 1-8 using a mix of the so-called Immediate Acceptance (Boston) algorithm (Steps (2) and (3)) and the Deferred Acceptance algorithm (Step (4)). In other words, consistent with the stated purpose, the assignment rules were designed to maximize the lowest score of accepted applicants.

To see whether or not actual school assignments are consistent with the above algorithm, Appendix Table A.4 presents the number of admitted applicants (to the Department of Law and Literature in each school) and their exam scores by their school preference order. Observe that, in the prestigious School 1 (Tokyo) and School 3 (Kyoto), all seats were filled with applicants who ranked these schools as their first choice. Both the maximum and minimum exam scores of School 1 entrants were the highest among all schools, indicating that School 1 was the most selective, followed by School 3, School 4, and School 2, in that order. By contrast, Schools 5 and 7 were admitting a fair number of students who ranked the school as their third choice or below, because they did not have sufficient number of high-scoring applicants who placed these schools on the top of there preference order. Observe also that students who were admitted to the school of their third choice or below are not necessarily low ability students. For example, the highest-score entrant to School 7 (with the score of 450) was the applicant admitted to his third choice after failing to enter Schools 1 and 3 by a narrow margin.

Finally, consistent with the principle of meritocracy that maximizes the lowest score of entrants, setting aside Schools 1 and 3, the lowest score was comparable across schools (374 in School 2, 364 in School 4, 362 in School 5, 364 in School 6, 364 in School 7, and 363 in School 8). In summary, these observations indicate that the centralized admissions system was carefully designed and well implemented.

3 Theory

To guide our empirical investigation, we develop a game-theoretical model to analyze the impacts of centralizing school admissions on application behavior. The model has two central predictions. First, the greater number of applicants will apply to the most prestigious school under centralized admissions (Capp) than under decentralized admissions (Dapp). Second, applicants will make more inter-regional applications under Capp relative to Dapp.

We consider the simplest model with two schools S_1 and S_2 with capacities q_1 and q_2, respectively, and a fixed set of male applicants $I = \{1, 2, , n\}$ where $q_1 + q_2 < n$. Each school can observe an individual's test score if he applies to the school. We assume applicants with homogeneous preference: let v_k be the utility from school S_k, and assume $v_1 > v_2 > 0$ for all applicants. This means that S_1 is more preferred than S_2 for all applicants. If an applicant does not receive any offer, then his utility is 0. We assume that it is costless to apply to any school.

Before applicants apply to schools, applicants take a standardized test and receive a privately known test score: $t_i \in [0, 1]$. Applicants cannot observe others' test scores and believe that others' test score follow a cumulative distribution function, $t_j \sim_{iid} F(t)$. This $F(s)$ is applicants' common belief about others' test scores.

Each applicant chooses a strategy that maximizes his expected utility. We assume that applicants are risk-neutral. The expected utility for applicant j from applying to S_i under Dapp is the following:

$$EU(S_i|t_j, Dapp) = v_i * \Pr(S_i|t_j, Dapp)$$

$\Pr(S_i|t_j, Dapp)$ is the probability of being accepted to S_i under Dapp conditional on score t_j and applying to S_i. Let n_i be the number of applicants applying to S_i. Since an applicant must be in the top q_i among all applicants to be accepted to S_i , we have

$$\Pr(S_i|t_j, Dapp) = 1 * \Pr(n_i \leq q_i) + \sum_{m=q_i+1}^{n} \Pr(n_i = m) \sum_{k=0}^{q_i-1} \binom{m-1}{k} F(t_j)^{m-k-1}(1 - F(t_j))^k.$$

The expected utility for applicant j from submitting a preference ranking (S_x, S_y) (where $x, y \in \{1, 2\}$ and $x \neq y$) under Capp is as follows:

$$EU((S_x, S_y)|t_j, Capp) = v_x * \Pr(S_x^1|t_j, Capp) + v_y * \Pr(S_y^2|t_j, Capp)(1 - \Pr(S_x^1|t_j, Capp))$$

where $\Pr(S_i^k|t_j, Capp)$ is the probability of being accepted to S_i with score t_j when ranking

S_i k-th under Capp. In order to be accepted to S_i, an applicant must be in the top q_i among all applicants whose first choice is S_i, so that:

$$\Pr(S_i^1|t_j, Capp) = 1 * \Pr(n_i^1 \leq q_i) + \sum_{m=q_i+1}^{n} \Pr(n_i^1 = m) \sum_{k=0}^{q_i-1} \binom{m-1}{k} F(t_j)^{m-k-1}(1-F(t_j))^k$$

where n_i^1 is the number of applicants ranking S_i first. We also have

$$\begin{aligned}\Pr(S_i^2|t_j, Capp) &= 0 \ * \ \Pr(n_i^1 \geq q_i) + \sum_{m=0}^{q_i-1} \Pr(n_i^1 = m) \sum_{k=0}^{q_i-m-1} \binom{n_i^2-1}{k} F(t_j)^{n_i^2-k-1}(1-F(t_j))^k \\ &= \sum_{m=0}^{q_i-1} \Pr(n_i^1 = m) \sum_{k=0}^{q_i-m-1} \binom{n_i^2-1}{k} F(t_j)^{n_i^2-k-1}(1-F(t_j))^k\end{aligned}$$

Based on the above model, we obtain the following prediction.

Proposition 1. *The number of applicants who apply to the most prestigious school S_1 is weakly larger under centralized admissions than under decentralized admissions.*

The intuition for this proposition is that Capp will cause applicants to give a shot at the most prestigious and selective school since Capp gives applicants a chance of acceptance by lower-choice schools after rejected by the first-choice school. The predicted increase in inter-regional applications is even more intuitive and mechanical since centralized admissions allow applicants to rank and apply to a greater number of schools.

4 Data

For analyzing short-run effects of centralization, we collect data on applications, enrollments, and other outcomes from several administrative and non-administrative sources.

First, we collect data on the number of applicants by year and the school of their first choice from 1898 to 1930 for Schools 1-8 from multiple sources: Government Gazettes for 1902; Letters Exchanged between the Ministry of Education and Tokyo Imperial University for 1903 and 1904; Yoshino (2001a) for 1907; the Investigation Records of Higher School Entrance Examinations by the Ministry of Education for 1917,1918 and 1927; and the Yearbook of the Ministry of Education for other years.

Data on applicants' birth prefectures are available only for 1916 (under Dapp) and 1917 (under Capp) from the Investigation Records of Higher School Entrance Examinations. For these two years, we collect the number of applicants by first-choice school and prefecture of the applicant's middle school. Birth prefecture is defined by the prefecture of legal domicile

registered in Japan's Family Registry. We include applicants born in all 47 prefectures (excluding colonies) in Japan and exclude foreign-born applicants.

Second, we compile data on the number of entrants (i.e., successfully admitted applicants) by school, year, and birth prefecture from 1898 to 1930. For this, we use the Higher School Student Registers published annually by each school to collect the number of freshmen by birth prefecture. We include only native-born freshman in the university preparatory division, excluding foreign-born students and students in medical and engineering divisions which were part of higher schools in early years. Strictly speaking, the number of freshman may differ from the number of entrants due to dropouts and holdovers. However, because the number of entrants by birth prefecture is not available, we use the number of freshmen in place of entrants in the following regression analysis.

Third, we also collect data on the number of middle school graduates by year, school type (public or private), and prefecture (defined by the location of middle school) from 1897 to 1930, using the Yearbook of the Ministry of Education, to control for the supply of potential applicants as well as the general education level. We also control for the numbers of national, public, and private high schools by prefecture that were established in addition to Schools 1-8 after the 1919 reform, using the same source.

Finally, to measure the geographical mobility of applicants and entrants, we compute distance as follows. Since the finest geographical unit of observation is a prefecture, we define the distance between an applicant's birth prefecture and the school of his first choice by a direct (straight-line) distance between the capital of the birth prefecture and the capital of the prefecture in which the school was located. Similarly, the distance between an entrant's middle school and the higher school he was admitted to is defined by a direct distance between the two prefectural capitals determined by the prefectural locations of the middle school and the higher school. The distance data are from the Geospatial Information Authority of Japan (GSI). Descriptive statistics of main variables are summarized in Appendix Table A.2.

5 Short-run Impacts

5.1 Strategic Responses by Applicants

As an immediate effect, switching back and forth between Capp and Dapp caused stark strategic responses in application behavior. Figure 3 shows that the three episodes of Capp (in 1902-07, 1917-18, and 1926-27) are associated with a sharp increase in the share of applicants who select the most prestigious School 1 as their first choice. This is consistent with the theoretical prediction (Proposition 1) in Section 3.

Furthermore, such response was present and statistically significant in all geographic areas. The top panel of Table 1 reports the difference in the propensity of applicants to rank School 1 first between the two years, 1916 (under Dapp) and 1917 (under Capp), using the following regression:

$$Y_{it} = \alpha + \beta \times Capp_t + \epsilon_{it},$$

where Y_{it} is the indicator variable that takes 1 if applicant i in year t selects School 1 as his first choice and $Capp_t$ is the indicator variable that takes 1 if year t is under Capp. The first column shows that, at the national level, the share of applicants who rank School 1 first increased by 16 percentage points under Capp. This is about 64% increase compared to the mean of 25% under Dapp (reported as the estimate of the constant term α). Next, to observe regional variations, we group applicants into school regions based on which of Schools 1-8 was the closest to the middle school from which the applicant graduated (see the map below Table 1) and run the same regression for each region. The results indicate that, in all school regions, the share of applicants selecting School 1 rose substantially (by 11 to 19 percentage points) under Capp.

These strategic responses have heterogeneous effects on application distance (i.e., the distance between an applicant's first-choice school and middle school) as the bottom panel of Table 1 shows. At the national level, the application distance seems to have changed little between Dapp and Capp (see the first column). However, at the regional level, there were major changes. The application distance decreased by 93 km (1 km is 0.62 miles) in the School 1 region under Capp as more applicants selected the nearest and most prestigious School 1, whereas it increased by more than 100 km in the School 5 and School 7 regions located in remote west.

Overall, the results in Table 1 show that the centralization of school admissions induced a greater number of applicants around the nation to apply to the most prestigious school in Tokyo as their first choice and encouraged applicants in remote areas to make more long-distance applications. As a result, the competition to enter School 1 became more intense under the centralized system. Appendix Figure A.1 depicts changes in the competitiveness of Schools 1-8, measured by the ratio of the number of applicants who select the school as their first choice (hereafter first-choice applicants) to the number of entrants to the school. It shows that, during the periods of centralized admissions, the ratio spiked at School 1 (Tokyo), increased modestly at School 3 (Kyoto), and declined sharply at the rest of the schools. For instance, at the second introduction of Capp in 1917, School 1 attracted 12 times more first-choice applicants (4,428 in total) than its capacity (of 361 seats). This implies that only a small fraction of the first-choice applicants were admitted to School 1,

producing hundreds of high-scoring but rejected applicants. These applicants were likely to be admitted to schools of their second choice and below under the centralized assignment rules.[11]

5.2 Regional Mobility in Enrollment

Now we turn to enrollment outcomes and analyze the geographical distribution of successful applicants admitted to Schools 1-8. Note that the geographical distribution of entrants is determined by the geographical distributions of applicants as well as their abilities.

Figure 4 plots the average enrollment distance (i.e., the distance between an entrant's birth prefecture and the school he entered) from 1898 to 1900. It shows that the centralized system is associated with a sharp and discontinuous increase in enrollment distance, especially in the first two episodes of Capp.[12]

This increase in regional mobility happened, to a large extent, through a sharp reduction in the number of "local" entrants (defined by entrants who were born in the prefecture in which the school is located). We estimate the following regression for each school s separately:

$$\begin{aligned} Y_{pt} = {} & \beta_1 \times Capp_t \times 1\{\text{school } s \text{ is located in prefecture } p\} \\ & + \beta_2 \times Capp_t \times 1\{\text{school } s \text{ is 1-100 km away from prefecture } p\} \\ & + \beta_3 \times Capp_t \times 1\{\text{school } s \text{ is 101-300 km away from prefecture } p\} \\ & + X_{pt} + \gamma_t + \gamma_p + \epsilon_{pt}, \end{aligned}$$

where Y_{pt} is the number of entrants born in prefecture p who entered school s in year t. $Capp_t$ is the indicator variable that takes 1 if the system was centralized in year t. $1\{$ school s is 1-100 km away from prefecture $p\}$ is the indicator variable that takes 1 if school s is not located in, but within 100 km from prefecture p. X_{pt} controls for observable characteristics of prefecture p and year t, including the number of middle school graduates from prefecture p and the number of higher schools other than School 1-8 in prefecture p. γ_t and γ_p are year and prefecture fixed effects.

According to the results in Table 2, the coefficients of $1\{$school s is located in prefecture $p\}$ are negative and significant for all schools, implying that Capp reduces the number of local

[11] Recall that, under the meritocratic assignment rules discussed in Section 2, schools would reject first-choice applicants whose score is below a threshold and accept second-choice applicants with a sufficiently high score.

[12] The centralized mechanism used in the third episode of Capp in 1926-27 was qualitatively different from that in the first and second episodes. Because the number of national schools increased to 25 in 1926 from 8 in 1918, the schools were divided into two groups and applicants were allowed to choose and rank at most two schools from different groups in 1926-27.

entrants born in the school's prefecture. The column (1) shows that the number of School 1 entrants born in Tokyo Prefecture declined by 28 under Capp from the average of 103 entrants under Dapp, or a 27% reduction. School 7 was the most affected where the number of local entrants declined by 48%, while School 8 was least affected with a decline of 17%. Schools 4-7 experienced reductions in the number of entrants born not only from the school's prefecture but also from surrounding prefectures. In other words, the centralization weakened the local monopoly power of each school by creating a national market for higher education.[13]

5.3 Meritocracy vs Equal Regional Access

If the centralization reduced the number of local entrants, who replaced them? Which prefecture gained more school seats under the centralized system? Figure 5a plots the change in the number of entrants to Schools 1-8 from Capp to Dapp by birth prefecture (where blue colors indicate negative changes and red colors indicate positive changes). It shows that most of western prefectures and northern most prefectures lost school seats, while Tokyo Prefecture and its surrounding areas gained school seats under Capp.

Figure 5b depicts the time evolution of the share of entrants to Schools 1-8 who were born in the Tokyo area defined as prefectures located within 100 km from Tokyo (see Appendix Figure A.3). It shows that the share of Tokyo-area born entrants rose significantly during the years of centralization.

More formally, Table 3 compares the effects of Capp on Tokyo-area born entrants and locally-born entrants, estimating the following equation for a given school s:

$$\begin{aligned} Y_{pt} = {} & \beta_1 \times Capp_t \times 1\{\text{prefecture } p \text{ is Tokyo}\} \\ & + \beta_2 \times Capp_t \times 1\{\text{prefecture } p \text{ is 1-100 km away from Tokyo}\} \\ & + \beta_3 \times Capp_t \times 1\{\text{prefecture } p \text{ is 101-300 km away from Tokyo}\} \\ & + \beta_4 \times Capp_t \times 1\{\text{school } s \text{ is located in prefecture } p\} \\ & + \beta_5 \times Capp_t \times 1\{\text{school } s \text{ is 1-100 km away from prefecture } p\} \\ & + \beta_6 \times Capp_t \times 1\{\text{school } s \text{ is 101-300 km away from prefecture } p\} \\ & + X_{pt} + \gamma_t + \gamma_p + \epsilon_{pt}, \end{aligned}$$

where Y_{pt} is the number of entrants born in prefecture p who entered school s in year t.

