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

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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 channel of creating a gentry class. Employing a panel dataset across 262 prefectures and exploring the variations in the quotas on the entry-level exam candidates, we find that higher quotas per capita were associated with a higher probability of revolution participation 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.

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1 Introduction

Social mobility is often considered by social scientists an important element in determining the fate of political regimes. An increase in the prospect of upward mobility may help bring stability to a society by decreasing the likelihood of a revolution whereas the lack of perceived mobility may fuel and facilitate 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. 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, there is no quantitative evidence on the link between social mobility (or the perceptions of social mobility) and political transitions. The lack of 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 in 1905. We examine how the abolition of a system that lasted over 1,300 years 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 short-lived republic.[2] 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 channel 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.[3] For example, studying the

[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 market reforms that changed the prospects of college education.

[2] The revolution is known as the *Xinhai* Revolution as 1911 was also the year of *Xinhai* in the sexagenary cycle of the Chinese calendar.

[3] 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).

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 '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). 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 Gilbert Rozman remarked, "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 revolutionary leaders, made a well-known 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 (Spence 1990). They provide a fruitful testing ground for the link between *perceived* social mobility and political transition. To link the abolition to the participation in the revolution, we 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 quotas

[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.

per capita across prefectures as a measure of *perceived* mobility. We realize that quotas might capture other dimensions beyond mobility and will discuss various alternatives in detail. We do not assume that quotas were randomly assigned and will explore instrumental variables for them. But two aspects of the quota assignment bear emphasis. First, the quota distribution was very stable in the Qing dynasty and did not vary with any change in prefecture characteristics.[6] Second, the quota for a prefecture comprised of quotas for the counties within the prefecture and an extra quota for the prefecture together. The quotas for the counties and the extra quotas for the prefectures 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.[7] As a result of these two features, there are great regional variations even if we control for population size 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.[8]

A second major dataset we construct is the prefectures of origins for the 1,277 registered revolutionaries between 1900 and 1906 (compiled by Chang (1982)). It is impossible to collect the information of all the participants in the revolution. The revolutionaries we can get information on were members of major revolutionary groups at the national level, who could motivate more participants at different local levels. We are concerned about whether the missing of information on 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 revolutionary activities. Based on reports from a major Japanese newspaper in 1911, we coded the spatial distribution of the early uprisings in 1911 across China. 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 of uprisings. Additionally, we construct a county-level dataset in Guangdong province where the earliest revolutionary

[6] See Section 2.1 for more discussions on the data and the one change due to the need of repressing the Taiping Rebellion (1851-1864).

[7] 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.

[8] It is worthwhile clarifying two possible understandings of the quota system. First, it is sometimes thought that quotas were 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. 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.

group emerged. Since the majority of those revolutionaries in the very early stages 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 on the social ladder) are higher than the costs. We assume that the perceived probability is increasing in quotas per capita. The model predicts more revolution participation in regions with higher quotas per capita 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 quotas per capita 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 revolutionary participation in the prefecture-level data between 1900 and 1906. One concern is whether our finding is confounded by size effect of quotas: more (educated) people got affected by the abolition in prefectures with higher quotas. We allow for this possibility in our estimations and find that our finding is driven by the probability of entering the gentry class rather than the size effect of quotas. In addition, cross-sectional results show that one standard deviation increase in the logged quota is associated with more than one percentage point higher uprising incidence in 1911. We also test the role of social capital using the fragmentation and polarization measures of languages (inverse measures of social capital) in a prefecture as proxies.

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 in a prefecture. However, it was uncorrelated with the exam system and we would not expect quotas to affect 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 the political control of the state, as such dramatic changes might be reflected by grain prices.

Despite the fact that the quota system was relatively stable and had the stepwise feature, it is still conceivable that the quota might be correlated with omitted variables not captured by our robustness checks. For example, political networks correlated with the quota system might influence the selection of bureaucrats more after the abolition. To deal with this concern, we further employ two instruments for the quotas based on geographical and historical features, namely the number of small rivers (given the length of rivers) in a prefecture and the short-run change in the number of successful candidates before the quota system (see Section 6.3 for the mechanisms and related checks). The estimates using the two instrument variables are generally larger.

We interpret the discontinuous change in the effect of quotas per capita as change in perceived mobility. Consequently, people in prefectures with higher quotas per capita 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 expected returns to the investment in the traditional education system 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. We consider the three major alternative hypothesis including the role of modern human capita, the role of gentry and the influence of ideology. 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 could not explain our finding on the impact of quotas.

This study contributes to several strands of literature. The role of mobility in this context complements 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. Unlike the rich evidence on

mobility and redistribution, the thin literature linking social mobility and revolution is only theoretical.[9] 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 impacts of quotas and modern human capital suggests that different groups could have contributed to the revolution. Our finding on how social capital facilitates the complementarity in participation in revolutionary organizations may be applied to other contexts of revolution.[10]

The rest of the paper is organized as follows. Section 2 discusses the historical background. Section 3 presents a model to guide the empirical analysis. Section 4 describes the data. Section 5 presents the baseline results, while Section 6 discusses robustness checks. Section 7 presents tests related to a few alternative hypothesis. Section 8 concludes.

2 Historical Background

We first describe the exam system, discuss its role in determining mobility and explain why it got abolished. Then we describe the revolutionary participation and the uprising in the critical year of 1911.

[9] For example, Leventoglu (2005, 2013) introduces mobility to the political transition framework in Acemoglu and Robinson (2001). One can also use this framework to model revolution participation in our context.

[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.

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 Sui 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 (1644-1911) dynasties. The structure and process of the civil examination system remained stable in the late imperial period (the Ming and Qing dynasties). The contents of 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. It consists 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 this exam were termed "the Literati" (*Xiucai* in Chinese). They became the lower gentry class and 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). Since this level determines the entry to the gentry class, it is our focus in the analysis.

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) and were eligible to become lower-level officials. The third level is a national examination (*Huikao* in Chinese) taking place in the the capital, with re-examination to rank the candidates in the imperial palace (*Dianshi* in Chinese). These candidates were termed "the Presented Scholar" (*Jinshi* in Chinese), many of whom were selected for high-level government positions.

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

F1: the exam was in principle open to people from all socio-economic backgrounds and hence had a significant impact 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, exam takers needed to invest time and money in preparing for the exam and to 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 and local prominent individuals. 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) and that 80 percent of the descendants beyond the grandson generation of the local prominent individuals became unknown due to the exam system.[11]

The exact estimate on inter-generational mobility is debatable.[12] What matters more for political stability is *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.[13]

F2: the exam system mattered for the political and economic prospect of a large amount of population. In historical China, people were ranked into four groups according to their social status. In descending order, these were the gentry scholars (*shi*), the peasant farmers (*nong*), the artisans (*gong*) and craftsmen and the merchants and traders (*shang*) (Chang 1962). According to the estimate in Chang (1962), the gentry class received about 24 percent of the national income, even though they constituted only about one to two percent of the population. As pointed out by the literature on the allocation of talents (Murphy, Shleifer and Vishny 1991, Acemoglu 1995), such a hierarchy naturally affected the allocation of resources and talents – individuals and families had strong incentives to invest in the exam system whenever they could afford it, given the open nature of the exam.

A relevant question is how many people were competing for gentry slots. While the total

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

[12]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".

[13]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).

quota for *eac*h prefecture-level exam that took place twice every three years was around 30,000, at least two million people registered for *each* prefecture-level exam (Elman 2013). Another upper bound estimate to understand the importance of the exam system is male literacy rates. For example, Rawski (1979) estimates that the literacy rate for the male population was around 30 to 45 percent thanks to the exam system.

On top of the exam-takers, in the 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 was amplified (Wang 2013).

F3: the numbers of successful candidates in each level were 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.[14] 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. The mobility variations across regions were determined by quotas per capita. See Section 4.1 for more discussions on the assignment of the quotas.

The Abolition of the Exam 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 among others. The exam system was seen by many intellectuals as one of the roots 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 gradually within the next five to ten years. However, in 1905, The Empress Dowager Cixi endorsed a memorandum ordering the discontinuance of the old examination system at all levels. One important external factor behind the abolition is the Russo-Japanese War of 1904-05. The success of Japan was attributed to the Meiji Restoration and Modernization,

[14]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.

which set an example for the Qing dynasty (Franke 1960).

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 individuals with a modern education. These facts effectively discouraged a large group of individuals who had invested in the traditional system. Even if some of them switched to the new system and received a higher salary than the case with a traditional educational background, the link between their education and their political status was interrupted without an elite background. We will also provide quantitative evidence for this change in Section 4.1.

2.2 The Revolutionaries and the Uprisings in 1911

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 were disclosed after the success of the revolution. In addition, he also added members based on biographies and memoirs. Table A.1 in the appendix describes the six groups in detail. In 1907, the largest group (the Chinese Revolutionary Alliance) was divided into many groups. As a result, a systematic data on the lists of major revolutionary groups were only available until 1906.

The revolutionaries started many revolts and uprisings. Most of them were repressed by the government. The turning point was the success of the Wuchang Uprising in Hubei Province on October 10, 1911. Following its success, uprisings took place across China. 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.[15] We will also link the number of revolutionaries to the uprisings in 1911.

3 A Simple Model of Revolution Participation

To guide our empirical analysis, we present a simple model of revolution participation, which introduces mobility to the simple framework in Passarelli and Tabellini (2013).[16] The aim of the model is 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 quotas per capita and η_0 is increasing in q.[17] 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 prefectures 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:

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

[15] The new republic was by no means a well-functioning democracy. Figure A.3 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.

[16] 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.

[17] 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.

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.[18] The revolution condition gives the following comparative 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 gets changed: $\frac{\partial \eta_0(q)}{\partial q}$ is changed to be $\frac{\partial \eta_0'(q)}{\partial q}$. 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 If $\frac{\partial \eta_0'(q)}{\partial q} < \frac{\partial \eta_0(q)}{\partial q}$ as discussed in Section 2.1, 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.

