Farewell to Confucianism: The Modernizing Effect of Dismantling China's Imperial Examination System*

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Abstract

Imperial China employed a civil examination system to select scholar bureaucrats as ruling elites. This institution dissuaded high-performing individuals from pursuing some modernization activities, such as establishing modern firms or studying overseas. This study uses prefecture-level panel data from 1896-1910 to compare the effects of the chance of passing the civil examination on modernization before and after the abolition of the examination system. Its findings show that prefectures with higher quotas of successful candidates tended to establish more modern firms and send more students to Japan once the examination system was abolished. As higher quotas were assigned to prefectures that had an agricultural tax in the Ming Dynasty (1368-1643) of more than 150,000 stones, I adopt a regression discontinuity design to generate an instrument to resolve the potential endogeneity, and find that the results remain robust.

Key Words: incentive, modern firms, studying overseas, imperial civil examination
JEL Code: N95, O10, O31

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I. INTRODUCTION

Rent seeking is costly to economic growth if "the ablest young people become rent seekers than producers" (Murphy, Shleifer, and Vishny 1991: 529). Theoretical studies suggest that if a society specifies a higher payoff for rent seeking rather than productive activities, more talent would be allocated in unproductive directions (Acemoglu 1995; Baumol 1990; Murphy, Shleifer, and Vishny 1991, 1993). This was the case in late Imperial China, when a large part of the ruling class – scholar bureaucrats – was selected on the basis of the imperial civil examination.[1] The Chinese elites were provided with great incentives to invest in a traditional education and take the civil examination, and hence few incentives to study other "useful knowledge" (Kuznets 1965), such as Western science and technology.[2] Thus the civil examination constituted an institutional obstacle to the rise of modern science and industry (Baumol 1990; Clark and Feenstra 2003; Huff 2003; Lin 1995).

This paper identifies the negative incentive effect of the civil exam on modernization by exploring the impact of the system's abolition in 1904-05. The main empirical difficulty is that the abolition was universal, with no regional variation in policy implementation. To better understand the modernizing effect of the system's abolition, I employ a simple conceptual framework that incorporates two choices open to Chinese elites: to learn from the West and pursue some modernization activities or to invest in preparing for the civil examination. In this model, the elites with a greater chance of passing the examination would be less likely to learn from the West; they would tend to pursue more modernization activities after its abolition. Accordingly, the regions with a higher chance of passing the exam should be those with a larger increase in modernization activities after the abolition, which makes it possible to employ a difference-in-differences (DID) method to identify the causal effect of abolishing the civil examination on modernization.

[1]There were no "effective legal barriers to status mobility," according to Ho (1962: 54) Historical evidence shows that the landed gentry and merchants translated "their economic and social power into cultural and educational advantages that enabled mainly the sons of gentry and merchants to pass the civil examinations" (Elman 2000: xix), thus allowing these elites to obtain political power through the political system (Elman 2000).

[2]The knowledge required to pass the examination focused on memorizing the Confucian classics and other less productive domains (Jones 2008; Yuchtman 2009).

I exploit the variation in the probability of passing the examination among prefectures – an administrative level between the provincial and county levels. To control the regional composition of successful candidates, the central government of the Qing dynasty (1644-1911) allocated a quota of successful candidates to each prefecture.[3] In terms of the chances of individual participants – measured by the ratio of quotas to population – there were great inequalities among the regions (Chang 1955). To measure the level of modernization activities in a region, I employ (1) the number of newly modern private firms (per million inhabitants) above a designated size that has equipping steam engine or electricity as a proxy for the adoption of Western technology and (2) the number of new Chinese students in Japan – the most import host country of Chinese overseas students (per million inhabitants) as a proxy of learning Western science. Though the two measures might capture other things, for instance entrepreneurship or human capital accumulation, the two activities are both intense in modern science and technology, and thus employed as the proxies of modernization.

Our empirical results show that the prefectures with higher quotas tended to establish more modern enterprises and send more students to Japan once the decision to abolish the examination system was taken. Evaluated at the sample mean, a one-standard deviation increase in the logged-quota density (0.70) would lead to 0.23 new modern firms and 0.66 students to Japan per year. The empirical results remain robust after controlling for geographical factors, population, the level of urbanization, and Western penetration and employing different model specification. Moreover, I estimate the yearly correlation between the logged-quota density and the density of modernization activities, and find that the correlation before the abolition remains stable, but suddenly increases after the abolition.

However, it is possible that the quotas are correlated with other omitted variables, such as political connectedness, whose effects may also have changed after the system's

[3] China's civil examination system included three stages of testing: a licensing examination in the prefectural capital, a qualifying examination in the provincial capital, and an academy examination in the national capital, with re-examination in the imperial palace. Only candidates who were successful in the lower-level examinations were eligible to sit for the higher levels. The central government allocated a quota of successful candidates in the licensing examination to each prefecture and county, whereas the quota for the higher-level examinations applied to the provinces.

abolition. To correct such biases and resolve the potential endogeneity, we employ a fuzzy regression discontinuity (RD) design: in the Ming Dynasty (1368-1643), the prefectures with an agricultural tax that exceeded 150,000 stones were classified as "important."[4] Higher quotas were allocated to the "important" prefectures in the early Qing Dynasty (1644-1910). Mid-way through the period, a new rule for classifying regions by importance was adopted, but the quotas remained stable throughout the Qing Dynasty. Thus, we exploit the discontinuity in the expected value of quotas as an instrumental variable to identify the causal effect of quotas. The results still show that the effect of logged-quota density significantly increases after the abolition of the civil exam.

This study can help us understand why China failed to undergo an industrial revolution and sustained growth, given its economic leadership in the 14th century and even in the 18th (Allen 2009; Maddison 1998, 2001; Pomeranz 2000). Landes (2006) describes two opportunities that China missed: (1) to generate a self-sustaining process of technological advancement based on its achievements and (2) to learn from European technology once foreigners had entered the Chinese domain. This paper empirically identifies the effects of the second missed opportunity and supports the extant hypothesis that the civil examination constituted an institutional obstacle to the rise of modern science and industry (Huff 2003; Lin 1995). I provide a counterfactual case to estimate the gap in the capacities of steam engine between Britain and China, which shows that China's capacity would have been larger than Britain's during the First Opium War (1839-41) if the civil examination had been abolished before 1813-27. Though the counterfactual case is limited, it provides a sense of the role of the civil exam as the barrier of modernization.

Moreover, it enhances our general understanding of the role played by institutions in economic development, and sheds light on the reasons for the great divergence in technological expertise and per capita income seen around the world in the past five centuries. Institutions, and the incentives they create, determine the economic outcomes of a society (North 1990, 1994). The recent literature suggests that good institutions, including secure property rights (Acemoglu and Johnson 2005; North and Thomas 1973),

[4] "Stone" is the English word for a historical Chinese unit of mass. The Chinese character is pronounced Dan as a unit of measure.

efficient legal systems (La Porta et al. 1997, 1998), and fewer barriers to entry or the absence of oligarchies (Acemoglu 2008; Acemoglu et al. 2011; Olson 1982), are correlated with better economic performance. This paper empirically identifies the effect of the reward structure on two types of economic activities – rent seeking and productive, which has been fully addressed in the theoretical literature (Acemoglu 1995; Baumol 1990; Murphy, Shleifer, and Vishny 1911, 1993).

The remainder of the paper is organized as follows. In Section II, I provide a brief review of historical background and introduce the dataset, and in Section III introduce a conceptual framework and my empirical specifications. Section IV presents the baseline results and the results of robustness checks, and I employ the regression discontinuity design in Section V to resolve the potential endogeneity. I show the implication of civil examination for great divergence using a counterfactual case in Section VI. Section VII summarizes the findings and concludes the paper.

II. DATA

II.A. Brief Introduction of Civil Examination

In AD 605, Emperor Yang of the Sui Dynasty (581-618) established the imperial examination system, through which intellectuals were formally selected to become officials (Keay 2009).[5] Although the system was used on a small scale during this and the subsequent Tang dynasty (618-907), it was expanded under the Song Dynasty (960-1276) (Chaffee 1995). After being interrupted during the Mongol Yuan Dynasty (1276-1368), the examination system became the primary channel for recruiting government officials during the Ming (1368-1644) and Qing (1644-1910) Dynasties (Ebrey 1999; Elman 2000; Ho 1962). The system was designed to select the best administrative officials for the state's bureaucracy using a test of educational merit, and created a class of scholar bureaucrats that was independent of family status (Elman 2000; Ho 1962).[6] The system helped the central

[5]The beginnings of this practice can be found in the Han Dynasty (Chaffee 1995; Elman 2000).

[6]Ho discusses "the lack of effective legal barriers preventing the movement of individuals and families from one status to another" (1962: 54) and shows that the civil examination system made upward

government capture and hold the loyalty of local-level elites (Man-Cheong 2004), selected suitable and efficient managerial elites (Elman 2000), and created cultural uniformity and consensus on basic values (Elman 1990, 1991).

After more than 1,200 years of using the exam system, the introduction of Western knowledge systems led to a series of reforms after the First and Second Opium Wars and the decline of the imperial examination system. Franke (1960) gives a detailed description of this phase of history. After the Siege of the International Legations during the Boxer Uprising in 1900, the Empress Dowager Cixi was forced to reform the traditional examination system. She abolished the eight-legged essay in 1901, but retained the three-level examination structures. In late 1903 and early 1904, the Committee on Education submitted a memorandum urging the abolition of the examination system, and they received imperial approval on January 13, 1904. This led to the decisive abolition of the examination system. On September 2, 1905, The Empress Dowager Cixi endorsed a memorandum ordering the discontinuance of the old examination system at all levels in the following year.

II.A.1. The Structure of the Civil Examination System

The structure and process of the civil examination system remained stable during Qing dynasty. There were three stages of testing: (1) the biennial licensing examination (*Yuankao* in Chinese), the lowest level, held in the prefectural capital after primary testing in the county seat;[7] (2) the triennial qualifying examination in the provincial capital (*Xiangshi* in Chinese); and (3) the third level in the capital (academy examination, *Huikao* in Chinese) with re-examination in the imperial palace (palace examination, *Dianshi* in Chinese). Successful candidates received a new title at each level and became automatically eligible to attend the next level of examination. Specifically, the candidates who passed the prefecture-level examination were termed *Shengyuan* or *Xiucai* (literati),

mobility possible. However, Elman (2000) argued that the civil examination "was not a system designed for increased social mobility. Instead, it served as an institutionalized system of inclusion and exclusion that publicly legitimated the impartial selection of officials."

[7] New candidates had to be chosen by magistrates and prefects for the county, department, and prefectural tests before they qualified as "apprentice candidates." After they were screened by the primary test, the successful candidates took a final licensing examination in the prefectural capital (Elman 2000).

and those who passed the provincial and national level testing were *Juren* (recommended man, a provincial graduate), and *Jinshi* (presented scholar, a graduate of the palace examination), respectively.

The contents of all the examinations were dominated by the Confucian classics – the Four Books and the Five Classics (Elman 2000). The examinations were bound by many regulations and presented within strict frameworks. Form was even more important than content; candidates were required to write eight-legged Confucian essays (Chang 1955; Elman 2000; Yuchtman 2009).

II.A.2. Return

Each of the degrees or titles carried different privileges, prestige, and income (Chang 1955, 1962; Elman 1990, 2000; Glahn 1996). Chang (1962) shows that the gentry received about 24 per cent of the national income, even though they constituted only about 2 per cent of the population. At the lowest level, the candidates who passed the district examination became members of the lower gentry, who were exempted from corporal punishment and corvee (i.e. forced labor), and had the right to wear a scholar's robes. This degree and title also provided the gentry with the opportunity to manage local affairs, become secretarial assistants to officials, and teach – three important sources of income for Chinese gentry (Chang 1962). The highest possible achievement was to become a government official, which brought great power and prestige. For instance, the district magistrate had great authority to carry out court orders, collect taxes, and implement central government policies, all of which provided "the greatest opportunity for the rapid accumulation of wealth" (Chang 1962: 7). Ni and Van (2006) estimate that circa 1873, officials' corrupt income was 14 to 22 times greater than their regular income, resulting in about 22% of the agricultural output being owned by 0.4% of the population. Chang (1962) estimates that the average regular and extra income of a government official at that time was about 5,000 Tael silver per year.[8]

[8] According to Allen et al. (2011), the nominal wage of unskilled labor in Beijing is about 33 Tael silver per year (0.09 Tael per day). According to Jastram (1981, pp. 164-188), one pound sterling was worth 244.4 grams of pure silver based on the market price in 1910. Then, 5000 Tael (1 Tael =37.5 grams) silver would be equivalent to approximately 767 pound sterling.

To qualify for appointment to government office, the candidates needed to pass at least the provincial-level examination. If they passed the higher-level academy or palace examinations, they were usually automatically appointed to a government position. In pursuit of the great power and prestige of an official, candidates began studying as young children and on average passed the district examination at 24. They were likely to continue to study for another ten years before passing the provincial and national examinations.[9]

II.B. Quota System

The dynasties distributed these opportunities to become rich according to provincial and prefectural quotas throughout the country "as an institutional means to confine and regulate the power of elites" (Elman 2000: 140). The quota system allowed the government to control the size of the gentry class, which consisted exclusively of candidates who had passed the licensing examinations. In the late empire, only 1.6 to 1.9 percent of the total population had gentry status (Chang 1955; Elman 2000).[10] Furthermore, by using regional quotas, imperial officials could be recruited from the country. The control of the regional composition of the gentry was inherent in the initial stages of the licensing examination system. By restricting the prefecture or county quotas, the dynasty could control the number and location of candidates entering the official selection process. The quotas for the higher-level examinations – Juren and Jinshi – were always allocated at the provincial level during the Qing Dynasty. There was no standard formula for the regional quota, but the size and importance of the administrative units were the key determinants (Chang 1955). Thus the regions were very unequal in terms of opportunities for individual participants.

