Freedom of Speech, Spirit of Innovation, and Long-Term Economic Development: Evidence from the Qing Dynasty of China

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Abstract

With the literary inquisition in the Qing Dynasty of China as a natural experiment, we empirically study the short- and long-term effects of extreme controls on freedom of speech on society. Through our empirical investigations, we attempt to contribute to the explanations of two fundamental puzzles: (1) China was the global leader in science and technology before 1700, why this advantage did not lead to an Industrial Revolution (the Needham puzzle); (2) why China declined in the late Qing Dynasty. With a Difference-in-Differences (DID) strategy, by exploiting the variation of the literary inquisition across region and over time, we find that the literary inquisition stifled spirit of innovation and significantly reduced scientific and technological innovations and further had a negative effect on the long-term economic development of the Qing Dynasty.

Key Words: Freedom of speech, spirit of innovation, economic development, literary inquisition

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1. Introduction

In the civilized world, freedom of speech has been accepted as a universal value and considered as a basic human right which has been protected by the constitutions in most countries. However, even in the modern world, citizens are not fully entitled to the right of free expression in some authoritarian regimes, where speech controls are common and unfavorable remarks on the government are strictly forbidden. How such restrictions on free expression affects society in the short and long terms, specifically, how it affects the spirit of innovation in the short term and economic development in the long term, forms an important empirical issue. Despite the evident importance of the issue and given the immense difficulty in empirically identifying the causal effect of expression controls on innovation and economic development, such empirical study has been lacking. To fill this gap in the literature, we attempt to provide a rigorous empirical analysis on the comprehensive effects of expression controls on society.

The literary inquisition in the Qing Dynasty of China provides a unique natural experiment to empirically study the issue. The literary inquisition is defined as "legal punishment for criminal acts committed through speech and written words expressed in various forms, including conversations, letters, essays, poems, pamphlets, books, dramas, novels, and diaries" (Fu, 1993). From Kangxi to Qianlong reign periods of the Qing Dynasty (1711–1788), the emperors implemented notorious literary inquisition to consolidate the regime of the Qing Dynasty. During that period, if an individual's speech was interpreted as offensive to the Qing regime, then he would be executed by dismembering the body and his whole family would also be sentenced to death or exiled.

Although the literary inquisition seems similar to the censorship at first glance, they are different in many ways. The censorship is defined as "the practice of officially examining books, films etc. and suppressing the unacceptable parts" (Pearsall et al., 2007), which is a common practice in authoritarian regimes and aims to prevent the spread of regime-threatening information among citizens. By keeping citizens in ignorance, the censorship is considered as the key to the popular support and stability of these regimes (Ford, 1935). By contrast, instead of pre-examining the books or other forms of expression and eliminating the unfavorable parts in advance, the literary inquisition re-examines the published books and punishes the authors severely if their expressions were interpreted as offensive to the regime. Such policy aims to deter potential opposition by sending strong messages to citizens that people who dare to oppose to the regime would face severe punishment. In brief, the censorship makes citizens supportive of the regime by keeping them in ignorance via information control, while the literary inquisition forces citizens to be obedient to the regime by threatening to kill them otherwise.

Both the literary inquisition and censorship are instruments of thought control on citizens for rulers to consolidate the authoritarian regimes. Nevertheless, the literary inquisition is the more unreasonable one which makes citizens feel insecure and dare not to express their opinions or engage in any potentially risky activities. Such extreme controls on expression created a terrifying atmosphere among citizens at the time and had profound effects on society.

By investigating the effect of the Qing literary inquisition, we attempt to contribute to the explanations of two fundamental puzzles: (1) why the Industrial Revolution did not originate in China (the Needham puzzle); (2) why China declined in the late Qing Dynasty.

China had made remarkable achievements in science and technology in the premodern period, and it had a considerable lead over the Western world in most of the major areas of science and technology before 1700 (Lin, 1995). However, China was undertaken by the west in science and technology and fell behind of the world in many ways thereafter. Needham comes up with the following challenging yet important question based on his research on Chinese history of science and technology: China had been in advance of other civilizations in science and technology over a long time, why did not the Industrial Revolution originate in China? This question was later known as "the Needham puzzle" and has been widely discussed yet not reached consensus.

In this study, we argue that the literary inquisition may have stifled spirit of innovation of society of the Qing Dynasty and led to China's decline in science and technology. We will show that the time of the implementation of the literary inquisition was also the turning point of China's decline in science and technology. Specifically, the case of Mingshi Dai in 1711 was the first case of the literary inquisition in the Kangxi period, which marks the turning point of Qing rulers' policy on free expression. Before 1711, the emperor Kangxi was tolerant of intellectuals' expressions and free speech was generally allowed. Mingshi Dai was a famous intellectual at the time, and in 1711, his published book *nan shan ji* was reported to the emperor Kangxi as containing offensive expressions to the Qing regime. Then the book was investigated and Dai was finally executed because of his "inappropriate" expression in a letter to a friend included in the book and more than 100 related people were punished. This sensational case of literary inquisition had a huge impact on society, particular on intellectuals. Later, the literary inquisition became the emperors' common instrument of thought control on citizens.

