

Long Live *Keju*! The Persistent Effects of China's Imperial Examination System*

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Abstract

The effect of *keju*—China's imperial examination system (607-1905)—on human capital outcomes persists to this day. Using the variation in the density of *jinshi*—the highest qualification—across 248 Chinese prefectures to proxy for the *keju* effect, and river distance to a prefecture's nearest printing center as instrument, we find that a 1% increase in *jinshi* density increases years of schooling by 6.6%. Moreover, the persistent effect of *keju* can be explained by the transmission of human capital across generations and a culture of valuing education. Finally, cultural transmission is aided by clans and weakened by the Cultural Revolution.

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Growing evidence suggests that historical institutions have had a long-lasting effect on modern economic development (Acemoglu, Johnson, and Robinson, 2001, 2002; Dell, 2010; Guiso, Sapienza, and Zingales, 2015; Michalopoulos and Papaioannou, 2013). In this study, we examine the possible legacies of one of China’s most important institutions—the imperial examination system or *keju*. The *keju* institution lasted for more than a millennium (607-1905) before being abolished shortly before the country’s 2,000 years of imperial rule came to an end. The institution is important for at least two reasons. First, as the world’s first meritocratic bureaucracy designed to recruit competent talents to serve as government officials, *keju* provided social mobility to essentially all (males). The so-called “commoners”—people whose ancestors did not possess any recognized scholastic achievements and hence held no public office—were able to rise through the ranks of the exam system and launched a career as government officials (or *mandarins*)—a social class sitting at the very top of the social hierarchy back then (Ho, 1967).¹ Second, to the extent that its abolition had hastened the demise of China’s two millennia-long dynastic rule, *keju* also bore significantly upon political stability.² But *keju* may be important for a third reason. In the light of a strong, positive correlation between success in *keju* exam several hundred years ago and years of schooling in 2010 (Figure 1), *keju* may in fact have an effect on the persistence of human capital over a long period of time. The question of overriding importance is whether this relationship is causal, and if so, through what channel(s) does such persistence occur?

[Figure 1 about here]

The most obvious candidate is the persistence of human capital itself. Above all, parents can transmit their own human capital—genetically but also through parenting—to their offspring (Becker, 1991; Becker and Tomes, 1979). With a premium placed upon literacy, bookishness, and education, for instance, the Jews have most persuasively demonstrated this process of passing skills and attitudes on to later generations (Botticini and Eckstein, 2012)—otherwise known as “vertical transmis-

¹The social hierarchy which existed back then consisted of the *shi* (officials) at the very top, followed by the *nong* (farmers), the *gong* (artisans), and the *shang* (merchants) in that order.

²By exploiting the variations in the quotas on entry-level exam candidates across China, Bai and Jia (2016) find that the probability that someone would participate in a revolution in 1911 after the abolition of the *keju* exam system was significantly higher in prefectures with higher quotas per capita. In China the prefecture is the administrative unit between a province and a county.

sion” (Bisin and Verdier, 2000). Likewise, we observe a similar tendency among the Chinese, who are also known for placing a huge emphasis on their children’s academic success, and as such are willing to invest heavily—in terms of time and money—in their children’s education (Chao and Tseng, 2002; Rozman, 2014; Stevenson and Lee, 1990).

But the persistence of human capital may not be the only channel. By shaping people’s beliefs and preferences, institutions may have bred and fostered a culture over time (Alesina and Giuliano, 2015). It is through the culture channel, many believe, that historical institutions impact upon the behavior of individuals and, more generally, economic development (e.g., Alesina and Fuchs-Schündeln, 2007; Becker, Boeckh, Hainz, and Woessmann, 2015; Grosjean, 2014). Moreover, once established, culture tends to endure through the ages (Nunn and Wantchekon, 2011; Voigtländer and Voth, 2012). As arguably the earliest meritocratic and most influential political institution in history, *keju* had likely bred a culture of valuing education, a culture that has possibly persisted to this day, even though the institution itself was abolished long ago. The extraordinary returns accrued to imperial exam success is the primary reason why *keju* had bred and nurtured a culture of valuing education over the long run.

To account for the persistent effect of *keju* on human capital outcomes today we draw upon the variation in the number of *jinshi* across the 248 Chinese prefectures (normalized by their population) in the Ming-Qing dynasties as our key independent variable (hereafter *jinshi* density). The baseline ordinary least squares (OLS) result shows that, for every 10,000 people, a 1% increase in the number of *jinshi* is associated with an increase in years of schooling in 2010 of 3.1 percentage points, with the marginal effect of 0.3 years when evaluated at the mean of 8.86.

The variation in *jinshi* density in the Ming-Qing period across the Chinese prefectures is clearly subject to many endogenous forces, with omitted variable bias and measurement error being our primary concerns. To address these issues, we construct an instrumental variable using the minimum river distance of a prefecture to its nearest printing center in the Ming-Qing period, for the following reasons. First, reference books, which contain nuanced, authoritative interpretations of the Confucian classics, were crucial to *jinshi* exam success, but their availability was highly uneven across space and depended on where the printing centers were located. Second, we choose river and not overland distance because books were typically transported by

boats along the river tributaries of the lower Yangtze in South China. The fact that altogether only 19 printing centers existed throughout the entire Ming and Qing dynasties, with the majority of them being located in the south, and that the books fetched several times higher prices in the north than in the south, are testimony to these historical stylized conditions.

Using river distance as our key instrumental variable and the number of printed books as check, the two-stage least square (2SLS) result turns out to be roughly twice the size of the OLS estimate. This time a 1% increase in the number of *jinshi* (per 10,000 people) is associated with a 6.6% increase in the average years of schooling, with a marginal effect of 0.6 years when evaluated at the mean. Our instrumental variable satisfies the exclusion restrictions condition as the old printing centers went out of business soon after China opened up to the West, plus the instrument has no direct effect on today's human capital outcome after controlling for the effect of *jinshi* density. The instrumental variable is also robust, as the effect of *jinshi* on schooling today remains highly significant after controlling for the effect of trade and commerce, and the possible unobserved effect associated with the density of river tributaries.³

Next we turn to identify the channel(s) through which the persistent effects of *keju* on human capital outcomes today occur. First, to test whether the persistence works through the channel of human capital within families we construct measures of human capital for both one's ancestors (whether any one of them was a *jinshi* in the Ming-Qing period) and parents (years of schooling) from China's 2005 1% mini-census, and find that all four measures of human capital channels (the patrilineal and matrilineal ancestors and parents are controlled separately) are significantly correlated with years of schooling today, suggesting a strong case of human capital persistence. For instance, a 10% increase in the number of patrilineal ancestors with a *jinshi* qualification increases the descendants' years of schooling by a hefty 19%. Second, while the magnitude of *jinshi* density has shrunk with the inclusion of these human capital measures, the variable remains highly significant, suggesting that culture has likely also played an important role in facilitating the positive effect of *keju* on years of schooling today.

To test this, we take advantage of several questions posed in a nationally representative social survey (China General Social Survey, 2006) to proxy for the cultural

³A denser river network may arguably facilitate transportation and therefore a variety of economic activities other than the book trade.

norm of valuing education. These questions asked (1) whether education is the “most important determinant of social status”, (2) whether the government “should prioritize its spending on education”, and (3) “the amount of educational expenditure the respondent had actually incurred (in the previous year)”. We find a significantly positive effect of *jinshi* density on these cultural norms. Moreover, once we control for these cultural proxies (or their first principal component) together with the parents’ years of schooling, the significant and positive effect of *jinshi* on schooling today disappears.

To further verify the above finding in a more fine-grained manner, we conduct a quasi-experiment on a group of 4,711 college students who came from all over China to study at one of 15 elite universities in Beijing during 2008-2012. Inspired by the attempts to identify the effect of culture on second-generation immigrants who now live in the same destination country (e.g., Alesina, Giuliano, and Nunn, 2013), we find that *jinshi* density in these students’ hometowns has a significantly positive effect on both their cognitive skills (class ranking, College English Test) and non-cognitive performance (class absenteeism and the intention to pursue postgraduate studies). Moreover, once we include these skills as right-hand-side variables, the magnitude of the effect of *jinshi* density in the students’ hometown is reduced, suggesting that both skill sets have a *mediating* effect on human capital outcomes (see Heckman, 2000; Heckman, Stixrud and Urzua, 2006). Last but not least, using average *jinshi* density in the hometowns of only those students who specialized in the same major, were in the same cohort and studied at the same university to proxy for the effect of social learning, we find that a higher *jinshi* density in the hometowns of this small group is positively correlated with both English test scores and the intention to pursue graduate studies, suggesting that “peer effects” do indeed exist.

Before concluding our study we also examine the conditions under which *keju* culture has persisted strongly (as in some regions) or, conversely, weakened (as in others) over time. In China, clans are a unique historical social organization defined by shared ancestry, whose aim was to foster loyalty among its members by means of providing public goods and social safety nets. We construct variables to measure the strength of this historical social organization, and find that *jinshi* does have an additionally positive effect both in regions predominated by strong clans, or among individuals associated with strong clans. But not all negative historical shocks have had the effect of weakening *keju* culture. For instance, we do not find any significantly weakening

effect on the association between *keju* culture and today’s schooling from the Taiping Rebellion—the largest peasant rebellion in China’s history in terms of death toll. Nor have the “treaty ports” prefectures significantly weakened *keju* culture and its persistence. Only the Cultural Revolution—a political movement aimed directly at attacking the Confucian culture and denouncing the merits of education—has had a significantly weakening effect.

Our study contributes to a growing literature examining how historical institutions can persist in the development process, and the channels through which such persistence occurs (e.g., Acemoglu, Johnson, and Robinson, 2001, 2002; Alesina, Giuliano, and Nunn, 2013; Glaeser, La Porter, Lopez-de-Silanes, and Shleifer, 2004; Grosjean, 2014; Guiso, Sapienza, and Zingales, 2015; Putterman and Weil, 2009). It is also relevant to the corpus of works investigating how historical shocks on long-run growth persist through the cultural elements embedded in these events (Nunn and Wantchekon, 2011; Voigtländer and Voth, 2012). In addition, by studying the effects of a culture bred by a historical institution on skills formation in contemporary times, we enrich the “persistence” literature with fine-grained micro-level evidence unearthed using an entirely different but exciting analytical lens borrowed from Heckman (2000) and Heckman, Stixrud and Urzua (2006). Last but not least our effort sheds light on the long-run economic importance of a Chinese institution—*keju*—for human capital outcome today, in a manner complementing the contributions of Bai and Jia (2016), who highlight the political significance of the same institution.

The remainder of this paper proceeds as follows. The next section provides a historical background on *keju* in the context of late imperial China. In Section 3 we examine the persistent effect of *keju* on years of schooling today, whereas in Section 4 we identify the specific channels through which the long-defunct *keju* has impacted on contemporary human capital outcome. Section 5 further investigates the conditions of this cultural transmission process. Section 6 offers a conclusion.

1 Historical Context

1.1 Exam Success and the Gentry Class in Late Imperial China

Established during the Sui dynasty (581-618) and consolidated and expanded in the Song (960-1276), *keju* was intended to break the monopoly power of the aristocrats in government administration by recruiting learned talents through the civil

examination. Due to military interruptions by the nomads (the Mongols in particular), however, China had to wait until the Ming dynasty (1368) for its imperial exam system to become more stable and fully institutionalized. The system then lasted until 1905—a few years before the last imperial rule (the Qing dynasty, 1644-1911) came to an end.

China's imperial or civil exam consisted of three levels. At the entry level was the county exam (*tongshi*), success in which led to the qualification of a *shengyuan*. The next level up was the provincial exam (*xiangshi*), which only the qualified *shengyuan* (earned by passing a qualifying exam) were eligible to take. In the fortunate event that they passed they were awarded a *juren*. Finally, only those with a *juren* qualification could take the *jinshi* exam—the final stage of the civil exam. *Jinshi* holders were guaranteed a position in mid-to-high-level government administration. Figure A3 in Appendix 3 summarizes the hierarchy of China's imperial exam.

A salient feature of China's imperial exam system was its extreme competitiveness, which only intensified over time. For instance, by the Qing dynasty, the chances that someone would become a *juren* and *jinshi* were a mere 0.00024% and 0.000048% (Ho, 1962, pp.112-116), respectively, thanks to the rapid growth in population from approximately 110 million in the Ming to 400 million in the Qing (Cao, 2000).

1.2 Rewards for the *Jinshi*

Under the lasting influence of Confucianism the officials (*shi*) or *mandarins* in imperial China were held in the highest regard, and civil exam was the only road to officialdom for commoners. While made up only 2% of the population, the civil exam scholars accounted for almost a quarter (24%) of the nation's income (Chang, 1955). This explains why their salaried income was about 16 times that of a commoner. But in reality the difference was so much greater, as salaries accounted for but a tiny portion of exam scholars' actual incomes. For instance, many were found to have invested in a variety of businesses like real estate, banks, jewelry shops, and even the monopoly trade of salt. In the extreme case of a very senior official who was extremely successful in business, for instance, total income earned amounted to 1,000 times the annual salaried income of a high-ranking official.⁴ Thus, the *jinshi* was, for

⁴Li Hongzhang, a *jinshi* of 1847 and who held a ministerial position in the late Qing, allegedly held much land and owned a number of pawnshops and was also extensively engaged in moneylending (Chang, 1962).

the majority, the ultimate qualification to achieve.