Below, we will also presents some quantitative evidence to support $\frac{\partial \eta_0'(q)}{\partial q} < \frac{\partial \eta_0(q)}{\partial q}$, after describes the data on quotas.

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 measure of social capital across prefecture to test whether the impact of quotas got strengthened by social capital.

[18] 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.

4 Data

4.1 Quotas (per capita)

The Assignment of Quotas Our main measure of perceived mobility for a large group of citizens across prefectures is the entry-level exam quotas per capita. The data on quotas comes from the Imperially Established Institutes and Laws of the Great Qing Dynasty (Kun, Gang et al. 1899). The quota for a prefecture consisted of two parts: each county in the prefecture got a quota and the prefecture together got an additional quota that could be shared by different counties. Therefore, the quota was binding at the prefecture level. Figure A.1 in the appendix gives an example of how the quotas were recorded.

There was no standard formula for the regional quota, but two features of the assignment deserve emphasis. First, quotas assigned to each county and the additional quota for each prefecture followed a stepwise rule: the most common numbers are 8, 12, 15 and 20. As Figure A.2 shows, the four most frequent cases account for over 70% of the observations. 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 prefecture (Chang 1955). Table A.2 in the appendix presents the correlations between logged quotas and prefecture characteristics including logged population and area sizes, geographical locations and urbanization measures (see Section 4.3 for description of the data sources for these measures). Columns (1)-(4) show that population size is the most important factor in determining quotas. We focus on the impact of logged quotas per capita (in column (5)) in our analysis and also use a few alternative transformations for robustness.

Second, the quota system was fairly 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 quotas per capita at the latter period as it is closer to the revolution.

Our empirical analysis focuses on the variations in quotas per capita 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 quotas, leaving a large chunk for our exploration within provinces. Figure 2 maps the spatial distribution of quotas as well as quotas per million of individuals. Table 1 provides the data sources and summary statistics for these variables.

In addition, we also collect information on 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). 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. We employ the number of presented scholars and key officials in each prefecture to measure the probability of moving up to the top of the social ladder.

Quotas as a Determinant of Mobility before and after the Abolition To show that the quotas mattered for mobility, 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 number of presented scholars and key officials.[19] 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.

To examine the change in the influence of quotas before and after the abolition of exam, we examine the link between 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-educational 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).

Together the qualitative historical studies such as Wang (1960), these results provide further support for the assumption $\frac{\partial \eta_0'(q)}{\partial q} < \frac{\partial \eta_0(q)}{\partial q}$. Conceptually, the abolition of the exam could have adverse impacts on perceived mobility for the commoners in two dimensions. Across prefectures, ceteris paribus, those who 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 the politically connected elites. Our empirical analysis will focus on the first

[19] To deal with observations of zeros, we employ different transformations including adding different positive numbers or using the inverse hyperbolic sine transformation: $\ln(\#\text{rev.} + (1 + \#\text{rev.}^2)^{\frac{1}{2}})$ (Burbidge, Magee and Robb 1988). The patterns are robust to these transformations.

dimension, exploring the variations in the quota assignment.

4.2 Origins of Revolutionaries and the Uprisings in 1911

Origins of the Revolutionaries 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 in Chang (1982), we construct a dataset of prefecture-level revolutionaries across China between 1900 and 1906.[20] This is the period when the revolution was spreading across the whole country and hence 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.

One concern on the data quality is whether the early records were less precise than the late ones. To deal with this concern, 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. Figure A.4 plots the probability of revolution participation over time. The trend of the county-level data is very similar to that in the prefecture-level data between 1900 and 1906.

Another important 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.

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 included 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

[20] As the data on the members in the Chinese Revolutionary Alliance was already compiled in Luo (1958), Chang (1982) only provides the information on the founders. We also add the information on members in Luo (1958).

of the uprisings.

This data helps us further check the reliability of the revolutionary data we collect. Figure A.5 in the appendix maps the spatial distribution of the uprisings and that of origin of revolutionaries. As it shows, 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. With this information, we can also link the number of revolutionaries to the incidence of uprisings.

Other Information on the Revolutionaries Ideally, one would also like to know the family and educational background of the revolutionaries. Unfortunately, there is no systematic information on the revolutionaries besides their origins. For the largest group (the Chinese Revolutionary Alliance), we also know the age of the revolutionaries. The median age is 24, suggesting that the majority of the revolutionaries were young. We have also gathered biographical information for 63 out of the 106 cadres of the Chinese Revolutionary Alliance. 32 of them received traditional education only whereas 31 received some modern or western education besides traditional education. Among those receiving traditional education only, 12 joined the revolutionary group before 1905 and 20 joined after 1905. In contrast, among those receiving some modern education, 17 joined the revolutionary group before 1905 and 14 joined after 1905. These numbers show that more people educated under the traditional system became revolutionaries after the abolition of the exam. Of course, this finding has to be taken with a grain of salt because those who have biographies available are the very top leaders and are not representative of all the revolutionaries.

4.3 Other Prefecture Characteristics

Social Capital in the model captures the role of social capital and can be interpreted as the easiness of coordination in revolution participation. One inverse measure for is language diversity explored in the ethno-linguistic fragmentation literature (Alesina and La Ferrara 2000). Specifically, we calculate an ethno-linguistic fragmentation (ELF) measure proposed by Alesina and LaFerrara (2005b): $ELF = 1 - \sum_{i=1}^{N} s_i^2$, in which s_i represents the share of dialect i over the total area in a prefecture. The information on dialects comes from the Language Atlas of China (1988).

Moreover, considering that it may be more difficult to organize two large distinct groups than many small groups, we borrow the polarization index (PI) in the ethnic conflict literature (Garcia-Montalvo and Reynal-Querol 2002), where $PI = 1 - \sum_{i=1}^{N} s_i(\frac{1/2 - s_i}{1/2})^2$.

Baseline Controls We include four sets of prefecture characteristics as our baseline controls. See Table 1 for more information on the data sources and summary statistics.

First, 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.

Second, 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).

Third, 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.

Fourth, the participation of revolution might also be correlated with economic conditions. We control for urbanization measures in Rozman (1974), where Chinese cities were classified into three groups: big cities were those with a population of 300,000 and above, middle-level cities between 70,000 and 300,000, and small cities between 30,000 and 70,000.

Economic and Political Importance Finally, besides these first four baseline controls, we construct another 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 belonged 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).

5 Baseline Results

Our baseline results comprise of three parts. First, we estimate the impact of quotas per capita 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.

5.1 Linking the Quotas to the Origins of Revolutionaries

The Impact of Quotas per capita Our baseline estimations are based on data across 262 prefectures between 1900 and 1906. To examine the impact of quotas per capita 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:

$$\begin{aligned} \mathrm{R}_{p,t} &= \beta \ln \left(\frac{\mathrm{Quota}}{\mathrm{Popu}}\right)_p \times \mathrm{Post}_t + \upsilon \ln \mathrm{Popu}_p \times \mathrm{Post}_t + \theta \mathrm{X}_p \times \mathrm{Post}_t + \lambda_p + \gamma_t + \delta_{prov} \times \gamma_t + \varepsilon_{p,t} \quad (5) \\ &= \beta \ln \mathrm{Quota}_p \times \mathrm{Post}_t + (\upsilon - \beta) \ln \mathrm{Popu}_p \times \mathrm{Post}_t + \theta \mathrm{X}_p \times \mathrm{Post}_t + \lambda_p + \gamma_t + \delta_{prov} \times \gamma_t + \varepsilon_{p,t}, \end{aligned}$$

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 5.2. To reduce potential influence of extreme values, we use logged quotas per capita for the entry-level exam ($\ln \left(\frac{\mathrm{Quota}}{\mathrm{Popu}}\right)_p$) to measure perceived mobility.[21] After controlling for $\ln \mathrm{Popu}_p$ that also matter for revolution participation, we can estimate the impact of $\ln \mathrm{Quota}_p$ (i.e., β) and that of $\ln \mathrm{Popu}_p$ (i.e., $\upsilon - \beta$) respectively, as shown in the second line of equation (5).

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 other prefecture-level characteristics discussed in Section 4.3. To further control for size effects, we control for logged area size. 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) reports the results after only controlling for all the fixed effects and column (2) also includes the impact of logged population. Columns (3)-(4) further include the interactions of the post dummy and different sets of controls. Column (5) reports the results weighted by 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).

Investigating the Size Effect We interpret our finding as the role of mobility proxied by quotas per capita. One concern is that our finding might be confounded by the impact of the size effect of quotas: more candidates got affected by the abolition in a prefecture with a higher quota. Therefore, the effect of quotas per capita might also depend on the absolute value of quotas. To check whether this alternative hypothesis drives our finding,

[21] Our results are robust to using $\left(\frac{\mathrm{Quota}}{\mathrm{Popu}}\right)_p$ (shown in Section 6.1).

we allow that the absolute value of quotas affected the impact of $\ln(\frac{\text{Quota}}{\text{Popu}})_p$ in a flexible way by introducing a polynomial function of quotas in our estimation:

$$\begin{aligned} \mathrm{R}_{p,t} &= \beta \ln(\frac{\text{Quota}}{\text{Popu}})_p[1+\beta_1 \ln \text{Quota}_p + \beta_2(\ln \text{Quota}_p)^2] \times \text{Post}_t + \upsilon \ln \text{Popu}_p \times \text{Post}_t \\ &\quad + \theta \text{X}_p \times \text{Post}_t + \lambda_p + \gamma_t + \delta_{prov} \times \gamma_t + \varepsilon_{p,t.} \end{aligned} \tag{6}$$

If our finding in columns (1)-(5) of Table 3 is mainly driven by quotas per capita, we should expect β_1 and β_2 to be zero. As shown in columns (6)-(7), the interactions of the post dummy with the nonlinear transformations of $\ln \text{Quota}_p$ and $\ln \text{Popu}_p$ do not have any significant impact on revolution participation, i.e., the size effect per se is unlikely to explain our finding.[22] The results are also robust if we include a polynomial of a higher order.

