Chapter 3: The Taiping Rebellion as a diversity shock: The failure of public primary schooling in the Lower Yangzi of the Republican Era: 1900-1949

3.1 Introduction

The question of how ethnic and linguistic divisions affect economic growth continues to draw attention from leading scholars, such as Easterly and Levine (1997); Alesina, Baqir, and Easterly (1999); and Alesina and Ferrara (2004). This chapter explores the differential impact of the Taiping rebellion (1851-1864) and consequent mass migration on 60 counties in the lower Yangzi region of China. I find that places were less successful in financing primary schooling if they experienced a greater diversity shock (DS). Places experiencing a greater diversity shock were those where the local population became more diverse culturally, dialectically and even genetically after the rebellion relative to its pre-Taiping population, as measured by inconsistency in surname distribution. Such diversity shocks had a negative impact on education in the lower Yangzi delta in the first few decades of the twentieth century, when traditional education was replaced by modern education and informal tutoring was replaced by formal schools. Overall, in the lower Yangzi delta, the richest area of China, modern primary enrollment was below 30% during the Republic era. This is one reason why elites from the exam era persist into the Republic era, and hence why there was low social mobility before 1949. This result is robust to controlling for trends in population density, for geographic factors that correlated with influences from the Western world, access to the political center, and initial educational outcomes (endowments).

Like other pre-modern agrarian societies, the social return to literacy was low in China for most the exam era (7th century A.D—1905). The civil service exam system provided incentives for individual commoners to invest in education that could advance them up the social ladder (Ho, 1965). So education was mainly provided privately, within families or by private tutors. But since an individual's success in exams benefited also his kinship, almost all clans provided schools, and education subsidies within communities or to kin members in different places. They funded this provision using common clan property such as kin land and temples. Such practices could have facilitated a broad spread of modern public schooling when the exam system was abolished in 1905, when the social return to universal literacy rose with spreading industrialization.

However, in the lower Yangzi region such communities and clan networks were weakened after the Taiping rebellion. Villages and cities were populated by migrants from difference places with various dialects, skills and social customs. Many clans lost their common properties, and their members lost contact with each other. Even worse, throughout 1900-1949, the central and provincial governments declined to finance primary schooling, and focused instead on secondary schools and universities. The burden of financing primary schools fell entirely on the shoulders of counties and communities, or more precisely, local elites. Heterogeneity in preferences matters for the amount and types of public goods provided (Alesina and Ferrara, 2004). With greater heterogeneity in preferences, and in cultural/social customs, it was difficult to coordinate conflicted interests and establish public schools that serve the general population.

Measuring homogeneity seems difficult in China. In particular, 99% of the Lower Yangzi population were Han people, who use a single written language. Nonetheless, over history the Han people developed into numerous cultural and dialectal groups thanks to geographic barriers, reflected by regional difference in surname distribution of population[1]. Scholars have been using disparity in the surname distributions to measure "genetic distance" across regions (Du, et al, 1991; Li, 2011)[2]. In this paper I use the disparity in surname distributions before and after Taiping Rebellion to measure diversity shocks, if not genetic, due to this natural experiment of history. The rebellion hit counties in the lower Yangzi partly randomly, but partly as a result of systematic factors such as proximity to treaty ports, proximity to provincial capital, land productivity, etc. There was some randomness in the degree of calamity and source of immigrants (from neighboring area or remote areas), which result in great disparity in the magnitude of diversity shock across counties.

The rest of this chapter is organized as follows: Section 1 gives an historical review of types of education provided from the exam era to the Republican era, and how the Taiping Rebellion changed the landscape. Section 2 summarizes the data, in particular, the measurement of diversity shock. Section 3 develops a reduced form econometric model, and gives the results and interpretation. Section 4 concludes.

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[1] A single family could prosper in a village or a town dominated by a few kinships as long distance migration was infrequent and of small scale. So surname distribution varies greatly from locality to locality.

[2] Du, et al., 2012, calculated "genetic distance between any two surnames by exploring the ethnic origin of each surnames and how surnames are related on the genealogy of surnames. They found that the blood type distributions are significantly different across surnames and across provinces. And the difference can be greater between any two Han people than between a Han people and a ethnic minority in China.

3.2 Historical overview

3.2.1 Financing traditional education: households, clans, and state

Prior to 1905, the primary education system was based upon Confucian classics and aimed at success in the Imperial Civil Service Exam (ICSE). At national, provincial and county levels, highly competitive exams selected a few degree holders,[3] and brought the individual, his clans, and communities "prestige, power, and wealth through government service (Rawsky, 1979, p. 21)". Within a community or a clan, an individual's literacy helped determine their social status, and was highly correlated with occupation and wealth. The rewards to high achievement on this exam generated considerable demand for privately or publicly provided traditional schooling throughout the country. Those who reached the threshold level in literacy to attend the exam (4,000 characters) were only 1%-2% of the male population (Rawsky, 1979, p. 96). In contrast, 30% to 40% of male population achieved basic literacy (numeracy and about 1000 characters) in the lower Yangzi area (Crayen and Baten, 2010)[4]. Literacy among women was limited to those from elite families (2-5%) where females taught their children at very early age (Mann, 1994; Rawsky, 1979, pp. 6-7).

As a result of specialization since 16th century in developed areas, 3-5 years of primary schooling brought practical advantages far from enough to obtain an exam degree. The ability to read posters, land deeds and receipts, and to write one's name, and to keep accounts all became important. So there was a growing demand for education, especially basic literacy. There were two phases, or two forms of education: the mass primary

[3] Male population share of various Exam degree holders (from high to low): *Jinshi*: 0.005%-0.01%; *Juren*: 0.03%-0.08%; *Shengyuan and Jiansheng*: 0.4%; *Tongsheng*: 2%

[4] The authors found that age-heaping, a method to measure the tendency for individuals to inaccurately report their actual age or date of birth, was 150 (corresponds to 30% of literacy rate) before 1850 in Cantonese China and declined thereafter, indicating a good level of human capital relative to other pre-modern societies.

education at age of 6-8 (蒙学) that taught basic literacy and discovered students with talent, and the education drilling candidates to prepare for exams (经学) (Leung, 1994).

Both kinds of education were mainly provided privately. Children in elite households were instructed at the earliest stage (age of 3-6) by family members, and later until age of 15 by hired private tutors (typically exam degree holders who had not been to a government position). Households of modest backgrounds pooled their resources and paid local teachers for instructions. There is no evidence of a village tax, nor any aid from government received for the support of such instructions. Parents paid the teacher a "rate-bill" in money or commodities. Each tutor taught 1-30 students in the tutor's own house or the village temple. Hours and schedules were flexible, adjusted to weather and season. The cost varied with the quality of instructions, and degree holders could require a higher price as tutors. At the age of nine or ten, decisions were made based on the observed talent of children. Families would support the talented ones to pursue exam careers, while prepare others for various lesser occupations.

Boys from families too poor to pay for schooling were not necessarily barred from the classroom. Clan schools (族学) were often established primarily to aid such students (Rawsky, 1979, pp. 30-32). Kinship leaders realized that the inheritance of educational talent is weaker than physical attributes across generation, and the exams admitted only the most talented ones. So it was rational to pool resources over households within a kinship to provide basic schooling to discover the talented clan members. Success in the exams brought not only glory to the kinship member, but also higher status and better protection of property rights of the entire kinship. These schools were financed by contributions, a clan tax, and clan land (学田) with the rent going to special funds for education and exam preparation. Clan temples (宗庙) often served as classrooms. For the talented students, their future study and exam taking were fully covered by land funds. Finally, big bonuses were awarded to exam passers and their families. A lowest exam degree (生员 and 监生, 0.4% of male population) would exempt his family member from taxes and labor services, and more important, build up connections with government officials. The benefits spilled over to the entire kinship.

Most clan schools limited admission to kin members but exceptions were made for talented non-kin members within the community[5]. Kin networks supported kin members beyond their local community: absentee landlords and merchants who lived in cities and towns support their relatives for schooling in rural area. Kinships varied in cultural traditions (ancestor's code), geographic concentration, political status, and wealth, and thus propensity and ability to finance such schools[6]. Overall, in the lower Yangzi about 5-8% of males were supported by their kinships for their education.[7]

States in late imperial time took a hands-off approach to financing education. Local magistrates advocated setting up primary schools for the poor but there was no record of direct funding from the government (Rawsky, 1979, pp. 38-40). The state directly financed

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5 Charity in pre-modern China was predominantly personal, given to kin, and provided by the clan. Buddhist organizations had limited resources after the persecutions in the 9th century. Similarly, the state-run granary system assisted the poor but did so only following a natural disaster that influenced many. For a detailed study of Chinese clans, see Greif and Tabellini (2011).