We plot several figures to demonstrate the potential effects of the literary inquisition on innovation in the Qing dynasty of China. Figure 1 shows the number of scientific and technological innovations in China and Britain during 1670 and 1790, in which each point represents the total number of innovations in the country during the past two decades. The dividing line indicates the year of 1711, in which the emperor Kangxi initiated the first case of literary inquisition. Evidently, China had a clear advantage over Britain in innovation before 1711. However, innovation in China decreased

dramatically after 1711, whereas Britain achieved considerable growth in innovation. Unsurprisingly, Britain exceeded China in innovation around 1750–1770, during which the Industrial Revolution begun, and after which China fell behind of Britain in many ways. As mentioned earlier, China begun to implement the literary inquisition in 1711, which also seems to be the turning point of China's decline in science and technology. It may not be only a coincidence.

Figure 2 plots the number of scientific and technological innovations in China and Europe during 1670 and 1790, which conveys similar information. Innovation in China tended to increase before 1711 and China still dominated Europe in innovation in 1711. However, China experienced a sharp decline while Europe enjoyed an explosive growth in innovation thereafter. Unsurprisingly, China fell far behind of Europe in innovation after 1750. Again, the year of 1711 is the turning point of China's decline and Europe's rise in science and technology. In brief, the sharp drop in innovation in China after 1711 marks the end of China's era in science and technology and such a dramatic drop probably resulted from certain huge shock on innovation in the country.

Figure 3 plots the number of scientific and technological innovations in the treatment and control prefectures which were and were not exposed to the literary inquisition during 1670 and 1790. Given that the literary inquisition cases mainly concentrated in developed regions with more intellectuals who are the primary targets of the policy, treatment prefectures generally had a clear advantage over control prefectures in science and technology before the literary inquisition.[3] Figure 3 shows that the number of innovations in the treatment prefectures are much more than that in the control prefectures before 1711. However, after 1711, innovation in the treatment prefectures declined sharply and maintained at a low level as that in the control prefectures. Such a dramatic drop in innovation in treatment prefectures was probably due to certain huge negative shock on innovation in these regions. In this study, we attempt to empirically prove that the literary inquisition was exactly such a shock on innovation which led to the turning point of China's decline in science and technology.

Figures 1–3 present some basic facts and draw a big picture of the potential effects of the literary inquisition on innovation in the Qing Dynasty of China, based on which we perform our empirical analysis. With a Difference-in-Differences (DID) strategy, by exploiting the variation of the literary inquisition across region and over time, we find that the literary inquisition significantly reduced the number of scientific and technological innovations in the treatment prefectures in the short term, and it also had a negative effect on the economic development of affected regions in the long term.

[3] The occurrence of the literary inquisition cases was random to a large extent and whether an individual's expression was interpreted as being offensive largely depends on the emperor's subjective judgement. However, as there were more intellectuals in developed regions who were the primary targets of the literary inquisition, these regions were thus more susceptible to the literary inquisition. We will discuss the background of the literary inquisition in details in Section II.

Why could the literary inquisition have such destructive effects on society of the Qing Dynasty of China? We can compare the Enlightenment in Europe and the literary inquisition in China during the 1700s to find the potential answer. Jones (2017) points out that the rise of the Enlightenment in Europe in the 1700s opened the way for the Industrial Revolution. The Enlightenment was promoted by philosophes who challenged the authority of institutions that were deeply rooted in society and tried to reform society with toleration, science, and skepticism. During the Age of Enlightenment, freedom, democracy, and equality became deeply held beliefs among citizens in Europe, which inspired people to contribute to society with their initiative and creativity. When the core ideology of the Enlightenment was widely accepted in Europe in the 1700s, the Qing government was implementing extreme expression controls to consolidate the authoritarian regime. Thus, such different strategies that rulers adopted may partly explain the rise of Europe and the decline of China after 1700. As Phelps et al. (2013) point out, freedom generates prosperity. By contrast, extreme speech controls may destroy the foundation of a society to make progress.

This study presents a novel yet convincing explanation of the Needham puzzle. Previous studies provide several hypotheses to explain China's decline in science and technology after 1700. Specifically, China's education system, particularly the civil service examinations and the criteria of promotion in the Qing Dynasty, hindered human capital investment necessary for modern scientific research (Lin, 1995; Cantoni and Yuchtman, 2013); the imperial system, which results in lack of vision, lack of fiscal capacity, lack of administrative structure, patronage economy, interlocking elite interests contributed to China's decline in Science (Brandt et al., 2014). Although these explanations provide important insights into this issue, they have evident limitations. Specifically, China had been the global leader in science and technology before 1700, and those claimed adverse factors had always existed in imperial China, then, why did they begin to become obstacles of innovation only after 1700? By contrast, our findings are highly consistent with the fact that China only begun to decline in science and technology after 1700. To sum up, our explanation of the puzzle enriches the literature and also shed light on the reinterpretation of Chinese history, particularly the decline of China as a result of unreasonable expression controls in the Qing Dynasty.

