COTTON REVOLUTION AND WIDOW CHASTITY IN MING AND QING CHINA[1]

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Abstract

Widow chastity in China's history is regarded as the outcome of traditional thoughts of Confucianism. The study examines how economic factors play key roles in the formation of a cultural tradition by studying the causality between the technological progress of cotton textile industry and the increase of widow chastity between Ming and Qing dynasties. We find that compared to those in non-cotton areas, widow chastity significantly increased in traditional cotton areas by 38 percent. This result is robust when we address issues of selection effects, and alternative economic and cultural channels that may influence widow chastity.

Key words: Cotton revolution; Widow chastity; Economic rationality; Confucianism

JEL Codes: *D1; N5*

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1. Introduction

The formation and persistence of culture have become increasingly exciting areas in the field of economics. Several studies document the evolution and transmission of gender roles, norms (Alesina et al., 2013; Hansen et al., 2015; Giuliano and Nunn, 2017), and social capital (trust) (Guiso et al., 2008, 2016; Durante, 2009; Nunn and Wantchekon, 2011; Lowes et al., 2017). Historical events, such as natural disasters, technological advances, social movements, revolutions, and wars, play key roles in cultural evolution. Most studies focus on cultural traits that appear in many cultures, such as the preference for boys over girls, polygamy, religious beliefs, trust, and trustworthiness. Compared with other cultures, in Chinese history, the widespread and long-lasting tradition of widow chastity has been more popular. This tradition is usually regarded as a unique outcome of Confucianism, but its origin has rarely been discussed in economic studies.

Why is chastity culture popular in China? Does chastity represent a unique feature of Chinese culture or, specifically, a unique environment of cultural evolution? According to Chang (1999), the invasion and conquest of Mongolia in the 13th century and the technological progress of the cotton industry in the late Ming and early Qing Dynasties represent key events in the proliferation of widow chastity. Specifically, the Mongolian conquest lay a foundation for the chastity tradition from an institutional perspective because *Han* widows could only choose between preserving chastity and remarrying their late husbands' brothers to maintain ownership of the family's assets. Furthermore, the cotton revolution provided widows with materials for their widowhood from an economic perspective. In addition to traditional food production, during the late Ming and early Qing Dynasties, cotton textile was both suitable for women's physical characteristics and could earn a sufficient amount of money to meet the basic demand for a living. Thus, the Mongolian invasion rendered widow

chastity necessary, and the cotton revolution enabled widow chastity.

Since the seminal work conducted by Becker (1973), economic theory has been well applied to analyzing social questions regarding marriage, divorce, remarriage, and polygamy (Becker, 1990; Becker and Murphy, 2000). The rationale underlying the formation of the family is based on the presumption that the benefits of marriage are greater than those of being single or living together without formal marriage. In marriage, the males' higher incomes tend to support the division of labor between males and females such that the husbands work outside the home, while the wives work at home. In contrast, due to improvement in women's education and incomes, women are more likely to seek employment rather than remain at home as housewives. This trend has delayed marriage and increased women's tendencies to remain single. This hypothesis has been empirically supported by an aggregate analysis performed in the US (Cready et al., 1997; Lichter et al., 1991; Preston and Richards, 1975), which showed a correlation between the lower rate of marriage and the higher employment rate among females.

Becker considered marriage an investment; thus, women's marriage decisions heavily depend on the tradeoff between its costs and benefits. This conjecture has been confirmed by an analysis of women's marriage behaviors in European history. Hajnal (1965) first discovered the European marriage pattern (EMP) during the late medieval period; west of the line between St. Petersburg and Trieste, women's marriage rates were low, a significant proportion of women remained celibate, and even those who married chose to marry late and had a low fertility rate. The EMP not only accelerated economic development in Northwestern Europe but also laid a foundation for the industrial revolution by facilitating human capital accumulation (De Moor and Van Zanden, 2010; Voigtländer and Voth, 2013; Foreman-Peck and Zhou, 2014). The institutional reason underlying the EMP is that in most Northwestern European countries, daughters have inheritance rights that are similar to their brothers' regardless of whether they marry, whereas in Southern Europe, women

can only transfer property if they marry. Another important reason is that after the Black Death, the labor market rose, providing sufficient economic conditions to women who remained single (De Moor and Van Zanden, 2010; Voigtländer and Voth, 2013).

A similar mechanism also exists in widows' remarriage behaviors. Brien et al. (2004) found that most widows remarried after the age of 60 years before 1979 because of the punitive provision on widows' remarriage in the Canadian pension system. Baker et al. (2004) also found that these provisions on widows' remarriage negatively affected their remarriage rate. Salisbury (2017) recently analyzed the remarriage behaviors of the widows of the soldiers killed in the US Civil War using the Civil War Pension Act enacted in 1862, which states that once widows of soldiers remarry, they are no longer qualified to obtain a pension. Following the Civil War Pension Act, the probability of widows remarrying decreased by 25 percent, and the duration between their husbands' death and their remarriage extended by 3.5 years.

In contrast, widows who are financially independent are not highly concerned about remarriage. In addition, in Medieval Europe, particularly in England, a woman could request asset transfer from her husband after marriage; after the husband died, the widow's right to the assets remained legally secured and even consuetude. The wife's assets could account for more than one third or even half of the total assets, and she could be entitled to the assets under the testament. This institution rendered widows more financially independent, and if they are more competitive in the marriage market, these widows' remarriage rate can increase (Hanawalt, 1986, 1993; Bennett, 1981). However, once the widow remarried, the ownership of the assets was transferred to her husband; thus, on average, rich widows were less likely to remarry than other widows (Todd, 1985).

Other studies have shown that women's increased financial capability improves their social status and sex ratio. Qian (2008) used the differences-in-differences (DID) method and found that the sex ratio of males to females

decreased, but educational attainment significantly increased in tea production areas during the economic reform that began in 1979. Xue (2014) found that in areas where textile industries were developed in China during the 13th century, women have a higher social status and a balanced sex ratio compared to women in areas where the textile industries were underdeveloped. Alesina et al. (2013) found that regions where plow was traditionally used in agricultural production currently have less equal gender norms and less female participation in the workplace, politics, and entrepreneurial activities. Thus, the development of industries that demand more female laborers improves the social status of women, and women become less likely to depend on their husbands. Particularly in conservative societies, such as those in the Ming and Qing Dynasties in China when Confucianism was dominant, whether widows remained unmarried (widow chastity) was influenced by their financial capability.

Using panel data of prefectures in the Ming and Qing Dynasties, this paper applies the DID method to identify the effect of cotton adoption on the existence of chaste widows in a society dominated by Confucianism and tests the interaction effects of cotton adoption and the Confucian culture. Our study's contribution is that within the economic framework, we successfully isolate the economic factors explaining the existence of widows from the influence of Confucianism. This study is similar to studies investigating widows in Western societies but explores different constraints.

This paper is organized into seven sections. Section two summarizes the historical background of institutional change and technological progress of the cotton textile industry. Section three presents the datasets and theoretical and empirical models. Section four presents the empirical results and the results of the robustness tests, placebo test, falsification test, and instrumental variable estimation. Section six further discusses the impact of Confucianism, culture, religion and bandwagon effects on widowhood. The final section presents the conclusions.

2. Historical background

2.1 Institutional background of widow chastity

Widow chastity appeared in China's history as a result of traditional Confucian ethics. "The three guidelines and five rules"[2] and "the three compliances and four virtues"[3] were followed extensively in China, leading to the institution of "Honor widow chastity". Despite the existence of this institution, lifetime widowhood was rare, and remarriage was common before the Ming Dynasty. According to the *New Book of Tang* and the *Tang Huiyao*, more than one-fifth of Tang Dynasty princesses remarried after their husbands passed away.[4] Thus, most Chinese individuals did not conform to the norm under traditional Confucianism. However, since the Song and Yuan Dynasties, the number of widows who did not remarry has dramatically increased.

According to the traditional perspective, the popularity of widow chastity was highly influenced by Neo-Confucianism during the Song Dynasty. Confucian representatives, including *Yi Cheng* and *Xi Zhu*, advocated for the "maintenance of justice at the expense of human desire" and the idea that "starvation is trivial while disloyalty is serious", thereby considering remarriage a severe act of betrayal. These theories ignore the economic factors that play significant roles in this culture's formation and evolution. Holmgren (1985) and Chang (1999) explored the levirate tradition in Mongolian ethnics and drew evidence from the Yuan Dynasty.[5] During the Yuan Dynasty, due to the

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[2] The three guidelines posit that the monarch guides the ministers, the father guides the children, and the husband guides the wife. The five rules include benevolence, righteousness, propriety, wisdom and trust.

[3] The three compliances advocate that before marriage, a girl must follow her father's guidance; after marriage, the wife must follow her husband's guidance; and if the husband dies, the widow must follow her son's guidance. The four virtues include the virtues to be a woman, a woman's words, a woman's capability and a woman's honor.

[4] During the Tang Dynasty, 134 princesses have married, 25 of which have married twice, three of which have married three times and one of which has married four times.

