Social Mobility and Revolution: The Impact of the Abolition of China's Civil Service Exam*

Ying Bai† and Ruixue Jia‡

July 21, 2014

Abstract

This paper studies how perceived social mobility affects participation in revolution using the case of the abolition of China's civil exam system that lasted over 1,300 years and served as a primary way of creating a gentry class. Employing a panel dataset across 262 prefectures and exploring the variations in the quota on the entry-level exam candidates, we find that higher quotas per capita were associated with a higher probability of having revolutionaries after the abolition and higher incidence of uprisings in 1911 that marked the end of the 2,000 years of imperial rule. This finding is robust to various checks including using the number of small rivers and short-run exam performance before the quota system as instruments. The pattern in the data appears most consistent with a model in which people perceiving more mobility under the exam system were more likely to be mobilized after the abolition of the exam. In addition, we document that modern human capital also contributed to the revolution and that social capital strengthened the effect of quotas on the participation in the revolution.

*We are grateful to Philippe Aghion, Davide Cantoni, Heng Chen, Julie Cullen, Gordon Dahl, Avner Greif, Gordon Hanson, Shuo Liu, Torsten Persson, Marit Rehavi, James Robinson, Gerard Roland, Guido Tabellini, Alan Taylor, Noam Yuchtman and the seminar/workshop participants at the NBER Summer Institute, CIFAR, Barcelona GSE Summer Forum, BREAD pre-conference, All-UC economic history conference, UC Davis, UCSD, UC Berkeley and UC Merced for their helpful discussions. Financial support from the Canadian Institute for Advanced Research is gratefully acknowledged.

†Division of Social Science, Hong Kong University of Science and Technology, rickybai@gmail.com

‡School of International Relations and Pacific Studies, University of California San Diego and CIFAR, rxjia@ucsd.edu.

1 Introduction

Social mobility is often considered an important element in determining the fate of political regimes. An increase in the prospect of upward mobility may facilitate the stability of a society by decreasing the likelihood of a revolution. For instance, Bourguignon and Verdier (2000) present a model on education and democratization and speculate that political leaders in France used public education to promote social mobility and create a middle class with less inclination towards revolution in the late 19th century. By the same token, the lack of perceived mobility may ignite and facilitate revolution. Zhao (2001) argues that the shrinking prospects for college students contributed to the Tian'anmen movement in 1989 in China.[1] More recently, Marlik and Awadallah (2013) point out that "the young who see little hope for economic and social mobility" played a central role in the Arab Spring, as the crony capitalism "denies a level playing field to potential aspirants and restricts economic mobility."

Despite many cases and conjectures, the link between social mobility (or the perceptions of social mobility) and political transitions has not been established empirically. The lack of solid evidence is not surprising, as social mobility often evolves together with other economic and political variables. This makes it difficult to find dramatic changes in mobility and evaluate its role in political transitions, independent of other variables. In this paper, we study a dramatic interruption in a mobility channel, namely the abolition of China's civil exam system. We examine how this abolition of the system that lasted over 1,300 years system affected citizens' participation in the revolution that was already ignited in the late 19th century. The revolution succeeded in 1911, replacing the over 2,000 years of imperial rule with a republic. We also examine a few other outcomes such as the incidence of uprisings in 1911 and party identification of revolutionaries in the republic.

The exam system was established in AD 605 and served as the primary way of creating a gentry class in the Ming and Qing dynasties until its abolition in 1905. As a system in theory open to men from all socio-economic background, the importance of the exam system on social mobility has been documented by historians.[2] For example, studying the biographies of the exam candidates in Ming (1368-1644) and Qing (1644-1910) dynasties, Ho (1959, 1962) shows that over 40 percent of those who succeeded in the highest level came from non-official backgrounds (i.e., neither their fathers nor grandfathers had earned a degree) and the number should be even higher for lower-level candidates, concluding that "probably more careers ran

[1] Zhao (2001) places the "pro-democracy" movement participants into two categories. While a few radical activists did take democracy as a primary goal, most students participated in the movement in reaction to China's rising market economy that changed the prospects of college education.

[2] Social mobility throughout this paper refers to the status change between the commoner class and the gentry class. The historians do not claim that the exam system was initially designed to promote social mobility. It is more likely that it was designed as a power-sharing system to promote political stability (Qian 1982). However, due to its open nature, it greatly affected social mobility, especially *perceived* social mobility. More generally, the exam system can be thought of as a type of inclusive institutions that contributed to political stability (Besley and Persson 2011, Acemolgu and Robinson 2012).

'from rags to riches' in Ming and Qing China than modern Western societies." Even though these estimates are sometimes criticized for not considering larger kin networks, it is agreed that the exam system greatly promoted *perceived* mobility (see Section 2.1 for more detailed discussions of related facts and debates).[3] With the abolition of the exam system in 1905, this channel of mobility no longer existed and a substitute institution that favored the elite arose.[4] As a result, the economic and political rewards were more likely to be distributed through ascription rather than exam achievement, which might have important consequences on political stability.

Indeed, scholars have conjectured the impact of the abolition on the success of the republican revolution a few year later. As remarked by Gilbert Rozman, "the year 1905 marks the watershed between old China and new; it symbolizes the end of one era and the beginning of another. It must be counted a more important turning point than the Revolution of 1911, because it unlocked changes in what must be the main institutional base of any government: the means of awarding status to the society's elites and of staffing the administration." (Rozeman 1982). Benjamin Elman also pointed out, "with the Republican Revolution of 1911, the imperial system ended abruptly, but its demise was already assured in 1904 when the Qing state lost control of the education system" (Elman 2009). Anecdotally, the association between the abolition of the exam and the success of revolution was also recognized by the leaders of revolutionary groups. Hu Hanmin, one of the key leaders of the *Kuomintang*, made a well-known emotional statement after the success of the revolution, "if the exam were not abolished, who would have followed our revolution?"

The abolition of the civil service exam system and the political transition of China from an imperial rule to a republican era are among the most important institutional changes in Chinese history. They provide a nice testing ground for the link between *perceived* social mobility and political transition. To link the abolition to the participation in the revolution, we have endeavored to collect a rich set of data from various sources and explore regional variations across 262 prefectures.[5] The variation across prefectures comes from differences in the quotas (after controlling for population sizes) under the exam system. The quota determined how many people could pass the entry-level exam in a prefecture. We use the quota (relative to the population size) as a measure of *perceived* mobility. We realize that the quota might capture other dimensions beyond mobility and will discuss various alternatives in details. We do not assume that the quotas were randomly assigned and will explore instrumental variables for them. But two aspects of the quota assignment bear emphasis.

[3]Benjamin Elman, whose works tend to emphasize the unequal aspects in succeeding in the exam, also points out that "the examinations, although unobtainable for them, affected even peasant belief in the value of education." Instead of blaming the system for inequality, Chinese turned to "fate" to explain the inequalities in the selection process (Elman 2013).

[4]See more discussions of the substitute in 2.1. The main message is consistent with that in Wang (1960): the link between political (and related economic) status and the investment in traditional education became much weaker for those without an elite background.

[5]A prefecture is the administrative level below the province. In the Qing dynasty, there were 18 provinces located in the traditional agricultural area, and each province has 10 to 20 prefectures.

First, the quota system was very stable in the Qing dynasty, except for an increase due to the need of repressing the Taiping Rebellion (1851-1864). We collect data for both the early Qing period (when the quota was initially assigned in 1724 and persisted until 1851) and the late Qing period (when the revised quota was introduced in 1873 and persisted until 1904) periods and use the latter quota to proxy the mobility in our baseline estimations. Second, the quota for a prefecture was assigned to the counties and the prefecture capital. The quota for a county (or a prefecture capital) followed a stepwise rule: the most common numbers are 8, 12, 15 and 20. The reason for using such a stepwise assignment is that the government needed a simplified way of implementing the quota system.[6] These two features of the quota assignment suggest that the quota could not be perfectly proportional to population and that they did not reflect changes in prefectures. As a result, there are great regional variations even if we control for population sizes and other prefecture characteristics. For instance, province fixed effects can only explain 30% of the variations in the quota across prefectures, leaving a large chunk of variations within provinces for us to explore.[7]

A second major dataset we construct is the number of registered revolutionaries in each prefecture between 1900 and 1906.[8] Naturally, it is impossible to get the information of all the participants in the revolution. The revolutionaries we can get are members of major revolution groups at the national level, who could motivate more participants at different local levels.[9] We are concerned about whether the missing of revolutionaries is random. This concern only matters if the missing was systematically correlated with the quota and changed before and after the abolition of the exam, which seems to be a strong assumption. Moreover, as a validity check, we collect another dataset to measure revolution activities. Based on reports from a major Japanese newspaper in 1911, we coded the spatial distribution of the uprisings in 1911 across China (known as the *Xinhai* Revolution as it was also the year of *Xinhai* in the sexagenary cycle of the Chinese calendar). We find a strong positive correlation between the cumulative number of revolutionaries and the incidence of uprisings. The latter information also allows us to link the impact on revolutionaries to the incidence

[6]This is a typical example of "state simplifications" discussed in James Scott's "Seeing like a State" (Scott 1998). Even if the state wanted to have a proportional system, it did not have the capacity of implementing such a complicated system.

[7]We would like to clarify two possible understandings of the quota system. First, it is sometimes thought that quotas are proportional to population sizes (Brandt et al., 2014). This is not true at the prefecture level due to the two features of the quota assignment emphasized here. Besides, the government did not really have the state capacity to implement a quota system proportional to the regional population, although the quota is naturally correlated with the population size. Second, because Zhengjiang and Jiangsu provinces were very successful in the national-level exam, people may think that the variations in the quota stem from province-level variations. This is not true for the prefecture-level exam either. In fact, we will explore within-province variations in our empirical analysis. These two thoughts may be more relevant for the national-level exam governed by a province-level quota system.

[8]The list of revolutionaries is compiled by Chang (1982). His primary source is the member rosters of revolutionary organizations that got disclosed after the success of the revolution. In addition, he also added members based on biographies and memoirs.

[9]For these early revolutionaries we are studying, their participation was voluntary. Therefore, the concern that the revolutionary groups tended to recruit more in certain regions is not very important.

of uprisings. Additionally, we construct a county-level dataset in Guangdong province where the earliest revolutionary group emerged. Since the majority of those revolutionaries in very early stage originated from Guangdong, this helps us trace the participants to even earlier periods. We complement the baseline prefecture-level analysis with the county-level information. We also collect a set of observable characteristics of prefectures to control for geographical characteristics, political and economic importance as well as urbanization.

To guide the empirical analysis, we introduce perceived mobility to the simple model on riots in Passarelli and Tabellini (2013), where one decides to participate in the revolution if the expected returns (determined by the perceived probability of moving upward the social ladder) are higher than the costs. Naturally, the perceived probability is increasing in quotas. This model does not aim to provide any new theory on revolution but to guide our empirical specifications. For example, the main prediction on quotas calls for a differences-in-differences strategy to evaluate the impact of quotas on revolution participation before and after the abolition of the exam. In addition, it predicts that the effect of quotas is strengthened by social capital.

In light of this framework, we use differences-in-differences as our baseline estimation strategy and compare the impact of the quotas before and after the abolition of the exam system. We find that a one standard deviation increase in the logged quota (0.57 after controlling for the logged population size) implies about six percentage points higher probability of having a revolutionary in the prefecture-level data between 1900 and 1906. Besides, cross-sectional results show that one standard deviation increase in the logged quota is associated with one percentage point higher uprising incidence in 1911. We also test the role of social capital using the number of temples and the diversity of languages (an inverse measure of social capital) in a prefecture as proxies. Existing literature has documented both positive and negative effects of social capital, but we have not noticed similar studies on how social capital may affect revolution.[10] Moreover, although we focus on mobility from the perspective of individuals in the simple model, the finding on social capital suggests group-level mobility might also be affected by the abolition of the exam. We do not disentangle the knotty relationship between individual mobility and group mobility.

The finding from differences-in-differences is robust to various checks including controlling for quotas at higher levels, controlling for various measures of the importance of a prefecture, and using county-level data from Guangdong where the earliest revolution group started and the data can be traced back to 1894. Besides these checks, we conduct two placebo tests to make sure that our finding is specific to the role of quotas and the abolition of the exam. The first test employs the incidence of the Boxer Rebellion between 1899 and 1901 as a placebo. Since the Boxer Rebellion was motivated by proto-nationalist sentiments and opposition to foreign imperialism and Christianity, it was correlated with ideology and conflict propensity.

[10]We will not give an overview of the large literature on social capital here. The role of social capital in revolution can be related to Satyanath, Voigtlander and Voth (2013), where they show that social capital facilitated the rise of the Nazi Party. However, different from the Nazi Party, the impact of the revolution on the society could be positive.

However, it was uncorrelated with the exam system and we would not expect that quotas affected its incidence. The second test employs grain price changes as a placebo and shows that the association between quotas and grain prices did not change dramatically before and after the abolition of the exam. This test suggests that the abolition of the exam itself did not necessarily imply dramatic changes in state capacity, as such dramatic changes might be reflected by grain prices.

Despite the fact that the quota system is relatively stable and has the stepwise feature, it is still conceivable that the quota may be correlated with omitted variables not captured by our robustness checks. If the impacts of the omitted variables differ before and after the abolition, our estimate from the differences-in-differences strategy would be biased. In particular, the selection of bureaucrats after the abolition is likely to be related to the omitted variables that are positively correlated with the quota. For example, political networks correlated with the quota system may influence the selection of bureaucrats after the abolition. This concern implies that our estimate from the differences-in-differences strategy is likely to be a lower bound. To deal with this concern of endogeneity, we further employ two instruments for the quotas based on geographical and historical features. We first use the number of small rivers (given the length of rivers) in a prefecture as our first instrument.This feature affects the number of counties and is positively correlated with the number of counties given population sizes.[11] Therefore, it increases quotas given population sizes because each county was usually assigned some quota. We conduct various placebo tests and show that this feature does not affect other dimensions such as transportation importance, agricultural suitability or climate shocks. The second instrument stems from historical roots of the quota assignment. In 1425, the regional quota system was initially introduced to balance the opportunity to pass the national exam and the assignment of quotas took into consideration the exam performance, especially in the most recent years before the system. Therefore, we use the short-run change in the number of successful candidates before 1425 as an instrument and show that it is positively correlated with the quotas but not the growth of the number of successful candidates in the long run. The estimates using the two instrument variables are generally larger.

We interpret the discontinuous change in the effect of quotas as change in perceived mobility. Consequently, people in prefectures with higher quotas were more likely to join the revolution with the abolition of the exam. Since mobility in this context was realized by investing in education, another way of interpreting our finding on the effect of the quotas is that the returns to the investment in the traditional education system got decreased more in regions with higher quotas. As these two interpretations essentially reflect the same channel, we do not attempt to disentangle them. However, we would like to compare these interpretations with a few other alternative hypothesis mentioned in qualitative historical studies. It is worthwhile clarifying that for any alternative factors to explain our main finding,

[11] This logic looks similar to Hoxby (2000) and Hatfield and Kosec (2013), while the channel is different since rivers did not serve as county boundaries but affected administrative costs in China. See Section 5.3 for more discussions.

they have to be systematically correlated with quotas and have a discontinuous effect before and after the abolition of the exam. We consider the three major alternative hypothesis including the modernization hypothesis, the economic shocks hypothesis and the ideology hypothesis. Compared with these alternatives, the mobility channel is more consistent with the data pattern. However, this is by no means to say that mobility was the only factor that contributed to the revolution. In fact, we find other factors such as modern human capital (proxied by the number of students studying in Japan) did have a positive impact on revolutionaries. However, its impact did not differ before and after the abolition of the exam and hence cannot explain our finding on the quota.

This study contributes to a few lines of literature. The role of mobility in this context resonates that in the literature on how social mobility determines attitude toward redistributive politics. For example, Benabou and Ok (2001) formalizes the POUM (prospect of upward mobility) hypothesis where the poor do not support high levels of redistribution because of the hope that they or their offspring may make it up the income ladder. This hypothesis is in general consistent with empirical evidence from the US (Alesina and La Ferrara 2005), Russia (Ravallion and Lokshin 2000) and a set of OECD countries (Corneo and Gruner 2001). Little evidence on this hypothesis comes from authoritarian regimes, as it is unclear how redistribution can be realized without a democracy. In this perspective, revolution can be thought of as a way to achieve redistribution. However, unlike the rich evidence on mobility and redistribution, the thin literature linking social mobility and revolution is only theoretical. For example, Leventoglu (2005, 2013) introduces mobility to the political transition framework in Acemoglu and Robinson (2001).[12] Our study provides empirical evidence on the role of social mobility in political transitions, where we have not noticed existing quantitative evidence.

The mobility perspective is also related to a literature on expected returns from education and participation in revolution. One interpretation of the modernization hypothesis in Huntington (1968) is that there is a mismatch of higher education in many modernizing countries and economic opportunities for the educated. This mismatch leads to the frustration of the educated and they become inclined bodies of revolution. Campante and Chor (2012) provide some evidence for this mismatch in the case of the Arab Spring. Seen in this light, with the abolition of the exam in 1905, the economic and political returns to the investment in the civil service exam system decreased significantly, which was highly correlated with perceived mobility. However, the discontinuous effect of the exam quota before and after the abolition is unlikely to be driven by those educated under the modern system.

Moreover, besides the mobility perspective, the roles of modern human capital and social capital in revolution documented in this paper also contribute to understanding revolutions and their participants. Our finding on the quota and modern human capital suggests that different groups could have contributed to the revolution.[13] Our finding on how social cap-

[12] In a previous version, we apply this framework to explain our finding. In the current version, we use a different framework to introduce the role of social capital.

[13] As pointed out in Huntington (1968), "a revolution necessarily involves the alienation of many groups

ital facilitates the complementarity in participation in revolutionary organizations may be applied to other contexts of revolution.

Finally, our study contributes to understanding two critical historical events in Chinese history: the abolition of the civil service exam system and the republican revolution of 1911. Our findings provide systematic evidence for the conjectures in Rozeman (1982) and Elman (2009). Our finding does not imply that the abolition of the exam *caused* the revolution but it clearly *facilitated* the revolution by providing a large pool of potential participants.

The rest of the paper is organized as follows. Section 2 discusses the historical background and presents the data. Section 3 presents a model to guide the empirical analysis. Following the model, Section 4 presents the baseline results, while Section 5 discusses robustness checks. Section 6 presents tests related to a few alternative hypothesis. Section 7 concludes.