6 For example, the Fan of Suzhou gave its clan school a priority before private tutoring because such codes of practices were written by its ancestor, Fan Zhongyan (范仲淹), prime minister in the Song dynasty;

7 The upper limit for kinship-provided public schooling is limited not only by the trade-off between private return and social return to education. Providing "public schooling" increases the chance of producing a high degree holder, but may potentially change **the social rank** within the clan, undermining the interest of elite members of the kin.

education establishments, called "government-based county and prefecture schools"（府县官学）, where no more than a few hundred lower degree holders were supervised and evaluated toward higher degrees (the state gave an allowance for basic living (廪膳) and traveling (宾兴)). In rare cases, the government financed establishing and maintaining schools in frontier areas populated by non-Han minorities, and helped establishing schools in areas that had just suffered calamities of wars and famine as a means to restoring the Confucian order (Rawski, p. 89). For example, after the Taiping rebellion, the magistrate of the county of *Wujiang* (吴江) set up 16 charity schools from the county budget, but those schools admitted no more than 500 students countywide, about 1% of school-aged children. These schools were closed after a decade because of "a tight budget" and because "private and clan schools were restored to pre-war level" (吴江县志). Overall, at most state initiated charity schools only admitted 0.5-1% of school-aged children, which was 2%-4% of all those educated.

3.2.2 Taiping rebellion: population loss, migration and diversity shock, 1850-1900

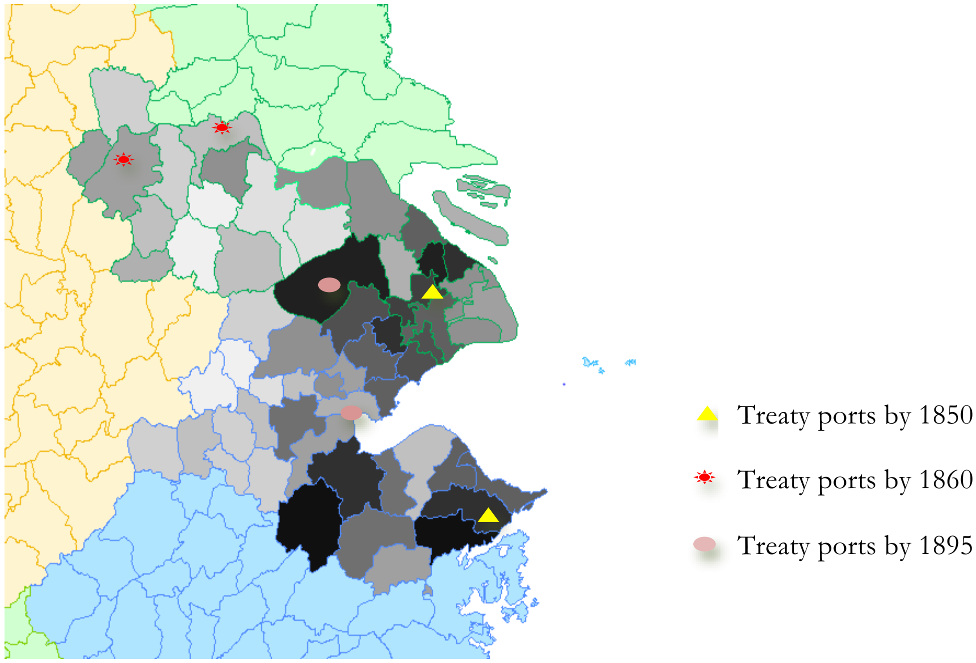
The Taiping Rebellion was a massive civil war in southern China from 1850 to 1864, against the ruling Manchu-led Qing Dynasty. At least 17 million people, or half of the region's population, died in the lower Yangzi. Battles took place in all counties in the lower Yangzi, and all except for Shanghai were occupied for more than 3 months. The area around Nanjing, the capital city of Taiping regime since 1853, was most severely affected as it was a battlefield for over ten years. The most prosperous and important cities in the lower Yangzi, Hangzhou and Suzhou, were occupied by the Taiping army after 1860 in an effort to find food supplies that were increasingly cut-off by the imperial armies, local militias, and foreign mercenaries. The least affected area was Shanghai, protected by foreign powers, and it became the refuge for 200,000 refugees (Ge, 2002, pp. 62-63). Famine and plague followed the battles. Population loss at the county level is difficult to estimate, as data on population is only available for 1850 and 1885, and population in 1885 includes immigrants that moved in 1865-1885.[8]

Migration took place during the Taiping Rebellion and thereafter. There was migration from relatively less affected areas within the lower Yangzi to those severely affected, but also long distance migration from North China and the middle Yangzi River. Migration before the 1850s was motivated largely by economic considerations, ethnic bonds and geographic proximity (Li, 2012). It happened slowly and at small scale. So it reduced population homogeneity to a limited extent. The migration after the 1860s had a much larger impact *not only* because of the large scale, but also because they came from a very wide range of geographic areas and diverse economic and cultural backgrounds. The provincial governments advertised all around China for migrants and depicted the lower Yangzi as a "kingdom of free land" and the "land of opportunities". Farmers from Henan, Anhui, Hubei, Hunan, North Jiangsu, and South Zhejiang came for a better living (Ge, 2002, pp.100-106). After 1900, industrialization drew massive immigrants into the urban area of Shanghai (Ma and Wright, 2010). Its population increased by fourfold from 1907 to 1947.[9] In all, villages and townships in lower Yangzi became much more diverse in their dialects and social customs.

[8] Various genealogies documented death among adult males during the rebellion, the population loss calculated can vary from 20% to 80% (Liu, 1990; Cao, 2003)

[9] The Nanjing area (江宁县和南京市区) also attracted immigrants after it became the capital of Republican government of China after 1928.

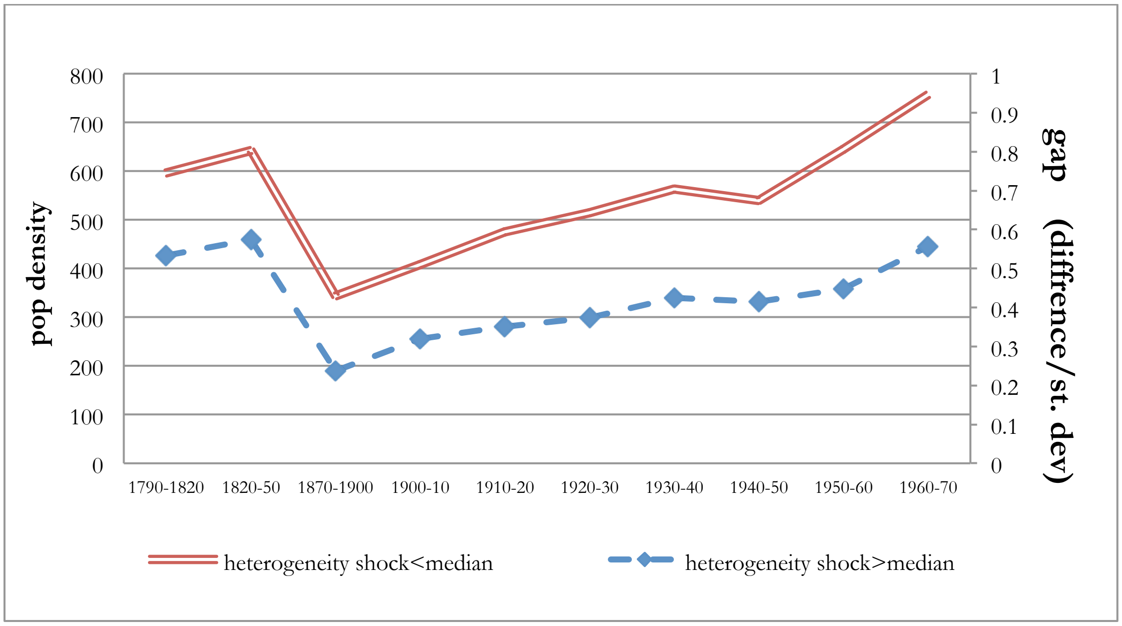
Figure 3.1: Magnitude of the diversity shock (DS)



Note: *darker* area indicates *smaller* diversity shock, which is measured by changes in the surname distribution in 1900 relative to 1850 (defined formally in section 3.3.1).

