MERITOCRACY AND ITS DISCONTENTS: LONG-RUN EFFECTS OF REPEATED SCHOOL ADMISSION REFORMS

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May 2024

COWLES FOUNDATION DISCUSSION PAPER NO. 2390

COWLES FOUNDATION FOR RESEARCH IN ECONOMICS

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Meritocracy and Its Discontents:

Long-run Effects of Repeated School Admission Reforms

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May 21, 2024

Abstract

What happens if selective colleges change their admission policies? We study this question by analyzing the world's first implementation of nationally centralized meritocratic admissions in the early twentieth century. We find a persistent meritocracy-equity tradeoff. Compared to the decentralized system, the centralized system admitted more high-achievers and produced more occupational elites (such as top income earners) decades later in the labor market. This gain came at a distributional cost, however. Meritocratic centralization also increased the number of urban-born elites relative to rural-born ones, undermining equal access to higher education and career advancement.

Keywords: Elite Education, Market Design, Strategic Behavior, Regional Mobility, Universal Access, Persistent Effects

JEL: D47, I23, I24, N35

*We thank Zach Bleemer, David Card, Yeon-Koo Che, Caroline Hoxby, Pat Kline, Joe Price, Al Roth, Chris Walters, Seth Zimmerman, and seminar participants at AEA, Berkeley, Columbia, Penn State, Princeton, Stanford, Rice, Yale, and the NBER (education group and market design group) for their helpful feedback, Hidehiko Ichimura and Yasuyuki Sawada for sharing a part of the data, and an extensive list of students for research assistance. We gratefully acknowledge financial support from JSPS Grant JP19K13719 and 24H00145, Yale Council on East Asian Studies, Hitotsubashi University IER Joint Usage and Research Center Grant (FY 2018). Chiaki Moriguchi: Institute of Economic Research, Hitotsubashi University, email: chiaki@ier.hit-u.ac.jp. Yusuke Narita (corresponding author): Department of Economics, Cowles Foundation, and Y-RISE, Yale University, email: yusuke.narita@yale.edu, address: Room 328, 87 Trumbull Street, New Haven CT 06511. Mari Tanaka: Faculty of Economics, University of Tokyo, and Institute of Economic Research, Hitotsubashi University, email: m.tanaka@e.u-tokyo.ac.jp, mari.tanaka@r.hit-u.ac.jp.

1 Introduction

One major trend in college admissions around the world is a growing degree of centralization. Today, over thirty countries use regionally- or nationally-integrated, single-application and single-offer college admissions (Appendix Figure A.1). These systems have well-specified admission criteria, mixing meritocratic achievement elements (such as GPA and entrance exams) and other priority considerations. Before the turn of the 20th century, however, no country used such a centralized system. How does the centralization of admission systems affect students' life trajectories? What are their impacts on the national production of highly skilled individuals and their composition? A key challenge in studying these questions is the lack of clear policy changes and data about students' long-run outcomes.

In this paper, we study the impacts of centralized and meritocratic college admissions. Our investigations reveal their pros and cons, especially a tension between meritocracy and equal access to higher education and career achievements in the long run. We reach these findings by combining a series of natural experiments in history and newly assembled historical data that trace students over decades.

Our empirical setting is the world's 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 National Higher Schools (roughly equivalent to today's colleges) as an exclusive entry point to the most prestigious tertiary education.[1] We focus on these selective colleges, as they later produced many of the most influential leaders of the society, including several Prime Ministers, Nobel Laureates, and founders of global companies like Toyota. Their prestige and social influences were similar to Oxbridge in the UK, Grandes Écoles in France, and the Ivy League in the US.

Acceptance into these schools was based on annual entrance exams. Initially, the government let each school run its own exam and admissions based on exam scores, similar to

[1] After WWII, National Higher Schools were transformed into parts of today's national universities. For example, the First National Higher School in Tokyo became the first two years of the University of Tokyo.

many of today's decentralized K-12 and college admissions. Under this decentralized system, the schools typically held exams on the same date so that each applicant could apply for only one school.[2] As a result, many high achieving applicants applied to and were rejected by the most competitive school, failing to enter any school.

This problem motivated the government to introduce a centralized system in 1902. The new system prioritized the admission of the highest-scoring students. Specifically, applicants were asked to submit preference rankings over multiple schools and to take a single unified exam.[3] Given their preference rankings and exam scores, each applicant was assigned to a school (or none if unsuccessful) based on a computational algorithm. The algorithm was a mix of the Deferred Acceptance and Immediate Acceptance (Boston) algorithms combined with a meritocracy principle that assigns only the highest-scoring applicants to any school. To our knowledge, this instance is the first nationwide use of any matching algorithm.[4]

Furthermore, 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 the different systems.[5] We exploit these bidirectional institutional changes to identify the short- and long-run impacts of meritocratic centralization. For the short-run analysis, we newly collect and digitize application and enrollment data from administrative school records and government documents, including Government Gazettes and Ministry of Education Yearbooks.

We first find that meritocratic centralization had large effects on application behavior and enrollment outcomes. In particular, centralization caused applicants in all areas to be more risk-taking and more often rank the most selective school first. Applicants also made

[2]Similar restrictions on the number of applications exist today in the college admission systems of Italy, Nigeria, and the UK.

[3]As shown later, the defining feature of the centralized system was to allow applicants to list multiple schools, not the use of a single unified exam.

[4]The earliest known large-scale use of the Boston algorithm is the assignment of medical residents to hospitals in New York City in the 1920s (Roth, 1990). The oldest known national use of the Deferred Acceptance algorithm is 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.

[5]During 1900–1930, there were three periods of centralization in 1902–1907, 1917–1918, and 1926–1927.

longer-distance applications, leading students to be enrolled at schools further away from their regional origin. The reform thus made the selective higher education market more meritocratic, competitive, and regionally integrated.

The effect of centralization was heterogeneous, however. Because high-achieving students were disproportionately located in urban areas (mainly Tokyo), the centralized system caused a greater number of urban applicants to be admitted to schools in rural areas, typically after being rejected by their first-choice schools.[6] As a result, urban high-achievers crowded out rural applicants: the number of urban-born entrants to any national higher school increased by about 10% during centralization.[7] Historical documents suggest that this distributional consequence upset rural schools and their local communities. Such rural discontents were a reason why the government oscillated between the centralized and decentralized systems.

Our main results are the long-run effects of the centralized system on the national production and regional distribution of occupational elites. To study the distributional consequence, we compare urban vs rural-born individuals' long-term career outcomes by each cohort's exposure to the centralized admission system. The career outcome data is based on the Personnel Inquiry Records (PIR) published in 1939 (more than thirty years after the first period of meritocratic centralization). The data provides a list of socially distinguished individuals—encompassing economic, political, and cultural elites—and their biographical information.[8]

Distributional effects of meritocratic centralization turn out to be persistent. Almost four decades after the reform, relative to the decentralized system, the centralized system produced a greater number of occupational elites (such as top income earners and top politicians and bureaucrats) who came from urban areas compared to rural areas. The number of urban-

[6]We use "urban areas" to refer to a region surrounding Tokyo (as defined in Section 3). As shown later, these areas were characterized by a greater population, higher income, and better educational infrastructure.

[7]It is also empirically true that the centralized system made a greater number of rural applicants apply to and enter urban schools. The centralized system thus increased regional mobility across the country. But their net effects are such that urban high-achievers crowded out rural applicants.

[8]We provide extensive investigations about the quality of the data (such as the coverage and sampling bias) in Section 4.1.

born elites increased by 10–20% for the cohorts exposed to meritocratic centralization. We also provide suggestive evidence that the centralized system increased the number of elites living in urban areas in their late adulthood. Meritocratic centralization thus impacted both the origins and destinations of highly skilled individuals.

We conclude our analysis by examining the impact of meritocratic centralization on the national production of occupational elites. We first focus on a specific subgroup, i.e., top bureaucrats. Top bureaucrats were an important category of elites in our empirical context, where higher civil service was one of the most prestigious and coveted jobs due to their political and legislative influence in building the state (Shimizu, 2019). Using comprehensive administrative data of all individuals who have passed the national exams to become higher civil officials, we compare the total number of bureaucrats promoted to top ranks between cohorts exposed to the centralized admissions and cohorts exposed to the decentralized admissions. We find that the number of top-ranking bureaucrats was 15% greater in the centralized cohorts than in the decentralized cohorts, suggesting that centralized cohorts won promotion competitions over decentralized cohorts. Moreover, we find that meritocratic centralization produced a greater total number of all occupational elites listed in the PIR data, including top-income earners. Meritocratic centralization thus produced a greater number of occupational elites for the whole country.

Overall, our findings show that the design of admission rules affects the production and distribution of highly educated and skilled individuals, which is an important determinant of economic growth and inequality (Glaeser, 2011; Moretti, 2012). On one hand, meritocratic centralization achieved the goal of recruiting applicants with higher academic performance. Moreover, this meritocracy produced a greater number of occupational elites in the long run. The policymaker may therefore embrace meritocratic centralization on the ground that it produces more high-quality leaders for the society.

On the other hand, this gain came at the equity cost of urban-born high-achievers overwhelming rural-born ones both in the short and long run. Meritocratic centralization expanded the urban-rural gap in the ability to produce highly skilled individuals. Meritocracy may thus dampen the society's capability to diversify the backgrounds of individuals in leadership positions and represent a broad range of socioeconomic groups.

Literature. Our analysis contributes to the empirical literature that uses policy reforms to study the impacts of the design of admission systems (Abdulkadiroğlu et al., 2006; Abdulkadiroğlu, Agarwal and Pathak, 2017; Chen, Jiang and Kesten, 2020; Machado and Szerman, 2021; Terrier, Pathak and Ren, 2021; Kapor, Karnani and Neilson, 2023; Campos and Kearns, 2024).[9] While these prior studies focus on the short-run effects (on application, enrollment, academic achievement, and welfare), we estimate the long-run effects by taking advantage of bidirectional, repeated policy changes in history.[10] This use of bidirectional policy changes echoes other studies with similar identification strategies (Niederle and Roth, 2003). Our analysis of the meritocracy vs equity tension has some similarities to ongoing policy discussions on affirmative actions, which are surveyed in Arcidiacono and Lovenheim (2016). Recent important contributions in this area include Bleemer (2020, 2022), Kapor (2020) and Otero, Barahona and Dobbin (2021).[11]

From a broader historical perspective, this study relates to the literature that investigates the long-term effects of institutions (Nunn, 2009), particularly the effects of resource allocation mechanisms (Bleakley and Ferrie, 2014). Our analysis is also related to Bai and Jia (2016), who examine political consequences of the abolition of a meritocratic elite recruitment system (civil service exam) in early twentieth-century China.

The next section provides the historical and institutional background. Section 3 examines the short-term effects of meritocratic centralization, while Section 4 analyzes the long-term

[9]Other studies measure the effects of selective schools conditional on particular admission systems (Dale and Krueger, 2002; Hastings, Neilson and Zimmerman, 2013; Pop-Eleches and Urquiola, 2013; Deming et al., 2014; Kirkeboen, Leuven and Mogstad, 2016; Clark and Del Bono, 2016; Abdulkadroğlu et al., 2017; Zimmerman, 2019; Abdulkadiroglu et al., 2021; Narita, 2021; Michelman, Price and Zimmerman, 2021; Chetty, Deming and Friedman, 2023).

[10]With its interest in long-run effects, this paper also relates to studies of the long-term effects of educational reforms (e.g., Duflo, 2001; Meghir and Palme, 2005; Ichimura et al., 2024). These studies focus on the effects of expanding resources (such as school constructions and compulsory education extensions), while we investigate the effects of changing resource allocation mechanisms given a fixed amount of resources.

[11]Kamada and Kojima (2015) and Agarwal (2017) study regional equity in other matching markets.

impacts. Section 5 summarizes our findings and outlines future directions.

2 Background

2.1 Bidirectional Admission Reforms

To analyze the impact of centralized admissions, we take advantage of unique historical episodes in early twentieth-century Japan. Since the opening of the country in the mid 19th century, to catch up with Western knowledge, science, and technologies, education reforms became a central part of modernization efforts by the Japanese government. In 1894, the government set up a national higher education system consisting of one Imperial University (four-year program) and five National Higher Schools (five-year program). By 1908, the system was expanded to four Imperial Universities (Tokyo, Kyoto, Tohoku, and Kyushu) and eight National Higher Schools located across the country.[12] We refer to these eight National Higher Schools as Schools 1–8 for short.[13] Our analysis focuses on Schools 1–8.

Schools 1–8 served as an exclusive entry point to Imperial Universities, the most prestigious tertiary education. Virtually all graduates of Schools 1–8 were admitted to these universities without further selection well into the 1920s. Imperial University graduates were also partially or wholly exempted from the Higher Civil Service Examinations and other selective national qualification exams to become high-ranking administrators, diplomats, judges, and physicians. As a result, entering Schools 1–8 was considered as a passport into the elite class. Indeed, Schools 1–8 produced highly distinguished and influential individuals, including Prime Ministers, Nobel Laureates, world-leading mathematicians, renowned novelists, and founders of global companies like Toyota. To apply to these schools, one must

[12]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 of establishment; see Appendix Figure A.2 for their locations.

[13]The number of higher education institutions increased after 1918, as the government permitted not only national but also local public and private higher schools and universities. See Appendix Section A.1 and Table A.1 for details. In our empirical analyses, we control for the number of National Higher Schools as well as other characteristics of higher education institutions.

be male aged 17 or older and have completed a five-year middle school.[14] Schools 1–8 admitted fewer than 2,300 students each year throughout 1900–1930, constituting less than 0.5% of the cohort of males aged 17. Descriptive statistics are presented in Appendix Table A.2.

Among Schools 1–8, School 1 in Tokyo was considered the most prestigious due to its location in the capital and its geographical proximity to Tokyo Imperial University (today's University of Tokyo). The next most prestigious was School 3 in Kyoto, the ancient capital of Japan. By contrast, located in a remote southwest region, Schools 5 and 7 were considered the least prestigious among all schools. Consequently, the schools differed substantially in their popularity and selectiveness.[15]

The admission to Schools 1–8 was based on annual entrance exams. Initially, the government let each school administer its own exam and admissions. Typically, Schools 1–8 coordinated to hold their exams on the same date so that each applicant could only apply to one school. We call this system "decentralized admissions" (or "decentralization" for short). The single choice aspect captures an essential feature of decentralization, which incentivizes each applicant to self-select into an appropriate school by comparing the selectivity of schools with his own standing (Che and Koh, 2016).

Under decentralization, however, many high-achieving students were rejected by popular schools, while lower-achieving students entered less popular schools. For the government, who wanted to send the most promising students to selective higher education, the decentralized system appeared inefficient.[16] The Education Minister criticized the decentralized system as follows:

> "*[Under the decentralized system] many applicants are rejected by Schools 1 and 3 [in Tokyo and Kyoto], which attract a large number of high ability applicants, despite the fact that these applicants have superior academic performance to that*

[14] The eligibility was changed in 1919 to males aged 16 or older who have completed the fourth year of middle school.

[15] Tuition was mostly uniform across Schools 1–8.

[16] Applicants who failed to enter Schools 1–8 chose either (1) to retake the exam in the following year, (2) to enter local public or private higher educational institutions, or (3) to give up receiving higher education.

of applicants admitted to other more rural schools. (...) As a result, hundreds of applicants with sufficiently high academic ability to enter rural schools are idly wasting another year [to retake the exam]. This is not only a pity for them, but also a loss for the country."[17]

To solve this problem, in 1901, the government first asked all schools to unify their entrance exams to a single one, while maintaining decentralized admission decisions. In 1902, the government launched a centralized system. Under the new system, applicants were allowed to apply for multiple schools by submitting their preference rankings over schools before taking the unified exam. Based on their exam scores and school preferences, applicants were then assigned to one school (or no school if unsuccessful) by an assignment algorithm announced ex ante. Each year, the government announced application procedures in April, three months before the exam in July, as a public notice in the Government Gazette. We call this system centralized admissions (or centralization for short).

The centralized assignment algorithm was specified as follows.[18]

(1) In the order of exam scores, select the same number of applicants as the sum of all schools' capacities. In the case of a tie, decide by lottery.

(2) For applicants selected in (1), in the order of exam scores, assign each applicant to the school of his first choice. In the case of a tie, decide by lottery.

(3) For applicants selected in (1) and for whom the school of his first choice is already filled at the end of (2), in the order of exam scores, assign each applicant to the school of his second choice. In the case of a tie, decide by lottery.

[17] A quote from *Educational Review* No.1146, p.21, published in February 15, 1917, right before the second introduction of the centralized system.

[18] This is the assignment algorithm in 1917 (see Appendix Figure A.3 for a reprint of the original assignment algorithm published in the Government Gazette). The centralized assignment algorithm was first introduced in 1902 and reintroduced in 1917 with a slight modification.

(4) For applicants selected in (1) and for whom the school of his second choice is already filled at the end of (3), assign each applicant to the school of his third choice or below, repeating the same procedure as (3).

(5) If all the schools in an applicant's preference list are filled, then the applicant is not admitted to any school.

Written more than a century ago in natural language, the rule description is mathematically precise. The above algorithm imposes meritocracy up front in which only top-scoring applicants were considered for admission regardless of their preferences (Step (1)). The centralized system is meritocratic in the sense that the test score distribution among the assigned students first order stochastically dominates that under any other mechanisms, including the original decentralized system. Step (1) also selects the same applicants as those who would be admitted by any school under the Deferred Acceptance algorithm, one of the most widely used algorithms in today's college and selective K-12 admissions (see Appendix B for details). These applicants are then assigned to one of Schools 1–8 using the Immediate Acceptance (Boston) algorithm (Steps (2) to (4)). This algorithm is therefore a variant of the Immediate Acceptance algorithm with a meritocracy constraint, making it closer to the Deferred Acceptance algorithm. To the best of our knowledge, this is the world's first recorded nation-wide use of any assignment algorithm.

2.2 Political Economy of the Admission Reforms

This institutional innovation was short-lived, however. Due to the opposition detailed below, the government switched back to decentralization (with a unified exam) in 1908. The government then continued to oscillate between the two regimes, reintroducing centralization in 1917, moving back to decentralization (with a unified exam) in 1919, reinstituting centralization (with modifications of allowing applicants to list at most two schools) in 1926, and finally settling down to decentralization (with separate exams) in 1928. In a space of thirty years, there were three periods of centralized admissions: first in 1902–1907, next in 1917–1918, and finally in 1926–1927.[19] We exploit the series of bidirectional policy changes to examine the impacts of centralization.

Historical documents suggest that the repeated policy changes were a result of annual bargaining between the Ministry of Education (representing the central government) and the Council of School Principals (representing local interests of Schools 1–8).[20] The admission policy, as a result of bargaining, was decided only a few months before the exam, making it difficult for applicants to anticipate the exact timing of the reforms. Indeed, we confirm that the timing of the reforms is not associated with the size and composition of applicants, school capacities, and other potential confounding factors (see Section 3.6).

Throughout the bargaining process, the Ministry of Education insisted on centralized admissions to select the best and brightest, while the Council of School Principals was opposed to centralization, pointing out its adverse impacts on rural schools located in remote regions.[21] They claimed that these rural schools lost the most talented students in their local areas (who would have entered local schools under decentralization) to urban schools, especially School 1. They also complained that rural schools instead received many reluctant and unmotivated students who only came to these schools as fallback options.

Moreover, a review of admission results revealed that the number of applicants from rural areas (areas where rural schools were located) *not* admitted to any of Schools 1–8 increased considerably under centralization.[22] This was upsetting to rural schools and their local communities, as rural communities contributed land and other resources to construct rural schools. A noted historian summarizes the situation as follows (Takeuchi, 2011, p.121):

> "*Urban applicants 'overwhelmed' rural applicants by applying for rural schools as fallback options. Urban applicants robbed rural applicants of opportunities that*

[19] For details of the evolution of the admission system, see Appendix Table A.1.

[20] Detailed accounts are provided in Moriguchi (2021), pp.195-199.

[21] Other reasons against centralization included a loss of school autonomy and independence as well as the high administrative cost of implementing centralized admissions.

[22] Ministry of Education (1917), *Report on National Higher School Entrance Examination of 1917: Extra Issue.*

were once open to them. This ruined the meaning of building national higher schools across the nation."

These observations highlight a potential meritocracy-equity tradeoff of centralization. On one hand, the centralized admissions made the school seat allocation more meritocratic, enabling high-achieving students to enter one of Schools 1–8 even if they failed at the most prestigious one. On the other hand, this meritocracy might have come at the expense of equal regional access to national higher education, whereby high-achieving urban applicants dominated rural applicants.

3 Short-run Impacts

3.1 Predicted Impacts

Motivated by the above historical observations, we first make predictions on the short-run effects of centralization. Online Appendix B formalizes the predictions using a simple model (Propositions 1, 2, and 3).

First, we predict changes in application behavior. Specifically, the centralized system would encourage applicants all over the country to rank the most preferred and selective urban school as their first choice. This is because the centralized system provides applicants with an option to apply for second and lower choice schools as insurance.

Second, if high-achieving applicants are disproportionately located in a specific geographical area, such as an urban area, then a larger fraction of all school seats in Schools 1–8 would be assigned to students coming from that area under the centralized system. This is because of the meritocratic constraint (Step 1) in the centralized assignment algorithm, which assigns only the top-scoring applicants to any school.

Finally, a smaller fraction of applicants would be assigned to their local school under centralized admissions. Intuitively, meritocratic centralization enables high-scoring applicants from urban areas to enter rural schools even if they fail to enter the most competitive urban school. At the same time, the centralized system would make a greater number of high-scoring rural applicants apply to and enter urban schools. Under the centralized system, therefore, rural students would more often move to urban areas, while urban students would more often move to rural areas. These effects would jointly increase the spatial mobility of students.

3.2 Data

To empirically analyze short-run effects of the centralized admission system, we newly assemble data on application and enrollment. First, we collect data on the number of applicants by school of their first choice from 1900 to 1930, using the *Ministry of Education Yearbook* and other sources. For two specific years (1916 and 1917), we have additional data on the number of applicants by school of their first-choice and by prefecture of their middle school. Japan was divided into 47 prefectures. Appendix Section A.3.1 provides detailed explanations for data sources and definitions.

Second, we compile data on the number of entrants (first-year students) by school and by their birth prefecture from 1900 to 1930, using *Student Registers* of Schools 1–8. Finally, to control for the size of potential applicants and the number of competing schools, we collect data on the number of middle-school graduates by prefecture of their middle school, as well as the number of other Higher Schools (established in addition to Schools 1–8 starting in 1919) by prefecture from 1900 to 1930. See Appendix Section A.3.2 for detailed descriptions of the data and sample. Descriptive statistics of main variables are reported in Appendix Table A.2.

3.3 Strategic Responses by Applicants

As an immediate effect, switching back and forth between the centralized and the decentralized admission systems causes stark strategic responses in application behavior. Figure 1a shows that the three periods of centralization are associated with sharp increases in the share of applicants who chose the most selective School 1 in Tokyo as their first choice, as predicted.

To observe regional variations, we examine how the propensity of applicants to rank School 1 as their first choice changes between 1916 (under decentralization) and 1917 (under centralization). The results in Appendix Table A.3 show that meritocratic centralization induced applicants in all regions to rank the most prestigious school first and to make more long-distance applications. The competition to enter School 1 thus became even more intense under centralization (Appendix Figure A.4). As a result, under centralization, only a small fraction of first-choice applicants were admitted to School 1, producing many high-scoring applicants who were rejected by School 1 and then assigned to their second or lower-choice school.