The empirical study of this paper covers the 262 prefectures of 18 provinces south of Great Wall – the traditional agricultural China (see Figure 1). During the Qing period, about 90 percent of the country's total population lived in this region (circa 1880,

[9]Chang (1955) estimates the average age at which examination candidates passed the district examination as 24, and suggests they passed the provincial and national examinations at approximately 30 and 35, respectively.

[10]Chang (1955) estimates that the percentage of gentry in the total population was 1.2 percent in the early nineteenth century and increased to 1.9 percent in the late nineteenth century.

according to Ge 2000).

Figure 1 about here

To exploit the cross-prefecture variation in the chance of passing the exam, I use the quotas for the licensing examination – the lowest level, which was conducted in the prefectural capitals. This prefecture examination was the threshold for obtaining gentry status. Candidates who passed the district examination became members of the gentry and earned the accompanying privileges and income. The prefectural level of examination corresponds to our analysis of firms at the prefecture level. The quotas for successful candidates in these district examinations were assigned to each administrative unit, prefecture, and county. To compute this number, we first combined the figures for the quotas in all administrative units. *The Qing Hui Dian Shi Li* (Kun 1991) gives the quotas from the beginning to the end of the nineteenth century. According to Chang (1955), the district examination quotas were stable after 1724, with the biggest change happening during the Taiping Rebellion, when the quota was increased in order to quell the revolt. Based on our data, the sum of the quotas in the 262 sample prefectures was 29,808 (up from 24,698 before the rebellion).[11]

Figure 2 depicts the geographical distribution of absolute values of quotas for licensing examinations and quota density (quota per million inhabitants). The average prefectural quota was 113.8 (SD = 75.6), and the average quota density is 135.8 (SD = 141.2). The prefecture with the highest chance of passing the exam is Anxi Zhou in Gansu Province (the quota per million inhabitants is 1704.2), and that with the lowest chance is Haimen Ting in Jiangsu Province (the quota per million inhabitants is 8.7).

Figure 2 about here

[11]In Chang (1955), the sum of the quotas before the Taiping Rebellion was 25,089 and increased to 30,113 after the rebellion. The reason for the difference with our figures is we cannot include the quotas for Eight Barner, Fengtian (Manchu) and the special quota for merchants.

II.C. Modernization (Y_{it})

II.C.1. Modern Firms

After its defeats in the First (1839-42) and Second (1856-60) Opium Wars, China began to adopt Western technologies and establish modern enterprises. Apart from the period of the Self-Strengthening Movement (1861-95), initiated by Qing government officials to acquire military technology and armaments, this adoption was primarily carried out by private firms that emerged in the mid-nineteenth century. I employ the number of mechanized industrial firms above a designated size as the proxy for measuring the adoption of Western technology. Chang (1989) compiled ten series of extant materials on Chinese private enterprises and listed all modern firms with their locations and establishment dates. All firms in this study meet the following five criteria: (1) they are organized as companies, (2) they have over silver yuan in capital,[12] (3) they use mechanization, (4) they have over 30 employees, and (5) the value of their output is over 50,000 silver yuan. I plot the number of private enterprises by the year they were established in Panel A of Figure 3.[13]

Figure 3 about here

This figure clearly shows that the firms began in 1848, were negligible before 1878, and started to grow during the height of the Self-Strengthening Movement (1861-95). After China's defeat in the First Sino-Japanese War (1894-95), which marked the failure of the Self-Strengthening Movement, the number of newly opened firms suddenly decreased from 18 in 1894 to three in 1895 and six in 1896. After a period of slow growth (1895-1903), private enterprises sprouted at the end of Qing Dynasty and the beginning of the Republic of China. For instance, 71 firms opened in 1916, the first year after the abolition of the imperial civil examinations, and 125 firms were established in 1912, the first year of the Republic of China.

[12] Approximately 1,094 pound sterling (Jastram 1981, pp. 164-188).

[13] I only include the firms located in the 18 provinces covered in my empirical testing.

II.C.2. Studying Oversea

In addition to establishing modern firms, other activities also related to learning from the West. For instance, in the late Qing period, more and more educated Chinese left home to study overseas – primarily in Japan, as it was regarded as the most suitable country due to its geographical proximity and cultural similarity. During 1900-11, 90% of the 20,000 overseas Chinese students studied in Japan (Yao 2004).

I constructed a dataset that includes all Chinese students in technological academies, higher education institutions, and universities. These data are gathered by Shen (1978) based on the rosters of various Japanese schools.[14] I then plot the number of new students arriving in Japan by year in Panel B of Figure 3, which shows that the number increased after 1902 and then decreased after 1905 since more students began to choose to study in Western Europe or the USA. Our data only includes the students who studied in technological academies, higher education institutions, and universities, the total number of Chinese students is 1,635 from 1900 to 1909.[15] I also plot the number of Chinese graduates in the same figure (Sanetou 1983). The figure shows that the number of arriving students in 1901-06 is very similar to that of graduates three or four years later in 1904-09, which implies that the 1901-06 data might be much more reliable.

II.D. Other Variables (Z_i)

I also include a further set of control variables in the analysis. Geography is always a key factor in accounting for differences in economic prosperity. To control for the differences in access to the coastline and navigable rivers, I include two dummy variables: coast (whether a prefecture is situated on the seaboard) and riverside (whether a prefecture is located along the Changjiang (Yangtze) River, the most navigable river in China). Approximately 13.4 per cent of the sampled prefectures are located on the coast, and 6.2 per cent are on the Changjiang River. Furthermore, I control for the longitude

[14] In his book, Shen lists the name, birthplace, and date of arrival in Japan of each student, so that we can count the number of new students from each prefecture in a given year.

[15] In 1900s, there were about 20,000 total Chinese students in Japan. But, only 4.4 percent studied in the types of schools I mentioned (Sanetou 1983).

and latitude of the prefecture's capital, as these might be correlated with conditions for agriculture and human health. I also control for the region's size, because a larger region might have a higher quota of civil servants and more businesses. To control for these effects, I include in the empirical estimates both the population density in 1880 and the size of the prefectures. Provincial dummies and constant terms are also included. Details concerning the definition, data sources, and summary statistics of the pertinent variables are summarized in Table 1.

Table 1 about here

III. CONCEPTUAL FRAMEWORK AND ESTIMATION STRATEGY

III.A. Conceptual Framework

For skilled labor (or "talent"), considering two choices 0 (traditional education) and 1 (modernization),[16] the relevant question for this analysis is the decision making on the occupational choice. An individual would be expected to compare the expected wages of the two occupations, and I expect that those who have higher expected earnings under the traditional education system will decide to participate in civil exam system, and vice versa. This framework bases on Roy (1951) and was developed by Borjas (1987): Assuming the log earnings to receive the traditional education as:

$$\ln w_0 = \kappa_0 + \eta_0,$$

where $\eta_0 \sim N(0, \sigma_0^2)$.

The log earnings to adopt Western science and technology are assumed as:

$$\ln w_1 = \kappa_1 + \eta_1,$$

where $\eta_1 \sim N(0, \sigma_1^2)$.

An individual will choose to adopt the Western system if:

[16] The choice 0 denotes receiving a traditional education in order to participate in the civil service examination and enter the government, and the choice 1 denotes learning from the West and pursuing modernization activities (e.g., erecting a modern firm or overseas study.

$$\ln w_1 - \ln w_0 = (\kappa_1 - \kappa_0) + (\eta_1 - \eta_0) > 0.$$

Then the probability that a randomly chosen individual from the population will decide to adopt the Western system is:

$$P = \Pr[v = \eta_1 - \eta_0 > (\kappa_0 - \kappa_1)] = \Phi(\frac{\kappa_1 - \kappa_0}{\sigma_v}), \tag{1}$$

where $\gamma = \rho_1 - \rho_0$.

The mean log earning (κ_0) in a region is determined by the probability of success, and the opportunity of success is regulated by quota system. Then:

$$\kappa_0 = \rho \cdot \ln(\frac{Q}{pop}) = \rho \cdot \ln q.$$

Before the abolition of the civil examination system, the effect of $\ln q$ on P was:

$$\frac{\partial P}{\partial \ln q} = -\frac{\rho}{\sigma_v}\phi(\frac{\kappa_1 - \kappa_0}{\sigma_v}) < 0.$$

After the abolition, the expected earning in the public sector (κ_0) is not determined by the quota system. Then, the effect of $\ln q$ on P can be written as:

$$\frac{\partial P'}{\partial \ln q} = 0.$$

III.B. Estimation Strategy

My basic estimation strategy is to employ a DID method to identify the change in the effects of $\ln q$ with the abolition of the civil exam:

$$\frac{\partial P'}{\partial \ln q} - \frac{\partial P}{\partial \ln q} = \frac{\rho}{\sigma_v}\phi(\frac{\kappa_1 - \kappa_0}{\sigma_v}) = \beta > 0. \tag{2}$$

Empirically, I employ the numbers of new modern firms (per million inhabitants) and new Chinese students in Japan (per million inhabitants), denoted by y_{it}, as the proxy of P, and regress it on the interaction between $\ln q_i$ and the dummy indicator on the post-abolition period ($Post_t$), which can be represented by:

$$y_{it} = \beta Post_t \times \ln q_i + \lambda_i + \eta_t + \varepsilon_{it}, \tag{3}$$

in which q_i is the ratio of quota to total population (unit: million). λ_i is the prefecture-specific effects, η_t represents the year dummies to control for year-specific effects, and

ε_{it} is the error term. To rule out the possibility that the change in the effect of the quota is caused by a change in the effects of other variables, I include the interaction terms between various control variables (Z_i) and the post-abolition dummy ($Post_t$) in the regression. These variables (Z_i) are highly correlated with quota density, and can explain about 60 percent of the variations in quota density (see Appendix II for details).

Before empirical testing, I present some descriptive evidence of the increase in the effect of quota density. In Panel B of Figure 3, I compare the density of modernization activities between the first quartile (which has the highest quota density) and the fourth quartile (which has the lowest quota density). The figure clearly shows that before 1904, there is little difference between the two groups, but the difference becomes larger once the exam system was abolished.

IV. EMPIRICAL TESTING: DIFFERENCE IN DIFFERENCES (DID)

IV.A. Baseline Results

I begin the empirical testing using a DID method and include the interaction between control variables and the post-abolition dummy ($Post_t$) as:

$$y_{it} = \beta Post_t \times \ln q_i + Post_t \times Z_i\gamma + \lambda_i + \eta_t + \delta_{prov} \cdot \eta_t + \varepsilon_{it}, \quad (4)$$

in which q_i is the ratio of quota to total population (unit: million). Z_i represents a vector of prefecture-level characteristics, including whether the prefecture is located along the Changjiang (Yangtze) River or on the coast; its latitude and longitude; and its size (area in log-term) and total population in 1880 (log-term). λ_i is the prefecture-specific effects, η_t represents the year dummies to control for year-specific effects, and $\delta_{prov} \cdot \eta_t$ represents the province-year specific effects.

The results are reported in Table 2. In Columns 1.1-1.4, I employ the number of new modern firms per million inhabitants as the dependent variable, and the result shows that the effect of the logged quota per million inhabitants increases by about 0.244 when only prefecture, year, and province-year specific effects are included. Moreover, the coefficient remains relatively stable when controlling for Z_i. In terms of magnitude, when evaluated at the mean population of sampled prefectures (1.315 million), one prefecture with one-standard-deviation higher logged-quota density (0.70) would erect 0.23 more modern firms each year. Comparing the prefecture with the highest chance of passing the civil exam (the quota per million inhabitants is 1704.2) and that with the lowest chance (where it is 8.7), the prefecture with the highest chance would erect 1.6 firms more per year (evaluated at the mean population of sampled prefectures).

Table 2 about here

The results also show that the prefecture with a higher chance sent more students to Japan after the abolition of the civil exam (Columns 2.1-2.4). Specifically, evaluated at the mean population of sampled prefectures, one standard deviation higher in the logged-quota density (0.70) will lead to sending 0.66 more students to Japan per year. Comparing the prefecture with the highest chance and that with the lowest chance, the prefecture with the highest chance would send five more people to study in Japan per year (evaluated at the mean population of sampled prefectures).

IV.B. Model Specifications

This paper employs the logged density of new modern firms and the logged density of new students (Y_i/P_i) as the dependent variable, and the log-term of the quota per million inhabitants ($\ln(Q_i/P_i)$) as the explanatory variable. To check the robustness of the results, I employ other specifications. First, I directly employ the quota per million inhabitants (Q_i/P) as the explanatory variable:

$$y_{it} = \rho Post_t \times q_i + Post_t \times Z_i\beta + \lambda_i + \eta_t + \delta_{prov} \cdot \eta_t + \varepsilon_{it}. \quad (5)$$

The results are reported in Column 1 of Table 3. The effect of quota density significantly increases after the abolition of the exam.

Table 3 about here

Second, I employ a dummy variable indicating whether there were any new firms/students as a dependent variable.

$$I(Y_{it} > 0) = \rho Post_t \times q_i + Post_t \times Z_i \beta + \lambda_i + \eta_t + \delta_{prov} \cdot \eta_t + \varepsilon_{it}. \tag{6}$$

The results are reported in Columns 2 and 3, in which quota density and logged-quota density are employed as explanatory variables, respectively. The results still support the hypothesis. Then I replace the dependent variable with the absolute number of new firms/students (Y_{it}) in Columns 4 and 5, or the logged number ($\ln(1 + Y_{it})$) in Columns 6 and 7. The effects of the quota do significantly increase after the abolition of the civil exam.