The column (1) of Table 3 shows that the number of Tokyo-area born students admitted

[13]These results are robust to whether to control for prefecture characteristics (results available upon request).

to any of Schools 1-8 increased by 23 under Capp, indicating a 10% increase from the average of 226 under Dapp. The estimates by school in the columns (2)-(9) reveal that this effect comes mainly from Tokyo-area born students entering not prestigious urban schools (Schools 1 and 3) but less selective schools (Schools 4-8).[14] In other words, the net effect of Capp is such that the increased inter-regional applications caused high-achieving students residing mainly in the Tokyo area to crowd out lower-achieving students in remote areas from their local schools.

To summarize, our analysis of the short-term impacts of the centralization highlights an equity-efficiency tradeoff. On the one hand, the centralized admissions made the school seat allocation more meritocratic, enabling high-ability students to enter one of the eight national schools even if they failed at the most selective one (Figure A.4). On the other hand, this meritocracy comes at the expense of equal regional access to education, as high-achieving urban applicants tended to dominate rural applicants in the competition (Table 3).

5.4 Other Institutional Changes

We briefly discuss whether changes in other institutional factors could explain the results of our short-run analysis. First, if there were simultaneous reforms of middle schools, it could affect higher school application behavior. Appendix Figure A.5 shows that the number of middle school graduates changed smoothly around the introductions of Capp. Second, if there were changes in the number of entrants across years, potentially due to expansions of school capacities or increases in the number of higher schools, this could affect application behavior and enrollment outcomes. Appendix Figure A.5 shows that there were no discontinuous changes in the numbers of applicants and entrants to School 1 before and after the centralization. These observations give us some confidence that the spikes in Figures 3 and 4 are the causal effects of Capp.

6 Long-run Impacts

6.1 Long-run Outcome Data

To assess longer-term effects, we use the Japanese Personnel Inquiry Records (JPIR) published in 1939.[15]. The JPIR select approximately 60,000 distinguished individuals (such as

[14]The results remain almost the same whether we control for observable prefecture characteristics or not (a table available upon request).

[15]See Tanaka et al. (2018) for the details of the JPIR data. Digital images of the JPIR are publicly available at the National Diet Library Digital Collections.

nobles, business managers, politicians, high-ranking bureaucrats, professionals, high-income earners) and provide detailed information for each individual including his or her full name, birth date, birth prefecture, residing prefecture, final education, occupational titles and positions, employer's name if applicable, and the amount of national tax paid.

To capture the effects of the first period of Capp in 1902-1907, we use the cohorts born in 1882-1894 who became age 17 in 1899-1911 in our regression analysis. The ages of these cohorts range from 45 to 57 in 1939, the year in which we observe them in the JPIR.[16] Appendix Figure A.6 shows the total number of individuals listed in the JPIR by cohort. (The colored segment indicates cohorts who were exposed to the centralized admissions system at age 17.) The number exhibits an inverse-U shape, because an earlier-born (i.e., older) cohort is more likely to be dead or retired by 1939, while a later-born (i.e., younger) cohort is less likely to be promoted to prominent positions by the same year. These limitations notwithstanding, we have more than 1,500 observations in each cohort aged 45 to 57 in 1939. Using the occupational titles, employer's name, and the payment of income tax, we define the following (mutually non-exclusive) groups of elites among JPIR-listed individuals: (1) high-income earners (with more than 1,200 yen of taxable income), (2) managers (employed in private sector with more than 1,200 yen of taxable income), (3) professionals (doctors, engineers, lawyers, and scholars), and (4) public officials (politicians and bureaucrats).

To control for demographical changes, we collect prefecture-level data on birth population for the cohorts born in 1886-1894 from national population census and estimate that for the cohorts born in 1882-1885 using age-specific population data available in 1876-1894. To control for economic conditions, we take prefecture-level manufacturing GDP estimates in 1874, 1890, 1909, and 1925 from Tangjun et al. (2009) and interpolate them linearly for each prefecture.

Finally, to measure the geographical mobility of elites, we observe whether or not their residing prefecture differs from their birth prefecture. Descriptive statistics of main variables are presented in Appendix Table A.2.

6.2 Regional Differences in Career Outcomes

A differences-in-differences analysis by cohorts and regions suggests persistent effects of the centralized school admissions system. The key idea behind our empirical strategy is that applicants born in the Tokyo area experienced a disproportionate gain in entering Schools 1-8 under Capp relative to Dapp (recall Figure 5 and Table 3). We exploit this differential gain in school access by comparing the career outcomes of cohorts born inside and outside

[16]The average life expectancy at age 20 for males born in 1880-1900 was about forty years.

the Tokyo area who became age 17 during Capp as opposed to Dapp.

First, to check the validity of our JPIR data, Figure 6 (a) compares the number of Imperial University graduates who were born inside and outside the Tokyo area by cohorts. In these and subsequent plots, the colored cohorts indicate those who became age 17 during the first period of Capp in 1902-1907. Lightly colored cohorts are those who became age 17 before 1902 but might have taken the entrance exam in 1902 under Capp if they failed to enter any school at age 17 and retook the exam in subsequent years. As a result, in terms of birth cohorts, we expect a sharp and discontinuous change at the end of Capp in 1908, but less sharp and more gradual change at the start of Capp in 1902.

Figure 6 (c) shows that the difference in the number of Imperial University graduates between the two areas gradually increases with the introduction of Capp and drops sharply after its abolition. Recall that during these years, all graduates of Schools 1-8 were automatically admitted to the Imperial Universities. Namely, this pattern is consistent with the results of our short-run analysis, providing some assurance that our JPIR data contain meaningful information.

In Figures 6 (b) and (d), we provide a similar analysis but using an alternative geographical area of comparison for robustness check. Instead of the Tokyo Area, we identify a set of prefectures that experienced a net increase in the number of entrants to Schools 1-8 in 1902-1908 under Capp and compare individuals born inside and outside this area. The results are qualitatively the same.

Our main results are presented in Figures A.7 and Table 4. Figures A.7 shows differences-in-differences plots that compares (a) the number of high-income earners, (b) elite managers, and (c) professionals who were born inside and outside the Tokyo area during and outside the Capp period. In each category of elites, the figure shows that around the introduction of Capp, the Tokyo Area began to produce more elites than other areas by a greater margin, but this discrepancy drops at the end of Capp. Overall, Figures A.7 suggest that, almost four decades after its introduction, Capp had persistent effects on the career outcomes of students.

To quantify the long-run effects, we provide statistical differences-in-differences estimates in Table 4, using the following regression:

$$Y_{pt} = \beta \times Capp_t \times Urban_p + \gamma_p + \gamma_t + \epsilon_{pt},$$

where Y_{pt} is the number of elites in prefecture p in cohort t, $Capp_t$ is the indicator variable that takes 1 if cohort t experienced Capp at age 17, $Urban_p$ is the indicator variable that takes 1 if prefecture p is in the Tokyo area or the area where the number of entrants to

Schools 1-8 increases under Capp, and γ_p and γ_t are prefecture and cohort fixed effects.

The prefecture fixed effects capture any systematic difference in career outcomes across prefectures. The cohort fixed effects control for common shocks that affect career outcomes in all prefectures as well as secular time trends. To allow for serial correlation of ϵ_{pt} within prefectures over time (without imposing a particular structure on the form of the serial correlation), we cluster the standard errors at the prefecture level.[17] The key coefficient is β, which measures the treatment effect of the centralization on career outcomes, and should be positive if centralization has a long-run impact.

The results in Table 4 show that the long-run effects are in fact statistically and economically significant. Quantitatively, the first row of the upper panel indicates that the number of high-income earners, managers, and professionals born in the Tokyo areas increases by 18%, 15%, and 20%, respectively, for cohorts exposed to Capp relative to Dapp. The lower panel of Table 4 show that the effects are symmetric with respect to the direction of institutional change, i.e., a change from Dapp to Capp and a change from Capp to Dapp produce statistically significant and quantitatively similar effects with an opposite sign.

Finally, in the last column of Table 4, we test if the centralization, which caused substantial inter-regional mobility in enrollment outcomes, increased the geographical mobility of elites. Somewhat surprisingly, the results indicate that it was not the case: the fraction of elites born in the Tokyo area who live in prefectures outside of their birth prefectures did not increase under Capp. It might be the case that applicants from the Tokyo area who entered rural schools in a greater number under Capp eventually returned to the Tokyo area when pursuing career. The results remain qualitatively the same when we control for time-varying prefecture characteristics, including each cohort's population and economic growth (a table available upon request). Appendix Table A.3 further verifies that the differences in pre-event outcome trends between urban and rural areas are small and insignificant; the pre-event trends are therefore parallel.

7 Conclusion

Natural experiments of history provide us with an opportunity to see how different school admission institutions impact short- and long-term student outcomes. Especially unusual natural experiments occurred during the first recorded nation-wide centralization of school admissions and its later abolitions in Imperial Japan. These policy episodes produced bidi-

[17] Bertrand et al. (2004) evaluate approaches to deal with serial correlation within each cross-sectional unit in panel data. They suggest that clustering the standard errors on each cross-section unit performs well in settings with 50 or more cross-section units, as in our setting.

rectional event-study variations that allow us to more credibly identify the effects of centralization than a usual single policy event would. This use of historical events may be valuable for measuring the long-term effects of the design of other markets, such as housing, labor, and health/medical markets.

Substantively, both in the short- and long-run, we find an equity-efficiency tradeoff between meritocracy and equal regional access to schools. In particular, as is predicted by theoretical results, the centralization led students to apply to the most prestigious school and make more inter-regional applications. This greater regional mobility made the school seat allocation more meritocratic, but also caused high-achieving applicants from urban areas to crowd out rural applicants from their local schools. These impacts were persistent. Four decades later, compared to the decentralized system, the centralized admissions increased the number of high-income earners and elite managers who were born in urban areas relative to those born in rural areas. The increased meritocracy thus came at the cost of distributional consequences of urban applicants dominating rural applicants, which motivated rural schools and communities to organize oppositions to the centralized system.

Perhaps as a result of this bitter-sweet historical experience, today's national college admissions in Japan are half centralized and half decentralized: The national government runs a system in which applicants apply to a limited number of colleges. Within the governmental system, however, each college runs its own exam and admissions. Such a mixture may be a justifiable response to the tradeoffs between the centralized and decentralized systems.

The bidirectional policy changes in history allow us to relatively credibly measure even the long-term effects. An unavoidable side effect is the limited quality and quantity of our historical data, as is often the case for historical studies. The ideal way to alleviate the data concerns would be to use contemporary administrative data about application, enrollment, and labor market outcomes. For example, one may imagine linking the US Internal Revenue Service data on tax returns and school district data to measure the long-term effects of school choice reforms in the US in the past few decades. Such an ambitious contemporary study would be a fruitful complement to our historical study reported here.

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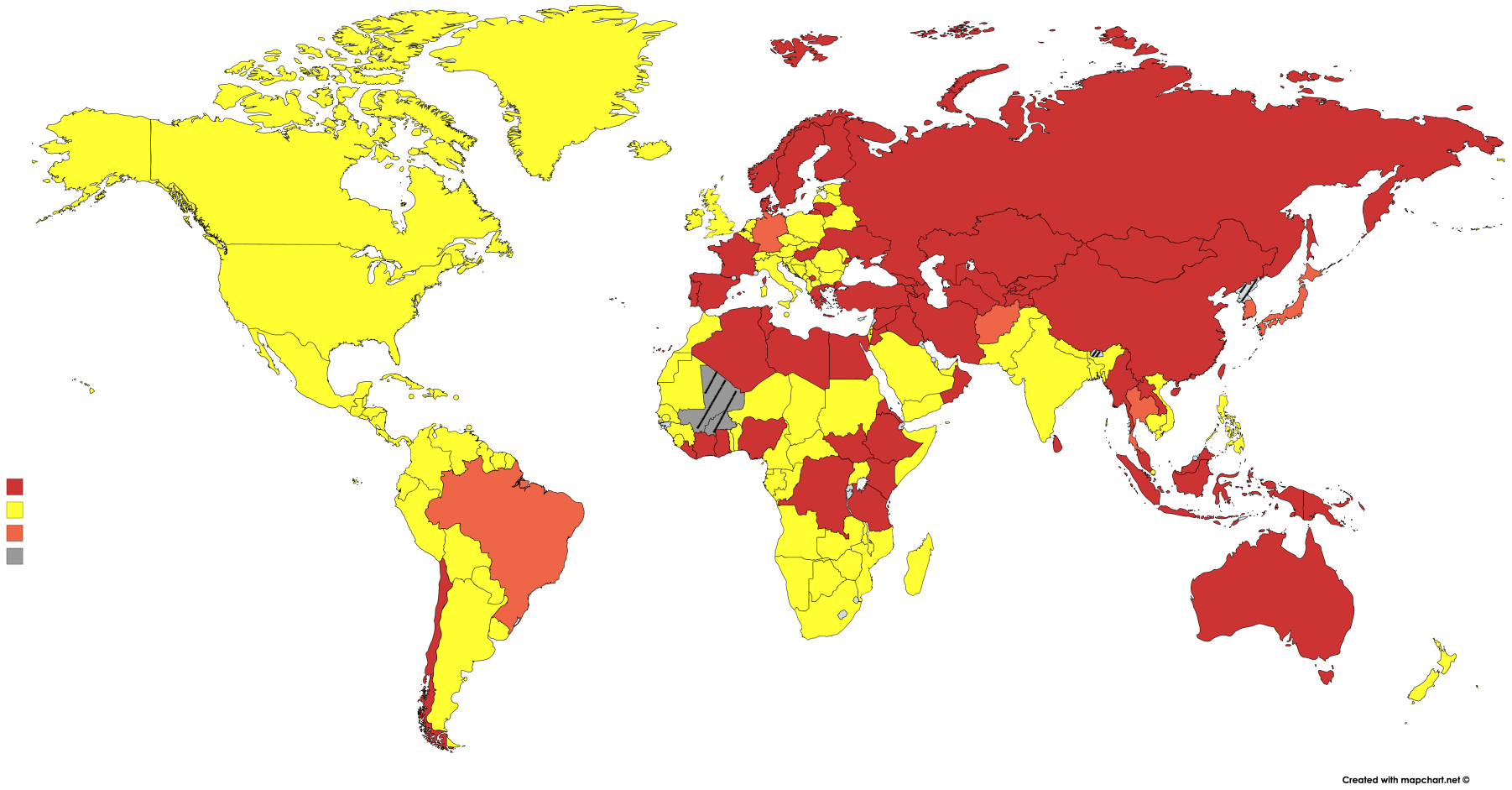
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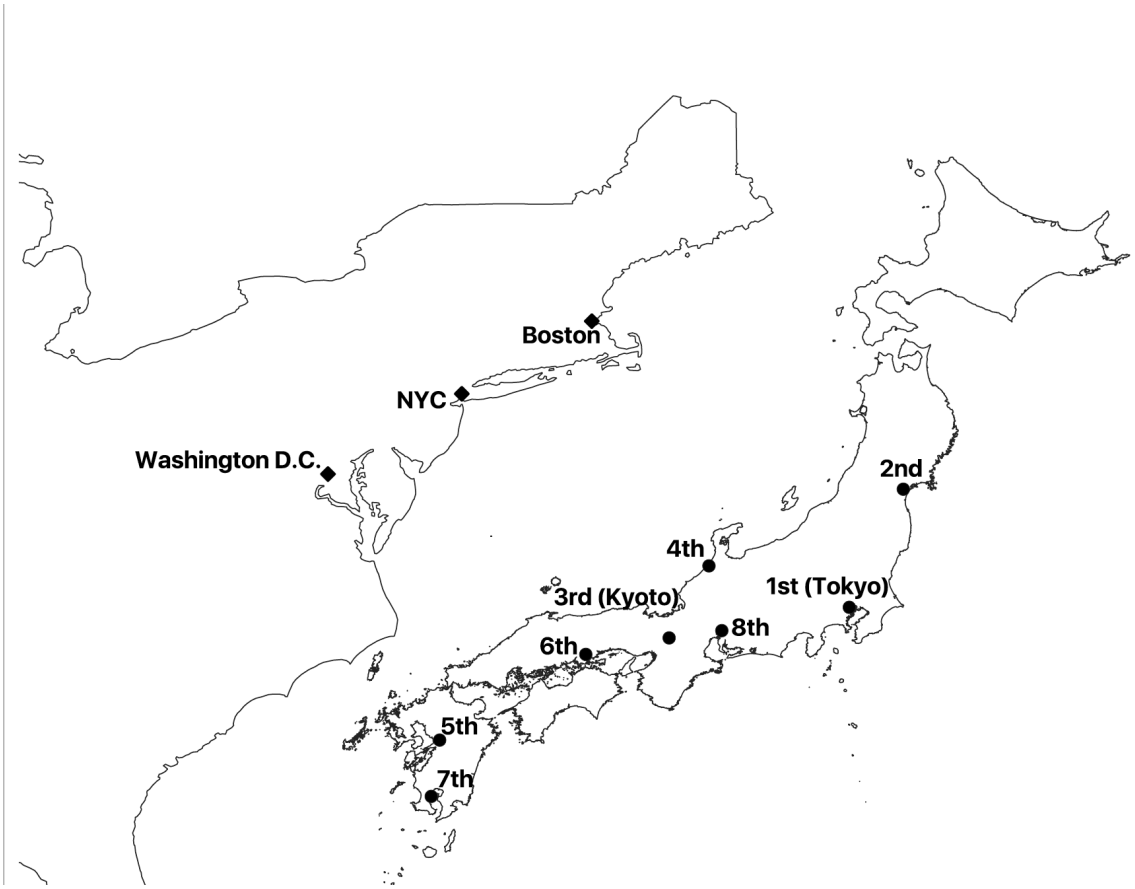
Figure 1: College Admissions around the World Today