Our findings also contribute to the growing literature on the comprehensive effects of thought control in authoritarian regimes on society. Becker et al. (2021) find that the Catholic censorship during the Counter-Reformation not only reduced printing of forbidden authors but also had a negative effect on the diffusion of knowledge and city growth. Blasutto and Croix (2021) also find that the Catholic censorship reduced by 30% the average log publication per scholar in Italy. Drelichman et al. (2021) show that the Spanish Inquisition in history had long-term negative effects on economic performance, educational attainment, and trust today. Xue (2021) also studies the effect of the literary inquisition in

the Qing Dynasty of China and finds that the literary inquisition had a long-term negative effect on social capital such as charities and trust in affected regions. We study the effect of the literary inquisition from a novel perspective and obtain significant results with more general implications.

2. Historical Background

In this section we briefly introduce the historical background of the literary inquisition during the Kangxi to Qianlong period (1661–1796).

In 1644, the Ming Dynasty was collapse, after which the Manchus invaded Beijing and established the Qing Dynasty. The Ming-Qing transition involved massacres and a high degree of tension between the Manchu conquerors and the Han population (Wakeman, 1985), and such a tension persisted for a long time and became eased after the emperor Kangxi begun to govern the country in 1667.

The first recorded literary inquisition in the Qing Dynasty was the case of History of the Ming Dynasty, which was investigated in 1661. In this year, the emperor Shunzhi died and his son Kangxi inherited the throne at the age of 8. At that time, Kangxi was still too young to govern the country and four ministers assisted (or substituted) him to make decisions. Tinglong Zhuang, a Han intellectual organized people to compile a book about the history of the Ming Dynasty and published it in 1660. In 1661, some people reported to the central government that this book was offensive to the Qing regime. The four ministers in charge of the government thought that it was a serious case and begun to comprehensively investigate the book. The book was interpreted as cherishing and praising the Ming Dynasty and showing great disrespect of the Qing regime. Consequently, in 1663, over 70 individuals related to the book was executed and more than 1000 were punished (quota).

This case was sensational at the time and intensified the tension between the Qing rulers and Han intellectuals, and it also reflected the Manchus' insecurity of the legitimacy of their regime. However, the case only had a limited impact on society of the Qing Dynasty for the following reasons.

First, the case was more of the Qing rulers' fight against the anti-Qing activities. Compiling a book about the history of the Ming Dynasty in that sensitive period of the Ming-Qing transition can be easily interpreted as not supporting the new regime by the Qing rulers. In fact, many individuals involved in the case used to participate in the activities of rebelling Qing and rebuilding Ming Dynasty, and thus their being punished in the case was predictable to some extent.

Second, the Qing rulers sent a clear message to citizens about what they should not do via this case. Individuals obedient to the new regime were largely safe and thus it only had a limited impact on citizens' activities that were unrelated to politics.

More importantly, the case occurred in a very special period when the four ministers were in power and made the decision. When Kangxi took over the reign of government at the age of 14 in 1667, he adopted completely different polices towards the Han population, particularly the Han intellectuals, and free expressions were generally allowed thereafter. Therefore, the case of History of the Ming Dynasty was more of an accident and its effect on society, if any, lasted for only a very short period.

When Kangxi took over the power in 1667, the country was devastated by wars, the economy was in a slump, and people lived in destitution. Many of the Han Chinese, which accounted for 95 percent of total population at the time, were still resistant to the Manchu rulers, which posed another potential threat to the Qing regime. To promote the economy and consolidate the regime, Kangxi adopted the conciliation policy towards the Han population to win their support. Specifically, Kangxi conducted special examinations *(bo xue hong ru*) to select the Han elites to work for the government, and the selected Han intellectuals were generally assigned to important positions. Kangxi himself visited some famous Han intellectuals to persuade them to serve the Qing regime, and even several rejected to meet him, Kangxi was not angry and still sent the messages to them. Kangxi's attitude towards the Han, particularly the intellectuals, were appreciated by the Han population and won the Han intellectuals' support for the Qing regime.

Kangxi was also tolerant to intellectuals' free expressions. In an examination selecting Han elites, one examinee expressed the idea that Manchus were barbarians, which obviously violated taboos of the Qing regime. However, Kangxi thought that it was not a big deal and let it go (Yan, 2016). Kangxi also made a rule that previously published books containing words that violated taboos of the Qing regime should not be banned and could be republished as their original versions (Yan, 2016). Kangxi also organized intellectuals to compile a book about the history of the Ming Dynasty, which officially announced that writing books of the Ming Dynasty became legal and virtually overturned the conviction of the previous case of History of the Ming Dynasty. In 1707, an intellectual, Fuxiang Zhang, wrote a poem to satirize Kangxi's inspection tour to the Chiangnan where local officials tried their best to please the emperor by spending huge amounts of money to build palaces. Such expressions showed great disrespect to the emperor, but Kangxi did not investigate the case (Yan, 2016).

Kangxi's conciliation policy greatly eased the tension between the Qing regime and the Han population and won the support of the majority of the Han Chinese, and his tolerance to free expressions and other enlightened policies injected vitality into society and inspired people to contribute to society with initiatives. Historians argue that Kangxi's conciliation policies towards intellectuals were critical to stabilize society and also boost the economy, and such policies were the

key factors that initiated the "Ages of Prosperity", or the "Kangxi-Qianlong Great Ages in the Qing Dynasty (Yan, 2016).