V.C. Dynamic Impacts of Quota Density (Logged Quotas per Million Populations)

The above analysis found that the effect of quotas significantly increased after the abolition. But if the effect of quotas was gradually increasing before the abolition, our estimator could be compounded with the pre-abolition trend. To examine this possibility, I implement an alternative specification:

$$y_{it} = \sum_{\rho=1899}^{1908} \beta^{\rho} (\ln q_i \times Year\ dummy_{\rho=t}) + \sum_{\rho=1899}^{1908} (Z_i \times Year\ dummy_{\rho=t}) \gamma^{\rho} + \eta_t + \delta_{prov} \cdot \eta_t + \varepsilon_{it}, \tag{7}$$

where $Year\ dummy_{\rho=t}$ equals 1 if $\rho = t$, and 0 otherwise. It is possible that the effects of these variables (Z_i) may change over time. For instance, the effect of coast on economic prosperity may have increased over time as China became more open. To find out, I interact them with the full set of year dummies ($Year\ dummy_{\rho=t}$) in the regression. Because there is an interaction term of quota for each year, I drop the main effect of quotas. Then, β^{ρ} represents the yearly correlation between the logged-quota density and the density of modernization activities. Figure 4 plots the yearly correlation along with the upper and lower bounds for 95% confidence intervals. There are two findings. First, the effect of quota on entrepreneurship does not show a clear trend in the seven years prior to the abolition. For modern firms/overseas study, none of the five coefficients is significant, and the null hypothesis that all pre-abolition effects are equal to zero cannot be rejected. Second, the effect immediately increases after abolition.

Figure 4 about here

IV.D. City and Western Penetration

To check the robustness of the results, I include more control variables, which might not be directly related to the quota density, but might be related to modernization. The results are reported in Table 4. The first is the interaction term between the level of urbanization in 1893 (proxied by the log-term of city population) and the post-abolition dummy ($Post_t$). The results are reported in Columns 1 and 5, which show that there would be more firms and overseas students in prefectures with more urban populations. I include two further variables related to Western economic penetration: the duration of treaty ports and the cumulative number of foreign firms. Since these two variables are time variant, I include them and their interaction term with the post-abolition dummy ($Post_t$) in the regression. The results are reported in Columns 2-3 and 6-7. After the abolition of the civil examination, people in prefectures with more Western penetration tended to erect more firms and send more students to Japan. The results are not surprising, since the Western penetration might provide necessary knowledge and information related to modernization.

Table 4 about here

I include these additional control variables in Columns 1.4 and 2.4. The results show that the effect of urbanization on the establishment of modern firms does not significantly increase, and that its positive effect might be captured by the number of foreign firms (Column 1.4). However, its effect on overseas study remains significant (Column 2.4). Moreover, when the two proxies are both included in the regression, the change in their effects is different. The effect on the establishment of new firms comes mainly from the foreign firms. With the inclusion of foreign firms (and its interaction with the post-abolition dummy), the effect of treaty ports decreases. But the effect on overseas study mainly comes from the duration of the treaty ports. In prefectures with more foreign firms, fewer people go to Japan once the exam system is abolished, which may be because there is a substitution effect between the establishment of modern firms and overseas study.

V. RD design

Our estimation may be biased by some unobserved time-invariant factor, which might be related to the quota. Using a DID method, the effects of unobserved factors can be ruled out only when their effects do not change before and after the abolition of imperial civil examinations. A change in the effects of omitted variables is possible. For instance, there are some omitted variables, (F_i), which are correlated with the logged-quota density. These variables are not related to the return to the public sector, namely that $\partial\kappa_0/\partial F = 0$. After the abolition of the civil exam, the government still needs to select some elites into the public sector. The new method is not directly related to quotas, but it might rely on these omitted variables, e.g. political connectedness. It implies that $\partial{\kappa'}_0/\partial F \neq 0$. If the quotas are positively related to the omitted variables (F_i, e.g., political connectedness), and the effect of omitted variables on the return to the public sector increases after the abolition, DID estimation might underestimate the change in the effects of the quotas.

V.A. Fuzzy RD design: Discontinuous Rule in Quota Assignment

Quotas were allocated to administrative units on the basis of their size and importance (Chang 1955).[17] The importance of administrative units can be measured by the rank of their post designations. In the Ming Dynasty, the prefectures were classified into

[17] "Quotas were allocated to administrative units. Each prefecture and district had its government school for *Shengyuan*, and each school had a specific quota of *Shengyuan* to be admitted in each examination. The size of these quotas varied according to the importance and size of the administrative unit" (Chang 1955: 77).

two groups: important ("troublesome, abundant", $I_i = 1$) and unimportant ("simple", $I_i = 0$). One criterion was whether the agricultural tax passed the threshold of 150,000 stones; if it did ($x \geq 150$, unit: 1,000 stones), the prefecture would be classified as important (Zhang 1987). When the Manchu conquered China and established the Qing Dynasty, it is clear that the central government adopted the dichotomous approach of the Ming Dynasty (Liu 1993).[18] Thus we hypothesize that there is a discontinuity rule in quota assignment and the prefecture that had an agricultural tax of more than 150,000 stones were more likely to have larger quotas. The quotas were assigned during 1644-1723, and remained stable until 1850, when they were disrupted by the Taiping Rebellion. During the rebellion, there was an increase of only about 10 per cent. Overall, the quotas remained relatively stable during the Qing Dynasty; the discontinuity rule during the early Qing Dynasty could have a persistent effect on the quotas during the late Qing period.

A remaining concern is that the discontinuity rule (during the early Qing Dynasty) is a measure of the importance of the prefecture, and that it might still directly affect the importance in the late Qing Dynasty. Fortunately, a new method of ranking administrative units was employed in 1731, seven years after the assignment of quotas. Under the new system, every administrative unit (prefecture) was characterized according to the presence or absence of four attributes based on the four aspects of administration: economy, transportation, governance difficulty, and security.[19] Based on these four variables, there were 16 possible post designations.[20] The Board of Personnel of the central government used this classification system to designate four post levels: most important, important, medium, and simple. This system continued until the end of the Qing Dynasty.

The fuzzy RD design and related historical background are illustrated in Figure 5.

[18]Though the schools were divided into three types, the Qing government did not adopt the triple classification for administrative units. The *Shunzhi* emperor ordered the Board of Personnel to classify the administrative units into the three types in 1655, but stopped the project in 1657.

[19]The four attributes were (1) "thoroughfare" (*Chong*), a center of communication; (2) "troublesome or abundant" (*Fan*), a great deal of official business; (3) "fatiguing" (*Pi*), an indicator of the difficulty of collecting taxes; (4) "difficulty" (*Nan*), an indicator that a post had to cope with a crime-prone populace.

[20]There is one designation consisting of four characters, four consisting of combinations of three characters, six consisting of two characters, four consisting of only one character, and one without any characters.

There was a clear demarcation between the important ($I_i = 1$) and unimportant prefectures ($I_i = 0$). The importance of the prefecture increases the quotas assigned during 1644-1724, which remain relatively stable before the abolition. But the discontinuity rule was replaced by a new rule of importance in 1731, which implies that the discontinuity rule has no direct effect on the importance of a prefecture in the late Qing Dynasty.

Figure 5 about here

It is worth pointing out that agricultural tax equal to 150,000 stones is a sufficient (but not necessary) condition of "important" entitlement. Prefectures could also be regarded as important if they contained a prince's mansion, or were the seat of a provincial government (a city with all three departments in it), or had troops stationed in it, or had vital postal routes, or provided for the armed forces (Zhang 1987). These conditions relax the concern that the central government might manipulate the agricultural tax to make a specific prefecture (e.g., the seat of a provincial government) "important."

The data of Ming tax (x) was gathered by Liang (2008) and is presented in Panel A of Figure 6. I employ the log-term and differ it with the cut-value (denoted by $c = 150,000$ stones), denoted by $\tilde{x} = \ln(x/c)$. The distribution of $\tilde{x}$ is presented in Panel B of Figure 6. Around the cut-value, there are 72 prefectures located in the one-standard-deviation bandwidth, of which 36 prefectures have tax larger than the cut-value.

Figure 6 about here

V.B. Model Specifications

We use fuzzy RD to exploit the discontinuity in the expected value of treatment I_i, conditional on agricultural tax (x_i). There is a jump in the expected value of $\ln q_i$ at $c = 15$ (unit: 10,000 stones), so that:

$$E[\ln q_i|\tilde{x}_i, Z_i] = \begin{cases} f_1(\tilde{x}_i, Z_i) & \text{if } \widetilde{x_i} \geq 0 \\ f_0(\tilde{x}_i, Z_i) & \text{if } \widetilde{x_i} < 0 \end{cases} \tag{8}$$

where $f_1(x_i) \neq f_0(x_i)$. Then, the non-parametric version of fuzzy RD can be represented by:

$$E[\ln q_i | 0 < \tilde{x}_i < \delta, Z_i] - E[\ln q_i | -\delta < \tilde{x}_i < 0, Z_i] \simeq \psi^*. \tag{9}$$

The non-parametric results are presented in Panel A of Figure 7. The fitted values come from non-parametric regressions using Cleveland's (1979) tricube weighting function and a bandwidth of 1, estimated separately for prefectures on either side of the cut-value. Thus they represent a moving average of quotas across the cut-value. The figure presents dramatic evidence that the important prefectures have a larger quota. An especially convincing feature is the evidence of a discontinuous increase when the taxes are just above the cutoff value of 150,000 stones. In the second figure, I also employ a kernel-weighted local polynomial regression and display the graph of the smoothed values with confidence bands, which shows a similar pattern.

Figure 7 about here

The reduced-form conditional expectation on modernization activities is:

$$E[y_i | 0 < \tilde{x}_i < \delta, Z_i] - E[y_i | -\delta < \tilde{x}_i < 0, Z_i] \simeq \beta\psi^*. \tag{10}$$

In Panel B, I first perform the same analysis but replace the size of the quotas with the average number of private firms (per million inhabitants) established per year from 1899 to 1903, and find that there is only a small increase across the threshold. Then I graph the change in the average number of private firms established per year from 1904 to 1908, and the graph clearly shows that there is a jump at the cutoff value. In Panel C, I repeat the exercises by replacing the dependent variable with the density of new students, which shows a similar pattern. β can be estimated by dividing 10 by 9 and taking a limit as δ tends to zero. However, a convincing non-parametric estimation would require a large number of observations near the treatment threshold (Imbens and Lemieux 2008); these maps would provide visual evidence that the prefectures with larger quotas tended to erect more firms/send more students to Japan after the abolition of the imperial civil examinations.

V.B.1. Parametric Method – Controlling for the Polynomials

Though non-parametric techniques have the advantage of not relying on the assumption of functional form, I use a parametric method here due to the small sample size. The Equation (8) can therefore be rewritten as:

$$E[\ln q_i|\tilde{x}_i, Z_i] = f_0(\tilde{x}_i, Z_i) + I_i \cdot [f_1(\tilde{x}_i, Z_i) - f_0(\tilde{x}_i, Z_i)]. \tag{11}$$

Assuming that $f_1(x_i, Z_i)$ and $f_0(x_i, Z_i)$ can be described by p^{th}-order polynomials, then Equation 11 can be rewritten as:

$$\ln q_i = \psi_0^* I_i + \sum_{j=1}^{P} (\psi_{00} + \psi_{0p}\tilde{x}_i^j + \psi_j^* \tilde{x}_i^j I_i) + Z_i\psi + v_i, \tag{12}$$

in which $\tilde{x}_i^j$ is the j^{th} polynomial and $\tilde{x}_i^j I_i$ is the interaction between the j^{th} polynomial and the importance indicator. Then, I_i could be regarded as an instrument of the logged-quota density, and Equation 12 is the first stage of regression. The second stage can be written as:

$$y_i = \beta \ln q_i + \sum_{j=1}^{P} (\kappa_{00} + \kappa_{0j}\tilde{x}_i^j + \kappa_j^* \tilde{x}_i^j I_i) + Z_i\gamma + \varepsilon_i. \tag{13}$$

In both stages, I control for p^{th}-order polynomials and their interaction with I_i, and then I use I_i to instrument $\ln q_i$ to correct the potential bias.

V.B.2. The Order of Polynomials and the Selection of Bandwidth

In the case of polynomial regressions, the key question is the choice of the order of the regressions. The Akaike information criterion (AIC) of model selection is used here to decide this order. In a regression discontinuity context, the AIC is given by $n\ln(\hat{\sigma}^2) + 2(P+1)$, where $\hat{\sigma}$ is the mean squared error of the regression (Lee and Lemieux 2010), and we can choose P to minimize AIC. Another key issue is to choose the appropriate bandwidth (δ) around the regression cutoff point. Using a large bandwidth around the cutoff point is generally more precise because more observations are available, but the polynomial function can provide a closer approximation within a small bandwidth. Thus, a number of bandwidths are chosen to illustrate the robustness of the results. The analysis starts with a small bandwidth ($\delta = 0.5$): the prefectures with -0.5 SD $\leq \tilde{x} \leq 0.5$ SD are included in the regressions, and then the bandwidth increases step by step, $\delta = 0.6, 0.7, 0.8, 0.9, 1.0$. Moreover, adhering closely to the methods of selecting the optimal bandwidth, as discussed in Imbens and Lemieux (2008), we select the optimal bandwidth as -0.55 SD $\leq \tilde{x} \leq 0.55$ SD.