The decline of homogeneity at the county level can be measured by surname distributions (defined formally in section 2.1). Two patterns can be observed about the surname distribution observed among lower Yangzi counties: (1) the surname distribution at county level was stable over time before 1850. Rare surnames may fluctuated in frequency, but the population share of the largest few surnames stayed constant over time at county level (chapter 1). (2) The surname distribution changed greatly after 1865 relative to before (table 2). For example, in Changzhou County (武进), the biggest surname, Wu (吴), accounted for 8% of its population before 1850 but only accounted for 4% in 1900. Figure 1 shows the diversity shock in lower Yangzi measured by changes in the surname distribution.

Figure 3.2: population loss and recovery (1820-1960)



Note: 1820-50 and 1870-1900: from local chronicles (year may vary from county to county)

1790-1820: projected from 1850s, assuming 0.5% of annual growth rate 0.25% which is the growth rate of Suzhou prefecture 1820-1850

1900-10: population census of 1910(宣统元年户口统计)

1910-20: average of 1915-1919; 1920-30: 1928; 1930-1940: 1937; 1940-1950: 1947; 1950-60: 1953; 1960-70: 1964

Figure 3.2 shows trends of population density of lower Yangzi from 1820 to 1960, by the size of diversity shock. Overall the lower Yangzi population was substantially reduced 1850-1870, and did not recover to the pre-rebellion level until 1950s. The less shocked group suffered less population loss (reduced by 50%) than the more shocked group (reduced by 67%) due to the war. In the last few decades of 19th century the more shocked group drew more immigrants, and hence caught up with the less shocked group. After 1900, however, as Shanghai-centered area became industrialized and expanded in size the less hit counties drew more immigrants. The difference in population density between the two groups enlarged until the Second World War.

From figure 3.1 and 3.2, it seems that the shock was smaller in the East, which had higher population density before the rebellion, and was closer to the sea. So it might be that the rebellion hit the lower Yangzi area differentially for some reasons that correlate to the future growth path (land productivity, tax revenue, if a treaty port, et al). Indeed the Rebels tried to make peace with the western forces in the treaty ports of Shanghai and Ningbo, and even tried to trade with western countries in exchange for weapons. Still there is some randomness in the degree of calamity and the source of immigrants (from neighboring area or remote areas), which resulted in great disparity in the magnitude of the diversity shock even between neighboring counties. So if I control for those systematic factors that drove future education outcomes, I can still identify the impact of diversity shock on primary schooling.

The diversity shock could have two effects on public goods provision. First, the clan networks of the native population were weakened. Members died, public properties were lost or damaged, but also the kinship members dispersed and lost touch with each other. A good case in point is the elite clan members settled in Shanghai. After the Taiping rebellion they provided less aid and charity to their places of origin because there were fewer relatives back there. Second, in any given community, there were more conflicts between the preferences and interests of natives and migrants, and conflicts among migrants with different dialects, skills and social customs. Their conflicts took place upon matters such as usage of public water, property rights of ownerless land, whether or not immigrants can take exams, etc (Ge, 2002, pp. 303-308), which are widely documented in local chronicles.

Nonetheless, as education was still financed mainly privately 1870-1900, primary enrollment (derived from *juren*/population) was NOT necessarily lower in the more shocked area before the end of exam era. This is because even if the more shocked area had a larger population loss and had a higher share of immigrants (potentially lower skills), the land/labor ratio was more favorable to the more shocked area (hence a higher labor productivity), indicating a temporary higher living standard and thus higher budget to spend on education. So the net effect may be ambiguous. This conjecture is confirmed in figure 3 in 1.3, where the normalized gap between the two groups did not enlarge after the rebellion. However, when counties, communities and clans tried to mobilize financial resources to establish modern schools in 1900s, diversity shocks had a great impact on the "public" portion of schooling, and the gap between the more-shocked and less-shocked counties increased.

3.2.3 Failure in financing modern education, 1905-1949

In the late nineteenth century growing economic openness gave rise to higher demand for education in science, technology, and other non-exam skills (Yuchtman, 2010). Attempts to build modern schools started in some coastal cities as early as the 1860s, most of which were funded by missionaries. But the expansion of modern schools did not start until the abolishment of the exam system in 1905. A Ministry of Education was established, and Offices of Provincial Education were founded, along with county-level agencies known as "Education Exhorting Offices" (劝学所). The finance of all levels of educational institutions resembled the traditional system, however, the central and provincial government financed universities, students studying abroad, and some elite secondary schools (including teacher training schools) at provincial capitals. The decentralization of fiscal authority after the Taiping Rebellion left most tax revenues to county-level authorities. So the central state had very limited resources to finance primary schooling at the local level. County governments financed public secondary schools and primary schools in "capital seats". These schools were typically financed by a combination of county tax receipts, business tax surcharges, the reallocation of endowments from traditional schools, and private contributions by local elites (Chaudhary, *et al.* 2012). In rural areas, clans and communities financed public primary schools, many of which were restructurings of existing clan schools and their properties. Other primary schools were initiated by local elites, entrepreneurs and missionaries. Many schools were also supported by tuition charges to subsidize public funds. Tuition accounted for 10%-20% of the educational budget in 1917. As a result, many children from impoverished households could not afford to attend these modern schools without support from clans.

Private informal tutorships, which continued teaching traditional content, were not counted as formal schools and the number of pupils under such tutorship was not reported. Primary enrollment in modern schools was only 1.5% in 1900s, and 10% in 1910s. Since we know that the literacy rate was 20%-40% for males in this area, private tutors must have still educated more than 90% of pupils in 1900s and more than 60% in 1910s. Villagers preferred informal tutorships for lower costs, for flexibility and practical value. According to the population census in 1947 Zhejiang, 23% of the adult population was educated by formal (modern) schools, and 22% of the population had some years of informal tutorship, so that the other 55% (of which 80% are women) were not educated at all. [10]

Despite lack of direct evidence on the channel by which diversity shocks had negative impacts on primary schooling, historical accounts give some insights. First, at the county

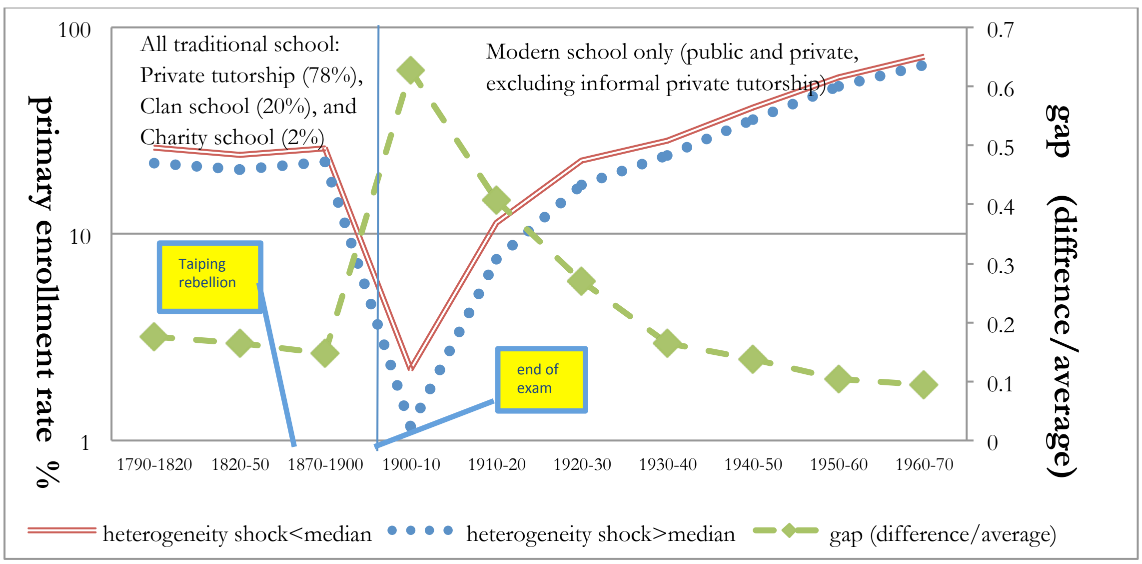
[10] Enrollment for females was much lower. For 1900-1920, data of enrollment is not reported by sex but in 1937, the ratio of male over female enrollment is 6.8:1 so it should be even higher than that for 1900-1920.

level it was more difficult to raise county taxes, and make within-county transfers to ensure universal primary school in counties of greater heterogeneity. Tian and Chen (2000) documented cases where rural immigrant residents refused to pay the county tax designated to finance schools because "the schools only serve the rich in the cities and towns" (Tian and Chen, 2000). Second, at the community level, the decision makers have less incentive to raise public fund in a community without familial and ethnic bonds. In the early 20th century, among 151 clans from lower Yangzi provinces that he studied, 116 held corporate properties. Among these clans, only 15 clans document charitable schools, and only 6 had school or educational land (Rawski, 1979, p. 86). On the contrary, 75 out of 151 clans provided funds for the reward and relief of clan members only. Of these 59 maintained funds to aid schooling and taking college entrance exams. One potential reason for this pattern is that clan members lived apart and it was impossible to provide schools to service a whole clan. The other reason is that in a diverse community, it was more difficult to exclude the non-clan members and keep the benefit of schools within the clan. In either case, clans would prefer direct financial aid to clan schools.