2 Historical Background and Data

In this section, we combine the discussion of the exam system, its abolition and the revolution and the presentation of data. We only present the major variables here and will introduce more data in our empirical analysis.

2.1 The Civil Service Exam System and Its Abolition

The Structure of the Exam The civil service examination system was established in AD 605 during the Sui Dynasty (581-618). It was designed to select the best potential candidates to serve as administrative officials, for the purpose of recruiting them for the state's bureaucracy. 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). 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.

The structure and process of the civil examination system remained stable especially in the late imperial period (the Ming and Qing dynasties). The contents of all the examinations were dominated by the Confucian classics – the Four Books and the Five Classics (Elman, 2000). Figure 1 illustrates the basic structure of this system, consisting of three stages of exams. The entry level is a prefecture-level licensing examination (*Yuankao* in Chinese) held in the prefecture capital after the annual primary testing in the county seat. This level of examination took place twice every three years. The candidates who passed the prefecture-level examination were termed "the Literati" (*Xiucai* in Chinese). The second level is a triennial provincial-level qualifying examination (*Xiangshi* in Chinese) in the provincial capital. The successful candidates were termed "the Recommended Man" (*Juren* in Chinese). The third level is a national examination (*Huikao* in Chinese) taking place in

from the existing order...Only a combination of groups can produce a revolution."

the the capital, with re-examination to rank the candidates in the imperial palace (*Dianshi* in Chinese). These candidates are termed "the Presented Scholar" (*Jinshi* in Chinese). These candidates at different levels and their family members constituted the gentry class, who played an important role in organizing the society (Chang 1955).

The degree or title of each level carried different political power, which was highly correlated with economic income. At the lowest level, the candidates who passed the prefecture-level examination became the lower gentry class, who were exempted from taxes and corporal punishment. Although the title was primarily a political status, it also provided the opportunity to manage local affairs, become secretarial assistants to officials, and to teach – three important sources of income for Chinese gentry (Chang 1962). Those who passed the provincial and national levels belonged to higher gentry class. The highest 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 the policies of the central government, all of which provided "the greatest opportunity for the rapid accumulation of wealth" (Chang 1962).[14]

The Exam as a Mobility Channel Historians have made many influential contributions to understand how the exam system works and its impacts. Here, we point out three facts related to mobility based on our data and influential historical studies (Edmunds 1906, Krack 1947, Chang 1955, 1962, Ho 1959, 1962, Rawski 1979, Hymes 1986, Elman 2000, 2013). Following these facts, we describe our data on the quotas.

F1: the exam was in principle open to people from all socio-economic backgrounds and hence had significant impacts on perceived mobility. In theory, every male could take the exam regardless of his background. There was no limit on age or on the number of attempts. In practice, the exam takers needed to invest in preparing for the exam and forgo the opportunities to work, which hindered people from very poor families to take the exam (Elman 2000). Despite some cost of entry, a large literature has documented that the exam was a fairly efficient mobility channel based on the biographies of exam candidates.[15] On average, the literature documents that 40-60 percent of successful candidates came from non-official backgrounds (i.e., neither their fathers nor grandfathers had earned a degree). Using a different method, Hsu (1949) studied the background of prominent individuals mentioned in the gazetteers of four widely separated regions in China and found that roughly 50 percent of the local prominent individuals came from unknown origins and roughly 80 percent of the descendants beyond the grandson generation of the local predominant became unknown. He

[14] According to the estimate in Chang (1962), the gentry class received about 24 percent of the national income, even though they constituted only about 2 percent of the population.

[15] Kracke (1947) examines the candidate lists in the Song dynasty and demonstrates that approximately 60 percent of all successful candidates came from non-official backgrounds (i.e., neither their fathers nor grandfathers had earned a degree). Chang (1955) indicates that at least of 35 percent of the gentry class in the 19th century were "newcomers" (neither their fathers nor grandfathers had held gentry status.) Studying the biographies of the candidates in Ming and Qing dynasties, Ho (1962) finds that over 40 percent of those succeeded in the highest level (i.e., the presented scholars) came from non-official backgrounds.

also pointed out that the fairly high degree of mobility was driven by the civil service exam system.

The exact estimate on inter-generational mobility can be debatable.[16] What matters more for political stability is the *perceived* mobility: even if the probability of success for the commoner class was smaller than the current estimates available, the open nature of the exam system gave commoners hope to move up the social ladder.

F2: the exam system matters for the prospect of a large amount of population. Chang (1955) estimated that the population of the gentry class (equal to or above the *Xiucai*degree) accounts for about 1 to 2 percent in the total population. The relevant question is how many people were competing for the gentry slots. While the total quota for *eac*h prefecture-level exam that took place twice every three years was around 30,000, at two million people registered for *each* prefecture-level exam (Elman 2013). Another benchmark estimate to understand the importance of the exam system is the male literacy rates. For example, Rawski (1979) estimates that the literacy rate for the male population is around 30 to 45 percent thanks to the exam system.

On top of the exam-takers, in family-centered society, an additional large number of people were actually involved in the system because of their family members' lifelong participation in the exam. As a result, the effect of the mobility opportunities got amplified (Wang 2013).

F3: the numbers of successful candidates in each level are controlled by a quota system at different administrative levels. The quota for the prefecture-level examination was at the prefecture level whereas the quota for the exams at higher level was assigned at the province level.[17] The quota system worked as an institutional means to confine and regulate the power of elites (Elman 2000). It also allowed to recruit officials from different parts of the country.

To proxy the perceived mobility across regions, we collect three sets of data on the exam candidates:

(i) the quota for the candidates who can pass the entry-level exam. This is our main measure of perceived mobility for a large group of citizens across prefectures (after considering population size and other factors). The data comes from the Imperially Established Institutes and Laws of the Great Qing Dynasty (Qinding da Qing huidian shili, edited by Kun, Gang et al.). The quota for a prefecture is the sum of the numbers for the counties and the prefecture capital (Figure A.2 in the web appendix gives an example of how the quotas were recorded).

[16]This line of research is sometimes criticized for not considering the background of extended families (Hymes 1986). Conceptually, including larger kin network or lineage could decrease the estimates and reveal more advantages of those from elite families than focusing on grandfather-father-son associations. However, using detailed inter-generational data, Campbell and Lee (2003) finds "even though distant kin influenced the chances of obtaining a title, kin networks did not monopolize opportunities".

[17]The quota for the prefecture-level examination was assigned to the counties and the capital in a prefecture. As people in the counties could also compete for the quota at the capital, it was binding at the prefecture level.

There was no standard formula for the regional quota, but two features of the assignment deserve emphasis. First, quotas assigned to the counties and the prefecture capital in a prefecture followed a stepwise rule: the most common numbers are 8, 12, 15 and 20. Figure 2 plots the frequency of numbers for a county (and a prefecture capital). As it shows, the four most frequent cases account for over 70% of all the cases. Due to this feature, there are a lot of variations across regions for us to explore, even though a higher quota is naturally correlated with the size and the importance of the administrative units (Chang 1955). For example, other things being equal, a prefecture with more counties tend to have a higher quota. Later, we will explore such variations as an instrument.

Second, the quota system is relatively stable during the Qing dynasty. The quota assigned in 1724 persisted until 1851, when the civil war (the Taiping Rebellion) started and the government increased quotas to encourage contribution to the fight. After the war, the revised quota assigned in 1873 persisted until the abolition of the exam. We collect the quota data for both the early Qing (1724-1851) and the late Qing (1873-1904). Our main analysis focuses on the quota at the latter period as it is closer to the revolution. During this period, the average prefecture quota was 113.8 with a standard deviation of 75.7 (see Table 1 for more summary statistics).

Our empirical analysis focuses on the variations in the quota at the prefecture level while controlling for province fixed effects. This helps us take into consideration potential confounding factors at the province level. In fact, the province fixed effects only explain 30% of the variations in the quota, leaving a large chunk for our exploration within provinces.

(ii) the origin of candidates who succeeded in the highest-level exams (i.e., the presented scholars) and the origin of all the key officials. The number of presented scholars was controlled by a province-level quota. The data comes from Zhu and Xie (1980) and Qian (2005), which list the name, and county of origins of all the presented scholars and key officials (higher than or equal to the level of vice-provincial governors). We count the number of presented scholars and key officials in each prefecture to measure the possibility of moving up to the top of the social ladder. Around 27,000 presented scholars came out of all the 112 national exams in the Qing dynasty. Over 90 percent of the 4,200 key officials held a presented scholar degree.

(iii) county-level quota for Guandong, where the revolution started. The data comes from the same source as in (i). The limitation of this data is that it misses the quota at the prefecture capital. However, the data on revolutionaries in Guangdong can be traced to earlier years, which complements our baseline of a short-run analysis.

Figure 2 maps the spatial distribution of quotas as well as quotas per million of individuals. Among the 262 prefectures, the quota ranges from 2 (Maogong Ting in Sichuan) to 423 (Shuntian Fu where the capital was located). Table 1 provides the data sources and summary statistics for these variables.

To show that the quotas mattered, we link the quota for a prefecture to the number of presented scholars and key officials from each prefecture during the Qing dynasty (1644-1904), while controlling for province fixed effects and population sizes in the mid-Qing period.

The results are presented in panel (a) of Table 2. Columns (1)-(3) present the results for presented scholars and columns (4)-(6) present the results for key officials. Standardized coefficients are reported. They show that the number of presented scholars and key officials from each prefecture is highly correlated with the quota: a one standard deviation increase in the quota would yield a 0.5-0.6 standard deviation increase in the the number of presented scholars and key officials.[18] These results show that the quota played an important role in determining political newcomers across prefectures. Therefore, it is conceivable that the quotas affected perceived mobility.

The Abolition and the Adverse Impacts on Commoners In the late Qing period, China was defeated in a series of wars against the West: the First Opium War, the Second Opium War, the Sino-French War, the Sino-Japanese War and others. The exam system was seen by many intellectuals as the root of the underdevelopment of China. For example, the exam sought out men who are "obedient to their elders" rather than candidates with technical knowledge or political ability. Besides, the exams focused on reciting the classics and did not include modern Western topics such as engineering and science (Castrillon 2012).

Motivated by the criticisms leveled against the exam system, several reforms led to the decline and eventual abolition of the exam system. Franke (1960) provides a detailed description of the process. In 1901, the format of the exam essay (known as the eight-legged essay because the essay had to be divided into eight sections) was relaxed and the three-level exam structure was retained. In late 1903 and early 1904, the Committee on Education submitted a memorandum urging the abolition of the examination system. The memorandum received imperial approval on 13 January 1904, indicating that the exam would be abolished within the next five to ten years. In 1905, The Empress Dowager Cixi endorsed a memorandum ordering the discontinuance of the old examination system at all levels. One external factor behind the abolition is the Russo-Japanese War of 1904-05 (Franke 1960). The success of Japan was attributed to the Meiji Restoration and Modernization, which set an example for the Qing dynasty.

Along with the abolition, the dynasty hoped to switch to a modern Western-style education system. The intention of the reform was to modernize China. However, the modern school system favored the elite by making study abroad the decisive stage of Chinese education and by affording privileges only to those who had studied abroad (Castrillon 2012). In his study on social mobility in this transition, Wang (1960) points out "whereas under the old scheme a scholar with limited financial resources had a good chance to succeed, under the new one the opportunity to receive higher education was virtually limited to a small group of men from official, professional, and mercantile families". He finds that foreign-trained Chinese received almost four times the salary of holders of the first degree. Yuchtman (2010) finds that high-paying jobs at the Tianjin-Pukou railroad were practically reserved for in-

[18]To deal with observations of zero, we add different positive numbers when use logged numbers and also use a dummy to indicate whether there was a presented scholar or an official. The patterns across periods presented are robust to these different measures.

dividuals with a modern education. These facts effectively discouraged the large group of individuals who had invested in the traditional system. Even if some of them switched to the new system and got a higher salary than the case with a traditional education background, the link between their education and their political status got interrupted without an elite background.

To examine the change in perceived mobility before and after the abolition of exam, we examine the link of quotas and the origins of political newcomers. For the period before the abolition, the political newcomers were the presented scholars that succeeded in the national exam who were eligible to become top officials. After the abolition, the government selected people with foreign-education background and gave them a degree of quasi-presented scholars. Panel (b) of Table 2 presents the correlations between the quota and the number of newcomers in 1904 (before the abolition) and in 1907 (after the abolition). They show that the importance of the quota in determining the number of newcomers decreased significantly after the abolition (the standardized coefficient of the quota changed from 0.30 to 0.13). The impact of the incumbents became more important relative to that of quotas.

Consistent with the qualitative historical studies such as Wang (1960), our quantitative evidence implies that the abolition of the exam could have adverse impacts on perceived mobility for the commoners in two dimensions. Across prefectures, ceteris paribus, those enjoyed a higher quota got a larger negative shock with the abolition of the exam. Within prefectures, the commoners were more likely to be hurt than those politically connected elites. Our empirical analysis will focus on the first dimension, exploring the variations in the quota assignment.

2.2 The Revolutionaries and the Uprisings in 1911

The Origins of the Revolutionaries In the 1890s, a few underground anti-Qing groups, with the support of Chinese revolutionaries in exile, tried to overthrow the Qing dynasty. These groups arose mainly in response to the decline of the Qing state, which had proven ineffective in its efforts to modernize China and confront foreign aggression, and was exacerbated by ethnic resentment against the ruling Manchu minority. The earliest revolutionary organizations were founded outside of China. For example, Sun Yat-sen's *Xingzhonghui* (Revive China Society) was established in Honolulu in 1894 and spread to Hong Kong and Guangzhou in Guangdong province.

Chang Yu-fa at the Academia Sinica is an influential historian studying revolutionary groups during this era. Chang (1982) describes the background of six major groups during 1900-06 and provides the lists of registered revolutionaries. His primary source is the member rosters of revolutionary organizations that got disclosed after the success of the revolution. In addition, he also added members based on biographies and memoirs. The six groups are as follows:

(i) *Xingzhonghui* (the Revive China Society) established in Honolulu in 1894;

(ii) *Junguomin Jiaoyuhui* (the Society of National Military Education) established in

Japan in 1903;

(iii) *Huaxinghui* (the China Arise Society), which was established in Changsha in 1903 and spread to Wuchang, Shanghai and other regions;

(iv) *Guangfuhui* (the Revive the Light Society), which was established in Shanghai in 1904 and spread to Zhangjiang and Anhui provinces;

(v) *Tongmenghui* (the Chinese Revolutionary Alliance), which united Xingzhonghui (Revive China Society) and Huaxinghui (China Arise Society) in 1905, attracting participants across China and later formed the nucleus of the Kuomintang (the governing political party of the republic);[19]

(vi) *Rizhihui* (the Society for Daily Improvement), which was established in 1905-6 in Wuhan and was more influential in Hubei and Hunan.

In 1907, *Tongmenghui* was divided into many groups. As a result, a systematic data on the lists of major revolutionary groups were only available until 1906. The revolution consisted of many revolts and uprisings. The turning point was the Wuchang Uprising in Hubei Province on October 10, 1911. The revolution ended with the abdication of the "Last Emperor" Puyi on February 12, 1912, which marked the end of over 2,000 years of imperial rule and the beginning of China's republican era.[20] We will also link the number of revolutionaries to the uprisings in 1911.

Based on the information of the six major groups that provides a revolutionary's name, county of origin and the year of joining the organization, we construct a dataset of prefecture-level revolutionaries across China between 1900 and 1906. This is the period when the revolution was spreading across the whole country. During this period, the origins of participants were widely distributed. The 1,277 recorded participants with identifiable origins came from 151 prefectures (across 17 out of the 18 provinces). The lowest share was 1.4% (from Shaanxi in the west) and the highest share is 11.93% (from Hubei). Related summary statistics are presented in Table 1. In our empirical analysis, we look at both the number of participants as well as whether there were any participants.

The main concern is the selection of registered revolutionaries. For this concern to matter for our analysis, the selection of registered revolutionaries needs to be systematically correlated with the quota and differs before and after the abolition of the exam, which seems to be a strong assumption. Nevertheless, as a validity check of the data, we collect a second dataset on the uprisings in 1911 from a major Japanese newspaper.

We are also concerned about whether the early records are less precise than late records.

[19] As the data on the members in *Tongmenghui* was already collected in Luo (1958), Chang (1982) only provides the information on the founders. We also add the information on members in Luo (1958).

[20] The new republic is by no means a well-functioning democracy. The central authority waxed and waned in response to warlordism (1915–28), Japanese invasion (1937–45), and the Chinese Civil War (1927–49), with central authority strongest during the Nanjing Decade (1927–37), when most of China came under the control of the *Kuomintang*. Figure A.1 in the appendix shows the polity scores of China between 1890 and 2000. As it shows, although the republican period had better scores than the previous dynasty (before 1911) and the following People's Republic of China (after 1949), China only obtained a positive score once in the year of 1912.

We construct a county-level dataset for in the province where the revolutionary groups started, namely Gongdong between 1894 and 1906. We complement the prefecture-level analysis with the county-level analysis within Guangdong.

The Uprisings in 1911 The *Xinhai* Revolution in 1911 consisted of many revolts and uprisings in a very short episode, which echoed the Wuchang Uprising in October, 1911. The information on them was followed by Japanese newspapers. On 3 November 1911, the Tokyo Nichi Nichi Shimbun (the Tokyo Daily News) provided a detailed map on the incidence of uprisings across China. We code the information to be a dummy variable indicating whether there was any uprising in a prefecture in 1911. The mean and standard deviation of the variable are 0.16 and 0.37. Note that this information only includes the early uprisings, while there were still uprisings in December 1911. Therefore, it is reasonable to think of them as the echoing by existing revolutionaries in a short episode rather than slow diffusion of the uprisings.

This data helps us further check the reliability of the revolutionary data we collect. Indeed, we find that the incidence of uprising is highly correlated with the number of revolutionaries. Specifically, the correlation between the cumulative number of revolutionaries during 1900-06 and the incidence of uprising is 0.33 and significant at one percent level (Figure A.3 in the appendix maps the spatial distribution of the uprisings and that of origin of revolutionaries). Meanwhile, using this information, we can also link the number of revolutionaries to the incidence of uprisings.