Table 5 examines the robustness of five specifications of the polynomial of $\tilde{x}$ in the given bandwidths. The first row reports results when only I_i is included, without any polynomial of $\tilde{x}$ (the polynomial order $P = 0$), and the second row reports the results with the inclusion of the 1^{st}-order polynomial of $\tilde{x}$ and its interaction with I_i (the polynomial order $P = 1$). The results with the quadratic polynomials ($P = 2$) and their interactions with I_i are reported in the third row, and the cubic polynomials ($P = 3$, and their interactions with I_i) and quartic polynomials ($P = 4$, and their interactions with I_i) are reported in the fourth and fifth rows, respectively. The significance of I_i in all specifications and all bandwidths shows that the results are not sensitive to the order of the polynomial.

Table 5 about here

The AIC statistics for each specification are also reported, and the optimal polynomial order can be decided by minimizing AIC. For instance, for $\tilde{x} \in [-0.5, 0.5]$, the optimal polynomial order is 1, which implies that only linear polynomials and their interaction with I_i are controlled. The optimal polynomial order is reported in the second to last row, which shows that it is not necessary to include the higher order of polynomial when the bandwidth is enlarged. Table 5 shows that the effects of I_i range from 0.168 to 0.603, which means that if the agricultural taxes in a given prefecture at the end of the Ming Dynasty exceeded 150,000 stones, it would have a 16.8 to 60.3 percent higher quota density.

V.C. The Validity of Instrument

An assumption of the instrument is that the classification system of administrative units, namely post-designation, greatly changed in 1731. But if I_i still influenced the importance of prefectures in the late Qing period, then our instrument might affect firm establishment via other channels. For instance, the Qing government could have paid more attention to the important prefectures and therefore more state enterprises were constructed in these locations. To test the validity of this assumption, two variables – a binary variable, "troublesome, abundant" or not and a category variable, "the rank of importance of prefecture: 1, simple, 2, medium, 3, important, 4, the most important" – are regressed on I_i based on the specification:

$$W_i = \psi_0^* I_i + \sum_{j=1}^{P} (\psi_{00} + \psi_{0p}\tilde{x}_i^j + \psi_j^* \tilde{x}_i^j I_i) + Z_i \psi + v_i. \quad (14)$$

The results are reported in the first and second rows of Table 6, respectively, and there is no significant relationship.

Table 6 about here

The RD approach requires another identifying assumption: all outcomes except quota size must vary smoothly at the cutoff point. Suppose W^1 and W^0 are potential outcomes in the two groups with $I_i = 1$ and $I_i = 0$. In this case $E(W^1|x, Z)$, and $E(W^0|x, Z)$ should be continuous at the threshold. To evaluate the plausibility of this assumption, I examine the following measurement of economic prosperity (W_i). Based on Equation 32, two dummies are used to signify economic prosperity: the city population in 1893 (log-term), and the number of bank branches open in the 1850s. We find that the effect of importance indicator (I_i) is insignificant. This suggests that I_i is not correlated with other variables related to economic prosperity – a key factor that might affect the establishment of enterprises. Moreover, I examine two factors of Western penetration: the duration of treaty ports in 1904 and the total number of foreign firms.

V.D. Instrumental Evidence

To instrument the logged-quota density and estimate its effect on the establishment of new enterprises, I employ a two-stage least squares method:

$$y_{it} = \rho Post_t \times \ln q_i + Post_t \times Z_i\gamma + \sum_{j=1}^{P} Post_t \times (\kappa_{00} + \kappa_{0j}\tilde{x}_i^j + \kappa_j^*\tilde{x}_i^j)$$

$$+ \lambda_i + \eta_t + \delta_{prov} \cdot \eta_t + \varepsilon_{it}$$

$$Post_t \times \ln q_i = \psi_0^* Post_t \times I_i + \sum_{j=1}^{P} Post_t \times (\psi_{00} + \psi_{0p}\tilde{x}_i^j + \psi_j^*\tilde{x}_i^j I_i) + Post_t \times Z_i\psi$$

$$+ \lambda_i + \eta_t + \delta_{prov} \cdot \eta_t + v_{it}$$

where $Post_t \times I_i$ is employed to instrument $Post_t \times \ln q_i$ while controlling for the polynomial of $\tilde{x}_i$ and its interactions with I_i (Angrist and Pischke 2009). The order of polynomials is determined by AIC statistics (Table 5).

Table 7 presents the results based on the optimal bandwidth, namely -0.55 SD $\leq \tilde{x} \leq 0.55$ SD. The main results support the hypothesis that the effect of quota density (logged) significantly increases after the abolition of the civil examinations. For instance, the effect of logged-quota density increases by about 0.697 and is significant at 1%. Moreover, I find that the instrumented effect of quota is much larger than the baseline results.[21] To test whether the results are sensitive to the order of polynomials, I further report the results with the inclusion of the quadratic, cubic, and quartic polynomials. The effect of $Post_t \times \ln q_i$ ranges from 0.582 to 0.608 and remains significant. To test whether the results are sensitive to the choice of bandwidth, I repeat the exercises with different bandwidths. The results are reported in Columns 2-7 of Table 7. The results remain robust and stable across different bandwidths: the coefficient ranges from 0.677 to 1.218 and remains highly significant.

Table 7 about here

I repeat the exercises but replace the dependent variable (modern firms) with the number of new Chinese students in Japan (per million inhabitants). The results are presented in Table 8. Based on the specification of Equation 15, I estimate the change in the effects of logged-quota density. After the abolition, the effect of quotas significantly increases by 3.771 (Column 1, Table 8). Then I report the instrumental evidence by

[21] I present the baseline results based on the corresponding subsample in the last row of Table 7.

different orders of polynomials and by different bandwidths. The last row of Table 8 reports the baseline results (by different bandwidths), and the increase in the effects of quota density (logged) range from 0.788 to 1.193. While employing the instrument to correct potential bias, the increase in the effects ranges from 2.470 to 3.711, which is much larger than the baseline.

Table 8 about here

Similar with the baseline results, I further estimate the yearly effect of logged-quota density on the modernization activities. The results are plotted in Figure 8. Panel A plots the yearly effect of logged-quota density on the density of new modern firms along with the upper and lower bounds for 95% confidence intervals. The first figure is the baseline results based on the optimal bandwidth, and the second is IV estimates. The results support my hypothesis that the effect of quota on modern firms does not display a clear trend in the seven years prior to the abolition, and immediately increases after abolition. Panel B repeats the exercises of Panel A by employing a longer period (1896-1916), which shows that the effect of logged-quota density similar increases thereafter. Panel C examines the yearly effect of logged-quota density on the density of students in Japan. The results remain robust. Moreover, comparing the IV estimates with the baseline results demonstrates that the effect of instrumented quota density (logged) is much larger than the baseline.

Figure 8 about here

VI. Implications for the Great Diverge – Counterfactual Case

Recent studies compare the standards of living in China and Britain on the eve of the Industrial Revolution (Allen et al. 2011). In Appendix III, I present the ratio of living standards in London to that in Beijing, which shows that in 1800 the ratio is about 2, but increases to 5-6 during the First Opium War between Britain and Qing China (1839-

41).[22] The Industrial Revolution is a key factor to explain the bifurcation between the East and West. Measured by the capacity of stationary steam engines, the difference is clear. In 1776, the capacity of steam engines in Britain was about 5,000 horsepower, and rapidly increased to 2 million horsepower in 1840; while in China, the capacity of steam engines remains zero in 1840 (Allen 2009).

What role did the civil examination system play in the great divergence between Britain and China? There is no better way to examine this than to present a case depicting what could have happened if China had abolished the system earlier. Then I attempt to estimate the number of new firms erected per year due to the abolition of the civil exam, and assume that only one steam engine is equipped in each firm. With further assumptions regarding the survival function of a firm, I can roughly estimate how many firms would have existed in 1840 if the civil examination were abolished in year T ($T < 1840$).

First, I regress the number of new modern firms on the interaction between the absolute value of quotas and the post-abolition dummy:

$$Y_{it} = \beta Post_t \times Q_i + Post_t \times Z_i\gamma + \lambda_i + \eta_t + \delta_{prov} \cdot \eta_t + \varepsilon_{it}, \tag{15}$$

and then instrument the quota using the importance indicator. The results are reported in Figure 9. One hundred quota increases will lead to the building of 0.661 firms each year. I perform a rough calculation as follows. The average quota of the prefectures in the sample is 113.8, and there are 262 prefectures. Overall, there will be firms built per year, in which n=197 (=0.661*1.138*262).

Second, I assume that the survival function of a firm is $s(t) = e^{-\lambda t}$. This solution is the exponential distribution. Estimation of λ is simple, since $E(t) = 1/\lambda$. If the average longevity is 10 years, $\lambda = 0.1$; if the average longevity is 20 years, $\lambda = 0.05$. I assume that $0.05 \leq \lambda \leq 0.1$, which implies that the average longevity is between 10 and 20 years.

Third, after the abolition of the civil examination (in year), the number of active firms can be calculated as $N = \sum_{t=T}^{1839} ne^{-\lambda(1840-t)}$.

[22] The living standard is measured using the ratio of estimated full-time earnings to the annual cost of the family budget (at the 'bare bones' level of consumption).

Fourth, I assume that the technology in China is 12 years lagged from Britain. For example, I assume that in 1840, Chinese firms adopted 1828-era technology, with 104-horsepower steam engines.

Thus the overall capacity of stationary steam engines in China was calculated; it is depicted in Figure 9 with the year of the abolition of the civil examination. With the assumption that the average longevity of Chinese firm is 20 years, China's total capacity would be larger than that of Britain if it had abolished the civil examination in or before 1827. Under the assumption that the average longevity is 10 years, China's total capacity would be larger than Britain's if China abolished the civil examination in or before 1813. In other words, during the early period of the Industrial Revolution, there was only a small gap between China and Britain. As Landes (2006) said, if China had learned from European technology, it might not have been so lagged during the First Opium War. Though this counterfactual case is very limited and is based on a set of assumptions, it implies that the civil examination system was an obstacle to modernization.

Figure 9 about here

VII. Conclusion

In this paper I account for the effects of initial institutions on the great divergence between Europe and China. The rigidity of the feudal system in Europe allowed economic elites to enrich themselves, and thus motivated possible political reform. However, in late imperial China, political power was much more diffused and the political system was less oligarchic. The ruling elites were not hereditary, but selected through the imperial civil examination. This institution provided Chinese gentry and merchants with more incentives to invest in traditional Chinese education, and fewer incentives to seek other types of knowledge such as science and technology. Our empirical results support this hypothesis. The prefectures with higher quotas tended to establish more modern private enterprises and study overseas once the examination system was abolished, which implies that the exam system provided negative incentives to adopt Western technology.

This paper helps explain the role of institutions in economic development. In strongly oligarchic societies, elites without political power might exploit other economic opportunities and attempt to change the political system with their increasing wealth. However, a less oligarchic society provides incentives for a wider variety of people to join the political game instead of pursuing other economic opportunities. This study also helps us understand the effect of existing institutions, especially a political system's rigidity, on the great divergences in technology and per capita income between the West and China. Finally, the findings demonstrate the effects of the civil examination system on the adoption of technology and support the extant hypothesis that the civil examination system limited the rise of modern science and industry.

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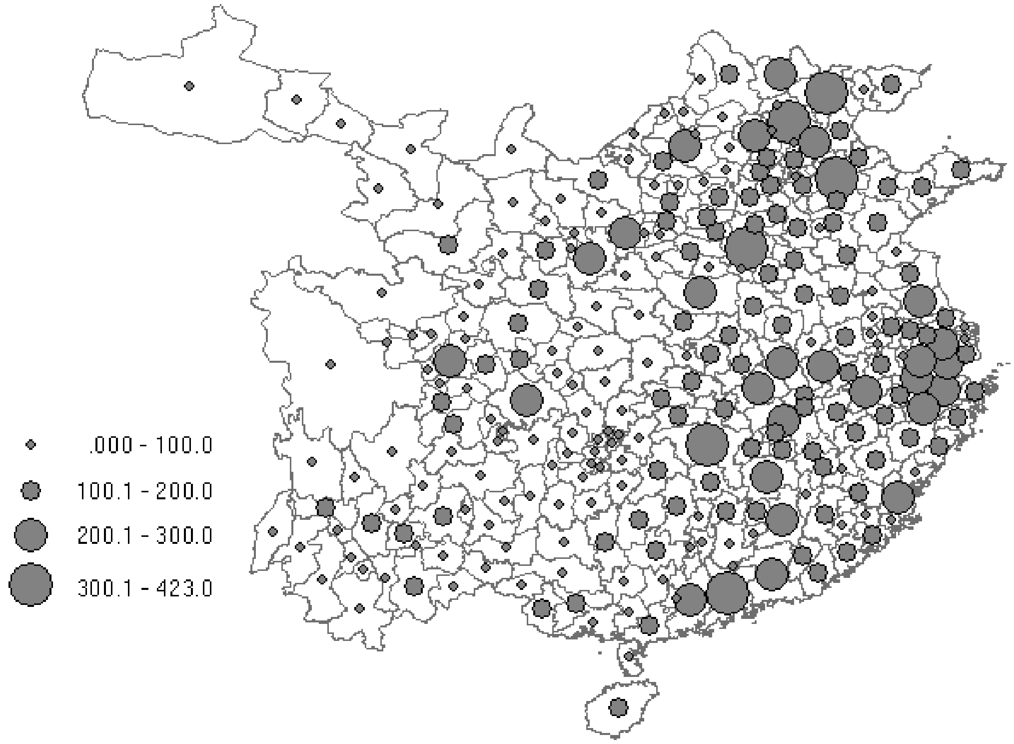
Figure 1: Geographic Distribution of Sampled Prefectures

Source: *"CHGIS, Version 4,"* Cambridge, MA: Harvard Yenching Institute, January 2007.