The impacts of the diversity shock can be illustrated by figure 3. In the 1880s, in less shocked area the traditional primary school enrollment rate was 26%, including private tutorship, clan schools and charity schools, whereas in more shocked one it was 22%. In the 1900s, only 2.3% of school-age children enrolled in the modern public primary schools in the less shocked area. It was 1.1% in the more shocked area for the same period. This is saying 9% of those being educated, privately or publicly, came to modern public schools in the less hit areas whereas only 4% of those being educated came to modern public schools. The gap in enrollment between two groups did not return to pre-rebellion levels until 1930s. Note that the gap in population density between the two groups was largest in 1885 (figure

1). So the trend of the gap in enrollment cannot be fully explained by the gap in population. One potential force for the enlarged gap in the 1900s is Western influence on public schools. My results show that even if I control for various proxies for western influence like Christian presence, distance to Shanghai, and longitude, the diversity shock still had a negative impact on enrollment. Furthermore, as figure 2 shows, treaty ports spread to the west of Lower Yangzi by 1895, so the western influence may have been similar in size along the Yangzi River.

Figure 3.3: primary enrollment % by the size of diversity shock (1790-1970)



Source: 1820-1900: transformed from *juren*/10,000 people (details in section 2.2)
1900-10: average of 1908-1910 enrollment rates (光绪/宣统教育统计图表)
1910-20, average of 1915-1917 enrollment rates (中华民国教育统计图表)
1920-30, Jiangsu province: 1928-1929 (江苏教育年鉴); Zhejiang Province, 1928
1930-40, Jiangsu: 1935-1937; Zhejiang: 1935-1936;
1940-50: 1947
1950-60: 1953
1960-70: 1964

3.3. Data And Descriptive Graphs

3.3.1. Measuring diversity shocks

The key independent variable of interest that affects the provision of public schooling is the disparity in surname distribution between 1850s and 1900s at the county level. In practice, the **diversity stability** for county *i* between 1850 and 1900 is given as:

$$\mathbf{G_i}=(\sum_m(S_{m,\,1850}\times S_{m,\,1900})/\sum S^2_{m,\,1850}),$$

and the **diversity shock,**

$$\mathbf{DS_i= 1/G_i}$$

Where $S_{m,\,t}$ is the population share of surname *m* at time of *t*, for all surnames 1… M. G_i=1 if surname shares are all the same in each period. G_i=0 if there is no correlation across periods in the surname shares. Intuitively, G_i is the OLS estimate of the coefficient of a simple regression, for a given county, of its surname distribution in 1900 on its own surname distribution in 1850: $S_{m,\,1900}$=□ $+\beta\times S_{m,1850} + \mu$. So the higher the estimated β is, the stronger that the surname distribution of county i in 1850 can predict/explain the surname distribution of the same county in 1900, and less the "diversity shock" for that county.

To obtain the surname distribution of a county i in 1850, I collected from county chronicles (1) surnames of exam degree holders that were born 1620-1850 (including *juren*, 举人, jiansheng, 监生, and gongsheng, 贡生), (2) surnames of women honored for their moral integrity (烈女节妇), and (3) surnames of their husbands if they are also recorded. The number of records for each county ranges from 400 to 3000. To obtain the surname distribution of a county *i* in 1900, I collected from (1) the surnames of dead soldiers

(1927-1953) and (2) college students graduated 1900-1949 who are born in that county (notwithstanding their places of origin). The number of surnames obtained in this way for each county ranges from 200 to 2500. Table 2 shows the surname distributions of four counties for the two periods, and the calculated diversity shock.

These samples seem to be too small to correctly display the true surname distribution of population if each surname accounts for a small fraction of population. This is not the case for China. In each county the largest few surnames each accounts for more than 5% of the population. To correctly estimate surname distribution of population at least for the largest few surnames, one only needs a population sample of as a few hundred.

It is noteworthy that the magnitude of the diversity shock can be driven by many factors other than population loss. The results in table 2 show some interesting comparison that is consistent with historical accounts. Hangzhou and Changzhou were besieged and battled longer than average. They suffered a larger population loss and received massive inflows of immigrants after 1865. Ningbo and Shanghai were protected by Western powers as they were treaty ports, and they suffered less population loss. It did not follow immediately, however, that counties with less population loss had higher genetic consistence. Shanghai was the destination of a much larger inflow of refugees than any other county, and continued to attract immigrants after 1865. Hangzhou received most of its immigrants from its neighboring Shaoxing (绍兴) county which had a close genetic distance to it (measured as a similar surname distribution), and was relatively less affected during the rebellion. Hence the heterogeneity consistency is even lower in Shanghai than Hangzhou. On the other hand, the immigrants to Changzhou came from provinces further West and North. This is because the neighboring counties of Changzhou also suffered heavy population losses. As a result, among the four counties Changzhou has the lowest score of diversity stability, or largest diversity shock.

Table 3.2: illustration of derivation of diversity shock (DS)

	Hangzhou (杭州）DS=1/0.6441			Ningbo （宁波）DS=1/0.7622			Changzhou (常州) DS=1/0.3403			Shanghai (上海）DS=1/0.6113	
	share in 1850 % (2618)a	share in 1900 %(2323)		share in 1850 % (886)	share in 1900 % (1747)		share in 1850 % (1616)	share in 1900 % (1549)		share in 1850 % (608)	share in 1900 % (1554)
吴	6.23	3.84	陈	9.77	8.07	吴	8.04	3.49	张	11.18	6.68
王	5.69	5.34	张	8.60	6.70	庄	6.62	1.22	王	5.26	7.76
陈	4.51	6.37	范	5.54	1.69	杨	5.38	3.29	赵	5.26	3.07
汪	4.24	1.29	李	5.25	4.41	张	4.89	5.55	朱	4.93	4.15
沈	4.09	3.40	王	4.08	5.90	刘	4.76	2.26	曹	4.28	2.35
张	3.82	5.42	徐	3.50	3.89	徐	3.47	2.91	李	3.95	3.25
周	3.28	3.10	董	3.35	1.32	赵	2.91	0.97	徐	3.62	1.44
朱	3.06	2.97	周	2.62	5.04	谢	2.66	1.48	刘	3.62	1.26
孙	2.71	2.41	郑	2.19	1.55	吕	2.54	0.45	顾	3.29	2.89
许	2.48	1.29	袁	2.19	0.80	恽	2.10	0.58	陆	2.96	2.17
徐	2.37	3.10	邵	2.19	0.92	王	2.04	5.87	杨	2.30	3.97
金	2.25	1.64	黄	2.04	0.92	黄	1.92	1.23	姚	2.30	1.81
陆	2.10	1.38	卢	1.90	0.52	董	1.92	1.19	乔	2.30	1.44
钱	1.95	1.64	林	1.75	2.00	李	1.86	1.87	黄	2.30	1.44
赵	1.87	1.68	郭	1.75	0.40	蒋	1.79	3.16	沈	1.97	4.87

Note: a, in parenthesis is the sample size from which I calculated surname distribution

3.3.2 Dependent variables (primary enrollment/literacy rate)

The main dependent variables are primary school enrollment by decade from 1820 to 1960. It is possible to infer county-level primary enrollment rate in the exam era by taking a linear transformation of *juren* per 10,000. First I did the following regression:

$$Literacy\ rate_{i,1947}=a + b \times college\_student\_per\ 10000_{i,\ 1947} + \mu_{it}$$