3.4 Regional Mobility in Enrollment

The changes in the assignment algorithm and application behavior influence enrollment outcomes. To measure the geographical mobility of entrants, we compute the "enrollment distance" defined as the direct distance between an entrant's birth prefecture and the school he entered. As Figure 1b shows, the centralized system is associated with a sharp and discontinuous increase in enrollment distance.[23] This increase in regional mobility is driven by a sharp reduction in the number of "local entrants" defined as entrants who entered a school in (or near) their birth prefecture. To show this, we estimate the following regression for each school s separately:

$$\begin{aligned} Y^s_{pt} = {} & \beta^s_1 \times Centralized_t \times 1\{\text{school } s \text{ is located in prefecture } p\} \\ & + \beta^s_2 \times Centralized_t \times 1\{\text{school } s \text{ is 1–100 km away from prefecture } p\} \\ & + \alpha^s X_{pt} + \gamma^s_t + \gamma^s_p + \epsilon^s_{pt}, \end{aligned} \tag{1}$$

[23]The effect is especially stark in the first two periods of centralization. The third period of centralization in 1926–27 was qualitatively different from that in the first and second periods. In the third period of centralization, schools were divided into two groups and applicants were allowed to choose and rank at most two schools (one school per group) in 1926–27.

where Y^s_{pt} is the number of entrants born in prefecture p who entered school s in year t. $Centralized_t$ is the indicator that the admission system was centralized in year t. 1{school s is located in prefecture p} is the indicator that school s was located in prefecture p. 1{school s is 1–100 km away from prefecture p} is the indicator that school s was located 1–100 km away from prefecture p, which roughly corresponds to the definition of school regions (defined by a set of prefectures for which school s is the nearest school). X_{pt} controls for observable characteristics of prefecture p and year t, including the number of middle-school graduates from prefecture p in year t and the number of higher schools other than Schools 1–8 in prefecture p in year t. γ^s_t and γ^s_p are year and prefecture fixed effects, respectively.

As shown in Panel (a) of Table 1, centralization reduces the number of local entrants born in the school's prefecture across the country. The coefficients β^s_1 are significantly negative for all schools. Column (1) shows that the number of School 1 entrants born in Tokyo prefecture declined by about 26% relative to its mean under decentralization. Schools 2–7 experienced reductions in the number of entrants born not only from the school's prefecture but also from surrounding prefectures. In other words, centralization weakened the local monopoly power of each school by integrating local markets into a national market, consistent with our prediction.

3.5 Meritocracy vs Equal Access

We now investigate the distributional effect of the centralized system on the allocation of school seats at Schools 1–8. Figure 2a plots the change in the number of entrants to Schools 1–8 from decentralization to centralization by their birth prefecture, where the darker blue color indicates the greater decline and the darker red color indicates the greater increase. The figure shows that Tokyo prefecture (where School 1 was located) and its surrounding area gained school seats under centralization, while most of western and northern prefectures lost school seats.

To see this quantitatively, we regress the number of entrants to Schools 1–8 in year t born in prefecture p on the interaction terms between $Centralized_t$ and each of the following two indicator variables: the indicator that takes 1 if prefecture p was Tokyo and the indicator that takes 1 if prefecture p was 1–100 km away from Tokyo. To control for the decline of local entrants, we also add the interaction terms between $Centralized_t$ and each of the following two indicator variables: the indicator that takes 1 if any of Schools 1–8 was located in prefecture p and the indicator that takes 1 if any of Schools 1–8 was located 1–100 km away from prefecture p. As in Equation (1), we also control for observable characteristics of prefecture p and year t and include year and prefecture fixed effects.

Column (1) in Table 1 Panel (b) shows the number of entrants born in Tokyo prefecture increased by 12% per year under centralization relative to its mean under decentralization. The increase in the number of entrants is even higher for its surrounding area; the number of entrants born in prefectures 1–100 km away from Tokyo increased by 45% per year under centralization relative to its mean under decentralization.[24]

Motivated by these observations, we define the "Tokyo area" as the set of prefectures located within 100 km from Tokyo (see Appendix Table A.3 for its location). Figure 2b depicts the time evolution of the share of entrants to Schools 1–8 who were born in the Tokyo area. Consistent with the above results, the share of Tokyo-area-born entrants rose during the periods of centralization.

To see which schools received more Tokyo-area-born entrants under centralization, we regress the number of entrants to each school s in year t born in prefecture p on the interaction terms between $Centralized_t$ and the variables indicating whether entrants' birth prefecture p is Tokyo or near Tokyo. We include the same variables used in Equation (1) to control for school locations and other prefecture and year characteristics. Under centralization, more Tokyo-area-born students entered less selective rural schools, as shown in Columns

[24] One possible reason for this concentration of the effect in surrounding prefectures is that applicants from this area might be marginal applicants who would not be admitted under decentralization but would be admitted under centralization. By contrast, many high-scoring applicants from the Tokyo prefecture might be admitted even under decentralization. Consistent with this hypothesis, the number of entrants from Tokyo (201) is much larger than the number of entrants from surrounding prefectures (26 per prefecture) under decentralization.

(2)–(8) in Table 1 Panel (b).[25] In summary, the net effect of centralization is such that the increased inter-regional applications caused high-achieving, urban-born students to crowd out lower-achieving, rural-born students from their local schools.

The Tokyo area shares common characteristics with what is generally considered urban and with high socioeconomic status. Prefectures in the Tokyo area had a larger population, higher income per capita, and better educational infrastructure (indicated by a greater number of middle-school graduates eligible for higher education) compared to other prefectures (Appendix Table A.5). In Appendix Table A.6, we use these urban characteristics instead of the Tokyo area indicator in the same specification as Column (1) in Panel (b) of Table 1. The result shows that these urban characteristics, especially educational infrastructure, positively predict the areas which produced a greater number of entrants under centralization. Therefore, richer educational infrastructures and a greater number of high achieving students in the Tokyo area may explain why the Tokyo area gained more school seats under centralization.

Students' heterogeneous preferences across school locations can be another reason why the Tokyo area gained more school seats under the centralized system. Students prefer their local school for geographical and cultural proximity. The local school for students born in the Tokyo area is the most competitive School 1. Holding academic achievement constant, during the decentralization, students born in the Tokyo area are more likely to apply to School 1 and therefore fail to enter any school (even though they might have been able to enter Schools 2–8 had they applied). This hypothesis is consistent with Appendix Table A.6, which shows that the share of applicants to School 1 during decentralization is associated with a larger increase in the number of entrants to Schools 1–8 during centralization.

In summary, the net effect of centralization is such that the increased regional mobility caused urban-born high achievers with high socioeconomic statuses to crowd out rural students from elite higher education. Key mechanisms behind this distributional effect are

[25] The results remain almost the same when we additionally control for observable prefecture characteristics (see Appendix Table A.4).

better educational infrastructures and strong preference for School 1.

3.6 Other Institutional Changes

We finish the short-run analysis by discussing potential threats. In particular, if changes in other institutional and policy factors were correlated with the admission reforms, it could influence application behavior and enrollment outcomes, explaining our finding that more applicants applied for School 1 during centralization. Such other institutional factors include simultaneous reforms in middle schools, the total number of applicants, capacities at Schools 1–8, and the capacity of School 1 relative to the capacities of other schools.

We investigate these concerns and confirm that centralization periods are not correlated with time-series changes in the following variables (Columns (1)–(6) in Appendix Table A.7): the number of middle school graduates, the national number of applicants as well as the level of competitiveness (measured by the number of entrants divided by the number of applicants), the total number of entrants to Schools 1–8, the share of entrants to School 1 in all entrants, the probability of unsuccessful applicants retaking the exam in subsequent years, the average age of entrants, and government expenditure on higher education.

A potential concern with the above time-series analysis is that the insignificant results in Appendix Table A.7 may be due to a small sample size (around 30). Yet, using the same empirical specification, we find that centralization is significantly correlated with our main outcome variables (the share of applicants to School 1, the enrollment distance, and the share of entrants who were born in the Tokyo area), as shown in Columns (8)–(10) of Appendix Table A.7. Taken together, these results suggest that our findings are unlikely to be driven by institutional changes other than the school admission reforms.

Finally, the centralization reform introduced not only the meritocratic assignment algorithm, but also the unified entrance exam that applicants could take at any school location (see Appendix Table A.1). As such, the estimated impacts of centralization may be confounded by the unification of entrance exams and more flexible exam location choices. To investigate this issue, we analyze how key outcomes change from 1900 to 1901, during which the government also introduced a single entrance exam that applicants were allowed to take at any school while the assignment method remained decentralized. Figures 1a and 1b show that this institutional change from 1900 to 1901 induced little changes in application and enrollment patterns. The estimated impacts of centralization are therefore likely due to the meritocratic assignment algorithm rather than the changes in exam contents and locations.

4 Long-run Impacts

To assess long-run effects of meritocratic centralization, we provide two sets of empirical analysis. First, we investigate the persistence of the distributional effect of centralization that we document in the short-run analysis. We do so by a difference-in-differences strategy comparing labor-market outcomes of urban- and rural-born individuals across birth cohorts with differential exposure to the centralized admissions. Our analysis shows that centralization increased both (a) the number of occupational elites born in urban areas and (b) the number of occupational elites living in urban areas as adults. The admission reforms thus influence the regional origins and destinations of elites.

Second, we compare the national production of elites between the two admission systems. We find that cohorts more intensely exposed to the centralized admissions produced a larger national number of civil officials who were promoted to top ranks, as well as other types of occupational elites (such as top income earners). This finding indicates that centralization boosted the national production of individuals reaching leadership positions.

4.1 Regional Distribution of Elites

Personnel Inquiry Records Data

To analyze the long-run effects of centralization on students' career outcomes, we use the *Personnel Inquiry Records* (PIR) published in 1939.[26] The PIR is an equivalent of Who's Who, which compiles a highly selective list of socially distinguished individuals—encompassing economic, political, cultural, and aristocratic elites—and provides their biographical information. The 1939 PIR lists 55,742 individuals or 0.15% of the adult Japanese population of that time.[27] According to their occupational distribution in Appendix Table A.8 Column (1), 66% hold managerial positions, 7.5% are politicians or bureaucrats, and the rest consists mainly of professionals such as scholars and engineers. Throughout this section, we refer to the individuals listed in the PIR as "elites."

To capture the effects of the first period of the centralized admissions in 1902–1907, we use the cohorts born in 1880–1894, who turned 17 years old (the age eligible for application) in 1897–1911. These cohorts were 45 to 59 years old in 1939. The number of elites in each of these cohorts is about 1,800. We use the following information from the PIR for each individual: full name, birth year, birth prefecture, prefecture of residence, final education, occupation titles and organization names, the medal for merit and the court rank awarded (if any), and the amount of national income tax and business tax paid (if any). Among all elites in our sample, 23% graduated from Imperial Universities.

We define the following subgroups of elites (as a subset of PIR-listed individuals): (1) the top 0.01% and 0.05% income earners according to the national income distribution, (2) prestigious medal recipients (civilians who received high-ranking imperial medals for their exceptional service or merit in various fields),[28] (3) corporate executives (individuals who

[26] Japan went into the military regime after the National General Mobility Act of 1938. Although the military government began massive economic interventions, their effect was relatively small in 1939 (Moriguchi and Saez, 2008). Moreover, most of the information in the 1939 PIR was based on 1938 data.

[27] We discuss the PIR's selection criteria in Appendix Section A.4.1.

[28] These prestigious medal recipients held a broad range of occupations, including scholars, managers, engineers, and bureaucrats as shown in Appendix Table A.8 Column (4).

hold an executive position in a corporation and pay a positive amount of income or business tax), (4) top politicians and bureaucrats (individuals whose occupation is either Imperial Diet member, Cabinet member, or high-ranking central government official), (5) Imperial University professors or associate professors, (6) all occupational elites (all individuals listed in the PIR except for hereditary elites defined as individuals whose sole occupation is either peerage or landlord). Appendix Section A.4.1 and Table A.9 provide detailed definitions and descriptions of each group. These categories encompass economic, political, and cultural definitions of occupational elites.

We use this data to count the number of elites in each subgroup defined by birth prefecture and birth cohort. These counts allow us to conduct a difference-in-differences analysis that compares long-term career outcomes of urban- and rural-born individuals by each cohort's exposure to the centralized admission system. Descriptive statistics of main variables are summarized in Appendix Table A.2.

Assessing the Coverage and Bias of the PIR Data

Since our PIR data is not exhaustive administrative data, we are concerned about potential sample selection bias. For the top income earners and Imperial University professors, we can compute the exact sampling rates by comparing the number of individuals in our data against complete counts reported in government statistics. We find that the sampling rates are decent even by modern standards: 70% for Imperial University professors, and 53% and 39% for the top 0.01% and 0.05% income earners, respectively. Consistent with the nature of our data, which lists only distinguished individuals, the sampling rates increase with the income level (see Appendix Figure A.5).

Sample selection bias becomes a problem for our difference-in-differences analysis only if the difference in sampling rates between urban and rural areas changes with cohorts' exposure to the centralized admission system. To assess this possibility, we examine the prefecture-level sampling rates for the top income earners. As Appendix Figure A.6 shows, the number of high income earners in our data and the complete count from tax statistics are highly correlated at the prefecture level, with similar sampling rates across prefectures. This result provides further support for the quality of our data. Even so, one potential concern is that Imperial University graduates might have a higher likelihood of being sampled by the PIR even after controlling for the income level. However, we find no positive correlation between the sampling rates of top income earners and the numbers of Imperial University graduates across prefectures (see Appendix Table A.10). This series of findings suggests that possible sample selection bias in the PIR data is unlikely to drive our empirical results.

Urban-Rural Disparity in Producing Elites

We estimate the long-run impacts of the centralized admission system by conducting a difference-in-differences analysis by birth cohorts and birth areas. The key idea behind our empirical strategy is that urban-born applicants experienced a greater gain in entering Schools 1–8 under centralization relative to decentralization, as shown in the short-run analysis in Figure 2 and Table 1. We exploit this differential gain in school access to compare the career outcomes of individuals born inside and outside the Tokyo area by the cohort's exposure to centralization. If admission to Schools 1–8 increases one's chance of becoming an elite, we should observe more elites born inside the Tokyo area for the cohorts exposed to centralization. We estimate a difference-in-differences specification as follows:

$$Y_{pt} = \beta \times Centralized_t \times Tokyo\_area_p + \gamma_p + \gamma_t + \epsilon_{pt},$$

where Y_{pt} is the number of elites born in cohort t and prefecture p. $Centralized_t$ is a measure of cohort t's exposure to centralization, which is, in the baseline specification, a binary indicator that cohort t turned 17 during centralization (1902–1907). $Tokyo\_area_p$ is the indicator that takes 1 if prefecture p is in the Tokyo area. γ_p and γ_t are prefecture and cohort fixed effects. To allow for serial correlation of ϵ_{pt} within prefecture over time, we cluster the standard errors at the prefecture level in our baseline specification.[29] In addition, we report the results of clustering at cohort level, which are estimated by wild cluster bootstrap (Cameron and Miller, 2015; Roodman et al., 2019) due to the small number of clusters (15 cohorts).

The above regression defines $Centralized_t$ to be a binary indicator as the simplest proxy for the intensity of exposure to centralization. In reality, however, a nontrivial number of unsuccessful applicants retook the exam at age 18 and beyond. As a result, the cohorts who turned age 17 in 1899–1901 were partially and increasingly exposed to centralization (as some of them took the exam in 1902). The cohorts who turned age 17 in 1902–1904 were fully exposed to centralization. The cohorts who turned age 17 in 1905–1907 were partially and decreasingly exposed to centralization (as some of them took the exam in 1908). Finally, the intensity of exposure drops to zero for the cohorts who turned age 17 in 1908.[30] In the following visual analysis, we explicitly incorporate cohort's intensity of exposure to centralization by coloring cohorts according to their intensity of exposure to centralization.

We first check whether the number of Imperial University graduates born inside the Tokyo area increased for the cohorts exposed to centralization. Since all Schools 1–8 graduates were automatically admitted to an Imperial University during this period, the areas that produced more Schools 1–8 entrants should produce more Imperial University graduates. Figure 3 confirms this expectation. Panel (a1) compares the average number of Imperial University graduates who were born inside and outside the Tokyo area by cohorts (represented by their birth year plus 17 on the horizontal axis). Panel (a2) shows that the urban-rural difference in the number of Imperial University graduates rises as the intensity of exposure to centralization increases and falls sharply when centralization ends in 1908. Column (1)

[29] Bertrand, Duflo and Mullainathan (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.

[30] The intensity of exposure to centralization is estimated to be 0.00, 0.02, 0.09, 0.36, 1.00, 0.98, 0.91, 0.64, and 0.00 for the cohort who turned age 17 in 1896–98, 1899, 1900, 1901, 1902–04, 1905, 1906, 1907, and 1908–11, respectively. See Appendix Section A.4.1 for data and methods.

in Table 2 shows that the estimate of β in the above regression is positive and statistically significant.

Our main results are presented in Figure 3 Panels (b)–(d) and Table 2 Columns (2)–(8). Figure 3 Panels (b1)–(d1) show difference-in-differences plots that compare the number of elites (the top 0.05% income earners, medal recipients, and all occupational elites) who were born inside and outside the Tokyo area by the cohort's exposure to centralization. For these elite categories, Panels (b2)–(d2) show that the difference between the Tokyo area and the rest grows as the intensity of exposure to centralization increased, and then drops sharply when centralization ended. Appendix Figure A.7 shows qualitatively similar difference-in-differences plots for the top 0.01% income earners, corporate executives, top politicians and bureaucrats, and Imperial University professors.

Table 2 Columns (2)–(7) show that the long-run effects of centralization are economically and statistically significant. For the cohorts exposed to centralization, the number of elites born inside the Tokyo area (compared to those born outside the Tokyo area) increases by 34% for the top 0.01% income earners, 24% for the top 0.05% income earners, 36% for medal recipients, 13% for corporate executives, 50% for top politicians and bureaucrats, 38% for Imperial University professors, and 14% for all occupational elites (in Panel B).[31] In Panel A, we control only for cohort and prefecture fixed effects. In Panel B, we additionally control for time- and cohort-varying prefecture characteristics.[32] The coefficients fall slightly in magnitude after adding control variables, but remain sizable.

Table 2 Panel C shows that the effects are symmetric with respect to the direction of the admission reforms, i.e., the change from decentralization to centralization and the change from centralization to decentralization produce similar effects of the opposite sign. In Table 2 Panel D, we replace the centralization dummy by the cohort's intensity of exposure to centralization. The results remain qualitatively the same as the baseline results.

[31]In Appendix Table A.11, we also examine other types of occupational elites and obtain similar results for scholars, engineers, and physicians.

[32]Cohort birth population, the number of primary schools, the number of middle school graduates, and prefecture-level GDP. See Appendix Section A.4.1 for variable definitions and data sources.

These results suggest that almost four decades after its implementation, centralization had lasting effects on the career trajectories of students. The above results are robust to alternative specifications. First, the analysis in Table 2 Panel D assumes that the cohort's intensity to exposure to centralization is exogenous and the same across years, which may be a strong assumption. However, even when we drop the cohorts who are exposed to both centralization and decentralization (i.e., cohorts who became age 17 in 1901 and 1907) from the sample, we still find qualitatively the same results (Appendix Table A.12). Second, we test if the assumption of parallel pre-event trends holds. Appendix Table A.13 verifies that the differences in pre-event trends between the areas of comparison are small and mostly insignificant.

Another potential threat to our identification strategy is that there may be some age-specific trends in the number of elites that covary with the cohort-region variation we use. Specifically, the number of elites listed in the 1939 PIR data peaks at around the cohort who were 51 years old in 1939 (corresponding to the cohort who turned age 17 in 1905) and gradually falls for younger and older cohorts. This suggests that there are certain ages at which individuals are more likely to be listed in the long-term data. Such age effects may generate different trends in the number of elites born in the Tokyo and other areas, due, for example, to differences in population size across these areas. To address this concern, we use an earlier edition of the PIR published in 1934, construct the prefecture-cohort level data for the same cohorts used in our main analysis (but observed 5 years earlier), and conduct similar regression analyses. The results in Appendix Table A.14 confirm that our key results remain qualitatively the same even when we use 1934 PIR data.

Finally, we conduct placebo tests to examine if the results are driven by other factors such as the sample selection of the PIR or changes in cohort populations. The urban-rural difference in the cohort's birth populations does not change significantly with the cohort's exposure to centralization, as shown in Appendix Table A.15. As an additional placebo test, we also look at unrelated career outcomes. Among the distinguished individuals listed in the PIR, we expect that landlords (defined in Appendix Section A.4.1) are least likely to be affected by the introduction of centralization as receiving higher education was not a typical pathway to become a landlord. As shown in Appendix Table A.15, the estimated effect of centralization on the number of landlords is small and statistically insignificant. These findings further support our conclusion that meritocratic centralization enlarged the urban-rural gap in the capacity to produce future individuals in leadership positions.

Geographical Destinations of Elites

Having established that centralization affects the geographic *origins* of occupational elites, we now ask how it affects their geographic *destinations*. While the former is about regional inequality in educational opportunities, the latter is about regional inequality in the supply of highly skilled human capital.

We first examine if the centralization-induced increase in inter-regional mobility in the short run boosted the geographical mobility of elites in the long run. It did not: The urban-rural difference in the fraction of elites whose prefectures of residence differ from their birth prefectures did not increase under centralization, as shown in Appendix Table A.15. We find similar results when we use the distance between an elite's birth prefecture and his prefecture of residence as an alternative measure of long-run mobility. This result suggests that, even though a greater number of students born in the Tokyo area entered rural schools under centralization, most of them returned to the Tokyo area when pursuing their careers.

If the increased number of Tokyo-area-born students admitted to rural schools under centralization returned to the Tokyo area eventually for their careers, we should observe a greater number of elites living in the Tokyo area for the cohorts exposed to centralization. To test this hypothesis, we redefine the outcome variables by changing the prefecture (p) from birth prefecture to prefecture of residence and estimate the same equation.

Table 3 shows large positive effects of centralization on the urban-rural gap in the number of elite residents. For the cohorts exposed to centralization relative to decentralization, the number of elites living in the Tokyo area in their middle age (compared to those living outside the Tokyo area) increases by 30% for the top 0.01% income earners, 25% for the top 0.05% income earners, 30% for medal recipients, 23% for corporate executives, 19% for top politicians and bureaucrats, 41% for Imperial University professors, and 20% for all occupational elites (Panel B). These results suggest that meritocratic centralization intensified the concentration of elites in urban areas in the long run.

4.2 National Production of Elites

The above analysis examines the distributional consequence of the centralized admissions. A complementary problem is its overall impact for the whole country. To study it, we now turn to whether meritocratic centralization increased the national production of occupational elites in the long run. We first focus on a specific subgroup of elites—higher civil officials—for whom we have complete-count data from administrative records. Top-ranking civil officials are also a key group of occupational elites; in our empirical context, higher civil service was considered to be one of the most prestigious jobs due to their political and legislative influence. As a result, high-achieving students at the top universities competed to enter the Ministry of Finance and other selective ministries (Shimizu, 2019). We investigate whether cohorts exposed to the centralized admissions produced a greater number of top-ranking civil officials compared to cohorts exposed to the decentralized admissions. After that, we also analyze the impact of centralization on the national production of all occupational elites listed in the PIR.

Higher Civil Officials Data

Our main data source is the list of individuals who passed the Higher Civil Service Examinations (HCSE) and their biographical information (Hata, 1981). The HCSE were selective national qualification exams held annually from 1894 to 1947. The 1893 ordinance required all individuals to pass the HCSE for appointment in the administrative division of higher civil service with some exceptions for special appointments (Spaulding, 1967, Chapter 25; Shimizu, 2019, Chapter 5). We digitized the information of all individuals who passed the administrative division of the HCSE in 1894–1941, including their full name, education (both university and higher school), year of university graduation, year of passing the exam, starting position, final position, year of retirement, and other notable positions held.

We define "top-ranking officials" as higher civil officials who were internally promoted to one of the top three ranks by the end of their career. In the prewar Japanese bureaucracy system, the higher civil service refers to the top ten ranks of national government offices in the administrative, judicial, and diplomatic divisions. Within the higher civil service, the top three ranks were distinctively called "imperial appointees." The first rank consisted of minister level positions, while the second and third ranks consisted of vice minister level positions (such as vice minister, director general, bureau chief, and prefectural governor). Appendix A.4.2 provides more details.

We count the number of top-ranking officials and the number of individuals who passed the administrative division of the HCSE (hereafter "exam passers") by cohort. Here cohort is defined by "the year of entering a higher school or its equivalent." Since we only observe the year of university graduation in the data, we estimate "the year of entering a higher school or its equivalent." We first find the exact year of entering a higher school for all top-ranking officials who graduated from Schools 1–8 by searching their names in Student Registers of Schools 1–8. Using this information, we then estimate "the year of entering a higher school or its equivalent" for the rest of higher civil officials using the method described in Appendix A.4.2.

Out of 6,255 exam passers in our dataset, 55.8% are Schools 1–8 graduates and 15.7% are top-ranking officials. Among 982 top-ranking officials, 71.4% are Schools 1–8 graduates. More descriptive statistics are shown in Appendix Table A.2.