Figure 2: The Geographic Distribution of Quotas

Panel A: Absolute value of quotas



Panel B: Quotas per million inhabitants

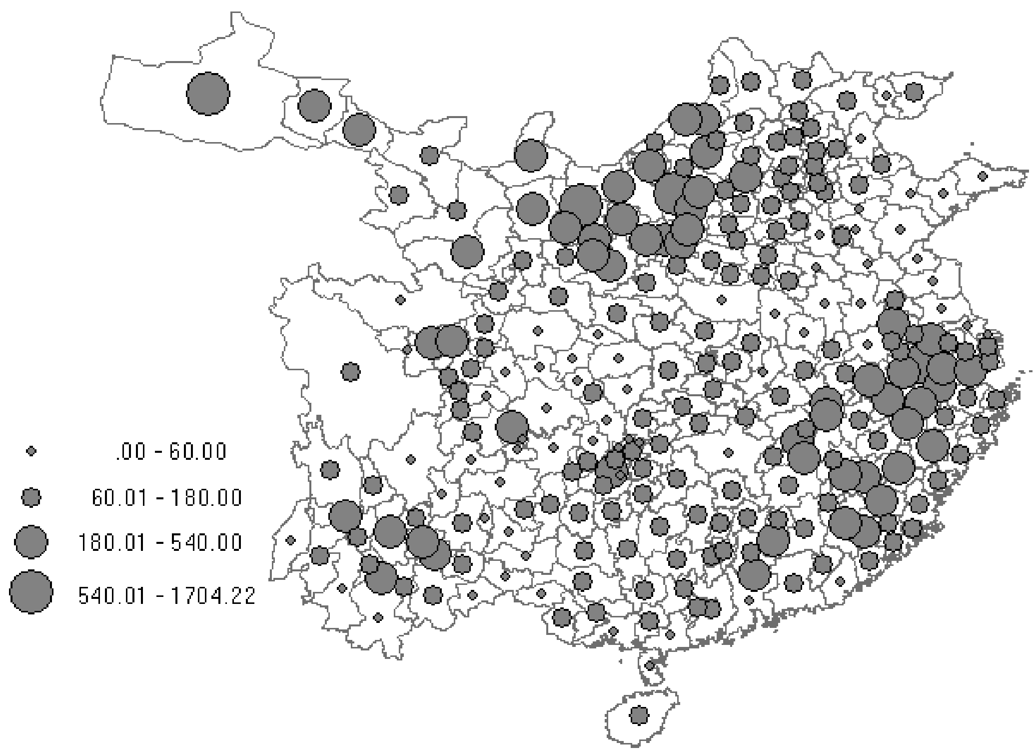
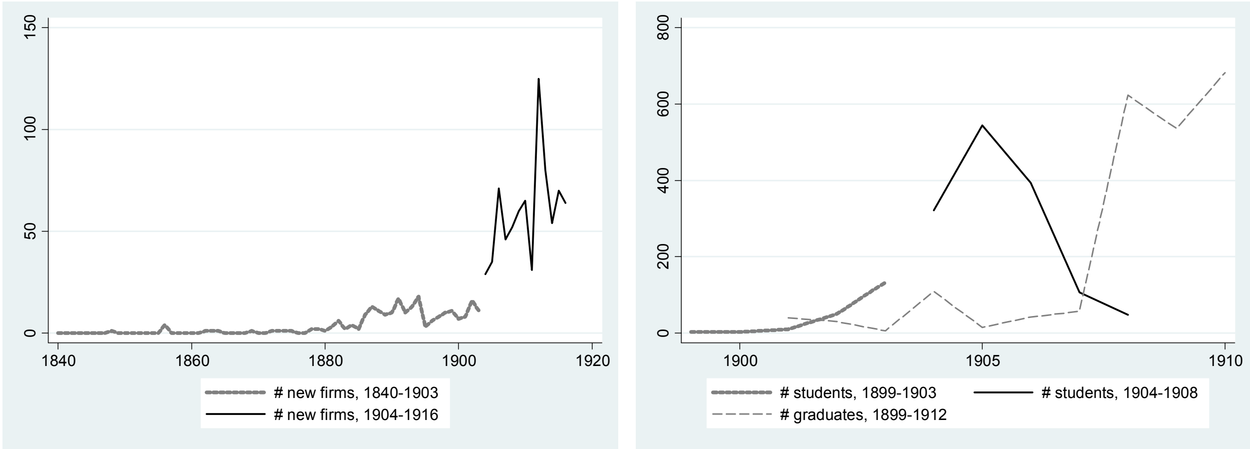


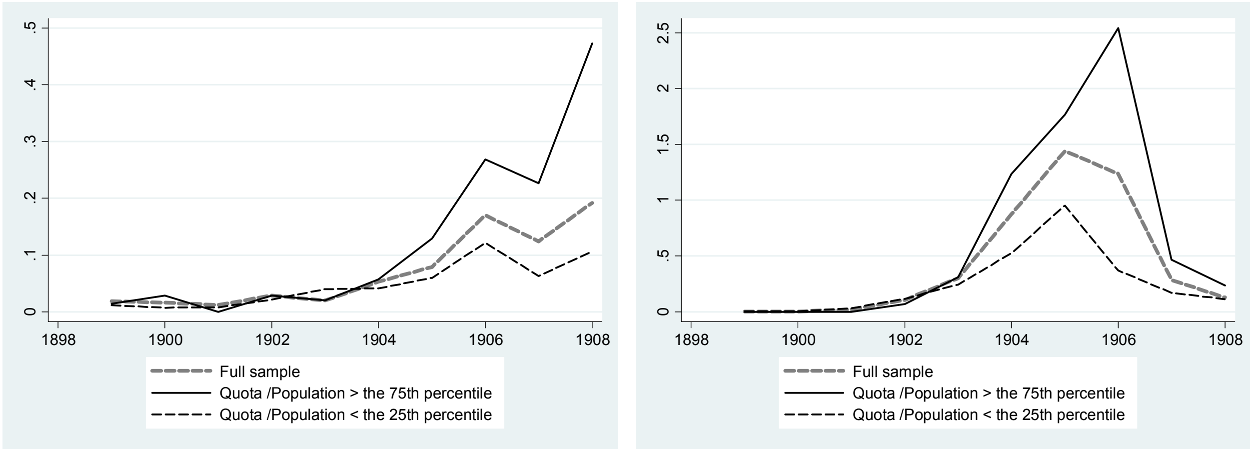
Figure 3: The Process of Modernization

Panel A: The erection of modern firms and new overseas students in Japan



Note: the Y-axis represents the number of modern firms or overseas students.

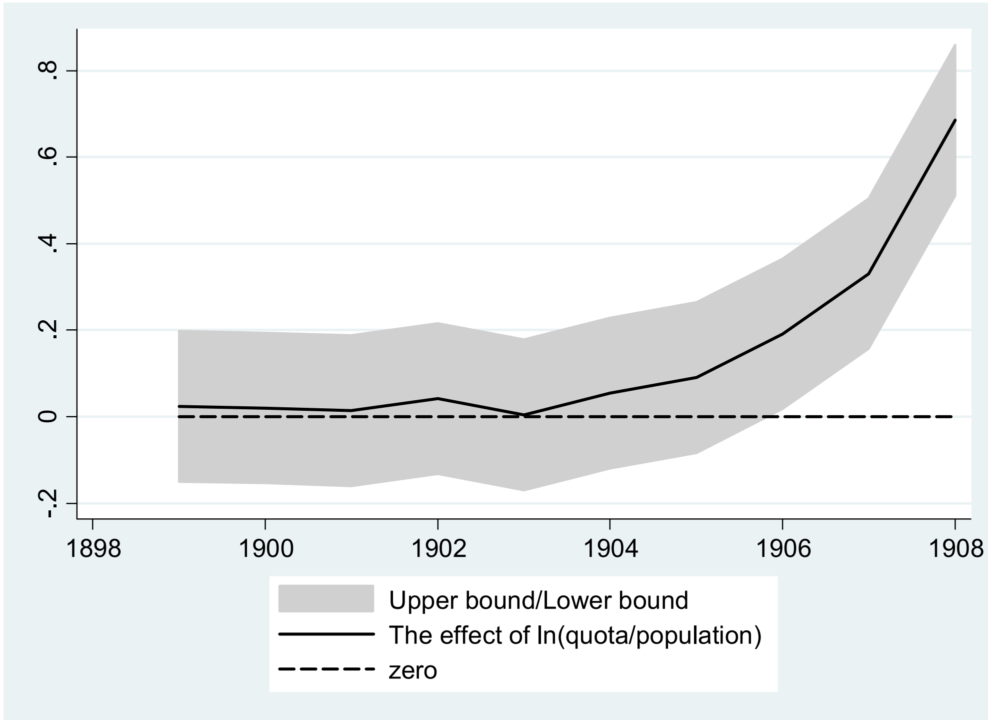
Panel B: The erection of modern firms and new overseas students in Japan – the effect of quotas per 100,000 inhabitants



Note: the Y-axis represents the number of modern firms or oversea students per million populations.

Figure 4: Robustness Checks – the Dynamic Impact of Quotas per 1,000,000 Inhabitants

Panel A: The effect of quotas per 1,000,000 inhabitants on firms, by year



Panel B: The effect of quotas per 1,000,000 inhabitants on overseas students, by year