In addition to the lucrative economic rewards that came their way as a learned class, civil exam success was associated with a gamut of social and political benefits ranging from exemption from corvée labor, poll tax, and corporal punishment to ritualistic recognitions (Chang, 1955; Ho, 1962). For all these reasons, incentives were strong for one to climb the social ladder in later imperial Chinese society and the civil exam provided just such a possibility,⁵ as *keju* was open to all males regardless of family background.⁶

2 The Effect of *Keju* on Contemporary Human Capital Outcome

2.1 The Empirical Setup

To examine whether *keju* has had a long-term effect on contemporary human capital outcome we begin with our baseline estimate of the following specification:

$$y_i = \beta keju_i + X_i\eta + \varepsilon_i \quad (1)$$

where i indexes a prefecture; the dependent variable y_i stands for the contemporary human capital outcome measure constructed from the 2010 population census, namely average years of schooling measured at the prefecture level and raised to the natural log. We choose the prefecture as our unit of analysis simply so that we can observe the rich variations that existed within a single province.

Our key explanatory variable of interest is $keju_i$, which is a measure of the degree of success in civil exams of *prefecture_i* in the Ming and Qing dynasties. Specifically, we measure a prefecture’s success in the *keju* exam by the total number of candidates who obtained the *jinshi* degree in that prefecture during the entire Ming-Qing period (circa 1368-1911). We choose *jinshi* because, of the three degrees it was the highest under the imperial exam and one that enabled a holder to become at least a *mandarin*

⁵They were so strong that even rich merchants would allegedly send their sons to “enter the imperial examination and to rise high in the bureaucracy” (Needham, 1969, p. 202).

⁶Overall, as many as 45.1% of *juren* and 37.6 of *jinshi* accordingly came from the commoner families (Ho, 1962). While some have disputed the extent of mobility (Elman, 2013; Hartwell, 1982), what really mattered for the nurturing of a *keju* culture was not actual mobility per se, but the expectations that social mobility was feasible insofar as one was able to persevere and study hard for the civil exam.

as mid-level official (Chang, 1955; Ho, 1962).

The choice of Ming-Qing is premised on the grounds that, while *keju* had been in place long before the Ming, it did not become fully stable and institutionalized until then (Ho, 1962). It is thus more likely for the cultural norm of valuing education to have received the strongest boost from Ming onwards.

The *jinshi* data are obtained from Zhu and Xie’s (1980) *Ming-Qing jinshi timing beilu suoyin* (*Official Directory of Ming-Qing Imperial Exam Graduates*). Enumerating such information as the names and birthplaces of *jinshi*, and the places of examination (in the event it differed from the birthplace), the *Directory* contains a complete list of all the 46,908 *jinshi* who sat a combined 242 imperial civil exams that took place between 1368 and 1905 (a period of just over 500 years) across 248 Chinese historical prefectures, which correspond to 284 municipalities in today’s China.⁷

As some prefectures were more sizeable than others, we normalize the number of *jinshi* by the prefecture population (in unit of 10,000) based on data compiled by Shuji Cao (2000)—the only Chinese historian to have provided population data at the prefecture level for various time points spanning both the Ming and Qing dynasties. For robustness we also normalize the number of *jinshi* by a prefecture’s land area (per 10,000 km²). Figure 2 shows both the geographic distribution of the number of *jinshi* (per 10,000 people) across the 248 Chinese prefectures and average years of schooling today, and reveals that regions exhibiting higher educational attainment today tend to be those that also produced distinctly more *jinshi* in the past.

[Figure 2 about here]

2.2 Confounding Variables

To avoid the possibility that the positive relationship between historical *jinshi* density and contemporary human capital outcome may be spurious, we control for the following covariates in our analysis, denoted by vector X_i in Equation (1).

Economic Prosperity. Considering that the civil exam was a long-drawn process, during which time continuous financial support from the family and/or lineage was absolutely essential (e.g., Elman, 2013), it is necessary to control for the effect of wealth on *jinshi* density. Following Paul Bairoch (1988), who employs population

⁷Our sample excludes a small number of the ethnic Manchu and Mongols (accounting for 2.8% of the *jinshi* in our full sample), as they were exempted from directly competing with the Han in the civil exam.

density and urbanization rate to proxy for local economic prosperity in lieu of GDP, we similarly use urbanization rate to proxy for local economic prosperity. In China, urbanization was indeed positively correlated with higher levels of output, exports, and commercialization (Skinner, 1977). Specifically, we employ population density (between 1393 and 1910) and the level of urbanization in 1393 and 1920 to be our proxies. These two proxies cover the entire period for which our *jinshi* variable is constructed. The data are obtained from Cao (2000, 2015) and Rozman (1973).

In addition, we also measure a prefecture’s prosperity using potential agricultural productivity, which we estimate based on its suitability for planting the prevailing major staple crops (wheat, rice, sorghum, soybean, millet), and where suitability is indexed according to a combination of climate, soil, and slope characteristics (Food and Agriculture Organization, 2002 Global Agro-Ecological Zones (GAEZ) database). Last, but not least, we also control for GDP per capita in 2010, as differences in historical prosperity may persist and impact upon educational attainment today.

Exam Quota. To ensure an equitable allocation of the *jinshi* degree across space the Qing government set up a quota for this coveted reward—beginning with the *shengyuan* degree at the county level. We thus control for this quota at the prefecture level. The data are obtained from Chang (1955).

Regional Dummies. Throughout the Ming and Qing dynasties, the 248 Chinese prefectures were divided into three broad examination regions (north, central, and south, *Nanzhongbei Bang*), with each region being assigned a quota for the maximum number of *juren* and *jinshi* (Shang, 2004). Thus, while there was essentially no competition for the coveted *jinshi* title across regions, competition was fierce among the *juren* candidates within the same region. To account for the possible effect of quotas on the number of *jinshi* in a prefecture we thus control for the regional dummies.

Regional Migration. By diffusing knowledge and stimulating competition with the native residents immigrants can affect development (Abramitzky, Boustan and Eriksson, 2014). In the historical Chinese context, migration may affect development if prefectures with a proven track record in civil exams attracted candidates to migrate to these places. To control for this possible effect we exclude from our analysis the 1,370 *jinshi* whose birthplace was different from the place of examination—a mere 2.65% of our overall sample of 46,908.⁸

⁸This information is available in the *jinshi timing beilu*—the same source that informs our key independent variable.

Educational Infrastructure. Historically, prefectures having done well in *keju* exam may also have established more and better educational infrastructure—most notably schools and libraries. We thus want to ensure that these omitted variables do not contaminate our estimates of the effect of historical *jinshi* on human capital outcome today. We construct three measures on the educational infrastructure in history. The first one is the number of private libraries before 1904. Unlike in modern times, in imperial China the collection of books was largely a private endeavor. Data on private libraries are obtained from Fan (2013), who enumerates all major libraries between the Song and the Qing dynasties. The second measure is the number of Confucian academies across the Chinese prefectures in the Qing dynasty.⁹ Data on the academies, which exist for the period up to 1904 (one year before the civil exam was abolished), are obtained from Ji’s (1996) *Zhongguo shuyuan cidian (A Compendium on the Chinese Academies)*, which enumerates all the academies between the Tang and Qing dynasties. The third measure is the number of “new” school in 1907. In 1907, two years after the abolition of the civil exam system the Confucian academies were eventually replaced by the “new” schools, which were modeled after the Western curriculum. Thus, as with the other two measures of educational infrastructure we similarly control for their possible effect on today’s human capital outcome. Data on these reformed elementary and middle schools are meticulously enumerated at the county level in a compilation entitled *minguo jiaoyu tongji ziliao huibian diyi fence (A Compendium on the Statistical Materials of Republican Education, Volume 1)* edited by Wang (2010). For our analysis we aggregate these statistics to the prefecture level.

Civil Conflict. To control for the disrupting effects of social unrests and conflicts on human capital accumulation, we enumerate peasant revolts and nomadic invasions in a prefecture during the Ming-Qing period. The data are obtained from the *zhongguo lidai zhanzheng nianbiao (Chronology of Warfare in Historical China)*.

Geography. According to some, geography can have a profoundly lasting effect on long-term economic development either through its direct impact (e.g., Diamond, 1997) or by means of its interaction with key historical events (e.g., Nunn and Puga, 2012). For this reason we control for the key geographic characteristics of the prefectures such as distance to the coast and terrain ruggedness.

The sources and descriptive statistics of all the variables are summarized in Table

⁹For sure prefectural and county governments also financed education. We do not include them in the analysis, however, because there was just one of each in every county or prefecture.

1.

[Table 1 about here]

Finally, in order to examine the long-term impact of *keju* on contemporary human capital outcome, we match the administrative boundaries of the Ming-Qing dynasties to those of today's China using the China Historical Geographic Information System (CHGIS) (see Appendix 1 for details). Doing so allows us to link the historical *jinshi* measure based on current geographical demarcation with the contemporary human capital outcome measure.

2.3 Baseline Results

The baseline results are reported in Table 2. We begin by using the number of *jinshi* normalized by a prefecture's population as our key independent variable (column (1)), before we fully control for the abovementioned covariates in column (2). In column (3) we employ the number of *jinshi* normalized by a prefecture's land area to check robustness. The baseline result suggests that, for every 10,000 people, a 1% increase in the number of *jinshi* in the Ming-Qing period corresponds to an increase of 3.3 percentage points in average years of schooling today. This is translated into a marginal effect of 0.3 years when evaluated at the mean of 8.86. We control for historical migration in column (4). We find that the *jinshi* variable remains significant at the 1% level, albeit with a smaller magnitude. We then add the three measures of historical educational infrastructure in column (5). Doing so does not change the effect of *jinshi*, which remains significant at the 1% level and with a magnitude strikingly similar to that of column (3).

[Table 2 about here]

The above estimates may trigger two concerns, however. The first is that *keju* existed for about a millennium beginning from the Song dynasty, but our measure captures only half of this period. To ensure that our *jinshi* measure is sufficiently representative we include the data on *jinshi* for also the Song dynasty.¹⁰ Another concern is that by taking the average of *jinshi* for the entire Ming-Qing period the

¹⁰We exclude the Sui, Tang and Yuan dynasties for the following reasons. First, exam eligibility during the Sui and Tang dynasties (581-907) was restricted to the offspring of the aristocratic families; as such it was not yet a major channel for social mobility. Moreover, throughout the 326 years in this period, only about 6,688 students had been awarded the *jinshi* title, compared to 26,837 in the Qing. Second, we exclude the Yuan dynasty because *keju* in that period was interrupted under the Mongol's rule. For instance, there were only 16 *jinshi* exams in the Yuan, resulting in the award of just 1,139 *jinshi*.

measure is invariant for a period of over 500 years. To find out if the effect of *jinshi* may have varied over this lengthy time period we thus divide the total number of *jinshi* based on a 50-year interval and regress the average years of schooling on *jinshi* in each of these periods. Reporting the coefficients of this set of regressions in Figure 3, we find that, while the *jinshi* coefficients for the Ming-Qing period are positively and significantly correlated with today’s schooling, the same cannot be said for the Song dynasty.

[Figure 3 about here]

We also check the robustness of our *jinshi* measure by replacing it with the number of *juren* in six provinces where we have data (collected from those *Provincial Gazetteers* in which data on the *juren* are available). The results remain unchanged.

2.4 Causal Identification: Printing as the Instrumental Variable of *Jinshi*

Although we have already controlled for a number of possible confounding factors, there may still be omitted variables—variables that are simultaneously associated with both *jinshi* degree and years of schooling today. For instance, prefectures that had produced more *jinshi* may be associated with some unobserved endowments—be they natural or genetic—that enabled the prefectures to persistently produce more talents. There may also be a measurement error problem, as the highest degree of the civil exam system, *jinshi*, may not fully capture the diffusion of the *keju* system in a region. To deal with these concerns, we employ an instrumental variable approach. In light of the profound impact of printing on the growing importance of civil exam in China (Needham, 1964), we turn to the importance of reference materials for success in the imperial exam for clues.¹¹ For one to succeed in the civil exam, the sheer memorization of the *Four Books* and the *Five Classics*—the lynchpin of the civil exam—was a necessary but not sufficient condition; one also needed to have a solid understanding of the nuanced, authoritative interpretations of these texts. This required candidates to consult a good number of references written by renowned Confucian scholars on the subject matter (Ho, 1962; McDermott, 2006).¹² However, the fact that only 19 printing centers were distributed across the 248 prefectures (Zhang

¹¹In Europe, printing contributed to the Reformation—so-called “vernacular to the Bible” (Needham, 1964).

¹²Indeed, from the early Ming onwards the majority of the books published were essentially literary works pertaining to the interpretations of the Confucian classics (Du and Du, 2001, 2009; Zhang and Han, 2006).

and Han, 2006), and that these 19 centers accounted for 80% of the 13,050 books published during that period (Du and Du, 2001, 2009), meant that access to reference books varied enormously from one prefecture to another in view of prohibitive overland transportation costs.¹³ The majority of the printing centers were located in the southeastern part of China (see upper panel of Figure A2 for the spatial distribution of these centers and Table A1 in Appendix 2 for a complete list).¹⁴

In the lower Yangtze region, there were private bookstores galore in the cities and towns near the printing centers and so books were affordable and commonplace (McDermott, 2006).¹⁵ The bookstores there owed much of their popularity to the “cheapness” and “good organization” of China’s river transport system.¹⁶ The book trade, as a result, flourished (Bai, 1937). In fact, to sell books from town to town, many book vendors decked out their boats with bookshelves and some even provided desks and chairs so customers could spend time on the boats to sample their collections. Indeed, some vendors were so entrepreneurial they even printed and distributed leaflets of books for sale to the customers (Zheng, 1969).

But that was not the case in north China, where only a few printing centers existed. The relatively sparse river network rendered the transport of books in the north much less feasible than in the south. Figure 4, which maps out the networks of river tributaries in the basins of the Yangtze River and Yellow River, reveals this stark contrast. Compared to the Yellow River, which spanned just 62 prefectures in its basin, the Yangtze ran through a massive 191 prefectures. Thus, even though books

¹³These publications included second and further editions and multi-volume collections (Du and Du, 2001, 2009). The remaining 20% of books were published in nearby localities with the publishers hiring both technical personnel and printing machines from these centers (Zhang and Han, 2006). County and prefecture schools relied on the central government for copies of the *Four Books* and *Five Classics*, whereas students had to resort to the private booksellers for their own copies (McDermott, 2006).