Moreover, if β_1 and β_2 are close to zero, equations (5) and (6) also imply that the impacts of $\ln \text{Popu}_p$ should be similar whether we include the nonlinear terms or not. As shown in columns (2)-(7), the impacts of $\ln \text{Popu}_p$ are very stable except for the case when we weight the regression by population size.

These results show that our finding in Table 3 on quotas per capita cannot be explained by the absolute value of quotas per se. Hence, we will not further include these nonlinear terms in the following analysis.

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

$$\begin{aligned} \mathrm{R}_{p,t} &= \sum_{\tau=1901}^{1906} \beta_\tau \ln \text{Quota}_p \times \text{Year}_\tau + \sum_{\tau=1901}^{1906} \upsilon_\tau \ln \text{Popu}_p \times \text{Year}_\tau + \sum_{\tau=1901}^{1906} \theta_\tau \ln \text{X}_p \times \text{Year}_\tau \\ &\quad + \lambda_p + \gamma_t + \delta_{prov} \times \gamma_t + \varepsilon_{p,t,} \end{aligned}$$

where the year of 1900 is left as a comparison.

We visualize the main results in Figure 3 and leave the results across different specifications in Table A.3 in the appendix. Panel (a) in Figure 3 visualizes the results in column (3) of Table A.3, where all the fixed effects, controls and the interactions of controls and year dummies are all included. The solid line connects the estimates and the shaded area indicate the 95% confidence intervals. As it shows, 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

[22] This can be more clearly seen if equation (6) is rewritten as a combination of equation (5) and four nonlinear terms: $\beta \ln \text{Quota}_p \times \text{Post}_t + (\upsilon - \beta) \ln \text{Popu}_p \times \text{Post}_t + \theta \text{X}_p \times \text{Post}_t + \lambda_p + \gamma_t + \delta_{prov} \times \gamma_t + \varepsilon_{p,t} + \beta\beta_1 (\ln \text{Quota}_p)^2 \times \text{Post}_t + \beta\beta_2 (\ln \text{Quota}_p)^3 \times \text{Post}_t - \beta\beta_1 (\ln \text{Quota} \ln \text{Popu}) \times \text{Post}_t - \beta\beta_2 [(\ln \text{Quota})^2 \ln \text{Popu}] \times \text{Post}_t$.

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.

5.2 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 1911 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 quotas per capita on the number of revolutionaries:

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

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:

$$\mathrm{Incidence}_{p,1911}=\alpha\Delta\ln(\mathrm{k}+\#\mathrm{rev.})_p+\nu\ln \mathrm{Popu}_p+\theta \mathrm{X}_p+\delta_{prov}+\varepsilon_p, \tag{8}$$

where $\mathrm{Incidence}_{p,1911}$ takes the value of 1 if there was any early uprising in the prefecture in 1911.

The impact of the quotas on the incidence of uprisings in 1911 is the multiplication of β' and α, while $\ln(\mathrm{k}+\#\mathrm{rev.})_{p,t}$ is only an intermediate variable. Similar to the results in Table 2, to make sure that our estimate of $\beta'\alpha$ is 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 $\ln(\#\mathrm{rev.}+(1+\#\mathrm{rev.}^2)^{\frac{1}{2}})$.

The results are presented in Table 4. 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 (0.017). Columns (3)-(6) present corresponding results using two alternative ways of defining intermediate variables. They generate a similar estimate as using $\ln(1+\#\mathrm{rev.})_{p,t}$. These results imply that a one standard deviation increase in the logged quota (after controlling for logged population) increases the incidence of upris-

ings in 1911 by about one percentage point (the mean incidence is 15%). 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 increased 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 6 in Section 6.2.

5.3 Testing the Role of Social Capital

To test whether the impact of quotas per capita got strengthened by social capital, we examine the triple effect of $\ln \text{Quota}_p$, the abolition timing dummy and the measures of linguistic fragmentation or polarization. Note that we also control for the triple effect of $\ln \text{Popu}_p$, the abolition timing dummy and the measures of linguistic fragmentation or polarization in this analysis. This way, the results should be interpreted as whether the impact of quotas per capita (rather than quotas per se) got altered by social capital. This is the same for all our analysis related to triple effects below.

The results are presented in Table 5. Columns (1)-(3) use the fragmentation index whereas columns (4)-(6) uses the polarization measure. Both groups of results show that the effect of quotas per capita was smaller in prefectures with lower social capital.

This finding is consistent with the role of social capital in facilitating complementarity in participation. 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 cannot disentangle the knotty relationship between individual mobility and group mobility.

6 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 6.1 presents two checks on the measures of our main variables. Section 6.2 presents two placebo tests to make sure that our finding captures the impact of quotas rather than that of other prefectural characteristics or weakened state capacity. To further deal with omitted variables, section 6.3 provides results using two instruments. To save space, we leave some of the results in the appendix.

6.1 Measurement Checks

Examining Mobility at Different Higher levels Our baseline analysis focuses on the first-level exam quotas because they provided the entry to the gentry class and concerned the largest group of candidates. We also collect information candidates at higher levels (presented scholars and key officials) and examine which level of mobility mattered most.

In addition, we define our measure of perceived mobility in an alternative way: instead of using ln Quota while controlling for ln Population, we can examine the impacts of $(\frac{\text{Quota}}{\text{Population}})_p$, $(\frac{\#\text{presented scholar}}{\text{Quota}})_p$, and $(\frac{\#\text{official}}{\#\text{presented scholar}})_p$ on revolution participation respectively. Thus, this robustness check serves two purposes. The first is to check that the baseline results are robust to an alternative way of measuring quotas per capita. The second is to check which level of mobility matters most for revolution.

The results are presented in Table A.5 in the appendix. Similar to our baseline, columns (1)-(4) employ logged quotas, logged numbers of presented scholars and logged key offices while controlling for logged population. Columns (5)-(8) present the results using the ratios to measure the impacts. Both groups of results show that what mattered is the entry-level quotas per capita.

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. With this data, we can trace revolutionaries back to 1894. As shown in Figure A.4, quite a few counties already had revolutionary participation before 1900. 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.

Replacing the variables in the prefecture-level analysis with county-level information, the estimates on the dynamic impacts are presented in Table A.4 in the appendix. Panel (b) of Figure 3 visualizes the results in column (4) of Table A.4. Once again, it shows that the effect of quotas took place after the abolition of the exam.

6.2 Endogeneity Checks

Using the Boxer Rebellion as a Placebo Quotas per capita might be correlated with other prefectural characteristics. For example, regions more prone to conflict might be assigned higher quotas per capita.

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 prefecture was important in transportation, important in business, difficult to gather taxes or had high crime rates. We examine whether these importance measures affected the revolution participation after the abolition of the exam. These results are presented in Table A.6 in the appendix. They show that the impact of quotas holds after controlling for these factors and their interactions with the post dummy.

To further make sure that our finding on the revolution participation is specific to the impact of quotas, we conduct a placebo test using the Boxer Rebellion between 1899 and 1901.[23] Similar to the 1911 Revolution, the Boxer Rebellion was also motivated by proto-nationalist sentiments and opposition to foreign imperialism and Christianity. However, it had nothing to do with the exam system. Therefore, we use it as a check to make sure that prefectures with higher quotas per capita were not necessarily always pro-conflict or more motivated by proto-nationalist sentiments.

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

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 control. Therefore, we would like to check whether state capacity had a discontinuous change when the exam was abolished. Grain prices in this period provided some useful information, 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).[24]

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) in panel (b) of Table 6. Columns (4)-(6) further show that the association of quotas and within-month price change did not change dramatically either with abolition of the exam.

These tests are not to deny that fact that the state capacity was deteriorating in the late

[23]The data on the Boxer Rebellion comes from the appendix in the Boxer Protocol (1901).
[24]The information on grain prices comes from Wang (2009).

Qing period. However, unlike our main finding on revolution participation, they show that there is no discontinuous change in the association between the quotas and price changes before and after the abolition of the exam.

6.3 Results from Instrumental Variables

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 the exam. Given that the government still selected bureaucrats after the abolition, 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. For this concern, 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 candidate for two reasons. First, counties usually were usually formed around rivers. As shown in Figure A.6 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 link between the number of rivers and the number of counties.[25]

However, the number of rivers might 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. 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:

$$(\frac{\#\text{small rivers}}{\text{River length}})_p \xrightarrow{(a)} (\frac{\#\text{counties}}{\text{River length}})_p \xrightarrow{(b)} (\frac{\text{Quota}}{\text{River length}})_p.$$

Figure 4 illustrates the channel. Panel (a) visualizes the positive correlation between the number of counties per 100 KM of rivers and the number of small rivers per 100 KM of

[25]This logic looks similar to that in Hoxby (2000), while the channel is different since rivers did not serve as county boundaries in China and other Asian countries where agriculture was the dominant sector.

rivers. Panel (b) visualizes the positive correlation between logged quotas per 100 KM of rivers and the number of counties per 100 KM of rivers. The two links together imply that the number of small rivers (given the length of rivers) has a strong positive impact on quotas, as presented in Table A.7 and discussed in Section A.1 in the appendix. We also 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 also presented in Table A.7.

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 Table A.9 and dicussed in Section A.2 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 (Li 1989). 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 was likely to be assigned higher quotas given the same population. 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.8 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:

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

and

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

The results are presented in Table 7. 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 shows that this instrument is significantly correlated with revolution participation. Column (2) reports the IV estimate (0.35). Column (3) includes the second instrument as a regressor. The insignificant effect of the second instrument suggests that it 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.

7 Alternative Explanations

In the baseline results, we have shown that our finding is not driven by the size effect of quotas. Here, we discuss three other alternative explanations. First, prefectures with higher quotas per capita might also be rich in modern human capital that could also contributed to the revolution. Second, the abolition of the exam might affect the role of the gentry class more in prefectures with higher quotas per capita. Finally, prefectures with higher quotas per capita might be also different in ideology that could also affect revolution.