Effect on Higher Civil Service Exam Passers

As an intermediate outcome, we first examine the impacts of the centralized admission system on the number of individuals who passed the selective HCSE. We divide exam passers into three mutually exclusive subgroups: (a) those who graduated from most selective urban School 1, (b) those who graduated from Schools 2–8, and (c) those who are not Schools 1–8 graduates. For each subgroup, we count the number of exam passers by cohort. We estimate the following equation for the entire group and for each subgroup:

$$Y_t = \theta Centralized_t + \xi_1 X_t + \xi_2 Trend_t + \xi_2 Trend_t^2 + \omega_t,$$

where Y_t is the number of exam passers in a given group in cohort t (defined by the year of entering a higher school or its equivalent), and $Centralized_t$ is the indicator that takes 1 if cohort t entered a higher school or its equivalent during centralization. For a subgroup regression, we control for the total number of exam passers in cohort t (denoted by X_t). We also control for a quadratic time trend where $Trend_t$ is the number of years since 1897.

Centralization changed the composition of exam passers. In Table 4 Panel (a), Column (3) shows that centralization increased the number of exam passers who graduated from Schools 2–8 by 23%, while Column (4) indicates that centralization reduced the number of exam passers who are not Schools 1–8 graduates by 13%. By contrast, centralization did not have a significant effect on the total number of exam passers or the number of exam passers who graduated from School 1 (Columns (1) and (2)). This reflects the fact that the total number of exam passers was determined mainly by demand-side factors (e.g., ministries' needs) rather than supply-side factors (e.g., the quality of exam takers). Thus, the main impact of centralization was not on the number but on the composition of exam passers, and its positive effect was concentrated on Schools 2–8 graduates. This finding is consistent with the result of our short-run analysis that centralization led to a large increase in Tokyo-area-born high-achieving entrants to Schools 2–8 (Table 1 Panel (b) Columns (2)–(8)), which likely improved the academic standing of graduates of these schools.

Effect on Top-Ranking Higher Civil Officials

We now analyze the impact of centralization on the national production of top-ranking officials. Our main outcome variable is the number of higher civil officials who were internally promoted to the top three ranks by the end of their career. We count the number of top-ranking officials by cohort and run the same regression as above for each group. For all regressions, we control for the total number of exam passers from the cohort.

Meritocratic centralization produced a larger number of high-quality bureaucratic elites for the whole country. Table 4 Panel (b) Column (1) shows that the total number of top-ranking officials increased for centralized cohorts by 15%, with high statistical significance. This result is consistent with the idea that the centralized system (which assigned top-scoring students to Schools 1–8) increased the quality of Schools 1–8 entrants, which in turn improved the likelihood of Schools 1–8 graduates to win promotion competitions over close decentralized cohorts. Indeed, Column (3) indicates that centralization had a large, positive, and significant effect on the number of top-ranking officials who graduated from Schools 2–8, where the number of urban-born high-achieving entrants spiked during centralization. The number of top-ranking officials who graduated from Schools 2–8 increased by 47% for centralized cohorts compared to decentralized cohorts. By contrast, in Column (2), centralization only had a small and insignificant effect on the number of top-ranking officials who graduated from School 1, where the number of urban-born high-scoring entrants did not change much during centralization.

Schools 1–8's impacts on the likelihood of promotion to top-ranking officials appear especially large for high-achieving students. Indeed, centralization's positive effect on Schools 2–8 graduates was so large (Column (3)) that it dominated centralization's small and negative effect on those who did not graduate from Schools 1–8 (Column (4)), resulting in a positive effect on the total number of top-ranking officials (Column (1)). This finding suggests that the meritocratic assignment of high achievers to Schools 1–8 produced a net positive effect on the national production of top-ranking officials. This result is inconsistent with the pure selection hypothesis that the role of the centralized admissions is simply to select and send a fixed number of high-achieving students to national higher education and that the value added of national higher education is homogeneous across all students.

Schools 1–8's particularly large value-added for high-achieving students can be due to multiple factors. First, human capital returns to education by these schools could be higher for high-achieving students (due to demanding curriculum, for example). Gathering high-achieving students in these schools may also produce higher peer effects. Second, high-achieving students may benefit more from their signaling value or from gaining connections with powerful alumni than low-achieving students. While our data and variation do not allow for a clear decomposition into these different factors, our analysis suggests that the effect of meritocratic centralization remains similar even after controlling for the size of same-cohort colleagues from the same schools or focusing on those with the highest educational qualification (Appendix Section A.4.4). Much of Schools 1–8's effects therefore likely come from the first human capital factor.

One potential threat to our identification is that the number of available top-ranking positions might increase during the centralization periods. To investigate this concern, recall that we define our cohort by the year of entering a higher school or its equivalent (not by the year of becoming top-ranking officials). Within each cohort, the number of years taken from entering a higher school to the appointment for the first top-ranking position varied widely from 20 to 30 years (see Appendix Figure A.9 and Appendix A.4.3 for details). Individuals in a given cohort were therefore promoted to top-ranking positions in different years. This limits the concern that a potential correlation between the number of top-ranking positions and the lagged periods of centralized admissions may drive our results.

Another potential threat is that the number of top-ranking officials may be differentially impacted by wars between decentralized and centralized cohorts. During the US occupation of Japan right after the WWII, a substantial number of top officials were purged from public service, and a few were sentenced to death for war crimes. However, we show that the number of top-ranking officials who died in wars, or were purged or executed after WWII, changes little between decentralized and centralized cohorts (Appendix Table A.17).

The last potential concern is that the number of top bureaucrats might increase at the expense of other types of elites. To examine this possibility, we use the 1939 PIR data to compute the share of top bureaucrats among all socially distinguished individuals listed in the PIR. As Appendix Figure A.10 shows, we observe no positive association between the share of government officials and the cohort's exposure to the centralized admissions (although the share of government officials is rising over time reflecting a growing public sector). Therefore, our result is unlikely to be driven by students' brain drain from other elite occupations into top bureaucrats under the centralized admissions.

Effect on All Occupational Elites

Moreover, we find that meritocratic centralization produced more occupational elites across fields, not just government officials. As Appendix Figure A.11 shows, higher exposure to the centralized system is associated with a greater total number of all occupational elites (as defined in Section 4.1) listed in the PIR (1939). A potential concern is that this analysis may conflate age effects and cohort effects because the centralized cohorts, who were in their fifties in the PIR (1939), may have a higher likelihood of holding prominent positions simply due to their age rather than the centralized system's impact. To distinguish the cohort effect from the age effect, we additionally use the 1934 edition of the PIR, in which we observe the centralized cohorts in their late forties. The total number of all occupational elites listed in the PIR (1934) also increased for the centralized cohorts, as Appendix Figure A.11 shows.

Table 5 shows this result in a regression analysis using both 1934 and 1939 editions of the PIR. We count the number of individuals who are aged 40–69 by birth cohort in each PIR edition, and obtain the cohort-edition level data. We regress this count on each cohort's exposure to centralization, while controlling for non-linear age trends defined by either quadratic age trends, quartic age trends, or edition-specific quadratic age trends. We also control for the edition fixed effect. Panel A shows that the total number of all occupational elites listed in the PIR is 5–13% higher among centralized cohorts. Looking at some specific groups of elites, the number of top 0.05% income earners and the number of medal recipients increased by 8–10% (Panel B) and 12-24% (Panel C), respectively, among centralized cohorts. The centralized system may therefore be more productively efficient not only for producing top bureaucrats but also for producing other types of individuals in leadership positions.

5 Conclusion

The design of selective school admissions persistently impacts the production and distribution of society's leaders. We reveal this fact by looking at the world's first recorded use of nationally centralized admissions and its subsequent abolitions in the early twentieth-century. While centralization was designed to make the school seat allocations more meritocratic, there turns out to be a tradeoff between meritocracy and equal access to selective higher education and career advancement. Meritocratic centralization led students to apply to more selective schools and make more inter-regional applications. As high-achieving students were located disproportionately in urban areas, however, centralization caused urban high achievers to crowd out rural applicants from advancing to higher education.

Most importantly, these impacts persist: Several decades later, the centralized system produced more individuals in leadership positions, especially top-ranking government officials. The distributional effect also persists: Meritocratic centralization increased the number of high income earners, medal recipients, and other occupational elites coming from urban areas relative to those from rural areas.

Even though our study uses the admission reforms unique to our historical setting, the implications of our study may have broader relevance. For instance, distributional consequences of centralized meritocratic admissions may be a reason why many countries continue to use seemingly inefficient decentralized college admissions. While this paper focuses on the particular decentralized system, the takeaway from our results would be relevant for other types of decentralized admissions as long as costly applications make applicants self-select into a limited number of schools. For any such decentralized systems, the meritocracy-equity tradeoff is an important concern.

Methodologically, the use of natural experiments in history may be also valuable for studying the long-run effects of market designs in other areas, such as housing, labor, and health markets. The disadvantage of using historical events is the limited availability of data. The ideal way to alleviate the data concerns would be to use modern administrative data. One may imagine linking administrative tax return data and school district data to measure the long-run effects of school choice reforms around the world in the past few decades. Such an effort would be a fruitful complement to our historical study.

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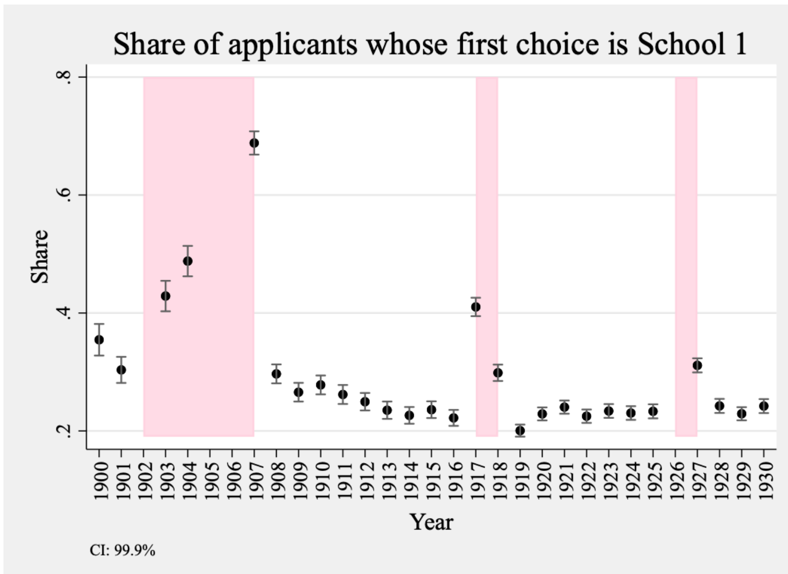
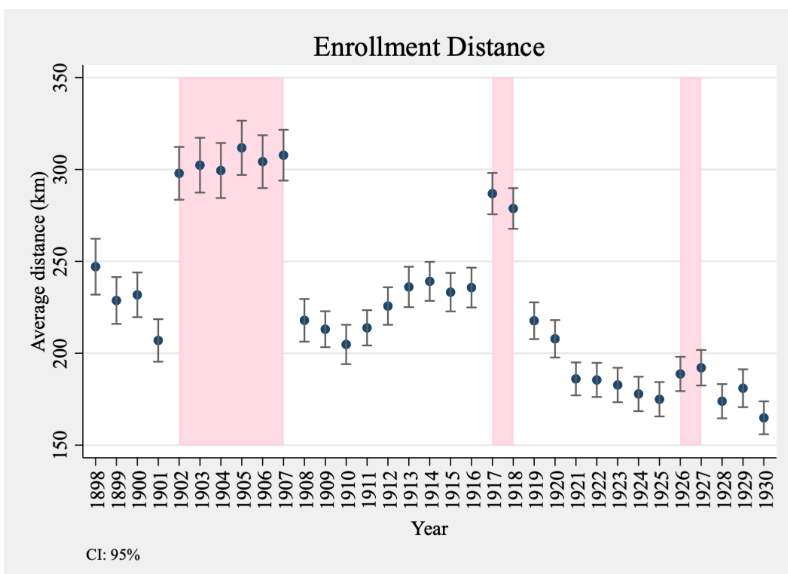
Figure 1: Short-run Effects of Centralization: First Look

(a) Centralization Caused Applicants to Apply More Aggressively



(b) Centralization Increased Regional Mobility in Enrollment



Notes: Panel (a) shows the time evolution of the share of applicants who selected the most prestigious School 1 (in Tokyo) as their first choice in all applicants. No data is available for 1902, 1905, 1906, and 1926. Colored years (1902–07, 1917–18, and 1926–27) indicate the three periods of the centralized admission system. Bars show the 99.9 percent confidence intervals. See Section 3.3 for discussions about this figure. Panel (b) shows the time evolution of the average enrollment distance (defined by the distance between an entrant's birth prefecture and the prefecture of the school he entered). Colored years indicate the three periods of the centralized admission system. Bars show the 95 percent confidence intervals. See Section 3.4 for discussions about this figure.

Table 1: Short-run Effects of Centralization on Enrollment

(a) Centralization Broke Local Monopoly and Increased Regional Mobility across the Country

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	-26.70	-18.60	-15.67	-23.45	-27.86	-22.72	-48.25	-13.79
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
	[0.003]***	[0.022]**	[0.073]*	[0.005]***	[0.001]***	[0.073]*	[0.001]***	[0.375]
Centralized x Born near school's prefecture (1–100 km)	0.13	-2.97	-4.09	-9.41	-11.60	-2.10	-1.86	0.60
	(0.852)	(0.265)	(0.056)*	(0.004)***	(0.001)***	(0.109)	(0.000)***	(0.523)
	[0.794]	[0.037]**	[0.000]***	[0.001]***	[0.001]***	[0.021]**	[0.456]	[0.838]
Observations	1,457	1,457	1,410	1,457	1,410	1,410	1,269	1,081
Year FE, Prefecture FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean dep var	7.95	5.55	6.23	5.69	6.32	5.23	5.02	5.74
Mean dep var (School's pref. under Decentralization)	104.70	62.86	56.15	60.33	73.38	76.35	95.94	77.00
Mean dep var (Within 1–100km under Decentralization)	9.12	20.90	17.87	27.07	34.96	8.37	8.56	15.53

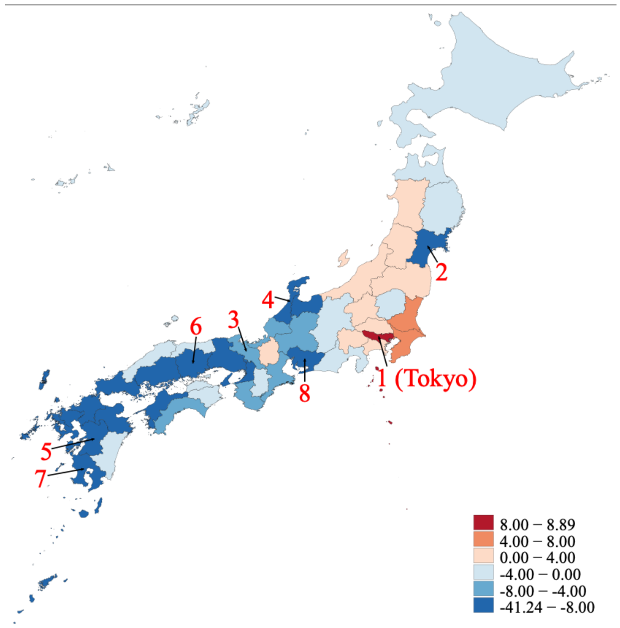
(b) Centralization Increased Tokyo-area-born Entrants to Schools 2–8

Dependent variable = No. of entrants to:	(1) All schools	(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 Tokyo prefecture	25.04	0.99	3.56	6.34	3.80	11.67	6.27	19.56
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
	[0.215]	[0.760]	[0.255]	[0.019]**	[0.028]**	[0.000]***	[0.049]**	[0.000]***
Centralized x Born near Tokyo prefecture (1–100 km)	11.81	0.17	0.76	1.95	0.55	1.11	0.53	0.57
	(0.000)***	(0.675)	(0.016)**	(0.000)***	(0.192)	(0.020)**	(0.290)	(0.365)
	[0.001]***	[0.722]	[0.001]***	[0.000]***	[0.092]*	[0.009]***	[0.307]	[0.079]*
Observations	1,457	1,457	1,410	1,457	1,410	1,410	1,269	1,081
Year FE, Prefecture FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean dep var	45.43	5.55	6.23	5.69	6.32	5.23	5.02	5.74
Mean dep var (Tokyo pref. under Decentralization)	201.10	27.52	10.85	14.48	6.10	9.200	11.72	20.21
Mean dep var (Within 1–100km from Tokyo pref. under Decentralization)	26.23	6.74	1.21	2.87	0.75	1.24	1.55	3.23

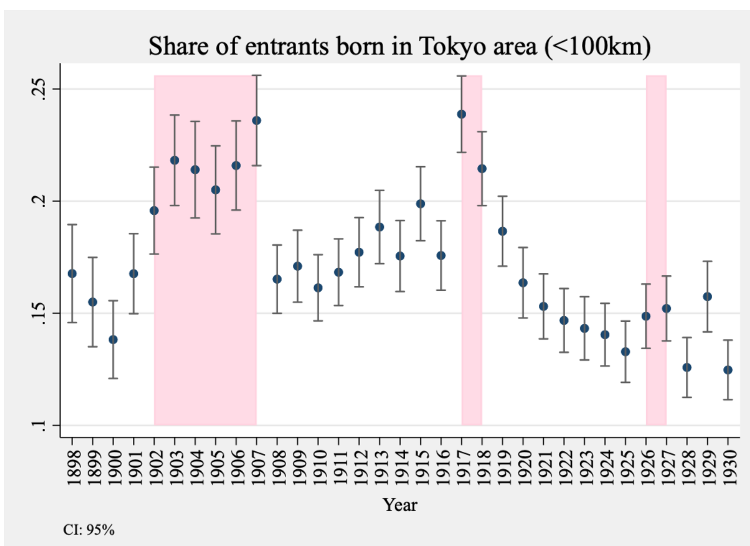
Notes: Using the prefecture-year level data in 1900–1930, we define the dependent variable as the number of entrants who were born in the prefecture and entered the school indicated in the column in each year. In both panels, we control for year fixed effects, prefecture fixed effects, the number of middle school graduates in the prefecture, and the number of higher schools other than Schools 1–8 in the prefecture. In Panel (b), we additionally control for "Born in school's prefecture" and "Born near school's prefecture (1–100 km)." "Mean dep var" shows the mean of the dependent variable during decentralization for all prefecture-year observations. "Mean dep var (school's pref. under decentralization)" shows the mean number of entrants to the school under the decentralized system, restricted to those born in the prefecture where the school is located. "Mean dep var (within 1–100km under decentralization)" shows the mean number of entrants to the school during decentralization, restricted to those born in the prefectures within 100 km (excluding the prefecture where the school is located). Parentheses contain p-values based on standard errors clustered at the prefecture level. Square brackets contain p-values based on standard errors clustered at the year level. ***, **, and * mean significance at the 1%, 5%, and 10% levels, respectively. See Sections 3.4 and 3.5 for discussions about these tables. See Section A.3.2 in the Appendix for details of the data used in these tables.

Figure 2: Which Regions Win from Centralization?

(a) Change in No. of Entrants to Schools 1–8 under Centralization

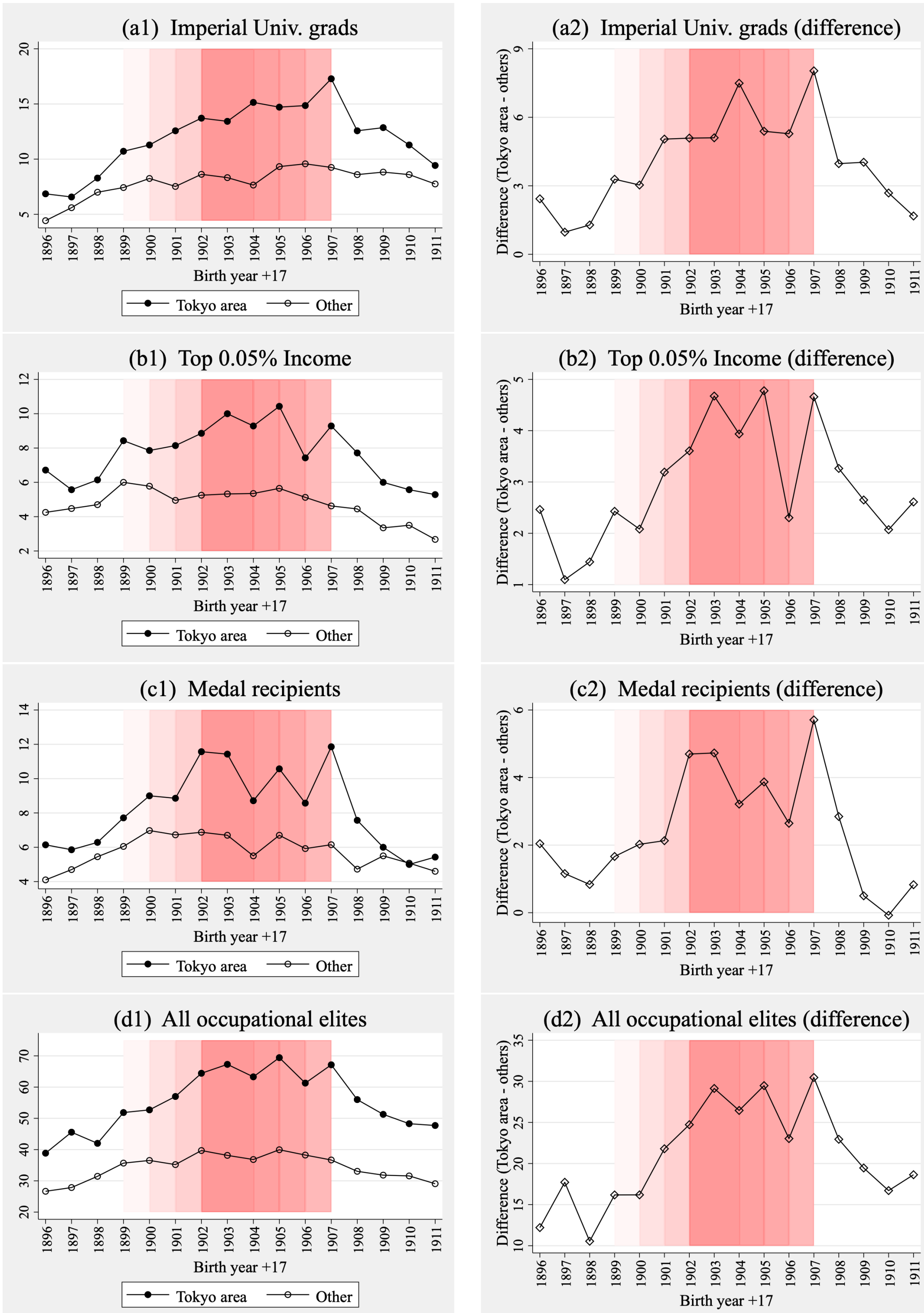


(b) Centralization Increased Tokyo-area-born Entrants to Schools 1–8



Notes: Panel (a) plots the estimated prefecture-specific coefficient β_p in $\#entrants_{pt} = \beta_p Centralized_t + \alpha_p X_{pt} + e_{pt}$, using the 1900-1930 data for each prefecture p, where $\#entrants_{pt}$ is the number of entrants in year t who were born in prefecture p and X_{pt} is the number of schools other than Schools 1–8 in prefecture p 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 the set of prefectures within 100 km from Tokyo; see Appendix Figure A.2 for a map). Bars show the 95 percent confidence intervals. See Section 3.5 for discussions about this figure.

Figure 3: Long-run Impacts of Centralization: Geographical Origins of Elites



Notes: This figure shows difference-in-differences plots that compare the average number of elites born in prefectures inside and outside the Tokyo area by cohort. The plots are based on the data from the *Personnel Inquiry Records* in 1939, which covers cohorts who were born in 1879–1894 and turned age 17 (main application age) in 1896–1911. The vertical axis shows the average number of indicated elites (per prefecture) born in the indicated area in the indicated cohort. The cohorts are colored according to their intensity of exposure to the centralized admissions in 1902–1907, where darker color indicates higher intensity. Because a portion of unsuccessful applicants retook the exam in subsequent years, the intensity began to increase from the cohort who turned age 17 in 1899, reaches the highest level for the cohorts who turned age 17 in 1902, and began to decline from the cohort who turned age 17 in 1904. See Section 4.1 for discussions about this figure.