¹⁴The printing centers were located in close proximity to prefectures where the two ingredients required for woodblock printing (the state-of-the-art technology back then)—ink and paper—were produced. The two ingredients were produced from pine trees and bamboo forests, respectively, which according to Chinese historians were natural habitats (Zhang and Han, 2006). Hence their spatial distributions can be regarded as random. The lower panel of Figure A2 in Appendix 2 presents the pertinent distributions.

¹⁵For example, in the 16th century in urban Suzhou there were as many as 37 bookstores and 650 engravers. The engravers were responsible for producing ink from the pine carbon. With adequate supply of books in the lower Yangtze region (of which Suzhou was a part), they were affordable even for many commoner families (Chow, 2004; McDermott, 2006).

¹⁶From the Tang dynasty (circa 618-907) onwards China had long “distinguished [itself] by the cheapness and, on the whole, the good organization of its water transport system” (Elvin, 1973, p. 144).

could be shipped from the south all the way up to the national capital of Shuntian Prefecture in the north (*Huzhou Gazetteer*), effectively dispersing them posed another obstacle. This rendered the prices of books in the north much higher (McDermott, 2006).¹⁷

[Figure 4 about here]

Against this background, we employ a prefecture’s minimum *river* distance to its nearest printing center to instrument the endogenous *jinshi* degree, computed using the historical GIS data on the rivers in Qing China (Harvard CHGIS) in ArcGIS and selecting the printing center with the shortest distance.¹⁸ To check robustness we also employ the number of printed books as corroborative evidence. Before proceeding to the 2SLS results, we first check to make sure our instrument satisfies the exclusion restrictions requirement and it does, in light of the fact that traditional Chinese block printing was replaced by modern Western printing technology—specifically lithography and relief printing machines invented by Johannes Gutenberg (1400-1468)—by the end of the 19th century (circa 1870s). Specifically, the adoption of these technologies had resulted in the establishment of several modern publishing companies such as Commercial Press and Chung Hwa Book Corporation, and which led to the demise of traditional Chinese block printing. With Shanghai and Tianjin emerging as the new centers of modern printing technology, the previous 19 printing centers eventually went out of business (Reed, 2004). Therefore, distance to the printing centers should also be orthogonal to contemporary human capital outcome. To prove this we directly regress years of schooling today on our instrumental variables. Reported in Table 3, the result shows that, while river distance to the printing center has a significant effect on the outcome variable (column (1)), the significant relationship disappears once we control for the *jinshi* measure (columns (2)). By the same token, the results in columns (3) and (4) similarly show that the effect of the number of printed books also disappears after controlling for the *jinshi* measure, suggesting that the effect of our instrumental variables on contemporary human capital outcome works only through the *jinshi* channel.

¹⁷According to Hu Yinglin, a famous book collector and scholar in the late 16th century, even in the imperial capital of Beijing the same books fetched 1.7 times higher prices than in the lower Yangtze, and 3.3 times higher prices than in Fujian Province. Book prices were lower in Fujian Province because Jianning Prefecture was a major printing center in the Ming dynasty (McDermott, 2006).

¹⁸In the 19 prefectures where a printing center was located the shortest distance is coded as zero.

[Table 3 about here]

We can now report the instrumented results in Table 4. Using river distance to the printing center as instrument, we find that *jinshi* density significantly and positively explains years of schooling in 2010 (columns (1) and (2)). Compared to the OLS estimate (0.033) the coefficient of the instrumented *jinshi* is now twice as large (0.066 in column (2)), suggesting that, due possibly to measurement error, the endogenous *jinshi* measure has likely underestimated the long-term effect of *keju* on contemporary human capital outcome. The instrumented result suggests that a 1% increase in *jinshi* (per 10,000 people) is associated with a 6.6% increase in average years of schooling in 2010, with a marginal effect of 0.6 years when evaluated at the mean. For robustness we also employ the number of books printed in a prefecture as alternative instrument (columns (3) and (4)), and obtain similar results. Regardless of our choice of instrument and estimation, the results in Table 4 reinforce our OLS finding that a prefecture’s historical achievement in the civil exam does have a significantly positive impact on human capital outcome over the very long run.

[Table 4 about here]

2.5 Robustness of Instrumental Variable

A remaining concern about our instrumental variable pertains to its exogeneity. In addition to its correlation with the printing centers, could river distance (and the tributaries in the river basin) also be correlated with trade and commercial activities? As a matter of fact, of the 19 printing centers three were found to overlap with the commercial centers in the Ming and seven with those in the Qing in their locations (refer to Figure A4 in Appendix 3).¹⁹ To rule out that possibility we perform the following checks. First, based on data provided by historians we construct a dummy variable indicating whether a prefecture was a major commercial center in respectively the Ming and Qing dynasties. Adding them to the regressions does not change the 2SLS estimation; the *jinshi* variable remains significant (columns (5) and (6) in Table 4). Second, to ascertain that the effect of our instrumental variable on *jinshi* density indeed comes from distance to the printing center rather than easy access to river transport enabled by the tributaries in the river basin, we conduct a placebo test by randomly assigning any 19 prefectures other than the actual printing centers as

¹⁹Data on the commercial centers in Ming are obtained from Cao (2015) and those on Qing are from Chen (1982).

instrument. Doing so yields an insignificant first-stage result, whereas the predicted value of *jinshi* has no significant effect on average years of schooling in the second stage (column (7) in Table 4).

3 Accounting for the Channels of *Keju* Persistence

In this section we explore the two possible channels through which *keju* may affect human capital outcome today. The first pertains to the persistence of human capital across generations—specifically parental educational attainment. Human capital advantages can transmit over time through several possible mechanisms. The first is genetics or genetic inheritance (Becker, 1991). Additionally, Becker (1991) notes that “the values and skills absorbed through membership in a particular family culture” (p.179) may also confer uncodified advantages often required for economic success ranging from educational achievements to labor market outcomes—the so-called “vertical transmission of culture” in the sense of Bisin and Verdier (2000) (see also Dohmen, Falk, Huffman, and Sunde, 2011). Indeed, historians concur that these advantages are transmitted across multiple generations over a long period of time—centuries in fact (e.g., Elman, 2013).

The direct income effect also comes into play. To the extent that credit constrains investments in education, children born into families earning a higher income enjoy an edge over their poorer counterparts (Behrman and Rosenzweig, 2002). Third, a related mechanism pertains to parental input, measured by the time parents effectively allocate to nurture their children’s development—specifically with respect to the formation of cognitive skills and academic performance (Guryan, Hurst and Kearney, 2008).

In addition to the persistence of human capital, a society’s culture represents the other possible channel through which the effect of *keju* may have endured the passage of time. Through peer imitation (the so-called “peer effects”), the cultural transmission of values is made feasible because culture (beliefs, values, and norms) is likely to remain stable and transmit from one generation to the next over a long period of time (e.g., Richerson and Boyd, 2008; Bisin and Verdier, 2000). This is arguably the case for *keju*. Although *keju* has long been abolished, the key role it played in facilitating social mobility for nearly a millennium means that it has likely bred and fostered a cultural norm of valuing education. For example, in *The*

Problem of China (1922) Bertrand Russell remarked that, “at any rate, for good or evil, the examination system profoundly affected the civilization of China. Among its good effects were a widely-diffused respect for learning...” (p. 46). There is indeed evidence to suggest that behavior consistent with this norm has manifested in the modern world—both in countries profoundly affected by this Confucian norm, as well as within those Chinese provinces that had historically produced more *jinshi*. In the former instance, students from East Asia are found to have spent significantly more time studying than either their European or American counterparts (Rozman, 2014; Stevenson and Lee, 1990) and invested more resources—time and money—in private tutoring (Chao and Tseng, 2002).

3.1 Human Capital Persistence

To verify whether the long-term persistent effect of *keju* is due to the transmission of human capital within the educated elite families, in this section we conduct a micro-level analysis using data from China’s 2005 1% mini-census. We construct four measures to proxy for such transmission: the father’s and mother’s years of schooling, and patrilineal and matrilineal ancestors’ achievements in the *keju* exam (the latter is a linear variable measuring the number of ancestors in a given population who had obtained a *jinshi* qualification). To identify the parents of the surveyed respondents, we make use of the identity number uniquely assigned to each survey household in the aforementioned mini-census, and easily verified the stated relationship between them. With regard to the ancestral measures, we match the surveyed individuals with their patrilineal ancestors based on the surname and hometown (prefecture) information, under the assumption that people born in the same prefecture and sharing the same surname are likely to be related along the patrilineal line (Clark, 2014). To illustrate this idea, suppose there were 10 *jinshi* with the surname Chen in prefecture i in the Ming-Qing period. Given the population in prefecture i with the surname Chen today is 10,000, the normalized *jinshi* density for patrilineal ancestors having the surname Chen in prefecture i is thus 0.001. Similarly, using the respondent’s mother’s surname and hometown information, we repeat the same procedure to construct the variable on matrilineal ancestors, i.e., the male *jinshi* from the mother’s family (e.g. the maternal grandfather and uncles).

The results are reported in Table 5. All specifications employ 2SLS estimates using

river distance to the printing center as instrument. In column (1), we include only the *jinshi* variable. Similar to the result in the baseline estimate, historical *jinshi* density in a given prefecture is significantly and positively correlated with years of schooling today. We then add the two measures of patrilineal and matrilineal ancestors' *jinshi* density in column (2); both are positive and significant (patrilineal at 1% and matrilineal at 10%, respectively), lending firm credence to the human capital channel. In terms of magnitude, a 10% increase in the human capital of one's patrilineal ancestors (i.e., the number of ancestors with a *jinshi* qualification) is associated with a massive 21% increase in one's years of schooling. The magnitude of the effect of the matrilineal ancestors, while distinctly smaller at 8%, is also significant. Consistently, parents' years of schooling are also positively and significantly correlated with children's years of schooling (both at the 1% level, column (3)). Most importantly, *jinshi* density remains highly significant (at the 1% level) after controlling for these various human capital measures, but with a smaller magnitude now than before (compare 0.092 in column (3) with 0.139 in column (1)). This suggests that, while clearly important, human capital cannot account for the entirety of the observed persistence.

[Table 5 about here]

3.2 The Culture Channel

To examine whether *keju* had left behind a long-lasting cultural legacy, we regress three contemporary attitudinal variables on the number of *jinshi*. These “cultural” variables are taken from the questions in the 2006 China General Social Survey, which is a nationally representative survey of 10,391 residents conducted in 107 sample municipalities across 31 Chinese provinces. Of these respondents, 6,469 had fully answered the three questions of interest.

The first variable is a dummy variable indicating whether a respondent regards education as “the most important determinant of social status”, whereas the second is also a dummy variable indicating whether one “prefers her government to prioritize spending on education” (among a long list of public expenditures).²⁰ Finally, to check robustness of the first question we enumerate the actual expenditure that each respondent had spent on education (in natural log of the Chinese currency, the

²⁰The list contains up to ten categories of expenditure: environmental protection, medical care, police and law enforcement, education, sport and recreation facilities, pension, social insurance, jobs creation, unemployment relief, and cultural and artistic activities.

renminbi, or *yuan*)—our third proxy for the cultural norm of valuing education.²¹

The results are reported in columns (1) through (3) of Table 6, in which all specifications employ 2SLS estimates using river distance to the printing center as instrument. To control for the effect of human capital persistence, we also include in the regressions parents’ years of schooling. Unfortunately, we cannot construct the same ancestors’ *jinshi* density as in Section 4.1, as the respondents’ surname is kept in strict confidentiality by the China General Social Survey. The results consistently show that *jinshi* has a significantly positive effect on the cultural norm of valuing education even up to this day. Specifically, respondents from prefectures having produced more *jinshi* historically are more likely to view education as “the most important determinant of social status”—resonating with the so-called “exam-to-mobility” norm that undergirded the *keju* system. It is thus not surprising that these respondents prefer their government to prioritize spending on education; moreover, by spending significantly more on education than other respondents they also put the money where their mouth is.

One may be concerned that valuing education may be the same as working hard (“work ethic”); if so, the latter may confound the alleged effect of civil exam. To find out, we construct a separate measure to see if it is, like the three cultural variables, also correlated with the *jinshi* measure. On a five-point scale (5=very important; 4=important; 3=neutral; 2= not important; 1=not important at all), the respondent was asked about the extent to which she saw “hard working as an important determinant of success in society”. As column (4) shows, *jinshi* is not correlated with “work ethic”, suggesting that working hard is not the channel through which the civil exam affects years of schooling today.

[Table 6 about here]

To further verify that culture is indeed an important channel through which historical exam success has impacted today’s schooling outcome, we regress the latter on both the *jinshi* measure and the three attitudinal questions and report the results in columns (5) through (8) of Table 6. As before, *jinshi* has a significant effect on today’s schooling (column (5)). But once we include the three cultural questions in the estimation, the *jinshi* effect disappears, whereas two of the three cultural variables

²¹Shown in Figure A5 in Appendix 3, the variance of the answers to the three questions, particularly the belief that education is an important determinant of social status, is large across the regions.

remain highly significant (column (6)). For robustness we also combine the three measures of education norms into a single index by taking their first principal component, and perform the same regressions in column (7). The results remain unchanged. Column (8) presents the results of estimating the “work ethic” variable, which shows that *jins*hi still has a significant effect on schooling today even after controlling for “work ethic” (at the 5% level of significance), and that “work ethic” has a significant effect independent of that of culture (*jins*hi) on schooling outcome.