[5] The husband's family took charge of the widow's remarriage. This process could be categorized as remarriage with the same or upper generation. For example, the former

Mongolian takeover and domination of the nomadic people in China, the Yuan government stipulated that after marriage, women's rights and assets would transfer from their parents to their husbands' families and that even after the husbands' deaths, the husbands' families would retain control over the wives' assets. Mongolia implemented the levirate primarily due to economic reasons. Because nomadic families are highly mobile, the husband's family would suffer severe economic losses if a widow remarried a man outside the tribe with her late husband's assets. Hence, if a Mongolian widow remarried or returned to her parents' family, she would lose ownership of her assets, including the guardianship of her children. However, the Han population resisted this levirate system, forcing the government to compromise; thus, a Han widow would not be required to remarry within her husband's family or to anyone (Holmgren, 1985, 1986; Birge, 1995; Chang, 1999).

In the Ming and Qing Dynasties, to maintain social order, rulers instituted a portfolio of social regulations inspired by Neo-Confucianism and Mongolian society. For example, Emperor *Yuanzhang Zhu* enacted a government policy honoring widows who became widowed before the age 30 years and did not remarry for more than 20 years. He also followed Yuan's inheritance law that stated that a remarried widow waived the right to inherit her husband's assets. During the Qing Dynasty, the duration during which the government honored widows was shortened to 15 years; in 1824, the duration was reduced to one decade, and in 1871, it was reduced to six years (Shen, 1936; Tien, 1988; Chang, 1999). The positive attitude toward widow chastity in the mainstream ideology and propaganda might have led to the observed increase in widows who did not remarry in the Ming and Qing Dynasties. However, even though the government encouraged widow chastity, widows were not forbidden from remarrying. More

indicated that after the elder brother died, the sister-in-law would be remarried to the younger brother, and if the younger brother died, the sister-in-law would be remarried to the elder brother; the latter indicated that after the father died, the mother would be remarried to the son born by the father with another wife; if the uncle died, the aunt would be remarried to the nephew. A summary of this remarriage system can be found in Guo (2000).

importantly, widow chastity was not rewarded in kind or cash. Even though a chaste widow's family was exempt from labor services, such a privilege would not materialize until at least 10 years after a widow lost her husband, i.e., the time when the government could honor her widow chastity.[6]

Consequently, widow chastity resulted in social esteem but not material or economic supports. Furthermore, a widow continued to face financial burdens and was more likely to be trapped in poverty because she had to take care of her dependents, including elders and children, during her widowhood. Obviously, the government and society's encouragement of long-term widowhood and the government-issued honors could not solve the financial constraints of widows; thus, these mechanisms are not convincing explanations of the tremendous growth in the number of widows who were not remarried. Based on the findings in the lower reaches of the Yangtze River by Li (1998), Chang (1999) hypothesized the following mechanism by which cotton's adoption affected widows' welfare: the cotton sector's rapid development since the middle of the Ming Dynasty rendered more widows capable of earning their living necessities.

2.2 Cotton revolution and women's financial capabilities

In general, widows in the Ming and Qing Dynasties secured their livelihoods by inheriting their husbands' assets and their own incomes. Inheritance only appeared among wealthy families, and widows were able to take over the assets only on their children's behalf, i.e., they did not have the right to directly inherit. Furthermore, other relatives in the family may force the widow to remarry to maintain the assets within the husband's family. If the husband's family was not very rich, the widow could not depend on the

[6] In the Qing Dynasty, the prize honoring widow chastity was as follows: the local government paid thirty *liang* (tael) silver coins to build a memorial gateway for widow chastity; the family was exempt from servitude and offered grain crops in kind in the event of a natural disaster. However, these incentives hardly improved the widow's well-being in normal times.

husband's assets. Most widows had to work in spinning, agriculture, housekeeping, and small businesses. The left panel in Figure 1 shows the change in widow chastity from the Ming to Qing Dynasties by prefecture. An increase in widow chastity is observed from the Ming to Qing Dynasties. However, the rapid growth of widow chastity during the Qing Dynasty cannot be solely explained by Confucianism's influence. Following Chang (1999), we test the hypothesis that the factors that improved widows' financial capability contributed to the increase in widow chastity.

The Cotton Revolution during the mid-Ming Dynasty refers to the rapid introduction of cotton production and the development of the textile handcraft industry (Chang, 1999). Until the early stage of the Qing Dynasty, the textile sector had evolved from sideline production within a rural family (cottage) to commercialized or even mainline production due to the significant technological progress at the end of the Ming Dynasty and the early stage of the Qing Dynasty (Li, 1998). The second panel in Figure 1 shows that approximately one-fifth of China, clustered along the Yangtze River and *Huang-Huai-Hai* plain, is suitable for cotton production. According to the Complete Works on Agriculture published during the Ming Dynasty (Xu, 1930), spinning machines with four or five axes appeared in Southeast China at the end of the Ming Dynasty. Until the Qing Dynasty, spinning machines, which could produce 0.5 kg of cotton per day, were widely used (Li, 1998).

Even in the Song and Yuan Dynasties, the spinning sector had already experienced significant technological progress. *Daopo Huang* from *Wunijing* Town in *Songjiang* Prefecture applied "defend, flick, spin and weave" to rolling carts, arches, spinning machines and weaving machines and techniques, such as mixing different colored threads, to form a picture. The weaving machine was invented by *Daopo Huang* four hundred years before the ginning machine was invented by Whitney in the US. This invention transformed Songjiang Prefecture into the center of the textile industry in the Yuan, Ming, and Qing Dynasties. Subsequently, sea ban (1371-1567) in the Ming Dynasty were lifted

to promote the textile sector's development. Following porcelain and silk, cotton was the third most important product exported to Europe, Japan, and Southeast Asia. Moreover, as proof of cotton production's commercialization, 15 to 20 million *pi* of cotton cloth were consumed annually by the government alone during the *Wanli* era (1573-1620) of the Ming Dynasty (Yan, 1955).

Due to the technological progress in the cotton textile sector, textile's share in the total value term of exchanged products reached 27 percent, while that of grain crops and silk were approximately 40 and 7 percent, respectively. More than half of cotton textile products entered the market (Wu and Xu, 1985). The cotton textile commercialization also improved women's financial capability. Pomeranz (2005) estimated that for a farmer who cultivated rice and wheat on land at 0.67 ha (10 *mu*), the agricultural production profit was equivalent to 14 *shi* (1 *shi* = 100 *jin*) of rice. One rural laborer who worked 200 days per year could only earn less than 5 *shi* of rice. However, one female textile worker could earn more than 7 *shi* of rice. During that time, the probability of women working in the cotton textile sector increased; thus, the role of women in their families changed from working at home to working outside the home and financially supporting their families. This change also allowed widow chastity to become a feasible choice for widows. Figure 2 presents the uptrend in widow chastity between the Ming and Qing Dynasties; the mean widow chastity in traditional cotton planted areas increased faster than that in non-cotton areas.

However, male productivity in the cotton textile sector is not lower than that of females. In addition, females were capable of working in other sectors, such as the linen, jute, hemp, ramie, and silk textile sectors. Males worked more efficiently than females because males could handle more labor-intensive work and males were more skilled than females, e.g., traditionally, only males inherited weaving techniques (Li, 1998). However, due to the technological progress at the end of the Ming Dynasty, women could work more efficiently, and men's comparative advantage diminished. Males began to play an important role in agricultural production and work as secondary laborers in the cotton

textile sector during the agricultural production off seasons. Even though the linen and silk textile sectors were important during the Ming and Qing Dynasties, the status of females in these two sectors could not explain the increase in widow chastity. Before the Yuan and Ming Dynasties, silk and linen were important materials for cloth, but the price of silk was high, and silk production was highly specialized. Silk production transitioned from rural families to manual workshops, and widows were hardly able to engage in silk production. Regarding linen production, linen's added value was low, and incomes from linen production were not sufficiently large to secure a family's livelihood (Li, 1998; Chang, 1999).

3. Models and data source

3.1 Models

This paper aims to find the economic mechanism explaining the variation in the numbers of widow chastity in a society dominated by Confucianism. Our main theme is that the improvement in women's work efficiency, which was supported by the technological progress in the cotton textile sector, provided better income opportunities for women to secure their livelihood; this change enabled widow chastity once the husband died. In particular, we test two hypotheses related to the rapid increase in widow chastity (Chang, 1999). One hypothesis posits that the rapid increase in widow chastity after the Yuan Dynasty could be explained by the transition of asset inheritance customs and the technological progress in the cotton textile sector that occurred at the end of the Song Dynasty. The other hypothesis posits that the large difference in widows' choice to pursue chastity between the Ming and Qing Dynasties was mainly the result of technological progress in the textile sector and the specialization in agricultural and textile production. To test the second hypothesis, this paper applies the DID model to explore the factors that explain the difference in widow chastity between the Ming and Qing Dynasties. Then, using the widow chastity number in the Song Dynasty as the baseline, we test

the common trend using the variation in the widow chastity numbers in the Yuan Dynasty.

The estimation model is described as follows:

$$lnrjf_{ic} = \alpha + \beta_0 t_c + \beta_1 cotton_i + \beta_2 t_c * cotton_i + \mathbf{Z}_{ic}\gamma + \mu_{ic} \quad (1)$$

where the dependent variable is $lnrjf_{ic}$, which is defined as the log form of the widow chastity number per 10 thousand people during period c in i prefecture; t_c is a dummy variable representing the dynasty, where 0 represents the Ming Dynasty, and 1 represents the Qing dynasty; and $cotton_i$ represents whether cotton production occurred in i prefecture (1 = yes; 0 = no). The interaction term $t_c * cotton_i$ captures the effect of textile sector development from the Ming to Qing Dynasties on widow chastity; $\mathbf{Z}_{ic}$ is a vector of the control variables, including the proxies of Confucianism and geographical characteristics; and μ_{ic} is the error term. The control variables include the prefecture dummy variables, the quota of imperial examination per 10 thousand persons, and the log form of the numbers of shrines and temples per 10 thousand persons; the geographical variables include the prefectures' average areas, elevations, slopes, longitudes, and latitudes.