Table 2: Long-run Impacts of Centralization: Difference-in-Differences Estimates

	(1) Imperial Univ. grads	(2) Top 0.01% income earners	(3) Top 0.05% income earners	(4) Medal recipients	(5) Corporate executives	(6) Top politicians & bureaucrats	(7) Imperial Univ. professors	(8) All occupational elites
				Panel A: Baseline Specification				
Age 17 under centralization	3.18	0.61	1.68	2.82	1.82	0.84	0.41	9.42
× Tokyo area (<100 km)	(0.027)**	(0.016)**	(0.060)*	(0.010)***	(0.085)*	(0.002)***	(0.025)**	(0.076)*
	[0.001]***	[0.032]**	[0.007]***	[0.000]***	[0.069]*	[0.011]**	[0.166]	[0.000]***
				Panel B: With Control Variables				
Age 17 under centralization	1.93	0.52	1.59	2.44	1.51	0.63	0.39	6.80
× Tokyo area (<100 km)	(0.002)***	(0.025)**	(0.060)*	(0.002)***	(0.060)*	(0.001)***	(0.041)**	(0.026)**
	[0.011]**	[0.013]**	[0.013]**	[0.002]***	[0.084]*	[0.049]**	[0.153]	[0.006]***
				Panel C: Bidirectional Specification with Control Variables				
Age≤17 in 1902	1.31	0.68	1.90	1.99	2.40	0.43	0.31	6.81
× Tokyo area (<100 km)	(0.165)	(0.078)*	(0.006)***	(0.004)***	(0.055)*	(0.010)***	(0.149)	(0.039)**
	[0.033]**	[0.061]*	[0.008]***	[0.002]***	[0.052]*	[0.207]	[0.345]	[0.001]***
Age≤17 in 1908	-2.59	-0.36	-1.26	-2.91	-0.57	-0.83	-0.48	-6.79
× Tokyo area (<100 km)	(0.001)***	(0.022)**	(0.183)	(0.004)***	(0.334)	(0.006)***	(0.025)**	(0.025)**
	[0.009]***	[0.134]	[0.026]**	[0.014]**	[0.585]	[0.030]**	[0.057]*	[0.018]**
				Panel D: Centralization Exposure with Control Variables				
Cohort's exposure to centralization	2.03	0.64	1.73	2.51	1.75	0.60	0.43	7.16
× Tokyo area (<100 km)	(0.001)***	(0.008)***	(0.020)**	(0.002)***	(0.012)**	(0.006)***	(0.074)*	(0.016)**
	[0.011]**	[0.000]***	[0.004]***	[0.002]***	[0.074]*	[0.025]**	[0.174]	[0.001]***
Observations	705	705	705	705	705	705	705	705
Cohort FE, Birth pref. FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean dep var	8.77	1.24	5.19	6.21	8.44	1.34	0.82	38.00
Mean dep var (Tokyo area under decentralization)	10.62	1.51	6.75	6.86	11.78	1.25	1.02	50.27

Notes: This table shows difference-in-differences estimates of the long-run effects of the centralized admissions on the geographical origins of elites. We construct prefecture-cohort level data by counting the number of individuals specified in (1)–(7) by birth prefecture and birth cohort (born in 1880–1894). "Imperial University grads" are individuals whose final education was Imperial University. "Top 0.01% (or 0.05%) income earners" are individuals whose income was above the 99.99th (or 99.95th) percentile of the national income distribution. "Medal recipients" are civilian individuals who received either the medal of the Fifth Order of Merit and above, or the court rank of the Junior Fifth Rank and above. "Corporate executives" are individuals who held an executive position in a corporation and paid a positive amount of national tax. "Top politicians & bureaucrats" are individuals who were Imperial Diet members or high-ranking central government officials. "Imperial University professors" are Imperial University professors or associate professors. "Age 17 under centralization" is the indicator variable that takes 1 if the cohort became age 17 (main application age) under the centralized admissions in 1902–07. "Age≤17 in 1902 (or 1908)" is the indicator variable that takes 1 if the cohort turned 17 years old in 1902 (or 1908) or later. "Mean dep var" is the mean of the dependent variable for all prefecture-cohort observations, and "Mean dep var (Tokyo area under decentralization)" is that for the Tokyo area under the decentralized admissions. "Cohort's exposure to centralization" is each cohort's intensity of exposure to the centralized admissions in 1902–07. In Panels B, C, and D, we control for time- and cohort-varying prefecture characteristics, i.e., the number of primary schools in the prefecture in the year when the cohort turned eligible age, the number of middle-school graduates in the prefecture in the year when the cohort turned age 17, log of GDP of the prefecture when the cohort turned age 20, and the birth population of the cohort in the prefecture. Parentheses contain p-values based on standard errors clustered at the prefecture level. Square brackets contain wild cluster bootstrap p-values based on standard errors clustered at the cohort level. ***, **, and * mean significance at the 1%, 5%, and 10% levels, respectively. See Section 4.1 for discussions about this table.

Table 3: Long-run Impacts of Centralization: Destinations of Elites

	(1) Imperial Univ. grads	(2) Top 0.01% income earners	(3) Top 0.05% income earners	(4) Medal recipients	(5) Corporate executives	(6) Top politicians & bureaucrats	(7) Imperial Univ. professors	(8) All occupational elites
				Panel A: Baseline Specification				
Age 17 under centralization	4.20	0.48	2.03	3.11	3.59	0.61	0.71	14.24
× Tokyo area (<100 km)	(0.060)*	(0.151)	(0.320)	(0.056)*	(0.233)	(0.000)***	(0.120)	(0.152)
	[0.000]***	[0.169]	[0.056]*	[0.009]***	[0.004]***	[0.093]*	[0.089]*	[0.000]***
				Panel B: Adding Control Variables				
Age 17 under centralization	3.16	0.74	2.44	2.90	3.72	0.41	0.54	12.45
× Tokyo area (<100 km)	(0.021)**	(0.221)	(0.263)	(0.038)**	(0.214)	(0.017)**	(0.043)**	(0.120)
	[0.007]***	[0.008]***	[0.013]**	[0.007]***	[0.001]***	[0.109]	[0.127]	[0.003]***
Observations	703	703	703	703	703	703	703	703
Cohort FE, Birth pref. FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean dep var	8.32	1.22	5.09	5.89	8.19	1.26	0.78	36.82
Mean dep var (Tokyo area under decentralization)	14.73	2.46	9.60	9.63	16.29	2.13	1.32	63.79

Notes: This table shows difference-in-differences estimates of the long-run effects of the centralized admission system on the geographical destinations of elites. By birth cohort (born in 1880–1894), we count the number of elites who reside in each prefecture as adults in 1939. Unlike the previous tables, all outcome variables are measured at the prefecture of residence. In Panel B, we control for time- and cohort-varying prefecture characteristics, i.e., the number of primary schools in the prefecture in the year when the cohort turned age 17, the number of middle-school graduates in the prefecture in the year when the cohort turned age 17, log GDP of the prefecture when the cohort turned age 20, and birth population of the cohort in the prefecture. Parentheses contain p-values based on standard errors clustered at the prefecture level. Square brackets contain wild cluster bootstrap p-values based on standard errors clustered at the cohort level. ***, **, and * mean significance at the 1%, 5%, and 10% levels, respectively. See Section 4.1 for discussions about this table.

Table 4: Long-run Impacts of Centralization: National Production of Top Government Officials

(a) Passers of the Higher Civil Service Exams

	(1) Exam passers	(2) Exam passers graduated from School 1 (Tokyo)	(3) Exam passers graduated from Schools 2–8	(4) Exam passers not graduated from Schools 1–8
Centralized	5.96	-2.81	14.93	-12.11
	(0.802)	(0.221)	(0.014)**	(0.044)**
Observations	33	33	33	33
Control time trend	Yes	Yes	Yes	Yes
Control exam passers	No	Yes	Yes	Yes
Mean dep var	189.55	37.29	68.47	83.80
Mean dep var (decentralization)	194.22	37.96	64.09	92.17

(b) Top-Ranking Higher Civil Officials

	(1) Top-ranking officials	(2) Top-ranking officials graduated from School 1 (Tokyo)	(3) Top-ranking officials graduated from Schools 2–8	(4) Top-ranking officials not graduated from Schools 1–8
Centralized	4.19	-0.48	5.22	-0.55
	(0.006)***	(0.648)	(0.000)***	(0.596)
Observations	33	33	33	33
Control time trend & exam passers	Yes	Yes	Yes	Yes
Mean dep var	29.77	8.27	12.97	8.53
Mean dep var (decentralization)	28.66	8.30	11.22	9.14

Notes: Panel (a) shows OLS estimates of the effects of the centralized admissions on the number of individuals who passed the administrative division of the Higher Civil Service Exams (administrative HCSE). Panel (b) shows OLS estimates of the effects of the centralized admissions on the number of top-ranking higher civil officials. The estimates are based on the cohort level data (1898–1930), where cohort is defined by the year of entering a higher school or its equivalent. The data is compiled from the complete list of individuals who passed the administrative HCSE in 1894–1941 and their biographical information. "Exam passers" is the number of individuals in cohort t who passed the administrative HCSE. "Top-ranking officials" is the number of top-ranking officials in cohort t (i.e., the number of individuals who entered a higher school or its equivalent in year t, passed the administrative HCSE, and were internally promoted to the top three ranks of higher civil service in their lifetime). "Centralized" is the indicator variable that takes 1 if cohort t entered a higher school or its equivalent under the centralized admissions in 1902–07, 1917–18, and 1926–27. "Mean dep var (decentralization)" is the mean of the dependent variable for the cohorts who entered a higher school or its equivalent under the decentralized admissions. In all regressions, we control for quadratic time trends. Parentheses contain P values based on Newey-West standard errors with the maximum lag order of 3. ***, **, and * mean significance at the 1%, 5%, and 10% levels, respectively. See Section 4.2 for discussions about this table.

Table 5: Long-run Impacts of Centralization: National Production of PIR-listed Elites

	No. of elites in the category specified in each panel (No. of elites aged 50 in the category = 100)					
	Panel A: Total number of all occupational elites					
Age 17 under centralization	9.34 (0.000)*** [0.003]***	4.52 (0.022)** [0.091]*	10.89 (0.000)*** [0.003]***			
Cohort's exposure to centralization				11.28 (0.000)*** [0.003]***	5.36 (0.020)** [0.100]*	13.18 (0.000)*** [0.001]***
R-squared	0.92	0.97	0.93	0.93	0.97	0.93
	Panel B: Total number of top 0.05% income earners					
Age 17 under centralization	7.66 (0.025)** [0.066]*	7.72 (0.006)*** [0.009]***	7.81 (0.035)** [0.047]**			
Cohort's exposure to centralization				9.26 (0.014)** [0.031]**	8.32 (0.011)** [0.024]**	9.52 (0.020)** [0.059]*
R-squared	0.89	0.95	0.89	0.90	0.95	0.90
	Panel C: Total number of medal recipients					
Age 17 under centralization	19.23 (0.000)*** [0.011]**	11.53 (0.008)*** [0.070]*	17.00 (0.000)*** [0.011]**			
Cohort's exposure to centralization				23.69 (0.000)*** [0.004]***	14.66 (0.002)*** [0.035]**	21.43 (0.000)*** [0.006]***
R-squared	0.84	0.90	0.85	0.85	0.91	0.86
Observations	60	60	60	60	60	60
Age control	Quadratic	Quartic	Edition-specific quadratic	Quadratic	Quartic	Edition-specific quadratic
PIR edition FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table examines the long-run effects of the centralized admissions on the total number of all occupational elites listed in the PIR (Panel A), the total number of top 0.05% income earners listed in the PIR (Panel B), and the total number of medal recipients listed in the PIR (Panel C). To distinguish the cohort effect from the age effect, we use two editions of the PIR (i.e., PIR (1934) and PIR (1939)), count the number of individuals (specified in the Panel) who are aged 40–69 by birth cohort in each edition (see Appendix Figure A.11), and pool the cohort-edition level data. We standardize the dependent variable by setting the number of individuals (specified in the Panel) at age 50 in each edition to be 100. "Age 17 under centralization" takes 1 if the cohort turned 17 years old under the centralized system in 1902–1907, and takes 0 otherwise. "Cohort's exposure to centralization" is defined as in Table 2 Panel D. We control for quadratic age trends in columns (1) and (4), quartic age trends in columns (2) and (5), and PIR edition specific quadratic age trends in columns (3) and (6). We additionally control for the edition fixed effect. Parentheses contain p-values based on robust standard errors. Square brackets contain wild cluster bootstrap p-values based on standard errors clustered at the cohort level. ***, **, and * mean significance at the 1%, 5%, and 10% levels, respectively. See Section 4.2 for discussions about this table.

A Online Empirical Appendix

A.1 The Evolution of the Admission System

Table A.1 shows changes in the number and the admission system of Schools 1–8 (*Kanritsu Koutou Gakkou* in Japanese) from 1900 to 1930. Despite the population increase and the growing demand for higher education, the number of National Higher Schools increased only slightly from 6 to 8 in 1900–1918 due to tight fiscal constraints. With the economic boom of WWI, the government expanded the higher education system and increased the number of Schools from 8 in 1918 to 25 in 1925.[33] Such expansions notwithstanding, Schools 1–8 remained the most distinguished among all higher schools throughout the pre-WWII period.

A.2 Relation to Historical Literature

The repeated reforms of the admission system of Schools 1–8 have been examined by historians of Japanese education, most notably by Yoshino (2001*a*,*b*), Takeuchi (2011), and Amano (2007, 2011, 2017). The preceding studies are mostly descriptive and qualitative in nature, providing institutional and historical details of the reforms. Among them, Yoshino (2001*a*,*b*) presents the most comprehensive historical accounts and basic statistics (such as the number of applicants and enrollment) combining a variety of historical documents. In this study, we reproduced and improved his data, using the same documents and additional sources as described in Appendix A.3.1 and A.3.2. The most closely related research is the study by Miyake (1998, 1999) that investigates regional variations in access to higher schools by comparing the number of students per population across prefectures across years. While her research remains descriptive, we provide quasi-experimental research designs to understand the short- and long-run impacts of the admission reforms.

Our study is also related to historical studies of elites in pre-WWII Japan. In particular, in his pioneering work, Aso (1978) uses multiple editions of the *Personnel Inquiry Records* (PIR) to examine occupational, educational, and regional compositions of elites and their evolution over time. His research is purely descriptive and based on a small sample of PIR-listed individuals, while we use a complete sample to examine the impact of school admission reforms on elite formation. As a more closely related study, Ichimura et al. (2024) use the same complete sample of the PIR to examine the long-run impact of middle school expansion on elite formation.

[33] In the late 1920s, in addition to 25 national higher schools, 3 local public higher schools, 4 private higher schools, and one colonial higher school were established.

A.3 Data for the Short-run Analysis

To analyze short-run effects of the centralized admission system, we collect data on application and enrollment outcomes for Schools 1–8 by newly digitizing several administrative and non-administrative sources.

A.3.1 Data on Application Behavior

We collect data on the number of applicants by school of their first choice (hereafter first-choice school) for 1900–1930 from the following sources: the *Ministry of Education Yearbook* (*Monbushou Nenpou* in Japanese) for 1900, 1901, 1908–1916, 1919–1925, and 1928–1930;[34] Correspondences from the Ministry of Education to the Tokyo Imperial University for 1903 and 1904;[35] the entrance exam preparation magazine called *Middle School World* (*Chugaku Sekai* in Japanese), vol.10, no.12, for 1907; and *Higher School Entrance Examination Investigation Report* (*Koutou Gakkou Nyugaku Shiken ni kansuru Shochousa* in Japanese) by the Ministry of Education for 1917, 1918 and 1927;[36] no data is available for 1902, 1905, 1906, and 1926. In addition, we collect data on the number of entrants by school for 1900–1930 from the *Ministry of Education Yearbook.*

First-choice school is defined as the school to which an applicant applies under the decentralized admission system and the school which an applicant ranks as his first choice under the centralized admission system. There is one issue in this data that requires data cleaning. As Table A.1 indicates, as exceptions under the decentralized system, Schools 7 and 8 are allowed to conduct their entrance exams on different dates from other schools in 1901 (School 7), 1908 (Schools 7 and 8), and 1909–1910 (School 7). In these years, applicants can apply for School 7 or 8 in addition to one of the other schools. For this reason, the number of first-choice applicants to Schools 7 and 8 in these years are double-counted. To correct for double-counting, we estimate the number of first-choice applicants for Schools 7 and 8 in these years using 1) the number of entrants to Schools 7 and 8 in these years and 2) the average ratio of applicants to entrants in 1911–1916 for School 7 and 1909–1916 for School 8, respectively. Using this data, we compute the share of applicants who choose School 1 as their first choice (in Figure 1a) and the ratio of first-choice applicants to entrants for each school (in Appendix Figure A.4).

Taking advantage of more detailed data in a supplementary volume of the *Higher School Entrance Examination Investigation Report* of 1917, we collect data on the number of applicants by their first-choice school and by their middle-school prefecture for 1916 and 1917.

[34] Digital images are available online at the National Diet Library Digital Collections.
[35] Digital images are available online at the University of Tokyo Digital Archives.
[36] Digital images are available online at the National Diet Library Digital Collections.

Middle-school prefecture is defined as the prefecture in which an applicant's middle school is located. To measure the geographical mobility of applicants, we define application distance (i.e., the distance between an applicant's middle school and his first-choice school) by the direct (straight-line) distance between the capital of the prefecture in which his middle school is located and the capital of the prefecture in which his first-choice school is located. The distance data is provided by the Geospatial Information Authority of Japan. These data is used to examine the impact of centralized admissions on (a) the share of applicants whose first choice is School 1 and (b) the application distance by regions (Appendix Table A.3).

A.3.2 Data on Enrollment Outcomes

To analyze enrollment outcomes, we use *Higher School Student Registers* (*Gakkou Ichiran* in Japanese) published annually by Schools 1–8.[37] For each school, as a proxy for the number of entrants, we collect data on the number of first-year students in the university preparatory course (*daigaku yoka* in Japanese). Our data starts in 1896 for Schools 1, 2, 4, and 5, 1897 for School 3, 1900 for School 6, 1901 for School 7, and 1908 for School 8, reflecting the year of establishment for each school (School 3 was established in 1896, but the university preparatory course started in 1897).[38] Birth prefecture is the prefecture of a student's legal domicile (*honsekichi* in Japanese) recorded in the official family registry system (*koseki* in Japanese). We include students born in any prefecture, but exclude foreign-born students and students born in colonies.

To measure the geographical mobility of entrants in Figure 1b, we define enrollment distance (i.e., the distance between an entrant's birth prefecture and the school he entered) by the direct distance between the capital of the birth prefecture and the capital of the prefecture in which the school he entered is located. The distance data is provided by the Geospatial Information Authority of Japan. To produce Figure 1b, we focus on the sample of schools that use single-school application under the decentralized system. As Schools 7 and 8 are allowed to conduct their entrance exams on different dates from other schools in 1901 (School 7), 1908 (Schools 7 and 8), and 1909–1910 (School 7), applicants can apply for these schools in addition to one of the rest of the schools in these years even under the decentralized system. We exclude these schools in these years from the sample.

To analyze the impact of centralized admissions on the geographical composition of entrants (Figure 2a, Figure 2b, and Table 1), we control for the size of potential applicants and the number of competing schools in each prefecture, using the following variables. From the

[37]Digital images are available online at the National Diet Library Digital Collections.

[38]The data is missing in the following years: 1929 for School 3, 1904 and 1907 for School 5, 1920 for School 6, and 1909 for School 7.

Ministry of Education Yearbook, we collect data on the number of middle-school graduates (including both public and private schools) by prefecture (defined by school location)[39] as well as the number of higher schools (including national, public, and private schools) by prefecture (defined by school location) for 1900–1930. The total number of higher schools increased from 8 (consisting of 8 national schools) in 1918 to 32 (consisting of 25 national, 3 public, and 4 private schools) in 1930.

To analyze why the Tokyo area has a greater number of entrants during the centralized admissions, we use prefecture-level population and GDP per capita. For GDP per capita, we use prefecture-level gross real value-added per capita estimates in 1890, 1909, 1925, and 1935 (expressed in 1934–36 constant prices) in the revised 2021 version of Tangjun et al. (2009) data (downloaded from "Database on Gross Prefectural Product in Prewar Japan" in the online databases at the Institute of Economic Research at Hitotsubashi University website in January 2021). We interpolate them linearly for each prefecture to obtain annual estimates for 1900–1930. Prefecture-level population estimates for 1900–1940 are provided by the authors of Tangjun et al. (2009) who produced annual population estimates to compute per capita gross prefectural products. Prefecture-level data on the share of applicants to School 1 in all applicants during the decentralized admissions is available only for 1916 (reported in the supplementary volume of the *Higher School Entrance Examination Investigation Report* of 1917).

Finally, to test the exogeneity of the timing of admission reforms, in addition to the data collected above, we collect data on the mean age of entrants for 1905–1930 from the *Ministry of Education Yearbook*.[40] We also collect data on government expenditures on national higher education (the sum of ordinary and extraordinary expenditures spent on National Higher Schools and Imperial Universities) for 1900–1930 from the *Ministry of Education Yearbook*. Our analysis is presented in Appendix Table A.7.

A.4 Data for the Long-run Analysis

A.4.1 Data on the Regional Distribution of Elites

Personnel Inquiry Records (PIR) data

To measure students' career outcomes, the first long-run analysis uses *Personnel Inquiry Records* (*Jinji Koushin-roku* in Japanese), which compiles a selective list of "socially distinguished individuals" (*shakai-teki meishi* in Japanese) and provides their biographical information. We use the 1939 edition of the PIR in our main analysis and the 1934 edition

[39]The data on middle-school graduates is missing for 1920 and is linearly interpolated.
[40]No data on the mean age of entrants is available for 1900–1904.

for a supplementary analysis.[41]

In compiling a list of socially distinguished individuals, the PIR explicitly states that it used multiple sources, including the government personnel directory (*Shokuin-roku* in Japanese), the directories of banks and companies (*Teikoku Ginkou Kaisha Youroku* and *Zenkoku Ginkou Kaisha Youroku* in Japanese), the directory of the national chamber of commerce and industry members (*Zenkoku Shoukou Kaigisho Giin Meibo* in Japanese), and the directory of Japanese notables (*Nihon Shinshi-roku* in Japanese) (PIR (1934), p.2).[42]

The government personnel directory provides a complete list of public servants (with their job titles and ranks) in national and local governments, including the Imperial Diet members, civil and military officials, and Imperial University professors. The directory of banks and companies provides a complete list of directors of banks and companies whose capital is 300,000 JPY or above (*Teikoku Ginkou Kaisha Youroku* (1938), p.2). The directory of Japanese notables includes "wealthy persons," defined by individuals who paid income tax of 80 JPY or greater or business tax of 70 JPY or greater, living in urban areas in 24 prefectures (out of 47 prefectures) in Japan (*Nihon Shinshi-roku* (1938), p.i).

We use the following information from the PIR for each individual: full name, birth year, birth prefecture, the prefecture of residence, final education, occupation titles and organization names, corporation type (if the organization is incorporated), the medal for merit and the court rank awarded (if any), and the amounts of national income tax and business tax paid in the previous year (if any). To check for accuracy, the PIR verifies the information of birth date and birth prefecture for each individual by obtaining a transcript of the official family register (PIR (1934), p.2).

Defining the Groups of Elites

As described in the main text, we define (mutually non-exclusive) subgroups of elites among the individuals listed in the PIR. To determine an individual's occupations, we search if one's occupational titles and organization names contain specific Japanese characters that signify a given occupation. The precise definitions of corporate executives, top politicians and bureaucrats, Imperial University professors, landlords, scholars, engineers, physicians, and lawyers are provided in Appendix Table A.9.

To define the top 0.01% income earners, we follow Moriguchi and Saez (2008) and use the number of income tax payers and the amount of income tax paid by income bracket from the *Tax Bureau Statistical Yearbook* (*Shuzei-kyoku Toukei Nenpousho* in Japanese)[43]

[41]We thank Hidehiko Ichimura and Yasuyuki Sawada for sharing their digitized the 1934 and 1939 PIR data.

[42]Digital images of these materials are available online at the National Diet Library Digital Collections.