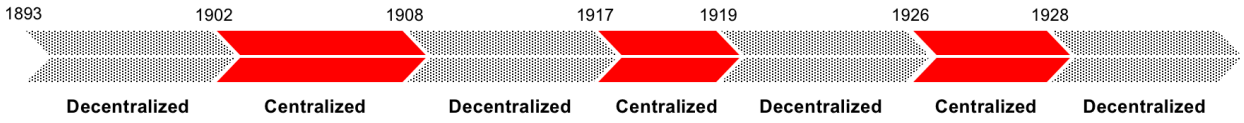
Notes: This figure summarizes each country's college admission system today. Red and dark color (e.g., China): Regionally- or nationally-centralized college admissions, where a single-application, single-offer assignment algorithm (well-defined rule) is used to make admissions to multiple colleges. Yellow and light color (e.g., the US): Decentralized college admissions, where each college makes its own admissions. Orange and medium color (e.g., Brazil): Partly centralized and partly decentralized. Grey with diagonal lines (e.g., Mali): Not enough information. See Section 2 for discussions about this figure.

Figure 2: Higher Schools in Imperial Japan

(a) Map of Schools 1-8 in Japan (with the US East Coast in Comparison)

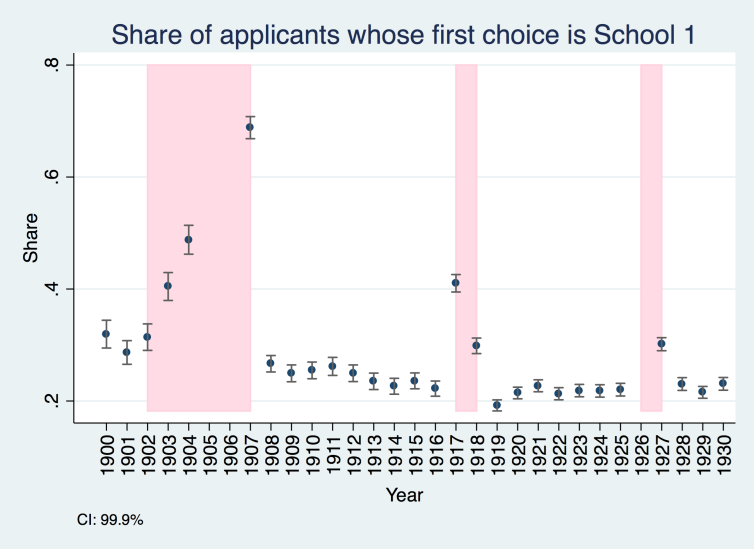


(b) Timeline of Policy Changes



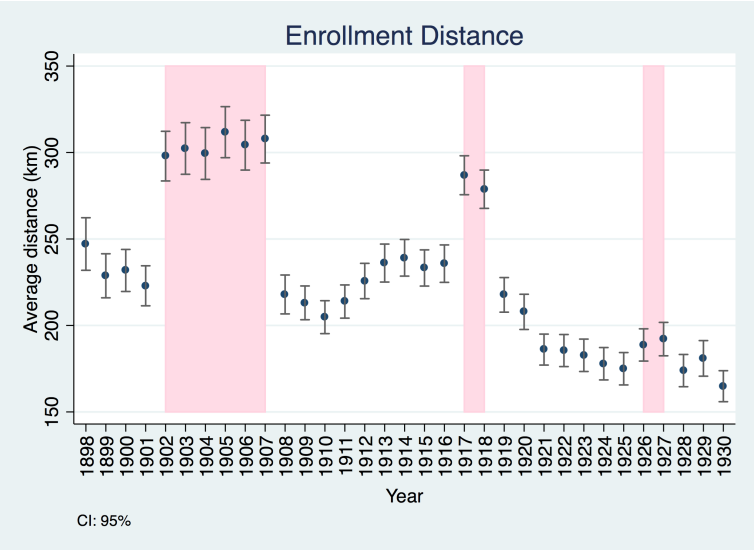
Notes: Panel (a) shows the locations of the eight national higher schools and compares their geographical distribution to the US east coast in the same scale unit. Panel (b) provides the timeline of key policy changes in school admissions systems. See Section 2 for discussions about this figure.

Figure 3: Centralization Caused Applicants to Apply More Aggressively: First Look



Notes: This figure shows the time evolution of the share of applicants who select the most prestigious School 1 (Tokyo) as their first choice. Colored years (1902-07, 1917-18, and 1926-27) indicate the periods of the centralized school admissions system. No data are available for 1905, 1906, and 1926. Bars show the 99.9 percent confidence intervals. See Section 5.1 for discussions about this figure.

Figure 4: Centralization Increased Regional Mobility in Enrollment: First Look



Notes: This figure shows the time evolution of the average enrollment distance, i.e., the distance between an entrant's birth prefecture and the prefecture of the school he entered (measured by the direct distance between the two prefectural capitals). Colored years indicate the periods of the centralized school admissions system. Bars show the 95 percent confidence intervals. See Section 5.2 for discussions about this figure.

Table 1: Centralization Caused Applicants Across the Country to Apply More Aggressively

Dependent var	Select School 1 as First Choice								
Sample region	All	S1 Region	S2 Region	S3 Region	S4 Region	S5 Region	S6 Region	S7 Region	S8 Region
Centralized	0.159***	0.192***	0.151***	0.146***	0.128	0.168***	0.180***	0.166***	0.114***
	(0.0106)	(0.00924)	(0.0329)	(0.0232)	(0.0646)	(0.0245)	(0.0336)	(0.0136)	(0.00786)
Constant	0.248***	0.494***	0.169***	0.0892***	0.178**	0.107***	0.184***	0.0813**	0.127*
	(0.0717)	(0.0437)	(0.0357)	(0.0162)	(0.0373)	(0.0185)	(0.0218)	(0.00991)	(0.0508)
Observations	20,913	6,505	2,555	3,248	1,266	2,730	2,276	615	1,718
Dependent var	Application Distance								
Sample region	All	S1 Region	S2 Region	S3 Region	S4 Region	S5 Region	S6 Region	S7 Region	S8 Region
Centralized	-2.534	-92.88***	10.95	2.080	-15.74	128.0***	46.52**	145.4**	-25.57
	(23.22)	(2.888)	(24.65)	(5.482)	(22.92)	(23.11)	(13.91)	(21.27)	(18.64)
Constant	226.2***	231.7***	289.7***	158.8***	166.7*	252.6***	294.1***	218.0*	154.2*
	(15.74)	(16.43)	(79.51)	(28.11)	(56.94)	(42.52)	(51.54)	(70.94)	(48.89)
Observations	20,913	6,505	2,555	3,248	1,266	2,730	2,276	615	1,718

Notes: In this table, we estimate the effects of centralization on the propensity of an applicant to select the most prestigious school (School 1) as his first choice, using the applicant-level data in 1916 (under the decentralized system) and 1917 (under the centralized system). The prefecture-level application data are available only for these two years. We group applicants into "school regions" based on which school (among Schools 1-8) is nearest to the applicant's middle school in 1916, where "nearest" is defined by the distance between the prefectural capitals. Standard errors are clustered at the prefecture level. ***, **, and * mean significance at the 1%, 5%, and 10% levels, respectively. See Section 5.1 for discussions about this table.

The following map shows the locations of the eight school regions.

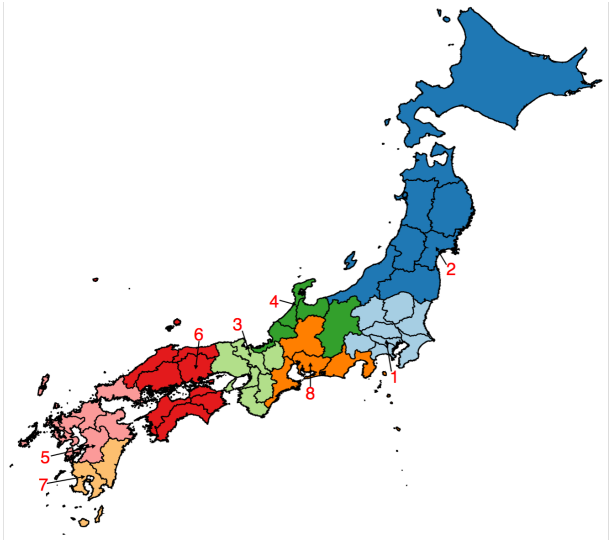


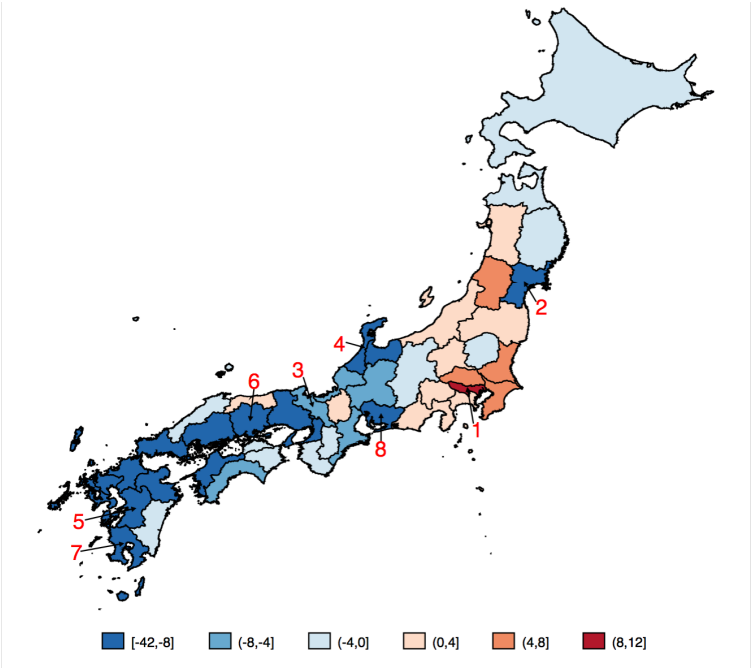
Table 2: Centralization Broke Local Monopoly and Increased Regional Mobility across Japan

Dependent variable = No. of entrants to:	(1) Sch. 1	(2) Sch. 2	(3) Sch. 3	(4) Sch. 4	(5) Sch. 5	(6) Sch. 6	(7) Sch. 7	(8) Sch. 8
Centralized x Born in school's prefecture	-27.80***	-17.61***	-15.63***	-23.08***	-28.43***	-23.02***	-45.86***	-13.42***
	(0.887)	(0.141)	(0.624)	(0.245)	(0.189)	(0.565)	(0.358)	(0.864)
Centralized x D to school's prefecture (1-100km)	0.298	-3.192	-3.993*	-9.316***	-11.99***	-2.866**	-1.996***	1.053
	(0.662)	(2.443)	(2.062)	(3.129)	(3.213)	(1.334)	(0.273)	(0.982)
Centralized x D to school's prefecture (100-300km)	1.064*	-0.104	-0.160	-0.210	-3.299***	-1.945**	-3.031***	1.240
	(0.550)	(0.655)	(0.549)	(0.551)	(0.908)	(0.836)	(0.777)	(1.061)
Observations	1,410	1,410	1,363	1,410	1,363	1,363	1,269	1,034
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prefecture FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean dep var	7.942	5.535	6.213	5.677	6.305	5.202	5.079	5.726
Mean dep var (school's pref dur. Dapp)	103.3	62.00	56.37	59.90	73.40	76.05	93.44	77.00
Mean dep var (within 1-100km dur. Dapp)	9.150	21.20	17.68	26.88	34.90	8.439	8.333	15.50

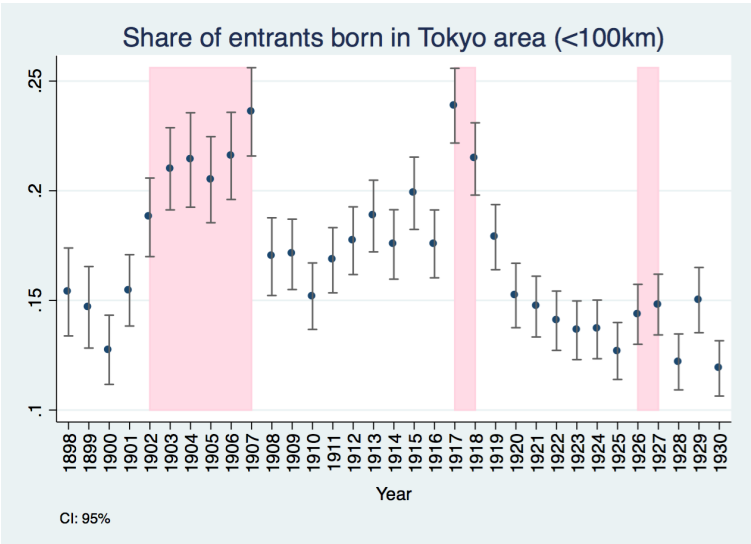
Notes: Using the prefecture-year level data in 1900-1930, we define the dependent variable as the number of entrants born in each prefecture entering the school indicated in the column in each year. "Born in school's prefecture" takes 1 if the school indicated in the column is located in the entrant's birth prefecture. "D to school's prefecture (1-100km)" takes 1 if the school indicated in the column is not located in, but within 100 km from the entrant's birth prefecture (measured by the distance between the two prefectural capitals). "D to school's prefecture (100-300km)" takes 1 if the school indicated in the column is between 100 km and 300 km from the entrant's birth prefecture. We control for year fixed effects, prefecture fixed effects, the lagged number of public and private middle school graduates in the prefecture, and the number of high schools other than Schools 1-8 in the prefecture. "Mean dep var" shows the mean of the dependent variable during decentralization for all prefecture-year observations. "Mean dep var (school's pref dur. Dapp)" shows the mean of the dependent variable who entered the school located in his birth prefecture during decentralization. "Mean dep var (within 1-100km dur. Dapp)" shows the mean of the dependent variable who entered the school that was not located in, but within 100km from his birth prefecture during decentralization. For Schools 7 and 8, we drop the years in which they held an early exam (School 7 in 1908-1910 and School 8 in 1908). Standard errors are clustered at the prefecture level. ***, **, and * mean significance at the 1%, 5%, and 10% levels, respectively. See Section 5.2 for discussions about this figure.