Quotas and Political Newcomers Before and After the Revolution We have shown the change in the impact of the quota on the political newcomers before and after the abolition in panel (b) of Table 2. We would also like to know how revolution changed the impact of the quota. The challenge is to collect comparable data. There was no information similar to the presented scholars after the revolution. So we turn to an additional set of comparable information: information on the parliament members. After the abolition of the exam, the Qing government adopted the parliament system in 1908 which was argued to be controlled by incumbents. When the Qing was replaced by the Republic, the parliament was also replaced by an elected parliament. We collect information on the origins of parliament members in 1908 (in the Qing dynasty) and in 1912 (in Republic of China) and use the same specification as in panel (c) of Table 2. We are interested in the role of the quota and the incumbents in determining the composition of parliament members.

As shown in panel (c), the importance of the incumbents decreased significantly after the revolution (changing from 0.396 to 0.166). Meanwhile, the role of the quota got recovered (changing from 0.182 to 0.456). This finding is consistent with the fact that more revolutionaries got rewarded after the success of revolution from the prefectures with higher quotas.

2.3 Prefecture Characteristics

We collect five sets of prefecture characteristics as follows.

Population size and area size Since we employ the logged quota as our main explanatory variable, to control for the size effect, we include the logged population size in 1880. Moreover, we also control for the logged area of the prefectures. As a robustness check, we also use the quota per million people as an alternative explanatory variable.

Geography Due to potential importance of geography, we include two dummy variables: coast – whether a prefecture is situated on the coast and major rivers - whether a prefecture is located along major rivers (those ranked first and second in the river hierarchies). Approximately 13.4 percent of the sampled prefectures are located on the coast and 61.8 percent are along the major rivers. These information is based on CHGIS.

Foreign influence Part of China was forced to open to trade after the first opium war (1839-42). The regions forced to open were known as treaty ports. Following the openness, new knowledge and economic forces began to penetrate China's economy, which might be correlated with the diffusion of revolutionary thought. Therefore, we use treaty ports indicators to control for the possible effect of foreign influence. 11.45 percent of prefectures had treaty ports in 1904, based on Yan (1955).

Urbanization The participation of revolution might also be correlated with economic conditions. We would like to have measures such as urbanization. Rozman (1974) provides classifications of Chinese cities: big cities were those with a population of 300,000 and up, middle-level cities between 70,000 and 300,000, and small cities between 30,000 and 70,000. According to these criteria, 19.84 percent (52 prefectures) of the prefectures are classified as small cities, 12.21 percent (32 prefectures) as mid-sized cities and 3.82 percent (10 prefectures) as big cities.

Political and economic importance Besides these baseline controls, we also construct a dataset to measure the importance of a prefecture. These measures include (i) whether a prefecture is a provincial capital, (ii) the land tax per capita in 1820 (Liang 1981) and (iii) the designations by the government indicating whether a region belongs to four groups: *chong* (important in transportation/communication), *fan* (import in business), *pi* (difficult to gather taxes) and *nan* (high in crimes). The designation information is available for both counties and prefectures and is coded based on Liu (1993).

3 A Simple Model of Revolution Participation

To guide the analysis of the data, we present a simple model of revolution participation, which introduces mobility to the simple framework in Passarelli and Tabellini (2013).[21] The aim of the model is not to present a general theory of revolution but to guide the empirical specifications. In addition, it delivers additional predictions that can be further tested.

Setup and Analysis There are two type of agents in economy: the poor commoners with income w_0 and the small group of rich elites with income w_1, where $w_1 > w_0$. Under the status quo without revolution, a commoner perceives that he will become a rich elite in the next period with probability $\eta_0(q)$ and stay as poor with probability $1 - \eta_0(q)$, where q indicates quota per capita and η_0 is increasing in q.[22] The abolition of the exam can be thought of as a decease in $\frac{\partial \eta_0(q)}{\partial q}$.

The commoner decides whether or not to participate in revolution. If revolution succeeds, the probability of becoming rich becomes $\eta_1(q)$ instead of $\eta_0(q)$. Joining a revolution is costly. The cost is the sum of two components: $\mu + \varepsilon^i$, where μ is known and common to all agents and ε^i reflects individual heterogeneity. ε^i follows a distribution $G(\varepsilon)$, which is continuous and has density $g(\varepsilon)$.

Following Passarelli and Tabellini (2013), we use a simplified way to capture the complementarity in participation, namely that the benefit of participation grows proportionately with the number of other members also participating in the revolution, $p\lambda$. λ captures the strength of complementarity. One natural interpretation of λ is the role of social capital: in regions with more social capital, the benefits are higher, reflecting a stronger identity or more easiness of coordination.

Given the cost and benefit of revolution, a poor agent i participates in the revolution if:

$$p\lambda[\eta_1(q) - \eta_0(q)](w_1 - w_0) - \mu - \varepsilon^i \geq 0.$$

The probability of participation becomes a fixed point of the following condition:

$$p = G(p\lambda[\eta_1(q) - \eta_0(q)](w_1 - w_0) - \mu). \tag{1}$$

We focus on the interior solution.[23] The revolution condition gives the following compar-

[21] Passarelli and Tabellini (2013) use the model to explain how emotions affect participation in riots. In our context, emotion per se is less important given that participating in revolutionary groups was very risky, although the decrease in perceived mobility was very likely to be correlated with frustration.

[22] Similarly, a rich agent perceives that he will become poor in the next period with probability η_0^r and stay as rich with probability $1 - \eta_0^r$. The question of their participation in the revolution is trivial.

[23] Similar to Passarelli and Tabellini (2013), we assume $\lambda(\eta_1 - \eta_0)(w_1 - w_0)g(p\lambda(\eta_1 - \eta_0)(w_1 - w_0) - \mu) < 1$ to rule out the case of multiple equilibria.

ative statics:

$$\frac{\partial p}{\partial q} = \frac{gp^*\lambda(w_1 - w_0)[\frac{\partial \eta_1(q)}{\partial q} - \frac{\partial \eta_0(q)}{\partial q}]}{1 - g\lambda(\eta_1 - \eta_0)(w_1 - w_0)} \tag{2}$$

Under the civil exam system, equation (2) captures the impact of quotas on revolution participation. After the abolition of the exam, the link between quotas and upward mobility chance decreases: $\frac{\partial \eta_0(q)}{\partial q}$ is decreased to $\frac{\partial \eta_0'(q)}{\partial q}$. As a result, the comparative statics after the abolition of the exam becomes:

$$\frac{\partial p'}{\partial q} = \frac{gp^*\lambda(w_1 - w_0)[\frac{\partial \eta_1(q)}{\partial q} - \frac{\partial \eta_0'(q)}{\partial q}]}{1 - g\lambda(\eta_1 - \eta_0)(w_1 - w_0)} \tag{3}$$

The difference between equations (3) and (2) gives the impact of quotas on the participation before and after the abolition of the exam:

$$\frac{\partial p'}{\partial q} - \frac{\partial p}{\partial q} = \frac{gp^*\lambda(w_1 - w_0)}{1 - g\lambda(\eta_1 - \eta_0)(w_1 - w_0)}[\frac{\partial \eta_0(q)}{\partial q} - \frac{\partial \eta_0'(q)}{\partial q}] > 0. \tag{4}$$

Predictions The fact that $\frac{\partial \eta_0'(q)}{\partial q} < \frac{\partial \eta_0(q)}{\partial q}$ has been discussed and documented in Section 2.1. Therefore, equation (4) implies that individuals of status w_0 is more likely to participate in the revolution in prefectures with higher q after the abolition of the exam. The test of this prediction calls for a differences-in-differences strategy: the first difference is with respect to q and the second difference is with respect to the abolition of the exam.

In addition, this simple model also delivers a few other predictions. For example, the impact of q is strengthened by inequality $(w_1 - w_0)$ and social capital (λ). We do not have information on inequality in this period. However, we can explore regional social capital to test whether it strengthened the impact of quotas.

4 Baseline Results

Our baseline results comprise of three parts. First, we estimate the impact of quotas on the origins of revolutionaries before and after the abolition of the exam. Second, we link this impact to the incidence of early uprisings in the 1911 Revolution. Third, we test the prediction on the role of social capital.

4.1 Linking the Quotas to the Revolutionaries

Before and After the Abolition Our baseline estimations are based on data across 262 prefectures between 1900 and 1906. To examine the impact of quotas on the participation of revolutionary groups before and after the abolition of the exam system in 1905, we use a

difference-in-difference strategy, following equation (4). The specification is as follows:

$$\mathrm{R}_{p,t}=\beta \ln \mathrm{Quota}_p \times \mathrm{Post}_t+\theta \mathrm{X}_p \times \mathrm{Post}_t+\lambda_p+\gamma_t+\delta_{prov} \times \gamma_t+\varepsilon_{p,t}, \tag{5}$$

where $R_{p,t}$ is a dummy indicating whether there is any revolutionary in prefecture p and year t. We also explore the number of revolutionaries in Section 4.2. $\ln \mathrm{Quota}_p$ is the logged quota for the first-level candidates at the prefecture level. Post_t is a dummy equal to 1 for the years of 1905 and 1906.

λ_p and γ_t indicate prefecture and year fixed effects. In addition, to control for potential confounding factors at the province level such as the quotas at the province level for the candidates in higher-level exams, we also include a very flexible provincial-specific trends: $\delta_{prov} \times \gamma_t$.

X_p is a vector of prefecture-level characteristics discussed in Section 2.3. To control for size effects, we control for logged population sizes and area sizes. Additionally, we include a set of dummy variables indicating whether the prefecture located on the coast, the Yangtze River or any major river, whether the prefecture is a treaty port and dummies for city ranks (to measure urbanization).

The estimates of β are presented in Table 3. Column (1) only controls for prefecture and year fixed effects and column (2) also controls for provincial specific year dummies. Columns (3)-(6) further include the interactions of the post dummy and different sets of controls. Column (7) reports the results weighted by the population size. The results are consistent across these specifications: on average, a one standard deviation increase in the logged quota (0.57 after controlling for logged population size) implies about six percentage points higher probability of having a revolutionary, which is large compared with the mean probability (16 percent).

In addition to focusing on $\ln \mathrm{Quota}_p$ while controlling for $\ln \mathrm{Population}_p$, we also use the ratio of the quota to population an alternative measure. The results are also consistent with our baseline results and are presented in the robustness checks in Section 5.1 when including candidates at higher levels.

The Dynamic Impacts A more flexible way to examine the link between the quota and the revolution is to look at the impacts of quotas year by year using the following specification:

$$\mathrm{R}_{p,t}=\Sigma_{\tau=1901}^{1906}\beta_\tau \ln \mathrm{Quota}_p \times \mathrm{Year}_\tau+\theta_\tau \Sigma_{\tau=1901}^{1906}\mathrm{X}_p \times \mathrm{Year}_\tau+\lambda_p+\gamma_t+\delta_{prov} \times \gamma_t+\varepsilon_{p,t}, \tag{6}$$

where the year of 1900 is left as a comparison.

The results are presented in Table 4. Column (1) only includes the fixed effects and column (2) also controls for the interactions of logged population and year dummies as well as the interactions of logged area size and year dummies. Column (3) further controls for the interactions of other prefecture characteristics and year dummies. Column (4) reports

the results after weighting by the population size.

The results in column (3) are visualized by panel (a) in Figure 4, where the solid line connects the estimates and the shaded area indicate the 95% confidence intervals. As shown in Table 4 and panel (a) of Figure 4, the impact of the quota was close to 0 before the abolition of the exam and the positive impact of quotas took place in 1905, when the exam system was abolished. These results show that there were no significant difference in the pre-trends for the prefectures with high and low quotas.

We find a significant effect in the year of abolition (i.e., 1905), suggesting that perceived mobility played a critical role: the abolition affected the expectations, even if the actual mobility change might take time to happen.

4.2 Linking the Quotas to the Uprisings in 1911

The differences-in-differences results provide an estimate of the impact of the quota on revolutionaries. What did such an impact imply for the *Xinhai* Revolution that replaced the dynasty? To answer this question, we link the quota to the incidence of uprisings in 1911 in two steps. First, we evaluate the impact of the quota on the number of revolutionaries:

$$\ln(\mathrm{k}+\#\mathrm{revolutionaries})_{p,t}=\beta'\ln \mathrm{Quota}_p\times \mathrm{Post}_t+\theta \mathrm{X}_p\times \mathrm{Post}_t+\lambda_p+\gamma_t+\delta_{prov}\times\gamma_t+\varepsilon_{p,t}, \quad (7)$$

where $\mathrm{k}>0$ is used to deal with the observations of 0. β' gives the impact of the quota on the change in the number of revolutionaries before and after the abolition.

Second, we link the change in the number of revolutionaries to the incidence of uprisings in 1911 by the following specification:

$$\mathrm{Incidence}_{p,1911}=\alpha\Delta\ln(\mathrm{k}+\#\mathrm{revolutionaries})_p+\theta \mathrm{X}_p+\delta_{prov}+\varepsilon_p, \quad (8)$$

where $\mathrm{Incidence}_{p,1911}$ takes the value of 1 if there is at least one uprising in the prefecture in 1911.

The impact of the quota on the incidence of uprisings in 1911 is the multiplication of β' and α. Note that $\ln(\mathrm{k}+\#\mathrm{rev.})_{p,t}$ an intermediate variable. To make sure that the final impact $\beta'\alpha$ should be robust to which k we add, we choose different values of k such as 0.1 and 1. Additionally, we explore another way to deal with the observations of 0 by using the inverse hyperbolic sine transformation as $\ln(\#\mathrm{rev.}+(1+\#\mathrm{rev.}^2)^{\frac{1}{2}})$ (Burbidge, Magee and Robb 1988).

The results are presented in Table 5. Columns (1)-(2) present the result using $\ln(1+\#\mathrm{rev.})_{p,t}$ as the intermediate variable. As column (1) shows, the results on the number of revolutionaries are consistent with those using dummies in the baseline. Column (2) shows that the change in the number of revolutionaries is significantly correlated with the incidence of uprisings in the critical year. The multiplication of these two effects gives the estimate of the effect of the quota on incidence of uprisings (0.016). Columns (3)-(6) present corresponding results using two alternative ways of defining intermediate variables. They generate a

similar estimate as using $\ln(1+\#\text{rev.})_{p,t}$. These results imply that a one standard deviation increase in the logged quota increases the incidence of uprisings in 1911 by about one percentage point (the mean incidence is 15%).

Note that this estimate is a lower bound as we only calculate the impact of revolutionaries 1905-06 on the incidence of uprisings. Quotas could also affect the revolutionaries after 1906 and hence further increases the incidence of uprisings. In fact, if we link quotas directly to the incidence of uprisings in 1911, a one standard deviation increase in the logged quota increases the incidence of uprisings in 1911 by about four percentage points. This will be shown in Table 8 in Section 5.2.

4.3 Testing the Role of Social Capital

To test the role of in the model, we employ two sets of proxies for social capital. First, as religious communities are regarded as one of the most important sources of social capital (Putnam 2000, Rose-Ackerman 1996), we employ the number of Buddhist temples as a proxy for social capital.[24] The information on the Buddhist temples comes from CHGIS. Second, since ethno-linguistic fragmentation is regarded as one of major determinants of the lack of social capital (Alesina and La Ferrara 2000, 2002), we employ the fragmentation of dialects as an inverses measure of social capital. Specifically, we calculate an ethno-linguistic fragmentation (ELF) measure proposed by Alesina and La Ferrara (2005b), denoted by $ELF = 1 - \sum_{n=1}^{N} s_n^2$, in which s_n represents the share of dialect n over the total area in a prefecture. The information on dialects comes from the Language Atlas of China (1988).

To test whether the impact of the quota got strengthened by social capital, we examine the triple effect of the quota, the abolition timing and the number of temples or the ethno-linguistic fragmentation. The results are presented in Table 6. Columns (1)-(2) use the number of temples per 10,000 individuals to measure social capital while columns (3)-(4) use the logged number of temples. Both measure show that the impact of quotas got strengthened by social capital, consistent with the simple model. Similarly, columns (5)-(6) show that the impact of quotas decreases with the diversity of dialects.

Both results are consistent with the role of social capital in facilitating complementarity in participation.

5 Robustness Checks

To make sure our baseline finding establishes a link between the entry-level exam quotas and participation in the revolution, we present various robustness checks in this section. Section 4.1 presents two checks on the measures of our main variables. Section 4.2 presents two placebo tests to make sure that our finding captures the impact of quotas rather than that

[24] Recently, Padro-i-Miquel et al. (2014) uses the number of temples as a proxy of social capital and shows that it interacts with election in determining public goods provision in modern China.

of other prefectural characteristics or weakened state capacity. To further deal with omitted variables, section 4.3 provides results using two instruments. To save space, we leave some of the results in the appendix.

5.1 Measurement Checks

Candidates at Higher levels We focus on the first-level exam quotas because they provided the entry to the bureaucracy and concerned the largest group of candidates. We also collect information candidates at higher levels (presented scholars and key officials) and can add the number of presented scholars and key officials to our baseline estimation.

In addition, we can also define our measure of perceived mobility in an alternative way: instead of using $\ln \text{Quota}$ while controlling for $\ln \text{Population}$, we can examine the impact of $\frac{\text{Quota}}{\text{Population}}$, $\frac{\text{PresentedScholar}}{\text{Quota}}$ and $\frac{\text{Official}}{\text{PresentedScholar}}$ on revolution participation respectively. This robustness check serves two purposes. The first is to check that the baseline results are robust to an alternative measure of the impact of quotas. The second is to check which level of mobility matters most for revolution.

The results are presented in Table 7. Columns (1)-(4) show that what matters is the entry-level quota, which is reasonable given that it concerns the entry for a large group of population. Columns (5)-(9) present the results using the ratios to measure the impacts. To facilitate the reading of coefficients, $\frac{\text{Quota}}{\text{Population}}$ and $\frac{\text{PresentedScholar}}{\text{Quota}}$ are multiplied by one hundred in the estimations. The results are consistent to those using the logged values.

Using County-level Data in Guangdong (1894-1906) In our prefecture-level analysis between 1900 and 1906, one possible measurement concern is that the number of revolutionaries might be small before 1905. This might mechanically lead to the finding of no pre-trends. Related to this concern, we construct is a county-level panel for 92 counties in Guangdong, where many people joined the revolutionary groups as early as in 1894. With this data, we can trace revolutionaries back to 1894. Considering that counties could still compete for some quotas at the prefecture capital, we also control for prefecture-specific trends ($\delta_{pref} \times \gamma_t$) in our analysis.