[43]Digital images are available online at the National Diet Library Digital Collections.

and the number of adults from the population census to compute the threshold (99.99th percentile) value of income tax payment. Using Pareto interpolation, the threshold income tax payment for the top 0.01% in 1938 is estimated to be 9,972 JPY. This is equivalent to around 50,000 JPY of taxable income, which is well over 50 times the estimated mean household income (Yazawa, 2004). Similarly, the threshold income tax payment for the top 0.05% income earners is estimated to be 2,135 JPY, which is equivalent to 16,950 JPY of taxable income.

In the pre-WWII Japanese honor system, the medals for merit (*kuntou* in Japanese) and the court ranks (*ikai* in Japanese) were conferred on individuals in recognition of their exceptional service or distinguished merit. The medals consisted of 8 grades from the First Order of Merit (the highest honor) to the Eighth Order of Merit (the lowest honor), and the court ranks consisted of 16 ranks from the Senior First Rank (the highest rank) to the Junior Eighth Rank (the lowest rank). According to Ogawa (2009), the First and Second Order of Merit were given almost exclusively to top military officers, politicians, and bureaucrats. We define prestigious medal recipients as those who receive either the Fifth Order of Merit (*kun-gotou* in Japanese) and above, or the Junior Fifth Rank (*ju-goi* in Japanese) and above.

Finally, we define all occupational elites as all individuals listed in the PIR except for those individuals whose only occupation is peerage membership or landlord. We exclude these elites because they became elites typically by inheritance.

Control Variables

In the regression analysis presented in Table 2 Panels B, C, and D, we control for time- and cohort-varying prefecture characteristics for the cohorts born in 1880–1894. For the robustness check to test the parallel trend assumption (Appendix Table A.13), we also use the cohorts born in 1874–1883.

First, to control for local educational conditions, we collect data on the number of primary schools and the number of middle-school graduates by prefecture (defined by school location) in the year when the cohort turns eligible age of 6 and 17, respectively, from the *Ministry of Education Yearbook*. Second, to control for local economic conditions, we take prefecture-level real GDP estimates in 1874, 1890, 1909, and 1925 (expressed in 1934–36 JPY) from the revised 2021 version of Tangjun et al. (2009) data (see above) and interpolate them linearly for each prefecture to obtain the value in the year when the cohort turns age 20.

Third, to control for local demographic changes, we estimate the prefecture-level male birth population of the cohorts born in 1874–1894 using the following data sources: (a) *Japanese Population Census* (*Nihon Zenkoku Kokou-hyo* in Japanese) in 1880–1892, which provides the number of male births by prefecture in each year, and (b) *Japanese Imperial*

Population Census (*Nihon Teikoku Minseki Kokou-hyou* in Japanese) in 1886, which provides the age-specific population by prefecture (from which we use the population of males who were born in 1874–1885 and were 1–12 years old in 1886).[44] For the cohorts born in 1874–1879, we estimate their birth population combining (a) and (b) as follows. For the cohorts born in 1880–1886, we define the survival rate of cohort c up to 1886 in prefecture j by the number of age-specific population of cohort c in 1886 from (b) divided by the number of births of cohort c from (a). We then estimate the following equation using OLS:

$$Ln(Survival_{jc}) = \phi_j Age_c + \theta Age_c^2 + \epsilon_{jc}, \tag{2}$$

where Age_c is the age of cohort c in 1886. Using the estimated coefficients, we predict the log of survival rates up to 7–11 years old in each prefecture. The birth population of cohorts born in 1875–1879 is obtained by

$$Ln(Birth\_Population_{jc}) = Ln(Population_{jc}^{1886}) - Ln(\widehat{Survival}_{jc}). \tag{3}$$

where $Population_{jc}^{1886}$ is the population of cohort c in 1886. There are several prefectures whose boundaries changed between 1874 and 1886, however. For these prefectures, we use birth population data in 1887–1892 to estimate the linear time trend of male birth population for each prefecture and impute the data prior to 1886. For the cohorts born in 1893 and 1894, we do not have data for their birth population by prefecture. Therefore, we impute them by the average birth population in the prefecture in 1891 and 1892.

Estimating the Intensity of Exposure to Centralization

Before 1918, the qualifications for the higher school entrance exam were male middle-school graduates who were at least 17 years old. Accordingly, applicants typically took the exam for the first time at age 17. Given this, in the regression analyses in Table 2 Panels A–C, Table A.15, and Table 3, we simply assume that, among cohorts who were born in 1880–1894 and turned age 17 in 1897–1911, only the cohorts who turned age 17 during the first period of centralized admissions in 1902–1907 were fully exposed to centralization, while the rest of the cohorts were fully exposed to decentralization.

Precisely speaking, however, a nontrivial number of unsuccessful applicants retook the exam multiple times in the subsequent years at age greater than 17. For this reason, we also estimate each cohort's intensity of exposure to centralization by taking into account the presence of exam re-takers as follows. We use a special table in the *Government Gazette* No.5838 (published in December 17, 1902) that reports the number of applicants and the

[44] Digital images of population censuses are available online at the National Diet Library Digital Collections.

number of admitted applicants in 1902 by the year of middle-school graduation. According to the table, 63.9% of the applicants in 1902 graduated from middle schools in 1902 (the same year), 27.3% in 1901 (the previous year), 7.2% in 1900 (two years before), 1.3% in 1899 (three years before), 0.2% in 1898 (four years before), and 0.1% in 1897 (five years before).

We use the 1902 data to compute the total number of exams taken and the number of exams taken under centralized admissions for each cohort, where cohort is defined by the year of middle-school graduation. This exercise requires us to estimate two sets of parameters. The first set of parameters is the probability of passing the exam in year t for applicants in cohort c who took the exam n times before year t, denoted by a_n^t (where $n = 0, ..., 5$ and $t = 1896, ..., 1911$). Note that the subscript for cohort c is suppressed because $c = t - n$. The second set of parameters is the probability of applicants (who took the exam n times) retaking the exam in year $t + 1$ conditional on failing the exam in year t, denoted by r_n^t. Because we only have the data for a single year, we assume that these parameters are constant across years (and therefore expressed as a_n and r_n) and that the cohort size is constant across cohorts. Under these assumptions, the probability of passing the exam is estimated to be $a_0 = 0.352$, $a_1 = 0.377$, $a_2 = 0.313$, $a_3 = 0.286$, $a_4 = 0.429$, $a_5 = 0.200$. The probability of retaking the exam is estimated to be $r_0 = 0.660$, $r_1 = 0.423$, $r_2 = 0.255$, $r_3 = 0.175$, $r_4 = 0.011$, $r_5 = 0.000$.

Using these parameters, we simulate the total number of exams taken by each cohort and compute the share of the exams taken under centralized admissions, which we define as the intensity of exposure to centralization. Here we assume that all cohorts graduated from middle-schools at age 17 (so that birth cohorts and cohorts defined by the year of middle-school graduation coincide). The estimated intensity of exposure to centralization is 0.00, 0.02, 0.09, 0.36, 1.00, 0.98, 0.91, 0.64, and 0.00 for the cohort who turned age 17 in 1896–98, 1899, 1900, 1901, 1902–04, 1905, 1906, 1907, and 1908–11, respectively. We color cohorts according to their intensity of exposure to centralization in Figure 3 and Appendix Figures A.7, A.10, and A.11. We also use the estimated intensity of exposure in the regression analyses in Table 2 Panel D and Table 5.

A.4.2 Data on the National Production of Top-Ranking Higher Civil Officials

In the second set of long-run analysis, we focus on a specific group of elites, i.e., higher civil officials for whom we have complete count data.

Higher Civil Service Examinations (HCSE) data

Our main data source is Hata (1981), which provides not only the list of all individuals who passed the Higher Civil Service Examinations (HCSE, *Bunkan Koutou Shiken* in

Japanese), but also their biographical information available as of 1981 (Hata, 1981, Section 3). The HCSE were selective national qualification exams held annually from 1894 to 1947. The administrative division of the HCSE consisted of two parts: the preliminary exams and the main exams. Until 1922, graduates of the law departments of imperial universities were exempted from the preliminary exams, but had to take the main exams (Hata, 1981, pp.663-666; Spaulding, 1967, Chapter 12).

We newly digitized the information of all individuals who passed the administrative division of the HCSE in 1894–1941, including their full name, education, year of university graduation, year of passing the HCSE, starting position, final position, year of retirement, and other notable positions held. Unlike the PIR data, we observe both university and higher school (or its equivalent) in the HCSE data. However, birth year and birth prefecture are missing in the HCSE data.

In the bureaucracy system in Japan, the higher civil service refers to the top ten ranks of national government offices in the administrative, judicial, and diplomatic divisions. Within the higher civil service, the top three ranks were distinctively called "imperial appointees" (*chokunin-kan* in Japanese) during the prewar period. The first rank consisted of minister level positions, and the second and third ranks consisted of vice minister level positions such as vice minister, director general, bureau chief, and prefectural governor (*fuku-daijin, jikan, kyokuchou*, and *chiji* in Japanese). The correspondence between civil service positions and their ranks was reported in the section of salary tables in the government personnel directory (*Shokuin-roku* in Japanese).

We define "top-ranking officials" as higher civil officials who were internally promoted to reach one of the top three ranks by the end of their career. More precisely, we define "top-ranking officials" as higher civil officials (a) whose final position was in the top three ranks excluding postwar governorship and (b) whose final and notable positions do not include positions in the first rank (i.e., minister-level positions). We exclude postwar governors from top-ranking officials, because starting in 1947 governors were no longer internally promoted but selected by direct election. We further exclude higher civil officials who were appointed to any minister-level positions, because these positions were filled by political appointments and not by internal promotion. See Spaulding (1967) and Shimizu (2019) for the establishment of the internal promotion system in prewar Japan.

Defining Cohorts (by the year of entering a higher school or its equivalent)

To identify each individual's exposure to the centralized admission system, we must find out in which year each individual took the entrance exam and entered a higher school (or failed and entered an alternative school). However, since we only observe the year of university graduation in the HCSE data, we estimate "the year of entering a higher school or its equivalent" separately for (1) top-ranking officials who graduated from one of Schools 1–8 (and an imperial university), (2) officials who graduated from one of Schools 1–8 (and an imperial university) but are not top-ranking officials, and (3) the rest of officials (who did not graduate from Schools 1–8), as follows.

First, for top-ranking officials who graduated from Schools 1–8, we find the exact year by searching each individual's full name in the list of first-year students in the Student Registers of Schools 1–8 in all editions. The exact match was found for 699 out of 733 individuals with a matching rate of 95.1%. For these individuals, in Appendix Figure A.8, we plot the number of years taken from entering Schools 1–8 to university graduation by cohort (defined by the year of university graduation) using a round marker. Because higher school and imperial university were both three-year programs, in principle one could complete both programs in 6 years. However, it was quite common for students to repeat the same year in both higher school and imperial university, especially in the earlier period when there was a strict system of holding back students who failed year-end exams. As a result, as the figure indicates, it took substantially longer than 6 years on average to complete both programs especially for the earlier cohorts.

Second, for non top-ranking officials who graduated from Schools 1–8, we assume that the distribution of the number of years taken from entering Schools 1–8 to university graduation is the same as that of the top-ranking officials (who graduated from Schools 1–8) of the same cohort (defined by the year of university graduate) computed above. To check the validity of this assumption, for two representative cohorts of 1914 and 1922, we randomly select 25% of the non top-ranking officials (who graduated from Schools 1–8) from each cohort and find the exact year of entering a higher school for each individual using the same method of searching a full name in the Student Registers. In Appendix Figure A.8, we plot the average number of years taken from entering Schools 1–8 to university graduation for each subsample in 1914 and 1922 using a diamond marker. The average number is not significantly different between top-ranking and non top-ranking officials (i.e., both numbers are mutually within the 95% confidence intervals) in both 1914 and 1922.

Third, for the officials who are not Schools 1–8 graduates, we assume that the year of entering a higher school or its equivalent is "the year of university graduation minus 6." Because the number of National Higher Schools increased from 8 in 1918 to 25 by 1925, this group includes the officials who graduated from a higher school other than Schools 1–8 and an imperial university, as well as the officials who graduated from private higher education institutions (e.g., Waseda or Meiji University and its affiliated high school). In either case, most universities and higher schools or their equivalent were three-year programs. For a robustness check, we alternatively assume that the year of entering a higher school or its equivalent is "the year of university graduation minus 7" and show that the empirical results are qualitatively the same (see Appendix Table A.16).

To proceed to an empirical analysis, we redefine cohort by "the year of entering a higher school or its equivalent" estimated above (so that we can see which cohorts are exposed to centralization as opposed to decentralization). That is, to create cohort-level data, we count the number of exam passers (i.e., those who passed the administrative division of the HCSE) and the number of top-ranking officials by the year in which they entered a higher school or its equivalent. Our dataset consists of 6,255 individuals who entered a higher school or its equivalent in 1898–1930 and passed the HCSE in 1901–1941.

Out of 6,255 exam passers, 3,490 individuals (55.8%) are Schools 1–8 graduates, 4,767 individuals (76.2%) are Imperial University graduates, and 982 individuals (15.7%) are top-ranking officials. The share of Imperial University graduates is greater than that of Schools 1–8 graduates because the number of higher schools increased from 8 to 25 in 1919–1930. Among 982 top-ranking officials, 701 officials (71.4%) are Schools 1–8 graduates, and 891 officials (90.7%) are Imperial University graduates. The HCSE consisted of preliminary and main exams, and because Imperial University law graduates were the only group exempted from the administrative preliminary exams from 1894 to 1922, they had substantial advantages in passing the HCSE (Hata, 1981, pp.663-666; Spaulding, 1967, Chapter 12). This exemption, however, does not explain why Imperial University graduates had such a high share in the top-ranking officials.

A.4.3 Variation in Years Taken to be Promoted to Top-ranking Positions

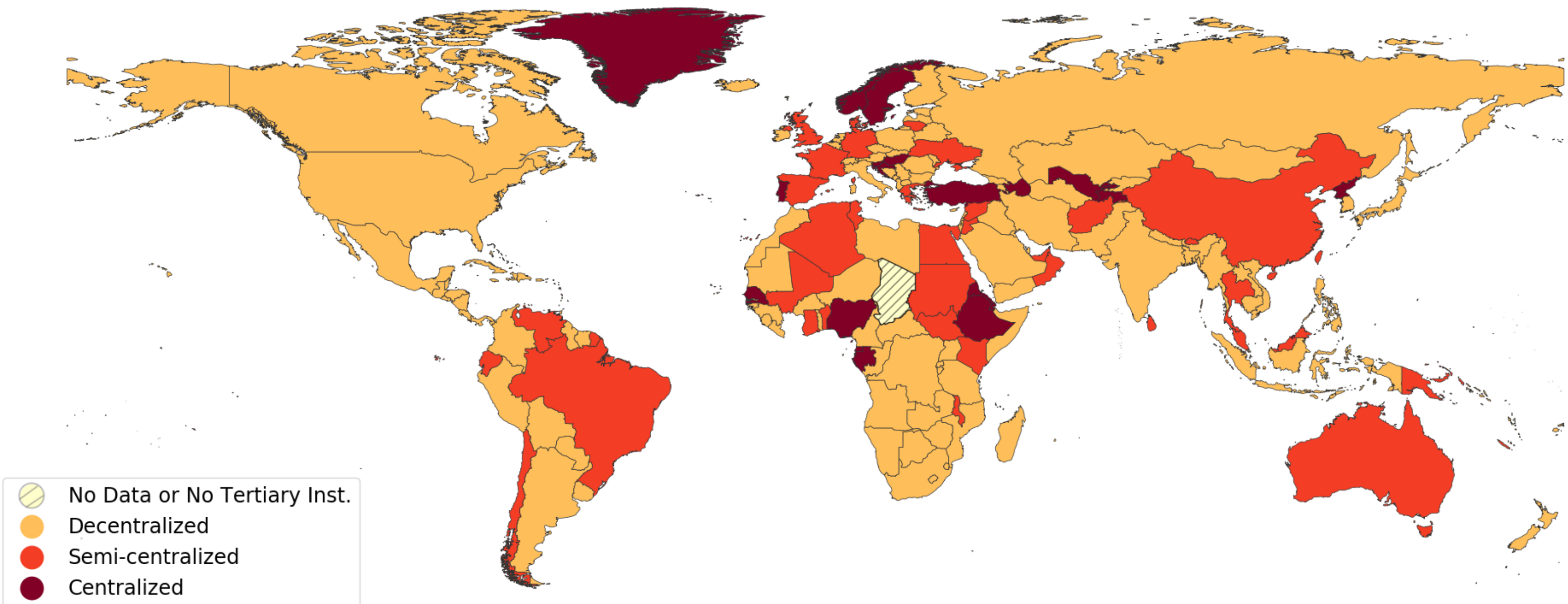
One potential threat to our identification in Table 4 Panel (b) is a possibility that the number of available top-ranking positions happened to have increased during the periods of centralization. However, we argue that even if this was the case, it is not likely to affect our results, since our cohort is defined by the year of entering a higher school or its equivalent, *not* by the year of becoming top-ranking officials. Namely, as long as individuals in a given cohort were not promoted to a top-ranking position in the same year, a potential correlation between the number of top-ranking positions and the lagged periods of centralized admissions does not bias our results.

To examine this possibility, we first randomly selected two cohorts exposed to centralization (1903 and 1916) and two cohorts exposed to decentralization (1913 and 1922). For all top-ranking officials who graduated from Schools 1–8 in these cohorts, we searched the years in which these officials were appointed to their first top-ranking positions. Using online searches to find biographical information for each official, we obtained necessary information for 82% of these officials. As shown in Appendix Figure A.9, within each cohort, the number of years taken from entering a higher school to the appointment for the first top-ranking position varied widely from 20 to 30 years. This within-cohort variation is a sum of two variations, the first variation in the number of years taken from entering a higher school to passing the exams and the second variation in the number of years taken from passing the exams to becoming a top-ranking official. Therefore, it is unlikely that the result in Table 4 Panel (b) is driven by a greater number of available top-ranking positions that coincided with the periods of centralization.

A.4.4 Connections and Signaling Hypotheses

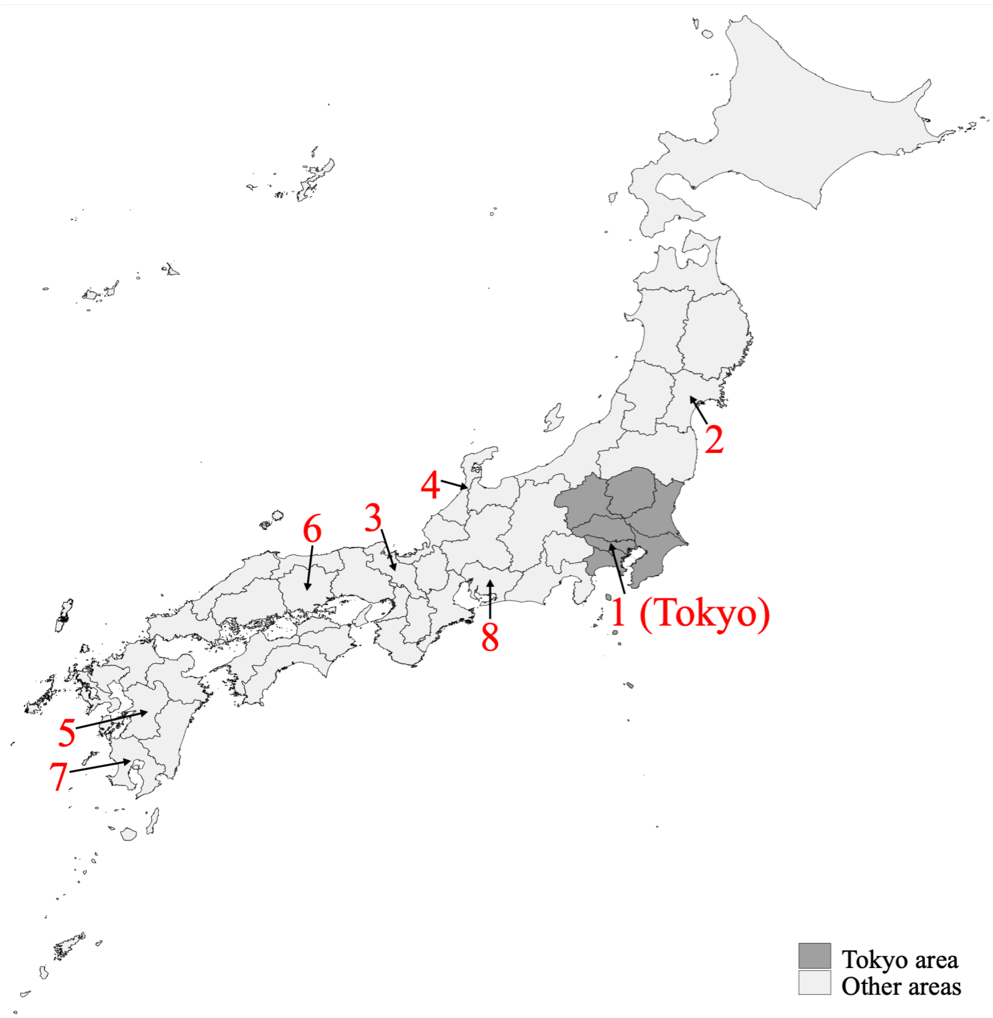
We investigate whether connections or signaling was an important mechanism through which meritocratic centralization increased the total number of top-ranking officials. First, to explore the connection channel, we reexamine the result of Table 4 Panel (b) Column (3) by controlling for the number of exam passers from the same schools (Schools 2–8) in the same cohort, instead of the total number of exam passers. This variable takes into account the size of same-cohort colleagues from the same schools who are likely to have network values. The coefficient of centralization remains sizable (2.72) and statistically significant at the 1% level, implying a 24% increase in the number of top-ranking officials from these schools relative to the mean during decentralization (11.22). Second, to investigate the signaling channel, we further restrict our sample to top-ranking officials who graduated from both Schools 2–8 and Tokyo Imperial University, the most prestigious institution with the strongest signaling value. We regress the number of this subgroup of top-ranking officials on centralization, controlling for the number of exam passers from the same schools in the same cohort. If signaling is a major channel, we expect the effect of centralization among this subgroup to be larger. The coefficient of centralization *de*creases to 1.76, implying a 18% increase in the number of top-ranking officials from these schools relative to the mean during decentralization (10.00). This effect size is smaller than the effect size of 24% above.

Figure A.1: College Admissions around the World Today



Notes: This figure summarizes each country and territory's college admission system today. Dark red color (e.g. Norway): Regionally- or nationally-centralized college admissions where a single-application, single-offer assignment algorithm (well-defined rule) is used to make admissions to both public and private universities. Medium orange color (e.g. Brazil): Semi-centralized college admissions defined as either (1) there is a centralized system, but not all universities (such as private universities) are included in the single-application, single-offer system or (2) students submit a single application and receive multiple offers. Light orange color (e.g. U.S.): Decentralized college admissions where each college defines its own admission standards and rules. Yellow with diagonal lines (e.g. Chad): Not enough information available or if the country or territory does not have tertiary institutions. We summarize the information sources at `https://www.scribd.com/document/437545135/Online-Appendix191018`. See Section 2 for discussions about this figure.

Figure A.2: Map of Schools 1–8 and Definition of the Tokyo Area



Notes: This figure shows the locations of Schools 1–8 and the location of the Tokyo area (in dark gray color) defined as a set of 7 prefectures that are within 100 km from Tokyo (i.e., Tokyo, Chiba, Kanagawa, Saitama, Ibaraki, Tochigi, and Gunma prefectures). See Sections 2 and 3.5 for discussions about this figure.