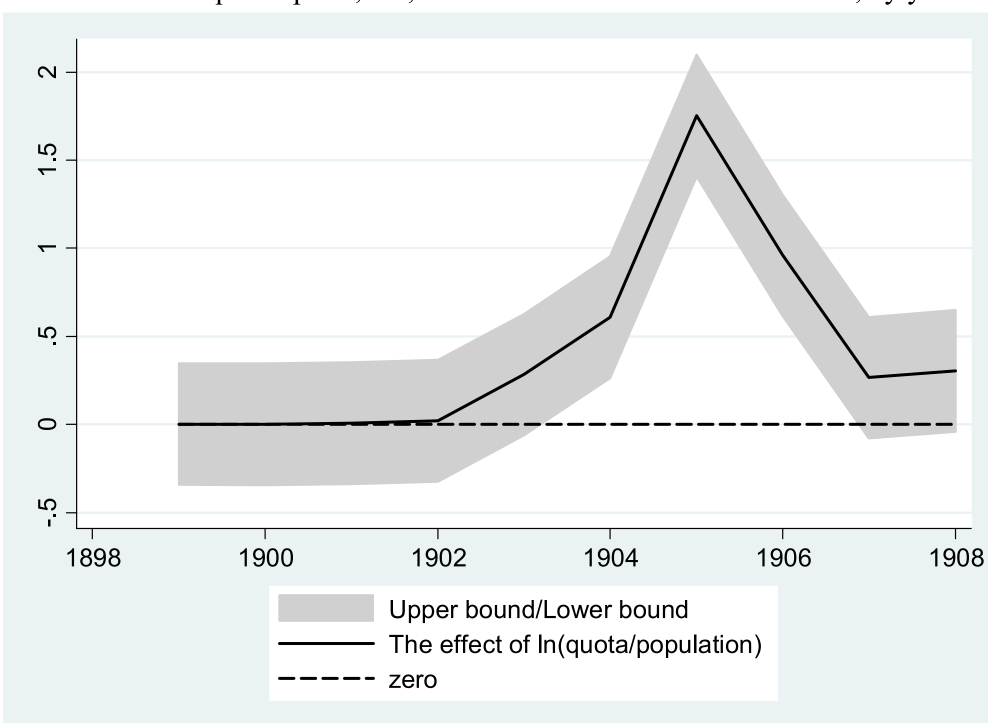


Figure 5: Historical Background of Regression Discontinuity Design

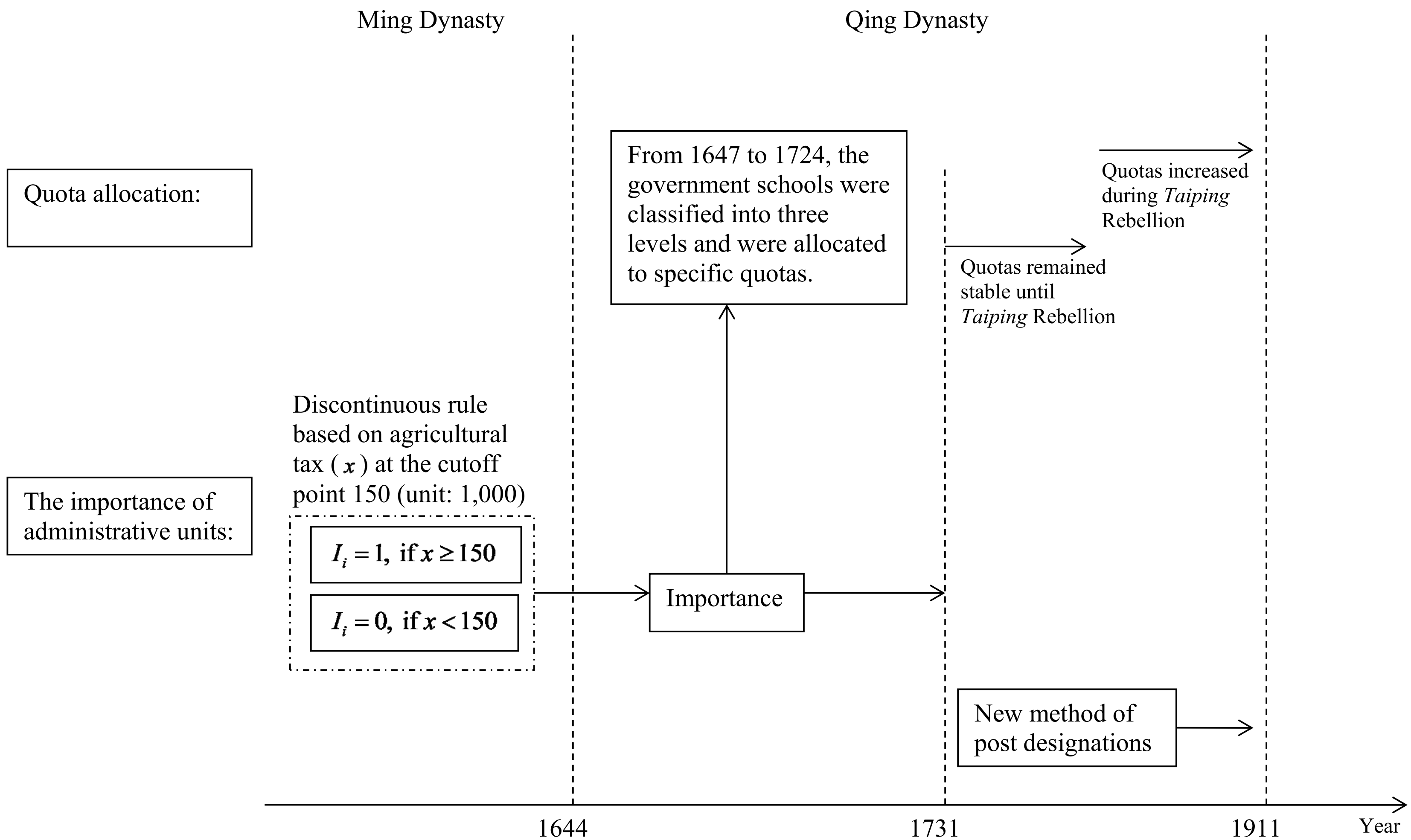
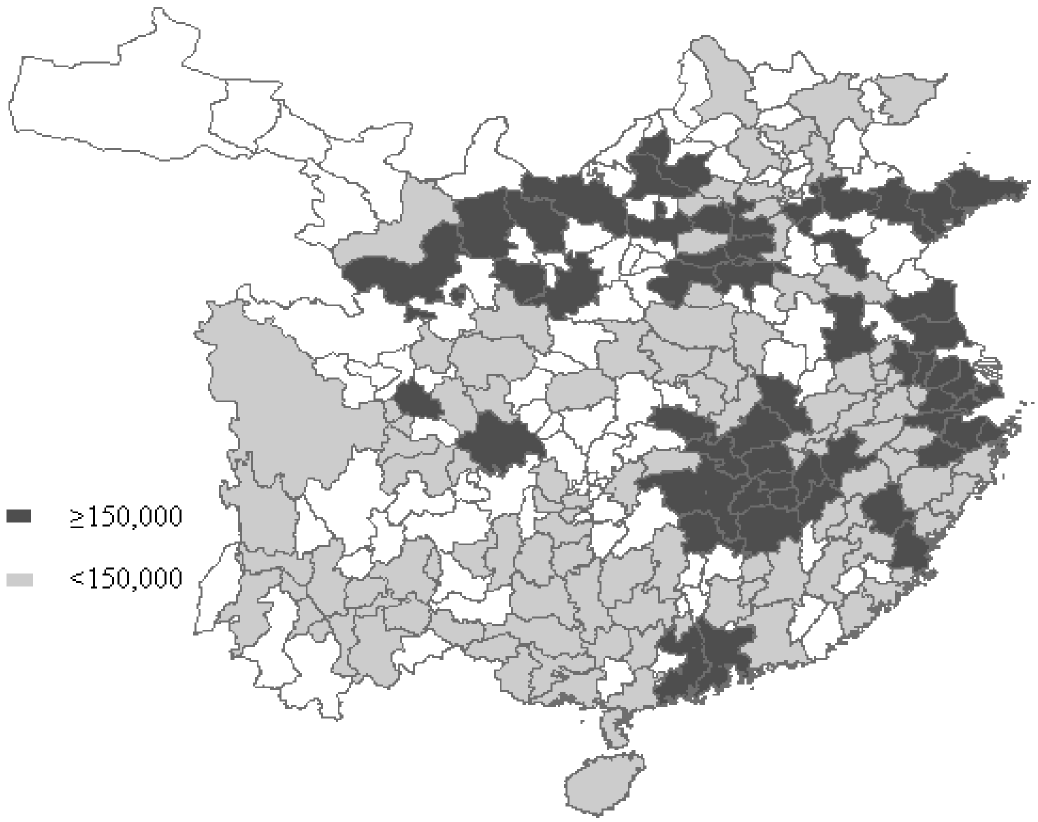


Figure 6: Description of Ming Tax

Panel A: Geographical distribution of prefectures with tax data in late Ming China



Panel B: Distribution of Ming tax

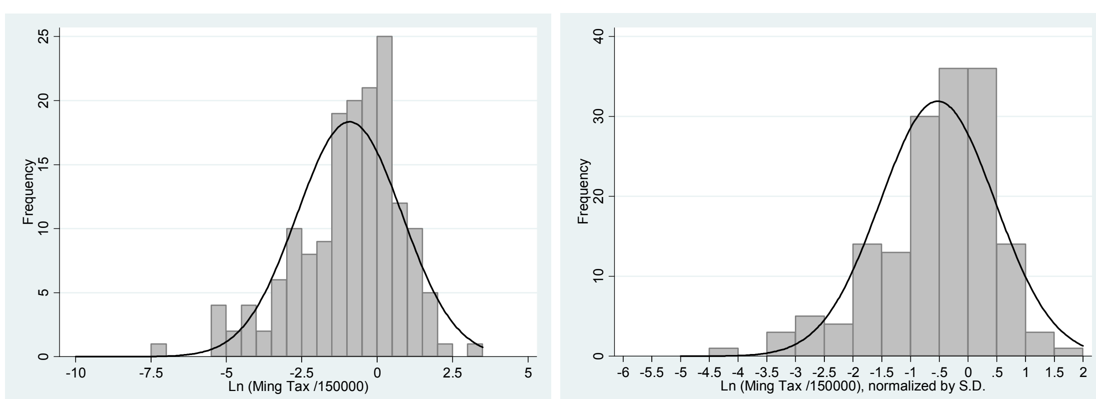
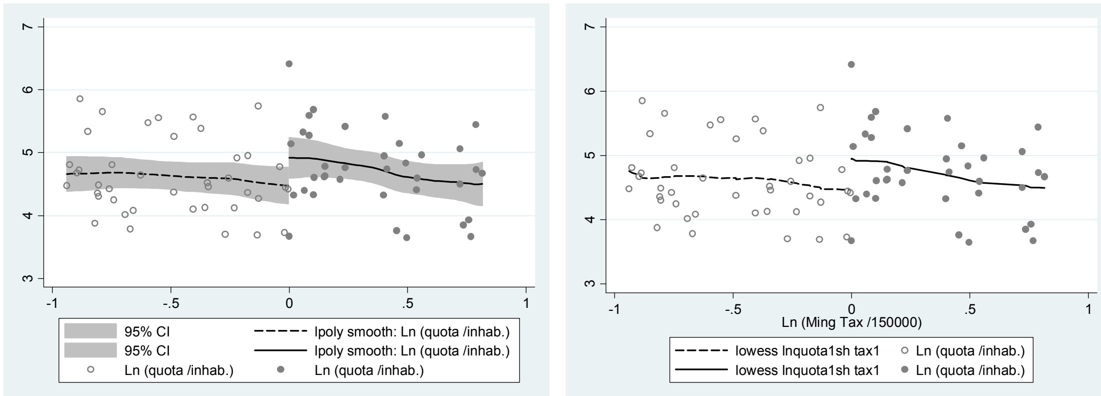
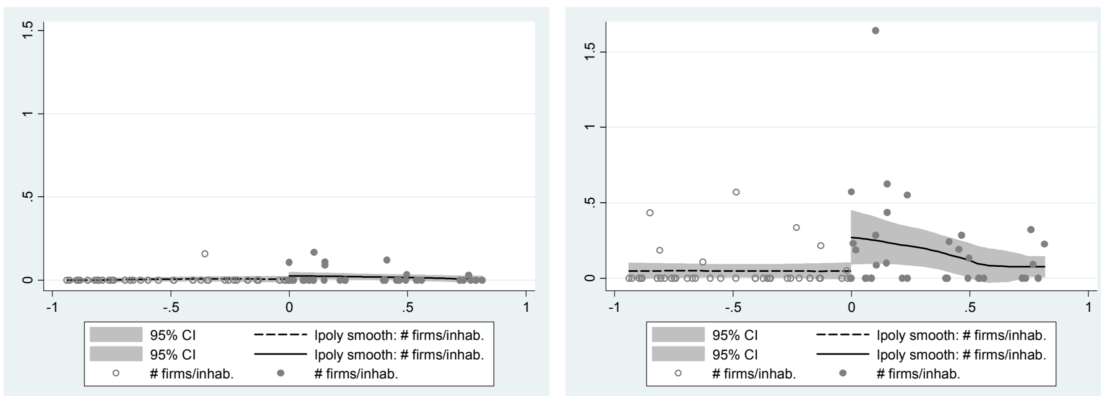


Figure 7: Non-parametric Estimation around the Cutoff Point

Panel A: Non-parametric estimation of RD on the number of quotas



Panel B: The number of private firms established per year



Panel C: The number of Chinese students who went to Japan per year

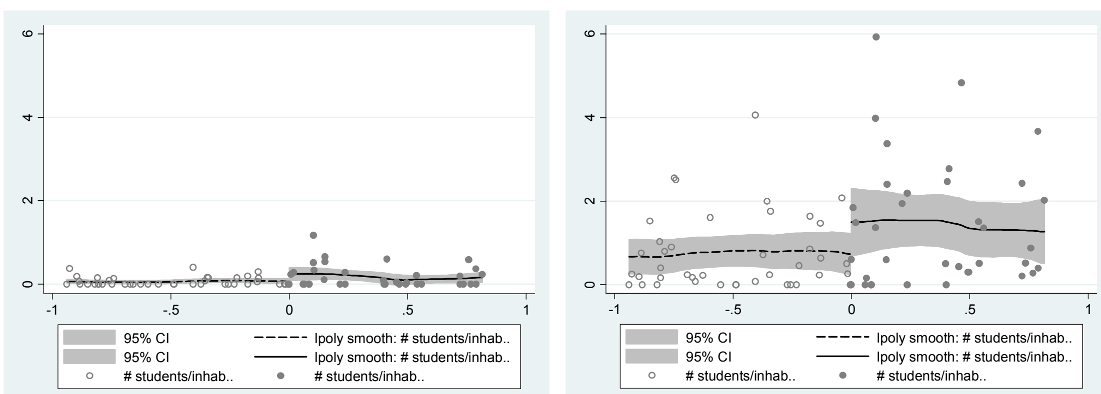
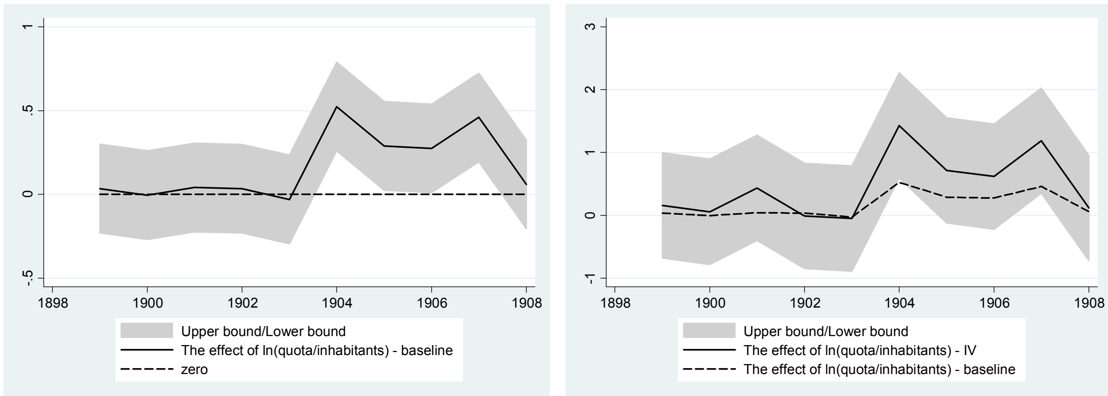
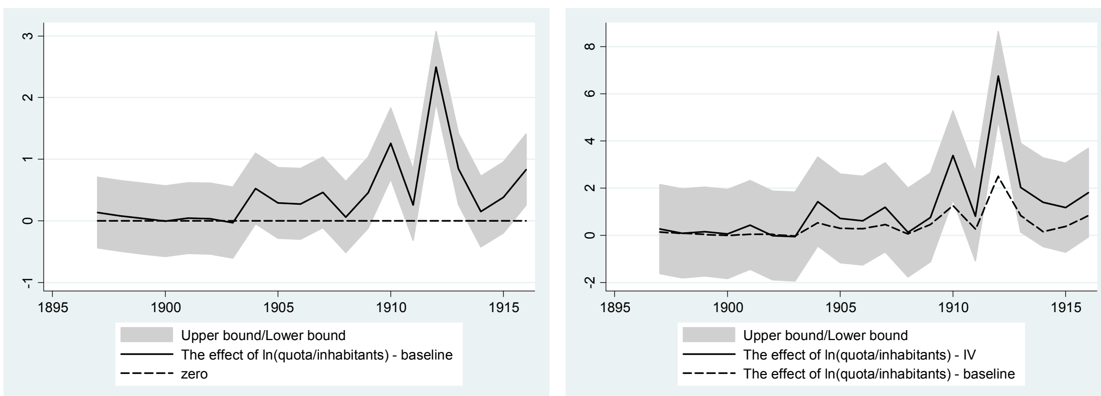