We also conduct a series of robustness tests. First, to test why widow chastity increased rapidly in the Qing Dynasty, we conduct a common trend test using the data prior to the Qing Dynasty. Second, to address the selection effects on widows and widow chastity, we use the distance to Beijing, distance to the provincial capital, maize planted in 2000, and frequency of conflicts and natural calamities as the control variables. Third, to test whether technological progress in the cotton textile sector or Confucianism's influence had an impact on the growth of widow chastity, we also conduct placebo tests and falsification tests. Finally, we discuss Confucianism and other religious effects on widow chastity.

3.2 Data sources

The key dependent variable is the widow chastity number (and its change between the Ming and Qing Dynasties). Furthermore, we use the number of dead widows in the falsification tests. The cotton production indicator is constructed based on whether cotton was produced in the prefecture (or province). In the placebo tests, we choose whether the area also produced silk, linen and tea. To test Confucianism's effect on widow chastity, we use the quota of imperial examination, the number of colleagues, and the number of shrines and temples, which represent the influence of Confucianism and religion. All data, including more than 84 thousand records of famous females, are manually derived from the "Compilation of the Qing Dynasty Revised in Jiaqing's Reign" by Guwargiya et al. (2008).[7]

Population data from 1820 were also obtained from Cao (2001) at the prefectural level to normalize the key dependent and independent variables per 10 thousand persons and the population density.[8] We also use geographical data obtained from The China Historical Geographic Information System (CHGIS), which was jointly developed by the Fairbank Center for Chinese Studies, Harvard University and Historical Geography Research Center of Fudan University, including the prefectures' average areas, elevations, slopes, longitudes and latitudes.[9] To test the selection bias of widow chastity, we also include distance to the provincial capital, distance to Beijing, and frequency of conflicts and natural calamities that should be fulfilled (Chen et al., 1986) (Figure 4). Finally, in the robustness tests, we select the following alternative variables of $cotton_i$: suitability for cotton planting and cotton planted, harvested

[7] This compilation was written in three series for the Kangxi, Qianlong and Jiaqing reigns. The final one, which was revised under Jiaqing's reign, includes 560 volumes (Figure 3). The compilation began in 1812 and was completed during the 22nd year of Daoguang's reign in 1842. All information is updated to the year 1820.

[8] This book also provides the population at the prefectural level in 1776. We also use this variable to normalize the key variables, and the results did not differ. Our study's limitation is that the prefectures' boundaries in the Ming and Qing Dynasties may differ; however, we only use the population from the Qing Dynasty to normalize the data during the Ming Dynasty. This calculation may lead to certain bias in the results.

[9] The data are available at http://www.fas.harvard.edu/~chgis/, and we use the version published in April 2007.

and produced in 2000; these data were obtained from the data platform of the Food and Agricultural Organization of the United Nations[10]. The descriptive statistics of the variables are presented in Table 1.

4. Empirical results

This section presents the empirical results. The main results are shown in Table 2. The results show that the coefficients of the cotton-Qing interaction term are positive and statistically significant, and the coefficient magnitudes are stable across the specifications. The first differenced specifications also showed qualitatively similar results. Interestingly, the widow chastity number in the cotton production areas was low in the Ming Dynasty, but the number significantly increased from the Ming to Qing Dynasties. Without the cotton revolution, the widow chastity number could have remained low in the cotton production areas. However, the total widow chastity number in the Ming and Qing Dynasties in the cotton production areas was 22.5 percent greater than that in the non-cotton production areas. In addition, the change in widow chastity from the Ming to Qing Dynasties in the cotton areas was larger than that in the non-cotton areas by 38 percent, and this result is statistically significant. Therefore, the growth rate of the widow chastity number was high in the cotton production areas in the Qing Dynasty.

Except for the number of shrines, prefecture's capital, and longitude, the control variables are not statistically significant. The positive coefficient of the number of shrines indicates that traditional culture had a positive and statistically significant impact on the widow chastity number. The longitude coefficient shows that a difference existed in the widow chastity number between Eastern and Western China.

5. Robustness tests

[10] The data are available at http://www.fao.org/nr/gaez/about-data-portal/agricultural-suitability-and-potential-yields/en/

5.1 Common trend test

DID estimations assume that a common trend is shared between the treatment and control groups; thus, without the treatment, the common trend in the treatment and control groups should be consistent, allowing for the determination of whether the differences between the treatment and control groups are caused by the treatment, i.e., the cotton revolution. In empirical studies testing the common trend, the trend between the treatment and control groups before the treatment's occurrence is widely used. If the estimated coefficient of the common trend between the treatment and control groups is statistically insignificant, the common trend exists between the treatment and control groups prior to the treatment. Thus, we test the difference in the widow chastity number across the dynasties before the Qing Dynasty. Specifically, we test the differences between during and before the Ming Dynasty, during and before the Yuan Dynasty, between the Ming and Yuan Dynasties, and between the Yuan and Song Dynasties. The strategy is chosen because the commercialization of the cotton textile sector began during the end of the Ming Dynasty and the early stage of the Qing Dynasty; thus, no significant changes occurred in the textile sector during the Ming, Yuan and other Dynasties. Therefore, the widow chastity number is not expected to change before the end of the Ming Dynasty and after the early stage of the Qing Dynasty. Furthermore, we test whether the marriage system and development of the textile sector during the Song and Yuan Dynasties affected the widow chastity number.

Table 3 presents the results of the common trend tests among the four groups. The results shown in Columns 1-3 explicitly illustrate that the common tests are valid. The indicator of the cotton textile production prefectures does not have a statistically significant impact on the widow chastity number. The coefficient of textile production is statistically significant between the Yuan and Song Dynasties, suggesting that the technological progress between the two dynasties could explain the variation in the widow chastity number. Thus, the reform of marriage assets and weaving innovation by *Daopo* Huang during the

Yuan Dynasty led to the increase in the widow chastity number between the two dynasties. However, the widow chastity number did not increase as much between the Song to Yuan Dynasties, partially because the Yuan Dynasty lasted only 97 years.

In the cotton textile sector, the weaving innovation by *Daopo Huang* was a necessary but not sufficient condition for the evolution of textile commercialization. However, other external conditions, such as cotton seeds, domestic demand and international trade of cotton and textile, are also necessary for textile commercialization. Furthermore, decades or centuries were required for the effect of asset inheritance in the marriage system during the Yuan Dynasty on the existence of widow chastity to weaken. The period of the Yuan Dynasty, which is less than a century, could not fully absorb the impact of the innovation in the textile sector and the reform of asset inheritance in marriage. During the Ming Dynasty (1371-1567), international trade was boycotted. The stagnation of international trade until the early seventeenth century ended after the boycott policy was lifted[11], but at that time, the Ming Dynasty was already in its twilight, and capitalism's prototype did not evolve into an industrial revolution.

5.2 Selection of widow chastity

The nomination for widow chastity should be performed by the husbands' clan or local gentries; then, the central government honored widow chastity upon the submission of applications by the local authorities. Even though the Qing government was more likely to approve widow chastity, not all widows could be honored. In fact, widow chastity was mainly selected from families in either rich areas or areas with better geographical positions (Guo, 2000). Widows who resided in remote areas or originated from poor families in poor areas were less likely to be honored with widow chastity. The variable

[11] Both emperor Shunzhi and Kangxi imposed "sea bans" in 1655 and 1716, respectively, but the restriction was subsequently lifted in 1683 by Kangxi and 1727 by Yongzheng. Even during the ban, the policy was not implemented restrictively.

representing cotton production could capture the selection effects of widow chastity; therefore, this variable may lead to bias. To solve this problem, we use the following two types of variables to explore the variation in widow chastity selection: the economic index–agricultural productivity proxied by the agricultural tax revenue per capita and a vector of geographical variables, including the distance between the prefecture seat to the capital of China (Beijing) and the distance between the prefecture seat to the province's capital city. These variables are included as additional controls.

Column 1 in Table 4 presents the results after controlling for agricultural tax revenue per capita, the distance between the prefecture seat and the province's capital city, and the interaction terms between these variables and the Qing Dynasty dummies. The coefficient of the interaction term between the agricultural tax revenue per capita and the Qing Dynasty dummy is positive and statistically significant. Thus, we conclude that first, rural income has a positive impact on the widow chastity number, and second, widows residing in rich regions enjoyed better financial capacity. The coefficients of the interaction terms between the geographical variables and the Qing Dynasty dummy are negative, indicating that the widow chastity number decreases with remoteness. However, the distance variables also capture the income gaps across regions. After controlling for all three variables and the interaction terms, the magnitude of the coefficient decreases on the interaction term between cotton production and the Qing Dynasty dummy. This result is possible because the income variable and distance measures capture part of the effects of the evolution of cotton textile in the following two dimensions: labor productivity is higher in more developed regions and cotton production is more specialized in developed regions. Thus, women's status in the cotton textile sector was more important. The coefficient of the interaction term of the Qing Dynasty dummy and cotton production remains significant (5 percent), indicating that cotton production can explain the regional difference in the observed increase in the widow chastity numbers even after considering the selection effects of widow chastity and

regional income effects.