Figure 5: Which Regions Win from Centralization? First Look

(a) In Which Prefectures Did Entrants Increase During Centralization?



(b) Centralization Increased Tokyo Area-born Entrants to Schools 1-8



Notes: Panel (a) estimates and visualizes prefecture-specific coefficient β_i in $\#entrants_{it} = \beta_i Capp_t + \alpha_i X_{it} + e_{it}$, using the 1900-1930 data for each prefecture i, where $\#entrants_{it}$ is the number of entrants in year t who were born in prefecture i and X_{it} is the number of schools other than Schools 1-8 in prefecture i in year t. Panel (b) uses the entrant-level data from 1898 to 1930 to show the time evolution of the fraction of entrants to Schools 1-8 who were born in the Tokyo Area defined as prefectures that are within 100km from Tokyo (see Appendix Figure A.3 for a map). Bars show the 95 percent confidence intervals. See Section 5.3 for discussions about this figure.

Table 3: Which Regions Win from Centralization?

Dependent variable = No. of entrants to:	(1) All schools	(2) Sch. 1	(3) Sch. 2	(4) Sch. 3	(5) Sch. 4	(6) Sch. 5	(7) Sch. 6	(8) Sch. 7	(9) Sch. 8
Centralized x Born in Tokyo prefecture	9.111***		0.338	2.544	7.062***	3.410***	10.21***	6.872***	19.87***
	(2.682)		(0.312)	(1.736)	(0.525)	(0.314)	(1.688)	(0.493)	(1.340)
Centralized x D to Tokyo prefecture (1-100km)	13.14***		0.525	0.964**	2.046***	0.122	0.875**	0.455	0.367
	(2.173)		(0.603)	(0.361)	(0.447)	(0.341)	(0.431)	(0.460)	(0.655)
Centralized x D to Tokyo prefecture (100-300km)	3.912		0.913*	1.674**	-0.0237	0.596*	1.360**	1.149**	0.133
	(3.751)		(0.459)	(0.776)	(0.891)	(0.336)	(0.593)	(0.479)	(0.523)
Centralized x Born in the school's prefecture		-27.80***	-17.41***	-15.14***	-22.81***	-28.16***	-22.08***	-47.82***	-13.42***
		(0.887)	(0.170)	(0.578)	(0.904)	(0.206)	(0.357)	(0.402)	(1.135)
Centralized x D to school's prefecture (1-100km)		0.298	-3.910	-3.761*	-9.068***	-11.70***	-1.912	-1.686***	1.030
		(0.662)	(2.476)	(1.962)	(3.150)	(3.205)	(1.298)	(0.275)	(1.015)
Centralized x D to school's prefecture (100-300km)		1.064*	-0.345	-0.367	-0.691	-3.025***	-1.166*	-2.503***	0.260
		(0.550)	(0.747)	(0.513)	(0.429)	(0.917)	(0.676)	(0.816)	(0.371)
Observations	1,410	1,410	1,410	1,363	1,410	1,363	1,363	1,222	1,034
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pref FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean dep var	45.26	7.942	5.535	6.213	5.677	6.305	5.202	5.020	5.726
Mean dep var (Tokyo pref dur. Dapp)	199.9	103.3	27.15	11.00	14.40	6.100	9.474	12.00	20.39
Mean dep var (within 1-100km from Tokyo pref. dur. Dapp)	26.38	9.150	6.733	1.246	2.867	0.767	1.254	1.618	3.250

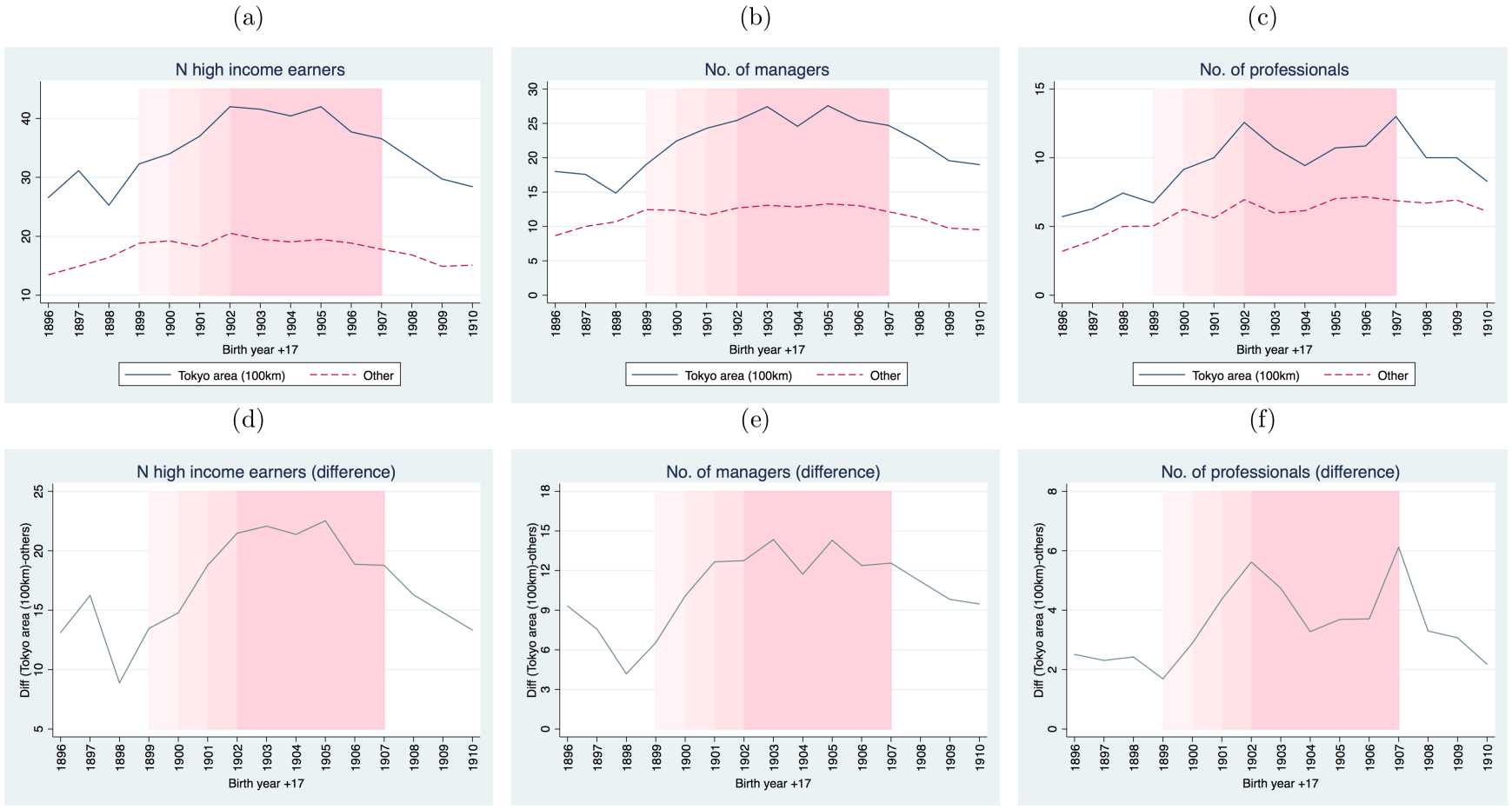
Notes: The table uses prefecture-year level data in 1900-1930. In column (1), the dependent variable is the number of students from birth prefecture i who entered one of Schools 1-8 in year t. In columns (2)–(10), the dependent variable is the number of students from birth prefecture i who entered the school indicated in the column in year t. For Schools 7 and 8, we drop the years in which they held an early exam (School 7 in 1908-1910 and School 8 in 1908). We control for prefecture fixed effects, year fixed effects, lagged number of public and private middle school graduates in the prefecture and the number of high schools other than Schools 1-8 in the prefecture. "Born in the school's prefecture" takes 1 if the school indicated in the column is located in the entrant's birth prefecture. "D to school's prefecture (1-100km)" takes 1 if the school indicated in the column is not located in, but within 100 km from the entrant's birth prefecture. "D to school's prefecture (100-300km)" takes 1 if the school indicated in the column is between 100 km and 300 km from the entrant's birth prefecture. "Mean dep var" shows the mean of the dependent variable during decentralization for all prefecture-year observations. "Mean dep var (Tokyo pref dur. Dapp)" shows the mean of the dependent variable whose birth prefecture is Tokyo during decentralization. "Mean dep var (within 1-100km dur. Dapp)" shows the mean of the dependent variable whose birth prefecture is within 100km from Tokyo excluding Tokyo prefecture. Standard errors are clustered at the prefecture level. ***, **, and * mean significance at the 1%, 5%, and 10% levels, respectively. See Section 5.3 for discussions about this figure.

Figure 6: Checki of Long-run Outcome Data: Differences-in-Differences



Notes: This figure shows differences-in-differences plots that compare the number of Imperial University graduates born in "urban" and "rural" areas by cohorts. The plots use the prefecture-cohort level data of the number of individuals listed in the Japanese Personnel Inquiry Records (JPIR) in 1939, which includes cohorts who became age 17 between 1896 and 1910. Darkly colored cohorts indicate those who became age 17 during the first period of Capp in 1902-1907. Lightly colored cohorts are those who became age 17 before 1902 but might have taken the entrance exam in 1902 under Capp if they failed to enter any school at age 17 and retook the exam in subsequent years. Panels (a) and (c) define "urban" area as the Tokyo area, while panels (b) and (d) define "urban" area as a set of prefectures that experienced a net increase in the number of entrants to Schools 1-8 during the first period of Capp in 1902-1907. The y axis shows the number of individuals who were born in the indicated area in the indicated cohort whose final education was one of Imperial Universities.
See Section 6 for discussions about this figure.

Figure 7: Long-run Impacts of Centralization: Differences-in-Differences



Notes: This figure shows differences-in-differences plots that compare the number of elites born inside and outside the Tokyo areas by cohorts. The plots use the prefecture-cohort level data of the number of individuals listed in the JPIR in 1939, which includes cohorts who became age 17 between 1896 and 1910. Darkly colored cohorts indicate those who became age 17 during the first period of Capp in 1902-1907. Lightly colored cohorts are those who became age 17 before 1902 but might have taken the entrance exam in 1902 under Capp if they failed to enter any school at age 17 and retook the exam in subsequent years. "High-income earners" are defined as individuals listed in the JPIR who paid income tax of above 9.6 yen, which corresponds to earning taxable income above 1200 yen. "Managers" is defined as individuals listed in the JPIR who hold a managerial position in a company and earns taxable income above 1200 yen. "Professionals" is defined as individuals listed in the JPIR whose occupation is either scholar, doctor, lawyer, or engineer. We measure the outcomes per prefecture per year. See Section 6 for discussions about this figure.

Table 4: Long–run Impacts of Centralization: Differences-in-Differences Estimates

VARIABLES	Imperial University		High-income earners		Managers		Professionals		Fraction moved	
Age 17 during centralization × Tokyo area (<100km)	2.681***		5.714**		3.164**		1.759***		-0.018	
	(0.842)		(2.584)		(1.314)		(0.586)		(0.018)	
Age 17 during centralization × Area where entrants increased		2.149***		4.396**		2.141**		1.725***		-0.006
		(0.665)		(1.876)		(1.062)		(0.440)		(0.017)
Observations	611	611	611	611	611	611	611	611	611	611
Cohort FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Pref FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Mean dep var	9.133	9.133	20.46	20.46	13.42	13.42	6.866	6.866	0.224	0.224
Mean dep var (Treated group during decentralization)	11.53	10.42	31.76	23.60	20.63	15.39	8.796	7.727	0.228	0.220
Age≤17 in 1902 × Tokyo area (<100km)	2.275		5.177**		3.248**		1.541		-0.009	
	(1.420)		(2.158)		(1.453)		(1.026)		(0.024)	
Age≤17 in 1908 × Tokyo area (<100km)	-2.986***		-6.116*		-3.101**		-1.923***		0.024	
	(0.704)		(3.066)		(1.326)		(0.700)		(0.017)	
Age≤17 in 1902 × Area where entrants increased		1.440		3.995**		2.227*		1.370*		0.010
		(1.050)		(1.659)		(1.154)		(0.730)		(0.022)
Age≤17 in 1908 × Area where entrants increased		-2.681***		-4.696**		-2.076*		-1.991***		0.018
		(0.588)		(2.235)		(1.145)		(0.512)		(0.016)
Observations	611	611	611	611	611	611	611	611	611	611
Cohort FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Pref FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: This table shows differences-in-differences estimates of the long-run effects of the centralized admission system. The estimates use the prefecture-cohort level data of the number of persons listed on the Japanese Personnel Inquiry Records (JPIR) in 1939, which includes cohorts who were born in 1882-1894 and became age 17 in 1899-1911. "Imperial University" is the number of individuals listed in the JPIR who were born in a given prefecture in a given cohort and whose final education was one of the Imperial Universities. "High-income earners" is the number of individuals listed in the JPIR who were born in a given prefecture in a given cohort and paid income tax of above 9.6 yen (which corresponds to earning of taxable income above 1200 yen). "Managers" is the number of individuals listed in the JPIR who were born in a given prefecture in a given cohort t and who holds a managerial position in a company and earns taxable income above 1200 yen. "Professionals" is the number of individuals listed in the JPIR who were born in a given prefecture in a given cohort and whose occupation is either scholar, doctor, lawyer, or engineer. "Fraction moved" is the fraction of individuals listed in the JPIR whose prefecture of residence is different from birth prefecture. "Age 17 during centralization" is the indicator variable that takes 1 if the cohort became age 17 during Capp in 1902-1907. "Age≤17 in 1902" is the indicator variable that takes 1 if the cohort became age 17 in 1902 or later. "Age≤17 in 1908" ta the indicator variable that takes 1 if the cohort became age 18 in 1908 or later. "Mean dep var" shows the mean of the dependent variable for all prefecture-year observations. "Mean dep var (Treated group during decentralization)" shows the mean of the dependent variable for the treated group (either the Tokyo area or the area where entrants to Schools 1-8 increased) during decentralization. Standard errors are clustered at the prefecture level. ***, **, and * mean significance at the 1%, 5%, and 10% levels, respectively. See Section 6 for discussions about this figure.