7.1 Modern Human Capital for Revolution

One alternative hypothesis is that regions with higher quotas per capita were also rich of modern human capital 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.[26] Based on this 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, 90% among whom studied in Japan (Yao, 2004).

We investigate the impacts of these two measures on revolution participation before and after the abolition. Moreover, we allow for the triple effect of logged quotas, modern human capital and the abolition of the exam (while controlling for the triple effect of logged population, modern human capital and the abolition of the exam). Columns (1)-(3) in Table 8 show that the number of firms did not have a significant impact on revolution participation except for some weak negative impact after the abolition of the exam. Columns (4)-(6) show that the number of students studying in Japan per se had a positive impact on the participation in revolution but its impact did not differ before and after the abolition of the exam. Column (7) includes everything together and shows that results are stable. Across all the specifications, the baseline effect of quotas per capita holds.

We also evaluate the impact of the students studying in Japan year by year and show

[26] 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.

that there is no systematic discontinuity before and after 1905. Once again, these results imply that modern human capital contributed to the revolution but its role cannot explain our main finding.

7.2 The Role of the Gentry Class

The gentry class created by the exam system played an important role in local governance, given that the central government was weak. For example, they contributed to the provision of public goods including the provision of schooling, the promotion of irrigation projects as well as disaster relief (Chang 1955). Considering the importance of the gentry class, another hypothesis is that the role of the gentry class was more important in prefectures with higher quotas per capita. Therefore, these prefectures responded more aggressively to the abolition of the exam by participating in revolution.

To test whether this hypothesis explains our main finding, we need to measure the demand for public goods. One candidate is the weather condition in a prefecture. Since historical China was an agrarian economy vulnerable to weather shocks, it is reasonable to assume that the demand for the contribution of public goods by the local gentry was stronger in regions suffering more from droughts and floods. Hence, we employ three measures of weather shocks to examine the importance of this alternative hypothesis.

The first measure is a dummy variable indicating whether the rainfall was extremely low or high in the same year of revolution participation.[27] Similar to the specifications in Table 8, we evaluate the impacts of this measure before and after the abolition as well as the triple effect of weather shocks, quotas and the abolition. As shown in columns (1) and (2) of Table 9, this measure does not affect revolution participation. The role of quotas per capita was not altered by this shock either.

The other two measures employ a longer horizon: the mean and standard deviation of the weather indicators during the past century (1800-1899). These long-run measures may affect the expectation of weather conditions in the future and hence citizens' evaluation of the abolition. The results are presented in columns (3)-(6). They show that neither measure can explain the variations in revolution participation after the abolition of the exam. The triple effects show that they did not affect the role of quotas per capita either.

In sum, the importance of public goods provided by the gentry class cannot explain our finding.

[27]The data comes from the State Meteorological Society (1981). Weather conditions are coded into five indicators: -2((extreme flood), -1 (flood), 0 (normal), 1 (drought) and 2 (extreme drought).

7.3 Ideology

One may wonder whether quotas per capita also captured certain political preference we cannot measure. For example, citizens in regions with higher quotas per capita might be more radical politically. The placebo test using the Boxer Rebellion suggests that this is unlikely to be the case. As a further check, we link the quota system to individuals' 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 their primary goal.

The results are presented in columns (1)-(3) in Table 10. Among the 703 party members we can identify the origins and ages, 434 were identified with the *Kuomintang*. Based on the individual-level information, we do not find any significant impact of quotas 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 per capita increased the number of party members in both the *Kungmintang* and the other parties. This finding is expected because more revolutionaries should be associated with more party members after the success of revolution. However, the magnitudes of the impacts on the *Kungmintang* and the other parties are similar (0.155 vs. 0.181).

Consistent with the placebo test using the Boxer Rebellion in Section 6.2, the finding on party identification once again shows that the ideology hypothesis cannot explain our finding.

8 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 per capita 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 quotas per capita 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.

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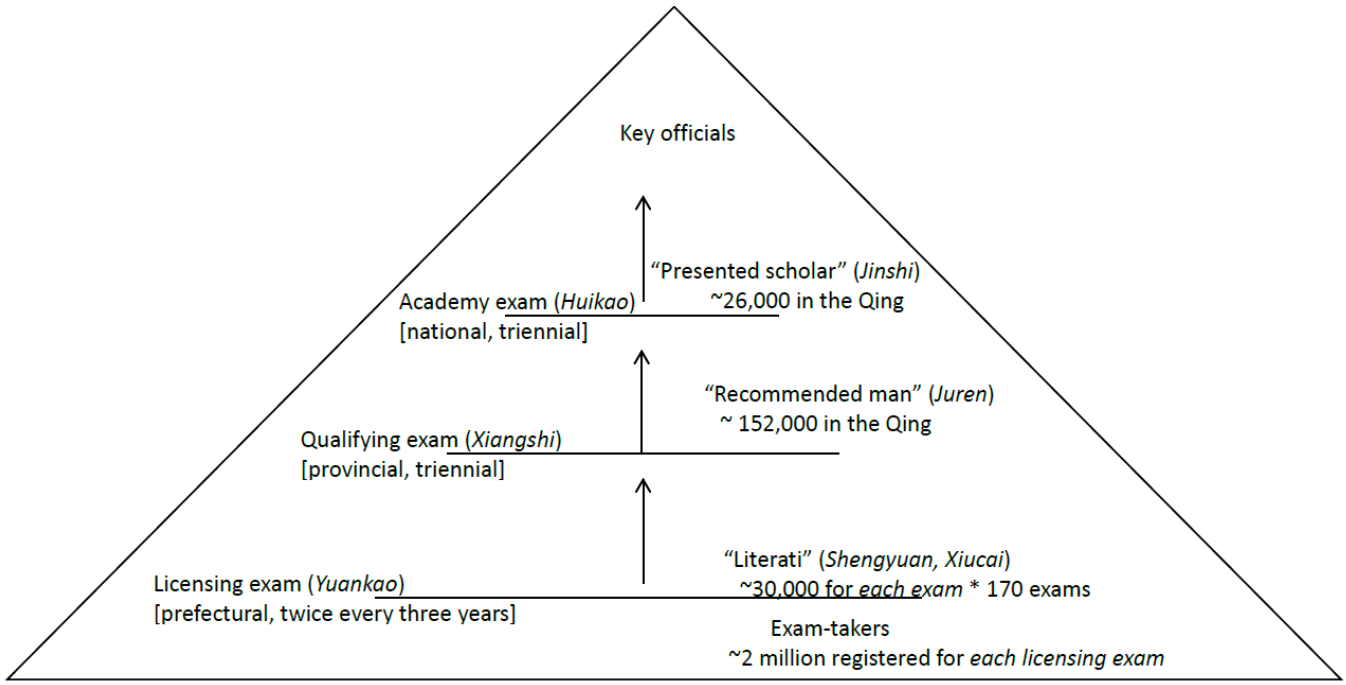
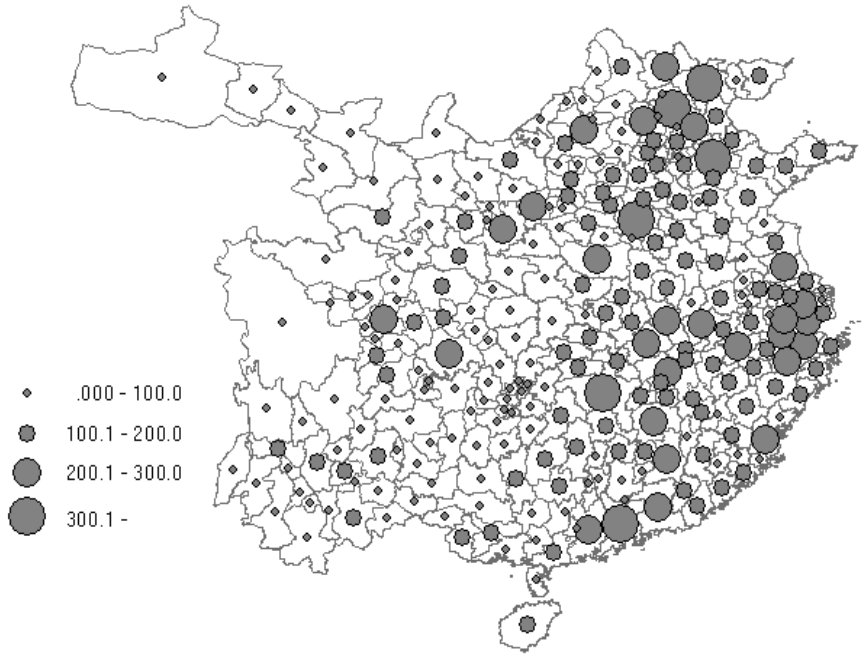
Figure 1: The Structure of the Civil Service Exam



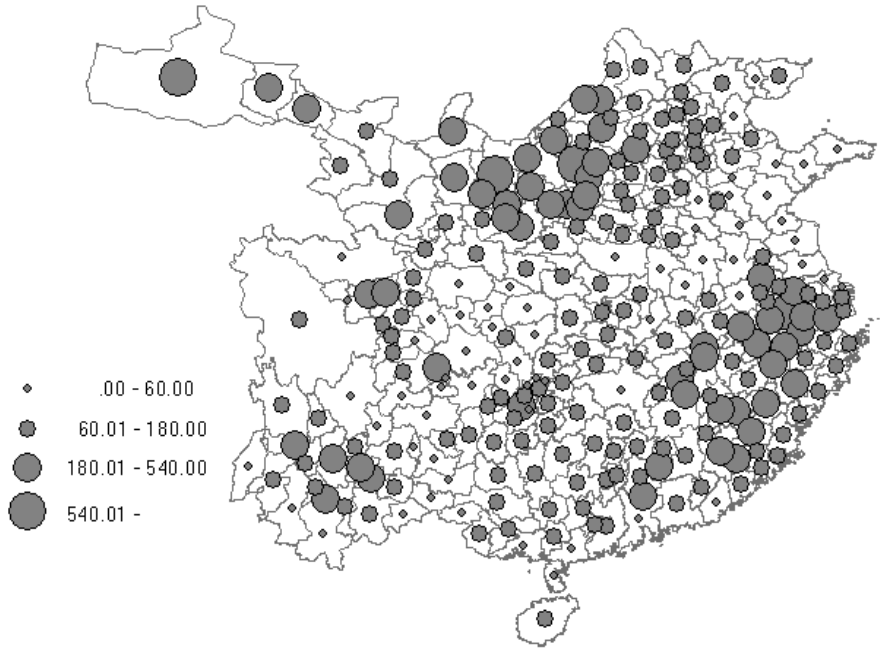
Notes: The number of the prefecture-level exam graduates was governed by a prefecture-level quota. We code the prefecture-level data based on Kun, Gang et al. (1899).
The number of the national-level exam graduates was governed by a province-level quota. We coded their prefectures of origins based on the lists of names and origins in Zhu and Xie (1980).
The number of provincial-level exam graduates was governed by provincial-level quota. We do not have prefecture-level information on these graduates.
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 Across Prefectures