The turning point of the Kangxi's policy towards free expression was the case of Mingshi Dai (or the case of *nan shan ji*), which was investigated in 1711. Mingshi Dai was a famous intellectual at the time. In 1711, an official of the government reported to the emperor that one book written by Mingshi Dai, namely, *Nan shan ji*, contained many contents that were wildly arrogant and obviously offensive to the Qing regime. Kangxi examined the articles in the book and was infuriated by one letter that Dai wrote to a friend. In the letter, Dai expressed that he intended to write a book about the history about the Ming Dynasty, and he mentioned and expressed his appreciation about a book written by a scholar Xiaobiao Fang, who used to serve the rebel army of Sangui Wu, whom Kangxi hated very much. Furthermore, Dai also commented that the team that Kangxi organized to compile the book of the history of the Ming Dynasty was terrible and he had to write a much better book by himself, which further irritated Kangxi.

Mingshi Dai was executed in the capital Beijing in 1713, and the descendants of Xiaobiao Fang were also punished severely. The case was sensational at the time and had a huge impact on society, particularly on intellectuals, who received a strong message that personal expressions, even those in private letters, may be investigated by the government and induce severe punishment.

Before 1711, Kangxi was tolerant to citizens' free expressions, why did he become sensitive to intellectuals' speech and investigate the case of Mingshi Dai in 1711? Some historians argue that the case of Dai may be only an accident. Specifically, Kangxi's sons had been fighting fiercely for the right of inheritance of the throne over a long time, and the crown prince was deprived of the right of succession due to his evil behavior for the second time in 1711. The scandals about internal fights within the royal court appealed to the public at the time, and Kangxi was angry and sad. Historians speculate that Kangxi intended to make a sensational case of literary inquisition to divert the public's attention from the scandals of the royal court (Guo and Lin, 1990). Furthermore, China had reached its zenith of prosperity up to 1711, and there were no external and internal threats to the Qing regime at the time. As the founder of this great age of prosperity, Kangxi was also at the peak of his power and authority, and he did not have to treat intellectuals well to win their support anymore and could do whatever he wanted. Therefore, it is not surprising that Kangxi decided to punish Dai severely when he was infuriated by Dai's offensive speech, considering that Kangxi was in a bad mood at the time.

After the case of Mingshi Dai, the literary inquisition became the Qing rulers' common instrument of thought control on citizens. As the successors of Kangxi, namely, Yongzheng and Qianlong, all admired Kangxi very much and thus continued or even strengthened the literary inquisition practice later.

Given that Chinese languages are subtle and ambiguous, any writings could be interpreted as offensive to the regime. As described by Wang (2002):

"Rash fortune-telling and discussion of military strategy could be offenses, as could poetic works with "excessive anger" or "excessive hate," or even expressions of "sorrow" regarding specific episodes in history. It was a crime to call oneself a non-collaborator, an expression used to refer to adherents of the former dynasty living under a new one without serving it. Use of taboo words and phases, or even nonsensical expressions like "a dog's wild bark" were offenses …… Careless use of such words as "Han," "Great Enterprise," "Ch'ing (Qing), "sun and moon (the components of the character for "Ming"), "barbarian", "Ming," and similar words also could be punishable."

Xue (2021) summarizes the features of the literary inquisition and concludes that it was very arbitrary and unreasonable. It was impossible to anticipate what speech or writing might result in a literary inquisition. It was the emperor who made the final decision of the literary inquisition and such decisions could be very arbitrary and subjective. Specifically, two cases similar in many ways may end up with completely different punishments. Furthermore, the punishment was in public and thus it sent strong messages to the citizens that people who dare to oppose to the regime would be punished severely.

Xue (2021) also examines all book titles related to the literary inquisition and finds that most belong to the genres of poetry and literary commentary, which have nothing to do with politics. Her findings are consistent with historians' views that the culprits of the literary inquisition were not obviously treasonable or even critical of the regime, and they may only be the victims of the Qing rulers' arbitrary and unreasonable policy of thought control on citizens.

Although the literary inquisition may appear irrational or unreasonable, the employment of arbitrary persecutions serves as a signal of state power, which could deter future opposition (Xue, 2021). Actually, the literary inquisition was implemented during the Kangxi-Qianlong Great ages when the country was in prosperity and the Qing regime was stable without visible external or internal threats, and the emperors were also among the most powerful in Chinese history. Therefore, it seems that the goal of the literary inquisition is not to purge opponents of the regime, and it may only be a way of building absolute authority of the emperor and nurturing consciousness of unconditional obedience among citizens.

3. Data

Data on the literary inquisition are from *Qingdai wenziyu dang (Zengding Ben)* (Qing Literary Inquisition Archives (Updated Edition)) (Shanghai Bookstore Publishing House, 2011). The book is a

revised edition of *Qingdai wenziyu dang ji* (1934), which was produced by historians with the Qing Imperial Archives in the 1930s. There are 88 cases of literary inquisition recorded in the book, dating from 1661 to 1788. We exclude these cases in which the emperor finally considered the related speech as unoffensive and thus the suspects were not punished and obtain a sample of 69 cases.[4]

Similar to Xue (2021), we examine the effect of the literary inquisition in the culprits' home prefectures, where their identities were lodged and their families and clans resided. In a typical case of literary inquisition, not only the culprits were executed, but also were their whole families and even clans punished severely. Therefore, the information about the literary inquisition cases spread fast in the culprits' hometown and thus the cases had a huge deterrent effect among citizens in those regions.