A Appendix

Table A.1: College Admissions around the World Today: Details

Country	Centralized System (Y/N)	Source
Afghanistan	Y (for public universities)	"Higher Education in Afghanistan", https://www.baag.org.uk/sites/www.baag.org.uk/files/resources/attachments/WB%20Afghan%20Higher%20Education%202013.pdf Higher Education in Afghanistan", https://www.engineering.sk/english/2745-higher-education-in-afghanistan
Albania	N	"Overview of the Higher Education System Albania", https://eacea.ec.europa.eu/sites/eacea-site/files/countryfiche_albania_2017.pdf "Education and diplomas Albania", https://www.nuffic.nl/en/publications/find-a-publication/education-system-albania.pdf "Admission Requirements for Higher Education Institutions in Albania", http://www.albaniaeducation.info/Admission-Requirements/Admission-Requirements-for-Higher-Education.html
Algeria	Y	"Overview of the Higher Education System Algeria", https://eacea.ec.europa.eu/sites/eacea-site/files/countryfiche_algeria_2018.pdf
Angola	N	"Higher education in Angola", https://www.justlanded.com/english/Angola/Angola-Guide/Education/Higher-education-in-Angola
Argentina	N	"Study in Argentina", http://www.universia.es/estudiar-extranjero/argentina/sistema-educativo/proceso-admision/2648 "Guía práctica para los ingresantes a la UBA", http://www.uba.ar/archivos_generales/ingresantesUBA.pdf
Armenia	Y	"Education for All 2015 National Review: Armenia", http://unesdoc.unesco.org/images/0022/002299/229906E.pdf "Improving Armenia's Unified Entrance Exam with Computer-Based Testing", http://www.worldbank.org/en/news/feature/2018/03/27/improving-armenias-unified-entrance-exam-with-computer-based-testing "Improving Education Quality through Stronger Student Assessment Systems Republic of Armenia", http://www.worldbank.org/content/dam/Worldbank/Event/education/Armenia%20Presentation%20with%20Note.pdf
Austira	N	"Admission and entry to university", https://europa.eu/youreurope/citizens/education/university/admission-entry-conditions/index_en.html "Admission in Austria", https://studyinaustria.at/en/study/admission/
Australia	Y (since 2009/2010)	"Tertiary education in Australia", https://en.wikipedia.org/wiki/Tertiary education in Australia "University and college admission in Austria", https://en.wikipedia.org/wiki/University and college admission#Australia "Australian Tertiary Admission Rank", https://en.wikipedia.org/wiki/Australian Tertiary Admission Rank "University of Sydney Admission Process", https://sydney.edu.au/study/admissions/apply/how-to-apply.html
Austria	N	"University and college admission: Indonesia", https://en.wikipedia.org/wiki/University_and_college_admission#Indonesia
Azerbaijani	Y	"Overview of the Higher Education System Azerbaijan", https://eacea.ec.europa.eu/sites/eacea-site/files/countryfiches_azerbaijan_2017.pdf "Education, Health, and Welfare", http://countrystudies.us/azerbaijan/23.htm
Bangladesh	N	"Bangladesh University Admission Process", http://www.bu.edu.bd/admission/admission-requirements/ "University of Raishahi", http://admission.ru.ac.bd/undergraduate/
Belarus	N	"Admission Requirements for Higher Education Institutions in Belarus", http://www.belaruseducation.info/Admission-Requirements/Admission-Requirements-for-Belarus-Higher-Education-Institutions.html
Belgium	N	"Higher Education in Belgium", http://www.matching-in-practice.eu/higher-education-in-belgium/
Belice	N	"University of Belize Admission Process", https://www.ub.edu.bz/admissions/apply-now/ "Galen Univeristy Admission Process", http://www.galen.edu.bz/undergraduateadmins
Benin	N	"World Higher Education Database (WHED), Benin - Education system", https://whed.net/home.php
Bolivia	N	"Universidad Católica Boliviana Admission Process", http://www.ucbscz.edu.bo/es/Requisitos-Inscripcion-Estudiantes-Nuevos "Universidad Mayor de San Simón Admission Process", http://www.umss.edu.bo/index.php/facultad-de-ciencias-juridicas-y-politicas-examen-de-ingreso-2018/
Bosnia and Herzegovina	N	"Overview of the Higher Education System Bosnia and Herzegovina", https://eacea.ec.europa.eu/sites/eacea-site/files/countryfiche_bosniaherzegovina_2017.pdf
Botswana	N	"University of Botswana Admission Process", https://www.ub.bw/admissions/apply-to-study
Brazil	Y (for over half of the institutions, since 2010)	"Plazo para confirmar inscripción de liceales", https://www.elpais.com.uy/informacion/plazo-confirmar-inscripcion-liceales.html "Oficina Reguladora De La Inscripcion Liceal", http://www.ces.edu.uy/ces/images/stories/2014/aaaaa_dic/reguladora/Fechas_destino_alumnos_diciembre_2014.pdf "Consejo de Educacion Secundaria", http://www.ces.edu.uy/files/EXP_5847_2_2017.pdf
Bulgaria	N	"Bulgaria Higher Education System", http://www.euroeducation.net/prof/bulgaco.htm
Burma	Y	"New admissions process to start at 11 universities", https://www.mmtimes.com/news/new-admissions-process-start-11-universities.html

Cambodia	N	"Zaman University Admission Process", https://www.zamanu.edu.kh/node/77/
Cameroon	N	"Nuffic Education Systems", https://www.nuffic.nl/en/publications/find-a-publication/education-system-cameroon.pdf "University of Buea Admission Process", http://www.ubuea.cm/admission-2016-open/
Canada	N (since 1970s)	"University and college admission", https://en.wikipedia.org/wiki/University_and_college_admission
Central African Republic	N	Each institution's admission process.
Chad	N	Each institution's admission process.
Chile	Y (for CRUCH universities, since 1960)	"Endogenous Market Formation: Theory and Evidence from Chilean College Admissions", link here: http://econweb.umd.edu/~espinoza/espinoza_lee_lopez_2016.pdf
China	Y	"Chinese College Admissions and School Choice Reforms: Theory and Experiments", http://yanchen.people.si.umich.edu/papers/Chen_Kesten_2014_01.pdf "National college entrance examinations: The dynamics of political centralism in China's elite education", https://www.jstor.org/stable/42743977
Colombia	N	"National Higher Education Entrance Examina", https://en.wikipedia.org/wiki/National_Higher_Education_Entrance_Examination "Study in Colombia Admission Process", http://www.universia.es/estudiar-extranjero/colombia/sistema-educativo/proceso-admision/3078 "ICFES Examination", https://en.wikipedia.org/wiki/ICFES_Examination
Congo	N	"University of Goma Admission Process", http://unigom.org/inscriptions/comment-sinscrire/
Costa Rica	N	"Centralized Assignment of Students to Majors: Evidence from the University of Costa Rica", https://kwet.ku.edu/sites/kwet.ku.edu/files/files/paper_Hernandez.pdf
Costa Rica	N	"Proceso de Inscripcion a las Universidades Estatales", http://163.178.170.40/SAU/menuPortada/FOLLETO%20INSCRIPCION%202018-2019-ANEXOS.pdf "National University of Costa Rica Admisson Process", http://www.registro.una.ac.cr/index.php?option=com_content&view=article&id=242&Itemid=796 "University of Costa Rica Admission Process", http://ori.ucr.ac.cr/web_adm/instruc/2018-2019/folleto05-18.pdf
Cote d'Ivoire	Y	"Education Systems in Africa Part XIV: Cote d'Ivoire", http://aevaluators.com/blog/education-systems-africa-part-xiv-cote-d%E2%80%99ivoire
Croatia	N (since 2010/2011)	"Croatia: How to apply", http://www.studyincroatia.hr/studying-in-croatia/admissions-and-enrolment/how-to-apply-undergraduate-studies
Cuba	N	"Universities in Cuba", https://es.wikipedia.org/wiki/Categor%C3%ADa:Universidades_de_Cuba
Czech Republic	N	Each institution's admission page. Each university's admission page.
Denmark	Y (since 1977)	"Den Koordinerede Tilmelding", https://ufm.dk/uddannelse/videregaende-uddannelse/sogning-optag-og-vejledning/kot
Dominican Republic	N	"Autonomous University of Santo Domingo Admission Process", https://uasd.edu.do/files/ADMISIONES/descargables/Requisitos_de_admisiones_Dominicanos_18917.pdf "Universidad Iberoamericana Admission Process", https://admisiones.unibe.edu.do/Ayuda/Proceso_Admision
DR Congo	Y	"Democratic Congo - Higher Education", http://education.stateuniversity.com/pages/363/Democratic-Congo-HIGHER-EDUCATION.html
Ecuador	N	"Pontificia Universidad Católica del Ecuador Admission Process" https://www.puce.edu.ec/admisiones_GP.php "Universidad Andina Simón Bolívar Admission Process" http://www.uasb.edu.ec/proceso-de-admision
Egypt	Y	"Admission Requirements for Higher Education Studies in Egypt", http://www.egypteducation.info/Admission-Requirements/Admission-Requirements.html "Overview of the Higher Education System Egypt", https://eacea.ec.europa.eu/sites/eacea-site/files/countryfiches_egypt_2017.pdf
El Salvador	N	"El Salvador University Study Programs", http://www.ues.edu.sv/programa-de-graduados "Don Bosco University Admisison Process", http://www.udb.edu.sv/udb/index.php/pagina/ver/matricula_nuevo_ingreso
Equatorial Guinea	N	"National University of Equatorial Guinea Homepage", http://www.unge.gq/
Eritrea	Y	"Nuffic Education Systems", https://www.nuffic.nl/en/publications/find-a-publication/education-system-eritrea.pdf
Estonia	N	Each institution's admission page.
Ethiopia	Y	"Nuffic Education Systems", https://www.nuffic.nl/en/publications/find-a-publication/education-system-ethiopia.pdf
Finland	Y (since 2013)	"Reformen av högskolornas gemensamma ansökan skjuts upp till hösten 2014", https://www.oph.fi/aktuellt/meddelanden/101/0/reformen_av_hogskolornas_gemensamma_ansokan_skjuts_upp_till_hosten_2014 "University of Helsinki Admission Process", https://www.helsinki.fi/en/networks/vakava/about-vakava-0
France	Y (since 2008)	"Matching in Practice", http://www.matching-in-practice.eu/university-admission-practices-france/ "Faut-il sauver les algorithmes d'affectation?", http://tnova.fr/system/contents/files/000/001/571/original/Terra_Nova_Rapport__Algorithmes_060618.pdf?1528276927
French Guiana	N	"University of French Guiana Homepage", https://www.univ-guyane.fr

		Individual Institution's admission page.
Gabon	N	http://universiteomarbongo.org/uob/index.php/la-formation/admission-inscription
		http://ufrse.org/Formation/Licence1/index.asp?Page=A#Debut
Gambia	N	"Toward an Integrated University of the Gambia", http://siteresources.worldbank.org/GAMBIAEXTN/Resources/TOWARDANINTEGRATEDUNIVERSITYOFTHEGAMBIADecember11.doc
Georgia	Y (since 2005)	"Overview of the Higher Education System Georgia", https://eacea.ec.europa.eu/sites/eacea-site/files/countryfiche_georgia_2017.pdf
Germany	Y (only for medicine, dentistry, veterinary medicine, and pharmacy in public universities, since 1973)	"An Analysis of the German University Admissions System", https://link.springer.com/content/pdf/10.1007%2Fs00199-012-0704-4.pdf "Matching in Practice", http://www.matching-in-practice.eu/higher-education-in-germany/
		"Imperfect Information and School Choice in Ghana", http://people.bu.edu/kajayi/AjayiTelli_ImperfectInformation.pdf
Ghana	Y (since 2005)	"University of Ghana Admission Portal", https://admission.ug.edu.gh/undergrad/login.php
		"How to Get Admission to Ghana Universities", https://buzzghana.com/get-admission-ghana-universities/
Gibraltar	N	https://www.unigib.edu.gi/applying/
Greece	Y	"Nuffic Education Systems", https://www.nuffic.nl/en/publications/find-a-publication/education-system-greece.pdf
Greenland	N	"Top Universities in Greenland", https://www.4icu.org/gl/
		Individual institutions' websites.
Guatemala	N	http://registro.usac.edu.gt/formularios_rye/GUIA_INSCRIPCION2018.pd http://principal.url.edu.gt/images/recursos/pdfs/admisiones/Proceso_CCentral.pdf http://uvg.edu.gt/admisiones/index.php#proceso-de-admision
Guinea	N	Each university's website, as an example https://www.univ-kag.org/admission-formation-initiale/
		List of universities: https://en.wikipedia.org/wiki/List_of_universities_and_colleges_in_Guyana
Guyana	N	University of Guyana, http://www.uog.edu.gy/admission-requirements
		Lincoln American University, https://www.laumed.org/admission.html
Haiti	N	"University Caraibe Admission Process", http://www.universitecaraibe.com/_UC/index.php/admission "University of Haiti Admission Process", http://www.ueh.edu.ht/etudes/index.php#
		Each institution's admission process.
Honduras	N	"UNAH Admission Process", http://www.admisiones.unah.edu.hn/Inscripcion.aspx "UNICAH Admission Process", http://www.unicah.edu/procesoAdmisiones.html
Hungary	Y (since 1985)	"Redesigning the Israeli Psychology Master's Match", https://scholars.huji.ac.il/sites/default/files/assafromm/files/redesigning_the_israeli_psychology_masters_match.pdf
Iceland	N	"University and College Admission", https://en.wikipedia.org/wiki/University_and_college_admission
		"Entrace Exams", https://www.mapsofindia.com/education/exam/entrance-exams.html
India	N	"Student Selection and Admission to Higher Education", https://www.istor.org/stable/pdf/3448186.pdf?refreqid=excelsior%3A1085f679f6e08832cd96aab6bd1981c5
Indonesia	N (since 1989)	"Student Selection and Admission to Higher Education: Policies and Practices in the Asian Region", https://www.jstor.org/stable/pdf/3448186.pdf?refreqid=excelsior%3A1085f679f6e08832cd96aab6bd1981c5
Iran	Y	"Education System in Iran", https://www.nuffic.nl/en/publications/find-a-publication/education-system-iran.pdf
Iraq	Y	"Education System Iraq", https://www.nuffic.nl/en/publications/find-a-publication/education-system-iraq.pdf "Strategies of the Iraqi Ministry of Higher Education and Scientific Research", https://iraqiculture-usa.com/i/u/10090719/f/Education%20in%20Iraq/hes.pdf
Ireland	N (since 1976)	"Matching in Practice", http://www.matching-in-practice.eu/higher-education-in-ireland/
		Each insitution's admission page.
Israel	N	http://info.huji.ac.il/reception-channels/
		http://www.israeleducation.info/Admission-Requirements/Index.html
Italy	N	"Matching in Practice", http://www.matching-in-practice.eu/higher-education/