Figure 8: Instrumental Evidence – the Dynamic Impact of Quotas per 1,000,000 Inhabitants

Panel A: The effect of quotas per 1,000,000 inhabitants on firms, by year (1899–1908)



Panel B: The effect of quotas per 1,000,000 inhabitants on firms, by year (1897–1916)



Panel C: The effect of quotas per 1,000,000 inhabitants on overseas students, by year (1899–1908)

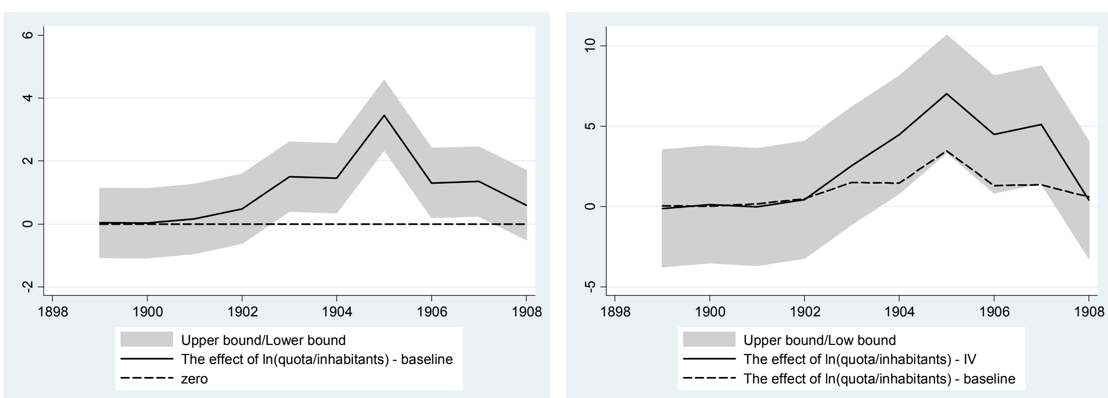
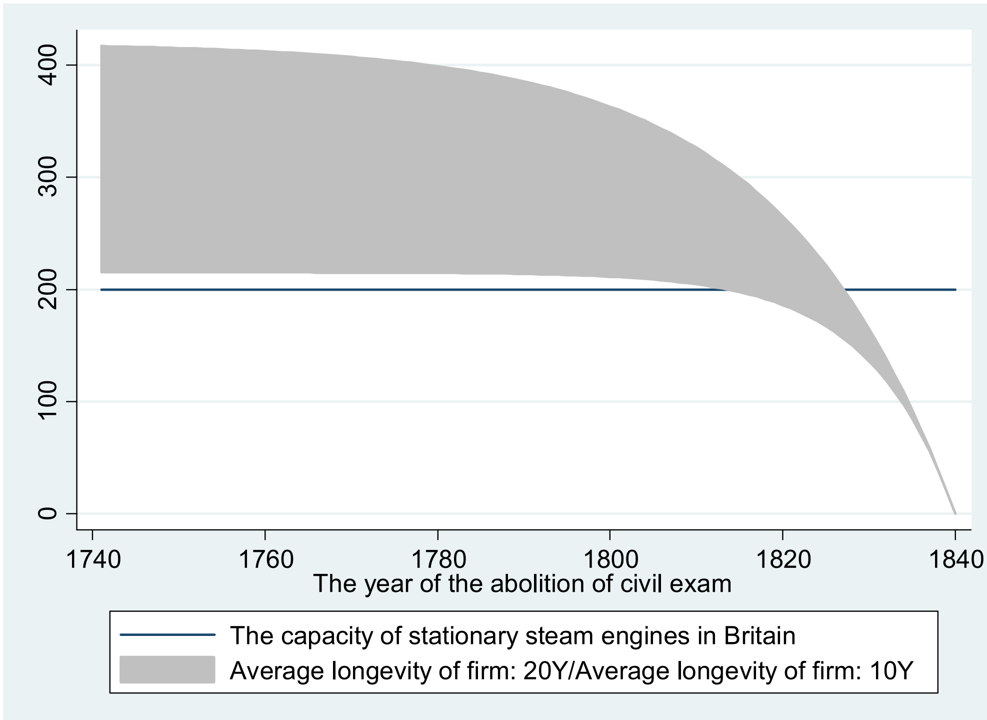


Figure 9: Counterfactual – the Difference between China and Britain



Note:

1. The divergence of the capacity of stationary steam engines (horsepower)

Britain	in 1760:	5,000 hp
	in 1840:	200,000 hp
China	in 1760:	0 hp
	in 1840:	0 hp

Source: Allen (2009): p. 179. hp: horsepower

2. The effect of quota (absolute value) on the number of new modern firms

	FE	IV-FE
Quota	0.272***	0.661**
	(0.037)	(0.268)
Control variables	Yes	Yes
Prefecture FE	Yes	Yes
Year FE	Yes	Yes
Province * Year FE	Yes	Yes
R-squared	0.211	
Observations	2,620	770

Assuming that there is only one steam engine per firm, that Chinese firms adopted the technology at the level of 1828 (104 horsepower per steam engine), and that the power per steam engine in 1834 is 149 horsepower.

Table 1: Definition of Variables and Data Sources

Variables	Variable Definitions	Data Sources	Observation	Mean	S.D.
Domestic firms	Number of new erected firms, 1899–1908	A	262*10	0.109	*(0.607)*
	Number of new erected firms per million inhabitants	A, B	262*10	0.071	*(0.696)*
Chinese students in Japan	Number of new students, 1899–1908	C	262*10	0.615	*(2.394)*
	Number of new students per million inhabitants	C, B	262*10	0.440	*(1.626)*
Quota of imperial examination	Quota of imperial civil examination (hundred)	D	262	1.138	*(0.756)*
	Quota per million inhabitants	D, B	262	135.777	*(141.272)*
	Ln (Quota per million inhabitants)	D, B	262	4.635	*(0.702)*
Control variables	Changjiang (Yangtze) River (=1, if riverside)	E	262	0.062	*(0.240)*
	Coast (=1, if coastal)	E	262	0.134	*(0.341)*
	Longitude	E	262	111.561	*(5.792)*
	Latitude	E	262	30.687	*(4.953)*
	Population, 1880 (log-term)	B	262	13.620	*(1.075)*
	Size (log-term)	E	262	9.336	(0.770)
Western economic penetration	Treaty ports duration	F	262*10	3.103	*(11.091)*
	Cumulative number of foreign firms	A	262*10	0.645	*(6.723)*
Initial economic conditions	Urban population (larger than 32,000 inhabitants), 1893	E	262	0.359	(0.481)
	Number of bank branches in 1850s	F	262	0.122	(0.496)
Taxation in late Ming Dynasty	Agricultural tax (10,000 stones)	G	160	17.441	(33.352)
Importance of prefecture	Rank in late Qing Dynasty	H	262	2.607	(0.972)
	Abundant in late Qing Dynasty	H	262	0.760	(0.428)

Notes: A: Chang 1989; B: Ge 2000; C: Shen 1978; D: Kun 1991. E: *"CHGIS, Version 4"* 2007; F: Yan 1955; G: Liang 2008; H: Liu 1993.

Table 2: Baseline Results

	(1) Firms/inhabitants (millions)					(2) Students/inhabitants (millions)				
	1899–1903 vs 1904–1908			1896–1903 vs 1904–1916		1899–1903 vs 1904–1908			1901–1903 vs 1904–1906	
	(1.1)	(1.2)	(1.3)	(1.4)	(1.5)	(2.1)	(2.2)	(2.3)	(2.4)	(2.5)
Post	0.244*	0.227**	0.249**	0.240***	0.245***	0.464*	0.690**	0.716**	0.971**	1.003**
*Ln(Quota/inhabitants)	(0.134)	(0.095)	(0.107)	(0.069)	(0.071)	(0.278)	(0.288)	(0.300)	(0.414)	(0.431)
Post*Coast			0.138		0.090			0.545**		0.688**
			(0.142)		(0.128)			(0.256)		(0.348)
Post*River			-0.009		0.074			0.494**		0.601**
			(0.164)		(0.192)			(0.239)		(0.305)
Post*Longitude			-0.041		-0.002			-0.017		-0.022
			(0.046)		(0.019)			(0.027)		(0.040)
Post*Latitude			0.026		0.002			-0.038		-0.070
			(0.035)		(0.020)			(0.064)		(0.092)
Post*Ln(area)		0.092	0.046	-0.026	-0.027		-0.139*	-0.130	-0.222*	-0.202
		(0.153)	(0.097)	(0.064)	(0.048)		(0.083)	(0.090)	(0.122)	(0.132)
Post*Ln(inhabitants)		-0.049	-0.011	0.050	0.046		0.311***	0.266***	0.418***	0.353***
		(0.093)	(0.050)	(0.043)	(0.032)		(0.079)	(0.084)	(0.113)	(0.121)
Prefecture FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province * Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,620	2,620	2,620	5,502	5,502	2,620	2,620	2,620	1,572	1,572
R-squared	0.097	0.099	0.102	0.113	0.113	0.437	0.441	0.444	0.456	0.460

Notes: a two-way fixed effects model is employed; standard errors are clustered at the prefecture level and reported in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3: Robustness Checks – Model Specifications

	Panel A: The establishment of modern firms						
	Firm /Inhab.	Firm (0/1)		# of Firms		Ln (# of Firms+1)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post*Quota/inhabitants $*10^{-3}$	2.682***	0.248***		0.645***		0.280***	
	(0.784)	(0.054)		(0.177)		(0.065)	
Post*Ln(Quota/inhabitants)			0.047***		0.144***		0.057***
			(0.017)		(0.053)		(0.017)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prefecture FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province * Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,620	2,620	2,620	2,620	2,620	2,620	2,620
R-squared	0.138	0.151	0.150	0.197	0.197	0.183	0.182
	Panel B: New overseas students in Japan						
	Stu. /Inhab.	Student (0/1)		# of Students		Ln (# of Students+1)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post*Quota/inhabitants $*10^{-3}$	2.944*	0.369***		1.818**		0.523***	
	(1.755)	(0.128)		(0.714)		(0.173)	
Post*Ln(Quota/inhabitants)			0.090***		0.411***		0.127***
			(0.026)		(0.133)		(0.035)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prefecture FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province * Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,620	2,620	2,620	2,620	2,620	2,620	2,620
R-squared	0.442	0.434	0.435	0.380	0.380	0.550	0.550

Notes: a two-way fixed effects model is employed; standard errors are clustered at the prefecture level and reported in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. Control variables (Z), province dummies, year dummies, and constant terms are included in the regressions but not reported.

Table 4: Robustness Checks – City and Western Penetration

	(1) Firms/inhabitants (millions)				(2) Students/inhabitants (millions)			
	(1.1)	(1.2)	(1.3)	(1.4)	(2.1)	(2.2)	(2.3)	(2.4)
Post*Ln (Quota/inhabitants)	0.215**	0.245**	0.231**	0.216**	0.540**	0.702**	0.704**	0.558**
	(0.109)	(0.106)	(0.103)	(0.107)	(0.260)	(0.300)	(0.301)	(0.257)
Post*Ln (City pop in 1893+1)	0.063**			0.027	0.326***			0.320***
	(0.028)			(0.027)	(0.085)			(0.090)
Duration of treaty ports		0.006		0.024		-0.029		-0.066
		(0.021)		(0.016)		(0.038)		(0.040)
Post*Duration of treaty ports		0.006*		-0.007*		0.020*		0.029**
		(0.003)		(0.004)		(0.011)		(0.015)
Ln (Cum. foreign firms+1)			0.016	-0.113			-0.240	0.296
			(0.120)	(0.131)			(0.310)	(0.197)
Post* Ln (Cum. foreign firms+1)			0.250***	0.328***			0.193	-0.525**
			(0.059)	(0.109)			(0.189)	(0.215)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prefecture FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province * Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,620	2,620	2,620	2,620	2,620	2,620	2,620	2,620
R-squared	0.104	0.104	0.109	0.110	0.454	0.447	0.445	0.457

Notes: a two-way fixed effects model is employed; standard errors are clustered at the prefecture level and reported in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. Control variables (Z), province dummies, year dummies, and constant terms are included in the regressions but not reported.