We empirically estimate the effect of the literary inquisition on innovation and long-term economic development in affected regions. The data on innovation are from the *Zhongguo kexue jishu shi: nianbiao juan* (Chinese History of Science and Technology: Chronological Volumes) (Ai and Song, 2006). This book records of all important events in scientific and technological activities in Chinese history, including important innovations or improvements in science (e.g., mathematics, physics) and technology (e.g., printing, medicine). The record of each innovation contains rich information, including the author, time, and site where the innovation was made.[5] On the basis of these recordings, we collect the data on innovations in science and technology in the Qing Dynasty of China.

We focus on innovation in the Qing Dynasty of China in the 18th century (1700–1800), during which the literary inquisition was implemented and China begun to decline in Science and technology and in the middle of which the Industrial Revolution begun in Britain.[6] There are 102 scientific and technological innovations in China during this period, among which 93 (accounting for more than 91 percent) were made by intellectuals, 4 were initiated by the central government, and 5 were brought in by western missionaries. Obviously, intellectuals were the main contributor of innovation at the time, and it is not surprising that extreme expression controls on intellectuals could have considerable negative effect on innovation in the Qing Dynasty of China. Given that innovations initiated by the government or imported from foreign countries were unlikely affected by the literary inquisition, we only include those innovations made by intellectuals in the sample of our empirical analysis, which were likely affected by extreme speech control directly.

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[4] As previously discussed, the case of History of the Ming Dynasty in 1661 was more of the Qing rulers' fight against the anti-Qing activities in the earlier period of the Qing Dynasty. Fifty years later, the second case of the literary inquisition in the Qing dynasty, i.e., the case of Mingshi Dai was investigated in 1711, which marked that the Qing rulers begun to implement extreme expression control on citizens to consolidate the regime. We thus focus on the literary inquisition cases following the case of Mingshi Dai.

[5] There are a few records (approximately 6 percent) in which we cannot exactly identify the time or location that the innovations took place, and we exclude these observations from our sample.

[6] We can extend the examined period to 1660–1800 or even longer to 1660–1820 and obtained similar estimate results.

We use the revenue of land tax to measure the economic performance across region. As Wang (1973) pointed out, the land tax was the most important source of public revenue in the Qing Dynasty. For instance, it accounted for 73.5 percent in total tax revenues of the Qing government in 1753. We collect a set of panel data on the amount of land tax paid in silver at the provincial level from Liang (1981). The original data contain information of the land tax in each province for the following years: 1661, 1685, 1724, 1753, 1766, 1784, and 1820. In order to perform our empirical analysis, we need to construct a set of more balanced panel data in which time intervals between observations are constant. In practice, we predict the revenue of land tax in each year in each province with its annual growth rate between two observations. For example, we can calculate the annual growth rate of the land tax during 1753 and 1766 with the actual revenue of land tax in the two years, and then, we can further obtain the predicted land tax in each year with the underlying assumption that the land tax grew at a constant rate during this period. Although this exercise may not be completely accurate, if our identification focuses on the effect of the literary inquisition on land tax in affected regions in the long term, such inaccuracy may not be a problem.[7] In this way, we can finally obtain a decadal panel data of land tax at the provincial level for 1670–1820.

In our empirical analysis, we also include geography and economic characteristics as baseline controls, the data on which are originally from Bai and Jia (2015). Specifically, geography characteristics include three dummy variables, i.e., whether a prefecture is situated on the coast, whether a prefecture includes one or more major rivers, whether a prefecture is in northern China, and a continuous variable for the area of prefectures. Economic characteristics include three dummy variables for city rank which measure the urbanization level of prefectures in the Qing Dynasty, the data on which are originally from Rozman (1973), who classifies Chinese cities in the Qing Dynasty into three categories: large (with a population of 300,000 and above), mid-level (with a population between 70,000 and 300,000), and small (with a population between 30,000 and 70,000). We also control the quota of the prefectural-level civil examination in the Qing Dynasty, which the candidate who pass was label "the literati" (*xiucai*). This variable reflects the human capital level for each prefecture at the time. Table 1 shows the summary statistics for the main and control variables at the prefectural and provincial levels.

[7] See the Appendix for more discussions.

4. The Effect of the Literary Inquisition on Innovation in Qing China

In this section we estimate the effect of the literary inquisition on scientific and technological innovation (at the prefectural level) in the Qing Dynasty of China.

4.1 Empirical Strategy

As shown in Figure 3, the number of scientific and technological innovations in control prefectures is relatively stable and remains at a low level over time, whereas it drops dramatically in the treatment prefectures after 1711 (when the case of Mingshi Dai was investigated), which presents suggestive evidence of the treatment effect. We now provide a rigorous empirical analysis of the effect of the literary inquisition on innovation in affected regions at the time.