In light of the finding that culture represents an important channel through which historical exam success has impacted on today’s schooling outcome, a second concern is whether it may serve to promote social mobility, thereby reducing the human capital advantage accrued to the elite families. We examine this issue in column (4) of Table 5, by interacting *jins*hi density with parents’ years of schooling. With a negative coefficient significant at the 1% level, the result provides suggestive evidence that *keju* culture has weakened the transmission of human capital advantages within the elite families over time. Consistently, the same is found for the interaction between *jins*hi density and ancestral human capital measures (column (5)). Conversely, the effect of parents’ years of schooling is significantly greater when the patrilineal (but not matrilineal) human capital is higher (column (6)), suggesting that human capital is transmitted primarily along the male descending line, as is typical of a patriarchal society.

3.3 A Quasi-experiment on Beijing College Students: Further Evidence on the Culture Channel

To further verify that culture does enable human capital to persist over time, we conduct a quasi-experiment on a group of 4,711 college students who came from all over China and studied at one of 15 elite universities in Beijing including Tsinghua and Peking—the two most prestigious universities in China—during 2008-2012.²² The underlying rationale is that cultural values change only gradually and that people retain their cultural values even when they move to a different culture (Alesina and Giulinao, 2015). This idea is central to a number of attempts intended to identify the effect of culture by examining the attitudes and behavior of immigrants’ descendants whose ancestors came from different parts of the world but they themselves now live

²²Tracked by the China Educational Panel Survey (CEPS), this sample thus represents the upper-tailed distribution of college students in China in terms of exam abilities.

in the same destination country. For instance, Alesina, Giuliano, and Nunn (2013) and Fernandez and Fogli (2009) both find that cultural traits persisted and affected female labor-force participation among second-generation immigrants in America.²³ By the same token, while all were studying in Beijing, the 4,711 college students in Beijing came from different parts of China with varying strengths of *keju* culture. More specifically, to the extent that both cognitive (numeracy and literacy) and non-cognitive (incentives, persistence, self-control, and so on) skills are seen as important determinants of an individual’s human capital outcome (Heckman, 2000; Heckman, Stixrud and Urzua, 2006), we investigate whether *jinshi* density in a student’s hometown (prefecture) may bear significantly upon the formation of cognitive skills and non-cognitive performance during the student’s college life.

To ensure that we are comparing these college students with respect to their differing exposure to *keju* culture, it is necessary to control for the differences in their ability before they entered college. To this end we use their test scores in the national entrance exam to proxy for the differences in their pre-college cognitive skills. Then, to ensure a valid comparison, we compare only those students who attended the same college, specialized in the same major, and enrolled in the same cohort year, using the fixed effects of their interaction term (i.e., college*major*cohort).

But before conducting this experiment we must also ensure external validity. Previously, to verify the culture channel we had used two subjective questions asking students about the perceived role of education in social mobility and their preference for government spending on education (Section 4.2). Given that this survey of college students asked the same two questions, we check the students’ answers to see if they deviate from our previous findings. Reported in columns (1) and (2) of Table 7, we similarly find that a high *jinshi* density in students’ hometowns has had a significantly positive effect on the same two measures.

We test the *hometown* effect of *jinshi* density on the college students’ cognitive ability in columns (3) and (4), and on their non-cognitive performance in columns (5) and (6). Following the literature on skills formation (e.g., Jackson, 2013), we employ two measures to proxy for cognitive abilities—class ranking based on Grade Point Averages (GPA) and test scores for the standard College English Test (CET).²⁴ The

²³A similar example of how culture in the home country can affect the behavior of future generations in the destination country can be found in Grosjean (2014).

²⁴In China, classes are organized around majors; students declaring the same major would thus be grouped together in the same class, and as such they are usually required to take the same

latter is a test college students in China must pass before they can graduate. As for non-cognitive skills, following Jackson (2013) we employ students' absenteeism and their intention to pursue graduate studies as pertinent measures. The results show that *jinshi* density in a student's hometown has a significantly positive effect on both cognitive and non-cognitive performance (columns 3 through 6). Not only does *jinshi* density raise a student's class ranking and English test scores, it also significantly reduces absenteeism from class, as well as improving his/her incentive to pursue graduate studies.

We then turn to examine the actual outcomes in terms of graduate schools admissions in columns (7) and (8). In column (7), in which we include only the *jinshi* density variable, we find that students who came from a hometown with a higher *jinshi* density were more likely to be admitted to a graduate school. After controlling for the variations in their cognitive and non-cognitive performance, however, the level of significance of *jinshi* density is reduced from 1% to 10%, whereas the corresponding magnitude drops by 20% (column (8)). Taken together, these results suggest that both cognitive and non-cognitive performance significantly mediate the historical effect of *keju* on educational outcome today.

Finally, if culture indeed represents an important channel facilitating the observed *keju* persistence, could the pertinent cultural norm be transmitted through "horizontal transmission" or social imitation among peers? To find out, we construct a measure to proxy for this "peer effect" by taking the average of the *jinshi* densities in the hometowns of students (the k^{th} density of n students) who specialize in the same major at the same university. Reported in columns (9) and (10), we find that this "peer effect" has a significantly positive effect on both CET scores and the intention to pursue graduate studies.

[Table 7 about here]

4 Conditions of Cultural Transmission

Studies on long-term persistence must account for the circumstances under which cultural norms and beliefs persist, and when they become malleable (Nunn, 2009; Voigtländer and Voth, 2012). In their attempt to account for the uneven persistence

compulsory courses together as required by the major curriculum. In this context, the GPA scores of students taking the same major are thus highly comparable.

of anti-Semitism in Nazi Germany, for example, Voigtländer and Voth (2012) find that such sentiments were decidedly weaker in German cities with higher levels of trade or immigration. While the culture embedded in the *keju* system has on the whole persisted to this day, its persistence is also uneven across regions. For instance, persistence is noticeably stronger in the lower Yangtze region and certain pockets of Shaanxi and Shanxi provinces in the north, but much weaker in south central and southwestern China (Figure 2). This uneven pattern inspires us to examine factors that may plausibly account for the uneven transmission of *keju* culture across China over time. We begin with the case of strong transmission.

Social organization, referring to family ties and social capital, is seen as playing a positive role in affecting cultural transmission (Alesina and Giuliano, 2014). In the context of Weimar Germany (circa 1913-1933), for example, Satyanath, Voigtländer, and Voth (2015) find that the social networks that existed within many civil associations had unwittingly led to the rise of Fascism. We suspect that, in the historical context of China, the social organization of clans might similarly have facilitated the transmission of *keju* culture.

Established with the overriding goal of providing public goods and social safety nets to its members, and where membership is defined by sharing the same ancestor (e.g., Greif and Tabellini, 2011; Watson, 1982), clans played a uniquely important role in nurturing *keju* culture by means of the resources they allocated to support its members—hiring tutors, collecting books, and funding academies (Elman, 2013; Ho, 1962). However, the strength of clans is also highly unevenly distributed across China, with those in the south—where a great many northerners had flocked from the north to the south during the Yuan dynasty—being decidedly stronger (Watson, 1982).

To proxy for the strength of clans across China we employ the log of the number of genealogies compiled during the Ming-Qing period as a measure normalized by the differences in population across prefectures. According to Bol (2008), genealogy is “essential to the existence of a lineage” (p. 241). This helps to explain why the more resourceful clans tend to revise their genealogies more frequently, as doing so helps to strengthen the sense of belonging and honor of their own lineages (Watson, 1982). To measure the strength of clans, we turn to the *Comprehensive Catalogue on the Chinese Genealogy*, which has collected genealogies of up to 52,401 clans involving more than 700 surnames across 280 prefectures in China (Shanghai Library, 2009). It is perhaps

not surprising to find that the spatial distribution between *jinshi* and genealogy is highly correlated (0.519). The majority of these genealogies were compiled during the Ming-Qing period, with many being able to trace their ancestors all the way back to the Qin dynasty (211 B.C.). In addition to a family’s surname and hometown origin, a genealogy also states clearly whether a family had ever migrated, and if so when and where. About 16.54% or 8,396 families had a history of migration that occurred before the Ming dynasty. This allows us to match a family’s hometown in the past with its contemporary prefectural location. Furthermore, by employing the 2005 1% mini-census we are also able to measure the strength of a clan at the individual level, by constructing a dummy variable indicating whether one’s clan has had a genealogy. About 37.15% of the families surveyed in the mini-census are found to hail from clans with one or more genealogies.

We report the results in Table 8. Column (1) shows that the interaction term between *jinshi* and number of genealogies is highly significant, suggesting that the cultural transmission of *keju* is indeed stronger in regions where clans and lineages were stronger historically. Column (2) reports the result at the individual level. It shows that, for individuals whose ancestors had written a genealogy the cultural norm of *keju* has a greater effect—both vertically and horizontally—on their schooling outcome today.

[Table 8 about here]

While strong lineages may better transmit *keju* culture over time, we also examine if negative historical shocks may have the converse effect of undermining such transmission. We select three major historical shocks that occurred at different times for this exercise. The first is Taiping Rebellion—the largest peasant rebellion that occurred around the mid-19th century. The second is the forced opening up of China via “treaty ports” by the eight allied nations after the First Opium War of the 1840s.²⁵ Last but not least we test the uneven strengths of the *keju* transmission using the Cultural Revolution, which occurred during the Communist period (1967-1977).

The rationale for selecting these three negative shocks is as follows. The Taiping Rebellion is chosen not for the colossal death toll it imposed on China (over 70 million, for example, Cao, 2000), but rather because the damage was concentrated

²⁵As a result of a series of “unequal treaties” signed between China and a number of Western countries following the former’s defeat in the Opium War, China was forced to open up to the West for trade and other forms of exchanges (such as religion) via the designated treaty ports. Initially restricted to only 5, the number of treaty ports eventually grew to 104.

in regions where *keju* culture had been strongest historically—the lower Yangtze and south central China in the provinces of Jiangxi and Anhui (Cao, 2000). We choose the treaty ports to be our second historical shock because Western culture and values may have diffused more strongly in prefectures where a treaty port had been established. Regardless of their effect on China’s development, we expect Western values may have undermined the traditional Confucian values in the treaty port prefectures.

We employ the Cultural Revolution as yet another historical shock with the hypothesized effect of weakening the transmission of the *keju* norm, given that this political movement was conceived precisely to attack the Confucian culture and denounce the merits of education. To achieve these goals, young people were encouraged to burn books, to accuse and attack scholars, to destroy historical relics, and, above all to condemn Confucius. During its initial phase (1967-1969), the Revolution was pursued with extreme violence, resulting in mass fighting and eventually the killing of nearly 300,000 (275,954) people. To measure the potential disruption the Cultural Revolution may have brought to bear upon the transmission of *keju* culture, we employ the spatial variation in mass killing in this period as proxy. Data on mass killing are collected by Andrew Walder (2014) from county and prefecture gazetteers published in the 1980s and 1990s. Intuitively, we expect the larger the magnitude of mass killing the weaker the transmission of *keju* culture.

Columns (3)-(5) present the results on the estimates of various historical shocks on cultural transmission. Column (3) shows that, while the Taiping Rebellion, measured by the number of battles fought in a prefecture, has a negatively significant effect on average schooling in 2010, its interaction with the *jinshi* measure is insignificant, suggesting that it has not weakened the transmission of *keju* culture. In column (4) we present the result of the treaty ports and in column (5) the result of the Cultural Revolution. Similar to the Taiping Rebellion, treaty ports (interacting with *jinshi*) has no significant effect on contemporary schooling but mass killing does; the latter’s significantly negative coefficient suggests that, perhaps due to its targeted attack at Confucianism the Cultural Revolution has significantly weakened the persistence of *keju* culture.²⁶ We conjecture that the Taiping Rebellion had no significant effect on

²⁶The significantly positive effect of the Cultural Revolution on today’s schooling is likely a result of reverse causality. The reason is, if we divide the surveyed respondents into two cohorts—one who had already completed their education before the Cultural Revolution and the other during and after, we would find that the significant effect applies only to the pre-Cultural Revolution cohort. Given that the main goal of the Cultural Revolution was to denounce education, places with initially

keju culture because it did not specifically target people who valued education, and so as soon as peace resumed, people began investing in human capital again. The Cultural Revolution, in contrast, not only disrupted educational opportunities but also threatened the lives of those who were either educated or intended to pursue education.

5 Conclusions

We began by observing a strong positive correlation between historical exam success several centuries ago and human capital outcome in China today. Specifically, we are able to document that prefectures with a strong historical tradition in exam success are positively correlated with higher years of schooling today, controlling for a rich multitude of confounding covariates. Moreover, using the river distance to a prefecture’s nearest printing center as instrument, we further showed that the documented relationship is causal, and that the instrument is orthogonal to other channels such as economic prosperity and trade and commerce.

Given that human capital advantages, once gained, can persist over time through a variety of means (genetic, family values, and so forth), we controlled for both historical (ancestors’) and contemporary (parents’) human capital and found, though unsurprisingly, that they do significantly account for the observed persistence. It is, however, not the only channel that matters. In fact culture has also played an important role alongside human capital in accounting for the latter’s persistence. This is feasible because of the exceptional social status conferred on a *jìnshì*, so much so that *keju* had likely bred a distinct culture of valuing education. This culture has persisted to this day, as is evidenced by the strong, positive correlation between *jìnshì* density and the subjective importance people in China attach to education today. To ensure the validity of the culture channel, we further conducted a quasi-experiment on several thousand college students of diverse geographical origins studying in Beijing, and confirmed that *jìnshì* density in their own hometowns does bear significantly upon their cognitive and non-cognitive performance, and which mediate human capital outcome today. This suggests that a pervasive culture of learning and examination at the societal level is crucial for social learning or the “horizontal transmission” of

higher average educational attainment would likely have witnessed more severe mass killing. The interaction effect between the Cultural Revolution and historical *jìnshì* is significant only for the Cultural Revolution cohort.

culture independently of the “vertical transmission” (i.e. that transmitted within the rich and powerful families and lineages).