The specifications are very similar to the prefecture-level analysis, except that the variables are replaced by county-level information. The results on the dynamic impacts are presented in Table A.1 in the appendix. Panel (b) of Figure 4 visualizes the results in column (4) of Table A.1, where the dashed line connects the estimates and the shaded area indicate the 95% confidence interval.

5.2 Endogeneity Checks

Using the Boxer Rebellion as a Placebo One concern of our finding is that the size of quotas might be correlated with other prefectural characteristics. For example, regions

with higher quotas might be regions of more importance. They might be also more prone to conflict and hence got higher quotas.

Thanks to the rich historical information, we can measure the importance in various ways: (i) whether a prefecture is a provincial capital, (ii) the land tax per capita in 1820 and (iii) the designations by the government indicating whether a region belongs to four groups: *chong* (important in transportation/communication), *fan* (important in business), *pi* (difficult to gather taxes) and *nan* (high in crimes). To save space, these results are presented in Table A.2 in the appendix. As they show, the impact of quotas holds after controlling for these factors and their interactions with the post dummy. Among these characteristics, difficulty of taxing has a positive impact on the revolution participation after the abolition of the exam.

To further make sure that our finding on the revolution is specific to the impact of quotas, we conduct a placebo test using the Boxer Rebellion between 1899 and 1901.[25] The Boxer Rebellion was motivated by proto-nationalist sentiments and opposition to foreign imperialism and Christianity, which was unlikely to be correlated with the exam system. Therefore, we use it as a check to make sure that prefectures with higher quotas were not necessarily always pro-conflict or more motivated by proto-nationalist sentiments.

The results are presented in panel (a) of Table 8. Columns (1)-(3) show that the quotas were not correlated with the incidence of the Boxer Rebellion. In contrast, as shown in columns (4)-(6), the quotas were highly correlated with the incidence of the uprisings in 1911.[26]

Using Grain Prices as a Placebo Another concern of our baseline finding is that the effect of quotas was not driven by the abolition of the exam but by the deterioration of state capacity. Therefore, we would like to check whether state capacity had a discontinuous change when the exam was abolished. Grain prices can be a good candidate to check for this concern, as a dramatic change in state capacity was likely to be reflected by prices. Based on monthly grain prices (available for both a high level and a low level for major grains in a prefecture), we calculate two variables to measure price changes: year-on-year growth of prices and within-month price change (the difference between the logged high price and the logged low price).

The year-on-year growth of prices for each prefecture p in year t is as follows: $G_{p,t} = \frac{1}{12}\sum_{m=1}^{12}\frac{1}{\#g}\sum_{g}\frac{1}{2}\sum_{i=1}^{2}\frac{P_{p,t,g,m,i}-P_{p,t-1,g,m,i}}{P_{p,t-1,g,m,i}}$, where $P_{p,t,g,m,i}$ indicates the high price or low price (denoted i) of grain g in prefecture p at year t and month m. Replacing the dependent variable in the baseline with $G_{p,t}$, we find that the association of quotas and year-on-year price growth did not change before and after the abolition of the exam, as presented in columns (1)-(3)

[25] The data on the Boxer Rebellion comes from the appendix in the Boxer Protocol (1901).

[26] The reduced-form effect of the quota on the incidence of uprisings in 1911 is larger than that using two-step estimation in Table 5. This is because the data for the two-step estimation stops in 1906, while the reduced-form effect captures the impact until 1911.

in panel (b) of Table 8.

Columns (4)-(6) further show that the association of quotas and within-month price change did not change dramatically before and after the abolition of the exam.

These tests are not to deny that fact that the state capacity was deteriorating in the late Qing period. However, unlike our main finding on revolution participation, they show that there is no significant change in the association between the quotas and price changes before and after the abolition of the exam.

5.3 Results from Instrumental Variables

We have shown that the results from differences-in-differences are robust to various checks. However, using the differences-in-differences strategy, we can rule out the effects of omitted variables only when their effects did not change before and after the abolition of civil examinations. Given that the government still selected bureaucrats after the abolition of the exam, which was likely to be affected by omitted variables positively correlated with quotas (such as political networks), the effect of these omitted variables was likely to increase after the abolition. As a result, the estimate from the differences-in-differences strategy is likely to be a lower bound. To correct the potential bias, we employ further explore two instruments for quotas.

Instrument I: The number of small rivers (given river lengths) Our first instrument stems from geographical characteristics. Conceptually, for two prefectures with the same population size, the prefecture with more counties enjoy more quotas, because the quota assignment followed the stepwise role and each county would get some quota. Therefore, we would like to find an instrument that affected the formation of counties in a prefecture but did not affect revolution through other channels such as economic development. The number of rivers (given river lengths) provides a reasonable candidates for two reasons. First, counties usually were usually formed around rivers. As shown in Figure A.4 in the appendix, county seats are generally located on rivers. Second, it is not efficient to have many rivers within a county due to high administrative costs (e.g. tax collection costs). These two reasons lead to a positive associate between the number of rivers and the number of counties.

However, there is a concern that the number of rivers may affect other dimensions besides the number of counties (e.g. economic development). To take into consideration potential confounding impacts of rivers on development, we exclude major rivers and use the number of small rivers divided by the total length of rivers while controlling for the logged length. The idea is that the shape of rivers affects the number of counties, given the length of them.

In sum, the channel that number of small rivers affects the prefecture-level is as follows:

$$\frac{\#\ small rivers}{River\ \ length}\ in\ a\ prefecture \rightarrow \#\ counties \rightarrow quota$$

Figure 5 illustrates the channel. Panel (a) plots the residual of regressing the number of counties on the logged population again the residual of regressing the $\frac{\#\ small rivers}{River\ \ length}$ on the

logged population. It a positive relationship between the number of small rivers per 1,000 km with the numbere of counties. Panel (b) plots the the residual of regressing the logged quota on the logged population again the residual of regressing the number of counties on the logged population. It shows a strong positive correlation between the number of counties and the quota.

To check statistically whether the number of rivers reasonable instrument, we first show that it is indeed positively correlated with prefecture-level quota. Then, we conduct four sets of placebo tests to check whether our instrument might affect other dimensions such as transportation, crop suitability, climate shocks and basin fragmentation. These results are presented in Section A.1 and Table A.3 in the appendix. Additionally, we define small rivers as rivers under 70,80,...,120 km and show that the results are robust to such variations. These checks are presented in Section A.2 and Table A.5 in the appendix.

Instrument II: Exam performance before the quota system Our alternative instrument stems from historical roots of the quota system. The regional quota system was initially employed during the Ming dynasty (AD 1368-1644). In 1425, a provincial-level quota system was introduced to balance the opportunity to pass the national exam. In 1436, the central government began to appoint government officials to each prefecture to select candidates for the province-level exam. In short, the quota system was initially introduced during 1425-36.

We hypothesize that the performance in civil exam before 1425, measured by the number of presented scholars (those succeeding in the national-level exam), could affect the subsequent quota assignment. The region with better performance is likely to be assigned higher quotas. However, we also need to make sure that the performance measure did not have long-run impact on candidates. Therefore, we would like to employ changes of the number of presented scholars in a very short run. The idea is that the short-run change in performance may be driven by random factors that did not have long-run impacts. Following this thought experiment, we divide the pre-1425 period into two sub-periods of similar length (1368-1398 and 1399-1425). Denote the number of presented scholars in log-term during Period 0 as $(\ln[1 + \text{PresentedScholar}_0])_p$ and that during Period 1 as $(\ln[1 + \text{PresentedScholar}_1])_p$, we employ $(\Delta \ln \text{PresentedScholar})_p$, namely the first difference of exam performance, as our alternative instrument. Another advantage to employ the first-difference is to rule out the time-invariant prefecture-specific factors. We also control for the effect of the initial level of presented scholars $(\ln[1 + \text{PresentedScholar}_0])_p$.

Similar to the first instrument, we examine the relevance of this instrument and whether it affects other factors besides the quota. These results are presented in Section A.1 and Table A.4 in the appendix.

Estimation results from two instruments Given the relevance tests as well as the placebo tests, we perform the instrument variable estimations. The first stage and second

stage estimations are as follows:

$$\begin{aligned}\ln \text{Quota}_p \times \text{Post}_t &= \rho_1 (\frac{\#\text{SmallRivers}}{\text{Riv.Leng.}})_p \times \text{Post04}_t + \delta \ln \text{Riv.Leng}_p \times \text{Post}_t \\ &+ \rho_2 \Delta \ln \text{Pres.Scholar}_p \times \text{Post04}_t + (\ln [1 + \text{Pres.Scholar}_0])_p \times \text{Post04}_t \\ &+ \theta \text{X}_p \times \text{Post}_t + \lambda_p + \gamma_t + \delta_{prov} \times \gamma_t + \varepsilon_{p,t},\end{aligned}$$

and

$$\begin{aligned}\text{R}_{p,t} &= \beta \ln \widehat{\text{Quota}_p \times \text{Post04}_t} + \delta \ln \text{Riv.Leng}_p \times \text{Post}_t + (\ln [1 + \text{Pres.Scholar}_0])_p \times \text{Post04}_t \\ &+ \theta \text{X}_p \times \text{Post}_t + \lambda_p + \gamma_t + \delta_{prov} \times \gamma_t + \varepsilon_{p,t}.\end{aligned}$$

The results are presented in Table 9. Before presenting the results using both instruments, Columns (1)-(3) report the results using the river instrument. Column (1) reports the reduced-form result and show that this instrument is significantly correlated with the probability of having revolutionaries. Columns (2) report the IV estimate (0.35). Column (3) includes the second instrument as a regressor. The insignificant effect of the second instrument suggests that the second instrument does not have any direct effect on revolutionaries besides the channel of quotas–this method can be regarded as an easy-to-interpret version of the over-identification test. Similarly, columns (4)-(6) report the corresponding results using the second instrument. The estimate from the instrument is around 0.27.

Column (7)-(9) combine the two instruments together. Column (7) reports the reduced-form result while column (8) presents the IV estimate. Column (9) further includes all the variables used in the placebo tests (transportation, crop suitability, climate shocks and basin fragmentation index) and the estimate varies little. Consistent with the tests in column (3) and (6), the p-value of the over-id test is around 0.6.

6 Alternative Explanations

We discuss three alternative explanations in this section. First, prefectures with higher quotas might also be rich in modern human capital that could also contributed to the revolution. Second, the abolition of the exam might work through current economics shocks. Finally, prefectures with higher quotas might be also different in ideology that could also affect revolution.

6.1 Modern Human Capital for Revolution

One alternative hypothesis is that regions with higher quotas were also rich of modern human capital and human minds that demanded modernization through revolution. There are two possible channels of this modernization hypothesis. One is that those educated under the modern system contributed to the revolution due to their ideology or their quest

for modernization. Another is that those educated under the modern system were frustrated by the mismatch between their investment in the modern education and the economic or political opportunities for them in the late Qing period. Both channels would predict a positive correlation between the abundance of modern human capital and participation in the revolution. However, neither would necessarily imply that such a positive correlation should vary in a very short period before and after the abolition of the exam.

To evaluate the impact of modern human capital, we collect two sets of data: the number of mechanized industrial firms that are above a designated size and the number of students studying in Japan. The information on firms is obtained from Chang (1989), who compiled ten series of detailed information on Chinese private enterprises including their locations and establishment dates.[27] Based on these information, we construct a prefecture-by-year dataset on the firms. The number of students studying in Japan is from Shen (1978), who edited the lists of all the Chinese students in technological academies, higher education institutions and universities based on the rosters of Japanese institutions. This gives us prefecture-by-year information on the number of students. Among the students studying abroad, we focus on those in Japan as it was the primary foreign country for the Chinese students in the late Qing period. For instance, the total number of Chinese students overseas was estimated to be around 20,000 during 1900-1911, among which 90% studied in Japan (Yao, 2004).

The results are presented in Table 10. Columns (1)-(2) show that the number firms does not have significant impact on the participation in revolution. Columns (3)-(4) show that the number of students studying in Japan per se has a positive impact on the participation in revolution but its impact does not differ before and after the abolition of the exam. Column (5) includes all the factors and delivers a similar message. Across all the specifications, the baseline effect of the quota changes little.

We can also examine the impact of the students studying in Japan year by year. The results are visualized in Figure 6, where the line connects the estimates between 1901 and 1906 and the shaded area indicates the 95 percent confidence intervals.[28] As it shows, there is no systematic discontinuity before and after 1905.

These results suggest that modern human capital contributed to the revolution but did not explain our main finding.

6.2 Current Economic Shocks

Under our simple conceptual framework, we interpret the impact of the abolition as a decrease of η_0 (i.e., a decrease in perceived mobility). Another interpretation is that the abolition decreased the current income (w_0) and this effect was larger in regions with higher quotas. We think that the latter is of less importance given that the abolition of the exam

[27] All the firms in this study meet the following five criteria: (i) the firm is organized as a company; (ii) the capital is over 10,000 dollars; (iii) mechanization is used; (iv) there are over 30 employees; and (v) the value of the output is over 50 thousand dollars.

[28] The number of students was very limited before 1901.

did not suddenly push people under subsistence level. One way to test whether the decrease of current income matters in this context is to employ weather shocks that have been documented to matter in conflict such as sino-normadic conflict and peasant rebellions (see Hsiang et al. (2013) for a recent survey of related studies).

The results are presented in Table 11. In Column (1) and (2), we employ a dummy variable indicating whether the rainfall is extremely low or high to measure the weather shock.[29] The results show that weather shocks (in the same year) had no significant effect on the participation in the revolution. Moreover, the effects of the abolition of civil examination in the region with more rainfall did not differ with that in the region with less rainfall, when we employ the average rainfall index during 1800-99 to proxy the average weather of a prefecture (Column (3) and (4)). Column (5)-(6) employ the standard deviation of rainfall index during 1800-99 to proxy the volatility of rainfall in a prefecture. We do not find a significant impact of the volatility either.

In sum, we do not find that current economic shocks proxied by weather shocks can explain our finding.

6.3 Ideology

One may wonder whether the quota also captures certain political preference we cannot measure. For example, citizens in regions with higher quotas might be more radical politically. The placebo test using the Boxer Rebellion suggests that this is not likely to be the case. As a further check, we link the quota system to individual's party identification among the parliament members in 1912, using the following cross-sectional specification:

$$KMT_{i,p} = \varphi \ln \text{Quota}_p + \delta_{prov} + \varepsilon_{i,p},$$

where $KMT_{i,p}$ is a dummy indicating whether a party member i belongs to the *Kuomintang* or not. Compared with the other parties (the *Kunghotang* and the *Minzhutang*), *Kuomintang* (which literally means "Chinese Nationalist Party") was known to be more radical. In contrast, the party ideology of the *Kunghotang* was based on Jean-Jacques Rousseau's The Social Contract whereas the *Minzhutang* emphasizes that stability was of their primary goal.

The results are presented in columns (1)-(3) in Table 12. Among the 703 party members we can identify the origins and ages, 434 are identified with the *Kuomintang*. Based on the individual-level information, we do not find any significant impact of the quota on party identification. However, consistent with the hypothesis that the *Kuomintang* was more radical, we find that younger people were more likely to identify themselves as the *Kuomintang* members.

Columns (4)-(7) report the results using prefecture-level information to examine the link between the quotas and the number of party members. As they show, quotas increased the number of party members in both the *Kungmintang* and the other parties. This find-

[29] The data comes from the State Meteorological Society (1981).

ing is expected because more revolutionaries were naturally associated with more party members after the success of revolution. However, the magnitudes of the impacts on the *Kungmintang*vs. the other parties are similar (0.155 vs. 0.181).

Consistent with the placebo test using the Boxer Rebellion in Section 5.2, the finding on party identification once again shows that the ideology hypothesis cannot explain our finding.

7 Conclusion

Exploring the unique historical event of the abolition of the civil exam system in historical China, this paper documents that more people became revolutionaries in regions with higher quotas (after controlling for population sizes) after the abolition. The finding is consistent with the interpretations that people perceiving more mobility under the exam system were more likely to be mobilized after the abolition of the exam. We realize that this important historical event might trigger many responses in the society and that the quota of a prefecture might be correlated with other prefecture characteristics. However, for other alternative channels to explain our finding, they have to be systematically correlated with the quota and their impacts have to be discontinuous before and after the abolition. After comparing with various types of alternative explanations, the mobility channel governed by the quota system appears to be the most likely one.

The paper contributes to the literature linking social mobility to political stability, where there has been very little empirical evidence. We also document the roles of a few other factors in the revolution such as modern human capital and social capital, which may be relevant in other contexts of revolution.

References

[1] Acemoglu, Daron, and James A. Robinson (2001), "A Theory of Political Transitions", *American Economic Review*, 938-963.

[2] Acemoglu, Daron and James A. Robinson (2012), *Why Nations Fail: The Origins of Power, Prosperity, and Poverty*, New York: Crown Business.

[3] Alesina, Alberto, and Eliana La Ferrara (2000), "Participation in Heterogeneous Communities", *Quarterly Journal of Economics* 115 (3), 847-904.

[4] Alesina, Alberto, and Eliana La Ferrara (2002), "Who Trust Others?" *Journal of Public Economics* 85(2): 207-234.

[5] Alesina, Alberto, and Eliana La Ferrara (2005a), "Preferences for Redistribution in the Land of Opportunities", *Journal of Public Economics*, 89(5): 897-931.

[6] Alesina, Alberto, and Eliana La Ferrara (2005b), "Ethnic Diversity and Economic Performance", *Journal of Economic Literature* 43(3): 762-800.

[7] Benabou, Roland, and Efe A. Ok (2001), "Social mobility and the Demand for Redistribution: the POUM Hypothesis"', *Quarterly Journal of Economics*, 116(2): 447-487.

[8] Besley, Timothy and Torsten Persson (2011), *Pillars of Prosperity: The Political Economics of Development Clusters*, Princeton University Press.

[9] Bourguignon, Francois, and Thierry Verdier (2000), "Oligarchy, Democracy, Inequality and Growth", *Journal of Development Economics,* 62(2): 285-313.

[10] Brandt, Loren, Debin Ma and Thomas Rawski (2014), "From Divergence to Convergence: Reevaluating the History Behind China's Economic Boom", *Journal of Economic Literature*, 52(1): 45–123.