Second, the regional differences in the male mortality rate can cause selectivity bias if the number of widows is affected by the mortality rate (even though the proportion of widow chastity is the same). Thus, if the observed regional differences in widow chastity could have resulted from the differences in the number of widows caused by the unobserved factors that determined male mortality (thus, the number of widows), the parameter of interest could be biased. Such factors include the introduction of high-yielding crops (increasing nutrition intake) and the frequency and intensity of wars and conflicts (directly increasing the mortality rate). We use maize planted in 2000 to proxy the maize planted during the early Qing Dynasty when the rapid population growth was explained by the spread of the maize plant (Chen and Kung, 2016). We also use the frequency of conflicts and natural calamities to control for their effects on the male mortality rate.[12]

Column 2 in Table 4 shows that the effect of maize planted is significantly negative, suggesting that maize's introduction might have lowered the widow chastity number by lowering the male mortality rate during the Qing Dynasty. The numbers of conflicts and natural calamities have significant positive effects, indicating that the male mortality rate increased with wars and natural calamities; therefore, the number of widows also increased. Despite the significant effects of the previous factors on the chastity number, the interaction term of the Qing Dynasty and cotton production dummies remains significant (1 percent). Therefore, our main results are robust against the population growth effect and male mortality effect, which may potentially and directly affect the widow chastity number.

5.3 Placebo test and falsification test

The previous estimates indicate that cotton textile production led to an

[12] Wars and natural calamities also affect the female mortality rate, rending the total effect on the number of widows ambiguous once combined with the effect on the male mortality rate.

increase in the widow chastity number. However, cotton production also helped grow the local economy and increased the average income, both of which could have increased the probability of widow chastity. Another potential cause could be that women were capable of working in industries others than cotton textile production even in cotton production areas, enabling them to earn enough to independently support their families. To further test whether the development of cotton textile production in which women played a more important role had an effect on the increase in widow chastity, we also conduct placebo tests. Thus, we analyze the evolution of other crop productions, such as linen, silk and tea, and their effects on the widow chastity number.

Existing studies confirm that linen production had a small value that was insufficient for a widow to support a family. However, silk prices were higher, and silk production was more specialized. Silk production shifted from the rural area to the city before the Qing Dynasty. Therefore, women in rural areas were hardly engaged in silk production. Tea was a type of cash crop in which women tended to specialize, but the technological progress in tea production was insignificant between the Ming and Qing Dynasties.

Our results are consistent with the hypothesis that the production of these three crops did not have a significant impact on the widow chastity number between the Ming and Qing Dynasties. Column 3 in Table 4 presents the results of the specification, including all three crops combined. The coefficients of the interaction terms between the production of the three crops and the Qing Dynasty dummy are not statistically significant (10 percent). Thus, even though women could specialize in the production of the three alternative crops, the evolution of their production did not have a significant impact on the increase in widow chastity between the Ming and Qing Dynasties.

Furthermore, there is a possibility that women from rich families were more likely to comply with Confucianism's common rules.[13] To test this hypothesis,

[13] Women from noble families or the courtier class held this opinion. Guo (1987) explored 50 genealogies and found only one case in courtier families in which the widow

we conduct falsification tests to analyze the effect of textile production on widow chastity and the number of widows who committed suicide. The objective of including the number of widow suicides was to assess whether the development of cotton textile production had any effect on widow suicide. Did the overall effect of cotton production on the widow chastity number change accordingly?

Columns 4-5 in Table 4 report the impact of the technological progress in cotton textile production on the number of widow suicides and the chastity and suicide numbers combined. The technological effect on the number of widow suicides is not statistically significant (Column 4), while its effect on the widow chastity number and suicide combined remains positive and statistically significant (Column 5). These results are consistent with the hypothesis that the cotton textile sector's development affects the rational behavior of widows pursing widow chastity instead of committing suicide but failed to support the possibility that the cotton textile sector's development decreases the number of widow suicides by improving widows' economic prospects.

Overall, our finding are consistent with the opinion expressed by the emperors during the Qing Dynasty. For example, both Kangxi (1654-1722) and Yongzheng (1678-1735) had reservations regarding widow suicide but honored widow chastity on several official occasions. The Yongzheng Emperor often commented on the two behaviors, i.e., widow chastity and widow suicide, and encouraged the former. For example, he said that "the widow commit[ing] the suicide…she should be responsible for the family after the death of the husband…and she should not absolve her responsibility by committing suicide" (Records Commission, 1985). He did not honor widow suicide, which to him was irresponsible. He also maintained a conservative opinion regarding widow chastity for those widows under the Eight Banners (Manchurian families). For example, he said "If Banner widows are young, childless and without clansmen,

remarried. Ju (2001) also examined 46 genealogies and found that among 5277 women, more than a quarter (1263 women) were widows.

it is not beneficial to them to maintain widow chastity" (Aisingoro et al., 1976). The reason is that once a banner widow chose to maintain her widow chastity, her expense would be covered by the government. To reduce the cost of widow chastity, the government should decide whether to allow the widow to maintain her chastity. In contrast, a Han widow whose expenses were not covered by the government was free to maintain her chastity.

5.4 Alternative measures

The cotton production variable is a dummy, whose quality was checked during the data entry process. However, the data source is the "Geographical and Biographical Chronicles of the Great Qing Dynasty", which is based on each county's documentary book; thus, data could be missing. Moreover, reverse causality could exist. For example, if the widow chastity number increased, the investment in human capital useful in cotton textile production was promoted, which contributed to the cotton textile sector's development. To solve endogeneity, we further adopt alternative measures representing the suitability, plant, production, and harvest of cotton production in 2000 (Figure 5). Figure 6 indicates positive correlations between the four alternative variables and the change in widow chastity.

Table 5 presents the Pearson correlations between the alternative cotton variables and the cotton dummy variable. Five variables are significantly correlated at the 1 percent level, indicating that our key independent variable of cotton production is validated by the current planting and production of cotton. To prove the robustness of the estimates shown in Table 2, we substitute the four alternative variables for the cotton dummy. Columns 1-4 in Table 6 report the effects of the four new cotton variables on the increase in widow chastity between the Ming and Qing Dynasties, and the results suggest that all variables are significantly positive at the 1 percent level, supporting the hypothesis that cotton production's evolution was a main contributor to the increased widow chastity number.

5.5 Endogeneity issues

In addition to widow chastity selection effects, endogeneity problems could arise due to the following: omitted variables, which could be addressed by the DID method, and measurement errors. Textile production is a dummy variable, whose quality has been checked during the data entry process. However, the data source is the "Compilation of the Qing Dynasty", which is based on each prefecture's documentary book; thus, data could be missing. Moreover, reverse causality could exist. For example, the widow chastity number increased, promoting the investment in human capital in textile production, thereby improving textile production. To solve endogeneity, we further estimate using an IV strategy with two variables, i.e., climate and geographical characteristics, as instrumental variables.

First, cotton originated in subtropical regions and was adapted to dry, hot and sunny regions. In China, cotton generally requires an annual accumulated temperature above 10 at 3300 C and above. Based on cotton's adaptation, we established data proxied by the ecological condition. We used ArcGIS and obtained the dummy temperature variable by prefecture (1 = above 3300; 0 = otherwise). Furthermore, cotton could be extensively planted between 25 south latitude and north latitude 42'30, i.e., nearly all provinces, except for those in Northeast China. To explore the regional difference in textile production's development, we use another geographical variable, i.e., the distance between the prefecture seat and *Songjiang*'s capital. This variable is used to capture cotton production's development according to the spatial distance to *Songjiang* because *Daopo Huang*, who was from *Songjiang*, contributed significantly to cotton production's technology. Regarding *Songjiang*'s important role in textile production's evolution, the regional difference in textile production could be captured by the region's distance to *Songjiang*. If the region is further from *Songjiang*, its textile production is less developed, and vice versa.

Columns 5 and 6 in Table 6 present the 2SLS estimates of two sets of

instrumental variables. The results report the estimates' second stage. Our results indicate that the coefficients of the two sets of instrumental variables are statistically significant, and the impacts are consistent with our expectation. The coefficient of the interacted term of cotton production and the dynasty dummy is positive, suggesting that economic factors promoted the increase in widow chastity after controlling for endogeneity. Furthermore, we test the validity of the IVs. First, the p-value of the IV overidentification (Hansen test) is 0.22, indicating that we cannot reject the h0 hypothesis positing that IV is an exogenous variable. Second, the Kleibergen-Paap rk LM test result is 11.38, and the underidentification cannot be accepted. Third, the F value of Kleibergen-Paap rk Wald is 6.196; thus, the h0 hypothesis of weak IV cannot be rejected at the 10% statistical level. To solve the weak IV problem, we also use limited information maximum likelihood (LIML) (Staigner and Stock, 1997; Stock and Yogo, 2005). The test of weak IV was not statistically significant at the 10% level, suggesting that a weak IV does not exist. The results estimated by LIML and 2SLS are consistent and better (larger magnitudes of the coefficients compared to those in OLS), suggesting that textile production's effects in OLS may be underestimated.

6. Cultural influence or "bandwagon effect"?

Since the influence of economic rationality cannot be ignored in widow chastity behavior, could traditional culture also exert the same influence? Four variables are used in this section to reflect the possible cultural impacts imposed by different social factors. The following three variables measure Confucianism's effect: the average quota of imperial examination, the number of academies of classical learning, and the number of ancestral halls per ten thousand population (representing official influence, non-official influence and folk-custom influence of Confucianism, respectively). The following final variable measures the influence of Buddhism and Taoism: the number of temples per ten thousand population. We estimate the interaction effects of each

of these variables with the Qing Dynasty dummy to determine the level and direction of the effects imposed by these social factors. Simultaneously, we include the interaction term of cotton production and the Qing Dynasty. As shown in Columns 1-5 in Table 7, even after controlling for the cultural variables, the key result remains robust. Despite the coexistence of cultural influences, the cotton revolution continues to hold considerable importance.