(a) Spatial Distribution of Quotas



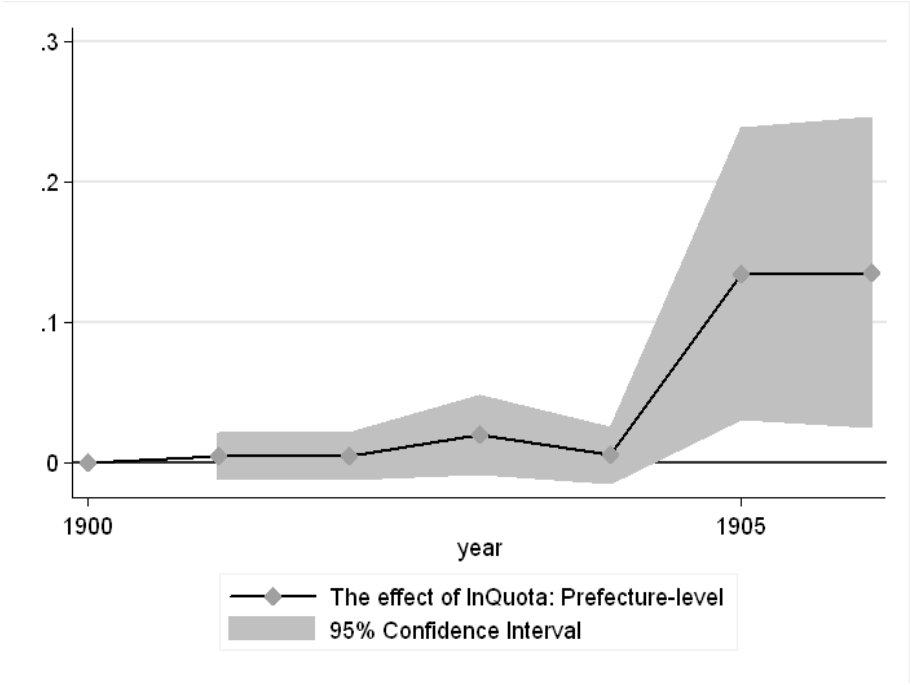
(b) Spatial Distribution of Quotas per 1 Million People



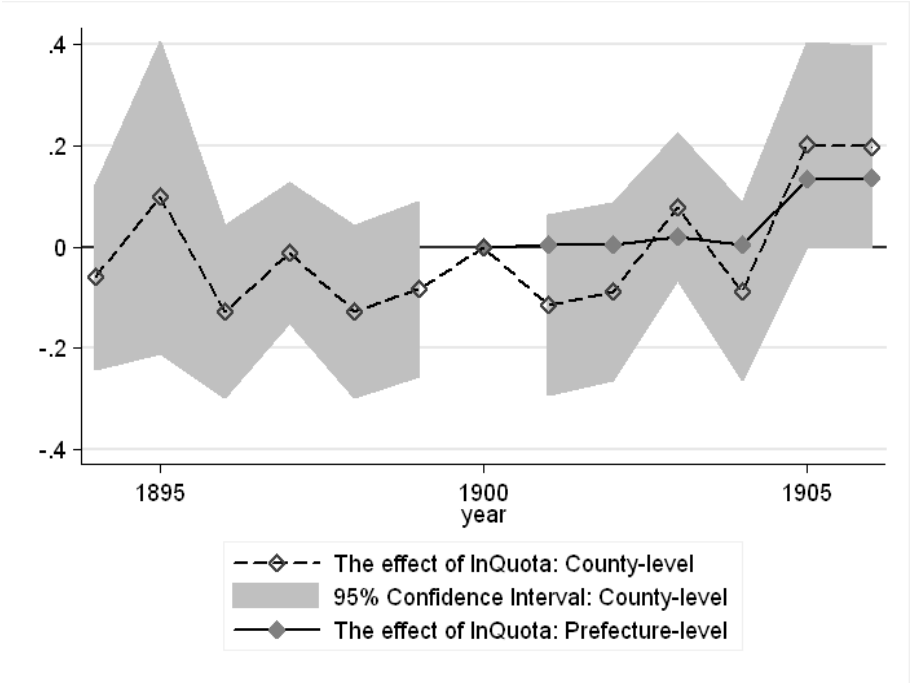
Notes: This figure shows that there are great regional variations in quotas and quotas per capita. For example, province fixed effects only explain 30% of the variations in the quotas across prefectures.

Figure 3: The Dynamic Impacts of ln Quota on Revolution Participation

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



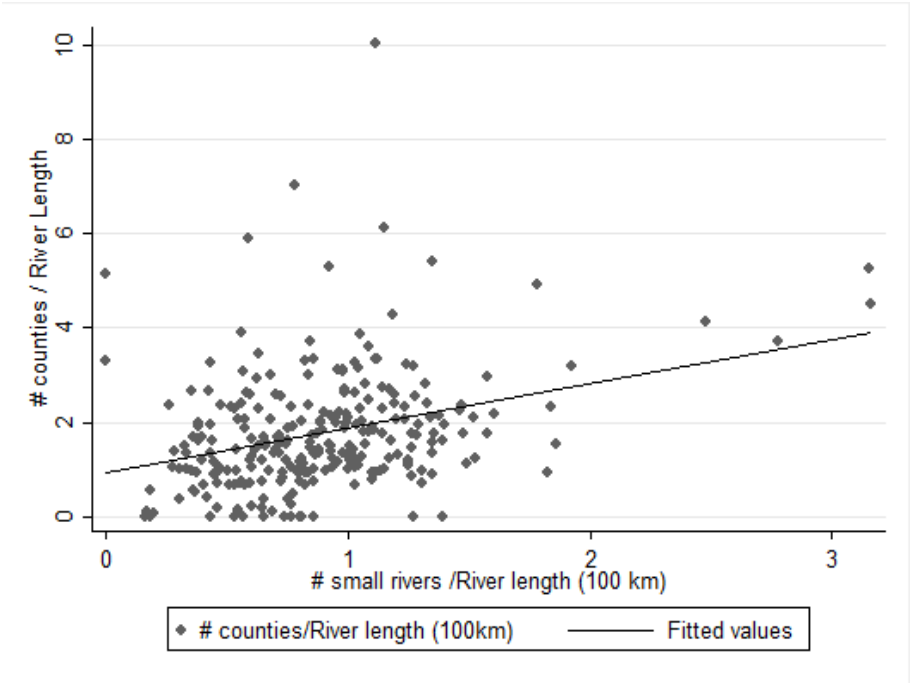
(b) County-level Analysis (1894-1906)



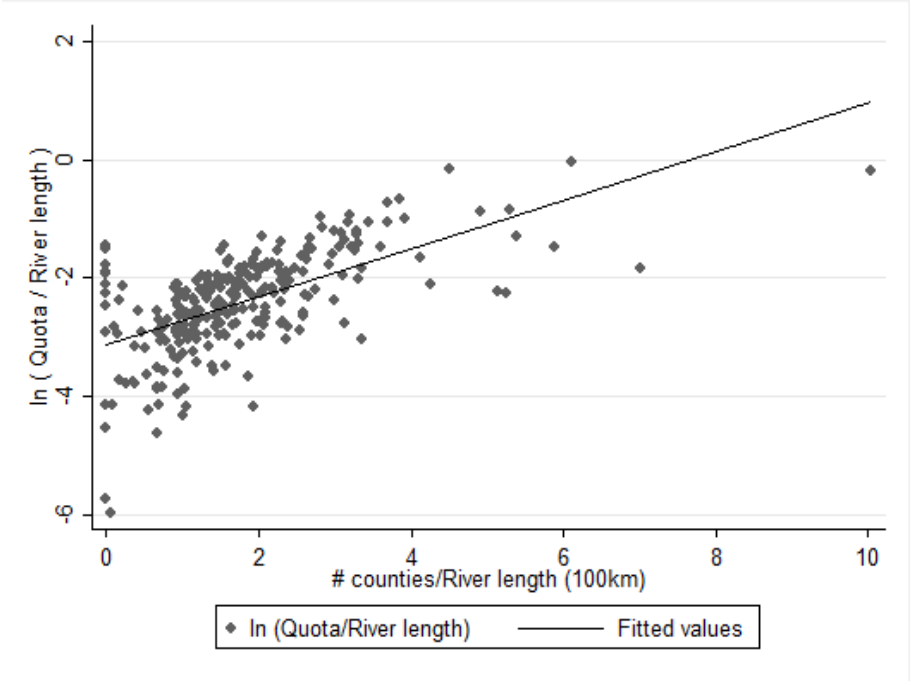
Notes: These figures present the dynamic effects of the quota on revolution participation, using the year 1900 as the reference. Panel (a) presents the results using the prefecture-level data between 1900 and 1906, where the solid line connects the estimates and the shaded area indicates the 95% confidence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

Figure 4: 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. Figure (b) shows that the number of counties is positively correlated with the quota.