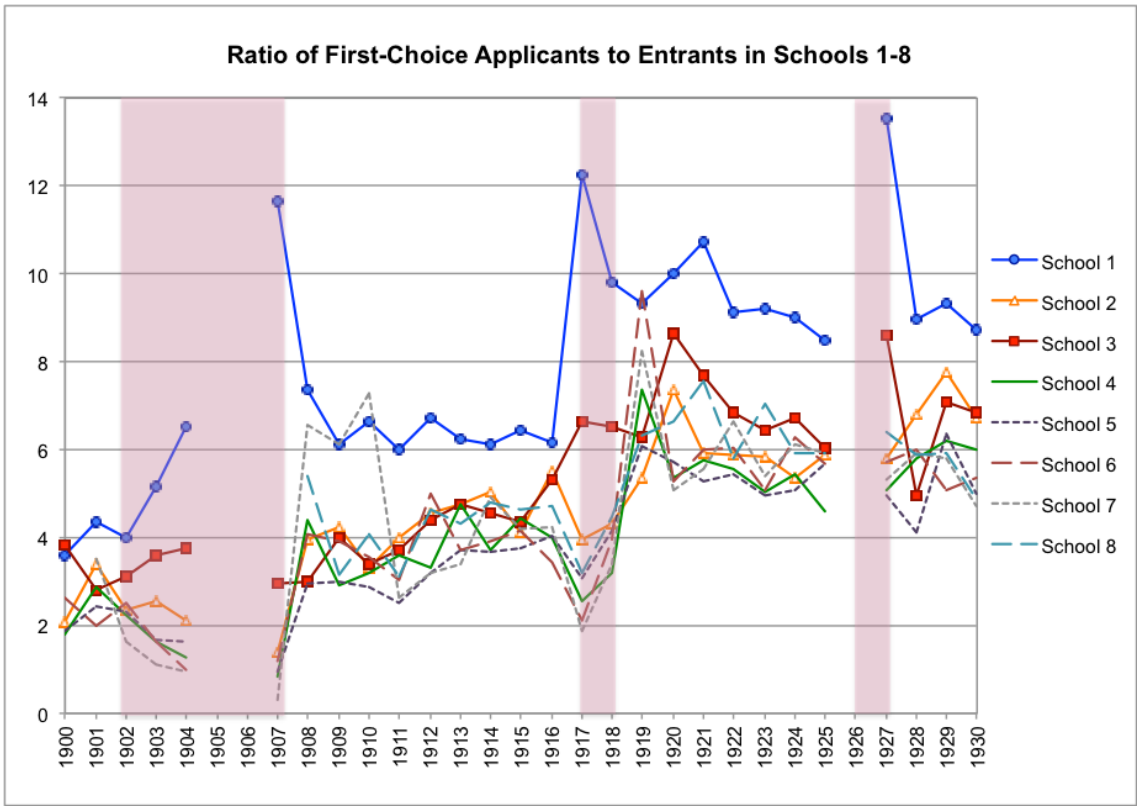
		Each institution's website.
Jamaica	N	MICO, https://www.themico.edu.jm/how-to-apply1 Northern Caribbean University, http://www.ncu.edu.jm/requeriments.html University of Technology, Jamaica, http://www.utech.edu.jm/admissions/how-to-apply/undergraduate-prospective-students/undergraduate
Japan	N	Yeon-Koo Che and Youngwoo Koh, "Decentralized College Admissions," Journal of Political Economy, 2016, 124 (5), 1295–1338.
Jordan	Y (for public schools)	"Country Profile Jordan", https://eacea.ec.europa.eu/sites/eacea-site/files/countryfiches_jordan_2017.pdf
Kazakhstan	Y (since 2004)	"Developments in Central Asian Higher Education", https://wenr.wes.org/2007/06/wenr-june-2007-feature "Country Profile", https://eacea.ec.europa.eu/sites/eacea-site/files/countryfiche_kazakhstan_2017.pdf
Kenya	Y (since 2012)	"Kenya Universities and Colleges Central Placement Service (KUCCPS) Replaces Joint Admission Board (JAB)", https://www.kuccps.net/?q=content/kenya-universities-and-colleges-central-placement-service-kuccps-replaces-joint-admission
Korea	N (since 1969)	"College Admissions as Non-Price Competition: The Case of South Korea", http://www.nber.org/papers/w20774 "Historical analysis of the policy on the college entrance system in South Korea", https://files.eric.ed.gov/fulltext/EJ1068660.pdf
Kosovo	Semi-centralized	"Country Profile Kosovo", https://eacea.ec.europa.eu/sites/eacea-site/files/countryfiche_kosovo_2017.pdf
Kyrgyzstan	Y (since 2002)	"Developments in Central Asian Higher Education", https://wenr.wes.org/2007/06/wenr-june-2007-feature
Laos	Y	"The Higher Education in Lao PDR and Roles of International Cooperation for Its University Development", https://www2.gsid.nagoya-u.ac.jp/blog/anda/files/2010/06/19_bounheng-siharath.pdf "Laos Higher Education System", http://www.headfoundation.org/featuredresearch/Final%20-%20Laos%20PB.pdf
Latvia	N	Each institution's website. https://www.lu.lv/gribustudet/katalogs/programmu-mekletajs/?user_phpfileexecutor_pi1%5Bprogram_id%5D=20771 http://www.studyinlatvia.eu/en/how-to-apply/admission-at-universities
Lechtenstein	N	"Admission Requirements fo Liechtenstein Higher Education Institutions", http://www.liechtensteineducation.info/Admission-Requirements/Admission-Requirements-for-Liechtenstein-Higher-Education-Institutions.html
Liberia	Y	"Every Single Applicant Fails University of Liberias Entrance Exam", http://newsfeed.time.com/2013/08/27/every-single-applicant-fails-university-of-liberias-entrance-exam/
Libya	Y	"Education in Libya", https://wenr.wes.org/2004/07/wenr-julyaugust-2004-education-in-libya
Lithuania	Y	"Higher Education Funding", https://eacea.ec.europa.eu/national-policies/eurydice/content/higher-education-funding-44_sl "Admission Requirements for Higher Education", http://www.lithuaniaeducation.info/Admission-Requirements/Admission-Requirements-for-Higher-Education.html
Luxembourg	N	"Education in Luxembourg", https://en.wikipedia.org/wiki/Education_in_Luxembourg
Macedonia	N	Each institution's admission page. https://www.anadolu.edu.tr/acikogretim/nasil-ogrenci-olabilirim/yeni-kayit http://education.stateuniversity.com/pages/896/Macedonia-HIGHER-EDUCATION.html
Madagascar	N	Each institution's admission page.
Malawi	N	Each institution's admission page. http://mchsmau.ac.mw/?q=node/26
Malaysia	Y	"Education System Malaysia", https://www.nuffic.nl/en/publications/find-a-publication/education-system-malaysia.pdf
Malta	N	"Short Cycle Higher Education", https://eacea.ec.europa.eu/national-policies/eurydice/content/short-cycle-higher-education-49_en
Mauritania	N	Each institution's admission page.
Mexico	N	Each institution's admission page.
Moldova	N	"Country Profile, Moldova", https://eacea.ec.europa.eu/sites/eacea-site/files/countryfiches_moldova_2017.pdf
Mongolia	Y (only in densely populated areas)	"Secondary Education", http://uis.unesco.org/sites/default/files/documents/secondary-education-regional-information-base-country-profile-for-mongolia-en.pdf
Montenegro	N	"Admission Requrements for Higher Education Institutions", http://www.montenegroeducation.info/Admission-Requirements/Admission-Requirements-for-Higher-Education-Institutions.html
Morocco	N	"Education System Morocco", https://www.nuffic.nl/en/publications/find-a-publication/education-system-morocco.pdf

Mozambique	N (since 1989)	"The Educational System of Mozambique", https://photos.state.gov/libraries/mozambique/164103/nguluvep/Edusys.pdf "Alighment of Higher Professional Education with the Needs of the Local Labor Market", https://www.nuffic.nl/en/publications/find-a-publication/alignment-of-higher-professional-education-with-the-needs-of-the-local-labour-market-the-case-of-mozambique.pdf
Namibia	N	Each institution's website. http://www.unam.edu.na/apply-to-unam/undergraduate-admission-requirements http://www.nust.na/?q=study-nust/admission/admission-requirements
Nepal	N	"Education in Nepal", https://wenr.wes.org/2018/04/education-in-nepal
New Zealand	N	Each institution's website.
Nicaragua	N	Each institution's website. https://portalestudiantes.unanleon.edu.ni/prematricula/informacion.php http://www.uca.edu.ni/images/pregrado/pdf/admision-nacional-nacional.pdf
Niger	N	"University of Agadez Admissions Page", http://www.univ-agadez.edu.ne/index.php/l-universite/admission
Nigeria	Semi-centralized	"University and College Admission", https://en.wikipedia.org/wiki/University_and_college_admission
Norway	Y (since 1990)	"Field of Study, Earnings, and Self-Selection", https://academic.oup.com/qje/article/131/3/1057/2461218 "University of Oslo Website", http://www.usit.uio.no/om/it-historien/studenter/so.html
Oman	Y (since 2006 when the higher education admission center established)	"Central Admission System", http://www.oman.om/wps/wcm/connect/en/site/home/gov/gov1/gov5governmentorganizations/mohe/moheheac "Higher Education Admissions Center", http://www.heac.gov.om/media/doc/EnglishIQ_Student_GB_2018-2019.pdf "Admission Systems", http://heac.gov.om/
Pakistan	N	"Unified admission for higher education", https://gulfnews.com/news/gulf/oman/unified-admission-for-higher-education-1.308926 "Management of higher education reforms in Pakistan", https://dspace.library.uu.nl/bitstream/handle/1874/29330/jahangir.pdf?sequence=1
Palestine	N (since 1994)	http://www.reconow.eu/files/fileusers/5140_National-Report-Palestine-RecoNOW.pdf
Panama	N	Each institution's website. http://www.up.ac.pa/ftp/2010/principal/imagenes/varias/AfricheAdmision.jpg http://www.utp.ac.pa/proceso-de-admision-para-las-carreras-de-pregrado
Papua New Guinea	Y (since 2018)	"Online Grade 12 School Leavers Forms Now Available", https://edu.pngfacts.com/education-news/online-grade-12-school-leavers-forms-now-available
Paraguay	N	Each institution's website. Universidad American, https://www.americana.edu.py/content/admisiones-carreras-de-grado Universidad Católica, http://www.universidadcatolica.edu.py/admision/
Peru	N	Each institution's website. Universidad de Lima, http://www.ulima.edu.pe/admision/examen-de-admision PUCP, http://www.pucp.edu.pe/admision/pregrado/modalidades-de-admision/
Poland	N	"University Admission Requirements", http://www.go-poland.pl/admission-requirements
Portugal	Y (for public universities)	"University and College Admission", https://en.wikipedia.org/wiki/University_and_college_admission
Puerto Rico	N	Individual institution's admission page. http://www.upr.edu/wp-content/uploads/2017/12/Manual-de-Admisiones-UPR-2018.pdf – public, main one. http://www.pucpr.edu/wp-content/uploads/2012/05/Instrucciones-subgraduada.pdf http://www.inter.edu/admisiones-2/
Qatar	N	"Qatar University Admission Page", http://www.qu.edu.qa/students/admission/undergraduate/admission-requirements/high-school-applicants
Romania	Y (for high school, since 2000)	"The Romanian Educational System", http://www.fulbright.ro/educational-advising-center/experience-romania/the-romanian-educational-system "Computerized Admission", http://www.siveco.ro/en/about-siveco-romania/press/press-releases/computerized-admission-high-schools-and-vocational-schools-provided-transparency-objectivity-and
Russia	Y (since 2009)	"University and College Admission", https://en.wikipedia.org/wiki/University_and_college_admission
Saudi Araibia	N	"Managing Admission in Saudi Universities: A System Approach", http://www.ijiet.org/vol6/706-E004.pdf "Admission Requirement for Higher Education in Saudi Arabia", http://www.saudiarabiaeducation.info/Admission-Requirements/Admission-Requirements-for-Higher-Education.html
Senegal	N	Individual institution's admission page.

Serbia	N	"Admission Requirements for Higher Education in Serbia", http://www.serbiaeducation.info/Admission-Requirements/Admission-Requirements-for-Higher-Education.html
Sierra Leone	N	Sierra Leone - Higher and Tertiary Education Sector Policy Note ", http://documents.worldbank.org/curated/en/857591468302730070/Sierra-Leone-Higher-and-tertiary-education-sector-policy-note
Singapore	N	"Student Selection and Admission to Higher Education", https://link.springer.com/article/10.1007/BF01432073
Slovakia	N	"Universities in Slovakia", http://office.studyin.sk/universities/
Slovenia	N	"Admission Requirements for Higher Education", http://www.sloveniaeducation.info/Admission-Requirements/Admission-Requirements-for-Higher-Education.html
Somalia	N	Individual institution's website. http://www.ku.edu.so/links.aspx https://simad.edu.so/
South Africa	N	"Higher Education Admission Requiements", http://www.southafricaeducation.info/Admission-Requirements/Admission-Requirements-Higher-Education.html "Education Systems South Africa", https://www.nuffic.nl/en/publications/find-a-publication/education-system-south-africa.pdf
South Sudan	Y	"Admission, Evaluation and Authentication", http://www.moest.org/he/?page_id=479 "More Than 5,000 Students Admitted To Public Universities In South Sudan", http://www.gurtong.net/ECM/Editorial/tabid/124/ctl/ArticleView/mid/519/articleId/16269/More-Than-5000-Students-Admitted-To-Public-Universities-In-South-Sudan.aspx
Spain	Y (since 1980s for elementary school and secondary school)	"College admissions with stable score-limits", https://editorialexpress.com/cgi-bin/conference/download.cgi?db_name=GAMES2012&paper_id=340 "Spanish Universities and Thier Origins", http://www.guninetwork.org/articles/history-spanish-universities-their-origins-12th-century "Matching Practices in Spain", http://www.matching-in-practice.eu/matching-practices-for-elementary-and-secondary-schools-spain/#5
Sri Lanka	Y	"Education in Sri Lanka", https://wenr.wes.org/2017/08/education-in-sri-lanka
Sudan	N	Each institution's admission page.
Suriname	N	"Anton de Kom Universiteit van Suriname Admission Page", http://www.uvs.edu
Sweden	Y (since 1977)	"En introduktion till den svenska högskolan", http://www.uka.se/download/18.12f25798156a345894e4af1/1487841869103/introduktion-arsrapport-2015.pdf "Swedish Council for Higher Education Website", https://www.uhr.se
Switzerland	N	"University and College Admission", https://en.wikipedia.org/wiki/University_and_college_admission
Syria	Semi-centralized	"Higher education in Syria", http://supporthere.org/page/higher-education-syria "Overview of the Higher Education System Syria", https://eacea.ec.europa.eu/sites/eacea-site/files/countryfiches_syria_2017.pdf "Understanding the Syrian Educational System in a Context of Crisis", https://www.oeaw.ac.at/fileadmin/subsites/Institute/VID/PDF/Publications/Working_Papers/WP2016_09.pdf
Taiwan	Y (since 1920s)	"New Admission Criteria for Higher Education", https://english.moe.gov.tw/cp-48-17303-93FB6-1.html
Tajikistan	Y	"Overview of the Higher Education System Tajikistan", https://eacea.ec.europa.eu/sites/eacea-site/files/countryfiche_tajikistan._2017pdf.pdf "Assessmet of Higher Education Tajikistan", https://www.adb.org/sites/default/files/institutional-document/175952/higher-education-taj.pdf
Tanzania	Y (since 2010)	"Nuffic Education Systems", https://www.nuffic.nl/en/publications/find-a-publication/education-system-tanzania.pdf "Undergraduate Students Admission Guidebook for Higher Education Institutions in Tanzania", http://www.tcu.go.tz/images/documents/Undegraduate_AdmissionGuideBook_2015_2016_Final.pdf
Thailand	N (since 2006; new reform starting 2018)	"Education in Thailand", https://wenr.wes.org/2018/02/education-in-thailand-2
The Netherlands	N	"Student selection and admission to higher education", https://link.springer.com/article/10.1007/BF01432073 "What grades do you need to get into a Dutch university?", https://www.studyinholland.co.uk/admissions_information.html
The Philippines	N	"Student Selection and Admission to Higher Education", https://www.jstor.org/stable/pdf/3448186.pdf?refreqid=excelsior%3A1085f679f6e08832cd96aab6bd1981c5
Togo	N	"Université des Sciences et Technologies du Togo Admission Page", http://rusta-usttg.org/inscription.html