[11] Burbidge, John B., Lonnie Magee, and A. Leslie Robb (1988), "Alternative Transformations to Handle Extreme Values of the Dependent Variable", *Journal of the American Statistical Association,* 83(401): 123-127.

[12] Campbell, Cameron and James Lee (2003), "Social Mobility from a Kinship Perspective: Rural Liaoning, 1789â1909", *International Review of Social History* 48: 1-26.

[13] Campante, Filipe and Davin Chor (2012), "Why was the Arab World Poised for Revolution? Schooling, Economic Opportunities, and the Arab Spring",*Journal of Economic Perspectives* (2012): 167-187.

[14] Castrillon, David (2012), "The Abolition of the Imperial Examination System and The Xinhai Revolution of 1911", Mimeo.

[15] Chang, Chung-li (1955), *The Chinese Gentry: Studies on Their Role in Nineteenth Century Chinese Society*, Seattle: University of Washington Press.

[16] Chang, Chung-li (1962), *The Income of the Chinese Gentry*. Seattle, WA: University of Washington Press.

[17] Chang, Yu-fa (1982), *Qingji de geming tuanti* (*Revolutionary Organizations of the Qing Period)*, Taipei: Academia Sinica, Institute of Modern History.

[18] Chang, Yu-fa (1985), *Minguo chunian de zhengdang (Political Parties in the Early Republic)*, Taipei: Academia Sinica, Institute of Modern History.

[19] Chang, Yu-fa (1989), "Private Industries in the Late Ch'ing and the Early Republic of China, 1860-1916", *Bulletin of the Institute of Modern History*, Academia Sinica (18): 315-561.

[20] Chang, Yu-fa (1992), *Xinhai geming shilun (The History of Xinhai Revolution)*, Taipei: Academia Sinica, Institute of Modern History.

[21] Corneo, Giacomo, and Hans Peter Gruner (2002), "Individual Preferences for Political Redistribution", *Journal of Public Economics*, 83-107.

[22] Edmunds, Charles Keyser (1906), "The Passing of China's Ancient System of Literary Examinations," *The Popular Science Monthly*, February: 104-105.

[23] Elman, Benjamin (2000), *A Cultural History of Civil Examinations in Late Imperial China*, University of California Press.

[24] Elman, Benjamin (2013), *Civil Examinations and Meritocracy in Late Imperial China*, Harvard University Press.

[25] Elman, Benjamin (2009), "Civil Service Examinations" in *Berkshire Encyclopedia of China*, Berkshire Publishing Group.

[26] FAO (2012), GAEZ (Global AgroEcological Zones), http://fao.org/Ag/AGL/agll/gaez/index.htm.

[27] Franke, Wolfgang (1960), *The Reform and Abolition of the Traditional China Examination System*, Cambridge, Massachusetts: East Asian Research Center.

[28] Ge, Jianxiong (Ed.) (2000), *Zhongguo renkoushi (China Population History)*, Shanghai: Fudan University Press.

[29] Harvard Yenching Insitute (2007), CHGIS, Version 4, Cambridge: Harvard Yenching Institute.

[30] Hatfield, John William Katrina Kosec (2013), "Federal Competition and Economic Growth", *Journal of Public Economics*, 97 (2013): 144-159.

[31] Ho, Ping-ti (1959), "Aspects of Social Mobility in China, 1368–1911", *Comparative Studies in Society and History* 1: 330-359.

[32] Ho, Ping-ti (1962), *The Ladder of Success in Imperial China: Aspects of Social Mobility*, 1368-1911, New York: Columbia.

[33] Hoxby, Caroline (2000), "Does Competition among Public Schools Benefit Students and Taxpayers?" *American Economic Review,* 1209-1238.

[34] Hsiang, Solomon M., Marshall Burke, and Edward Miguel (2013),"Quantifying the Influence of Climate on Human Conflict", *Science*, 341.6151: 1235367.

[35] Hsu, Francis LK (1949), "Social Mobility in China", *American Sociological Review*: 764-771.

[36] Huntington, Samuel (2006), *Political Order in Changing Societies*, Yale University Press.

[37] Hymes, Robert (1986), *Statesmen and gentlemen: The Elite of Fu-chou, Chiang-hsi, in Northern and Southern Sung*, Cambridge University Press.

[38] Kun, Gang et al. (Ed.), (1899), *Qinding da Qing huidian shili (Imperially Established Institutes and Laws of the Great Qing Dynasty)*, Beijing: Zhonghua shu ju reprinted in 1991.

[39] Kracke, Edward (1947), "Family vs. Merit in Chinese Civil Service Examinations Under the Empire", *Harvard Journal of Asiatic Studies*, 10: 102-121.

[40] Leventoglu, Bahar (2005), "Social Mobility and Political Transitions" , *Journal of Theoretical Politics* 17: 465-496.

[41] Leventoglu, Bahar (2013), "Social Mobility, Middle Class and Political Transitions", Forthcoming in *Journal of Conflict Resolution*.

[42] Li, Tie (1989), *China's Civil Severice System*. Beijing: China University of Political Science and Law Press

[43] Li, Xiaobing (2007), *A History of the Modern Chinese Army*. Lexington: University Press of Kentucky.

[44] Liang, Fangzhong (1981), *Zhongguo lidai hukou, tiandi, tianfu tongji (Historical Statistics of Population, Land and Taxation in China)*, Shanghai, Shanghai renmin chubanshe.

[45] Liu, Cheng-yun (1993), "Chong, Fan, Pi, and Nan: An Exploration of the Ranking of Qing Administrative Units", *Bulletin of Institute of History and Philology*, Academia Sinica 64 (1): 175-204.

[46] Luo, Jialun (Ed.) (1958), *Geming wenxian (Documents on the Revolutionary)*, vol. 2. Taipei: Zhongyang wenwu gongyingshe.

[47] Malik, Adeel, and Bassem Awadallah (2013), "The Economics of the Arab Spring", *World Development*, 45: 296–313.

[48] Padro-i-Miquel Gerard, Nancy Qian, Yiging Xu and Yang Yao (2014),"Making Democracy Work: the Effects of Social Capital and Elections on Public Goods in China", mimeo.

[49] Passarelli, Francesco, and Guido Tabellini (2013),"Emotions and Political Unrest", mimeo, Bocconi University.

[50] Putnam, Robert D (2000), *Bowling Alone: The Collapse and Revival of American Community*. New York: Simon and Schuster.

[51] Qian, Mu (1982), *Traditional Government in Imperial China: A Critical Analysis*, Chinese University Press, 1982.

[52] Qian, Shifu (2005), *Qingdai zhiguan nianbiao (A Chronological Table of Qing Officials)*. Beijing: Zhonghua shuju.

[53] Ravallion, Martin, and Michael Lokshin. (2000), "Who Wants to Redistribute? The Tunnel Effect in 1990 Russia", *Journal of Public Economics*, 87-104

[54] Rawski, Evelyn Sakakida (1979), *Education and Popular Literacy in Ch'ing China*, Ann Arbor, MI: University of Michigan Press.

[55] Rose-Ackerman, Susan (1996), "Altruism, Nonprofits, and Economic Theory", *Journal of Economic Literature*, XXXIV: 701-728.

[56] Rozman, Gilbert (1973), *Urban Networks in Ch'ing China and Tokugawa Japan*, Princeton: Princeton University Press.

[57] Rozman, Gilbert (Ed.) (1982), *The Modernization of China*, Simon and Schuster.

[58] Scott, James C. (1998), *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*, Yale University Press, 1998.

[59] Shen Yunlong (Ed.) (1978), *Qingmo gesheng guanfei zifei liuri xuesheng xingmingbiao (The Lists of Oversea Students in Japan in the Late Qing Period),* Taipei: Wenhai Press.

[60] Spence, Jonathan (1990), *The Search for Modern China*, WW Norton & Company.

[61] The State Meteorological Society (1981). Zhongguo jinwubainian hanlao fenbu tuji (Yearly Charts of Dryness/Wetness in China for the Last 500-Year Period), Beijing: Ditu chubanshe.

[62] Satyanath, Shanker, Nico Voigtlander, and Hans-Joachim Voth (2013), "Bowling for Fascism: Social Capital and the Rise of the Nazi Party in Weimar Germany, 1919-33", NBER Working paper No. 19201.

[63] Wang, Kaixuan. (2005), *Mingdai keju zhidu kaolun (A Study on the Civil Sevice Examin System in the Ming Dynasty)*, Shenyang: Shenyang chubanshe.

[64] Wang, Rui (2013), *The Chinese Imperial Examination System: An Annotated Bibliography*. Rowman & Littlefield.

[65] Wang, Y.C. (1960), "Western Impact and Social Mobility in China", *American Sociological Review*, 25: 843-855.

[66] Wurm, Stephen Adolphe, Rong Li, Theo Baumann, Mei W. Lee (ed.) (1987): *The Language Atlas of China*, Hong Kong : Longman Group.

[67] Yan, Zhongping (1955), *Zhongguo jindai jingjishi tongji ziliaoxuanji (Selected Statistical Materials on Modern Chinese Economic History)*, Beijing: Kexue chubanshe.

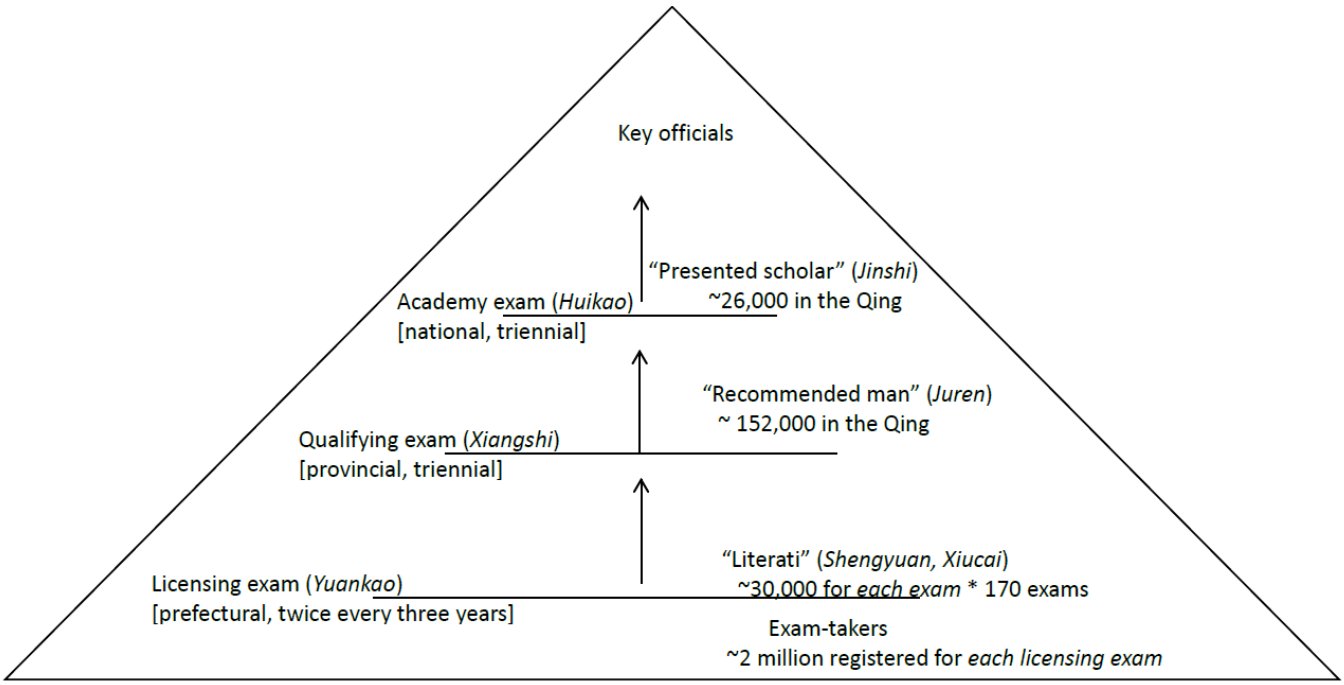
[68] Yao, Linqing (2004), "The Chinese Overseas Students: An Overview of the Flows Change", *12th Biennial Conference of the Australian Population Association*: 15-17.

[69] Yuchtman, Noam (2010), "Teaching to the Tests: An Economic Analysis of Educational Institutions in Late Imperial and Republican China", Mimeo, UC Berkeley.

[70] Zhao, Dinxing (2001), *The Power of Tiananmen: State-Society Relations and the 1989 Beijing Student Movement*, University Of Chicago Press.

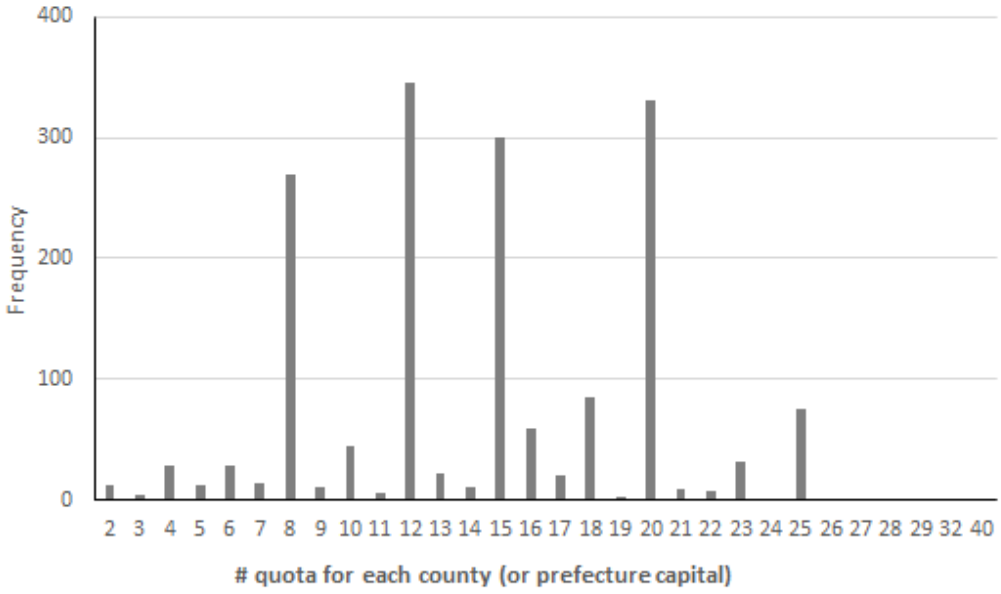
[71] Zhu, Baojiong, and Peilin Xie (Ed.) (1980), *Ming Qing jinshi timing beilu suoyin (Index of Names of Jinshi Graduates in the Ming and Qing Periods)*, Shanghai: Shanghai guji chubanshe.

Figure 1: The Structure of the Civil Service Exam



Notes: (1) The number of the prefecture-level exam graduates was governed by a prefecture-level quota. We code the prefecture-level data based on Kun, Gang et al. I1899).
(2) The number of the national-level exam graduates was governed by a province-level quota. We coded their prefectures of origins based on the lists of names and origins in Zhu and Xie (1980).
(3) The number of provincial-level exam graduates was governed by provincial-level quota. We do not have prefecture-level information on these graduates.
(4) The number of exam-takers comes from Elman (2013). Note that there was no limit on age or number of attempts to take the exam.

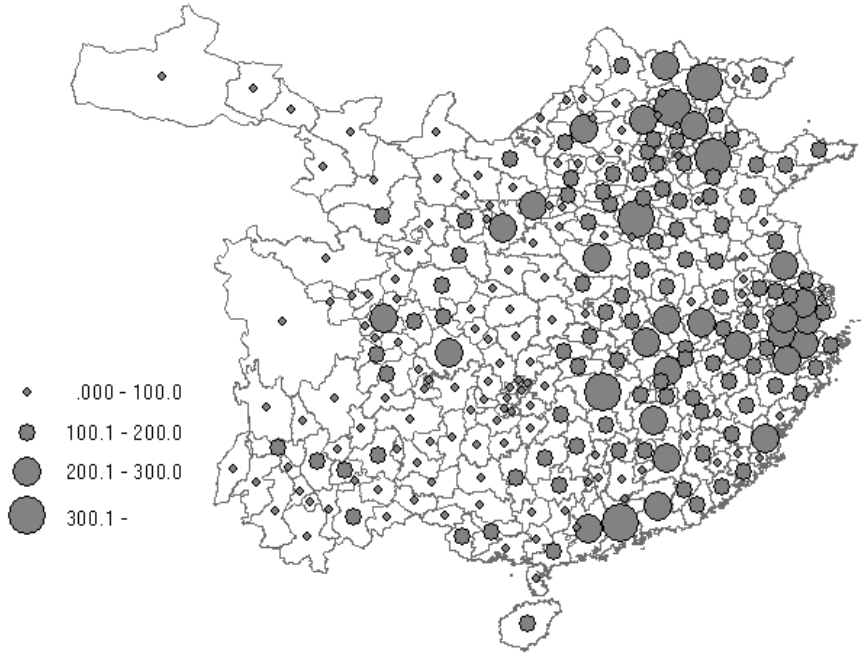
Figure 2: Distribution of Quotas for Each County



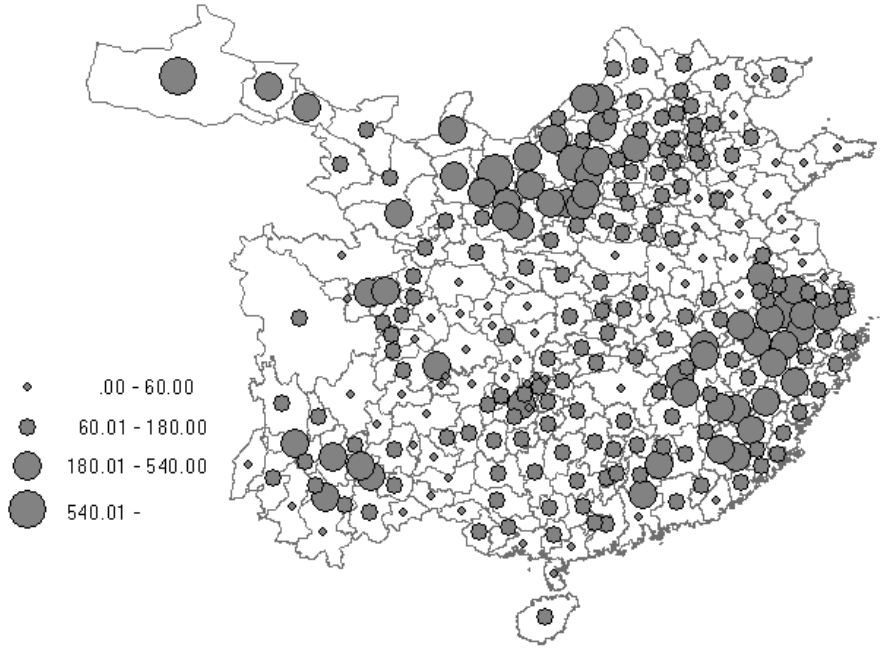
Notes: This figure shows that the quota assigned to counties within a prefecture follows a stepwise rule: the most frequent numbers are 8, 12, 15 and 20. This is because the government did not have the capacity of implementing a complicated proportional system and needed a simplified way of implementing the quota system.