We employ a staggered difference-in-differences strategy to identify the effect of the literary inquisition on innovation. Specifically, we construct a prefectural-level panel during the period of 1700–1800 with a five-year time interval between observations. The treatment is a prefecture's first exposure to the literary inquisition case. In practice, we estimate the following equation:

$$\#Innovation_{pt} = \beta Literary\ Inquisition_{pt} + \theta X_p \times \gamma_t + Treat_p \times After1790_t + \lambda_p + \gamma_t + \delta_{prov} \times \gamma_t + \epsilon_{pt}, \quad (1)$$

where $\#Innovation_{pt}$ is the number of scientific and technological innovations in prefecture p in period t (during the past 5 years), $Literary\ Inquisition_{pt}$ is a dummy indicating whether prefecture p was exposed to the literary inquisition in period t, X_p includes a set of prefectural characteristics, γ_t and λ_p represent time fixed effect and prefecture fixed effect, respectively, $Treat_p$ is a dummy indicating whether prefecture p was ever exposed to the literary inquisition, $After1790_t$ is a dummy that equals 1 when observations were after 1790, δ_{prov} reprents a province fixed effect and thus $\delta_{prov} \times \gamma_t$ is a provincial-specific trend, and ϵ_{pt} is an error term. The coefficient of interest is β, which is likely to capture the impact of the literary inquisition on scientific and technological innovation in treatment prefectures.

We include an interaction term of dummies of the treatment and after 1790 in the regression to make our estimate more accurate. Specifically, the last case of literary inquisition was in 1788, after which the expression controls were relaxed and no more case was investigated. Such relaxation of speech control could restore the innovative vitality of society to some extent, and we also observe a significant increase of innovations in treatment prefectures after 1790. Therefore, we include the interaction term to control effect of the potential rebound in innovation in treatment prefectures after the termination of the literary inquisition.

Given that the trial of the first case of the literary inquisition, e.g., the case of Mingshi Dai, was in the capital Beijing where Dai was finally executed, the case was sensational in Beijing from where the information of the case spread to the whole country. Undoubtedly, Beijing was also considerably affected by the case. Therefore, we also include Beijing in the sample of treatment prefectures after 1711 in our empirical analysis.

The DID strategy carries a underlying assumption that the innovation levels in treatment and control prefectures share a common trend if the literary inquisition was not implemented. As previously shown in Figure 3, there were much more innovations in treatment prefectures than that in control prefectures before 1711 and the gap in innovation between the two groups is relatively stable during the pretreatment period, which provides suggestive evidence that the common trend assumption is likely to hold. We now further confirm whether the treatment and control prefectures share a common trend in innovation with a flexible event study framework. In practice, we estimate the following equation similar to Equation (1):

$$\#Innovation_{pt} = \sum_{\tau=-25}^{25+} \beta_\tau literary\ inquisition_{p\tau} + \theta X_p \times \gamma_t + Treat_p \times After1790_t + \lambda_p + \gamma_t + \delta_{prov} \times \gamma_t + \epsilon_{pt}. \quad (2)$$

This is equation is similar to Equation (1), except that the variable $literary\ inquisition_{p\tau}$ is a set of indicator variables that equal 1 if it has been τ years since the first literary inquisition case, where $\tau \in \{-25, -20, -15, -10, -5, 0, 5, 10, 15, 20, 25, 25+\}$. The reference groups are the years more than 25 years before the first literary inquisition case. The coefficient of interest is β_τ, which likely captures the difference between the treatment and control prefectures in innovation during each period.

Figure 4 demonstrate the estimate results of Equation (2). Evidently, the coefficient is never significant prior to the literary inquisition, and it decreases considerably after the literary inquisition and becomes significantly negative soon. Such results indicate that the treatment and control prefectures may share a common trend in innovation before the treatment, and such a common trend vanishes after the literary inquisition, with the treatment prefectures experiencing a sharp decline in innovation thereafter. Such results indicate that the literary inquisition may have had a considerable negative effect on innovation in the treatment prefectures.

We have shown that the literary inquisition seems to be a plausible exogenous shock on innovation in treatment prefectures, in which the number of innovations decreased significantly after exposing to the literary inquisition, which presents strong evidence of the treatment effect. As previously discussed, the emperor made the final decision of the literary inquisition cases and such

decisions could be arbitrary and subjective. Therefore, the occurrence of a literary inquisition case could be exogenous to some extent. However, given that the literary inquisition cases mainly occurred in developed regions where there were more intellectuals who were the primary targets of the literary inquisition, and thus the treatment and control prefectures differ in many ways and such differences may change over time, leading to concerns that the change in differences in innovation between treatment and control prefectures over time may not be completely driven by the literary inquisition. To alleviate such concerns, we further employ matching to reduce heterogeneity in the sample. After matching, there are no longer systematic differences between treatment and control prefectures prior to treatment and the DID estimator is likely to capture the treatment effect of the literary inquisition. Under this scenario, the literary inquisition serves as a natural experiment for identifying the effect of expression controls on innovation. Specifically, if all prefectures in the matched sample were initially similar, and if some prefectures were randomly chosen to be exposed to the literary inquisition, and if we observe that the number of innovations in these treatment prefectures decreases sharply compared with that in the control prefectures after the treatment, then it would be reasonable to conclude that the literary inquisition has a negative effect on innovation in the treatment prefectures.