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	Language fragmentation index	18	262	0.087	0.164
	Language polarization index	18	262	0.162	0.298

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)

	(1)	(2)	(3)	(4)	(5)	(6)
	#presented scholar: 1644-1904			#officials: 1644-1904		
Dependent Var.	ln (1+#)	ln (0.1+#)	ln (#+(#^{2} + 1)$^{\frac{1}{2}}$)	ln (1+#)	ln (0.1+#)	ln (#+(#^{2} + 1)$^{\frac{1}{2}}$)
ln Quota	0.652***	0.666***	0.657***	0.527***	0.508***	0.526***
	(0.066)	(0.068)	(0.066)	(0.090)	(0.095)	(0.089)
ln Popu 1880	0.164**	0.187**	0.172**	0.163**	0.226**	0.178**
	(0.070)	(0.077)	(0.072)	(0.080)	(0.087)	(0.080)
Province FE	Y	Y	Y	Y	Y	Y
Observations	262	262	262	262	262	262
R-squared	0.752	0.769	0.759	0.626	0.635	0.637

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

	(1)	(2)	(3)	(4)	(5)	(6)
	Before the Abolition			After the Abolition		
	#present. scholar: 1904			#quasi-present. scholar: 1907		
Dependent Var.	ln (1+#)	ln (0.1+#)	ln (#+(#^{2} + 1)$^{\frac{1}{2}}$)	ln (1+#)	ln (0.1+#)	ln (#+(#^{2} + 1)$^{\frac{1}{2}}$)
ln Quota	0.305***	0.289***	0.306***	0.131*	0.118	0.136**
	(0.092)	(0.093)	(0.092)	(0.067)	(0.072)	(0.067)
ln Popu 1880	0.091	0.116	0.090	-0.045	-0.015	-0.050
	(0.084)	(0.091)	(0.084)	(0.068)	(0.074)	(0.068)
ln (1+	0.414***	0.332***	0.409***	0.423***	0.358***	0.420***
#incumbents)	(0.073)	(0.059)	(0.071)	(0.097)	(0.076)	(0.094)
Province FE	Y	Y	Y	Y	Y	Y
Observations	262	262	262	262	262	262
R-squared	0.411	0.371	0.411	0.510	0.487	0.513

Notes: 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)).
Beta coefficients are reported. The results are robust to different transformation to deal with zeros. Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3: Baseline Result I: The Impact of Quotas on the Revolutionary Indicator
D.V.: Revolutionary = 0/1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ln Quota * Post	0.206***	0.139***	0.126***	0.113**	0.128**	0.166**	0.156**
	(0.025)	(0.044)	(0.046)	(0.046)	(0.050)	(0.064)	(0.064)
(ln Quota)^2 * Post						0.034	0.069
						(0.026)	(0.064)
(ln Quota)^3 * Post							0.014
							(0.024)
ln Quota * ln Popu * Post						-0.005	-0.018
						(0.030)	(0.056)
(ln Quota)^2 * ln Popu * Post							-0.006
							(0.027)
ln Popu * Post		0.073*	0.103**	0.101**	0.057	0.099*	0.101*
		(0.037)	(0.043)	(0.044)	(0.035)	(0.053)	(0.056)
ln Area * Post			-0.057*	-0.054	-0.019	-0.066*	-0.065*
			(0.034)	(0.035)	(0.026)	(0.035)	(0.035)
Coastal * Post			-0.049	-0.080	-0.047	-0.088	-0.087
			(0.091)	(0.093)	(0.091)	(0.092)	(0.092)
Major River * Post			0.090*	0.083*	0.082*	0.075	0.074
			(0.046)	(0.048)	(0.044)	(0.048)	(0.049)
Treaty Port * Post				0.096	0.120	0.107	0.114
				(0.078)	(0.078)	(0.077)	(0.078)
Small City * Post				-0.012	0.023	-0.013	-0.013
				(0.059)	(0.093)	(0.059)	(0.059)
Middle City * Post				0.016	-0.008	-0.009	-0.016
				(0.082)	(0.083)	(0.084)	(0.086)
Large City * Post				0.153	0.275**	0.084	0.054
				(0.136)	(0.131)	(0.137)	(0.139)
Pref. FE, Year FE	Y	Y	Y	Y	Y	Y	Y
Prov. FE * Year FE	Y	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	0.449	0.452	0.458	0.462	0.403	0.464	0.464

Notes: This table reports the impact of quotas per capita on revolution participation after the abolition of the exam, compared with that before the abolition. The results in column (5) are weighted by population size. Columns (6)-(7) show that the impact of quotas per capita cannot be explained by the effect of the absolute value of quotas. Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: Baseline Result II: 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: 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). We are interested in $\beta' * \alpha$, which is robust to different ways of dealing with the zero observations. The baseline controls include (i) logged population in 1880 and logged area; (ii) whether a prefecture is located on the coast and whether it is located on a major river; (iii) whether a prefecture has a treaty port; and (iv) whether a prefecture was counted as a big city, a middle-size city or a small city. Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: Baseline Result III: The Impact of Social Capital
D.V.: Revolutionary = 0/1

	(1)	(2)	(3)	(4)	(5)	(6)
ln Quota * Post	0.205***	0.111**	0.113**	0.206***	0.113**	0.115**
	(0.025)	(0.046)	(0.046)	(0.025)	(0.045)	(0.046)
Fragmentation index * ln Quota * Post	-0.353**	-0.349**	-0.475**			
	(0.146)	(0.143)	(0.227)			
Fragmentation index * ln Popu * Post			0.125			
			(0.187)			
Polarization index * ln Quota * Post				-0.172**	-0.171**	-0.257**
				(0.073)	(0.071)	(0.120)
Polarization index * ln Popu * Post						0.087
						(0.106)
Fragmentation index * Post	-0.042	0.014	0.047			
	(0.148)	(0.161)	(0.174)			
Polarization index * Post				-0.043	-0.030	-0.015
				(0.079)	(0.084)	(0.090)
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
Observations	1,834	1,834	1,834	1,834	1,834	1,834
R-squared	0.453	0.465	0.465	0.453	0.465	0.465

Notes: The table shows that the impact of quotas per capita was smaller in regions with lower social capital. The baseline controls are the same as in Table 4. Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6: Checking Endogeneity with 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 Popu.	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 Popu. * 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: 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. Other controls include (i) whether a prefecture is located on the coast and whether it is located on a major river; (ii) whether a prefecture has a treaty port; and (iii) whether a prefecture was counted as a big city, a middle-size city or a small city. Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7: 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: 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.The baseline controls include (i) logged population in 1880 and logged area; (ii) whether a prefecture is located on the coast and whether it is located on a major river; (iii) whether a prefecture has a treaty port; and (iv) whether a prefecture was counted as a big city, a middle-size city or a small city. The placebo variables are the transportation importance, crop suitability, climate shocks and basin fragmentation discussed in Section A.1 in the appendix. Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 8: Investigating Alternative I: The Impact of Modern Human Capital
D.V.: Revolutionary = 0/1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ln Quota * Post	0.112**	0.121**	0.125***	0.099**	0.093**	0.089**	0.101**
	(0.046)	(0.047)	(0.048)	(0.044)	(0.044)	(0.043)	(0.045)
ln (Firm+1)	0.041	0.079	0.075				0.041
	(0.055)	(0.084)	(0.084)				(0.085)
ln (Firm+1) * Post		-0.710	-1.440*				-1.581*
		(0.629)	(0.850)				(0.896)
ln (Firm+1) * ln Quota * Post		0.125	0.299				0.337*
		(0.119)	(0.182)				(0.191)
ln (Firm+1) * ln Popu * Post			-0.156				-0.172
			(0.118)				(0.125)
ln (Japan stu.+1)				0.127***	0.122***	0.118***	0.119***
				(0.026)	(0.034)	(0.034)	(0.034)
ln (Japan stu. +1) * Post					0.155	-0.178	-0.127
					(0.237)	(0.304)	(0.311)
ln (Japan stu. +1) * ln Quota * Post					-0.029	0.049	0.039
					(0.046)	(0.065)	(0.066)
ln (Japan stu. +1) * ln Popu * Post						-0.075	-0.067
						(0.051)	(0.055)
Prefecture FE, 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	1,834	1,834	1,834	1,834	1,834	1,834
R-squared	0.462	0.463	0.464	0.477	0.477	0.479	0.482

Notes: The table shows that the number of students studying in Japan had a positive impact on revolution participation but the effects did not change before and after the abolition of the exam in 1905. The baseline controls include (i) logged population in 1880 and logged area; (ii) whether a prefecture is located on the coast and whether it is located on a major river; (iii) whether a prefecture has a treaty port; and (iv) whether a prefecture was counted as a big city, a middle-size city or a small city. Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 9: Investigating Alternative II: The Role of the Gentry Class
D.V.: Revolutionary = 0/1

	(1)	(2)	(3)	(4)	(5)	(6)
Measures of Weather Shocks	Drought or Flood in year t		Average indicator 1800-99		s.d. in indicators 1800-99	
ln Quota * Post	0.109**	0.113**	0.117**	0.110**	0.113**	0.125**
	(0.046)	(0.047)	(0.046)	(0.045)	(0.046)	(0.050)
Weather	0.024	0.025				
	(0.027)	(0.027)				
Weather * Post	0.068	0.052	0.272	0.195	0.017	-0.033
	(0.098)	(0.106)	(0.233)	(0.217)	(0.087)	(0.083)
Weather * ln Quota * Post		0.093		-0.752		-0.024
		(0.187)		(0.488)		(0.152)
Weather * ln Popu * Post		-0.064		0.789**		0.148
		(0.126)		(0.377)		(0.103)
Prefecture 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	0.463	0.463	0.462	0.465	0.462	0.464

Notes: The table shows that weather shocks did not have significant impact on revolution participation. The baseline controls include (i) logged population in 1880 and logged area; (ii) whether a prefecture is located on the coast and whether it is located on a major river; (iii) whether a prefecture has a treaty port; and (iv) whether a prefecture was counted as a big city, a middle-size city or a small city. Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 10: Investigating Alternative III: 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: 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 the results using prefecture-level data: quotas increase the number of party members in both the *Kungmintang* and the other parties and the magnitudes of its impacts are similar (0.155 vs. 0.181). The baseline controls include (i) logged population in 1880 and logged area; (ii) whether a prefecture is located on the coast and whether it is located on a major river; (iii) whether a prefecture has a treaty port; and (iv) whether a prefecture was counted as a big city, a middle-size city or a small city. Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%.