Among the cultural variables, the interaction term (column 1) of the number of academies of classical learning (representing the non-official influence of Confucianism) and the Qing Dynasty dummy is significantly negative (10 percent), while the other interaction terms are insignificant. This result is not consistent with traditional thoughts and long-lasting opinions and suggests the opposite direction that Confucianism either failed to promote widow chastity behavior during the Qing Dynasty or curbed such behavior. This result shows that the Qing Dynasty did not surpass the Ming Dynasty in terms of formal or informal approaches through education that affected chastity behavior. Thus, the Confusion culture may have failed to thoroughly control the free will of the people; in contrast, women in more advanced areas where schools were more common were less likely to face traditional ethic constraints on their decision-making, including chastity.

Do factors other than economic rationality explain widow chastity? Chang (1999) stated that the "bandwagon effect" or group psychology may be another crucial factor. In this paper, we use the population density at the prefecture level to test this hypothesis (Column 5, Table 7). The significantly positive effect indicates that chastity behavior during the Qing Dynasty became more common in prefectures where the population density was high, which directly supports the previously mentioned conjecture that women might be forced to behave under pressure from their peers and the public. Meanwhile, the parameter estimate and significance level of the cotton-Qing interaction term decreased after controlling for the population density. The income effect was partially captured by the population density because the population density is also related

to the income level. From this perspective, the results support the main hypothesis as observed in Table 4, where both the income and distance variables were included as controls.

The results presented in Columns 1-4 of Table 7 show that Confucianism, Buddhism and Taoism failed to promote widow chastity behavior. Does this result lead to the conclusion that cultural developments curbed the effect of traditional ethics? To answer this question, we examine the effect of cultural factors on martyrdom behavior. Columns 6-9 estimate the effects of various cultural variables on martyrdom behavior (the number of widow suicides). We find a significant negative effect only in Column 7 (representing the non-official influence of Confucianism), confirming that cultural factors curb martyrdom behavior; furthermore, this result indirectly supports the previously discussed argument that the Qing government may discourage such behavior. Women's self-awareness may have also increased. Finally, Column 10 shows that the popular custom effect is insignificant, suggesting that during the Qing period, a social environment accepting martyrdom behavior did not exist.

7. Conclusion

Widow chastity behavior experienced dramatic growth during the Ming and Qing Dynasties, and the widow chastity number during the Qing Dynasty was ten times greater than that during the Ming Dynasty. This phenomenon has long been considered the impact of Confucian culture, which belongs to the domain of social-cultural studies, whereas in this article, we discuss the institutional background and economic roots of this phenomenon from economical perspectives. In the empirical analysis, we use the cotton producing area as a key variable to explain the change in the widow chastity number per thousand by county level using the DID method and find a significant positive relationship. In addition, the common trend test shows that these conclusions did not exist before and during the Ming Dynasty. Thus, since women's financial capabilities were enhanced by the "cotton revolution", chastity

behavior became economically more endurable; therefore, the number of widows who performed chastity behavior increased accordingly.

This article uses three additional methods to test these conclusions. In the selection effects test, we use agricultural tax revenue per capita, distance between the prefecture seat and the province's capital city, and distance between the prefecture seat and China's capital (Beijing) to control for selection effects on honored widow chastity. We also use the maize planted area in 2000 and the frequency of conflicts and natural calamities to control for selection effects on widows. Even though these effects exist, the cotton revolution continued to significantly explain the change in widow chastity between the Ming and Qing Dynasties. In the placebo test, to determine whether the cotton revolution was solely effective, we use other production activities, such as the production of linen, silk or tea as placebos, and find that the effects of these activities are all insignificant, thereby refuting the possibility of effects from these economic activities. In the falsification test, we use martyrdom statistics to investigate the effect of cotton production, which is also insignificant, suggesting that economic factors only had effects on rational behaviors, such as chastity, and had no effect on irrational behaviors, such as martyrdom. Finally, this article tests the following two additional hypotheses: cultural determinism of traditional norms and popular custom effects. Regarding the first hypothesis, we use the average quota of imperial examination, the number of academies and the number of ancestral halls shared by every ten thousand to represent Confucianism's official, non-official and folk-custom influence on chastity and martyrdom behavior and found that the impacts of these variables are either significantly positive or insignificant, suggesting that Confucianism failed to promote the growth of these behaviors. Thus, the cultural determinism hypothesis was rejected. Regarding the second hypothesis, we use the population density to represent the "popular custom effect". This effect was significantly positive, suggesting its notable influence on widow's chastity behavior, which, however, did not change our main finding regarding the impact

of the cotton revolution.

Therefore, economic theories hold a powerful explanatory ability for both historical phenomena and current events, enabling us to detect rational strength behind seemingly irrational actions. Certainly, a shortfall remains in this article due to limited conditions. First, regarding the widows' chastity behavior, although we clarified the main reasons for the change between the Ming and Qing Dynasties, the institutional change in the relationship between marriage and wealth in the Yuan Dynasty cannot be verified due to the lack of statistics, thereby failing to provide integrated evidence supporting the institutional change hypothesis. This limitation is our study's main shortfall and should be solved in future studies. Second, since great differences existed in the administrative division between the Ming and Qing Dynasties, the Ming dynasty's population statistics could not match the Qing Dynasty's administrative districts at the county level. Therefore, this article can only use population data from 1820 to construct the main variables, which may lead to an estimation bias. In fact, the shortcomings in this study are mainly related to the availability and quality of the data, which is a frequently occurring dilemma in historical economics studies. Third, although this article considers the change in official attitudes towards the behavior of commending chastity or martyrdom, we cannot investigate the magnitude effect of the commendation of chastity behavior. Finally, the empirical result in this study's final section shows that Confucianism's development negatively affected widow chastity and martyrdom, which is inconsistent with traditional explanations. However, this study also failed to provide a more persuasive explanation; therefore, this conflicting result requires further investigation.

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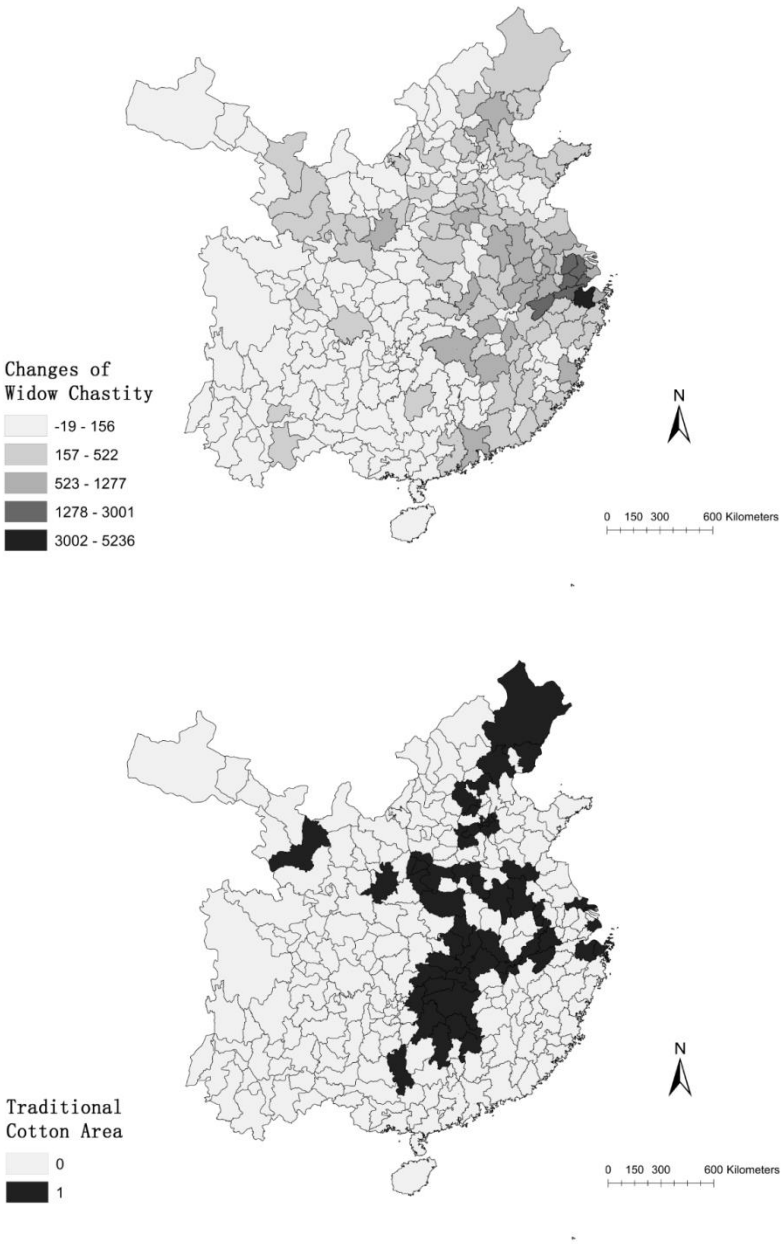


Figure 1 Changes in widow chastity and traditional cotton areas

Source: Guwargiya et al. (2008).