4.2 Baseline Estimate Results

We first estimate Equation (1) and report the baseline estimate results in Table 2. Columns (1) to (4) of Table 2 shows that as we gradually add control variables in the regressions, the DID estimators change little and are always significant, indicating that our estimates are largely robust. After controlling all available variables, Column (4) presents that the coefficient is approximately -0.044, which indicates that the literary inquisition reduces the number of innovations in a five-year span in the treatment prefectures by 0.044. Given that the mean of the number of innovations for all prefectures during 1700–1800 is approximately 0.018, such an estimate indicates a huge negative effect of the literary inquisition on innovation in treatment prefectures. Specifically, the mean of the number of innovations in treatment prefectures after treatment is approximately 0.036, and it indicates that the corresponding value would be 0.080 if these prefectures were not affected by the literary inquisition. In other words, the literary inquisition reduced the number of innovations in treatment prefectures from the potential value 0.080 to the actual one 0.036, indicating a reduction of 55 in percentage. Such evidence of the destructive effect of the literary inquisition on innovation is consistent with the information conveyed in Figure 3.

In our above DID framework, the treatment prefectures are treated at different times and we use the two-way fixed effect estimator to estimate the treatment effect. However, there may exist heterogeneity in treatment effect over time or across groups. De Chaisemartin and D'Haultfoeuille (hereafter, CD) (2020) show that such a two-way fixed effect estimator is actually a weighted sum of

the average treatment effect (ATE) in each group and period, but the weight can be negative when the treatment effect is heterogeneous over time or across groups. Undoubtedly, such negative weight problem can render the DID estimator unreliable.

CD (2020) develop a Stata package (twowayfeweights) with which we can obtain all the weights attached to the fixed effect estimator. In the baseline regression (Column (4) in Table 2), there are 425 weights attached to the DID estimator among which 64 are negative (accounting for 13.1%). Figure 5 presents the distribution of all the weights. Obviously, most weights are positive and for the few negative weights, most are close to 0 (with the mean being -0.0013). Specifically, the sum of all the positive and negative weights are 1.086 and -0.086, respectively. Given that all the negative weights are extremely small, the significant estimate in our baseline regression is unlikely driven by some exceptional large negative weights attached to the fixed-effect estimators.

Considering that the traditional two-way fixed effect estimator may not be completely reliable, CD (2020) propose an alternative estimator to estimate the causal effect even if treatment effects are heterogeneous across groups or over time. Specifically, they define a term δ^s as the ATE of all switching cells, i.e., the average of the treatment effect at the time when a group starts receiving the treatment, across all groups that become treated at some point. They prove that under some assumptions, the estimator DID_M they proposed is a consistent and asymptotically normal estimator of δ^s. The validity of the estimator DID_M relies on the assumption that the control group (whose treatment is stable) shares a common trend with the treatment group (which switches from being untreated to treated) if their treatment had not changed. To check whether this assumption holds, CD (2020) further propose a placebo estimator, that essentially compares the outcome's evolution from $t-2$ to $t-1$, in groups that switch and do not switch treatment between $t-1$ and t. Specifically, if the treatment and control groups share a common trend before the treatment arrives (or the estimator DID_M is not significant), then the common trend assumption is likely to hold.

We now use CD's new estimator DID_M to estimate the effect of the literary inquisition on innovations in treatment prefectures. Table 3 reports the estimate results. Columns (1) – (4) show that the DID_M estimator is never significant prior to the treatment, and it becomes significantly negative after the treatment prefectures were exposed to the literary inquisition. Given that there seems no systematic difference in innovation between treatment and control prefectures before the literary inquisition and treatment prefectures experience a sharp drop in innovation after the literary inquisition, the literary inquisition may have had a nonnegligible negative effect on innovation in treatment prefectures.

In sum, the two-way fixed effect estimates and the alternative DID_M estimator are similar, which confirms the robustness of our estimate results. We thus can safely conclude that the literary inquisition have had significantly reduced the innovation in treatment prefectures.

4.3 Further Robustness Check: A Propensity Score Matching Approach

Although we have presented strong evidence of the treatment effect of the literary inquisition on innovation in treatment prefectures, we still cannot completely exclude the possibilities that other omitted time-varying factors may also lead to a significantly negative DID estimator. Specifically, given that the literary inquisition primarily occurred in more developed regions, the treatment and control prefectures differ in many ways. Suppose that the treatment and control prefectures begun to converge in innovation after the literary inquisition, we could also obtain a negative DID estimator. However, we cannot interpret such a DID estimator as the evidence of a destructive effect of the literary inquisition on innovation in treatment prefectures.

To further check the robustness of our empirical results, we use the propensity matching approach to construct a sample in which treatment and control prefectures are similar prior to the treatment. Intuitively, if the treatment and control prefectures are initially similar and show no significant difference in all observable characteristics, and if treatment prefectures experienced a sharp decrease in innovation after being exposed to the literary inquisition compared with control prefectures, then we could reasonably infer that the literary inquisition may have a considerable negative effect on innovation in treatment prefectures. In brief, if treatment and control prefectures initially show no observable difference and are thus largely comparable, them a significantly negative DID estimator presents strong evidence of the treatment effect of the literary inquisition on treated prefectures.