Table 5: Model Specification of RD Design – Bandwidth and Polynomials

Bandwidth	(1)	(2)	(3)	(4)	(5)	(6)	(7) Optimal Bandwidth
	(-0.5, 0.5)	(-0.6, 0.6)	(-0.7, 0.7)	(-0.8, 0.8)	(-0.9, 0.9)	(-1.0, 1.0)	(-0.55, 0.55)
A: No polynomial	0.290***	0.273***	0.282***	0.290***	0.303***	0.314***	0.287***
	(0.068)	(0.066)	(0.058)	(0.055)	(0.055)	(0.054)	(0.067)
R-squared	0.913	0.902	0.894	0.892	0.884	0.880	0.913
B: Linear polynomial	0.336***	0.313***	0.282***	0.222**	0.168*	0.167*	0.328***
	(0.110)	(0.102)	(0.094)	(0.094)	(0.094)	(0.085)	(0.104)
R-squared	0.914	0.903	0.894	0.893	0.888	0.888	0.914
AIC:	-166.979	-186.5	-219.473	-250.571	-261.306	-293.238	-185.301
C: Quadratic polynomial	0.469***	0.457***	0.415***	0.356***	0.338***	0.329***	0.494***
	(0.155)	(0.138)	(0.125)	(0.118)	(0.109)	(0.107)	(0.145)
R-squared	0.917	0.908	0.898	0.896	0.893	0.893	0.917
AIC:	-162.066	-184.191	-216.279	-246.839	-259.196	-292.345	-181.596
D: Cubic polynomial	0.434**	0.448**	0.462***	0.410***	0.355**	0.393***	0.411**
	(0.177)	(0.174)	(0.156)	(0.137)	(0.138)	(0.124)	(0.162)
R-squared	0.925	0.909	0.899	0.900	0.895	0.896	0.924
AIC:	-161.938	-177.462	-209.881	-243.673	-254.385	-289.154	-180.432
E: Quartic polynomial	0.603***	0.481***	0.410**	0.382**	0.358**	0.359**	0.588***
	(0.200)	(0.177)	(0.183)	(0.156)	(0.152)	(0.146)	(0.185)
R-squared	0.932	0.924	0.900	0.900	0.895	0.897	0.931
AIC:	-161.468	-184.843	-203.963	-237.239	-247.741	-283.031	-180.898
Optimal specification:							
Order of polynomial	1	1	1	1	1	1	1
Number of observations	72	81	92	101	107	116	77
< 0	36	43	50	56	60	66	41
≥ 0	36	38	42	45	47	50	36

Notes: robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. Control variables (Z), polynomials, the interaction terms between polynomials and "Important" entitlement, province dummies, and constant terms are included in the regressions but not reported.

Table 6: RD Estimates of the Effect of "Important" Entitlement in Late Ming Dynasty on other Economic Factors

Bandwidth	(1) (-0.5, 0.5)	(2) (-0.6, 0.6)	(3) (-0.7, 0.7)	(4) (-0.8, 0.8)	(5) (-0.9, 0.9)	(6) (-1.0, 1.0)	(7) Optimal Bandwidth (-0.55, 0.55)
(1) On the "abundant"	-0.336	-0.228	-0.283	-0.074	-0.074	-0.030	-0.190
	(0.425)	(0.396)	(0.353)	(0.313)	(0.296)	(0.275)	(0.398)
R-squared	0.496	0.413	0.427	0.427	0.365	0.359	0.437
(2) On the importance	-0.025	0.049	0.018	-0.008	0.036	0.061	0.059
	(0.165)	(0.158)	(0.143)	(0.139)	(0.129)	(0.129)	(0.162)
R-squared	0.435	0.393	0.358	0.352	0.288	0.280	0.419
(3) Ln (City pop in 1893+1)	-0.384	0.642	-0.108	-0.119	-0.157	-0.671	-0.687
	(2.373)	(2.210)	(1.972)	(1.876)	(1.653)	(1.682)	(2.184)
R-squared	0.528	0.491	0.468	0.434	0.432	0.387	0.523
(4) Ln (Bank in 1850+1)	0.153	0.095	0.072	0.045	0.030	-0.023	0.107
	(0.209)	(0.174)	(0.154)	(0.122)	(0.116)	(0.125)	(0.181)
R-squared	0.326	0.310	0.277	0.288	0.274	0.214	0.303
(5) Duration of treaty ports	5.774	5.851	5.861	4.250	5.159	4.886	7.167
	(10.052)	(8.776)	(7.340)	(6.167)	(5.929)	(5.548)	(9.387)
R-squared	0.443	0.421	0.373	0.367	0.348	0.317	0.439
(6) Ln (Cum. foreign firms+1)	-0.003	0.020	0.035	0.060	0.061	0.111	0.027
	(0.252)	(0.220)	(0.182)	(0.149)	(0.142)	(0.155)	(0.230)
R-squared	0.535	0.525	0.470	0.462	0.420	0.339	0.534
Number of observations	72	81	92	101	107	116	77

Notes: robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. Control variables (Z), polynomials, the interaction terms between polynomials and "Important" entitlement, province dummies, and constant terms are included in the regressions but not reported.

Table 7: The Effect on the Establishment of Modern Firms

Bandwidth	(1) Optimal Bandwidth (-0.55, 0.55)				(2) (-0.5, 0.5)	(3) (-0.6, 0.6)	(4) (-0.7, 0.7)	(5) (-0.8, 0.8)	(6) (-0.9, 0.9)	(7) (-1.0, 1.0)
The Second Step										
Post * Ln(Quota/inhabitants)	0.697***	0.582***	0.608*	0.582**	0.731***	0.677***	0.961***	0.904**	1.218***	0.956**
	(0.239)	(0.220)	(0.318)	(0.248)	(0.254)	(0.239)	(0.314)	(0.354)	(0.458)	(0.426)
The First Step	0.328***	0.494***	0.411***	0.588***	0.336***	0.313***	0.282***	0.222***	0.168***	0.167***
Post *D	(0.036)	(0.049)	(0.057)	(0.060)	(0.038)	(0.037)	(0.035)	(0.031)	(0.030)	(0.028)
Post*Linear polynomial	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Post*Quadratic polynomial		Yes	Yes	Yes						
Post*Cubic polynomial			Yes	Yes						
Post*Quartic polynomial				Yes						
Post*Polynomials *D	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prefecture FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province * Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	770	770	770	770	720	810	920	1,010	1,070	1,160
Baseline Results										
Post * Ln(Quota/population)	0.306***				0.310***	0.269***	0.164**	0.156**	0.121*	0.127*
	(0.080)				(0.084)	(0.072)	(0.080)	(0.075)	(0.068)	(0.068)
Observations	770				720	810	920	1,010	1,070	1,160
R-squared	0.291				0.295	0.278	0.208	0.196	0.206	0.223

Notes: standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. Control variables (Z), polynomials, the interaction terms between polynomials and "Important" entitlement, province dummies, and constant terms are included in the regressions but not reported.

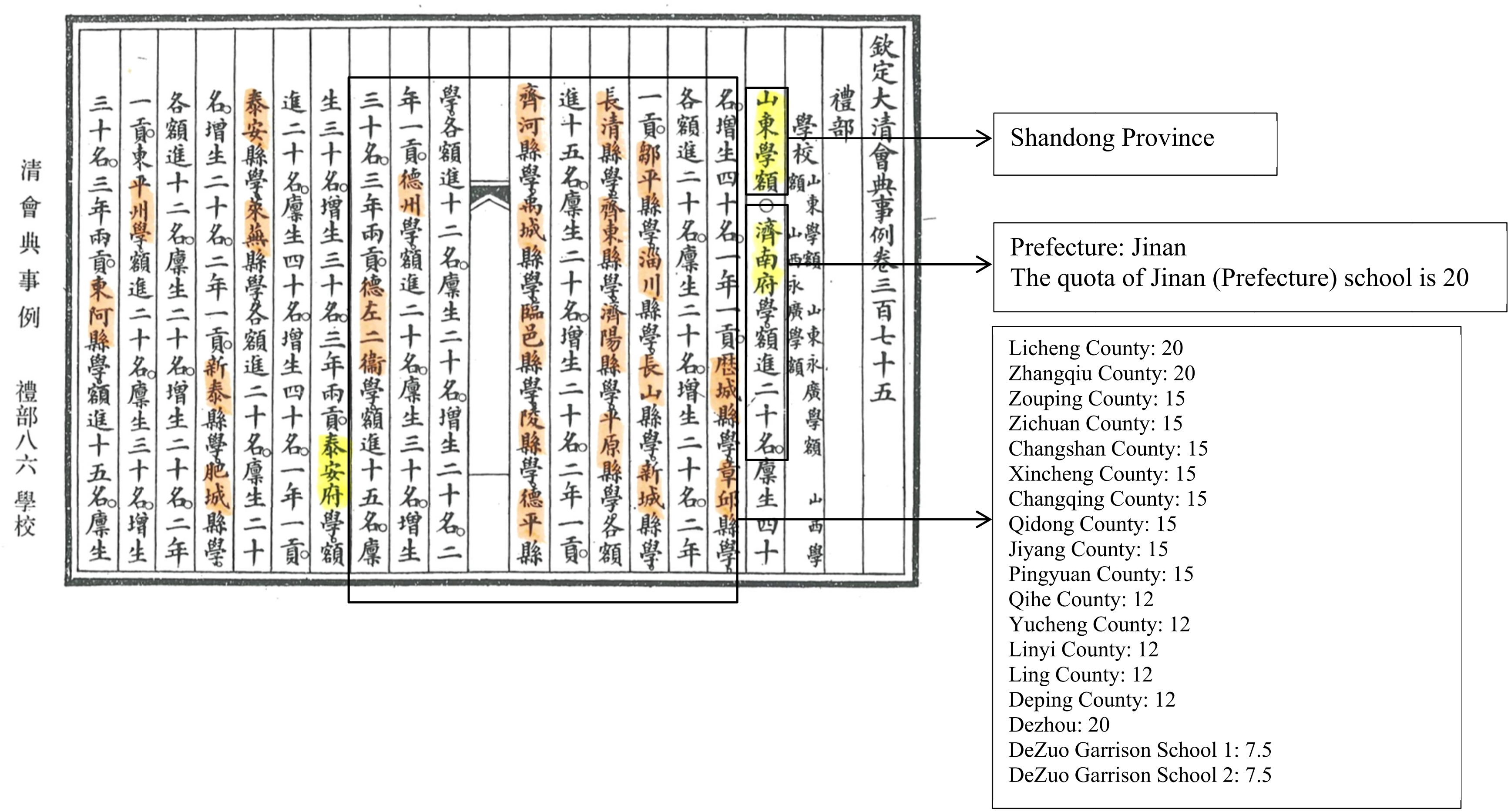
Table 8: The Effect on the Overseas Study

Bandwidth	(1) Optimal Bandwidth (-0.55, 0.55)				(2) (-0.5, 0.5)	(3) (-0.6, 0.6)	(4) (-0.7, 0.7)	(5) (-0.8, 0.8)	(6) (-0.9, 0.9)	(7) (-1.0, 1.0)
The Second Step										
Post *	3.711***	2.973***	2.382*	1.650*	3.647***	3.612***	3.000***	2.470**	3.328**	2.816**
Ln(Quota per 100,000)	(0.986)	(0.894)	(1.274)	(0.980)	(1.036)	(0.980)	(1.025)	(1.158)	(1.466)	(1.328)
The First Step	0.328***	0.494***	0.411***	0.588***	0.336***	0.313***	0.282***	0.222***	0.168***	0.167***
Post *D	(0.036)	(0.049)	(0.057)	(0.060)	(0.038)	(0.037)	(0.035)	(0.031)	(0.030)	(0.028)
Post*Linear polynomials	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Post*Quadratic polynomial		Yes	Yes	Yes						
Post*Cubic polynomial			Yes	Yes						
Post*Quartic polynomial				Yes						
Post*Polynomials *D	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prefecture FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province * Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	770	770	770	770	720	810	920	1,010	1,070	1,160
Baseline Results										
Post *	1.193***				1.122***	1.149***	0.992***	0.996***	0.788***	0.834***
Ln(Quota per 100,000)	(0.317)				(0.334)	(0.289)	(0.270)	(0.253)	(0.232)	(0.219)
R-squared	770				720	810	920	1,010	1,070	1,160
Observations	0.760				0.764	0.755	0.770	0.760	0.757	0.750

Notes: robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. Control variables (Z), polynomials, the interaction terms between polynomials and "Important" entitlement, province dummies, and constant terms are included in the regressions but not reported.

Appendix I: Coding Quota Data

The data come from the *Qing Hui Dian Shi Li* (Kun 1991), in which all schools and their quotas are listed. In each prefecture, there is one prefecture-level school and various county-level schools. I sum all quotas of all schools to obtain the total quota of each prefecture, as the following example shows.


欽定大清會典事例卷三百七十五
禮部
學校 額山東學額山西永廣學額山東永廣學額山西學
山東學額○濟南府學額進二十名○廩生四十
名○增生四十名○一年一貢○歷城縣學章邱縣學
各額進二十名○廩生二十名○增生二十名○二年
一貢○鄒平縣學淄川縣學長山縣學新城縣學
長清縣學齊東縣學濟陽縣學平原縣學各額
進十五名○廩生二十名○增生二十名○二年一貢○
齊河縣學禹城縣學臨邑縣學陵縣學德平縣
學各額進十二名○廩生二十名○增生二十名○二
年一貢○德州學額進二十名○廩生三十名○增生
三十名○三年兩貢○德左二衛學額進十五名○廩
生三十名○增生三十名○三年兩貢○泰安府學額
進二十名○廩生四十名○增生四十名○一年一貢○
泰安縣學萊蕪縣學各額進二十名○廩生二十
名○增生二十名○二年一貢○新泰縣學肥城縣學
各額進十二名○廩生二十名○增生二十名○二年
一貢○東平州學額進二十名○廩生三十名○增生
三十名○三年兩貢○東阿縣學額進十五名○廩生
清會典事例 禮部八六 學校

Appendix II: The Correlation between the Control Variables and Quota Density (log-term)

	(1)	(2)	(3)	(4)
Ln(population)	-0.370***	-0.335***	-0.526***	-0.381***
	(0.042)	(0.042)	(0.057)	(0.069)
Coast			0.053***	0.016
			(0.008)	(0.023)
River			0.012**	-0.013
			(0.006)	(0.027)
Longitude			-0.315***	-0.311***
			(0.114)	(0.105)
Latitude			0.043	0.289**
			(0.097)	(0.140)
Ln(area)			0.279***	0.133
			(0.084)	(0.081)
Province		Yes		Yes
Observations	262	262	262	262
R-squared	0.321	0.562	0.460	0.595

Note: robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix III: The Divergence between China and Britain

Data source: Allen et al. (2011)