Table A.1: The Evolution of the Admission System

Year	No. of National Higher Schools	Admission System	Exam Questions	Exam Dates	Exam Location
1900	6	Decentralized	School-specific	Same	School of application
1901	7	Decentralized	Unified (except S7)	Same (except S7)	Any School
1902	7	Centralized	Unified	Same	Any School
1903	7	Centralized	Unified	Same	Any School
1904	7	Centralized	Unified	Same	Any School
1905	7	Centralized	Unified	Same	Any School
1906	7	Centralized	Unified	Same	Any School
1907	7	Centralized	Unified	Same	Any School
1908	8	Decentralized	School-specific	Same (except S7&S8)	School of Application
1909	8	Decentralized	Unified (except S7)	Same (except S7)	School of Application
1910	8	Decentralized	Unified (except S7)	Same (except S7)	School of Application
1911	8	Decentralized	Unified	Same	School of Application
1912	8	Decentralized	Unified	Same	School of Application
1913	8	Decentralized	Unified	Same	School of Application
1914	8	Decentralized	Unified	Same	School of Application
1915	8	Decentralized	Unified	Same	School of Application
1916	8	Decentralized	Unified	Same	School of Application
1917	8	Centralized	Unified	Same	Any School
1918	8	Centralized	Unified	Same	Any School
1919	12	Decentralized	Unified	Same	School of Application
1920	15	Decentralized	Unified	Same	School of Application
1921	17	Decentralized	Unified	Same	School of Application
1922	20	Decentralized	Unified	Same	School of Application
1923	22	Decentralized	Unified	Same	School of Application
1924	24	Decentralized	Unified	Same	School of Application
1925	25	Decentralized	Unified	Same	School of Application
1926	25	Centralized (2 Groups)	Unified within Group	Same within Goup	Any School
1927	25	Centralized (2 Groups)	Unified within Group	Same within Goup	Any School
1928	25	Decentralized	School-specific	Same	School of Application
1929	25	Decentralized	School-specific	Same	School of Application
1930	25	Decentralized	School-specific	Same	School of Application

Notes: This table shows changes in the admission system of National Higher Schools (including Schools 1–8) from 1900 to 1930. In 1901, all schools held their exams on the same date, with the exception of newly established School 7. In 1908, all schools held their exams on the same date, with the exception of Schools 7 and 8. See Moriguchi (2021) for historical details and the sources of information. See Section 2.1 and Appendix Section A.1 for discussions about this table.

Figure A.3: Centralized Assignment Rule

第六條　入學ヲ許可スヘキ者ハ左ノ方法ニ依リ之ヲ定ム

一、高等學校ヲ通シ各部毎ニ其ノ部ニ入學セシムヘキ人員ノ總數ト同數ノ人員ヲ試驗ノ成績順ニ依リ選出ス

二、前號ノ場合ニ於テ試驗成績相同シキトキハ抽籤ニ依ル

三、前號ニ依リ選出セル人員ニ就キ試驗ノ成績順ニ依リ第一部又ハ第二部ノ志望者ニ在リテハ本人ノ指定スル第一ノ志望類ニ基キ第一ノ志望學校ニ第三部ノ志望者ニ在リテハ本人ノ指定スル第一ノ志望學校ニ配當ス

四、前號ノ場合ニ於テ試驗成績相同シキトキハ抽籤ニ依ル

五、第三號及第四號ニ依リ配當ノ結果本人ノ指定スル第一ノ志望學校已ニ滿員トナリタル場合ニ於テハ更ニ成績順ニ依リ本人ノ指定スル第二ノ志望學校ニ配當ス

六、前號ノ場合ニ於テ試驗ノ成績相同シトキハ抽籤ニ依ル

七、第五號及第六號ニ依リ配當ノ結果本人ノ指定スル第二ノ志望學校已ニ滿員トナリタル場合ニ於テハ更ニ其ノ第三以下ノ志望學校ニ就キ第五號及第六號ニ準シ配當ス

八、第一部又ハ第二部ノ志望者ニ在リテハ本人ノ指定スル第一ノ志望類カ志望學校ニ於テ悉ク滿員トナリタルトキハ更ニ本人ノ指定スル第二以下ノ志望類中缺員アルモノニ之ヲ配當ス其ノ方法ハ第三號乃至第七號ニ準ス

九、本人ノ志望スル類及學校悉ク滿員トナリタルトキハ入學スルコトヲ得サルモノトス

前項ニ依リ配當ノ結果又ハ事故ノ爲メ入學者ニ缺員ヲ生シタルトキハ入學スルコトヲ得サリシ者ニ就キ更ニ前項ノ方法ニ依リ之ヲ補塡ス

Notes: This figure is a reprint of the assignment algorithm of the centralized admission system stated in the Ordinance of the Ministry of Education No.4 published in *Government Gazette* No.1419, pp.580-581, on April 27, 1917. See Sections 2 and 3.4 for an English translation and discussions.

Table A.2: Summary Statistics

Variable	Mean	Std. Dev.	Median	N
Year level data on short-run outcomes, 1900–1930				
No. of applicants to Schools 1–8	10777	4122	10187	27
Share of applicants choosing School 1 as their first choice	0.29	0.11	0.24	27
No. of entrants to Schools 1–8	2007	333	2147	31
Applicant level data on short-run outcomes, 1916–1917				
Distance between middle-school prefecture and the first-choice school (km)	224.88	272.03	117	20913
Applying to School 1 as first choice	0.33	0.47	0	20913
Entrant level data on short-run outcomes, 1900–1930				
Distance between birth prefecture and the school entered (km)	224	255	139	65251
Entering the nearest school from birth prefecture	0.49	0.5	0	66193
Born in Tokyo prefecture	0.09	0.29	0	66193
Born in the Tokyo area (7 prefectures within 100 km from Tokyo)	0.17	0.38	0	66193
Prefecture-year level data on short-run outcomes, 1900–1930				
No. of entrants to Schools 1-8	45.06	37.45	34	1469
No. of entrants to School 1	7.88	14.11	5	1469
No. of entrants to School 2	5.50	10.40	2	1469
No. of entrants to School 3	6.19	10.34	3	1421
No. of entrants to School 4	5.64	9.91	3	1469
No. of entrants to School 5	6.27	14.20	1	1422
No. of entrants to School 6	5.19	11.80	2	1421
No. of entrants to School 7	5.03	12.99	2	1328
No. of entrants to School 8	5.67	12.45	2	1093
No. of middle-school graduates	533.35	617.82	359	1457
No. of national higher schools other than Schools 1–8	0.14	0.43	0	1469
Prefecture-cohort level data on long-run outcomes, PIR-listed individuals born in 1880–1894				
No. of all Imperial University graduates	8.77	7.81	7	705
No. of individuals in the top 0.01% income group	1.24	2.05	1	705
No. of individuals in the top 0.05% income group	5.19	7.57	3	705
No. of civilians receiving medal of the Order of Fifth Class and above	6.21	4.94	5	705
No. of corporate executives with a positive amount of tax payment	8.44	9.57	6	705
No. of top politicians and high-ranking bureaucrats	1.34	1.38	1	705
No. of Imperial University professors	0.82	1.18	0	705
No. of all occupational elites	38.00	35.29	28	705
Cohort level data on long-run outcomes, government officials entering higher school or equivalent in 1898–1930				
No. of passers of the Higher Civil Service Exams	189.55	84.27	159.7	33
No. of top-ranking officials (internally promoted to top three ranks)	29.77	8.36	29.1	33
No. of top-ranking official who are School 1 graduates	8.27	3.36	8	33
No. of top-ranking officials who are Schools 2–8 graduates	12.97	5.98	12	33
No. of top-ranking officials who are not Schools 1–8 graduates	8.53	5.73	6.8	33

Table A.3: Centralization Caused Applicants Across the Country to Apply More Aggressively

	A. Selecting School 1 as First Choice								
Centralized	0.159	0.192	0.151	0.146	0.128	0.168	0.180	0.166	0.114
	(0.000)***	(0.000)***	(0.003)***	(0.001)***	(0.142)	(0.001)***	(0.001)***	(0.007)***	(0.001)***
Constant	0.248	0.494	0.169	0.0892	0.178	0.107	0.184	0.0813	0.127
	(0.001)***	(0.000)***	(0.002)***	(0.003)***	(0.018)**	(0.002)***	(0.000)***	(0.015)**	(0.088)*
Sample region	All	S1 Region	S2 Region	S3 Region	S4 Region	S5 Region	S6 Region	S7 Region	S8 Region
Observations	20,913	6,505	2,555	3,248	1,266	2,730	2,276	615	1,718

	B. Application Distance								
Centralized	-2.534	-92.88	10.95	2.080	-15.74	128.0	46.52	145.4	-25.57
	(0.914)	(0.000)***	(0.670)	(0.720)	(0.541)	(0.003)***	(0.012)**	(0.021)**	(0.264)
Constant	226.2	231.7	289.7	158.8	166.7	252.6	294.1	218.0	154.2
	(0.000)***	(0.000)***	(0.008)***	(0.002)***	(0.061)*	(0.002)***	(0.001)***	(0.092)*	(0.051)*
Sample region	All	S1 Region	S2 Region	S3 Region	S4 Region	S5 Region	S6 Region	S7 Region	S8 Region
Observations	20,913	6,505	2,555	3,248	1,266	2,730	2,276	615	1,718

Notes: In Panel A, we estimate the effects of the centralized admissions on the propensity of an applicant to select the most prestigious and selective school (School 1 in Tokyo) as the first choice, using the applicant-level data in 1916 (under the decentralized system) and 1917 (under the centralized system). The prefecture-level application data is available only for these two years. We estimate the following regression: $Y_{it} = \alpha + \beta \times Centralized_t + \epsilon_{it}$, where Y_{it} is the indicator that applicant i in year t selects School 1 as the first choice. $Centralized_t$ is the indicator that year t is under the centralized system. To observe regional variation, we estimate the equation separately by region of the applicant's middle school. More specifically, we group applicants into "school regions" based on which school (among Schools 1–8) is closest to the applicant's middle school in 1916. The following map shows the locations of the eight school regions. In Panel B, we estimate the effects of centralization on the application distance defined by the distance between an applicant's first-choice school and middle school. Parentheses p-values based on standard errors clustered at the prefecture level. ***, **, and * mean significance at the 1%, 5%, and 10% levels, respectively. See Section 3.3 for discussions about this table.

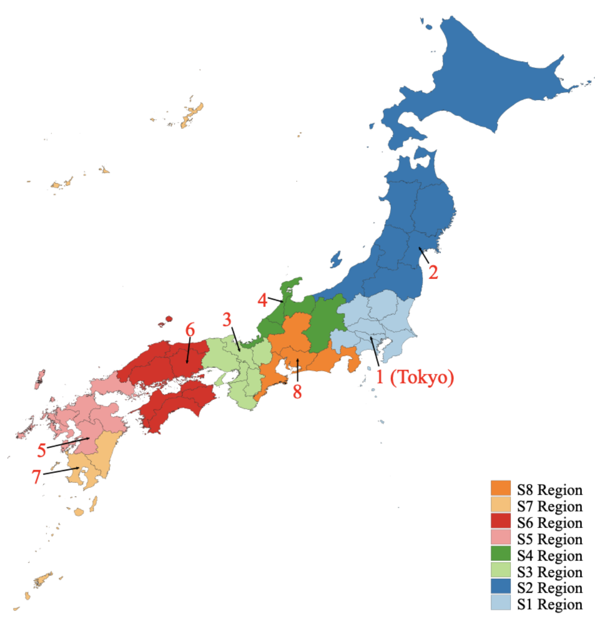
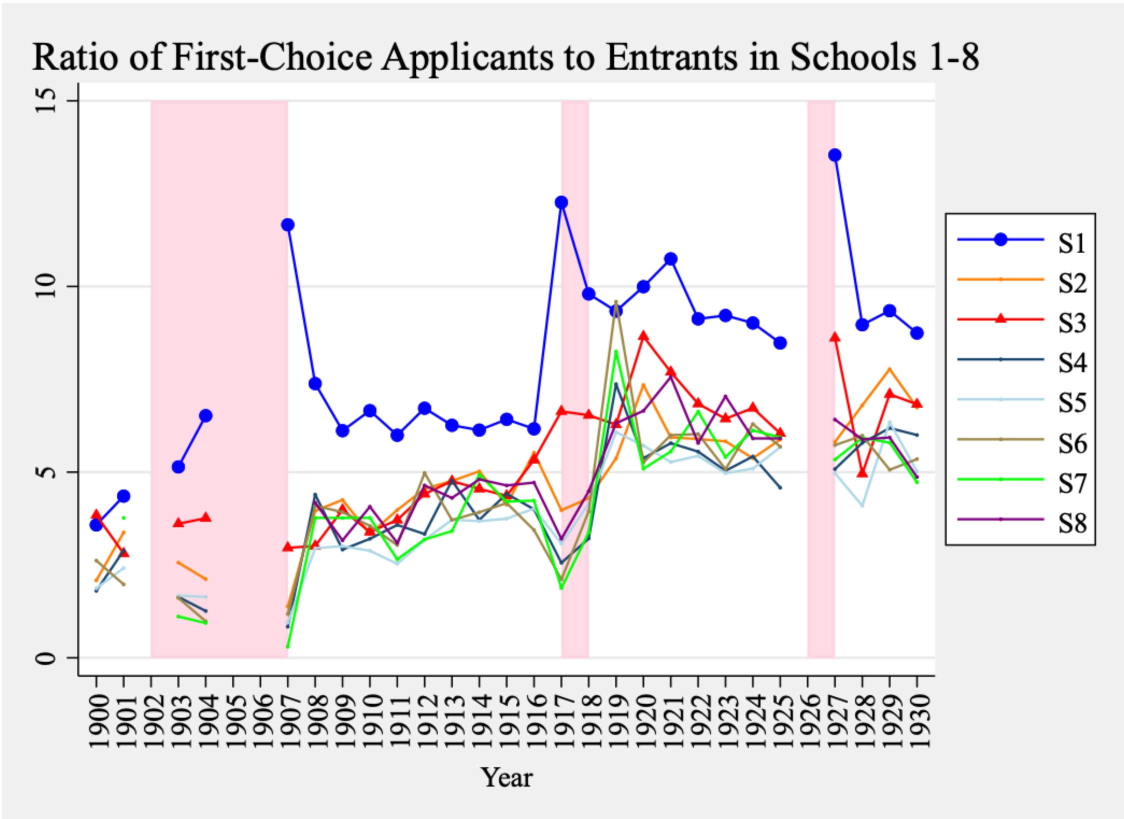


Figure A.4: Changes in the Competitiveness of Schools 1–8



Notes: This figure shows the time evolution of the competitiveness of Schools 1–8 (measured by the ratio of the number of applicants who rank the school first to the number of entrants to the school) from 1900 to 1930. No data is available for 1902, 1905, 1906, and 1926. Colored years (1902–07, 1917–18, 1926–27) indicate the periods of the centralized admission system. See Section 3.3 for discussions about this figure.

Table A.4: Centralization Increased Urban-born Entrants to Schools 2–8: Additional Control Variables

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	40.25		3.96	6.14	6.91	3.87	10.72	4.08	19.41
	(0.000)***		(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.016)**	(0.000)***
	[0.028]**		[0.160]	[0.036]**	[0.010]**	[0.031]**	[0.000]***	[0.264]	[0.000]***
Centralized x Born near Tokyo prefecture (1–100 km)	11.20		0.14	0.66	1.85	0.51	1.01	0.59	0.59
	(0.000)***		(0.725)	(0.072)*	(0.000)***	(0.214)	(0.040)**	(0.240)	(0.382)
	[0.000]***		[0.769]	[0.128]	[0.000]***	[0.057]*	[0.018]**	[0.194]	[0.044]**
Centralized x Born in school's prefecture	-17.77	-18.84	-18.47	-14.75	-23.00	-27.66	-21.99	-47.49	-13.33
	(0.001)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
	[0.025]**	[0.006]***	[0.021]**	[0.065]*	[0.005]***	[0.001]***	[0.079]*	[0.001]***	[0.386]
Centralized x Born near school's prefecture (1–100 km)	-3.79	-0.01	-2.86	-3.29	-8.96	-11.33	-1.65	-1.55	1.16
	(0.116)	(0.987)	(0.271)	(0.107)	(0.007)***	(0.001)***	(0.177)	(0.000)***	(0.231)
	[0.047]**	[0.980]	[0.043]**	[0.000]***	[0.001]***	[0.001]***	[0.062]*	[0.510]	[0.687]
No. middle-school grads in prefecture	6.02	-2.64	-0.77	0.78	-0.16	2.76	1.87	2.77	1.67
	(0.200)	(0.136)	(0.336)	(0.440)	(0.800)	(0.001)***	(0.434)	(0.211)	(0.406)
	[0.010]***	[0.000]***	[0.021]**	[0.077]*	[0.645]	[0.003]***	[0.003]***	[0.000]***	[0.013]**
No. middle-school grads in prefecture (1–100km)	-1.62	-0.18	-0.27	1.72	-0.31	0.09	-0.43	-1.32	-0.17
	(0.439)	(0.580)	(0.579)	(0.191)	(0.632)	(0.898)	(0.589)	(0.140)	(0.819)
	[0.003]***	[0.303]	[0.032]**	[0.000]***	[0.274]	[0.695]	[0.067]*	[0.000]***	[0.274]
No. other schools	-24.06	-1.83	-2.74	-3.01	-1.94	-3.33	-2.40	-3.42	-4.87
	(0.000)***	(0.031)**	(0.011)**	(0.054)*	(0.005)***	(0.006)***	(0.080)*	(0.027)**	(0.066)*
	[0.000]***	[0.001]***	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.000]***
Population in prefecture	14.35	8.80	3.55	1.39	-0.33	-0.59	-2.32	-1.20	1.42
	(0.043)**	(0.066)*	(0.014)**	(0.066)*	(0.729)	(0.540)	(0.380)	(0.204)	(0.674)
	[0.000]***	[0.000]***	[0.000]***	[0.058]*	[0.622]	[0.465]	[0.001]***	[0.118]	[0.184]
GDP per capita in prefecture	18.36	2.84	0.25	4.65	4.60	2.86	5.34	-3.40	0.03
	(0.074)*	(0.209)	(0.878)	(0.087)*	(0.034)**	(0.033)**	(0.031)**	(0.530)	(0.986)
	[0.000]***	[0.000]***	[0.573]	[0.001]***	[0.000]***	[0.012]**	[0.000]***	[0.002]***	[0.978]
Observations	1,457	1,457	1,457	1,410	1,457	1,410	1,410	1,269	1,081
Year FE, Prefecture FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean dep var	45.43	7.95	5.55	6.23	5.69	6.32	5.23	5.02	5.74
Mean dep var (Tokyo pref under decentralization)	201.1	104.7	27.52	10.85	14.48	6.10	9.20	11.72	20.21
Mean dep var (Within 1–100km from Tokyo pref. under decentralization)	26.23	9.119	6.738	1.208	2.865	0.746	1.242	1.546	3.228

Notes: This table uses the prefecture-year level data in 1900–1930. "Middle-school graduates in prefecture" is the number of students who graduated from middle schools in prefecture p in year t. "Middle-school graduates in nearby prefectures" is the number of students who graduated from middle schools in the prefectures within 100 km from prefecture p (excluding prefecture p) in year t. "Population in prefecture" is the population in prefecture p in year t. "GDP per capita in prefecture" is gross value-added per capita in prefecture p in year t. See Tables 1 for the definition of other variables. Parentheses contain p-values based on standard errors clustered at the prefecture level. Square brackets contain p-values based on standard errors clustered at the year level. ***, **, and * mean significance at the 1%, 5%, and 10% levels, respectively. See Section 3.5 for discussions about this table.

Table A.5: Characteristics of the Tokyo Area

	Mean	Std. Dev.	Min	Max	N
Tokyo Area					
Population in prefecture (in million)	1.497	0.866	0.820	5.437	217
GDP per capita in prefecture (in 1,000 yen)	0.209	0.095	0.108	0.469	217
Middle-school graduates in prefecture	0.871	1.172	0.011	6.427	217
Middle-school graduates in nearby prefectures (1-100 km)	4.604	2.150	0.395	12.212	217
Share of applicants at School 1 under decentralization	0.379	0.090	0.270	0.545	217
Other Areas					
Population in prefecture (in million)	1.072	0.522	0.414	3.568	1240
GDP per capita in prefecture (in 1,000 yen)	0.173	0.058	0.097	0.494	1240
Middle-school graduates in prefecture	0.474	0.431	0.029	3.307	1240
Middle-school graduates in nearby prefectures (1-100 km)	1.299	1.594	0.000	11.729	1240
Share of applicants at School 1 under decentralization	0.156	0.078	0.044	0.421	1240

Notes: This table shows the characteristics of the Tokyo area (defined as 7 prefectures within 100 km of Tokyo as in the map in Appendix Figure A.2) compared to other areas. All numbers are the prefecture-level average in 1900–1930. GDP per capita is in real terms expressed in 1934–1936 prices.

Table A.6: Replacing the Tokyo Area Indicator by Urban Characteristics

	(1)	(2)	(3)	(4)
	Entrants to Schools 1-8			
Centralized × Population in prefecture	2.63			
	(0.440)			
	[0.183]			
Centralized × GDP per capita in prefecture		3.16		
		(0.274)		
		[0.224]		
Centralized × Middle-school graduates in prefecture			3.73	
			(0.003)***	
			[0.171]	
Centralized × Middle-school graduates in nearby prefectures (1–100 km)			4.32	
			(0.001)***	
			[0.019]**	
Centralized × Share of applicants at School 1 (under Decentralization)				5.48
				(0.000)***
				[0.002]***
Population in prefecture	11.74			
	(0.061)*			
	[0.000]***			
GDP per capita in prefecture		17.30		
		(0.099)*		
		[0.001]***		
Middle-school graduates in prefecture	10.70	13.64	15.65	16.59
	(0.004)***	(0.001)***	(0.000)***	(0.000)***
	[0.000]***	[0.000]***	[0.000]***	[0.000]***
Middle-school graduates in nearby prefectures (1–100 km)			-0.73	
			(0.765)	
			[0.322]	
Observations	1,457	1,457	1,457	1,457
Year FE, Prefecture FE	Yes	Yes	Yes	Yes
Mean dep var	45.43	45.43	45.43	45.43

Notes: This table uses the prefecture-year level data in 1900–1930. The dependent variable is the number of students from birth prefecture p who entered one of Schools 1–8 in year t. "Population in prefecture" is population in prefecture p in year t. "GDP per capita in prefecture" is real gross value-added per capita in prefecture p in year t. "Middle-school graduates in prefecture" is the number of students who graduated from middle schools in prefecture p in year t. "Middle-school graduates in nearby prefectures" is the number of students who graduated from middle schools in the prefectures within 100 km from prefecture p (excluding prefecture p) in year t. "Share of applicants to School 1 (under decentralization)" is the share of applicants to School 1 among all applicants to Schools 1–8 in prefecture p under the decentralized system in 1916 (the only year for which the data is available). All variables interacted with "Centralized" are standardized to be mean 0 and standard deviation 1. We control for year fixed effects, prefecture fixed effects, and the number of higher schools other than Schools 1–8 in prefecture p in year t. We also control for "Born in school's prefecture," "Born near school's prefecture (1–100 km)," and "Born near school's prefecture (100-300 km)" as in Table 1. Parentheses contain p-values based on standard errors clustered at the prefecture level. Square brackets contain p-values based on standard errors clustered at the year level. ***, **, and * mean significance at the 1%, 5%, and 10% levels, respectively. See Section 3.5 for discussions about this table.

Table A.7: Testing Exogeneity of Centralization

	Placebo outcomes							Main outcomes		
	(1) No. middle school graduates	(2) No. entrants to Schools 1–8	(3) Share of entrants to School 1	(4) No. applicants to Schools 1–8	(5) Ratio of entrants to applicants	(6) Mean age of entrants	(7) Government expenditures on higher education	(8) Share of applicants to School 1	(9) Enrollment distance	(10) Share of entrants born in Tokyo area
Centralized	1.357	-0.101	0.00556	-0.460	0.0224	0.0523	0.760	0.164	58.54	0.0392
	(0.418)	(0.109)	(0.104)	(0.486)	(0.110)	(0.518)	(0.676)	(0.001)***	(0.000)***	(0.000)***
No. of middle-school graduates		0.00493	-0.000942	-0.150	0.00134	0.0656	-0.429	0.00194	1.448	0.00150
		(0.291)	(0.022)**	(0.046)**	(0.165)	(0.000)***	(0.062)*	(0.468)	(0.104)	(0.033)**
Observations	31	31	31	27	27	26	31	27	31	31
Mean dep var	23.41	2.007	0.180	10.78	0.217	19.03	13.56	0.291	228.4	0.174

Notes: Columns 1–7 test if important institutional variables are correlated with the timing of centralization using year-level data. Columns 8–10 do the same our main short-run outcomes using year-level data. All numbers are at the national-level from 1900 to 1930. The numbers of middle school graduates, entrants, and applicants are denominated by 1,000. In all regressions, quadratic time trends (i.e. trend and trend squared, where the trend is defined by "year - 1899") are controlled. Parentheses contain p-values based on Newey-West standard errors with the maximum lag order of 3. See Section 3.6 for discussions about this table.