Last but not least we also endeavored to document the conditions under which *keju* culture has shown greater resilience, vis-à-vis those that undermine its transmission. Specifically, we found that clans and lineages served to facilitate the persistence of *keju* culture, and that negative historical shocks do not invariably undermine its transmission. Only the Cultural Revolution, with its targeted attack at Confucianism and education, has demonstrably weakened an otherwise extremely persistent culture of valuing education and its expected returns.

References

- [1] Abramitzky, Ran, Leah P. Boustan, and Katherine Eriksson. 2014. “A Nation of Immigrants: Assimilation and Economic Outcomes in the Age of Mass Migration.” *Journal of Political Economy*, 122(3): 467-506.
- [2] Acemoglu, Daron, Simon Johnson, and James A. Robinson. 2001. “The Colonial Origins of Comparative Development: An Empirical Investigation.” *American Economic Review*, 91(5): 1369-1401.
- [3] Acemoglu, Daron, Simon Johnson, and James A. Robinson. 2002. “Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution.” *Quarterly Journal of Economics*, 107(4): 1231-94.
- [4] Alesina, Alberto, and Nicola Fuchs-Schündeln. 2007. “Good-Bye Lenin (or Not?): The Effect of Communism on People’s Preferences.” *American Economic Review*, 97(4): 1507-28.
- [5] Alesina, Alberto, Paola Giuliano, and Nathan Nunn. 2013. “On the Origins of Gender Roles: Women and the Plough.” *The Quarterly Journal of Economics*, 128 (2): 469-530.
- [6] Alesina, Alberto, and Paola Giuliano. 2014. “Family Ties.” In Philippe Aghion and Steven N. Durlauf, ed., *Handbook of Economic Growth*, Vol. 2A, pp.177-215.
- [7] Alesina, Alberto, and Paola Giuliano. 2015. “Culture and Institutions.” *Journal of Economic Literature*, 53(4): 898-944.
- [8] Bai Shouyi. 1937. *Zhongguo jiaotongshi (The Transportation History of China)*. Shanghai: The Commercial Press.
- [9] Bai Ying and Jia Ruixue. 2016. “Elite Recruitment and Political Stability: The Impact of the Abolition of China’s Civil Service Exam.” *Econometrica*, 84(2): 677-733.
- [10] Bairoch, Paul. 1988. *Cities and Economic Development: From the Dawn of History to the Present*. Chicago: University of Chicago Press.
- [11] Becker, Gary. 1991. *A Treatise on the Family, Enlarged Edition*. Cambridge: Harvard University Press.
- [12] Becker, Gary S. and Nigel Tomes. 1979. “An Equilibrium Theory of the Distribution of Income and Intergenerational Mobility.” *Journal of Political Economy*, 87(6):1153-89.
- [13] Becker, Sascha O., Katrin Boeckh, Christa Hainz, and Ludger Woessmann. 2015. “The Empire Is Dead, Long Live the Empire! Long-Run Persistence of Trust and Corruption in the Bureaucracy.” *The Economic Journal*, doi: 10.1111/eoj.12220.
- [14] Behrman, Jere R. and Mark R. Rosenzweig. 2002. “Does Increasing Women’s Schooling Raise the Schooling of the Next Generation?” *American Economic Review*, 92(1): 323-34.
- [15] Bisin, Alberto, and Thierry Verdier. 2000. “Beyond the Melting Pot: Cultural Transmission, Marriage, and The Evolution of Ethnic and Religious Traits.”

- The Quarterly Journal of Economics*, 115(3): 955-88.
- [16] Botticini, Maristella, and Zvi Eckstein. 2012. *The Chosen Few: How Education Shaped Jewish History, 70-1492*. N.J.: Princeton University Press.
- [17] Cao, Shuji. 2000. *Zhongguo renkoushi, diwujuan (History of Population in China, Volume 5)*. Shanghai: Fudan University Press.
- [18] Cao, Shuji. 2015. *Zhongguo renkoushi, Mingshiqi (History of Population in China, the Ming Period)*. Manuscript.
- [19] Chang, Chung-li. 1955. *The Chinese Gentry: Studies on Their Role in 19th Century Chinese Society*. Seattle: University of Washington Press.
- [20] Chang, Chung-li, 1962. *The Income of the Chinese Gentry*. Seattle: University of Washington Press.
- [21] Chao, Ruth, and Vivian Tseng. 2002. "Parenting of Asians." In Marc H. Bornstein, ed., *Handbook of Parenting*, Vol. 4, pp. 59-93.
- [22] Chen, Ciyu. 1982. *Jindai zhongguo chaye de fazha yu shijie shichang (The Development of Chinese Tea Trade in the Modern World Market)*. Taipei: Zhongyang yanjiuyuan jingji yanjiusuo.
- [23] "CHGIS, Version 4." Cambridge: Harvard Yenching Institute, January 2007.
- [24] Chow, Kai-wing. 2004. *Publishing, Culture, and Power in Early Modern China*. Stanford: Stanford University Press.
- [25] Clark, Gregory. 2014. *The Son Also Rises: Surnames and the History of Social Mobility: Surnames and the History of Social Mobility*. N.J.: Princeton University Press.
- [26] Dell, Melissa. 2010. "The Persistent Effects of Peru's Mining Mita." *Econometrica*, 78(6): 1863-1903.
- [27] Diamond, Jared. 1997. *Guns, Germs, and Steel*. New York: Norton.
- [28] Dohmen, Thomas, Armin Falk, David Huffman, and Uwe Sunde. 2011. "The Intergenerational Transmission of Risk and Trust Attitudes." *The Review of Economic Studies*, 9(3): 522-50.
- [29] Du, Xinfu and Tongshu Du. 2001. *Quanming fengshengfenxian keshukao (A Catalogue of the Books Printed in the Ming)*. Beijing: Xianzhuang shuju.
- [30] Du, Xinfu and Tongshu Du. 2009. *Quanqing fengshengfenxian keshukao (A Catalogue of the Books Printed in the Qing)*. Beijing: Xianzhuang shuju.
- [31] Elman, Benjamin A. 2013. *Civil Examinations and Meritocracy in Late Imperial China*. Cambridge, Massachusetts: Harvard University Press.
- [32] Elvin, Mark. 1973. *The Pattern of the Chinese Past: A Social and Economic Interpretation*. Stanford: Stanford University Press.
- [33] Fan, Fengshu. 2013. *Zhongguo zhuming cangshujia yu cangshulou (The Famous Chinese Book Collectors and Chambers)*. Zhengzhou: Daxiang chubanshe.
- [34] Fernandez, Raquel, and Alessandra Fogli. 2009. "Culture: An Empirical Investigation of Beliefs, Work, and Fertility." *American Economic Journal: Macroeconomics*, 1(1): 146-77.
- [35] Glaeser, Edward L., Rafael La Porta, Florencio Lopez-de-Silanes, and Andrei

- Shleifer. 2004. "Do Institutions Cause Growth?" *Journal of economic Growth*, 9(3): 271-303.
- [36] Greif, Avner, and Guido Tabellini. 2011. "The Clan and the City: The Evolution of Cooperative Organizations in China and Europe." Working paper.
- [37] Grosjean, Pauline. 2014. "A History of Violence: the Culture of Honor and Homicide in the US South." *Journal of European Economic Association*, 12(5): 1285-1316.
- [38] Guiso, Luigi, Paola Sapienza, and Luigi Zingales. 2015. "Long-term Persistence." *Journal of European Economic Association*, forthcoming.
- [39] Guryan, Jonathan, Erik Hurst, and Melissa Kearney. 2008. "Parental Education and Parental Time with Children." *Journal of Economic Perspectives*, 22(3): 23-46.
- [40] Hartwell, Robert M. 1982. "Demographic, Political, and Social Transformations of China, 750-1550." *Harvard Journal of Asiatic Studies*, 42 (2): 365-442.
- [41] Ho, Ping-ti. 1962. *The Ladder of Success in Imperial China*. New York: Columbia University Press.
- [42] Heckman, James J. 2000. "Policies to Foster Human Capital." *Research in economics*, 54(1): 3-56.
- [43] Heckman, James J., Jora Stixrud, and Sergio Urzua. 2006. "The Effects of Cognitive and Noncognitive Abilities on Labor Market Outcomes and Social Behavior." *Journal of Labor Economics*, 24(3): 411-482.
- [44] Jackson, C. Kirabo. 2012. "Non-Cognitive Ability, Test Scores, and Teacher Quality: Evidence from 9th Grade Teachers in North Carolina." No. w18624. National Bureau of Economic Research.
- [45] Ji, Xiaofeng, edited, 1996. *Zhongguo shuyuan cidian (A Compendium on the Chinese Academies)*. Hangzhou: Zhejiang jiaoyu chubanshe.
- [46] McDermott, Joseph P. 2006. *A Social History of the Chinese Book: Books and Literati Culture in Late Imperial China. Vol. 1*. HKU Press.
- [47] Michalopoulos, Stelios, and Elias Papaioannou. 2013. "Pre-Colonial Ethnic Institutions and Contemporary African Development." *Econometrica*, 81(1): 113-52.
- [48] Needham, Joseph. 1964. "Science and China's Influence in the World." In *The Legacy of China*, edited by Raymond Dawson. Oxford: Oxford University Press, 234-308.
- [49] Needham, Joseph. 1969. *The Grand Titration*. Toronto: University of Toronto Press.
- [50] Nunn, Nathan. 2009. "The Importance of History for Economic Development." *Annual Review of Economics*, 1(1): 65-92.
- [51] Nunn, Nathan and Leonard Wantchekon. 2011. "The Slave Trade and the Origins of Mistrust in Africa." *American Economic Review*, 101(7): 3221-52.
- [52] Nunn, Nathan, and Diego Puga. 2012. "Ruggedness: The Blessing of Bad Geography in Africa." *The Review of Economics and Statistics*, 94(1): 20-36.

- [53] Putterman, Louis, and David N. Weil. 2010. "Post-1500 Population Flows and the Long Run Determinants of Economic Growth and Inequality." *Quarterly Journal of Economics*, 125(4): 1627-82.
- [54] Reed, Christopher A. 2011. *Gutenberg in Shanghai: Chinese Print Capitalism, 1876-1937*. Vancouver: UBC Press.
- [55] Richerson, Peter J., and Robert Boyd. 2008. *Not by Genes Alone: How Culture Transformed Human Evolution*. Chicago: University of Chicago Press.
- [56] Rozman, Gilbert. 1973. *Urban Networks in Ch'ing China and Tokugawa Japan*. N.J.: Princeton University Press.
- [57] Rozman, Gilbert. 2014. *The East Asian Region: Confucian Heritage and Its Modern Adaptation*. N.J.: Princeton University Press.
- [58] Russell, Bernard. 1922. *The Problem of China*. London: Allen & Unwin.
- [59] Satyanath, Shanker, Nico Voigtländer and Hans-Joachim Voth. 2015. "Bowling for Fascism." *Journal of Political Economy*, forthcoming,
- [60] Shanghai Library, 2009. *Comprehensive Catalogue on the Chinese Genealogy*. Shanghai: Shanghai guji chubanshe.
- [61] Shang, Yanliu. 2004. *Qingdai keju kaoshi shulu ji youguan zhuzuo (Review on the Civil Exam in Qing China)*. Tianjin: Baihua Wenyi Press.
- [62] Skinner, G. William. 1977. *The City in Late Imperial China*. Stanford. Stanford: Stanford University Press.
- [63] Stevenson, Harold W. and Shin-Ying Lee. 1990. *Contexts of Achievement: A Study of American, Chinese and Japanese Children*. Chicago: University of Chicago Press.
- [64] Voigtländer, Nico, and Hans-Joachim Voth, 2012. "Persecution Perpetuated: the Medieval Origins of Anti-Semitic Violence in Nazi Germany." *The Quarterly Journal of Economics*, 127(2): 1339-92.
- [65] Walder, Andrew G. 2014. "Rebellion and Repression in China, 1966-1971." *Social Science History*, 38(4), 513-539.
- [66] Wang, Yanlai, edited. 2010. *Minguo jiaoyu tongji ziliao huibian, diyi fence (A Compendium on the Statistical Materials of Republican Education, Volume 1)*. Beijing: Guojia tushuguan chubanshe.
- [67] Watson, James L. 1982. "Chinese Kinship Reconsidered: Anthropological Perspectives on Historical Research." *The China Quarterly*, 92: 589-622.
- [68] Zhang, Xiumin and Qi Han. 2006. *Zhongguo yingshuashi (Chinese Printing History)*. Hangzhou: Zhejiang guji chubanshe.
- [69] Zheng, Yuanqing. 1969. *Hulu jingji kao (Records of Huzhou Prefecture)*. Taipei: Guangwen shuju.
- [70] Zhongguo junshishi bianxiezu. 2003. *Zhongguo lidai zhanzheng nianbiao (Chronology of Warfare in Historical China)*. Beijing: Jiefangjun chubanshe.
- [71] Zhu, Baojiong and Peilin Xie, edited, 1980. *Ming-Qing jinshi timing beilu suoyin (Official Directory of Ming-Qing Imperial Exam Graduates)*. Shanghai: Shanghai guji chubanshe.