Figure 2: Distribution of Quotas Across Prefectures

(a) Spatial Distribution of Quotas



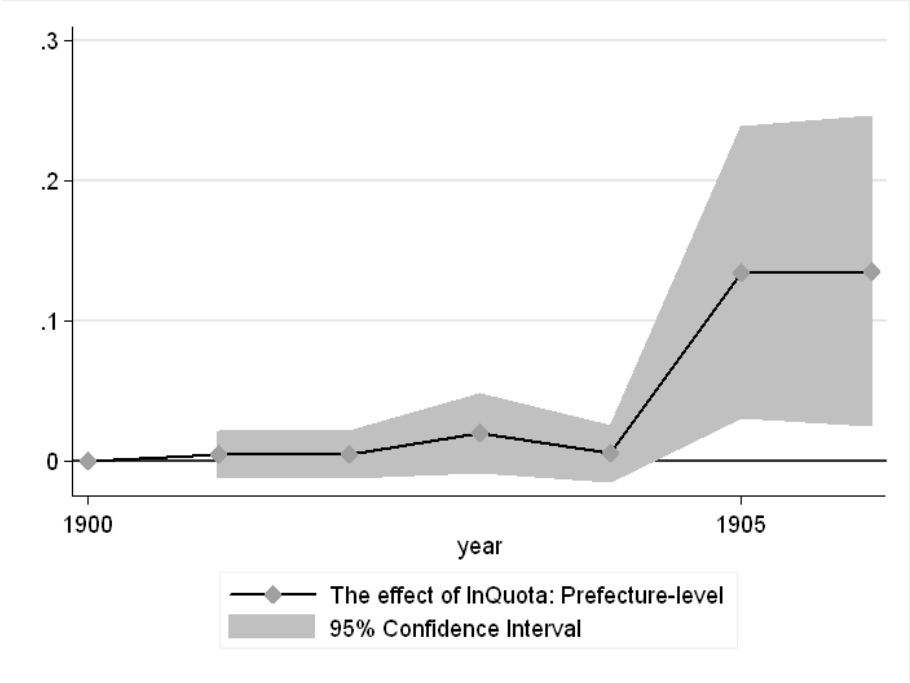
(b) Spatial Distribution of Quotas per 1 Million People



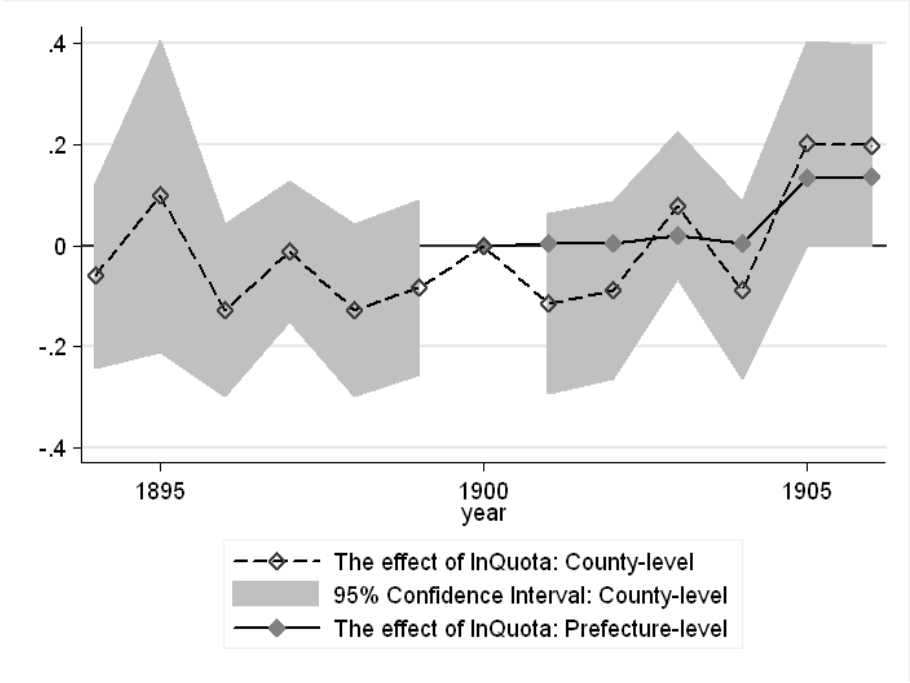
Notes: This figure shows that there are great regional variations in quotas and quotas per capita. For example, province fixed effects only explain 30% of the variations in the quotas across prefectures.

Figure 4: The Dynamic Impacts of ln Quota on the Probability of Having Revolutionaries

(a) Prefecture-level Analysis (1900-1906)



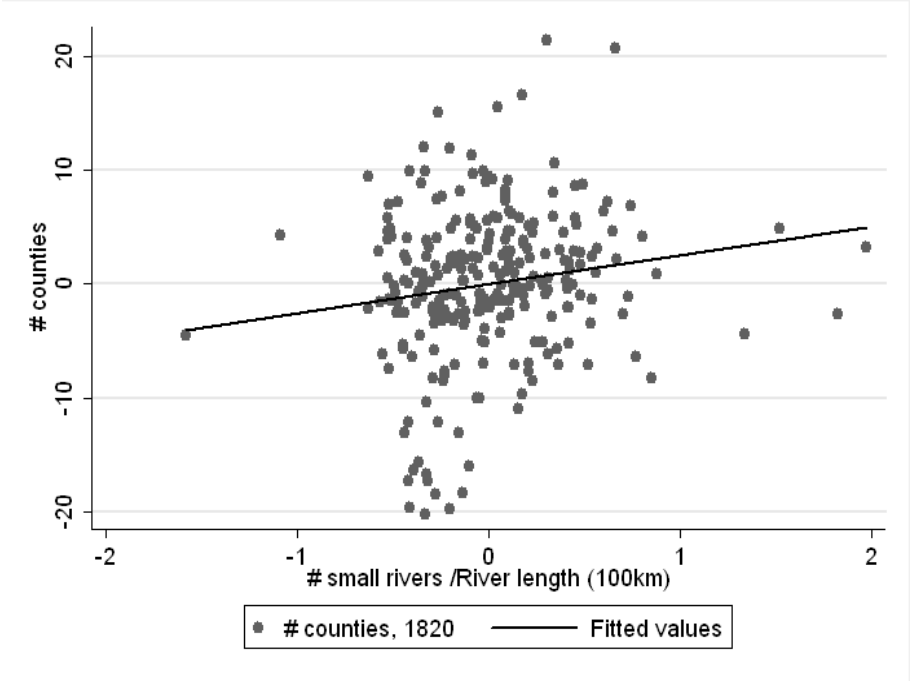
(b) County-level Analysis (1894-1906)



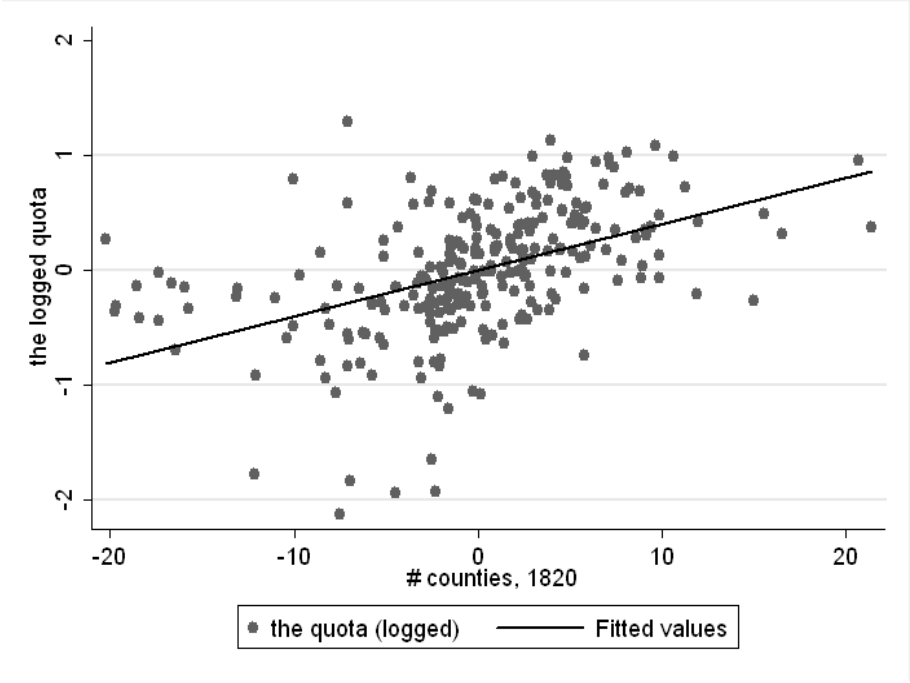
Notes: These figures present the dynamic effects of the quota on the number of revolutionaries, using the year 1900 as the reference. Panel (a) presents the results using the prefecture-level data between 1900 and 1906, where the solid line connects the estimates and the shaded area indicates the 95% confidence intervals. Panel (b) adds the results using the county-level data between 1894 and 1906, where the dashed line connects the estimates.

Figure 5: Small Rivers, Counties and Quotas

(a) #Small Rivers/Riv.Length and #Counties

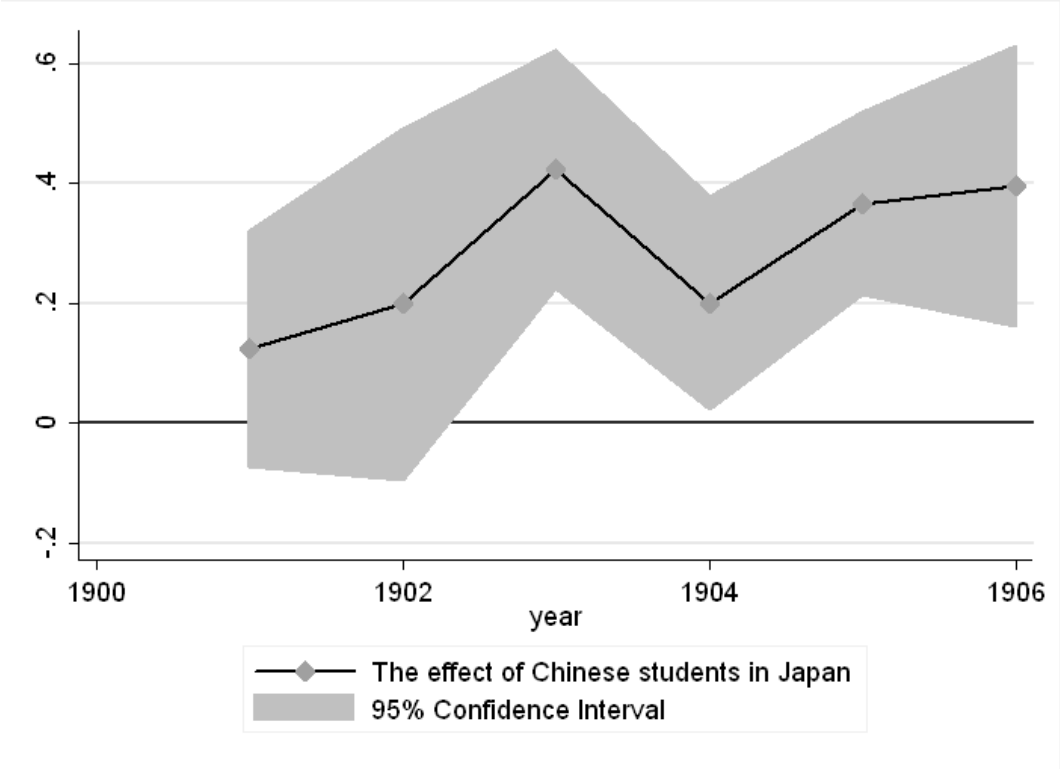


(b) #Counties and the Quota



Notes: Figure (a) shows that the number of small rivers (given the length of river) in a prefecture is positively correlated with the number of counties, after controlling for population sizes; Figure (b) shows that the number of counties is positively correlated with the quota, given population sizes. *** indicates that the significance level is at 1%.

Figure 6: The Impacts of Chinese Students in Japan on the Prob. of Having Revolutionaries



Notes: This figure shows that the positive impacts of the number of students studying in Japan did differ not systematically before and after the abolition in 1905. These estimates are obtained by examining the impact of the number of students studying in Japan year by year between 1901 and 1906. The number of the students in Japan was very limited before 1901.

Table 1: Summary Statistics and Data Sources

Variables	Variables Definition	Data Sources	Obs.	Mean	S.D.
Revolutionaries	Having or not	1, 2	1,834	0.155	0.362
	# revolutionaries	1, 2	1,834	0.696	3.231
Early Uprisings in 1911	Incidence of early uprisings in 1911	3	262	0.160	0.367
Measures of the Exam	The quota	4	262	113.771	75.604
	Ln Quota	4	262	4.441	0.890
	# presented scholars	5	262	95.977	146.355
	# key officials	6	262	15.580	30.390
Baseline Controls	Ln (Popu. in 1880)	7	262	13.620	1.074
	Ln Area	8	262	9.336	0.770
	Treaty port	9	262	0.115	0.319
	Small city	10	262	0.198	0.400
	Middle city	10	262	0.122	0.328
	Large city	10	262	0.038	0.192
	Major river	8	262	0.618	0.487
	Coast	8	262	0.134	0.341
Instrumental Variables	# small rivers/river length	8	262	0.886	0.435
	River length	8	262	6.847	0.713
	Δ Presented scholars before 1425	5	262	0.377	0.727
Placebo Tests	Incidence of the Boxer Rebellion	11	262	0.099	0.300
	Year-on-year price growth	12	1,497	0.040	0.175
	Transportation (pref)	13	262	0.615	0.488
	Transportation (cnty)	13	262	0.380	0.300
	Fox millet suitability	14	262	2.877	1.334
	Rice suitability	14	262	1.991	1.075
	Sweet Potato suitability	14	262	2.622	0.992
	Climate shocks	15	262	0.063	0.092
	Basin HHI	8	262	0.608	0.243
Modern Human Capital	# domestic private firms	16	1,834	0.097	0.573
	# oversea students in Japan	17	1,834	0.793	2.725
Social Capital	# temples per 10,000 people	8	262	0.443	0.157
	Language fractionalization	18	262	0.087	0.164

Data Sources:

1: Chang, Yu-fa (1982), Revolutionary Organizations of the Qing Period.

2: Luo, Jialun (1958), Documents on the Revolutionary, vol. 2.

3: The Tokyo Nichi Nichi Shimbun, 3 November, 1911.

4: Kun, Gang et al. (Ed.) (1899), Imperially Established Institutes and Laws of the Great Qing Dynasty.

5: Zhu, Baojiong, and Peilin Xie (Ed.) (1980), Index of Names of Jinshi Graduates in the Ming and Qing Periods.

6: Qian, Shifu (2005), A Chronological Table of Qing Officials.

7: Ge, Jianxiong (2000) China Population History.

8: Harvard Yenching Institution (2007), CHGIS, Version 4.

9: Yan, Zhongping (1955), Selected Statistical Materials on Modern Chinese Economic History.

10: Rozman, Gilbert (1973), Urban Networks in Châing China and Tokugawa Japan.

11: The Boxer Protocol (1901).

12: Wang, Yeh-chien (2009). Grain Price Database in the Qing Dynasty.

13: Liu, Cheng-yun (1993), "Chong, Fan, Pi, and Nan: An Exploration of the ranking of Qing Administrative Units".

14: FAO (2012), GAEZ: http://fao.org/Ag/AGL/agll/gaez/ index.htm.

15: The State Meteorological Society (1981).

16: Chang, Yufa (1989), "Private Industries in the Late Ch'ing and the Early Republic of China, 1860-1916".

17: Shen, Yunlong (Ed.) (1978), The Lists of Oversea Students in Japan in the Late Qing Period.

18: The Language Atlas of China (1987).

Table 2: The Impacts of Quotas on Political Newcomers Under Different Regimes

(a) During the Qing Dynasty (1644-1904)

Dependent Var.	Ln (k+ # Presented Scholars)			Ln (k + # Officials)		
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(Quota)	0.818***	0.734***	0.652***	0.720***	0.582***	0.527***
	(0.039)	(0.059)	(0.066)	(0.056)	(0.080)	(0.090)
Ln(Popu 1880)		0.110*	0.164**		0.181***	0.163**
		(0.059)	(0.070)		(0.064)	(0.080)
Province FE			Y			Y
Observations	262	262	262	262	262	262
R-squared	0.669	0.674	0.752	0.518	0.532	0.626

(b) Before and After the Abolition of the Exam in 1905

	Before the Abolition			After the Abolition		
	Ln (k+ # Presented Scholars in 1904)			Ln (k+ # Quasi-Presented Scholars in 1907)		
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(Quota)	0.375***	0.378***	0.305***	0.191***	0.218***	0.131*
	(0.076)	(0.097)	(0.092)	(0.069)	(0.078)	(0.067)
Ln(Popu 1880)	0.156**	0.148	0.091	0.197***	0.048	-0.045
	(0.069)	(0.094)	(0.084)	(0.072)	(0.086)	(0.068)
Ln(1+# in office)			0.414***			0.423***
			(0.073)			(0.097)
Province FE		Y	Y		Y	Y
Observations	262	262	262	262	262	262
R-squared	0.255	0.279	0.411	0.132	0.381	0.510

(c) Before and After the Republican Revolution in 1911

	Before the Revolution			After the Revolution		
	Ln(k + # parliament members in 1908)			Ln(k+ # parliament members in 1912)		
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(Quota)	0.278***	0.252**	0.182*	0.523***	0.490***	0.456***
	(0.078)	(0.102)	(0.093)	(0.066)	(0.083)	(0.080)
Ln(Popu 1880)	0.227***	0.241**	0.186*	0.288***	0.363***	0.327***
	(0.077)	(0.109)	(0.102)	(0.056)	(0.079)	(0.078)
Ln(1+# in office)			0.396***			0.166***
			(0.073)			(0.039)
Province FE		Y	Y		Y	Y
Observations	262	262	262	262	262	262
R-squared	0.225	0.250	0.369	0.586	0.604	0.624

Notes: (1) The table shows the link between the quota and the number of political newcomers across prefectures under different regimes: there was a strong link between the quota and the number of political newcomers (shown by panel (a) and columns (1)-(3) in panel (b)). This link was very much weakened with the abolition of the exam (shown by the comparison in panel (b)) but got recovered after the success of the revolution (shown by the comparison in panel (c)).