Second, using the obtained coefficient, *a* and *b* (1.72 and 13.56 respectively), I projected literacy rate in the exam era from juren per 10,000,

$$Literacy\ rate_{i,t}=a+b\times f_t\times juren\_student\_per\ 10000_{i,t}$$

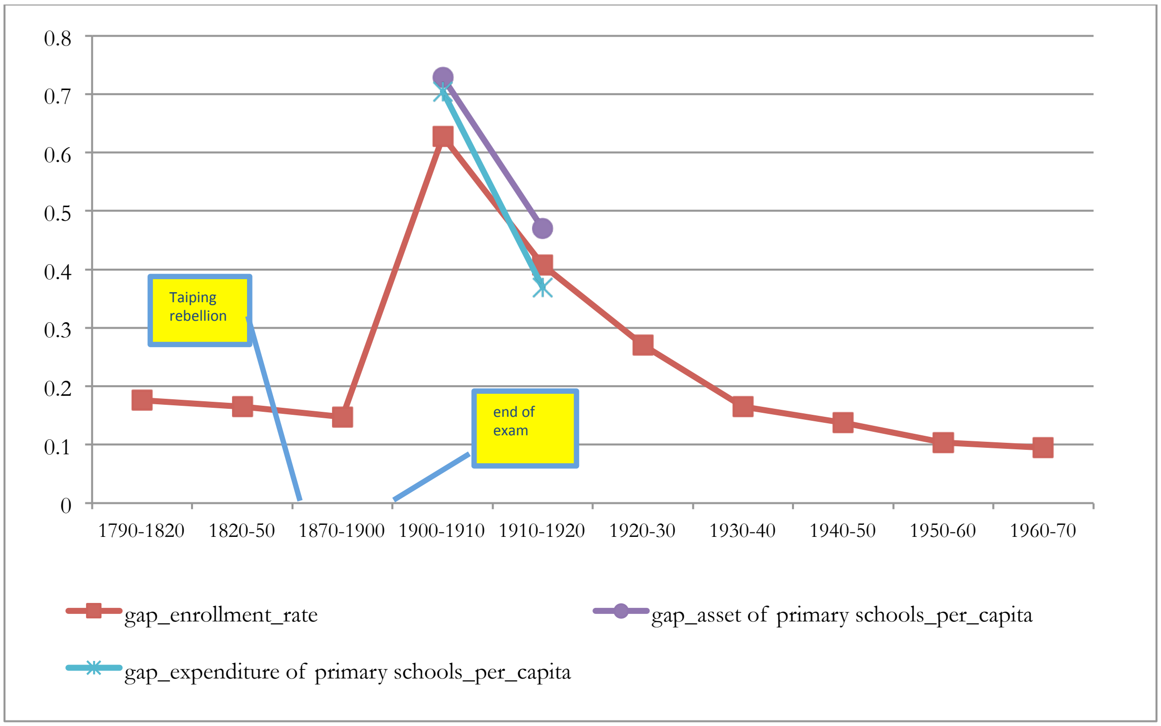
Where f_t is a time-varying ratio that transforms *juren* per 10,000 can into college students 1947. For example, in 1820 and 1850, juren were 0.03% of the male population in lower Yangzi, and in 1885 *juren* were 0.06% (the *juren* quota changed little but the population halved after 1860), whereas college students account for 0.3% of the total population in 1947. So the f_t=10 for 1820 and 1850, and f_t=5 for 1885.

This transformation is based on the observation that college students made up a bigger, yet still small fraction of the population, and literacy had improved little from 1850 to 1950. The derived literacy ranges from 15% to 57% of the male population with a mean of 23%. For simplicity I also assume that a and b are the same for all t. The "production function" of exam degree holders (as a function of literacy) shares the same linear from as the production function of college students in the Republic era. This seems to be an unrealistic assumption but due to data limitation this is the only way that I can transform "elite productivity" into literacy rate across regimes.

For the five decades of 1900-1949, the enrollments of informal schooling were not included. In 1935 and 1949, both provinces attempted to do a census of these informal schools and forced the registration, but the data quality varies greatly from county to county. By 1953, all informal schools had been converted to formal public schools. Mostly, the primary enrollment data reflect the county and community level public schooling supplied, including those that were initiated by individuals and clans.

Figure 3.5 shows the trend of normalized gap in enrollment rates for all periods, along with expenditure on primary schooling per capita and the value of school assets per capita for 1900s and 1910s. My data on those measures in these two decades show a similar pattern to that on enrollment. Enrollment thus seems a good proxy for public educational spending.

Figure 3.5: the normalized gaps in primary enrollments, expenditures and assets



Note: normalized gap defined as difference between more shocked area and less shocked one divided by the average of the lower Yangzi.

3.3.3 Control variables

The main control variables include population of these counties from 1820-1960 interacting with year dummies, which captured differential trends of economic prosperity. Other variables are time-invariant: longitude, latitude, distance to the provincial capital and to Shanghai, arable land share, occupational share 1930, population of Christians and vicars per 10,000 people in 1900, and an index of adverse weather 1900-1920 (collected by Chen *et* *al.* (2012)). It seems that the diversity shock was smaller in the East, which had had higher population density before the rebellion, and was closer to the sea. So it might be that the rebellion hit the lower Yangzi area differentially for some reasons that correlate with the future growth path (land productivity, tax revenue, if a treaty port, et al). Still there is some randomness in the magnitude of diversity shock even between neighboring counties. So if I control for those factors that drove future education outcomes, I can still identify the impact of the diversity shock on primary schooling.

Table 3: Descriptive statistics of time-invariant variables by groups

	Diversity shock <median	Diversity shock >median	t-value between
Diversity shock	1.50 (0.19)	2.92 (1.19)	20.76
Latitude	30.80 (0.74)	31.03 (0.73)	3.97
Longitudes	120.81 (0.72)	119.86 (0.65)	-6.73
Distance to provincial capital (km)	180.40 (104.25)	94.83 (65.34)	-12.23
Distance to Shanghai (km)	129.27 (85.86)	213.03 (69.84)	13.31
Arable land share(0-1)	0.59 (0.20)	0.48 (0.27)	-4.61
Non-agriculture Occupation 1930 (0-1)	0.25 (0.13)	0.22 (0.10)	-2.10
Christian Per 10,000 people 1900	47.74 (47.51)	17.58 (17.32)	-10.49
Vicars per 10,000 people 1900	1.38 (1.74)	.58 (0.45)	-7.85
Adverse weather Frequency (1900-1920) (0-1)	0.57 (0.07)	.53 (0.12)	2.19

3.4. Results And Interpretation

3.4.1. Reduced-form model

In this section I use OLS regressions to investigate the reduced-form relationship between my measures of diversity shock and the relative educational outcome across the 60 lower Yangzi counties. The panel includes data for two pre-rebellion periods 1790-1820 and 1820-50, the post-rebellion period 1870-1900 when exam system was still in practice, and seven periods 1900-1970. For purpose of simplicity, I re-label them as 1805, 1835, 1885, 1900, 1910, 1920, 1930, 1940, 1950 and 1960. The econometric strategy is similar to Acemoglu *et al.* (2009), Jia (2013), Nunn and Qian (2012). My basic reduced-form regression model is as follows:

$$ln(enrollment_{it}) = \alpha + d_t + d_i + \mu\, ln(population_{it}) + \delta\, pop\ density_{it} + \sum_t(\beta_t\, dummy_t\, diversity\ shock_i) + \sum_t(\gamma_t\, dummy_t\, X_i) + \varepsilon_{it}$$

The dependent variable is the natural log of primary enrollments of county i at time t (in number of students). The independent variable of our interest is the treatment variable diversity $shock_i$. I include all interactions between diversity shocks and year dummies to allow the treatment effect of diversity shocks to vary across time. The variable d_t denote a full set of time effects, while d_i denotes a full set of county fixed effects. The natural log of population in numbers of people is meant to capture the trend of economic prosperity. Population density of county i at time t is also included because it is expected that enrollment should expand more rapidly when people lived closer to each other, and it is a good proxy for urbanization rate, which is not available at the county level. X_i is a vector of other time invariant variables, which will be included in some of the robustness checks, and e_{it} is a disturbance term.

With time and county fixed effect included, μ is expected to be positive because enrollment should be proportional to the population. The coefficients of interest, β_t, where t includes 10 periods, together allow us to look at both pre-and-post-treatment differential effects. Under our hypothesis that the diversity shock was exogenous, we expect the coefficient β_t to be close to zero and not significant for t=1805 and 1835. Under my hypothesis that the diversity shock had mixed impacts on school enrollment in 1885 when education was financed privately, we expect that β_t is not significant afterwards. The negative impact is expected to show up in 1900 and after, when modern public schools were first established at county and community levels. The impact will diminish over time as immigrants and natives became more assimilated. If policies favored the areas with lower enrollment rates, such as in 1950 and 1960, β_t could be positive. Throughout the paper, all standard errors are robust and clustered at the county level to allow for potential serial correlation in the error terms.