Table A.8: Occupations of Individuals Listed in the PIR (1939)

	(1) All individuals listed	(2) Sampled cohorts	(3) Top 0.05% income earners	(4) Medal recipients
Corporate executives and managers	0.660	0.672	0.803	0.320
Politicians and bureaucrats	0.075	0.070	0.030	0.213
Scholars, lawyers, and artists	0.119	0.142	0.048	0.473
Engineers and physicians	0.090	0.110	0.048	0.259
Military personnels	0.045	0.047	0.019	0.000
Landlords	0.048	0.033	0.060	0.001
Imperial and peerage family members	0.006	0.004	0.004	0.016
None of the above	0.130	0.109	0.098	0.087
No. observations	55,742	28,423	3,864	4,739

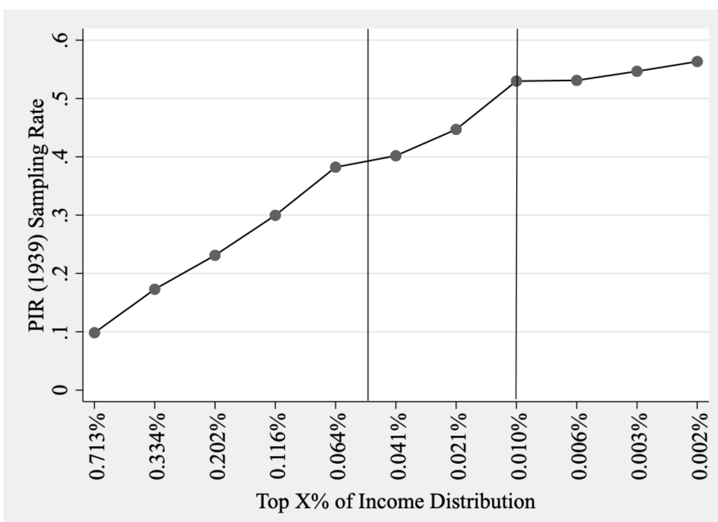
Notes: This table shows occupational distributions of individuals listed in the PIR (1939). Column (1) shows the share of each specified occupational category among all individuals listed in the PIR (1939). Column (2) restricts the sample to cohorts who were born in 1880–1894. Columns (3) and (4) further restrict the sample to the top 0.05% income earners and civilian medal recipients (as defined in Section 4.1), respectively. Occupational categories are not mutually exclusive, except for "None of the above" which is defined as individuals not included in the specified categories. See Section 4.1 for discussions about this table.

Table A.9: Definitions of Occupational Categories of Elites

Corporate Executives	
	[Last letters of Occupation Title are 社長, 会長, 頭取, 理事, 店長, 常務, 取締役, 監査役, 企業家, 経営主, 代表社員, or 支配人]
	AND [Corporation Type is 株, 名, 資, or 合] AND [Income or Business Tax Payment is positive]
Top Politicians and Bureaucrats	
	{[Last letters of Occupation Title are 議長 or 議員] AND [Organization Name contains 貴族院 or 衆議院]}
	OR {[Last letters of Occupation Title are 大臣] AND [Organization Name contains 内閣]}
	OR {[Last letters of Occupation Title are 長官, 次官, 局長, 大使, 公使, 領事, 知事, 総督参事官, 参與官, 書記官, 秘書官, 事務官, or 理事官]
	AND [Organization Name cointains neither 薬局, 新聞, 新報, 放送郵便局, 放送局, 電気局, 水道局, 土木局, nor 印刷局]
	AND [Corporation Type is neither 株, 名, 資, nor 合]}
Imperial University Professors	
	[Last letters of Occupation Title are 教授, 講師, 学長] AND [Organization Name contains 帝国大学 or 帝大]
Scholars	
	[Last letters of Occupation Title are 教授, 講師, 博士, 学長, 校長, 研究員, or 研究家]
Engineers	
	[Occupation Title contains 技 or 工]
Physicians	
	{[Occupation Title contains 医]}
	OR {[Last Letters of Occupation Title are 院長] AND [Last letters of Organization Name are 病院 or 医院]}
Lawyers	
	[Last letters of Occupation Title are 判事, 検事, 検察官, 裁判官, 裁判長, or 弁護士]
Landlords	
	[Last letters of Occupation Title are 地主 or 家主]
	AND [Neither top 0.05% income earners, medal recipients, corporate executives, top politicians and bureaucrats, nor IU professors]

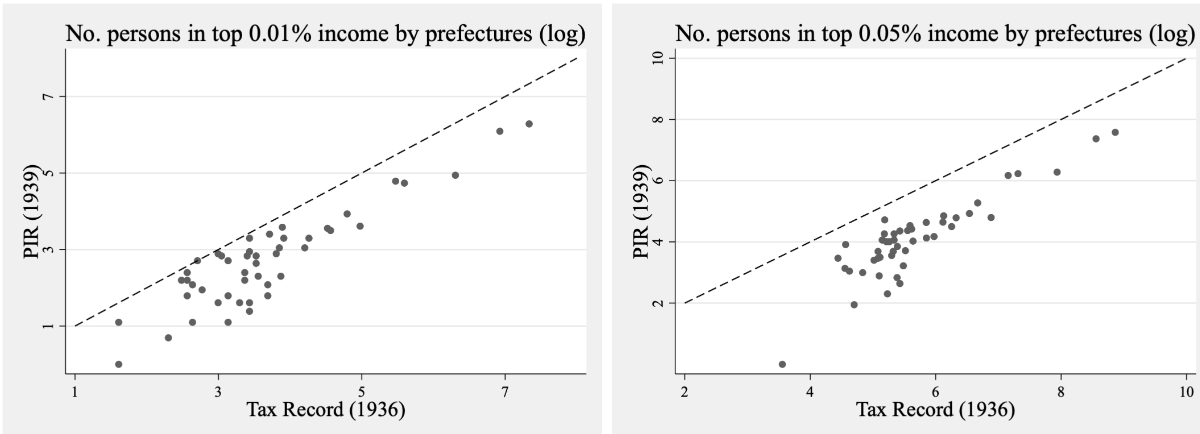
Notes: This table provides the precise definitions of occupational categories of elites. Individuals in each category are defined as a subset of individuals listed in the PIR. See Section 4.1 for the analysis using these categories.

Figure A.5: Sampling Rates of High Income Earners in the PIR Data



Notes: This figure plots the sampling rate of the high income earners listed in PIR (1939) by the income level expressed as a top percentile of the national income distribution. The sampling rates and the top income percentiles are computed from the complete count data in the National Tax Bureau Yearbook. The vertical lines indicate the top 0.05% and 0.01% thresholds used in our analysis. See Section 4.1 for discussions about this figure.

Figure A.6: High Income Earners in the PIR vs Income Tax Statistics across Prefectures



Notes: These figures compare the number of high income earners in each prefecture listed in the PIR (1939) and the complete count of high income earners in each prefecture reported in the National Tax Bureau Yearbook (1936). The vertical axis is the log of the number of individuals in the PIR who earned more than 50,000 JPY taxable income (corresponding to the top 0.01% income group) or 16,950 JPY taxable income (corresponding to the top 0.05% income group) in 1938. The horizontal axis is the log of the number of individuals in tax statistics who earned more than 30,000 JPY taxable income (corresponding to the top 0.013% income group) or 10,000 JPY taxable income (corresponding to the top 0.08% income group) in 1936 (the closest year to 1938 for which prefecture-level tax statistics are available). See Section 4.1 for discussions about these figures.

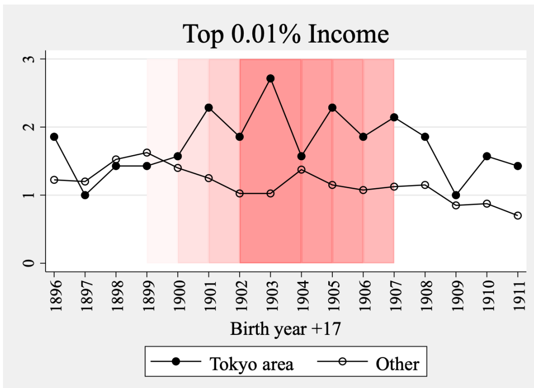
Table A.10: Correlations between Prefecture-level Sampling Rates and Outcome Variables

	Top 0.01% income earners	Top 0.05% income earners	Top 0.01% income earners	Top 0.05% income earners
Entrants to Schools 1–8	-0.000078	0.000018		
	(0.000060)	(0.000036)		
Imperial Univ. grads			-0.000052	0.000030
			(0.000032)	(0.000022)
Observations	47	47	47	47
R-squared	0.015	0.003	0.006	0.008
Mean dep var	0.44	0.24	0.44	0.24

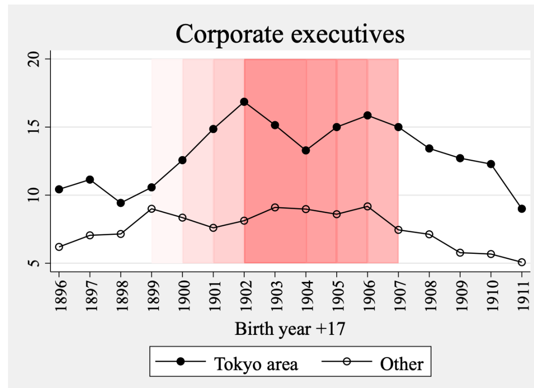
Notes: This table shows the results of regressing the sampling rates of PIR (1939) on our outcome variables using prefecture-level data. "Top 0.01% income earners" is the sampling rate of the top 0.01% income earners defined by the number of individuals with more than 50,000 JPY of taxable income in 1938 divided by the complete count of the number of individuals with more than 30,000 JPY of taxable income in 1936. "Top 0.05% income earners" is the sampling rate of the top 0.05% income earners defined by the number of individuals with more than 16,950 JPY of taxable income in 1938 divided by the complete count of the number of individuals with more than 10,000 JPY of taxable income in 1936. "Entrants to Schools 1–8" is the number of entrants to Schools 1–8 during 1900–1911 who were born in the prefecture (mean=590 and SD=383). "Imperial Univ. grads" is the number of individuals residing in the prefecture in 1938 who graduated from one of the Imperial Universities (mean=224 and SD=349). See Section 4.1 for discussions about this table.

Figure A.7: Long-run Impacts of Centralization: Geographical Origins of Other Elites

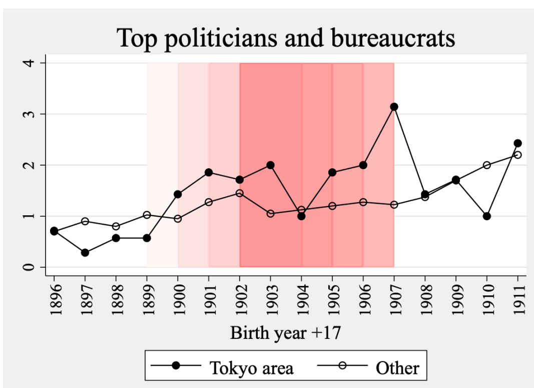
(a)



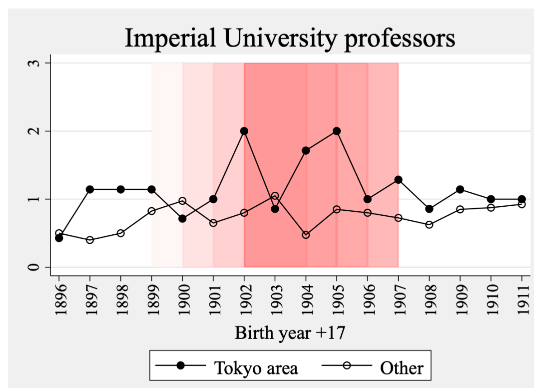
(b)



(c)



(d)



Notes: This figure shows additional difference-in-differences plots that compare the average number of elites born in prefectures inside and outside the Tokyo area by cohort (see Figure 3). The plots are based on the data from PIR (1939), which covers cohorts who were born in 1879–1894 and turned age 17 (main application age) in 1896–1911. The vertical axis shows the average number of indicated elites (per prefecture) born in the indicated area in the indicated cohort. The cohorts are colored according to their intensity of exposure to the centralized admissions in 1902–07, where the darker color indicates the higher intensity. See Section 4.1 for discussions about this figure.

Table A.11: Long-run Impacts: Other Elites

	(1) Scholars	(2) Engineers	(3) Physicians	(4) Lawyers
Age 17 under centralization	1.36	0.66	0.46	0.18
× Tokyo area (<100 km)	(0.004)***	(0.048)**	(0.038)**	(0.420)
	[0.003]***	[0.125]	[0.091]*	[0.544]
Observations	705	705	705	705
Birth cohort FE, Birth pref. FE	Yes	Yes	Yes	Yes
Mean dep var	4.29	2.46	1.92	1.11
Mean dep var (Tokyo area under decentralization)	5.41	3.13	2.52	1.16

Notes: This table shows difference-in-differences estimates of the long-run effects of the centralized admission system. The estimates are based on the birth-prefecture-cohort level data from PIR (1939) which covers cohorts who were born in 1880–1894 and turned age 17 (main application age) in 1897–1911. All regressions control for birth-prefecture fixed effects and cohort fixed effects. "Scholars," "Engineers," "Physicians," and "Lawyers" are defined at the prefecture-cohort level as the number of individuals listed in PIR (1939) whose occupations include scholar, engineer, physician, and lawyer, respectively. "Age 17 under centralization" takes 1 if the cohort turned 17 years old during 1902–07 under the centralized admissions, and takes 0 otherwise. "Mean dep var" shows the mean of the dependent variable for all prefecture-cohort observations. "Mean dep var (Tokyo area under decentralization)" shows the mean of the dependent variable in the Tokyo area under the decentralized admissions. Parentheses contain p-values based on standard errors clustered at the prefecture level. Square brackets contain wild cluster bootstrap p-values based on standard errors clustered at the cohort level. See Section 4.1 for discussions about this table.

Table A.12: Long-run Impacts: Excluding Cohorts who Turned Age 17 in 1901 or 1907

	Imperial Univ. grads	Top 0.01% income earners	Top 0.05% income earners	Medal recipients	Corporate executives	Top politicians & bureaucrats	Imperial Univ. professors	All occupational elites
				Panel A: Baseline Specification				
Age 17 under centralization	3.05	0.68	1.65	2.61	1.94	0.68	0.45	9.27
× Tokyo area (<100 km)	(0.003)***	(0.007)***	(0.048)**	(0.008)***	(0.020)**	(0.019)**	(0.067)*	(0.068)*
	[0.000]***	[0.038]**	[0.019]**	[0.000]***	[0.081]*	[0.022]**	[0.193]	[0.001]***
				Panel B: Adding Control Variables				
Age 17 under centralization	1.70	0.58	1.53	2.18	1.61	0.45	0.41	6.48
× Tokyo area (<100 km)	(0.021)**	(0.013)**	(0.007)***	(0.001)***	(0.007)***	(0.028)**	(0.095)*	(0.007)***
	[0.019]**	[0.010]**	[0.013]**	[0.001]***	[0.081]*	[0.095]*	[0.207]	[0.009]***
Observations	611	611	611	611	611	611	611	611
Cohort FE, Birth pref. FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean dep var	8.68	1.23	5.16	6.08	8.41	1.32	0.83	37.72
Mean dep var (Tokyo area under decentralization)	10.38	1.41	6.57	6.61	11.39	1.18	1.02	49.43

Notes: This table repeats the same difference-in-differences analysis in Table 2, but excluding the cohorts who turned age 17 (main application age) in 1901 or 1907 from the sample as these cohorts were exposed to both centralized and decentralized admission systems. All the variables are defined as in Table 2. Parentheses contain p-values based on standard errors clustered at the prefecture level. Square brackets contain wild cluster bootstrap p-values based on standard errors clustered at the cohort level. See Section 4.1 for discussions about this table.

Table A.13: Long-run Impacts: Pre-event Trends Are Parallel

	Imperial Univ. grads	Top 0.01% income earners	Top 0.05% income earners	Medal recipients	Corporate executives	Top politicians & bureaucrats	Imperial Univ. professors	All occupational elites
				A. Baseline Specification				
Tokyo area (< 100 km)	0.19	-0.02	0.07	0.17	0.11	-0.01	0.02	0.92
× Time trend	(0.673)	(0.802)	(0.822)	(0.476)	(0.768)	(0.879)	(0.835)	(0.511)
				B. Adding Control Variables				
Tokyo area (< 100 km)	0.21	-0.01	0.10	0.18	0.13	-0.01	0.02	1.01
× Time trend	(0.630)	(0.836)	(0.751)	(0.448)	(0.703)	(0.885)	(0.841)	(0.463)
				C. Squared Trend Term				
Tokyo area (< 100km)	-0.93	-0.08	-0.48	0.01	0.06	-0.13	0.22	-0.11
× Time trend	(0.415)	(0.817)	(0.275)	(0.990)	(0.927)	(0.629)	(0.412)	(0.923)
Tokyo area (< 100km)	0.07	0.00	0.03	0.01	0.00	0.01	-0.01	0.07
× Time trend^2	(0.465)	(0.824)	(0.288)	(0.870)	(0.893)	(0.695)	(0.333)	(0.586)
Observations	470	470	470	470	470	470	470	470
Cohort FE, Birth pref. FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean dep var	5.02	1.21	4.50	4.34	6.71	0.66	0.39	28.62
Mean dep var (Tokyo area under decentralization)	6.47	1.29	5.96	5.23	9.21	0.61	0.54	38.97

Notes: This table tests if there are differences in pre-event trends between urban and rural areas in the difference-in-differences analysis in Table 2. For cohorts who were born in 1874–1883 and thus turned age 17 in 1891–1900, we run the following regression in Panels A and B:

$$Y_{pt} = \beta \times Trend_t \times Tokyo\_area_p + \alpha_p + \alpha_t + \epsilon_{pt},$$

where $Trend_t$ is defined as the cohort's birth year minus 1870 (the linear time trend). In Panel C, for the same cohorts, we run the following regression:

$$Y_{pt} = \beta_1 \times Trend_t \times Tokyo\_area_p + \beta_2 \times (Trend_t)^2 \times Tokyo\_area_p + \alpha_p + \alpha_t + \epsilon_{pt},$$

In Panels B and C, we control for the number of primary schools in the prefecture in the year when the cohort turned eligible age and the birth population of the cohort in the prefecture. All the other variables are defined in the same way as in Table 2. Parentheses contain p-values based on standard errors clustered at the prefecture level. See Section 4.1 for discussions about this table.

Table A.14: Long-run Impacts: Difference-in-Differences Estimates Using the PIR in 1934

	(1) Imperial Univ. grads	(2) Top 0.01% income earners	(3) Top 0.05% income earners	(4) Medal recipients	(5) Corporate executives	(6) Top politicians & bureaucrats	(7) Imperial Univ. professors	(8) All occupational elites
Age 17 under centralization	1.71	0.50	1.81	1.44	1.20	0.39	0.08	4.86
	(0.016)**	(0.044)**	(0.029)**	(0.070)*	(0.026)**	(0.018)**	(0.717)	(0.072)*
	[0.011]**	[0.004]***	[0.005]***	[0.002]***	[0.001]***	[0.261]	[0.690]	[0.005]***
Observations	705	705	705	705	705	705	705	705
Cohort FE, Birth pref. FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean dep var	4.79	0.81	3.64	3.86	2.95	1.15	0.52	14.91
Mean dep var (Tokyo area under decentralization)	5.68	1.11	6.17	4.46	4.63	1.13	0.70	22.35

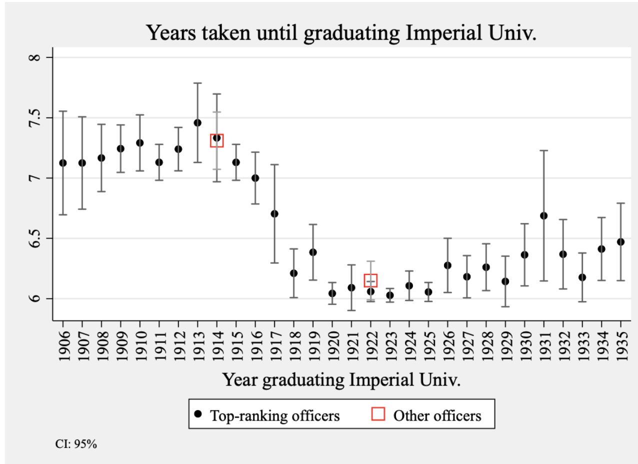
Notes: In this table, we repeat the same difference-in-differences analysis as in Table 2 Panel B, but using PIR (1934) instead of PIR (1939). In PIR (1934), we observe the cohorts born in 1880–1894 when they are 40 to 54 years old. Sampling rates in PIR (1934) for top income earners are similar to those in PIR (1939): 51% and 40% for the top 0.01% and 0.05% income earners, respectively. All the variables are defined as in Table 2. Parentheses contain p-values based on standard errors clustered at the prefecture level. Square brackets contain wild cluster bootstrap p-values based on standard errors clustered at the cohort level. See Section 4.1 for discussions about this table.

Table A.15: Long-run Impacts of Centralization: Placebo Tests and Pathways

	(1) Placebo: Population	(2) Placebo: Landlords	(3) Pathway: Fraction moved in the long-run	(4) Pathway: Distance moved in the long-run
	A. Baseline Specification			
Age 17 under centralization × Tokyo area (<100 km)	0.34	-0.12	-0.01	-18.41
	(0.270)	(0.474)	(0.449)	(0.173)
	[0.245]	[0.767]	[0.422]	[0.307]
	B. Adding Control Variables			
Age 17 under centralization × Tokyo area (<100 km)	-0.06	-0.01	-0.02	-23.44
	(0.872)	(0.955)	(0.360)	(0.173)
	[0.790]	[0.978]	[0.361]	[0.259]
Observations	705	705	705	705
Birth cohort FE, Birth pref. FE	Yes	Yes	Yes	Yes
Mean dep var	11.67	0.93	0.29	297.92
Mean dep var (Tokyo area under decentralization)	13.18	2.88	0.37	463.52

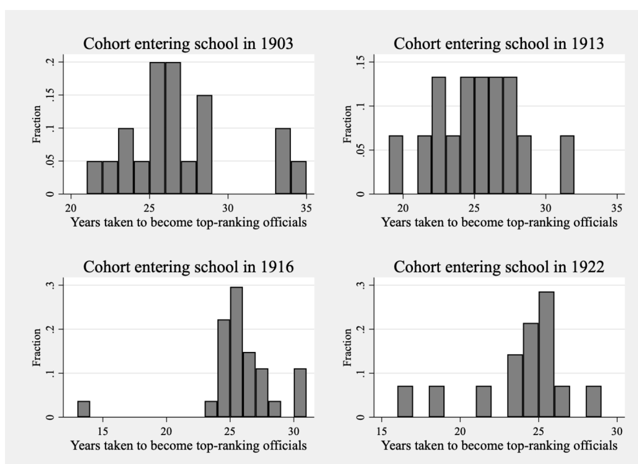
Notes: This table provides placebo tests and explores pathways of the long-run effects. We construct the prefecture-cohort level data from PIR (1939) by counting the number of elites by birth prefecture and by birth cohort (born in 1880–1894). In (1), "Population" is the cohort's birth population in the birth prefecture. In (2), "Landlords" is defined as individuals listed in the PIR whose occupations include landlord, but excluding the top 0.05% income earners, medal recipients, corporate executives, top politicians and bureaucrats, and Imperial University professors. In (3), "Fraction moved" is defined as the fraction of individuals listed in the PIR whose prefecture of residence is different from his birth prefecture. In (4), "Distance moved" is defined as the average distance between the birth prefecture and the prefecture of residence among individuals listed in the PIR. "Age 17 under centralization" is the indicator variable that takes 1 if the cohort became age 17 under the centralized admissions in 1902–07. "Mean dep var" shows the mean of the dependent variable for all prefecture-cohort observations. "Mean dep var (Tokyo area under decentralization)" shows the mean of the dependent variable in the Tokyo area under the decentralized admissions. In Panel B, we control for time- and cohort-varying prefecture characteristics, i.e., the number of primary schools in the prefecture in the year when the cohort turned eligible age, the number of middle-school graduates in the prefecture in the year when the cohort turned age 17, log GDP of the prefecture when the cohort turned age 20, and the birth population of the cohort in the prefecture (except for Column (1)). Parentheses contain p-values based on standard errors clustered at the prefecture level. Square brackets contain wild cluster bootstrap p-values based on standard errors clustered at the cohort level. ***, **, and * mean significance at the 1%, 5%, and 10% levels, respectively. See Section 4.1 for discussions about this table.