(2) Beta coefficients are reported; * significant at 10%; ** significant at 5%; *** significant at 1%. The results are based on k=1. We also repeat the exercises using k=0.1, and the patterns across periods are very similar. Moreover, we use Ln(#+(#21)1/2) as well as a dummy to indicate whether there is a presented scholar or an official to check the robustness.

Table 3: Baseline Results: The Impact of ln Quota on the Revolutionary Indicator

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ln (Quota) * Post	0.138***	0.206***	0.139***	0.147***	0.126***	0.113**	0.128**
	(0.020)	(0.025)	(0.044)	(0.044)	(0.046)	(0.046)	(0.050)
Ln (Population) * Post			0.073*	0.090**	0.103**	0.101**	0.057
			(0.037)	(0.039)	(0.043)	(0.044)	(0.035)
Ln (Area) * Post				-0.048	-0.057*	-0.054	-0.019
				(0.034)	(0.034)	(0.035)	(0.026)
Coastal * Post					-0.049	-0.080	-0.047
					(0.091)	(0.093)	(0.091)
Major River * Post						0.083*	0.082*
						(0.048)	(0.044)
Treaty Port * Post						0.096	0.120
						(0.078)	(0.078)
Small City * Post						-0.012	0.023
						(0.059)	(0.093)
Middle City * Post						0.016	-0.008
						(0.082)	(0.083)
Large City * Post						0.153	0.275**
						(0.136)	(0.131)
Prefecture FE	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y
Province FE*Year FE		Y	Y	Y	Y	Y	Y
Weighted by Popu.							Y
Observations	1,834	1,834	1,834	1,834	1,834	1,834	1,834
R-squared	0.279	0.449	0.452	0.454	0.458	0.462	0.403

Notes: (1) This table reports the impact of quota on the number of revolutionaries after the abolition of the exam, compared with that before the abolition.
(2) Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%.
(3) The results in column (7) are weighted by population size.

Table 4: Year-by-Year Effects of ln Quota on the Revolutionary Indicator

	(1)	(2)	(3)	(4)
Ln (Quota) * 1901	-0.006	-0.001	-0.004	0.005
	(0.012)	(0.012)	(0.015)	(0.008)
Ln (Quota) * 1902	-0.006	-0.001	-0.004	0.005
	(0.012)	(0.012)	(0.015)	(0.008)
Ln(Quota) * 1903	0.059**	0.054	0.053	0.020
	(0.025)	(0.037)	(0.039)	(0.014)
Ln (Quota) * 1904	0.039**	0.009	-0.010	0.006
	(0.018)	(0.028)	(0.029)	(0.010)
Ln (Quota) * 1905	0.228***	0.174***	0.133**	0.134**
	(0.029)	(0.052)	(0.055)	(0.053)
Ln (Quota) * 1906	0.219***	0.144***	0.098*	0.136**
	(0.031)	(0.055)	(0.059)	(0.056)
Prefecture FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Province FE*Year FE	Y	Y	Y	Y
ln Popu* Year FE, ln Size *Year FE		Y	Y	Y
Other Pref. variables * Year FE			Y	Y
Weighted by Popu.				Y
Observations	1,834	1,834	1,834	1,834
R-squared	0.452	0.459	0.479	0.419

Notes: (1) This table reports the dynamic effects of the quota on the revolutionary indicator, using the year of 1900 as the reference group. It shows that the effect of quotas only took place after the abolition.
(2) Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: Linking Revolutionaries to the Incidences of Uprisings in 1911

Dependent Var.	Ln (1+#rev.)	Incid.	Ln (0.1+#rev.)	Incid.	Ln(#+(#^{2} + 1)$^{\frac{1}{2}}$)	Incid.
	(1)	(2)	(3)	(4)	(5)	(6)
Ln (Quota) * Post	0.155**		0.372**		0.196**	
(β')	(0.071)		(0.155)		(0.089)	
Δ Ln (1+#rev.)		0.107**		0.041*		0.085**
(α)		(0.051)		(0.023)		(0.041)
$\beta' * \alpha$	**0.017**		**0.015**		**0.017**	
Baseline * Post	Y		Y		Y	
Prefecture FE	Y		Y		Y	
Year FE	Y		Y		Y	
Prov. FE*Year FE	Y		Y		Y	
Baseline Controls		Y		Y		Y
Province FE		Y		Y		Y
Observations	1,834	262	1,834	262	1,834	262
R-squared	0.477	0.274	0.500	0.265	0.481	0.273

Notes: (1) This table links the number of revolutionaries to the incidence of uprisings across prefectures in 1911 reported by a Japanese newspaper (the Tokyo Nichi Nichi Shimbun 1911).
(2) We are interested in $\beta' * \alpha$, which is robust to different ways of dealing with the zero observations.
(3)Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%. The baseline controls are the same as those in column (7) of Table 3.

Table 6: The Impact of Social Capital

	(1)	(2)	(3)	(4)	(5)	(6)
Temples Per 10,000 * Ln (Quota) * Post	0.041***	0.044***				
	(0.014)	(0.013)				
Ln (Temples) * Ln (Quota) * Post			0.045***	0.041***		
			(0.012)	(0.014)		
Fractionalization index* Ln (Quota) * Post					-0.353**	-0.349**
					(0.146)	(0.143)
Ln (Quota) * Post	0.210***	0.120**	0.246***	0.164***	0.205***	0.111**
	(0.024)	(0.047)	(0.039)	(0.062)	(0.025)	(0.046)
Temples Per 10,000 * Post	0.056***	0.054**				
	(0.017)	(0.022)				
Ln (Temples) * Post			0.003	0.012		
			(0.042)	(0.047)		
Fractionalization index* Post					-0.042	0.014
					(0.148)	(0.161)
Baseline Controls * Post		Y		Y		Y
Prefecture FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Province FE*Year FE	Y	Y	Y	Y	Y	Y
Observations	1,834	1,834	1,834	1,834	1,834	1,834
R-squared	0.457	0.467	0.457	0.466	0.453	0.465

Notes:(1) The table shows that the impact of quotas was strengthened by social capital.
(2)Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%. The baseline controls are the same as those in column (7) of Table 3.

Table 7: Mobility at Different Levels

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ln (Quota) * Post	0.113**			0.116**				
	(0.046)			(0.053)				
Ln (Prese. Scholars +1) * Post		0.034		-0.029				
		(0.026)		(0.037)				
Ln (Officials+1) * Post			0.045*	0.044				
			(0.026)	(0.031)				
(100*Quota/Popu) * Post					0.034***			0.039***
					(0.009)			(0.011)
(100*Pres.Scholar/Quota) * Post						0.058		0.039
						(0.077)		(0.076)
(Official/Pres.Scholar) * Post							-0.030	0.015
							(0.074)	(0.073)
Prefecture FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Province FE*Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Baseline controls * Post	Y	Y	Y	Y	Y	Y	Y	Y
Observations	1,834	1,834	1,834	1,834	1,834	1,834	1,778	1,778
R-squared	0.462	0.459	0.459	0.463	0.464	0.457	0.469	0.466

Notes: (1) This table shows that what matters for the number of revolutionaries is the mobility at the entry level (measured by Ln Quota or Quota/Popu).

(2) Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%. The baseline controls are the same as those in column (7) of Table 3.

Table 8: Two Placebo Tests

(a) Using the Boxer Rebellion as a Placebo

	The Boxer Uprising, 1899-1901			The Xinhai Revolution, 1911		
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(Quota)	0.023	0.010	0.000	0.094**	0.085**	0.075*
	(0.023)	(0.024)	(0.024)	(0.040)	(0.043)	(0.044)
Ln(Population)	Y	Y	Y	Y	Y	Y
Ln(Area)		Y	Y		Y	Y
Other controls			Y			Y
Province FE	Y	Y	Y	Y	Y	Y
Observations	262	262	262	262	262	262
R-squared	0.385	0.394	0.422	0.231	0.242	0.248

(b) Using Grain Prices as a Placebo

	Year-on-year Price Growth			Within-month Price Variation		
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(Quota) * Post	0.011	0.011	0.008	0.029	0.032	0.034
	(0.017)	(0.018)	(0.019)	(0.022)	(0.021)	(0.023)
Ln(Population) * Post	Y	Y	Y	Y	Y	Y
Ln(Area) * Post		Y	Y		Y	Y
Other controls * Post			Y			Y
Prefecture FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Province FE * Year FE	Y	Y	Y	Y	Y	Y
Observations	1,497	1,497	1,497	1,549	1,549	1,549
R-squared	0.534	0.534	0.535	0.133	0.134	0.141

Notes: (1) Panel (a) shows that the quota did not affect the Boxer Rebellion. The Boxer Rebellion was motivated by proto-nationalist sentiments and opposition to foreign imperialism and Christianity, which was unlikely to be correlated with the exam system. Panel (b) shows that the association between quotas and grain price variations did not change before and after the abolition of the exam.
(2)Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 9: Results from Using Instrumental Variables

	IV1: #SmallRivers./Riv. L. * Post			IV2: ΔLn (Pres. Scholar) * Post			Both		
	Reduce Form	IV	IV	Reduced Form	IV	IV	Reduced Form	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ln (Quota) * Post		0.352**	0.373**		0.272**	0.269**		0.300**	0.302***
		(0.166)	(0.188)		(0.112)	(0.119)		(0.098)	(0.089)
#SmallRivers./Riv. L. * Post	0.092**					0.024	0.086*		
	(0.044)					(0.052)	(0.044)		
ΔLn (Pres. Scholar) * Post			-0.022	0.061**			0.057*		
			(0.048)	(0.026)			(0.026)		
		First Stage			First Stage			First Stage	
#SmallRivers./Riv. L. * Post		0.260***	0.231***			0.231***		0.231***	0.282***
		(0.036)	(0.034)			(0.034)		(0.034)	(0.033)
ΔLn (Pres. Scholar) * Post			0.212***		0.224***	0.212***		0.212***	0.227***
			(0.020)		(0.021)	(0.020)		(0.020)	(0.020)
Baseline Controls * Post	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ln (River Length) * Post	Y	Y	Y			Y	Y	Y	Y
Ln (Pres. Scholar$_0$) * Post			Y	Y	Y	Y	Y	Y	Y
Placebo Variables * Post									Y
Prefecture FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Province FE * Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834
R-squared	0.459	0.440	0.437	0.459	0.452	0.453	0.461	0.449	0.451
p-value of the over-id Test								0.646	0.662

Notes: (1) Columns (3) and (6) show that the effect of one instrument is not significant once the other is employed, suggesting that the instrument did not affect revolutionaries beyond the quota channel.
(2)Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%. The baseline controls are the same as those in column (7) of Table 3. The placebo variables are the transportation importance, crop suitability, climate shocks and basin fragmentation discussed in Section A.1 in the appendix.

Table 10: The Impact of Modern Human Capital

	(1)	(2)	(3)	(4)	(5)
Ln (Quota) * Post	0.112**	0.115**	0.099**	0.094**	0.097**
	(0.046)	(0.046)	(0.044)	(0.044)	(0.045)
Ln (Firm+1)	0.041	0.079			0.046
	(0.055)	(0.084)			(0.083)
Ln (Firm+1) * Post		-0.710			-0.620
		(0.629)			(0.636)
Ln (Firm+1)* Ln (Quota) * Post		0.125			0.112
		(0.119)			(0.120)
Ln (Japan stu.+1)			0.127***	0.122***	0.121***
			(0.026)	(0.035)	(0.034)
Ln (Japan stu. +1) * Post				-0.008	-0.007
				(0.008)	(0.008)
Ln (Japan stu. +1)* Ln(Quota) * Post				0.009	0.008
				(0.013)	(0.013)
Prefecture FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
Province FE*Year FE	Y	Y	Y	Y	Y
Baseline Controls * Post	Y	Y	Y	Y	Y
Observations	1,834	1,834	1,834	1,834	1,834
R-squared	0.462	0.463	0.477	0.478	0.478

Notes: (1) The table shows that the number of students studying in Japan had a positive impact on the probability of having revolutionaries but the effect did not change before and after the abolition of the exam in 1905.
(2)Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%. The baseline controls are the same as those in column (7) of Table 3.

Table 11: The Impact of Economic Shocks

	(1)	(2)	(3)	(4)	(5)	(6)
Ln (Quota) * Post	0.112**	0.109**	0.117**	0.117**	0.113**	0.133***
	(0.046)	(0.046)	(0.046)	(0.047)	(0.046)	(0.051)
Weather shocks	0.037	0.024				
	(0.026)	(0.026)				
Weather shocks * Ln (Quota) * Post		0.015				
		(0.021)				
Average weather * Post			0.272	0.256		
			(0.233)	(0.223)		
Average weather * Ln (Quota) * Post				0.046		
				(0.286)		
Weather S.D. * Post					0.017	-0.030
					(0.087)	(0.085)
Weather S.D. * Ln (Quota) * Post						0.121
						(0.105)
Prefecture FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Province FE*Year FE	Y	Y	Y	Y	Y	Y
Baseline Controls * Post	Y	Y	Y	Y	Y	Y
Observations	1,834	1,834	1,834	1,834	1,834	1,834
R-squared	0.462	0.463	0.462	0.463	0.462	0.463

Notes: (1) The table shows that weather shocks did not have significant impact on the revolution.
(2)Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%. The baseline controls are the same as those in column (7) of Table 3.

Table 12: The Quota and Party Identification

	Individual-Level			Prefecture-Level			
	Kungmingtang=0/1			Ln (1+ #Kungmintang Mem.)		Ln (1+ #Other Party Mem.)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ln Quota	0.070	-0.035	-0.039	0.226***	0.155**	0.250***	0.181***
	(0.045)	(0.048)	(0.048)	(0.066)	(0.067)	(0.055)	(0.058)
ln Population	-0.049	0.009	0.012	0.232***	0.200***	0.100**	0.086
	(0.031)	(0.037)	(0.037)	(0.053)	(0.055)	(0.050)	(0.055)
Age in 1912			-0.005*				
			(0.003)				
Baseline Controls					Y		Y
Province FE		Y	Y	Y	Y	Y	Y
Observations	703	703	701	262	262	262	262
R-squared	0.004	0.181	0.185	0.494	0.519	0.472	0.505

Notes: (1) This table shows that the number of quotas did not affect party identification, although younger people tend to join the more radical party (the *Kuomintang*), as shown in the individual-level analysis in columns (1)-(3). Columns (4)-(7) reports results using prefecture-level data: quotas increase the number of party members in both the *Kungmintang* and the other parties and the magnitudes of the impacts are similar (0.155 vs. 0.181).
(2) Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%. Baseline controls are the same as those in column (7) of Table 3.

A Appendix

A.1 Testing the Validity of the Instruments

In this section, we present several tests on the validity of the two instruments. These tests show that (i) the instruments affected the level of the quotas and that (ii) they did not affect other observables that might affect revolutionaries besides quotas.

The Number of Small Rivers Given River Lengths We begin with examining the correlation between the quota and the instrument using the following specification:

$$\ln \text{Quota}_p = \rho(\frac{\#\text{SmallRiver}}{\text{Riv.Length}})_p + \theta \text{X}_p + \delta \ln \text{Riv.length}_p + \delta_{prov} + \varepsilon_p,$$

where $(\frac{\#\text{SmallRiver}}{\text{Riv.Length}})_p$ measures the number of confluences relative to total river lengths in prefecture p.

We control for the same variables as in the baseline estimations. In addition, to take into account possible effects of rivers, we also include the logged river length and whether there are major rivers. Columns (1)-(2) in Table A.3 report the impacts of the instrument on the logged quota and show that it is strongly positively correlated with the quota. During the whole Qing dynasty, the quotas were very stable, with only one change due to fighting the Taiping Rebellion. The increase was about 15% on average. As our instrument should be uncorrelated with the change in the quota, we should expect similar correlations between the instrument and the quota in the early and the late Qing periods. As shown in Column (3), the instrument is uncorrelated with the change in the quota.

Our instrument is valid only when it affects the participation of revolution only via quotas. To check whether this is a concern, we conduct four sets of placebo tests. First, we examine whether the river feature affects transportation conditions. Using the official designation of transportation centers (*Chong* in Chinese, see Section 2.3 for discussions of the data source), columns (4) and (5) show that our instrument is uncorrelated with the importance in transportation regardless of using a dummy for a prefecture or the average of the counties in a prefecture. As expected, being located on a major river is correlated with transportation importance.

Second, we examine whether the instrument is correlated with suitability of different crops premised on the notion that the number of small rivers might be correlated with agricultural suitability. We employ the suitability for three crops: rice - a crop highly dependent on water; foxmillet - a traditional Chinese drought-resistant crop; and sweet potato - the main New World crop adopted in China. Columns (6)-(8) show that there is no significant correlation between our instrument and crop suitability.

Third, we also wonder whether the incidence of climate disasters might systematically differ between the two prefectures with different density of small rivers. We construct a measure on the drought/flood index from -2 to 2 during 1800-99, and find that our instrument

is not significantly correlated with it (shown in columns (9)).

Finally, we check whether the number of small rivers affect the fragmentation of basins that may also affect suitability of agriculture. As shown in column 10, we do not any significant impact on basin fragmentation measured by the Herfindahl-Hirschman index.

In sum, the relevance and placebo tests in Table A.3 suggest that the number of small rivers is a reasonable instrument.