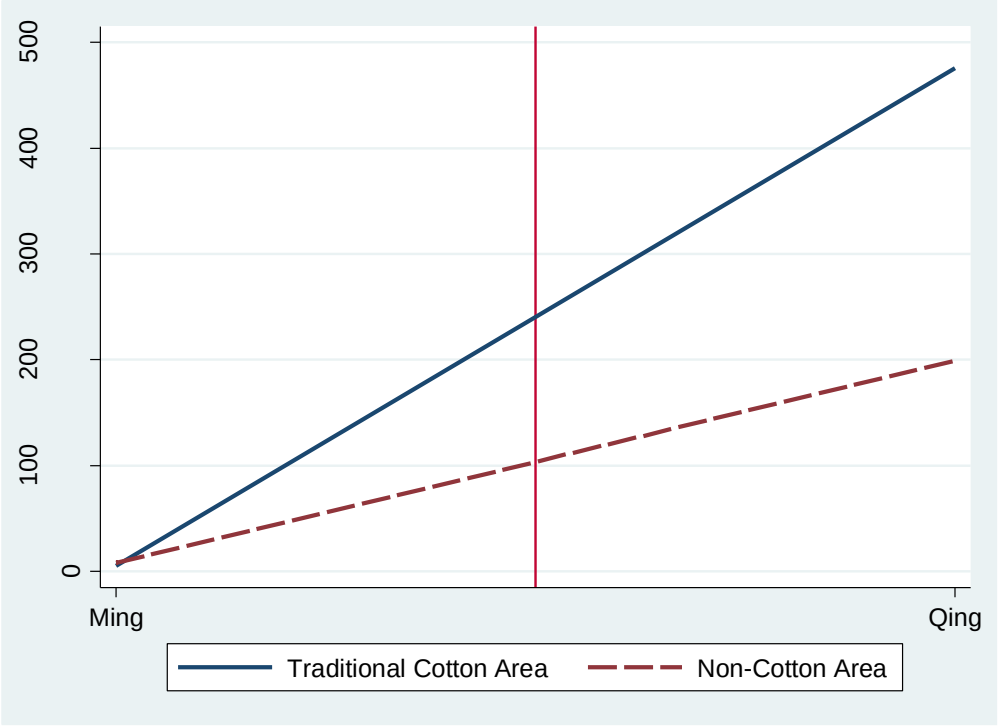


Figure 2 Traditional cotton areas and increase in widow chastity

Source: Guwargiya et al. (2008).

Figure 3 Compilation of the Qing Dynasty revised under Jiaqing's reign

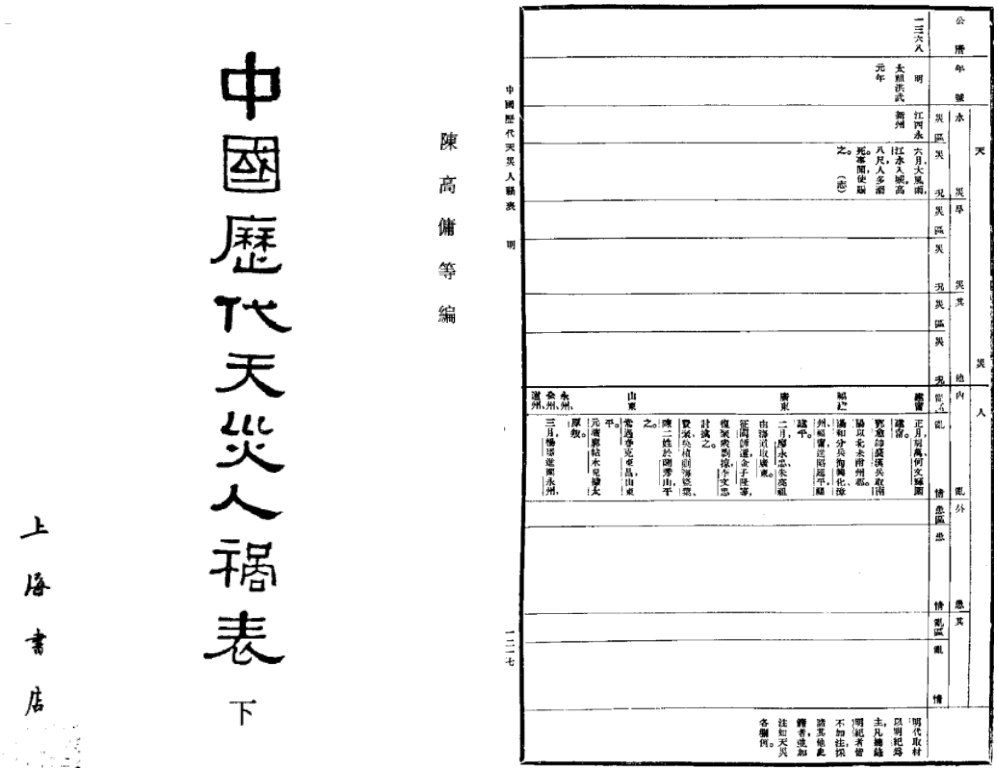
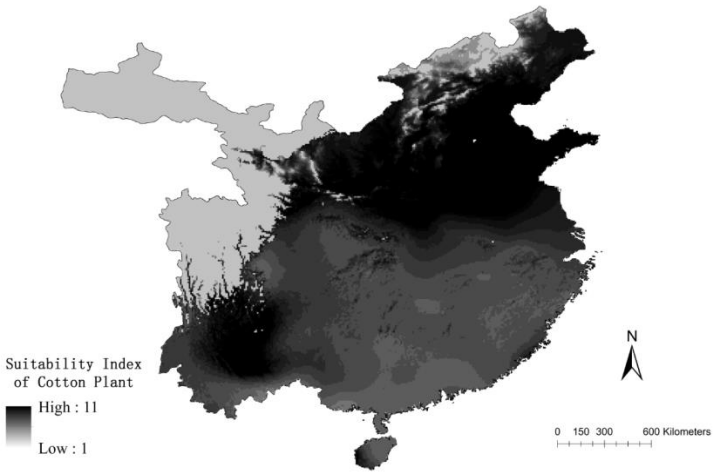
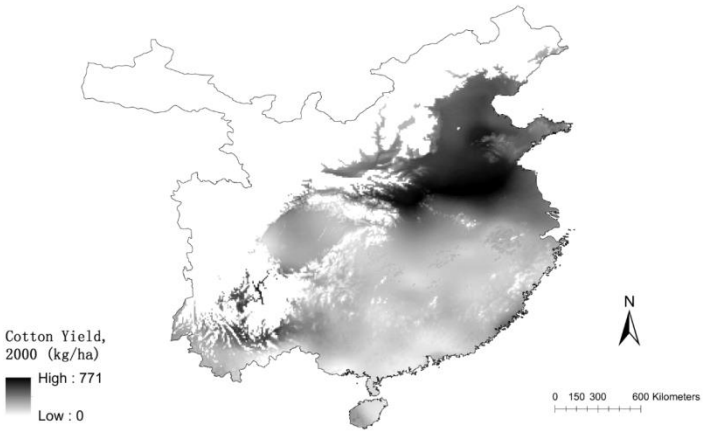