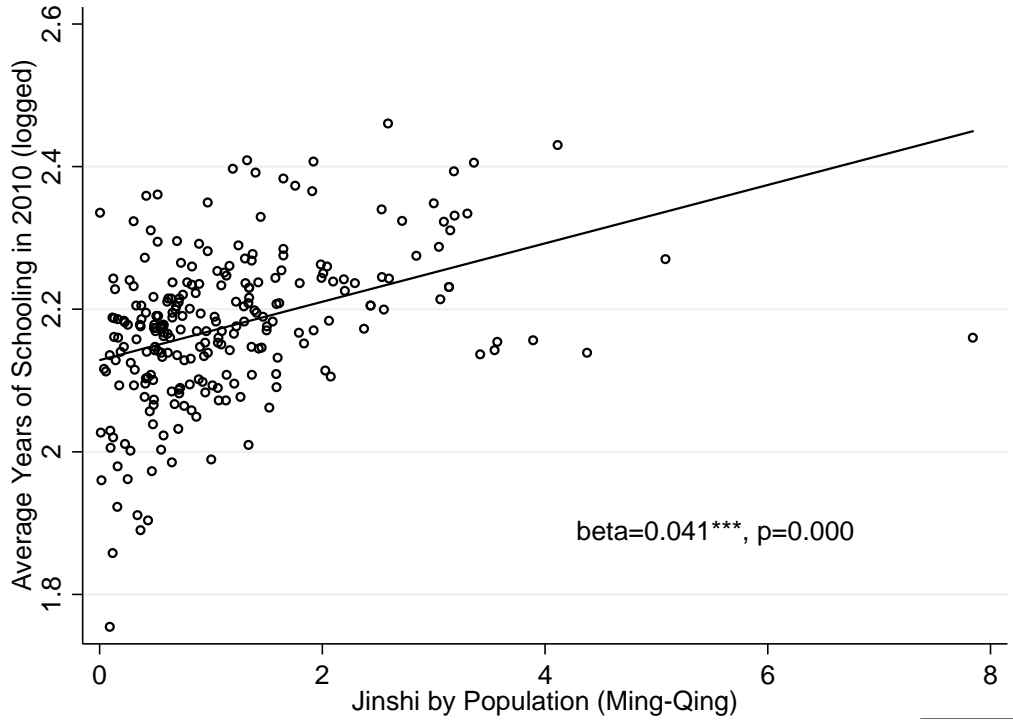


Figure 1. Correlation between Historical Success in China's Civil Exam (*Keju*) and Human Capital Outcome Today

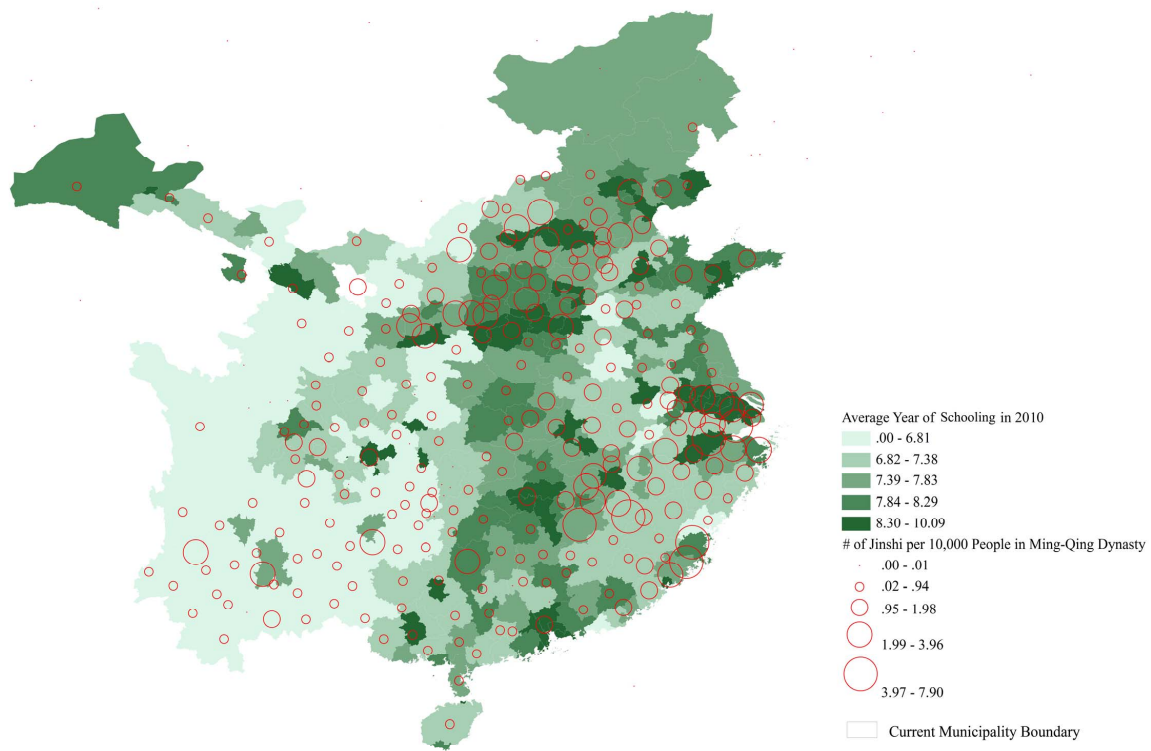


Figure 2. Number of *Jinshi* (1368-1905) and Average Years of Schooling in 2010

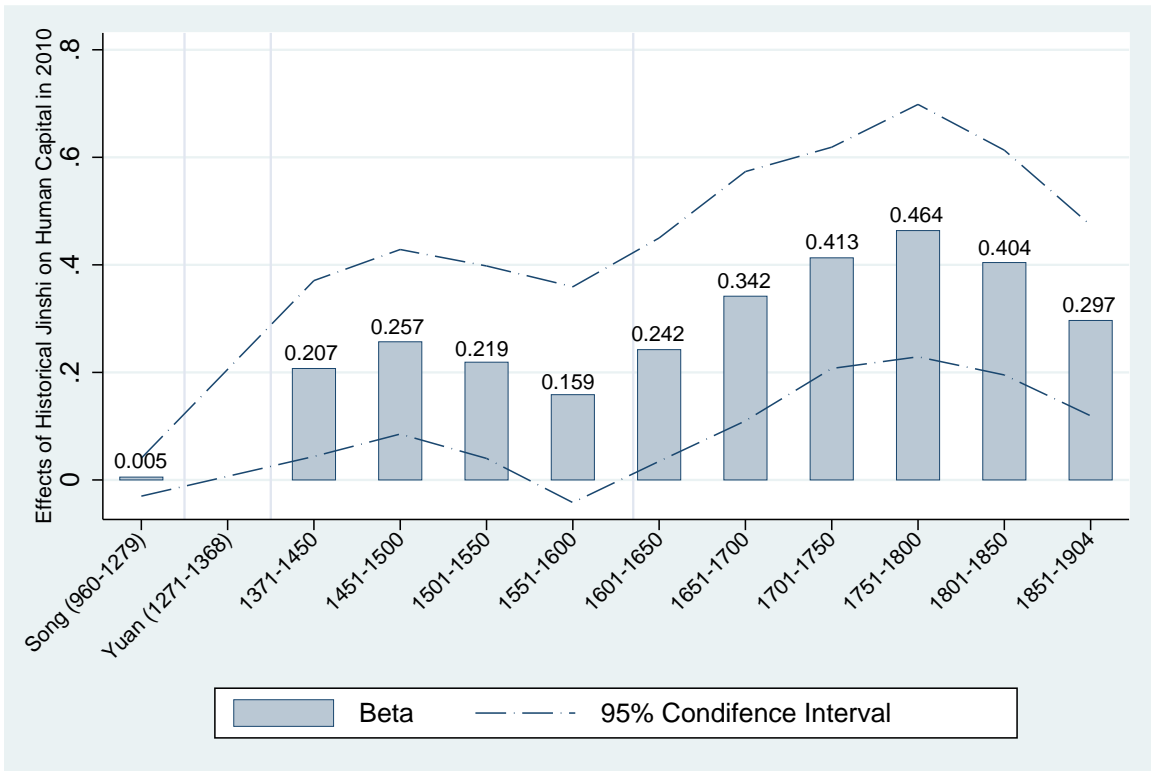


Figure 3. Impact of *Keju* on Years of Schooling in 2010 by Period

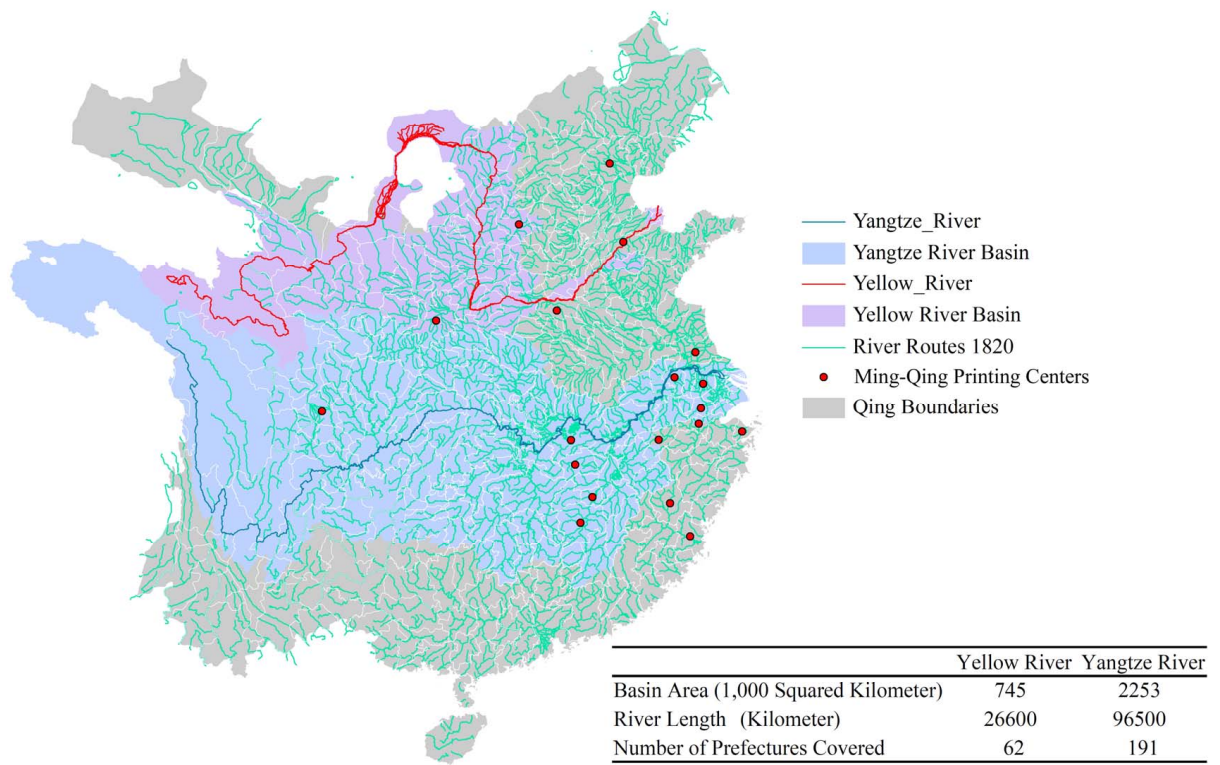


Figure 4. River Tributaries in the Basins of Yangtze River and Yellow River

Table 1. Summary Statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Contemporary					
<i>Human Capital Variables (2010)</i>					
Average Years of Schooling	243	8.86	0.93	5.78	11.71
<i>Control Variables</i>					
Distance to Coast	243	446483.8	366766.8	16832	1459774
Terrain Ruggedness Index	243	183.97	160.42	4.57	820.56
Per Capita GDP	243	18991.69	22595.22	3073.25	262183.5
Fiscal Expenditure on Education	243	457.8	322.73	195.68	3409.82
Historical					
<i>Jinshi</i> (by Population)	243	1.16	1.02	0	7.84
<i>Jinshi</i> (by Area)	243	0.02	0.03	0	0.24
<i>Jinshi</i> (excluding migrant candidates)	243	1.11	1.07	0	7.43
Number of Printed Books	243	38.53	120.97	0	1082
River Distance to Printing Center	243	12.71	10.17	0.03	53.59
Distance to Coast	243	446483.8	366766.8	16832	1459774
Population Density (Ming-Qing)	243	0.01	0.01	0	0.06
Agricultural suitability	243	12.89	4.25	0.26	25.46
<i>Shengyuan</i> Quota	243	103.95	53.51	0	337.78
Frequencies of Wars	243	2.88	3.91	0	30
Urbanization Level in 1920s	243	0.03	0.05	0	0.52
Urbanization Rate in 1393	243	8	4.16	0	21.5
Private Libraries (before 1904)	243	5.86	3.96	0	25
New Schools (in 1907)	243	136.9	187.92	0	1141.17
Confucian Academies (before 1904)	243	27.72	28.53	0	203

Table 2. Impact of *Keju* on Contemporary Human Capital: OLS Estimates

	Average Years of Schooling in 2010 (logged)				
	(1)	(2)	(3)	(4)	(5)
<i>Jinshi</i> (by Population)	0.061*** (0.009)	0.033*** (0.008)			0.031*** (0.009)
<i>Jinshi</i> (by Area)			0.035*** (0.008)		
<i>Jinshi</i> (excluding migrant <i>candidates</i>)				0.025*** (0.009)	
Confucian Academies (<i>before</i> 1904)					-0.001 (0.007)
New Schools (in 1907)					0.000 (0.005)
Private Libraries (<i>before</i> 1904)					0.010 (0.011)
Urbanization Level in 1920s		-0.002 (0.003)	-0.003 (0.003)	-0.003 (0.003)	-0.001 (0.003)
Urbanization Rate in 1393		0.002* (0.001)	0.002* (0.001)	0.003* (0.001)	0.002 (0.001)
Population Density (<i>Ming – Qing</i>)		-0.047*** (0.013)	-0.079*** (0.016)	-0.043*** (0.013)	-0.047*** (0.013)
Frequencies of War		-0.013* (0.007)	-0.012 (0.007)	-0.011 (0.007)	-0.013* (0.007)
Agricultural Suitability		0.003* (0.002)	0.003** (0.002)	0.003* (0.002)	0.003* (0.002)
<i>Shengyuan</i> Quota		0.000** (0.000)	0.000** (0.000)	0.000** (0.000)	0.000* (0.000)
Distance to Coast		0.012* (0.006)	0.013** (0.006)	0.012* (0.006)	0.012* (0.007)
Terrain Ruggedness Index		-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
Per Capita GDP (2000 – 2010)		0.000* (0.000)	0.000** (0.000)	0.000* (0.000)	0.000** (0.000)
Fiscal Expenditure on Education (2000 – 2010)		-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Regional Fixed Effects	No	Yes	Yes	Yes	Yes
Number of Observations	243	243	243	243	243
Adj. R-squared	0.205	0.503	0.507	0.489	0.499

Notes: * p<0.1; ** p<0.05; *** p<0.01. Robust standard error in parentheses. Constant added but not reported.