Exam Performance Before the Quota System Similar to the tests on the first instrument, we examine the correlation between the instrument and the quota using the specification as follows:

$$\ln \text{Quota}_p = \rho \Delta \ln \text{Pres.Scholar}_p + \theta \text{X}_p + \delta(\ln[1+\text{Pres.Scholar}_0])_\text{p} + \delta_{prov} + \varepsilon_p,$$

where we control for the same variables as in the baseline estimations and the performance of civil exam during 1368-1398.

Column (1) of Table A.4 reports the effects of $(\Delta \ln \text{PresentedScholar})_p$ on the logged quotas in the late Qing period and shows that they significantly positively correlated. A similar correlation between $\Delta \ln \text{PresentedScholar}_p$ and the quota in the early Qing is presented in column (2) while column (3) shows that $\Delta \ln \text{PresentedScholar}_p$ did not affect the difference in the quota in the late Qing and the early Qing.

As placebo tests, we examine whether this instrument affect changes in the number of presented in longer periods. We looked at seven periods (defined by the tenures of emperors), and take first difference in the number of presented scholars. By regressing these differences on our instrument, we do not find any significant correlations, as shown in columns (4)-(9).

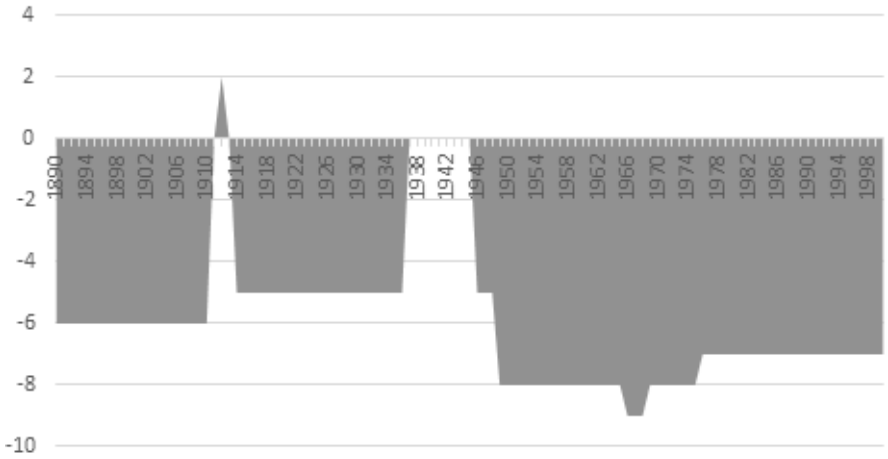
Thus, the relevance and placebo tests in Table A.4 also suggest that the short-run performance before the quota system is another reasonable instrument.

A.2 Varying the Definition of Small Rivers

For robustness checks of using small rivers as an instrument, we vary the definition of small rivers to be those under the length of X km (X = 70, 80, 90,...,120), while controlling for the interaction of the post dummy and those above X km. These results are presented in Table A.5. They show that the results are robust to these variations.

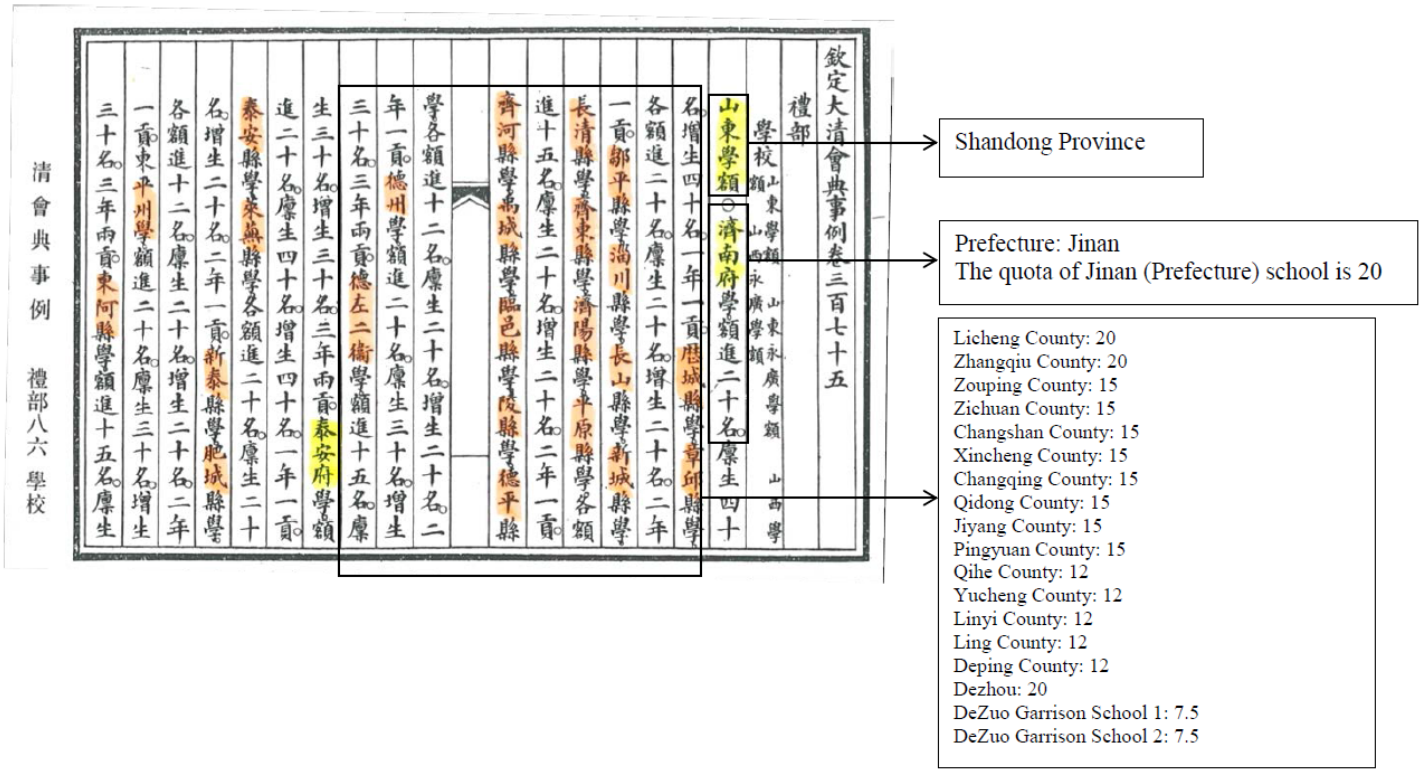
Moreover, we find no similar impact of the number of big rivers per se, which once again confirms that our river instrument is reasonable.

Figure A.1: Polity Scores for China between 1890 and 2000



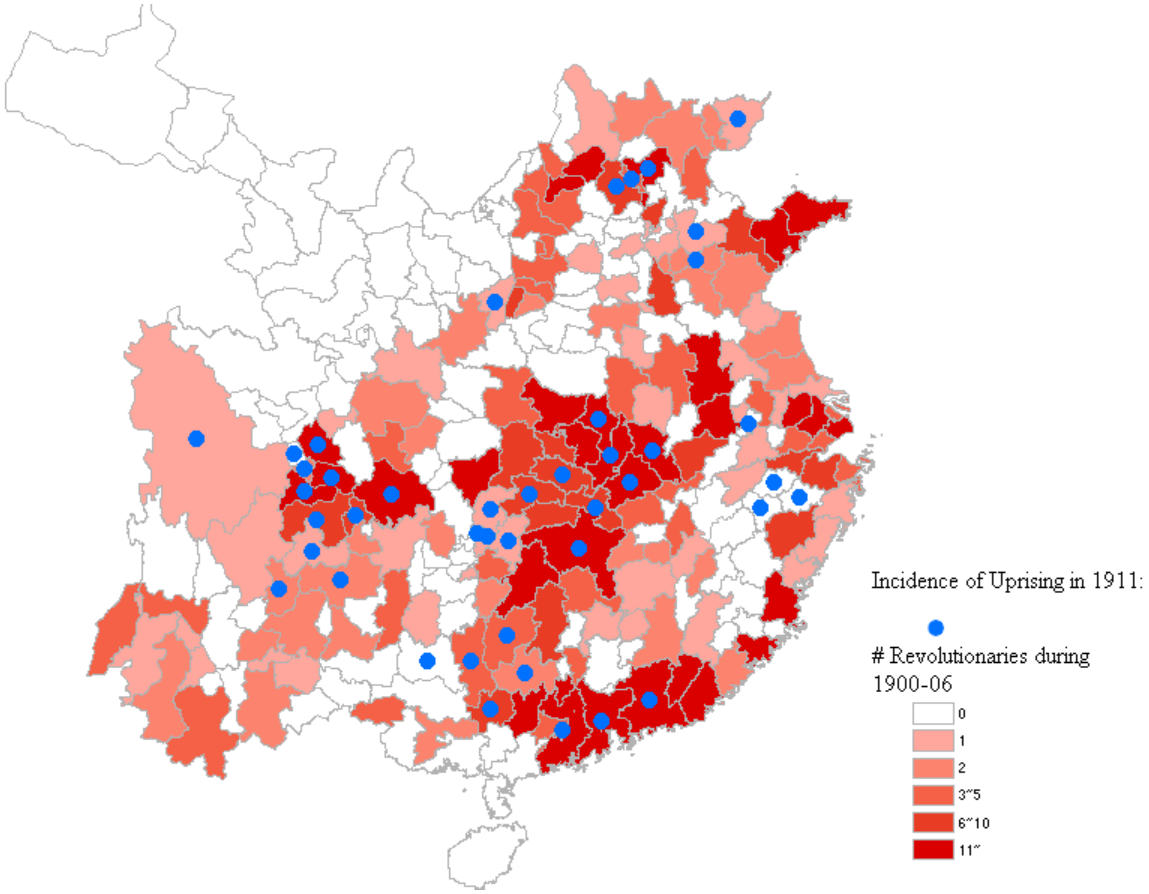
*Notes:*This figure reports the polity scores of China between 1890 and 2000, based on the information from Polity IV. The range of the score is between -10 and 10.

Figure A.2: The Data on Quotas



Notes: The data on the Quotas were recorded in the Qing Hui Dian Shi Li (edited by Kun, Gang). This figure gives an example for one prefecture (Jinan in Shandong Province). The quota for the prefecture capital is 20 and the total quota of the counties is 255. Thus, the total quota for the Jinan prefecture is 275.

Figure A.3: Revolutionaries and the 1911 Revolution



Notes: This map shows that the origins of revolutionaries are correlated with the incidence of uprisings in 1911.

Figure A.4: Rivers and County Seats

Notes: This map shows that county seats (indicated by the dots) are generally located on rivers. The bold rivers indicate the major ones (ranked 1 or 2 in the river hierarchies).

Table A.1: Year-by-Year Impacts across Counties in Guangdong

	(1)	(2)	(3)	(4)
Ln (Quota) * 1894	0.003	-0.033	-0.009	-0.072
	(0.149)	(0.145)	(0.156)	(0.076)
Ln (Quota) * 1895	0.127	0.067	0.110	0.043
	(0.168)	(0.176)	(0.172)	(0.107)
Ln (Quota) * 1896	-0.217	-0.212	-0.219	-0.141
	(0.166)	(0.176)	(0.176)	(0.107)
Ln (Quota) * 1897	-0.049	-0.070	-0.067	-0.048
	(0.164)	(0.175)	(0.173)	(0.107)
Ln (Quota) * 1898	-0.217	-0.212	-0.219	-0.141
	(0.166)	(0.176)	(0.176)	(0.107)
Ln (Quota) * 1899	-0.185	-0.184	-0.188	-0.124
	(0.149)	(0.164)	(0.161)	(0.098)
Ln (Quota) * 1901	-0.199	-0.196	-0.199	-0.137
	(0.168)	(0.178)	(0.179)	(0.107)
Ln (Quota) * 1902	-0.157	-0.166	-0.162	-0.109
	(0.137)	(0.158)	(0.153)	(0.092)
Ln (Quota) * 1903	0.165	0.136	0.151	0.030
	(0.165)	(0.181)	(0.181)	(0.090)
Ln (Quota) * 1904	-0.191	-0.192	-0.194	-0.127
	(0.149)	(0.165)	(0.162)	(0.099)
Ln (Quota) * 1905	0.471**	0.427*	0.433*	0.231
	(0.225)	(0.234)	(0.229)	(0.142)
Ln (Quota) * 1906	0.500**	0.436**	0.454**	0.274**
	(0.213)	(0.217)	(0.211)	(0.135)
County FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Prefecture FE*Year FE	Y	Y	Y	Y
ln Popu* Year FE, ln Size *Year FE		Y	Y	Y
Other County Dummies * Year FE			Y	Y
Weighted by Popu.				Y
Observations	1,196	1,196	1,196	1,196
R-squared	0.438	0.461	0.478	0.449

Notes: (1) This table reports the dynamic effects of the quota using data from 92 counties in Guangdong between 1894 and 1906, using the year of 1900 as the reference. It shows that the effect of quotas only took place after the abolition.
(2) Standard errors in parenthesis are clustered at the county level: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A.2: Controlling for the Role of Regional Importance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ln(Quota) * Post	0.111**	0.132**	0.107**	0.111**	0.106**	0.110**	0.115**
	(0.045)	(0.052)	(0.046)	(0.048)	(0.046)	(0.045)	(0.052)
Province Capital	0.089						0.101
*Post	(0.121)						(0.118)
Tax per capita in 1820		-0.124					-0.089
*Post		(0.261)					(0.239)
Communication (Chong)			0.031				0.056
*Post			(0.051)				(0.051)
Business (Fan)				0.008			-0.035
*Post				(0.053)			(0.061)
Difficulty of taxing (Pi)					0.091*		0.095*
*Post					(0.055)		(0.057)
Crime (Nan)						0.063	0.063
*Post						(0.046)	(0.053)
Prefecture FE	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y
Province FE * Year FE	Y	Y	Y	Y	Y	Y	Y
Baseline Controls * Post	Y	Y	Y	Y	Y	Y	Y
Observations	1,834	1,799	1,834	1,834	1,834	1,834	1,799
R-squared	0.462	0.462	0.462	0.462	0.464	0.463	0.467

Notes: This table shows that the impact of the quota cannot be explained by the importance measures.
(2) Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A.3: Testing the Validity of Instrument I (#small river / river length)

	Relevance Tests			Placebo Tests						
	Ln (Quota)			Transportation		Suitability			Climate	Basin
	Late Qing	Early Qing	Change	Pref.	County Average	Rice	Foxmillet	Sweet Potato	Drought /Flood	HH Index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
#Small River/RiverLeng.	0.260**	0.262*	-0.001	-0.118	-0.071	0.172	0.034	0.135	0.010	0.034
	(0.121)	(0.140)	(0.029)	(0.084)	(0.060)	(0.124)	(0.184)	(0.132)	(0.014)	(0.053)
Ln (River Length)	0.213*	0.223	-0.009	0.020	0.033	0.066	-0.064	-0.273*	0.020*	-0.068
	(0.126)	(0.140)	(0.032)	(0.087)	(0.072)	(0.143)	(0.201)	(0.144)	(0.011)	(0.042)
Major River	0.131*	0.113	0.018	0.150**	0.126***	0.010	-0.078	0.101	0.011	-0.020
	(0.069)	(0.069)	(0.015)	(0.070)	(0.046)	(0.106)	(0.123)	(0.116)	(0.009)	(0.035)
Baseline Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	262	262	262	262	262	262	262	262	262	262
R-squared	0.772	0.749	0.702	0.287	0.237	0.690	0.720	0.541	0.400	0.378

Notes: (1) Columns (1)-(3) show that the instrument is correlated with the level of quotas but not the change. Columns (4)-(10) present four different sets of placebo tests, showing that the instrument does not transportation importance, agricultural suitability, climate shocks or basin fragmentation.
(2) Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%. The baseline controls are the same as those in column (7) of Table 3.

Table A.4: Testing the Validity of Instrument II (Δln(PresentedScholar))

	Relevance Tests			Placebo Tests: Changes in Presented Scholars in the Long Run					
	Ln Quota			1436-1505 vs.	1506-1572 vs.	1573-1643 vs.	1644-1722 vs.	1723-1795 vs.	1796-1861
	Late Qing	Early Qing	Change	1368-1435	1436-1505	1506-1572	1573-1643	1644-1722	1723-1795
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δln(PresentedScholar)	0.224***	0.214***	0.009	-0.024	-0.104	-0.084	-0.125	0.037	-0.058
	(0.044)	(0.044)	(0.013)	(0.087)	(0.079)	(0.064)	(0.081)	(0.096)	(0.072)
ln(PresentedScholar$_0$)	Y	Y	Y	Y	Y	Y	Y	Y	Y
Baseline Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	262	262	262	262	262	262	262	262	262
R-squared	0.785	0.761	0.704	0.424	0.135	0.160	0.273	0.471	0.183

Notes: (1) Columns (1)-(3) show that the instrument is correlated with the level of quotas but not change. Columns (4)-(9) present different sets of placebo test, showing that the instrument did not affect the growth of successful candidates in the long run. The periods are divided based on the tenure of emperors.
(2) Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%. The baseline controls are the same as those in column (7) of Table 3.

Table A.5: Robustness Checks of Using Small Rivers

Small Rivers	≤70 KM	≤80 KM	≤90 KM	≤100 KM	≤110 KM	≤120 KM
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(Quota) * Post	0.359**	0.352**	0.348**	0.349**	0.372*	0.369*
	(0.165)	(0.166)	(0.174)	(0.176)	(0.194)	(0.204)
# Rivers (>70 km)/River L * Post	-0.062					
	(0.076)					
# Rivers (>80 km) /River L * Post		-0.020				
		(0.097)				
# Rivers (>90 km) /River L * Post			-0.038			
			(0.121)			
# Rivers (>100 km) /River L * Post				-0.018		
				(0.116)		
# Rivers (>110 km) /River L * Post					0.062	
					(0.137)	
# Rivers (>120 km) /River L * Post						0.047
						(0.156)
Baseline Controls * Post	Y	Y	Y	Y	Y	Y
Ln(River Length) * Post	Y	Y	Y	Y	Y	Y
Major river * Post	Y	Y	Y	Y	Y	Y
Prefecture FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Province FE*Year FE	Y	Y	Y	Y	Y	Y
Observations	1,834	1,834	1,834	1,834	1,834	1,834
R-squared	0.439	0.440	0.441	0.441	0.436	0.437

Notes: Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%. The baseline controls are the same as those in column (7) of Table 3.