Figure 4 Chronological record of natural and man-made disasters in China


Suitability Index
of Cotton Plant
High : 11
Low : 1
N
0 150 300 600 Kilometers


Cotton Yield,
2000 (kg/ha)
High : 771
Low : 0
N
0 150 300 600 Kilometers

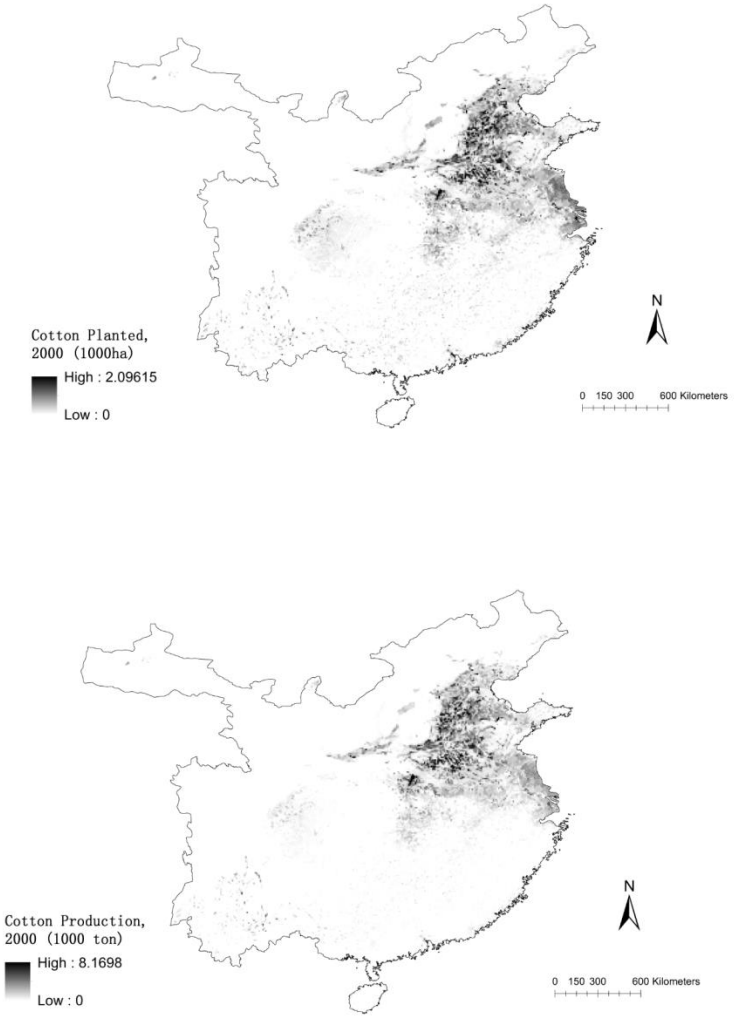
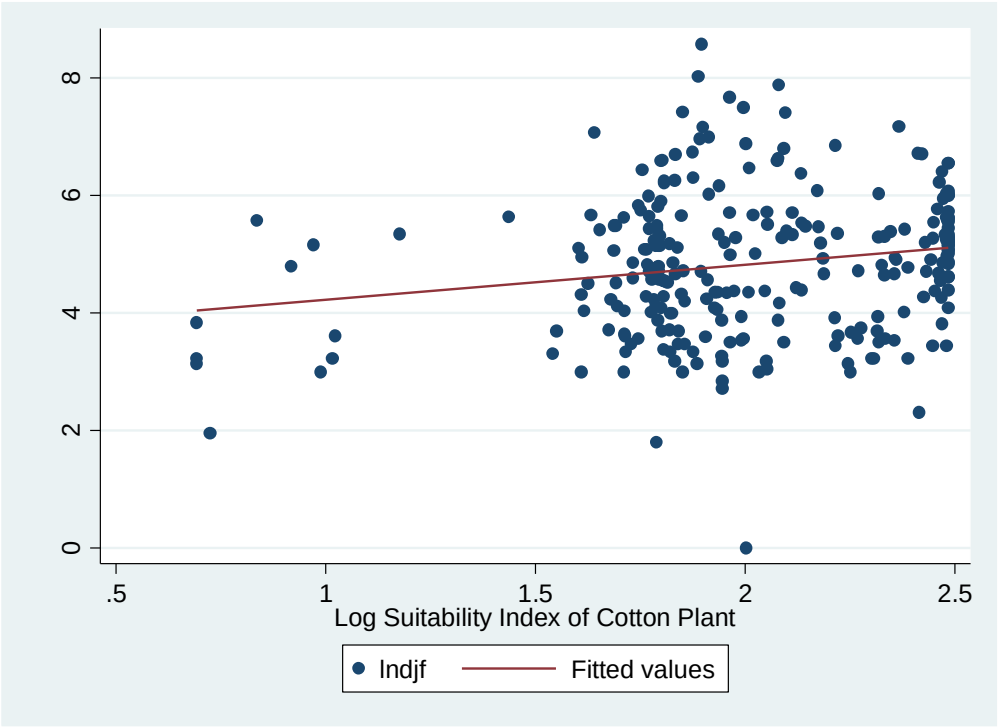


Figure 5 Alternative variables for the traditional cotton area

Source: GAEZ (2002).


0
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4
6
8
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1
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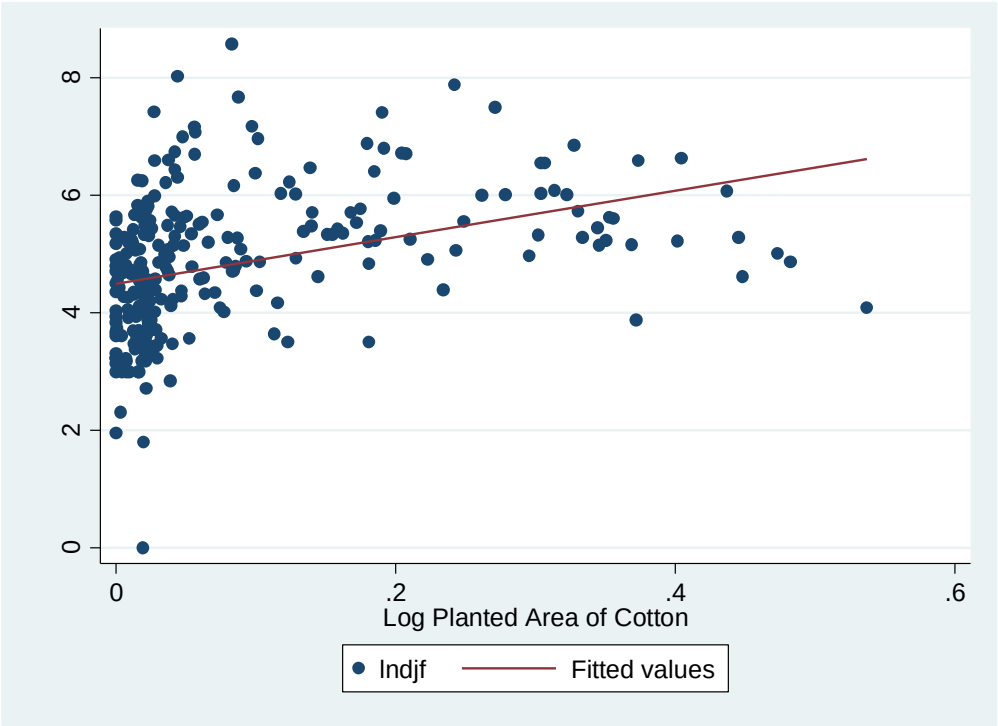
2
2.5
Log Suitability Index of Cotton Plant
lndjf
Fitted values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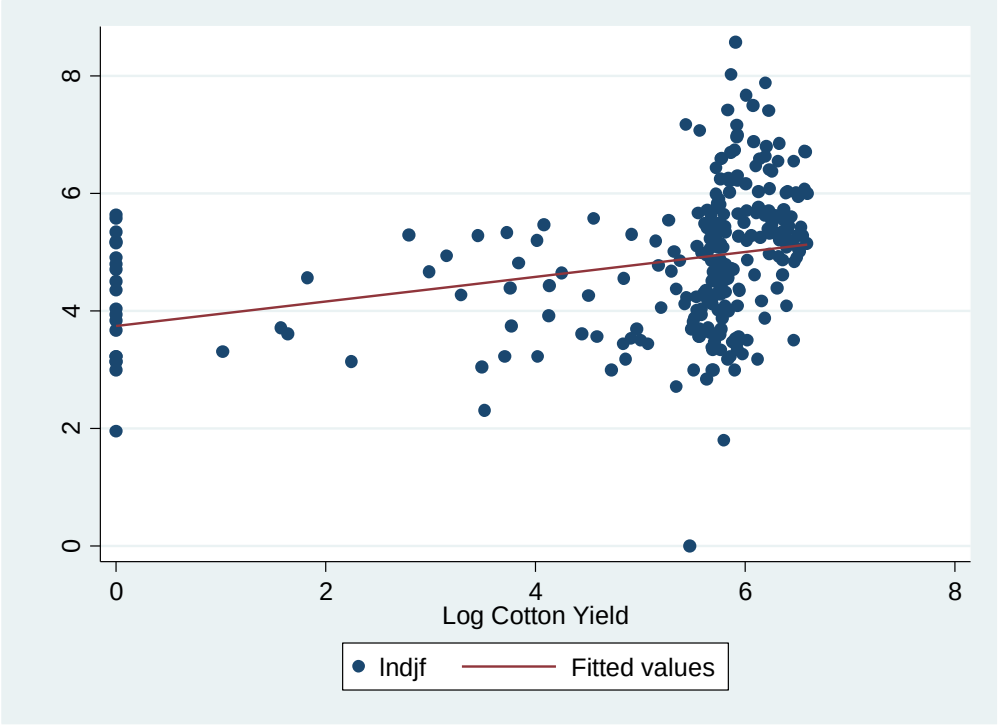
Log Planted Area of Cotton
lndjf
Fitted values



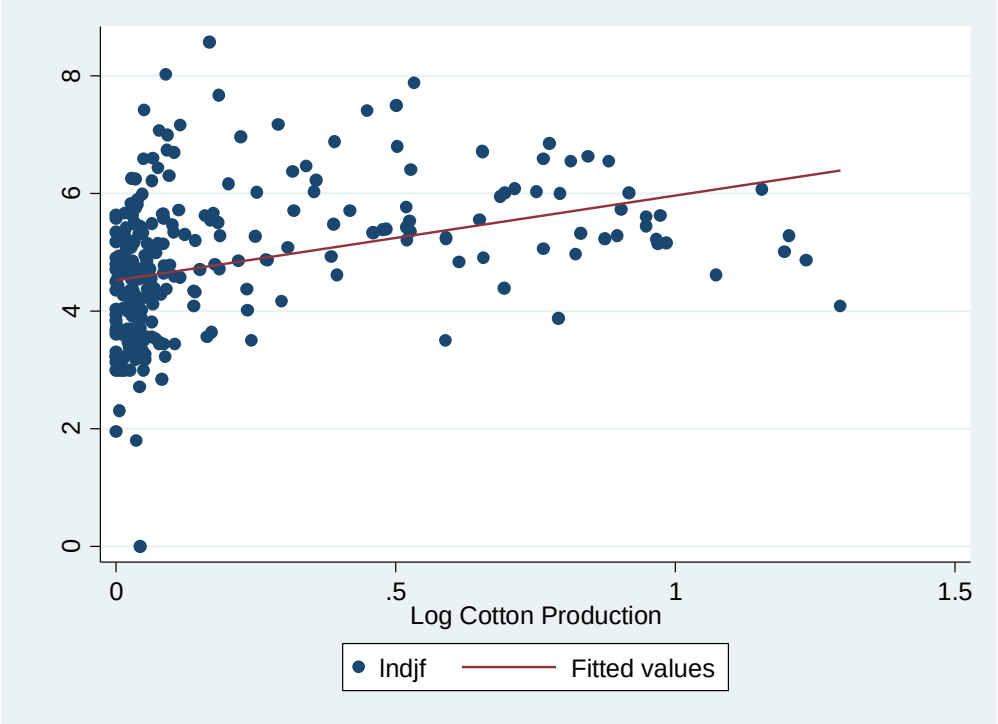


Figure 6 Alternative variables for the traditional cotton area and widow chastity