		"Trinidad and Tobago's education system is multi-faceted and well funded", https://oxfordbusinessgroup.com/overview/trinidad-and-tobagos-education-system-multi-faceted-and-well-funded
Trinidad and Tobago	N	"Trinidad and Tobago: Education Reform and Societal Mobilization", http://www.coha.org/trinidad-and-tobago-education-reform-and-societal-mobilization/
		"Educational System of Trinidad and Tobago", https://photos.state.gov/libraries/port-of-spain/223843/PDFs/EDUCATIONAL%20SYSTEM%20T_amp_T%202011.pdf
		"The University Entrance Exam in Turkey", https://ac.els-cdn.com/0191491X9600020X/1-s2.0-0191491X9600020X-main.pdf?_tid=9c107890-7161-43d7-82c6-bf79fd8b7ed9&acdnat=1528333168_4c7acdb9995839c7f290cba8d4babee3
Turkey	Y (since 1963)	"A Tale of Two Mechanisms: Student Placement", https://ac.els-cdn.com/S0022053198924693/1-s2.0-S0022053198924693-main.pdf?_tid=2814c837-1087-45d4-83ca-b3a11ded6b25&acdnat=1528334822_cc8a698544f7dc7c63e584fbd6552086
		"Anadolu University info package". http://abo.anadolu.edu.tr/en/kurumsal/genelKabul
Turkmenistan	Y	"Overview of the Higher Education System Turkmenistan", https://eacea.ec.europa.eu/sites/eacea-site/files/countryfiche_turkmenistan_2017.pdf
		"Overview of the Higher Education System Tunisia", https://eacea.ec.europa.eu/sites/eacea-site/files/countryfiches_tunisia_2017.pdf
Turnisia	Y	"Admission Requirements for Higher Education Institutions in Tunisia", http://www.tunisiaeducation.info/Admission-Requirements/Admission-Requirements-for-Higher-Education.html
Uganda	N	"Uganda - Higher Education", http://education.stateuniversity.com/pages/1588/Uganda-HIGHER-EDUCATION.html
UK	N	"Matching in Practice", http://www.matching-in-practice.eu/higher-education/
Ukraine	Semi-centralized	"Matching in Practice", http://www.matching-in-practice.eu/higher-education/
United Arab Emirates	N	"UAEU Admission Process", https://www.uaeu.ac.ae/en/admission/children_of_national_mothers.shtml
United States	N	Yeon-Koo Che and Youngwoo Koh, "Decentralized College Admissions," Journal of Political Economy, 2016, 124 (5), 1295–1338.
		Each insitution's website.
Uruguay	N	UCU, https://carreras.ucu.edu.uy/index.php/admision
		UM, http://www.um.edu.uy/admisiones/proceso-grado/
		ORT, https://www.ort.edu.uy/inscripcion
		"Developments in Central Asian Higher Education", https://wenr.wes.org/2007/06/wenr-june-2007-feature
Uzbekistan	Y (since 2002)	"Overview of the Higher Education System Uzbekistan", https://eacea.ec.europa.eu/sites/eacea-site/files/countryfiche_uzbekistan_2017.pdf
		Each institution's admission website.
Venezuela	N	"Universidad de Los Andres Homepage", http://www.ula.ve/ofae/
Vietnam	N	"Education in Vietnam", https://wenr.wes.org/2017/11/education-in-vietnam
West Sahara	N	Individual institution's admission page.
Yemen	N	"Al Nasser University Admission Process", http://www.al-edu.com/en/admissions/admission-process/application-process/
Zambia	N	"University of Zambia Admission Page", https://www.unza.zm/uncategorised/admission-applications-for-2019
Zimbabwe	N	"Nuffic Education Systems", https://www.nuffic.nl/en/publications/find-a-publication/education-system-zimbabwe.pdf

Figure A.1: Changes in the Competitiveness of Schools 1-8



Notes: This figure shows the changes in the competitiveness of each school (measured by the ratio of the number of applicants who select the school as their first choice to the number of entrants to the school) from 1900 to 1930. The number of entrants is the number of applicants who are admitted to the school in that year and is a proxy for school capacity. No data are available for 1905, 1906, and 1926. Colored years (1902-07, 1917-18, 1926-27) indicate the periods of the centralized system, while other years were under the decentralized system. (School 7 in 1901, 1908, 1909, and 1910, and School 8 in 1908 held their exams on different dates from other schools due to special circumstances, attracting a high number of applicants in these years.) Under the decentralized system, because an applicant can apply to only one school in principle, entrants are chosen from the applicants who select the school as their first choice. By contrast, under the centralized system, because an applicant can apply to multiple schools and is assigned to a school based on his exam score and school preference order, entrants are not necessarily a subset of the applicants who select the school as their first choice. See Section 5.1 for discussions.

Figure A.2: Centralized Assignment Rules of 1903


第九條　選拔試驗ヲ受ケタル者ハ之ヲ第一部、第二部及第三部ノ三部ニ分類シ其ノ試驗ノ成績順ニ依リ各高等學校ニ於ケル各部募集ノ總員ト同數ナル人員ヲ選出シ其ノ內ニ就キ左ノ方法ニ依リ各高等學校ニ配當スルモノトス

一　入學試驗ノ成績順ニ依リ本人ノ指定スル第一ノ入學志望學校ニ於ケル第一ノ志望部類ニ配當ス

二　第一號ノ場合ニ於テ試驗成績相同シキトキハ抽籤ニ依ル

三　第一號第二號ニ依リ配當ノ結果本人ノ指定スル第一ノ入學志望學校已ニ滿員トナリ配當スルコトヲ得サル者ニ付テハ更ニ成績順ニ依リ本人ノ指定スル第二以下ノ入學志望學校ニ於ケル第一ノ志望部類ニシテ缺員アルモノニ配當ス

四　第三號ノ場合ニ於テ試驗ノ成績相同シキトキハ入學志望學校ノ順序相同シキトキハ抽籤ニ依ル

五　第三號ノ場合ニ於テ試驗ノ成績及入學志望學校ノ順序相同シキトキハ抽籤ニ依ル

六　前數號ニ依リ配當ノ結果本人ノ志望スル學校悉ク滿員トナリタルトキハ第一部又ハ第二部志望者ニ在テハ更ニ本人ノ指定スル第二以下ノ志望部類ニシテ缺員アルモノニ配當ス其ノ方法ハ第一號乃至第五號ニ準ス

七　前數號ニ依リ配當ノ結果本人ノ志望スル學校及部類悉ク滿員トナリタルトキハ入學スルヲ得サルモノトス

前項ニ依リ配當ノ結果又ハ事故ノ爲入學者ニ缺員ヲ生シタルトキハ前項選出人員以外ニ就キ更ニ前項ノ方法ニ依リ之ヲ補塡スヘシ

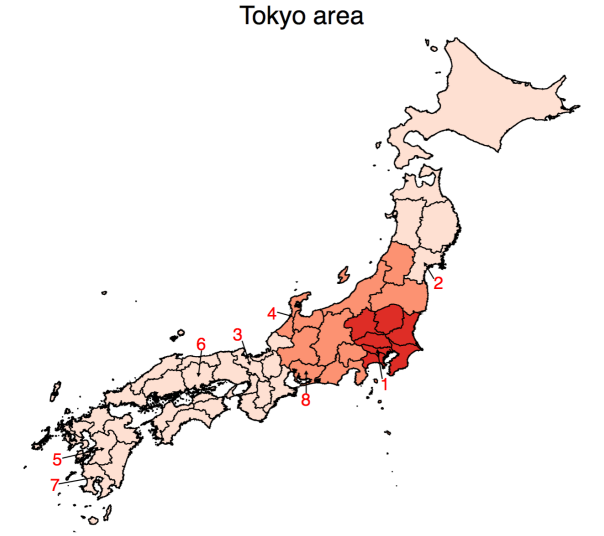
Notes: This figure is a reprint of the assignment rules in the centralized admissions system announced in the public notice of the Ministry of Education No 84 published in Government Gazette No. 5937 p.428, on April 21, 1903. See Section 2 for discussions.

Table A.2: Summary Statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Applicant level data on short-run outcomes					
Distance between middle school prefecture and the school applied as first choice (km)	224.88	272.03	0	1821.7	20913
Share of applicants applying to School 1 as first choice	0.33	0.47	0	1	20913
Entrant level data on short-run outcomes					
Distance between birth prefecture and the school entered (km)	226.8	258.65	0	1821.7	66193
Share of entrants entering the nearest school from birth prefecture	0.49	0.5	0	1	66193
Share of entrants born in Tokyo prefecture	0.09	0.29	0	1	66193
Share of entrants born in Tokyo area (7 prefectures within 100km from Tokyo)	0.17	0.38	0	1	66193
Prefecture-year level data on short-run outcomes					
No. of entrants to Schools 1-8	45.06	37.45	0	337	1469
No. of entrants to School 1	7.88	14.11	0	132	1469
No. of entrants to School 2	5.5	10.4	0	100	1469
No. of entrants to School 3	6.19	10.34	0	104	1421
No. of entrants to School 4	5.64	9.91	0	90	1469
No. of entrants to School 5	6.27	14.2	0	103	1422
No. of entrants to School 6	5.19	11.8	0	131	1421
No. of entrants to School 7	5.03	12.99	0	156	1328
No. of entrants to School 8	5.67	12.45	0	133	1093
No. of public middle school graduates	415.38	350.01	11	3095	1410
No. of private middle school graduates	118.49	435.12	0	4675	1410
No. of schools other than School 1-8	0.13	0.43	0	5	1469
Prefecture-year level data on long-run outcomes in JPIR (1939)					
No. of all Imperial University graduates	9.13	8.12	0	74	611
No. of people earning more than 1200 yen of taxable income	20.46	26.04	0	189	611
No. of managers of private companies earning more than 1200 yen of taxable income	13.42	16.55	0	119	611
No. of scholars, doctors, lawyers, and engineers	6.87	6.17	0	52	611
Fraction of people who live in a prefecture different from birth prefecture	0.22	0.11	0	1	611

Notes: This table provides summary statistics of variables used in the empirical analysis. The sample period for applicant level data is during 1916 and 1917. The sample period for entrant level data and prefecture level data for short-run outcomes is from 1900 to 1930. The birth cohorts of long-run outcomes span from 1882 to 1894. The information on the school applications is based on the applications to the school selected as first choice. The information on the school "entrants" is based on the first year students in the schools.

Figure A.3: Definition of the Tokyo Area



Notes: This figure shows the Tokyo area (in the dark color, also known as the Kanto area) defined as prefectures that are within 100 km from Tokyo (Tokyo, Chiba, Kanagawa, Saitama, Ibaraki, Tochigi, and Gunma) and the Outer Tokyo area (in the medium color) defined as prefectures that are 100-300 km away from Tokyo. See Section 5.2 for discussions about this figure.

Table A.3: Parallel Pre-event Trends

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Imperial University		High incomeearners		Managers		Professionals	
Tokyo area (< 100km) × Time trend	0.261		0.933		0.597		0.254	
	(0.390)		(1.027)		(0.681)		(0.236)	
Area where entrants increased × Time trend		0.211		0.374		0.233		0.160
		(0.259)		(0.706)		(0.469)		(0.163)
Observations	658	658	658	658	658	658	658	658
Cohort FE	YES	YES	YES	YES	YES	YES	YES	YES
Pref FE	YES	YES	YES	YES	YES	YES	YES	YES
Mean dep var	4.564	4.564	14.52	14.52	9.257	9.257	3.594	3.594
Mean dep var (Treated group dur. Dapp)	5.980	5.617	23.63	17.93	14.51	11.04	4.969	4.481

Notes: This table tests if there are differences in pre-event trends between urban and rural regions in the differences-in-differences analysis in Section 6. This table runs the following regression:

$$Y_{pt} = \alpha_p + \alpha_t + \beta \times Timetrend \times Urban_p + \epsilon_{pt},$$

where the linear time trend is defined as the cohort's birth year minus 1870 and other variables are defined in the same way as in Table 4. The estimates use the prefecture-cohort level data of the number of individuals listed in the JPIR in 1939, which includes cohorts who became age 17 in 1871-1884. See Section 6 for discussions about this figure.