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:

$$\ln \text{Quota}_p = \rho\left(\frac{\#\text{small river}}{\text{River length}}\right)_p + \nu \ln \text{Popu}_p + \theta \text{X}_p + \delta \ln \text{River length}_p + \delta_{prov} + \varepsilon_p,$$

where $\left(\frac{\#\text{small river}}{\text{River length}}\right)_p$ 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.7 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 4.3 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.7 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:

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

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.8 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).

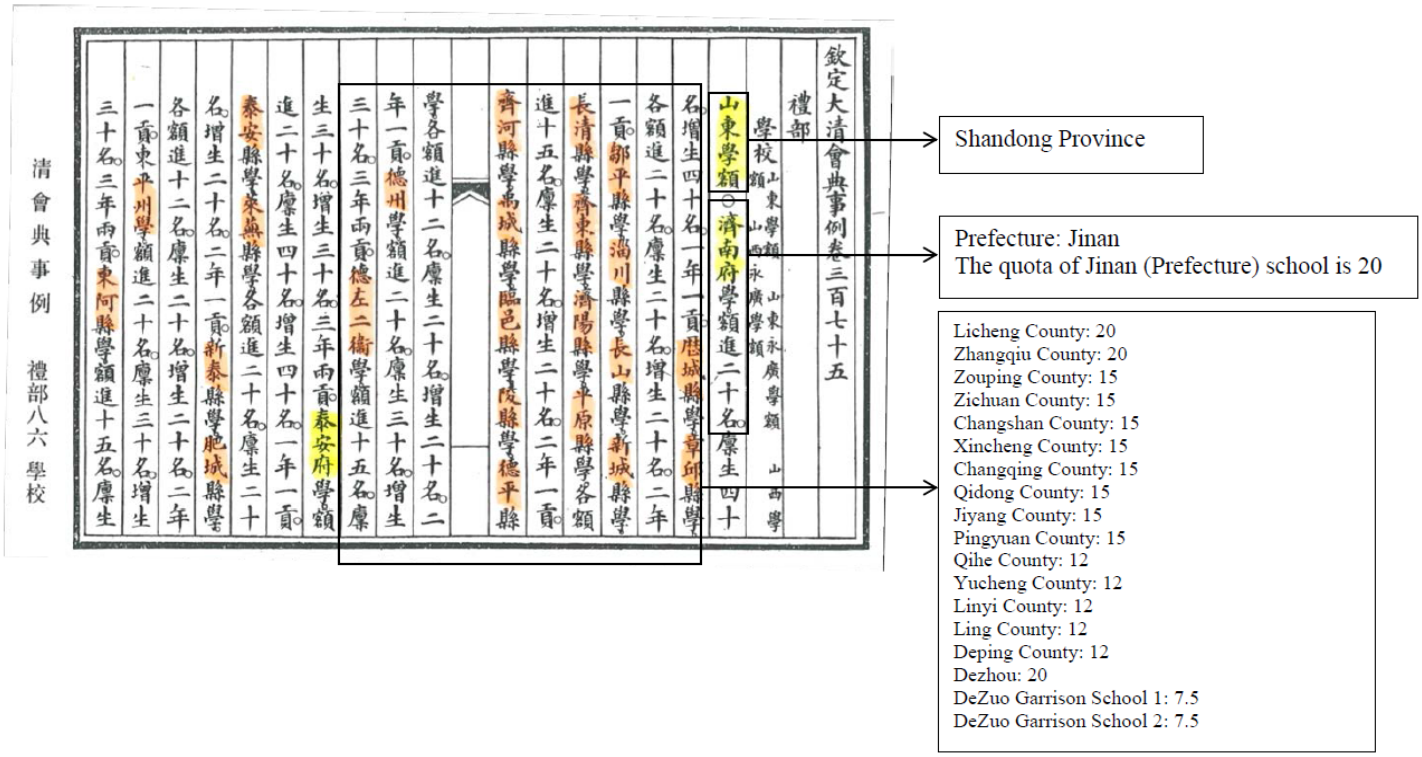
Thus, the relevance and placebo tests in Table A.8 also suggest that the short-run performance before the quota system is another reasonable instrument.

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.9. They show that the results are robust to these variations.

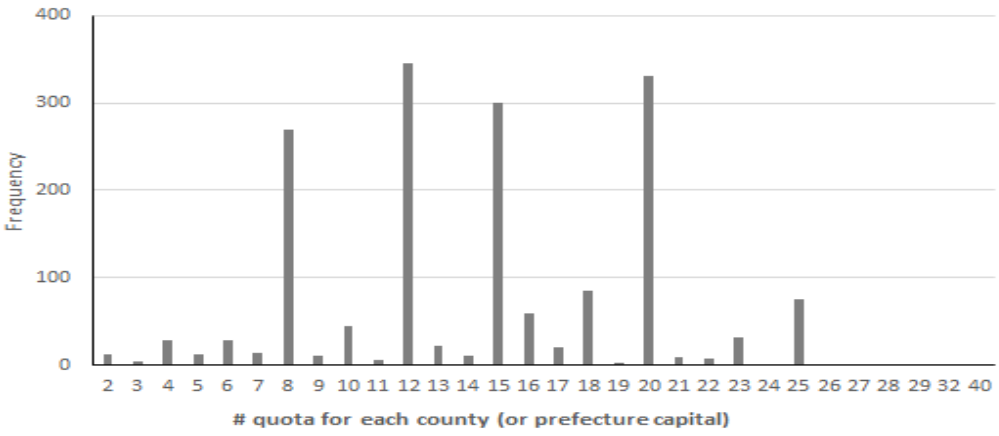
Moreover, we find no similar impact of the number of big rivers per se, which once again confirms that our river instrument is reasonable.

Figure A.1: The Data on Quotas



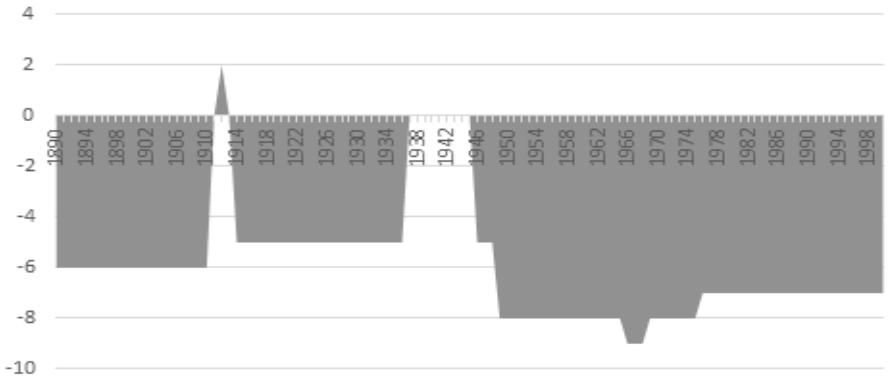
Notes: The data on the Quotas were recorded in the Qing Hui Dian Shi Li (edited by Kun, Gang). This figure gives an example for one prefecture (Jinan in Shandong Province). The quota for the prefecture capital is 20 and the total quota of the counties is 255. Thus, the total quota for the Jinan prefecture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

Figure A.2: Distribution of Quotas for Each County



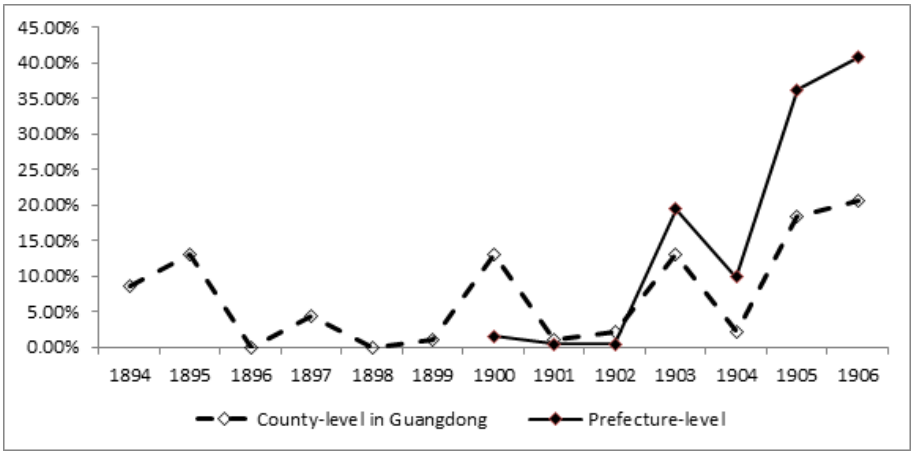
Notes: This figure shows that the quota assigned to counties within a prefecture follows a stepwise rule: the most frequent numbers are 8, 12, 15 and 20. This is because the government did not have the capacity of implementing a complicated proportional system and needed a simplified way of implementing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