Table 1 Descriptive statistics of the variables

Variable	Variable definition	Obs.	Mean	S.D.	Data sources
rjf	Widows preserve chastity per 10000 persons in the Ming and Qing Dynasties	528	1.03	1.94	A
rlf	Widow suicide per 10000 persons in the Ming and Qing Dynasties	528	0.25	0.49	A
rln	Widows preserving chastity or committing suicide per 10000 persons in the Ming and Qing Dynasties	528	1.36	2.29	A
cotton	Whether an area is a traditional cotton production area (0,1)	264	0.20	0.40	A
silk	Whether an area is a traditional silk production area (0, 1)	264	0.19	0.39	A
linen	Whether an area is a traditional linen production area (0, 1)	264	0.32	0.47	A
tea	Whether an area is a traditional tea production area (0, 1)	266	0.05	0.21	A
rquo	Civil exam quotas per 10000 persons in the Qing Dynasty	266	0.86	0.50	A，B
rsch	Schools per 10000 persons in the Qing Dynasty	264	0.08	0.08	A，B
rcm	Ancestral temples per 10000 persons in the Qing Dynasty	264	0.12	0.11	A，B
rsg	Buddhist or Taoist Temples per 10000 persons in the Qing Dynasty	264	0.13	0.12	A，B
popu	Population in 1820 (10000 persons)	266	141.52	124.19	B
popden	Population density in 1820 (10000 persons per km^2)	266	0.02	0.05	B，C
capi	Capital prefecture of the province	266	0.08	0.26	C
area	Area (km^2)	266	16110.80	19383.90	C
longi	Longitude	266	111.63	5.79	C
lati	Latitude	266	30.77	5.05	C
slope	Slope	266	2.90	2.25	C
alti	Altitude (meter)	266	737.06	778.14	C
dist2bj	Distance to *Beijing* (km)	263	197.73	123.46	C
dist2pc	Distance to provincial capital (km)	263	1220.92	576.97	C
plant	Planted area of cotton in 2000 (1000 ha)	264	0.10	0.14	D
prod	Cotton production in 2000 (1000 ton)	264	0.31	0.51	D
harv	Cotton yielded in 2000 (kg/ha)	264	316.96	189.07	D
suit	Suitability index of cotton plant	264	6.98	2.67	D
maize	Planted area of maize in 2000 (1000 ha)	264	0.19	0.20	D
conflict	Number of conflicts and wars	528	3.51	4.51	E
calamity	Number of natural calamities	528	9.77	15.70	E

Sources: A: Guwargiya et al. (2008); B: Cao (2001); C: CHGIS (2007); D: GAEZ (2002); E: Chen et al. (1986).

Table 2 Cotton and widow chastity

	Lnrjf	*lnrjf*	*lnrjf*	*rjf*
	(1)	(2)	(3)	(4)
t	0.738***	0.738***	0.738***	1.631***
	(0.036)	(0.036)	(0.036)	(0.165)
cotton	-0.075***	-0.079***	-0.119***	-0.271***
	(0.018)	(0.024)	(0.027)	(0.072)
*t*cotton*	0.322***	0.322***	0.322***	0.804**
	(0.077)	(0.077)	(0.078)	(0.353)
lnrquo		0.125	0.187*	0.327
		(0.114)	(0.105)	(0.315)
lnrcm		0.763**	0.669**	2.252**
		(0.300)	(0.302)	(1.114)
lnrsg		-0.0554	0.0507	0.424
		(0.214)	(0.209)	(0.759)
capi		0.209***	0.199***	0.597**
		(0.0674)	(0.070)	(0.279)
lnarea			0.002	-0.038
			(0.019)	(0.058)
slope			0.009	0.055
			(0.017)	(0.061)
alti			0.000	-0.000
			(0.000)	(0.000)
lati			0.003	0.005
			(0.005)	(0.016)
longi			0.018***	0.056**
			(0.005)	(0.024)
cons	0.114***	-0.0517	-2.192***	-6.549***
	(0.015)	(0.055)	(0.547)	(2.391)
Observation	528	528	528	528
Prefectures	264	264	264	264
Adjusted R^2	0.515	0.544	0.564	0.268

Notes: Numbers in parentheses indicate the prefecture cluster robust standard errors; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 3 Common trend test

	Ming and before (1)	Yuan and before (2)	Ming and Yuan (3)	Yuan and Song (4)
*t*cotton*	-0.220	0.068	-0.111	0.233***
	(0.148)	(0.093)	(0.141)	(0.084)
Controls	Y	Y	Y	Y
Observation	528	528	528	528
Prefectures	264	264	264	264
Adjusted R^2	0.293	0.107	0.347	0.099

Notes: Numbers in parentheses indicate the prefecture cluster robust standard errors; Control variables are the same as those in column (3) of Table 2; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4 Chastity selection and placebo and falsification tests

	Selection bias		*Placebo test*	*Falsification test*	
		A: Widow chastity		*B: Widow suicide*	*A+B*
	Lnrjf	*lnrjf*	*lnrjf*	*Lnrlf*	*lnrln*
	(1)	(2)	(3)	(4)	(5)
*t*cotton*	0.184**	0.335***	0.322***	0.007	0.262***
	(0.079)	(0.075)	(0.079)	(0.036)	(0.072)
*t*lnrtax*	0.103***				
	(0.024)				
*t*lndis2pc*	-0.054***				
	(0.019)				
*t*lndis2bj*	-0.075**				
	(0.035)				
*t*lnmaize*		-0.052*			
		(0.026)			
*t*lnconflict*		0.040*			
		(0.023)			
*t*lncalamity*		0.038**			
		(0.015)			
*t*linen*			0.083		
			(0.070)		
*t*silk*			-0.030		
			(0.093)		
*t*tea*			0.000		
			(0.003)		
Controls	Y	Y	Y	Y	Y
Observation	526	526	528	528	528
Prefectures	263	263	264	264	264
Adjusted R^2	0.589	0.596	0.571	0.549	0.556

Notes: Numbers in parentheses indicate the prefecture cluster robust standard errors; Control variables are the same as those in column (3) of Table 2; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5 Pearson correlation of alternative cotton variables

	lnsuit	*lnplant*	*lnprod*	*lnharv*
Lnplant	0.510***			
Lnprod	0.556***	0.987***		
Lnharv	0.455***	0.430***	0.423***	
Cotton	0.152***	0.317***	0.319***	0.207***

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 6 Alternative cotton variables and widow chastity endogeneity problem

	OLS				*IV-2SLS*	*IV-LIML*
	lnrjf	*lnrjf*	*lnrjf*	*lnrjf*	*lnrjf*	*lnrjf*
	(1)	(2)	(3)	(4)	(5)	(6)
*t*lnplant*	1.061***					
	(0.265)					
*t*lnprod*		0.366***				
		(0.093)				
*t*lnharv*			0.065***			
			(0.017)			
*t*lnsuit*				0.241***		
				(0.081)		
*t*cotton*					2.320***	2.378***
					(0.615)	(0.644)
Controls	Y	Y	Y	Y	Y	Y
Observation	528	528	528	528	526	536
Prefectures	264	264	264	264	263	263
Adjusted R^2	0.562	0.561	0.564	0.557		
Hansen p-value					0.220	0.227
K-P LM test					11.38***	11.38***
K-P Wald F test					6.196	6.196

Notes: Numbers in parentheses indicate the prefecture cluster robust standard errors; Control variables are the same as those in column (3) of Table 2; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 7 Cultural effect and bandwagon effect

	Widow chastity					Martyrdom				
	lnrjf	*lnrjf*	*lnrjf*	*lnrjf*	*lnrjf*	*lnrlf*	*lnrlf*	*lnrlf*	*lnrlf*	*lnrlf*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
*t*cotton*	0.282***	0.326***	0.322***	0.326***	0.186**	0.011	-0.013	0.007	-0.000	0.002
	(0.077)	(0.078)	(0.078)	(0.077)	(0.080)	(0.035)	(0.038)	(0.037)	(0.036)	(0.036)
*t*lnrsch*	-1.263**					0.125				
	(0.544)					(0.321)				
*t*lnrquo*		0.040					-0.188***			
		(0.142)					(0.070)			
*t*lnrcm*			0.135					-0.349*		
			(0.372)					(0.190)		
*t*lnrsg*				0.119					-0.225	
				(0.353)					(0.188)	
*t*lnpopden*					0.185***					0.007
					(0.036)					(0.014)
Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observation	528	528	528	528	528	528	528	528	528	528
Prefectures	264	264	264	264	264	264	264	264	264	264
Adjusted R^2	0.558	0.551	0.552	0.552	0.612	0.138	0.148	0.142	0.140	0.144

Notes: Numbers in parentheses indicate the prefecture cluster robust standard errors; Control variables are the same as those in column (3) of Table 2; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.