3.4.2. Baseline estimates

Column 1 of table 4 only includes time effects but not county fixed effects. The diversity shock has a negative and significant impact on enrollment for 1885, 1900, 1910 and 1920. After including county fixed effects, the diversity shock has a negative and significant impact only in 1900. Column 2 reports the result of my baseline model with only ln($population_{it}$) and pop $density_{it}$ as controlled variables. I also included all time effects and county fixed effects. As expected, the log of population has a positive impact on enrollment and the coefficient is close to 1. The diversity shock has a small and insignificant effect in 1805 and 1885 (1850 dropped), indicating that the diversity shock was not correlated with enrollment before 1900. The diversity shock has a significant and negative effect for 1900, and is insignificant afterwards. For 1900, if diversity shock doubles, the enrollment in number of students will decrease by 23%. For 1910, the impact reduced to 5% and is not significant. For 1920 and thereafter, the impacts are small and insignificant and there is no evidence of catching up by the low enrollment counties, even the two decades after 1949, when "elimination of illiteracy was given great priority on Communist agenda" (Petersen, 1995). Even though enrollment improved greatly in 1950s and 1960s as a result of the higher shares of county budget that went to primary schools, there is no evidence of the transfer of resources from high enrollment counties to lower ones.

In column 3, I used populations in 1960 as weights so that the model gives more weight to the counties with larger population in fitting the data. The results are similar to column 2 but the coefficient on the treatment in 1900 is even larger and more significantly significant (-0.285). The coefficient on the diversity shock is also larger and now significant in the 1910s (-0.128). In column 4, I also allow the diversity shock to interact with population density and I allow this effect to vary across time. This tests if the diversity shock is more detrimental to education when population is more concentrated. Agents with heterogeneous preferences would find it even more difficult to coordinate and achieve an agreement in a community of more people, and counties with a larger population density tend to have more people in the average community. The coefficient on other variables changed little and the coefficient on these added interactions are insignificant. The result does not alter if Shanghai is excluded from the sample, as shown in column 5 of table 4.

Table 3.4: primary enrollment on treatment

	With year effect; No county fixed effect	With and year and county fixed effect	Weight =pop1960	Including pop density and DS interaction	excluding Shanghai
Ln(pop)	**1.055*** **	**1.051*** **	**1.650*** **	**0.971*** **	**1.076*** **
	(26.70)	**(7.98)**	**(11.25)**	**(9.03)**	**(6.95)**
Pop density	0.0000815	0.0000608	**-0.000220** **	0.000514	0.000458
	(1.89)	(0.76)	**(-3.39)**	(1.22)	(1.87)
Diversity shock*year dummy					
1805	-0.0431	0.0203	-0.0600	dropped	0.0168
	(-1.31)	(1.50)	(-1.68)		(0.42)
1835	-0.0633	dropped	**-0.0751***	-0.00838	0.00395
	(-1.92)		(-2.28)	(-0.81)	(0.10)
1885	**-0.0631***	-0.000326	0.0455	-0.0462	dropped
	(-2.68)	(-0.01)	(0.64)	(-0.92)	
1900	**-0.295*** **	**-0.232*** **	**-0.285*** **	**-0.268*** **	**-0.228*** **
	(-4.79)	**(-3.59)**	**(-4.46)**	**(-3.58)**	**(-3.76)**
1910	**-0.113** **	-0.0503	**-0.128***	-0.0697	-0.0310
	(-2.70)	(-1.11)	(-2.16)	(-1.39)	(-0.54)
1920	**-0.0695***	-0.00633	-0.00985	-0.0185	0.0423
	(-2.05)	(-0.17)	(-0.23)	(-0.41)	(0.93)
1930	-0.0146	0.0487	0.0249	0.0440	0.0739
	(-0.43)	(1.41)	(0.58)	(1.06)	(1.42)
1940	-0.0299	0.0334	-0.00210	0.0249	0.0483
	(-1.65)	(1.35)	(-0.08)	(0.72)	(1.14)
1950	-0.0249	0.0381	-0.0131	0.0374	0.0545
	(-1.48)	(1.64)	(-0.76)	(1.14)	(1.14)
1960	-0.0206	0.0422	dropped	0.0641	0.0758
	(-1.18)	(1.75)		(1.68)	(1.66)
_cons	**-2.942*** **	**-4.071***	**-10.79*** **	**-3.196***	**-4.288***
	(-5.80)	**(-2.43)**	**(-5.58)**	**(-2.33)**	**(-2.22)**
N	600	600	600	600	590

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

3.4.3. Robustness check

Table 5 investigates the robustness of my baseline results by adding in a full set of interactions between the time-invariant variables and time dummies that captures the greater

Western influence in some counties. As figure 1 shows, longitude was strongly negatively correlated to the diversity shock. The more “eastern”, the closer to Shanghai, the less population loss due to the rebellion and the longer distance for immigrants to move in. The direct impact of diversity shock after 1900 that I found in table 4 could have actually been the long-lasting and ever stronger impacts of Western influence on education, rather than impacts of the diversity shock.

In column 1 of table 5, for example, I include interactions between the year dummies and longitude (i.e. $\sum\eta_t(d_t\times longitude_i)$). As a result, the size of the coefficients on the diversity shock for 1900 is reduced from -0.23 to -0.17 and but is still significant at 5%. It reduced to -0.0536 for 1910s and is not significant. After 1910, the diversity shock has neither last-lasting impacts nor "catching-up" effect. The coefficients on longitude, on the other hand, were not significant before 1900, but positive and significant for 1900-1930.

I also used other measures to quantify Western influence and allow its impact to vary over time. Column 2 and 3 reports the results controlling for latitude and distance to Shanghai, both interacted with year dummies. Column 4 and 5 reports the results controlling for the number of Christians and vicars per 10,000 people, respectively, both interacted with year dummies. In all of these regressions, the diversity shock has a negative and significant impact on enrollment for 1900 (the elasticity being 0.16 to 2.34). Interestingly, all measures of western influence have positive and significant impacts on enrollment for 1900, and for 1910, 1920 and 1930 in some cases. On the other hand, more access to Western influence did not affect enrollment before 1900 and after 1940. Chen et al. (2012) find that Western influence affect educational attainment and urbanization rate after 1990. Jia (2013) finds similar results but she finds no such impacts during 1949-1978. This is consistent with my result.

Table 3.5: with time-invariant controlled variables capturing western influence (interacted with years)

All with year and county fixed effects

Dependent variable: ln(enrollment) in number of students

Control	(1) longitude	(2) latitude	(3) Distance to Shanghai (km)	(4) Christian per 10,000 in 1900	(5) Vicars per 10,000 in 1900
Ln(pop)	**0.934*** **	**1.086*** **	**1.009*** **	**1.022*** **	**0.987*** **
	(7.22)	**(7.88)**	**(7.73)**	**(9.88)**	**(8.64)**
Pop density	0.000121	0.0000339	0.000107	0.0000827	0.000119
	(1.44)	(0.44)	(1.22)	(1.14)	(1.71)
Diversity shock*year dummy					
1805	-0.0478	-0.0223	0.0329	0.0233	0.0241
	(-1.61)	(-0.92)	(1.32)	(1.61)	(1.80)
1835	**-0.0628***	-0.0385	0.00859	dropped	dropped
	(-2.37)	(-1.78)	(0.37)		
1885	-0.0441	-0.0323	dropped	-0.00837	-0.00958
	(-1.42)	(-0.81)		(-0.37)	(-0.40)
1900	**-0.170***	**-0.238*** **	**-0.167** **	**-0.163***	**-0.204** **
	(-2.49)	**(-3.78)**	**(-2.68)**	**(-2.66)**	**(-3.24)**
1910	-0.0536	-0.0550	-0.0664	0.00606	-0.0235
	(-1.29)	(-1.51)	(-1.71)	(0.13)	(-0.51)
1920	0.0387	-0.0208	0.0443	0.0308	0.00687
	(0.88)	(-0.67)	(1.01)	(0.78)	(0.18)
1930	**0.0698***	0.0405	0.0726	0.0730	0.0562
	(2.56)	(1.52)	(1.85)	(1.96)	(1.60)
1940	-0.000507	0.00530	0.0418	0.0510	0.0382
	(-0.03)	(0.36)	(1.33)	(1.77)	(1.44)
1950	-0.00761	0.00161	0.0483	**0.0593***	0.0450
	(-0.66)	(0.16)	(1.57)	**(2.28)**	(1.86)
1960	dropped	dropped	0.0508	0.0538	0.0437
			(1.53)	(1.99)	(1.75)
Control*year dummies					
1805	-0.0724	0.0259	-0.000120	-0.000787	dropped
	(-1.39)	(0.71)	(-0.33)	(-0.59)	
1835	-0.0569	-0.00477	0.0000257	-0.00106	-0.0138
	(-1.23)	(-0.17)	(0.08)	(-0.96)	(-1.80)
1885	-0.0220	dropped	dropped	-0.00125	0.00110
	(-0.35)			(-0.97)	(0.05)
1900	**0.333** **	**-0.221***	**-0.00221***	**0.00574*** **	**0.122***
	(3.15)	**(-2.20)**	**(-2.24)**	**(3.93)**	**(2.26)**