Figure A.3: Polity Scores for China between 1890 and 2000



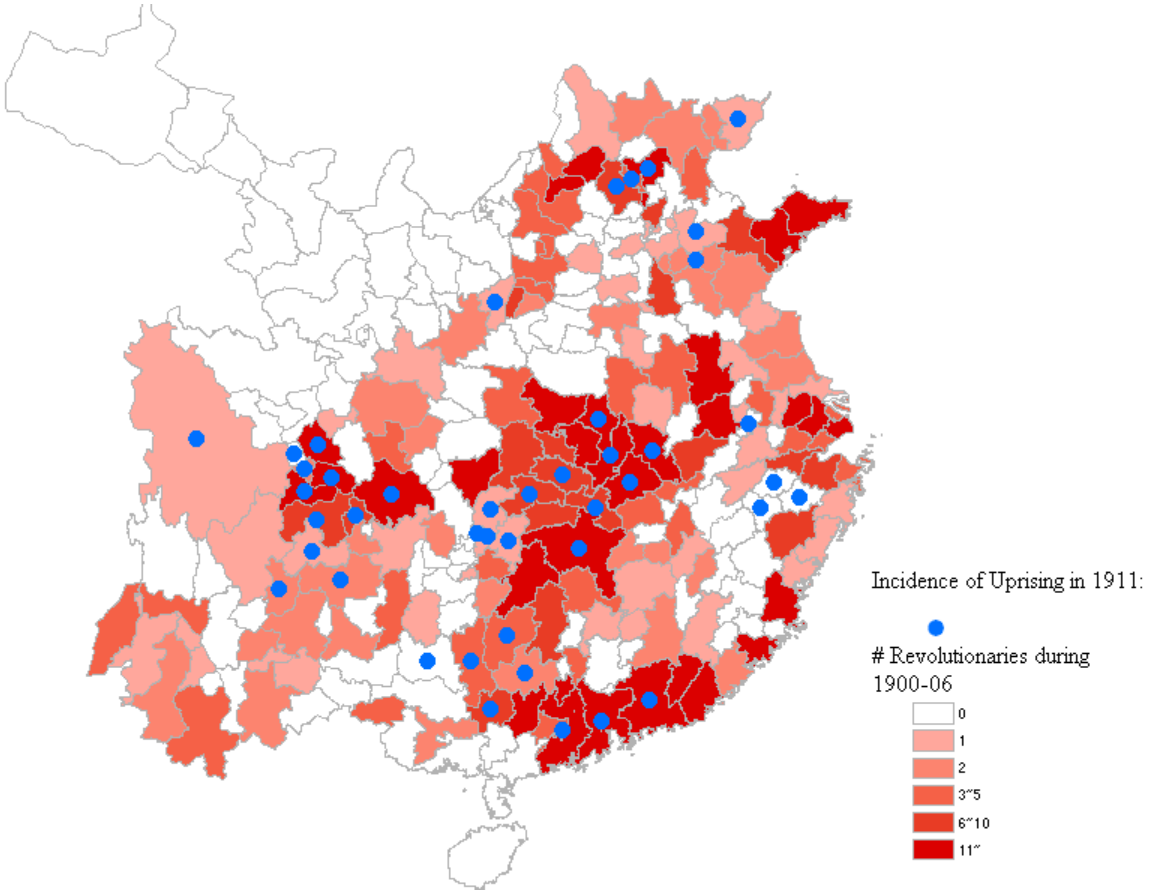
Notes: This figure reports the polity scores of China between 1890 and 2000, based on the information from Polity IV. The range of the score is between -10 and 10.

Figure A.4: Revolution Participation Over Time



Notes: This figure plots the mean of revolutionary probability in the prefecture-level data between 1990 and 1906 and in the county-level data between 1894 and 1906.

Figure A.5: 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.6: Rivers and County Seats

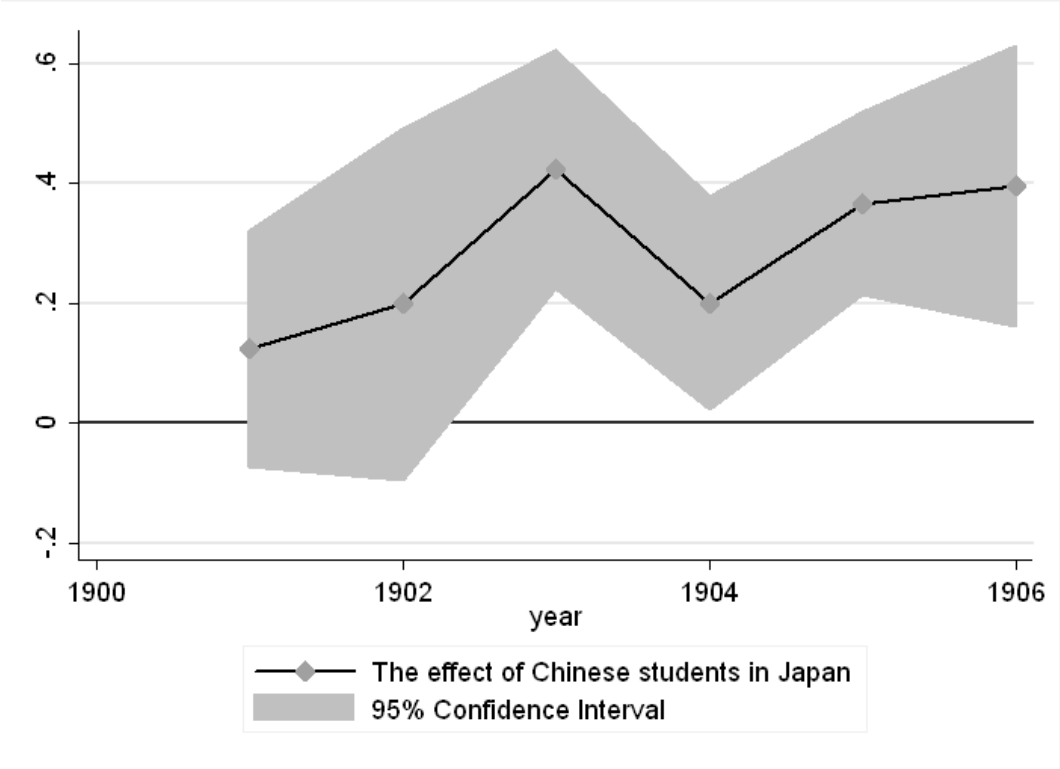
Notes: This map shows that county seats (indicated by the dots) are generally located on rivers. The bold rivers indicate the major ones (ranked 1 or 2 in the river hierarchies).

Table A.1: Revolutionary Groups between 1900 and 1906

Revolutionary Group	Year of Estab.	Origin
(i) *Xingzhonghui* (the Revive China Society)	1894	Honolulu
(ii) *Junguomin Jiaoyuhui* (the Society of National Military Education)	1903	Japan
(iii) *Huaxinghui* (the China Arise Society)	1903	Changsha, Hunan
(iv) *Guangfuhui* (the Revive the Light Society	1904	Shanghai
(v) *Tongmenghui* (the Chinese Revolutionary Alliance)	1905	Alliance between (i) and (iii)
(vi) *Rizhihui* (the Society for Daily Improvement)	1905-06	Wuhan, Hubei

Notes: The table lists the information on the six major revolutionary groups between 1900 and 1906. The data source is Chang (1982).

Figure A.7: The Impacts of Chinese Students in Japan on Revolution Participation



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 in this dataset was very limited before 1901.

Table A.2: The Quotas and Prefecture Characteristics

	(1)	(2)	(3)	(4)	(5)
Dependent Var.	ln Quota	ln Quota	ln Quota	ln Quota	ln (Quota/Popu)
ln Popu	0.630***	0.665***	0.641***	0.586***	
	(0.042)	(0.042)	(0.065)	(0.068)	
ln Area			0.112	0.102	-0.154**
			(0.079)	(0.081)	(0.075)
Coastal			-0.339***	-0.280**	-0.504***
			(0.108)	(0.114)	(0.126)
Major Rivers				0.079	0.076
				(0.070)	(0.084)
Treaty Ports				-0.077	-0.044
				(0.087)	(0.095)
Small City				0.096	-0.048
				(0.083)	(0.103)
Middle City				0.229***	-0.020
				(0.087)	(0.095)
Large City				0.567***	0.190
				(0.111)	(0.132)
Province FE		Y	Y	Y	Y
Observations	262	262	262	262	262
R-squared	0.579	0.728	0.743	0.761	0.466

Notes: This table reports the correlations between quotas and other prefecture characteristics. It shows that population size and urban population size are the most important factors in determining quota in a prefecture. Therefore, we need to allow flexible effects of population size. Standard errors in parenthesis are clustered at the county level: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A.3: Year-by-Year Effects of Quotas on the Revolutionary Indicator
D.V.: Revolutionary = 0/1

	(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: 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. 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. Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A.4: Year-by-Year Impacts across Counties in Guangdong
D.V.: Revolutionary = 0/1

	(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: 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. Standard errors in parenthesis are clustered at the county level: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A.5: Mobility at Different Levels
D.V.: Revolutionary = 0/1

	(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: 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). The baseline controls include (i) logged population in 1880 and logged area; (ii) whether a prefecture is located on the coast and whether it is located on a major river; (iii) whether a prefecture has a treaty port; and (iv) whether a prefecture was counted as a big city, a middle-size city or a small city. Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A.6: Controlling for the Role of Regional Importance
D.V.: Revolutionary = 0/1

	(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. The baseline controls include (i) logged population in 1880 and logged area; (ii) whether a prefecture is located on the coast and whether it is located on a major river; (iii) whether a prefecture has a treaty port; and (iv) whether a prefecture was counted as a big city, a middle-size city or a small city. Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A.7: 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: 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. The baseline controls include (i) logged population in 1880 and logged area; (ii) whether a prefecture is located on the coast and whether it is located on a major river; (iii) whether a prefecture has a treaty port; and (iv) whether a prefecture was counted as a big city, a middle-size city or a small city. Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A.8: 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: 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. The baseline controls include (i) logged population in 1880 and logged area; (ii) whether a prefecture is located on the coast and whether it is located on a major river; (iii) whether a prefecture has a treaty port; and (iv) whether a prefecture was counted as a big city, a middle-size city or a small city. Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A.9: Robustness Checks of Using Small Rivers
D.V.: Revolutionary = 0/1

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: This table show that the results using the number of smaller rivers as an instrument are robust to variations in defining smaller rivers. The baseline controls include (i) logged population in 1880 and logged area; (ii) whether a prefecture is located on the coast and whether it is located on a major river; (iii) whether a prefecture has a treaty port; and (iv) whether a prefecture was counted as a big city, a middle-size city or a small city. Standard errors in parenthesis are clustered at the prefecture level: * significant at 10%; ** significant at 5%; *** significant at 1%.