Table 3. Effect of Distance to Printing Centers on Contemporary Human Capital Outcome

	Average Years of Schooling in 2010 (logged)			
	(1)	(2)	(3)	(4)
River Distance to Printing Center	-0.001** (0.001)	-0.001 (0.001)		
<i>Jinshi</i>		0.031*** (0.009)		0.027*** (0.010)
Number of Printed Books (logged)			0.012*** (0.004)	0.006 (0.005)
Control Variables	Yes	Yes	Yes	Yes
Number of Observations	243	243	243	243
Adj. R-squared	0.477	0.503	0.489	0.504

Notes: * p<0.1; ** p<0.05; *** p<0.01. All control variables are the same as in column (5) of Table 2. Robust standard error in parentheses. Constant added but not reported.

Table 4. Impact of *Keju* on Contemporary Human Capital: 2SLS Estimation

	Average Years of Schooling in 2010 (logged)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Jinshi</i>	0.088*** (0.020)	0.066** (0.027)	0.070*** (0.013)	0.051*** (0.015)	0.093** (0.040)	0.099*** (0.037)	0.010 (0.065)
River Distance to Commercial Center in Ming					0.002 (0.001)		
River Distance to Commercial Center in Qing						0.004*** (0.001)	
Adj. R-squared	0.163	0.465	0.200	0.489	0.392	0.401	0.476
Instruments in the first stage:							
River Distance to Printing Center	-0.036*** (0.004)	-0.027*** (0.006)			-0.021*** (0.007)	-0.022*** (0.006)	
Adj. R-squared	0.216	0.461			0.467	0.476	
# of Printed books (logged)			0.326*** (0.024)	0.258*** (0.029)			
Adj. R-squared			0.460	0.572			
River Distance to Random Prefecture							-0.002 (0.001)
Adj. R-squared							0.400
Control Variables	No	Yes	No	Yes	Yes	Yes	Yes
Number of Observations	243	243	243	243	243	243	243

Notes: * p<0.1; ** p<0.05; *** p<0.01. Columns (1), (2), (5), and (6) are the 2SLS results using river distance to the nearest printing center to instrument *Jinshi* by population (Ming-Qing). Columns (3)-(4) are the 2SLS results using number of printed books (Ming-Qing) to instrument *Jinshi* by population (Ming-Qing). Column (7) uses the river distance to 19 random prefectures as instrument. The dependent variable is the average years of schooling in 2010 (logged) in columns (1) to (7). All control variables are the same as in column (5) of Table 2. Robust standard error in parentheses. Constant added but not reported.

Table 5. Channels of Human Capital Persistence Decomposed

	Years of Schooling (logged)					
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Jinshi</i>	0.139*** (0.025)	0.083** (0.029)	0.092*** (0.027)	0.213*** (0.042)	0.091*** (0.027)	0.091*** -0.027
Patrilineal <i>Jinshi</i> Ancestors		0.021*** (0.002)	0.019*** (0.002)	0.019*** (0.002)	0.012*** (0.003)	0.012*** -0.003
Matrilineal <i>Jinshi</i> Ancestors		0.008* (0.003)	0.008* (0.003)	0.008* (0.003)	0.008* (0.003)	0.005* -0.003
Father's Years of Schooling			0.029*** (0.001)	0.049*** (0.005)	0.004 (0.007)	0.026*** (0.001)
Mother's Years of Schooling			0.028*** (0.001)	0.061*** (0.005)	0.023*** (0.007)	0.029*** (0.001)
<i>Jinshi</i> *Father's Years of Schooling				-0.034*** (0.007)		
<i>Jinshi</i> *Mother's Years of Schooling				-0.054*** (0.007)		
<i>Jinshi</i> *Patrilineal <i>Jinshi</i> Ancestors					-0.028*** (0.008)	
<i>Jinshi</i> *Matrilineal <i>Jinshi</i> Ancestors					-0.019** (0.007)	
Patrilineal <i>Jinshi</i> Ancestors*Father's Years of Schooling						0.025*** (0.003)
Matrilineal <i>Jinshi</i> Ancestors*Mother's Years of Schooling						0.021 (0.014)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Clustered at Prefecture Level	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	563498	563498	563498	563498	563498	563498
Adj. R-squared	0.202	0.208	0.219	0.219	0.216	0.221

Notes: * p<0.1; ** p<0.05; *** p<0.01. All regressions run by 2SLS based on 2005 mini-census individual level data. Individual-level control variables include age, gender, ethnicity and household's status (rural/urban). Prefecture-level control variables are the same as column (5) of Table 2. Robust standard error in parentheses.

Table 6. The Culture Channel

	Whether education is the most important determinant of social status (1=yes, 0=not)	Whether the government should prioritize spending on education (1=yes, 0=not)	Annual household expenditure on education (log, in Chinese yuan)	Whether hard working is important for success in society (1-5: very important)	Years of Schooling (logged)	Years of Schooling (logged)	Years of Schooling (logged)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Jinshi</i>	0.178*** (0.062)	0.363** (0.170)	0.548* (0.312)	0.187 (0.115)	0.516*** (0.194)	0.416 (0.261)	0.437 (0.737)
Whether education is most important for social status (1=yes, 0=not)							0.496** (0.196)
Whether the government should prioritize spending on education (1=yes, 0=not)						0.251*** (0.084)	
Annual household expenditure on education (Log, in RMB yuan)						0.103 (0.151)	
Norm of valuing education						0.037*** (0.003)	
Work ethic							0.169*** (0.045)
Parents' Average Years of Schooling	-0.007*** (0.001)	-0.002 (0.007)	0.094*** (0.011)	0.027*** (0.010)	0.404 (0.400)	0.406 (0.400)	0.404*** (0.047)
Two-way Clustering at Prefecture and HRS	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	8807	8807	8807	8796	8018	8018	8018
Adj. R-squared	-0.010	0.022	0.090	0.015	0.440	0.444	0.444

Notes: * p<0.1; ** p<0.05; *** p<0.01. All results are based on 2SLS estimates of the 2006 CGSS survey data. Individual-level control variables include age, gender, ethnicity, parents' education, household status (rural/urban), religion, sibling size, marital status and personal social status. The prefectural-level control variables are the same as column (5) of Table 2. The norm of valuing education is the first principal component of the above three measures of education culture. Robust standard error in parentheses. Constant added but not reported. HRS refers to a household's status (rural/urban) under the Household Registration System.

Table 7. Robustness of the Culture Channel: Quasi-Experiment on 4,711 Undergraduates Studying at 15 Beijing Universities, 2008-2012

	How important is education in determining ones social status (1-5 very important)	Whether the government should prioritize spending on education (1==yes, 0=not),	Class Ranking (# of student ranking)	College English Test Scores	Academic Absence 2=often; 1=sometimes; 0=never)	Intend to Pursue Graduate Studies	Admitted by Graduate Schools	College English Test Scores	Intend to Pursue Graduate Studies	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>Jinshi</i> (hometown)	0.807*** (0.170)	0.073* (0.042)	6.335*** (1.115)	0.084* (0.048)	-0.105** (0.050)	0.136*** (0.037)	0.107* (0.061)	0.154*** (0.039)	0.193*** (0.034)	
Class Ranking										
Intend to Pursue Graduate Studies										
Average <i>Jinshi</i>										
Entrance Exam Scores (logged)	0.088 (0.159)	-0.010 (0.071)	6.282*** (1.715)	0.169*** (0.054)	-0.018 (0.059)	0.394*** (0.036)	0.009 (0.076)	-0.038 (0.073)	0.051*** (0.049)	0.091*** (0.047)
Father's Education	0.017* (0.010)	0.003 (0.004)	0.047 (0.110)	0.002 (0.003)	0.006 (0.004)	0.012*** (0.003)	0.003 (0.005)	0.001 (0.005)	0.007** (0.003)	0.018*** (0.003)
Mother's Education	0.004 (0.010)	-0.005 (0.005)	0.145 (0.139)	-0.002 (0.003)	-0.002 (0.004)	0.019*** (0.003)	0.002 (0.005)	0.001 (0.005)	-0.003 (0.003)	0.019*** (0.003)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Enrollment Cohort FE	No	No	No	No	No	No	No	No	Yes	Yes
University-major-cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Number of Observations	3892	3892	11960	6015	9094	11960	3020	3020	6022	11964
Adj. R-squared	0.091	0.031	0.174	0.142	0.088	0.287	0.373	0.404	0.063	0.102

Notes: * p<0.1; ** p<0.05; *** p<0.01. All results are based on 2SLS estimates of the 2012 survey of Beijing university students. Individual-level control variables include age, gender, household income (logged). The prefectural-level control variables are the same as column (5) of Table 2. In column 1-8, *Jinshi* is instrumented by river distance to the nearest printing center. Robust standard error in parentheses.

Table 8. Conditions of Cultural Transmission

	Years of Schooling (logged)				
	(1)	(2)	(3)	(4)	(5)
<i>Jinshi</i>	0.031*** (0.008)	0.015*** (0.003)	0.029** (0.011)	0.026*** (0.008)	0.066*** (0.016)
# of Genealogy	-0.005 (0.004)				
<i>Jinshi</i> *# of Genealogy	0.093*** (0.032)				
Genealogy (dummy)		-0.223** (0.101)			
<i>Jinshi</i> *Genealogy (dummy)		0.051*** (0.019)			
Taiping Rebellion			-0.023* (0.012)		
<i>Jinshi</i> *Taiping Rebellion			0.014 (0.018)		
Treaty Ports				0.053*** (0.012)	
<i>Jinshi</i> *Treaty Ports				0.012 (0.014)	
Cultural Revolution					0.013*** (0.003)
<i>Jinshi</i> *Cultural Revolution					-0.007** (0.003)
Control Variables	Yes	Yes	Yes	Yes	Yes
Number of Observations	243	563498	243	243	243
Adj. R-squared	0.518	0.249	0.501	0.546	0.536

Notes: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$. All regressions run by OLS. Columns (1), (3) to (5) use the prefecture level data. Column (2) uses 2005 mini-census individual-level data. In column (1), genealogy is a prefectural-level variable measuring the number of historical genealogies normalized by population in a prefecture. In column (2), genealogy is measured at the individual level, referring to a dummy variable indicating whether one belongs to a strong clan with genealogy in history. The specification and control variables in columns (1), (3) to (5) are the same as column (5) in Table 2, while the specification and control variables in column (2) are the same as column (3) of Table 5. Robust standard error in parentheses.

Appendix (For Online Publication)

Appendix 1. Matching Historical *Jinshi* with Contemporary Human Capital Outcome

A difficulty in conducting our empirical analysis is that the administrative boundaries have changed substantially over a period of six hundred years. In order to examine the impact of imperial examinations on contemporary human capital, we need to link the historical number of *jinshi*, which is measured at the Ming-Qing county boundaries, with the contemporary human capital outcome measured at the prefectural-level boundaries today.

To do this we first organize the *jinshi* data in the Ming-Qing county boundaries based on the China Historical Geographic Information System (CHGIS) (see Figure A1a for an example). Each polygon in the GIS map represents a historical county boundary in Ming or Qing dynasty. To merge the Ming-Qing *jinshi* data with the contemporary prefecture boundaries, we intersect the historical and current boundaries using the 30 arc-second by 30 arc-second (roughly 1km by 1km) grid cell map. We then merge the *jinshi* data with each grid cell based on the spatial proximity between each grid and the historical boundaries (each grid cell will be given the attributes of the polygon if the centroids of the cell falls into the polygon, see Figure A1b). In this way, we match the grid cell map with the current prefectural boundaries (Figure A1c). By taking the average of the number of cells falling into the current boundaries, we can measure the historical number of *jinshi* in the current prefecture boundaries.