1910	**0.247****	**-0.239***	-0.00158	**0.00443*****	0.103
	(2.83)	**(-2.46)**	(-1.59)	**(3.95)**	(1.72)
1920	**0.264****	-0.170	-0.00159	**0.00258****	0.0497
	(2.93)	(-1.81)	(-1.67)	(3.45)	(1.28)
1930	**0.190****	**-0.224*****	-0.000595	0.00132	0.0237
	(3.22)	**(-3.56)**	(-0.86)	(1.48)	(0.66)
1940	0.0352	-0.0736	-0.0000288	0.000683	0.0128
	(1.09)	(-1.40)	(-0.05)	(1.22)	(0.35)
1950	0.000102	-0.0132	-0.0000698	**0.000988****	0.0174
	(0.00)	(-0.26)	(-0.12)	**(3.13)**	(0.54)
1960	dropped	0.0210	0.0000471	dropped	-0.0107
		(0.42)	(0.08)		(-0.38)
_cons	6.308	-1.655	**-3.436***	**-3.669****	**-3.257***
	(0.95)	(-0.68)	**(-2.19)**	**(-2.78)**	**(-2.23)**
N	600	600	600	600	600

In table 3.6, I include other time invariant variables interacted with year dummies. Column 1 control for distance to the provincial capitals to capture potential resources transferred from the provincial budget. As in previous results, the effect of the diversity shock is negative and significant in 1900 (-0.162). On the other hand, proximity to the provincial capital (Nanjing and Hangzhou, for Jiangsu and Zhejiang province, respectively) has positive effects on enrollment before 1900 when the provincial exam (乡试) is taken at provincial capital. This effect disappeared after 1900 and even turns negative for 1900 and 1930.

Column 2 controls for the non-agricultural share in the labor force from the 1930 census. Presumably the non-agricultural labor force requires higher skill and has higher demand for education. The effect of diversity shock is negative and significant in 1900 and 1910. The effects of non-agricultural share on enrollment, however, are negative in 1940 and 1960. Column 3 controls arable land share of total area to explore if being more "rural" has negative impacts on education. Treatment effects are similar to that of column 12. Being "rural" turn out to affect enrollment positively in 1805 and 1835 but have no effects afterwards.

In column 4, I explore if the diversity shock was coincided with adverse weather shocks 1900-1920 (as a fraction from 0-1), which could potentially affect primary schooling for a limited time span. I might have mis-interpreted impacts from adverse weather in the 1910s as impacts by diversity shock. Again, the results are robust to controlling these variables. The diversity shock has negative impacts for 1900s but not significant afterwards.

Finally, column 15 explicitly introduces a lagged dependent variable of enrollment on the right-hand side to address the fact the enrollment can be highly auto correlated as educational endowment (school assets, school land, etc) in last period can be used in next few periods. To ensure consistency, these models are estimated using the Generalized Method of Moments (GMM) strategy suggested by Arellano and Bover (1995); Blundell and Bond (1998). To implement this strategy, 1805, 1835 and 1885 are dropped so that I have a panel with equi-distant dates. The results are generally similar to those without the lagged dependent variable. The effect of the lagged dependent variable itself is positive significant. And the size of treatment effect is similar to columns of table 3.4-3.6, but is insignificant at 5%.

Table 3.6: with other time-invariant controlled variables (interacted with years)
Dependent variable: ln(enrollment) in number of students

Control	(1) Distance to provincial capital (km)	(2) non agricultural share in employment in 1930 (0-1)	(3) arable land share (Buck, 1933) (0-1)	(4) Adverse weather 1900-1920 (0-1)	(5) Arellano-Bond and control for longitude
Ln(pop)	**0.952*****	**1.697*****	**1.013*****	**1.067*****	**0.729*****

	(7.60)	**(7.14)**	**(7.05)**	**(7.69)**	**(3.66)**
Pop density	0.0000864	-0.000193	0.0000475	0.0000565	0.000117
	(1.19)	(-1.64)	(0.57)	(0.69)	(0.64)
Lag (1)_y					**0.221****
					(3.16)
Diversity shock*year dummy					
1805	0.0337	-0.0521	0.0223	0.0225	Dropped
	(1.49)	(-1.60)	(1.72)	(1.74)	
1835	0.0151	**-0.0702***	dropped	dropped	Dropped
	(0.69)	(-2.31)			
1885	dropped	0.0386	-0.00526	-0.000102	dropped
		(0.65)	(-0.19)	(-0.00)	
1900	**-0.162****	**-0.246*****	**-0.236*****	**-0.228*****	-0.238
	(-2.91)	**(-3.51)**	**(-3.56)**	**(-3.49)**	(-1.72)
1910	0.0207	**-0.105***	-0.0738	-0.0494	-0.0555
	(0.44)	**(-1.99)**	(-1.64)	(-1.05)	(-0.42)
1920	0.0661	-0.0440	-0.0188	-0.00440	-0.0441
	(1.97)	(-1.07)	(-0.45)	(-0.11)	(-0.31)
1930	**0.103****	0.0212	0.0349	0.0442	-0.0285
	(3.04)	(0.52)	(0.90)	(1.25)	(-0.24)
1940	0.0701*	-0.0128	0.0178	0.0288	-0.104
	(2.23)	(-0.57)	(0.61)	(1.13)	(-0.93)
1950	**0.0816***	-0.00561	0.0206	0.0375	-0.0959
	(2.57)	(-0.29)	(0.75)	(1.60)	(-0.86)
1960	0.0858*	dropped	0.0307	0.0417	-0.0831
	(2.54)		(1.11)	(1.70)	(-0.75)
Control*year dummies					
1805	**-0.00122***	0.0750	**0.302***	-0.389	Dropped
	(-2.30)	(1.00)	**(2.45)**	(-1.23)	
1835	**-0.00114***	dropped	**0.262***	-0.223	Dropped
	(-2.57)		(2.39)	(-0.75)	
1885	**-0.000956***	-0.571	0.311	dropped	dropped
	(-2.32)	(-1.12)	(2.00)		
1900	**0.00154***	0.527	0.275	-0.362	0.311
	(2.07)	(1.22)	(0.91)	(-0.45)	(1.72)
1910	0.00137	0.122	-0.241	-0.189	0.178
	(1.97)	(0.13)	(-1.12)	(-0.23)	(1.06)
1920	**0.00136***	-1.239	0.0114	-0.289	0.208
	(2.22)	(-1.33)	(0.07)	(-0.47)	(1.07)
1930	0.000540	-0.556	-0.0397	0.151	0.119
	(1.27)	(-1.57)	(-0.25)	(0.26)	(0.74)
1940	-0.000159	**-0.744***	-0.0919	0.158	-0.00998
	(-0.69)	**(-2.11)**	(-0.95)	(0.38)	(-0.06)
1950	0.0000981	-0.408	**-0.131***	-0.145	-0.00422
	(0.59)	(-1.49)	**(-2.21)**	(-0.32)	(-0.03)
1960	dropped	**-0.584***	dropped	-0.183	-0.000731
		(-2.38)		(-0.40)	(-0.00)
_cons	**-2.607**	**-11.28*****	**-3.712***	**-4.165***	-0.772
	(-1.74)	**(-3.60)**	**(-2.04)**	**(-2.47)**	(-0.03)
N	600	600	600	600	420

3.5 Conclusion

In this chapter I prove that in the Lower Yangzi counties were less successful in financing primary schooling in early 19th century if they experienced a greater diversity shock after the Taiping rebellion (1851-1864) relative to the pre-Taiping population, as measured by changes in the surname distribution. Such regionally differential diversity shocks were caused by population loss during the rebellion, and the following massive in-migration, which made villages and townships in the lower Yangzi much more diverse in their surnames, dialects, cultures and social customs.

Diversity shocks did not affect education in 1870-1900 when education was mainly financed privately, and to much less extent by clans and states. The negative impacts on education via weakening clan network and damaged educational endowments were partially compensated by higher living standards post rebellion due to favorable land/labor ratio. However, after the end of exam era mass primary schooling required villages, towns, and communities to mobilize financial resources to establish modern schools. At the county level it was more difficult to raise county tax, and make within-county transfers to ensure universal primary school in counties of greater diversity. At the community level, the decision makers have less incentive to raise public funds in a community of weaker kin/family bonds. In 1907-1910, only 3% of children of school age were enrolled to modern public primary schools. In contrast, informal tutorship (私塾) that taught traditional content enrolled at least 20% of school-aged children.