Figure A.8: Years Taken from Entering Higher School to University Graduation



Notes: This figure plots the average number of years taken from entering a higher school to graduating from an Imperial University by cohort (where cohort is defined by the year of university graduation) for two groups of individuals who passed the administrative division of the Higher Civil Service Exams. The first group is top-ranking officials who graduated from Schools 1–8 (shown in black circles). The second group is non-top-ranking officials who graduated from Schools 1–8 (shown in red rectangular markers for two representative years, 1914 and 1922, only). For both groups, we find the exact year of entering Schools 1–8 for each individual using the Student Registers. The figure shows that the average number of years is not significantly different between the two groups. See Section 4.2 for discussions about this figure.

Figure A.9: Years Taken to Become Top-ranking Government Officials



Notes: This figure plots the distribution of the number of years taken from entering a higher school to becoming a top-ranking government official for representative cohorts. We focus on top-ranking officials who graduated from Schools 1–8 and four randomly selected cohorts (the cohorts entering a higher school in 1903, 1913, 1916, and 1922). For each top-ranking official in each cohort, we look for his biographical information by online searches to find the year of appointment to his first top-ranking position (with a success rate of 82%). The figure shows that, for all cohorts, there is a large within-cohort variation in the number of years taken to be promoted to a top-ranking position. See Section 4.2 for discussions about this figure.

Table A.16: Long-run Impacts on Top-Ranking Government Officials: Alternative Definition of the Year of Entering Higher School or Its Equivalent

	(1) Top-ranking officials	(2) Top-ranking officials graduated from School 1	(3) Top-ranking officials graduated from Schools 2-8	(4) Top-ranking officials not graduated from Schools 1-8
Centralized	4.15	-0.54	5.05	-0.36
	(0.003)***	(0.600)	(0.001)***	(0.702)
Observations	33	33	33	33
Control time trend & exam passers	Yes	Yes	Yes	Yes
Mean dep var	29.77	8.273	12.97	8.53
Mean dep var (decentralization)	28.57	8.30	11.22	9.05

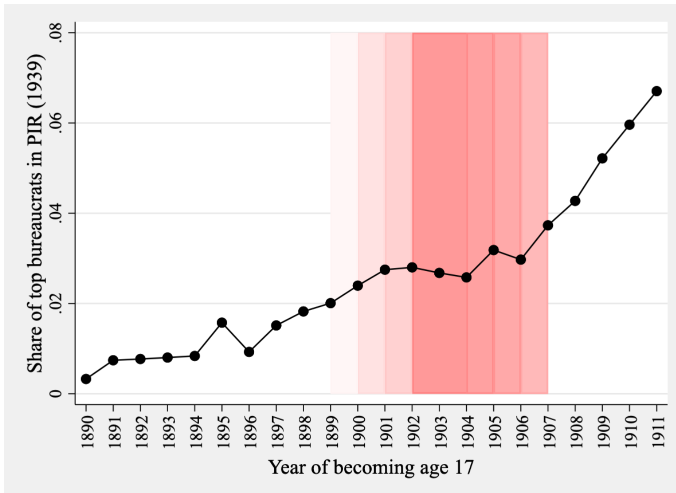
Notes: This table shows OLS estimates of the long-run effects of the centralized admission system on the number of top-ranking government officials. The definitions of the variables and the specifications are the same as in Table 4, except that the computation of the year of entering a higher school or its equivalent for individuals who did not graduate from Schools 1–8 is changed from "year of graduating the final education - 6" to "year of graduating the final education - 7." The results are qualitatively the same as the results in Table 4. In all regressions, we control for quadratic time trends and the number of individuals in the cohort who passed the administrative HCSE. Parentheses contain p-values based on Newey-West standard errors with the maximum lag order of 3. ***, **, and * mean significance at the 1%, 5%, and 10% levels, respectively. See Section 4.2 for discussions about this table.

Table A.17: Robustness Check: Government Officials Died in Wars or Purged after WWII

	(1) Exam passers who were purged	(2) Exam passers who died in wars	(3) Top-ranking officials who were purged	(4) Top-ranking officials who died in wars
Centralized	0.854	0.010	0.847	-0.037
	(0.767)	(0.952)	(0.682)	(0.214)
Observations	33	33	33	33
Control time trend & exam passers	Yes	Yes	Yes	Yes
Mean dep var	15.58	0.61	6.18	0.03
Mean dep var (decentralization)	15.03	0.69	5.88	0.0435

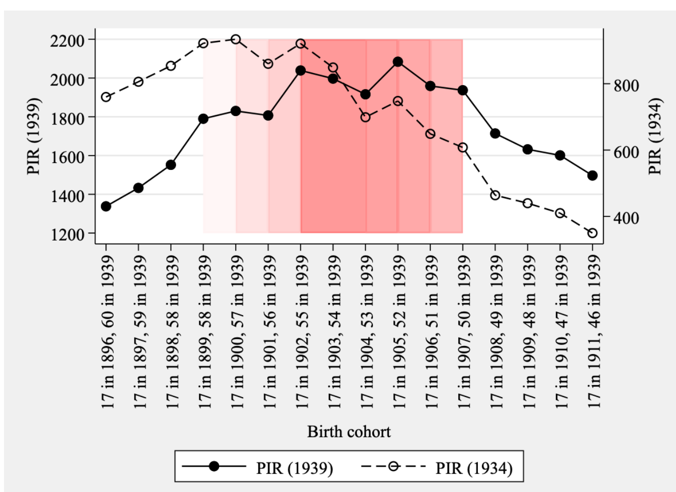
Notes: This table tests if the results in Table 4 are affected by war deaths and post-WWII purge of government officials. Column (1) shows an OLS estimate of the effect of the centralized admissions on the number of individuals who passed the administrative division of the Higher Civil Service Exams and who were purged from public service after WWII by the occupational authority. Column (2) shows an OLS estimate of the effect on the number of HCSE passers who died in wars or were executed after WWII for war crimes. Columns (3) and (4) show OLS estimates of the effects on the number of top-ranking officials who were purged after WWII (Column (3)) or died in wars or were executed after WWII (Columns (4)). The estimates are based on the cohort level data, 1898–1930, where cohort is defined by the year of entering a higher school or its equivalent. "Mean dep var (decentralization)" is the mean of the dependent variable for the cohorts who entered a higher school or its equivalent under the decentralized admissions. In all regressions, we control for quadratic time trends and the number of exam passers. Parentheses contain p-values based on Newey-West standard errors with the maximum lag order of 3. ***, **, and * mean significance at the 1%, 5%, and 10% levels, respectively. See Section 4.2 for discussions about this table.

Figure A.10: Share of Government Officials in Elites Listed in the PIR



Notes: This figure plots the share of central government officials in all individuals listed in the PIR (1939) by birth cohort. The cohorts are colored according to their exposure to the centralized admissions in 1902–1907, where darker color indicates higher intensity of exposure. We observe no significant increase in the share of central government officials for the cohorts exposed to the centralized admissions. See Section 4.2 for discussions about this table.

Figure A.11: Total Number of All Occupational Elites by Cohort



Notes: This figure plots the total number of all occupational elites listed in the PIR (1939) and PIR (1934) by birth cohort. The cohorts are colored according to their exposure to the centralized admissions in 1902–1907, where the darker color indicates the higher intensity of exposure. In both PIR (1939) and PIR (1934), cohorts exposed to centralization tend to have a greater number of individuals selected into the PIR. See Table 5 for a statistical analysis and Section 4.2 for discussions about this figure.

B Online Theoretical Appendix

To guide our empirical investigation, we develop a simple model to predict the impacts of centralization on application behavior and assignment. We first confirm that the centralized admissions (referred to as "Capp" in this section) was indeed designed to make the school seat allocation more meritocratic compared to the decentralized admissions (referred to as "Dapp" in this section). Our model also predicts changes in application behavior. First, a greater number of applicants apply to the most popular school under Capp than under Dapp (Proposition 1). Second, when high-achieving applicants are disproportionately located in a geographical area (the urban area for example), then a larger fraction of school seats are assigned to students coming from that advantageous area (Proposition 2). Finally, a smaller fraction of applicants are assigned to their local school under Capp relative to Dapp (Proposition 3).

A school admission problem is $(S, I, q, (t_i)_{i\in I}, \succ)$ where $S = \{s_1, \ldots, s_m\}$ is the set of schools while $I = \{i_1, \ldots, i_n\}$ is the set of students. A capacity vector is $q = (q_{s_1}, \ldots, q_{s_m})$ where q_s is the number of students school s can accommodate. Motivated by our empirical setting, schools' common priority order over students is based on test scores $(t_i)_{i\in I} \in \mathbb{R}^n_+$ (the higher the better). Without loss of generality, sort students so that $t_{i_j} > t_{i_k}$ if $j < k$. We also assume that all students are acceptable for any school, which, in our institutional setting, is true conditional on the pool of eligible applicants. The profile of student (strict) reported preferences is $\succ = (\succ_{i_1}, \ldots, \succ_{i_n})$ defined over $S \cup \{o\}$ where o is the outside option. Let P_i denote the set of all possible preference relations for student i. $P = \times_{i\in I} P_i$ is the set of all preference profiles. Let $\succ$, $\succ'$ and so on denote students' reported preference profiles. Motivated by the fact that Schools 1–8 are prestigious national schools with no significant competitors, we assume that every student prefers Schools 1–8 over the outside option: $s \succ_i o$ for all $i \in I$ and $s \in S$. We also assume $n > \Sigma_{s\in S} q_s$, which is always true in our data.

The outcome of a school admission problem is a matching $\nu : I \to S \cup I$ where $\nu(i)$ means the school that admits student i (or no assignment if $\nu(i) = i$) with the following properties.

- $\nu(i) \notin S \implies \nu(i) = i$ for every $i \in I$, and
- $\left|\nu^{-1}(s)\right| \leq q_s$ for every $s \in S$.

A mechanism is a systematic procedure that determines a matching for each reported preference profile. Formally, it is a function $\mu : P \to \mathcal{M}$ where $\mathcal{M}$ denotes the set of all matchings. Let $\mu_s(\succ)$ denote the set of students assigned to s in mechanism μ for reported preference profile $\succ$. Let μ^C be the Capp mechanism introduced in Section 2.

We compare mechanisms with a thought experiment where the same set of applicants with the same true preferences and test scores participate in different mechanisms. Applicants may change their preference reports, depending on which mechanism they participate in. The set of schools and their capacities are also assumed to stay constant. Index each school seat by $j = 1, \ldots, k \equiv \sum_{s\in S} q_s$. Let $t_{\mu(\succ)}(j)$ be the test score of the student assigned to seat j under mechanism μ for preference profile $\succ$. $t_{\mu(\succ)}(j) = 0$ if no student is assigned to seat j. Let $F_{\mu(\succ)}$ be the cumulative distribution of test scores among assigned students under any mechanism μ for preference profile $\succ$, defined as

$$F_{\mu(\succ)}(t) = \frac{\left|\{j \in \{1, \ldots, k\} \mid t_{\mu(\succ)}(j) \leq t\}\right|}{k}$$

for all $t \in \mathbb{R}_+$.

As should be the case given the official goal of centralization, Capp is more meritocratic than any other mechanism, especially Dapp. Specifically, Capp induces a first-order-stochastic-dominance improvement of the test score distribution among admittees.

Fact 1. *For any school admission problem and any mechanism μ, we have $F_{\mu^C(\succ)}(t) \leq F_{\mu(\succ')}(t)$ for all $t \in \mathbb{R}_+$ and $\succ, \succ' \in P$.*

This fact implies that the worst test score among assigned students under Capp is weakly better than that under any other mechanism, including Dapp. Fact 1 holds regardless of how applicant behavior changes between mechanisms.

We also confirm that the centralized assignment rule is as meritocratic as the possibly most meritocratic mechanism, i.e., the Deferred Acceptance mechanism. Let μ^I be the mechanism that selects a matching based on the following Student-Proposing Deferred Acceptance algorithm.

- Step 1. Each student i proposes to her most-preferred school. Each school s holds top q_s students and rejects the rest. If less than q_s students proposed, then it holds all the students that proposed to s.

- Step l. Any student who was rejected at step $l-1$ makes a new proposal to his most-preferred school that has not yet rejected him. If no acceptable choices remain, she makes no proposal. Each school holds its most-preferred q_s students to date and rejects the rest. If less than q_s students proposed, then it holds all the students who proposed to s.

- The algorithm terminates when there are no more rejections. Each student is assigned to the school that holds her in the last step.

The following property holds:

Fact 2. $\cup_{s \in S} \mu^C_s(\succ) = \cup_{s \in S} \mu^I_s(\succ')$ *for all $\succ, \succ' \in P$.*

This result says that the same students are assigned to Schools 1–8 under Capp and the Deferred Acceptance algorithm, which is the most meritocratic mechanism we can design. Like Fact 1, Fact 2 holds regardless of applicant behavior.

To derive additional predictions about applicant behavior, we impose more structures on the model. Each applicant takes an action under each mechanism μ. Under Capp, for example, each applicant submits a preference list $\succ_i$. Under Dapp, each applicant applies to a school. The mechanism then uses these actions to obtain a matching. This procedure induces a strategic form game, $\langle I, (A_i)_{i \in I}, \succ^o \rangle$. The set of players is the set of applicants I.

The action space of each applicant is A_i. Under Capp, this is the set of all possible preference relations P_i over schools. Under Dapp, this is the set of schools $S = \{s_1, ..., s_m\}$. The outcome is evaluated through the true preferences $\succ^o = (\succ^o_{i_1}, \ldots, \succ^o_{i_n})$. A strategy vector $a = (a_1, \ldots, a_n)$ is an *equilibrium* if for each applicant $i \in I$ and each strategy $a'_i \in A_i$, we have $\mu_i(a) \succeq_i \mu_i(a'_i, a_{-i})$. We say that strategy a_i is a (weakly) *dominant strategy* if we have $\mu_i(a) \succeq_i \mu_i(a'_i, a_{-i})$ for all $a'_i \in A_i$ and $a_{-i} \in A_{-i}$.

Proposition 1. *Suppose that applicants share homogeneous preferences $s_1 \succ^o_i s_2 \succ^o_i \ldots \succ^o_i s_n \succ^o_i \emptyset$. Also assume that every applicant submits the true preference whenever it is a dominant strategy. In any equilibrium, the number of applicants who apply to the most preferred school s_1 is weakly larger under centralized admissions than under decentralized admissions.*

This assumption is motivated by our institutional setting, where applicants share a perceived vertical hierarchy over schools. Intuitively, Capp would incentivize applicants to give a shot at the most prestigious and selective school since Capp gives applicants a chance of acceptance by lower-choice schools even if they are rejected by the first-choice school.

Assume that each applicant lives in the local area of a school. Let n_j be the number of students from school s_j's area. Interpret s_1 as an advantageous urban school whose the test score distribution first order stochastically dominates that in any other school's area.

Proposition 2. *In any equilibrium, a larger share of all school seats are allocated to urban-born applicants from s_1's area under centralized admissions than under decentralized admissions.*

We now specialize our model to a case with two schools s_1 and s_2, respectively, and any number of applicants. Assume the cardinal utility of applicant i from school s to be $U_{is} = U_s + V \times 1\{i \text{ is from } s\text{'s area}\}$. Applicants cannot observe their test scores when submitting their preferences. Assume that each applicant believes that every applicant's test score is independent and identically distributed, i.e., $t \sim_{iid} F(t)$ for some distribution F.

As above, an admission mechanism induces a strategic form game $\langle I, (A_i)_{i\in I}, (U_i)_{i\in I}\rangle$. The set of players and the action space remain the same. The outcome is now evaluated accordingly to cardinal utility. Define $U_i(.)$ as the expected payoff of player i at the application stage. For Dapp, for example, $U_i(a_i, a_{-i}) = \min\{\frac{q_{a_i}}{\sum_{j\in I} 1\{a_j = a\}}, 1\} \times U_{ia_i}$ if he plays action a_i, given action profile a_{-i} of other applicants. An equilibrium $(a_1, \ldots, a_n)$ is called a *symmetric equilibrium* if $a_i = a_j$ for all i and j from the same area. We make the following assumptions for the rest of this section: Applicants play a symmetric equilibrium, which is assumed to exist.

For a given mechanism and an equilibrium play, q_{jk} denotes the number of applicants assigned to school s_j who come from school s_k's area. Define the *proportion of assigned applicants assigned to their local school* as

$$\frac{q_{11} + q_{22}}{q_{11} + q_{12} + q_{21} + q_{22}}.$$

Proposition 3. *For sufficiently large V or sufficiently large $|U_1 - U_2|$, the proportion of assigned applicants assigned to their local school is higher under Dapp than under Capp.*

Capp therefore reduces the number of local entrants born in the school's prefecture.

B.1 Proofs

Proof of Fact 1. As required in step 1 of Capp, school seats are assigned to applicants $i_1, \dots, i_k$ under μ^C, i.e., $\cup_{s \in S} \mu_s^C(\succ) = \{i_1, \dots, i_k\}$ and $\cup_{j \in \{1,\dots,k\}} \{t_{\mu^C(\succ)}(j)\} = \{t_{i_1}, \dots, t_{i_k}\}$. Here we use the assumption that $s \succ_i o$ for all $i \in I$ and $s \in S$. Let $\cup_{s \in S} \mu_s(\succ') = \{i_{j_1}, \dots, i_{j_l}\}$ with $k \leq l$, $j_1 < \dots < j_l$ and $\{j_1, \dots, j_l\} \subseteq \{1, \dots, n\}$. This gives $\cup_{j \in \{1,\dots,k\}} \{t_{\mu(\succ')}(j)\} = \{t_{i_{j_1}}, \dots, t_{i_{j_l}}, \cup_{i=1}^{k-l}\{0\}\}$. Since $t_{i_1} \geq t_{i_{j_1}}$,..., $t_{i_l} \geq t_{i_{j_l}}$, we have $\big|\{j \in \{1, \dots, k\} \mid t_{\mu^C(\succ)}(j) \leq t\}\big| \leq \big|\{j \in \{1, \dots, k\} \mid t_{\mu(\succ')}(j) \leq t\}\big|$ so that

$$F_{\mu^C(\succ)}(t) = \frac{\big|\{j \in \{1, \dots, k\} \mid t_{\mu^C(\succ)}(j) \leq t\}\big|}{k} \leq \frac{\big|\{j \in \{1, \dots, k\} \mid t_{\mu(\succ')}(j) \leq t\}\big|}{k} = F_{\mu(\succ')}(t).$$

Therefore, we have that $F_{\mu^C(\succ)}(t) \leq F_{\mu(\succ')}(t)$ for all $t \in \mathbb{R}_+$ and $\succ, \succ' \in P$. □

Proof of Fact 2. As required in step 1 of Capp, school seats are assigned to applicants $i_1, \dots, i_k$ under μ^C, i.e., $\cup_{s \in S} \mu_s^C(\succ) = \{i_1, \dots, i_k\}$ for all $\succ \in P$. Again, we use the assumption that $s \succ_i o$ for all $i \in I$ and $s \in S$. Under the assumption that any school is acceptable for any student, any student $i_{k'}$ with $k' > k$ will be rejected at some step of the student-proposing Deferred Acceptance algorithm. Therefore, the top k students are assigned to some school under μ^I, i.e., $\cup_{s \in S} \mu_s^I(\succ') = \{i_1, \dots, i_k\}$ for all $\succ' \in P$. Therefore, $\cup_{s \in S} \mu_s^C(\succ) = \cup_{s \in S} \mu_s^I(\succ') = \{i_1, \dots, i_k\}$ for all $\succ, \succ' \in P$. □

Proof of Proposition 1. This result follows from the following intermediate facts.

Lemma 1. *Under Dapp, it is the only equilibrium that*

- *the q_{s_1} highest-scoring applicants apply to s_1,*
- *the next $(q_{s_1} + 1)$ to $(q_{s_1} + q_{s_2})$ highest-scoring applicants apply to s_2,*
- *...*
- *the next $(\sum_{s=s_1}^{s_{n-1}} q_s + 1)$ to $(\sum_{s=s_1}^{s_n} q_s)$ highest-scoring applicants apply to s_n.*

Proof. The proof is inductive. The q_1 highest-scoring applicants are assigned to the most preferred school s_1, so there is no incentive for them to deviate from this equilibrium. Given the behavior of the q_{s_1} highest-scoring applicants, the next $(q_{s_1} + 1)$ to $(q_{s_1} + q_{s_2})$ highest-scoring applicants cannot get the most preferred school s_1. They are assigned to the second most preferred school s_2, so there is no incentive for them to deviate from this equilibrium. Similar arguments show that the above behavior is an equilibrium. It is also the only equilibrium since any difference from the above for any applicant would give the applicant a profitable deviation with which the applicant could get the same result as in the above equilibrium. □

Lemma 2. *Under Capp, ranking s_1 is a dominant strategy at least for the q_{s_1} highest-scoring applicants.*

Proof. It is because they would be assigned to the most preferred school s_1 whenever ranking s_1 first. □

The above lemmas jointly imply that in any equilibrium, the number of applicants who apply to the most popular school s_1 is weakly larger under centralized admissions than under decentralized admissions. □

Proof of Proposition 2. Under Capp, by the meritocracy constraint and the assumption that $s \succ_i o$ for all $i \in I$ and $s \in S$, the top k highest score students are assigned to any school. Count how many of the top $k(\equiv \Sigma_{s=s_1}^{s_m} q_s)$ students are from s_1's area. Under Dapp, in any equilibrium, any of these students from s_1's area is also assigned to one of the schools. To show this, suppose not. There is student i^* from another area whose test score is below the top k scores. Let s_{i^*} be the school that admits i^*. If any unassigned, top k student i_1 from s_1's area apply to s_{i^*}, i_1 would be assigned to s_{i^*}, a contradiction to the definition of an equilibrium. □

Proof of Proposition 3. We use the following lemma.

Lemma 3. *For sufficiently large V, all applicants apply to their local schools in any symmetric equilibrium under Dapp.*

Proof of Lemma 3. First, we show that for sufficiently large V, none of the following symmetric equilibrium survives: (i) all applicants apply to s_i (for $i = 1, 2$), or (ii) applicants from s_1's area apply to s_2 while those from s_2's area apply to s_1. Define $p(n, q)$ as the probability of being one of the top $q \in \mathbb{N}$ applicants among $n \in \mathbb{N}$ applicants as per i.i.d test scores, i.e., $p(n, q) = \min\{\dfrac{q}{n}, 1\}$. Let $\bar{n}_a = \sum_{j \in I} 1\{a_j = a\}$.

Case (i). Applicants from school j's area apply to s_i if $p(n_i + n_j, q_{s_i}) \times U_i \geq U_j + V$. Since $V > p(n_i + n_j, q_{s_i}) \times U_i - U_j$, therefore, all applicants applying to s_i (for $i = 1, 2$) cannot be a symmetric equilibrium.

Case (ii). Suppose applicants from s_1's area apply to s_2 while those from s_2's area apply to s_1. For applicants from s_1's area, it must be the case that $p(n_1, q_{s_2}) \times U_2 \geq p(n_2+1, q_1)*(U_1+V)$. For applicants from s_2's area, it must be the case that $p(n_2, q_{s_1}) \times U_1 \geq p(n_1 + 1, q_{s_2}) \times (U_2 + V)$. For sufficiently large V, these inequalities cannot hold.

Now we show that, for large enough V, all students applying to their local schools is indeed a symmetric equilibrium. For applicants from s_1's area to apply to s_1, it must be the case that $p(n_1, q_{s_1}) \times (U_1 + V) \geq p(n_2 + 1, q_{s_2}) \times U_2$. For applicants from s_2's area to apply to s_2, it must be the case that $p(n_2, q_{s_2}) \times (U_2 + V) \geq p(n_1 + 1, q_{s_1}) \times U_1$. Since the left hand sides of both the inequalities are increasing in V, the equilibrium conditions hold for sufficiently large V. □

From Lemma 3, for sufficiently large V, applicants apply to their locals schools under Dapp. Therefore, the expected proportion of assigned applicants assigned to their local school under Dapp is 1 (the highest). With sufficiently large $|U_1 - U_2|$, every applicant ranks s_1 first in any equilibrium under either mechanism, so the same appplicants are assigned to s_1 and s_2, meaning that the expected proportion of assigned applicants assigned to their local school stays the same. This completes the proof.

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