Figure A1 about here

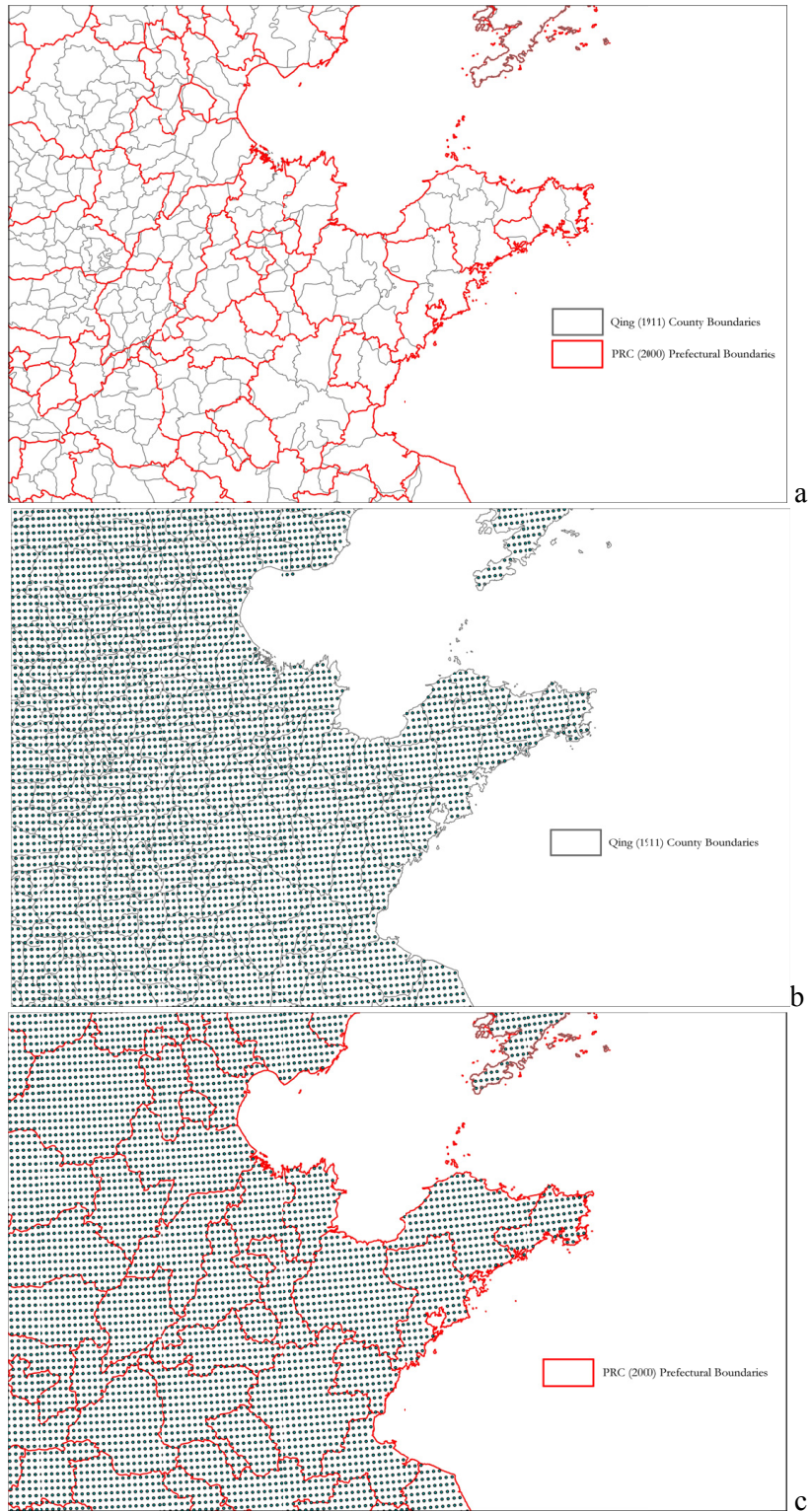


Figure A1. Merging the Qing Counties with the Contemporary Prefectural Boundaries

Appendix 2. Printing Centers in Ming-Qing Dynasties

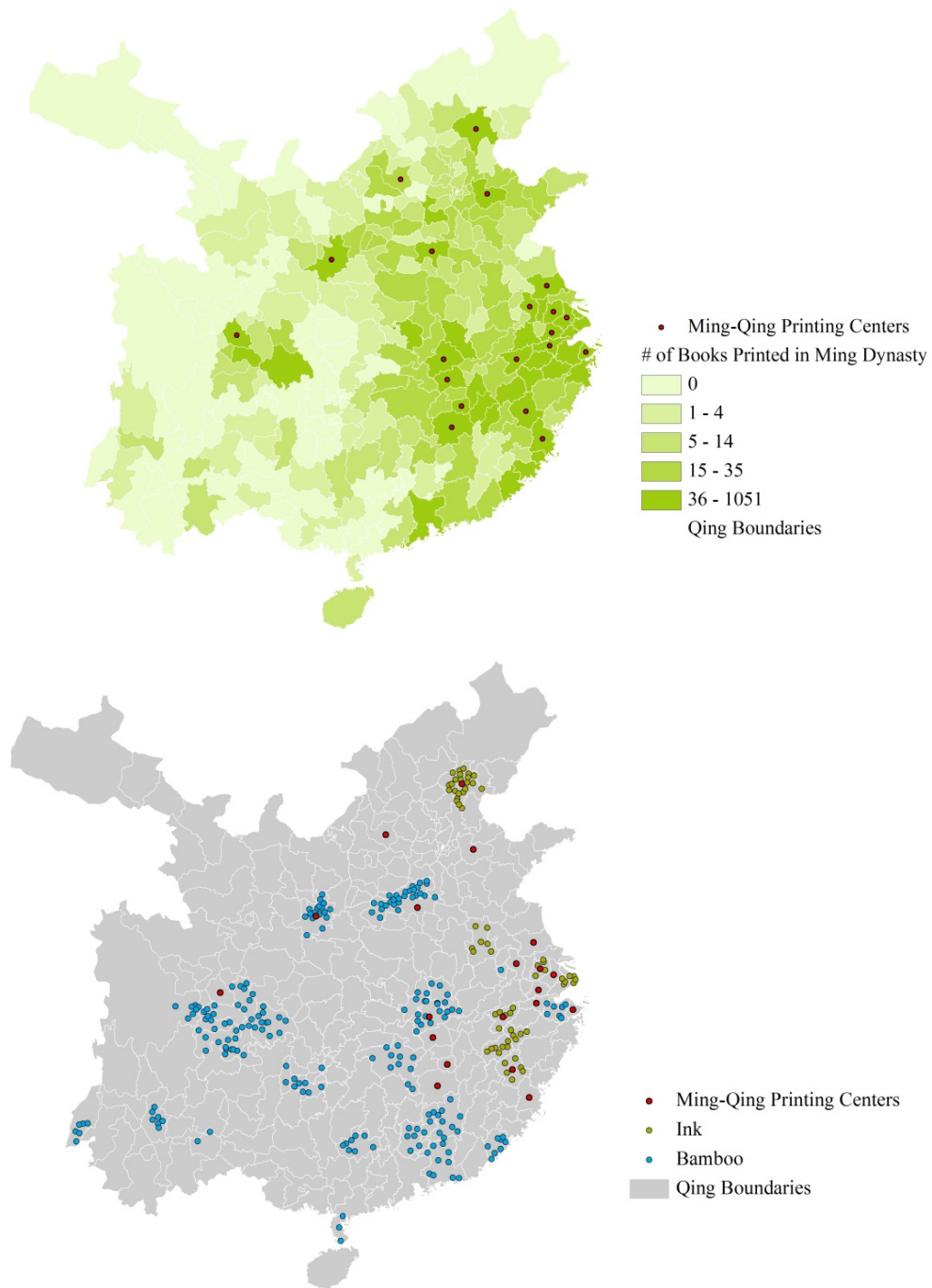


Figure A2. Factor Endowment, Printing Centers, and Number of Books Printed in the Ming-Qing Dynasties

Table A1. Complete List of Printing Centers in Ming and Qing Dynasties

Printing Center	Province	# of Books Printed in Ming	# of Books Printed in Qing
Suzhou Fu	Jiangsu	1001	1853
Hangzhou Fu	Zhejiang	355	1021
Huizhou Fu	Anhui	490	526
Jiangning Fu	Jiangsu	855	129
Jianning Fu	Fujian	1051	653
Changzhou Fu	Jiangsu	382	169
Ningbo Fu	Zhejiang	182	295
Huzhou Fu	Zhejiang	228	153
Kaifeng Fu	Henan	69	283
Shuntian Fu	Zhili	264	14
Nanchang Fu	Jiangxi	165	98
Ji'an Fu	Jiangxi	196	63
Wuchang Fu	Hubei	73	135
Fuzhou Fu	Fujian	144	43
Yangzhou Fu	Jiangsu	96	78
Taichang Fu	Jiangsu	112	52
Linjiang Fu	Jiangxi	133	24
Chengdu Fu	Sichuan	68	39
Jinan Fu	Shandong	81	24

Appendix 3. Other Figures

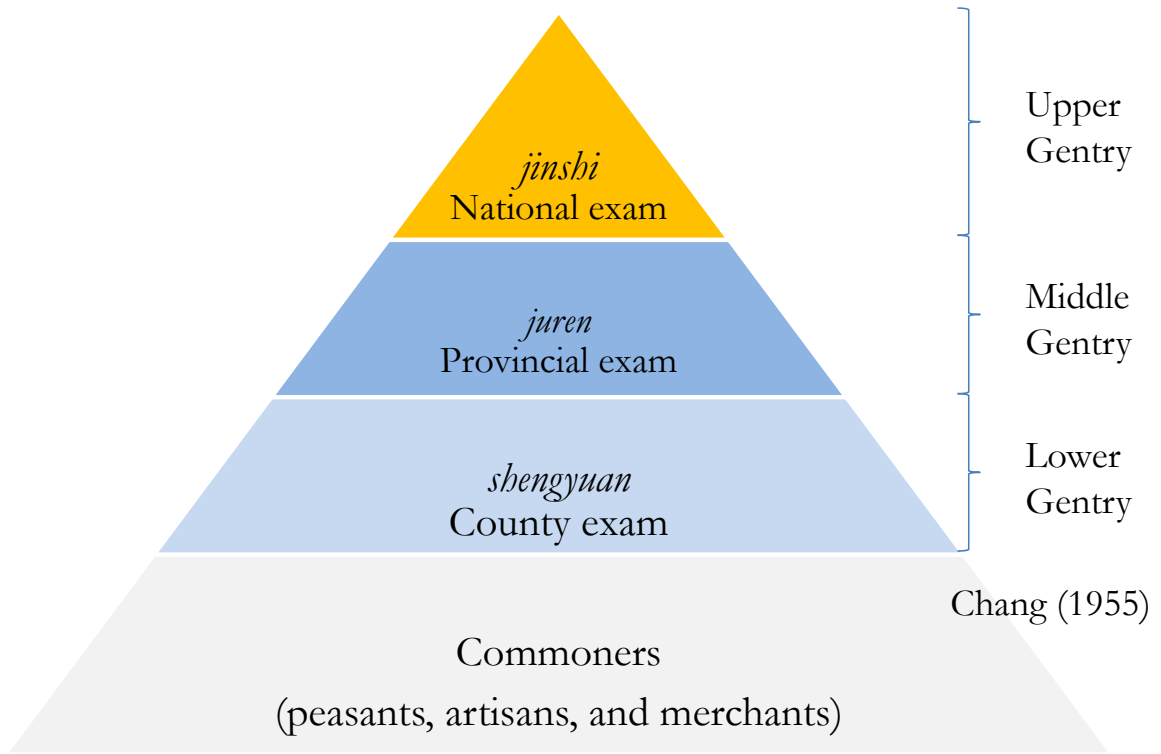


Figure A3. The Hierarchy of *Keju*

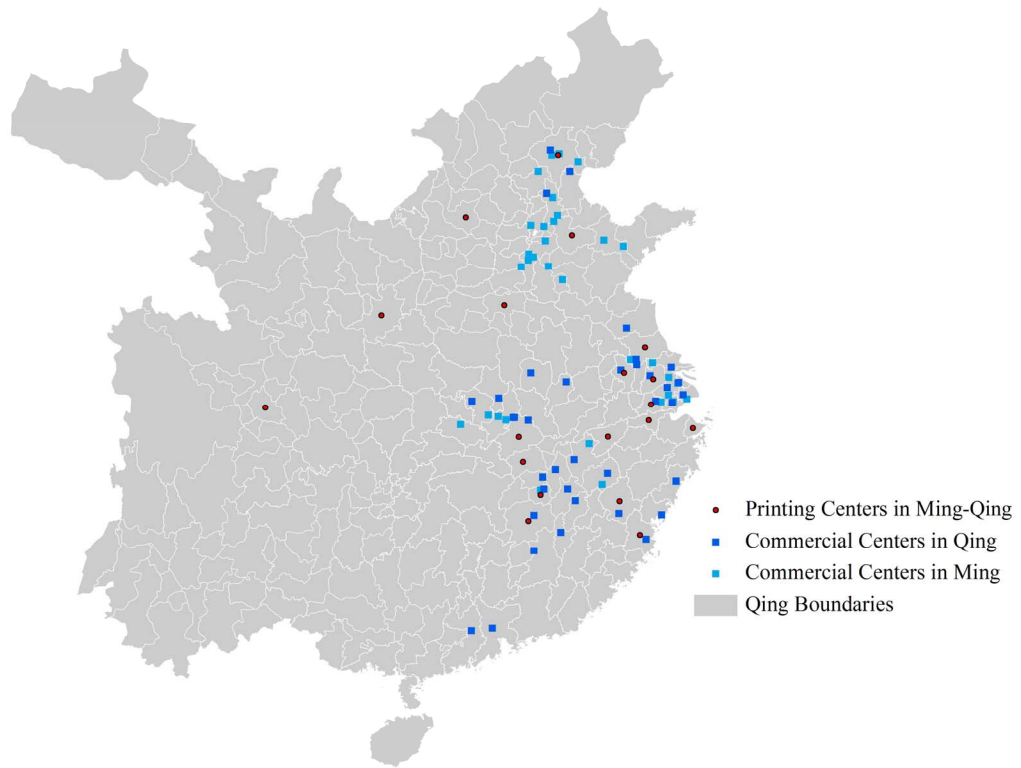


Figure A4. The Geographic Distribution of Printing Centers and Commercial Centers in Ming-Qing Period



Figure A5. The Geographic Distribution of Education Norms in 2006