Figure A.4: Admission Outcomes of the Centralized Assignment Algorithm

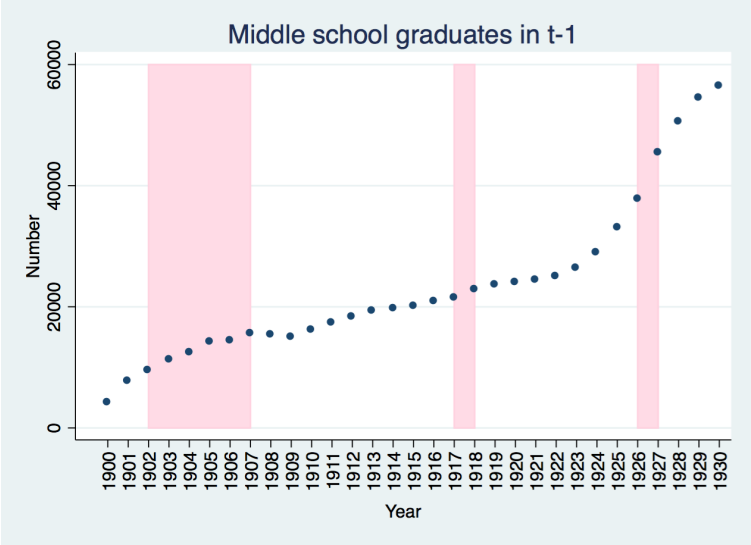
Exam Scores of Entrants in 1917 Under Centralized Admission System

School Name	School 1	School 2	School 3	School 4	School 5	School 6	School 7	School 8
Location	Tokyo	Sendai	Kyoto	Kanazawa	Kumamoto	Okayama	Kagoshima	Nagoya
Total no. of entrants	77	29	38	22	68	36	37	64
Entrants Admitted to their 1st Choice								
No. of entrants	77	14	38	18	23	18	6	18
Max exam score	548	462	521	496	471	456	415	455
Min exam score	451	374	404	364	363	364	364	363
Entrants Admitted to their 2nd Choice								
No. of entrants		15		4	30	18	8	46
Max exam score		450		450	438	433	449	450
Min exam score		442		421	362	369	372	363
Entrants Admitted to their 3rd Choice								
No. of entrants					15		3	
Max exam score					450		450	
Min exam score					393		407	
Entrants Admitted to their 4th Choice								
No. of entrants							9	
Max exam score							400	
Min exam score							366	
Entrants Admitted to their 5th Choice								
No. of entrants							11	
Max exam score							444	
Min exam score							369	

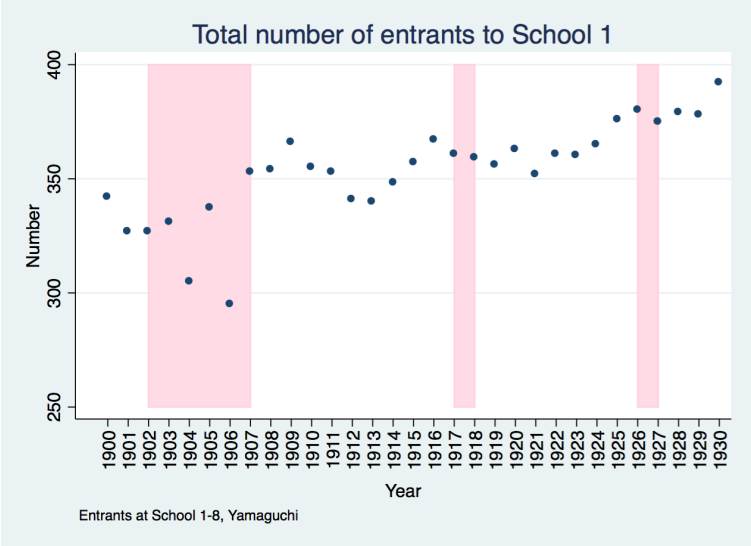
Notes: This figure shows admission outcomes for the Department of Law and Literature in Schools 1-8 in 1917 under the centralized assignment algorithm. See Section 5.2 for discussions about this figure.

Figure A.5: Smoothness of Other Policy Variables

(a)

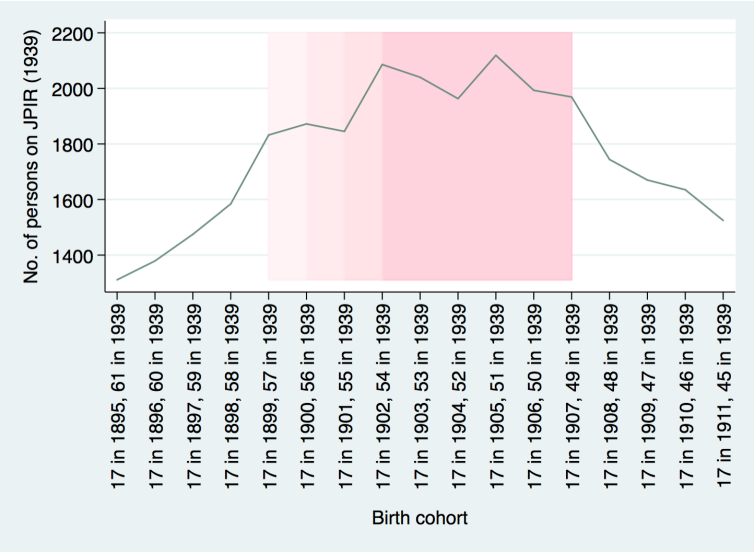


(b)



Notes: This figure shows the time evolution of policy variables other than those directly affected by the admission system we analyze. Colored segments indicate the years under Capp, while the rest of the years were under Dapp. See Section 2 for discussions about this figure.

Figure A.6: Total Number of Individuals in the JPIR of 1939 by Cohort



Notes: This figure shows the total number of individuals who are listed in the JPIR published in 1939 by cohorts. These cohorts were born in 1882-1894 and became age 17 in 1895-1911. Dark colored cohorts indicate those who became age 17 during the first period of Capp in 1902-1907. Lightly colored cohorts are those who became age 17 before 1902 but might have taken the entrance exam in 1902 under Capp if they failed to enter any school at age 17 and retook the exam in subsequent years.

Table A.4: Long–run Impacts of Centralization: Differences-in-Differences Estimates: Details

VARIABLES	Professionals: Scholars		Professionals: Doctors/Lawyers		Professionals: Engineers		Government		Landowners	
Age 17 during centralization × Tokyo area (<100km)	0.771**		0.524		1.010*		1.038***		0.486	
	(0.350)		(0.323)		(0.508)		(0.383)		(0.438)	
Age 17 during centralization × Area where entrants increased		0.662**		0.550*		0.893**		0.503		0.121
		(0.311)		(0.277)		(0.379)		(0.362)		(0.328)
Observations	611	611	611	611	611	611	611	611	611	611
Cohort FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Pref FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Mean dep var	3.697	3.697	2.980	2.980	2.484	2.484	3.481	3.481	1.277	1.277
Mean dep var (Treated group during decentralization)	5.102	4.442	3.694	3.260	3.082	2.701	4.184	3.831	3.327	2.273

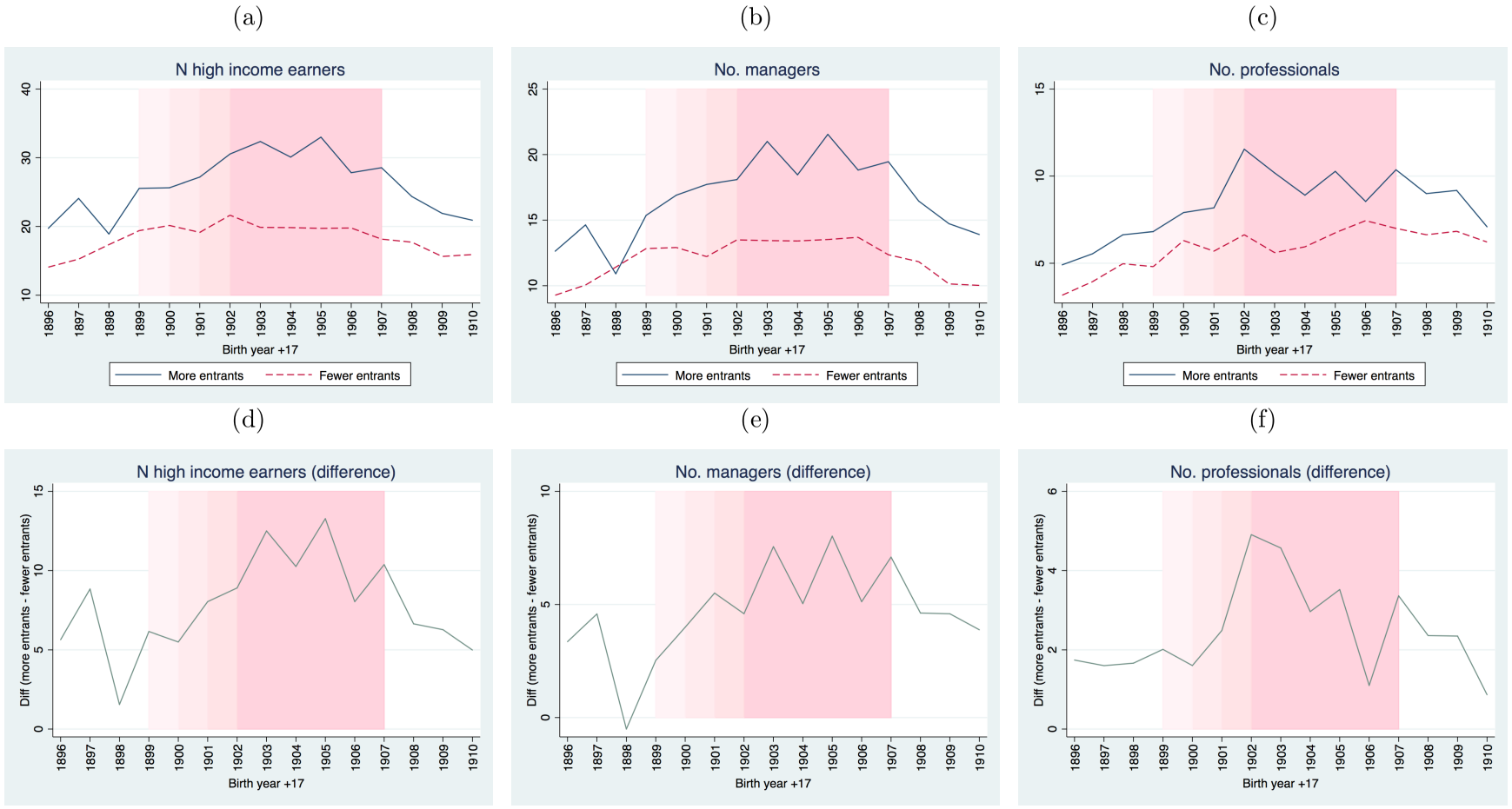
Notes: This table shows differences-in-differences estimates of the long-run effects of the centralization of the admission system. The estimates use the prefecture-cohort level data of the number of persons listed on the Japanese Personnel Inquiry Records (JPIR) in 1939, which includes cohorts who became age 17 during 1899 and 1911. "Scholars" is the number of persons on the JPIR who were born in the prefecture in the cohort and who worked as a scholar. "Doctors/Lawyers" is the number of persons on the JPIR who were born in the prefecture in the cohort and who worked as a doctor or a lawyer. "Engineer" is the number of persons on the JPIR who were born in the prefecture in the cohort and who worked as an engineer. "Government" is the number of persons on the JPIR who were born in the prefecture in the cohort and who worked as a high-ranked central government officer or worked as a politician. "Landowner" is the number of persons on the JPIR who were born in the prefecture in the cohort and who owned land. "Age 17 during centralization" takes 1 if the cohort became 17 years old during 1902–1907, and takes 0 otherwise. "Mean dep var" shows the mean of the dependent variable for all prefecture-year observations. "Mean dep var (Treated group during decentralization)" shows the mean of the dependent variable for the treated group (either the Tokyo area or the area where selective-school entrants increased) during decentralization. Standard errors are clustered at the prefecture level. ***, **, and * mean significance at the 1%, 5%, and 10% levels, respectively. See Section 6 for discussions about this figure.

Table A.5: Long–run Impacts of Centralization: Differences-in-Differences Estimates with control variables

VARIABLES	Imperial University		High-income earners		Managers		Professionals		Fraction moved	
Age 17 during centralization × Tokyo area (<100km)	2.067***		5.664**		2.987**		1.339**		-0.019	
	(0.561)		(2.715)		(1.134)		(0.504)		(0.020)	
Age 17 during centralization × Area where entrants increased		1.688***		4.295**		1.992**		1.362***		-0.008
		(0.527)		(1.965)		(0.958)		(0.418)		(0.018)
Observations	563	563	563	563	563	563	563	563	563	563
Cohort FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Pref FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Mean dep var	9.231	9.231	20.90	20.90	13.72	13.72	6.961	6.961	0.228	0.228
Mean dep var (Treated group during decentralization)	11.88	10.82	32.43	24.26	21.12	15.85	9.024	8.030	0.234	0.226
Age≤17 in 1902 × Tokyo area (<100km)	1.219		5.771**		3.306**		0.695		-0.016	
	(0.848)		(2.806)		(1.471)		(0.707)		(0.028)	
Age≤17 in 1908 × Tokyo area (<100km)	-2.794***		-5.572*		-2.713**		-1.889**		0.022	
	(0.760)		(2.837)		(1.039)		(0.750)		(0.017)	
Age≤17 in 1902 × Area where entrants increased		1.149*		4.204**		2.220*		1.162*		0.011
		(0.676)		(2.056)		(1.166)		(0.632)		(0.024)
Age≤17 in 1908 × Area where entrants increased		-2.161***		-4.375**		-1.791*		-1.538**		0.024
		(0.749)		(2.100)		(1.004)		(0.646)		(0.018)
Observations	563	563	563	563	563	563	563	563	563	563
Cohort FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Pref FE	YES	YES	YES	YES	YES	YES	YES	YS	YES	YES

Notes: This table shows differences-in-differences estimates of the long-run effects of the centralization of the admission system. The estimates use the prefecture-cohort level data of the number of persons listed on the Japanese Personnel Inquiry Records (JPIR) in 1939, which includes cohorts who became age 17 during 1899 and 1911. These regressions control for the numbers of primary schools and middle schools in the prefecture in the year when the cohort becomes eligible for these schools, log of prefecture manufacturing GDP when the cohort becomes 20 years old, and the prefecture birth population of the cohort. "Imperial University" is the number of persons on the JPIR who were born in the prefecture in the cohort and whose final education was at one of the Imperial Universities. "High-income earners" is the number of persons on the JPIR who were born in the prefecture in the cohort and paid income tax of above 9.6 yen of income tax, which corresponds to earning of taxable income above 1200 yen. "Managers" is the number of persons on the JPIR who were born in the prefecture in the cohort and who worked at a managerial position in companies and earned taxable income above 1200 yen. "Professionals" is the number of persons on the JPIR who were born in the prefecture in the cohort and who worked as either a scholar, a doctor, a lawyer, or an engineer. "Fraction moved" is the fraction of persons on the JPIR whose prefecture of residence is different from the birth prefecture. "Age 17 during centralization" takes 1 if the cohort became 17 years old during 1902–1907, and takes 0 otherwise. "Age≤17 in 1902" takes 1 if the cohort become 17 years old in 1902 or later. "Age≤17 in 1908" takes 1 if the cohort becomes 18 years old in 1908 or later. "Mean dep var" shows the mean of the dependent variable for all prefecture-year observations. "Mean dep var (Treated group during decentralization)" shows the mean of the dependent variable for the treated group (either the Tokyo area or the area where selective-school entrants increased) during decentralization. Standard errors are clustered at the prefecture level. ***, **, and * mean significance at the 1%, 5%, and 10% levels, respectively. See Section 6 for discussions about this figure.

Figure A.7: Long-run Impacts of Centralization: Differences-in-Differences: Area where entrants increased



Notes: This figure shows visual differences-in-differences plots that measure how the centralization affected the number of elite executives, public officials, and high income taxpayers born in the prefectures where entrants increased during Capp in 1902–1907. The plots use the prefecture-cohort level data of the number of persons listed on the Japanese Personnel Inquiry Records (JPIR) in 1939, which includes cohorts who became age 17 during 1899 and 1912. We measure the outcomes per prefecture per year. Most darkly colored years used the centralized system while other years used the decentralized system. Lightly colored years are those with the decentralized system but potentially affected by centralization due to the presence of students who wait and prepare for additional years after having failed in a particular year. See Section 6 for discussions about this figure.