My measure of the diversity shock only addresses the diversity from places of origin, dialect, culture and possibly genetic aspects. The negative impact of the diversity shock on schooling largely disappeared by 1920. In contrast, in US and Africa the negative impacts of ethnic-linguistic diversity on public schooling were long-lasting and reinforcing (Alesina and Ferrara, 2004: communities formed along ethnic lines). According to Alesina et al.(1999), Becker (1957) and Habyarimana et al.(2007), public goods are under-supplied because (1) different ethnic groups have different preferences over which type of public goods to produce with tax revenues, (2) each ethnic group's utility level for a given public good is reduced if other groups also use it (a taste for discrimination), and (3) people trust co-ethnics but don't trust non-co-ethnics in making simultaneous contributions to the public goods. In the case of schools, ethnic groups may disagree about what language courses should be taught in and about what content to cover. The members of one ethnic group may find it dissatisfying to see their children attend schools with those of other ethnic groups. Each ethnic group may think that other groups would free ride on their contribution to the schools. These mechanisms seem not to be long lasting in China. Differences in dialects normally died out in 1-2 generations (people spoke parent's dialects at home but the popular dialect in public). People share the same writing language and the same set of written classics. Moreover, it was difficult to distinguish a person's background by their appearance and it was rather common to see marriages across different dialect groups.

Since I did not attempt to measure local heterogeneity of other aspects of communities (income, skills and rural-urban difference), I cannot fully explain the lack of investment in human capital 1900-1949. Modern school enrollment rate rose to only 40% in late 1940s. Informal tutorship persisted throughout the Republican era (1912-1949) and still enrolling 10%-30% of school-aged children in the early 1950s, when they were prohibited by the Communist Party. Summing up modern schools and informal tutorship, the literacy rate in 1953 was no more than 40%, not improved since the late Qing period. This is astonishing given Yuchtman's finding (2011) that "modern" human capital has much higher private return than "traditional" human capital in the early Republican era (data from railway sector). The social return to modern human capital should have been even bigger. It is also noteworthy that except for 1937-1945, the lower Yangzi enjoyed more political stability than any other regions of China. Wars between warlords and civil war affected this area little. Furthermore, the Shanghai-based industrialization generated great demands for skilled labor in this area (Ma, 2008). Finally, this area as a whole had more access to Western influence including in trade, investment and religious activities.

It was therefore the failure of local governments and the local elites, who had local autonomy, to overcome conflicting interest among households, overcome household's budget constraints and provide public schooling. Ironically, "promoting universal schooling for the poor" had been pursued by the Ming, Qing and Republican government since the 13th century. People such as Wu Xun (武训), who donated all his wealth to set up charity schools, were highly recognized. Unfortunately, communities and local government proved unable to achieve this goal in the absence of either voices from below (Go and Lindert, 2010) or central planning and transfer payment from above. History took the second path and "sweeping illiteracy" became one of the sources of legitimacy for the communist revolution and, arguably, one of the legacies of the Communist era. This chapter addresses the failure of coordinating conflicting interest among local dialect and culture groups in early 20th century. Future research should study through the channels through which the diversity shock affected primary schooling, and more important, how political-economy at the local level retarded the spread of universal schooling until 1949.

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3.A.1 Appendix: data and archival source

1. Diversity shocks at county level derived from the following two variables:

Surname distribution pre 1850: juren (举人), gongsheng (贡生), jianshen (监生), wujuren (武举人), women honored for their moral integrity (烈女) pre 1850, from historical county chronicles (旧方志) accessible at National Digital Library of China:http://mylib.nlc.gov.cn/web/guest/shuzifangzhi

Surname distribution after 1850: juren and Gongsheng (1870-1905) , College students (1898-1949) (see chapter 1 for data source), dead soldiers (1933-1953) from new county chronicles (新方志) edited from 1985-1995

2. Enrollment rate:

1820-1900: transformed from juren/10,000 people (details in section 2.2)
1900-10: 清学部总务司，1908-10, 光绪/宣统教育统计图表
1910-20: 中华民国教育部，1915-17，中华民国第三次、第四次、第五次教育统计图表
1920-30, Jiangsu: 江苏省教育部，1929-30，江苏教育概览
1920-30, Zhejiang: 国立浙江大学，1928,中华民国浙江省教育统计图表
1930-40, Jiangsu: 江苏省教育厅, 1935-37, 江苏省教育统计图表
1930-40, Zhejiang: 浙江省教育厅, 1935-36, *浙江省三年来教育概况*
1940-50: 1947, from new county chronicles
1950-60: 1953, from new county chronicles
1960-70: 1964, from new county chronicles

3. Population:

1820-50 and 1870-1900: from historical county local chronicles
1790-1820: projected from 1850s, assuming 0.5% of annual growth rate 0.25% which is the growth rate of Suzhou prefecture 1820-1850
1900-10: population census of 1910(宣统元年户口统计)
1910-50: 江苏省人口志；浙江省人口志
1950-60: 1953 年人口普查
1960-70: 1964 年人口普查

4. Controlled variables:

Latitude, longitude, and distance to provincial capital and to Shanghai:
From Google Map

Arable land share:
From Buck (1937), p22-30

Non-agricultural occupational share:
Jiangsu: from 江苏省长公署统计处, 1924, 江苏省政治年鉴
Zhejiang: from 浙江省银行, 1947, 浙江省经济年鉴

Christian Per 10,000 people 1900:
From new county chronicles (chapters on religion)

Vicars per 10,000 people 1900:
From new county chronicles (chapters on religion)

Adverse weather frequency (1900-1920):
Provided by Se Yan, from the Gallery of Drought and Water logging Distribution in Past Five Hundred Years China, available for 120 stations over the period of 1470 to 2000

3.A.2 Appendix: list of 60 counties in lower Yangzi delta （as in county jurisdictions in 1928 and Prefectural jurisdictions in 1910）

South Jiangsu，江苏南部

Nan-jing: Nan-jing, Lu-he, Ju-rong, Jiang-pu, Li-shui, Gao-chun
原南京府：南京（今南京市区和江宁县）、六合、句容、江浦、溧水、高淳

Su-zhou: Wu-xian, Chang-Shu, Wu-jiang, Kun-Shan
原苏州府：吴县（今苏州市区和吴县市）、常熟（今常熟市和张家港大部）、吴江、昆山

Tai-Cang: Tai-cang, Jia-ding, Bao-shan, Chong-ming
原太仓州：太仓、嘉定、宝山、崇明

Song-jiang: Shang-hai, Song-jiang, Qing-pu, Nan-hui, Jin-shan, Chuan-sha
原松江府：上海、松江、青浦、南汇、金山、川沙

Chang-zhou: Chang-zhou, Wu-xi, Jiang-yin, Yi-xing
原常州府：常州（今常州市区和武进县）、无锡、江阴（今江阴市和张家港小部）、宜兴

Zhen-jiang: Zhen-jiang, Dan-yang, Li-yang, Jin-tan
镇江府：镇江（今镇江市区和丹徒县）、丹阳、溧阳、金坛

North Zhejian，浙江北部

Hang-zhou: Hang-zhou, Hai-ning, Yu-hang, Fu-yang, Xin-deng, Lin-an, Yu-qian,Chang-hua
原杭州府：杭州（今杭州市区和余杭县大部）、海宁、余杭（今余杭县小部）、富阳、新登、临安、於潜、昌化

Hu-zhou：Wu-xing, De-qing, Chang-xing, Wu-kang, An-ji, Xiao-feng
原湖州府：吴兴（今湖州市区和郊区）、德清、长兴、武康、安吉、孝丰

Jia-xing: Jia-xing, Ping-hu, Hai-yan, Jia-shan, Tong-xiang, Chong-de
原嘉兴府：嘉兴（今嘉兴市区和郊区）、平湖、海盐、嘉善、桐乡、崇德

Shao-xing: Shao-xing, Xiao-shan, Yu-yao, Shang-yu, Zhu-ji, Xin-chang, Sheng-xian
原绍兴府：绍兴（今越城区和绍兴县）、萧山、余姚、上虞、诸暨、新昌、嵊县

Ning-bo: Ning-bo, Zhen-hai, Ci-xi, Feng-hua
原宁波府：宁波（今宁波市海曙区、江东区、江北区、鄞州区）、镇海（今宁波市北仑区和镇海区）、慈溪、奉化