We now match the prefectures on a range of covariates using propensity score matching. In practice, we generate a propensity score for each prefecture by estimating:

$$Prob\big(Literary\ Inquisition_p = 1\big) = F(X_i), \tag{3}$$

where $Prob$ is the probability that a prefecture was exposed to the literary inquisition and X_i is the vector of covariates.

We include a set of covariates which reflect prefectural geographical characteristics, economic development and human capital level before the literary inquisition. Specifically, the geographical characteristics include whether the prefecture is located on any major river or the coast, whether it is in northern China (the latitude is larger than 26.9), basin fragmentation measured by the Herfindahl–Hirschman index, land area, agricultural suitability of crop such as rice, sweet potato and foxtail millet. Economic and human capital indicators include city size and quota of the literati of the civil examination in the early period of the Qing Dynasty. The variable quota is a key predictor of whether

a prefecture was exposed to the literary inquisition, and it accounts for a R^2 of 0.122. Such finding is not difficult to explain. As previously discussed, intellectuals were the primary targets of the literary inquisition, and prefectures with more quotas also have more intellectuals and thus have a higher probability of being exposed to the literary inquisition.

Table 4 presents the balance of geographical, economic and human capital characteristics across treatment and control prefectures before and after matching. Evidently, the treatment and control prefectures show considerable differences in these observable characteristics before matching.

In practice, we adopt the single nearest-neighbor match strategy and match the treatment prefectures with corresponding control prefectures that have similar propensity scores. Figure 6 presents the distribution of the propensity scores for treatment and control prefectures with different caliper widths. Theoretically, if the two distributions are alike, then the matching creates a sample in which treatment and control prefectures are similar. Apparently, as shown in Panels (a) and (d) of Figure 6, if the caliper width is too small (0.03) or too large (0.06), the two distributions show significant differences. By contrast, the middle Panels of Figure 6 demonstrate that if the caliper width is 0.04 or 0.05, the two distributions are much more similar. Given that a tight caliper could reduce bias and produce closer matches (Lunt, 2014), we select a relatively smaller caliper width (0.04).

As shown in Panel (b) of Table 4, we obtain a balanced sample after matching, in which the treatment and control prefectures no longer show significant differences. We now use this matched sample in which treatment and control prefectures are similar prior to the treatment to estimate the treatment effect of the literary inquisition on innovation in treatment prefectures.

We first perform the event-study analysis and estimate Equation (2) with this matched sample. We demonstrate the estimate results in Figure 7 to visualize the dynamic effect of the literary inquisition on innovation in treatment prefectures for the matched sample. Figure 7 show that before the literary inquisition ($t<0$), the estimates are very close to 0 and never significant; by contrast, after the literary inquisition, the estimates decrease sharply and become significantly negative soon. Such results indicate that the treatment and control prefectures did not show significant difference in innovation before the treatment, and the treatment prefectures experienced a sharp decline in innovation after being exposed to the literary inquisition compared with the control prefectures. Therefore, the estimate results demonstrated in Figure 7 present strong evidence of the treatment effect of the literary inquisition on innovation in treatment prefectures.

We next obtain the DID estimates by estimating Equation (1) with the matched sample. Table 5 presents the estimate results. These estimates are similar to those obtained with the full sample demonstrated in Table 2. As shown in Columns (1)–(4) of Table 5, when we gradually add control variables in the regressions, the DID estimates do not change much and are always significant at the

1% level. Specifically, the DID estimator is as large as -0.062 when we add all control variables in the regression (Column (4) of Table 5), which is larger than the corresponding estimate (-0.044) obtained with the full sample presented in Column (4) of Table 2. Given that the mean of the number of innovations in treatment prefectures after treatment is approximately 0.022, and it indicates that the corresponding value would be 0.084 if these prefectures were not affected by the literary inquisition. In other words, the literary inquisition reduced the number of innovations in treatment prefectures from the potential value 0.084 to the actual one 0.022, indicating a reduction of 74 in percentage. This estimate is much larger than that obtained from the full sample. Considering the estimates obtained from the matched sample are more likely to capture the treatment effect of the literary inquisition on innovation, such results present strong evidence that the literary inquisition may have had a huge negative effect on innovation in treatment prefectures.

Given that both the DID estimates obtained from the full and matched samples are highly consistent, our identification are robust to a large extent. To conclude, the literary inquisition could have stifled the spirit of innovation of society, particularly among intellectuals who were the main contributor of scientific and technological innovation at the time, and consequently, the number of innovations dropped sharply in the treatment prefectures after exposing to the literary inquisition.

4.4 The Spillover Effect of the Literary Inquisition on Innovation

In our above empirical analysis, we assume that the literary inquisition only affected the treatment prefectures and thus we can use untreated prefectures as controls and obtain the DID estimator to capture the treatment effect of the literary inquisition in those prefectures. However, in reality, all prefectures, include those control prefectures, could be affected by the literary inquisition to some extent. As mentioned earlier, the Qing rulers implemented the literary inquisition to send strong messages to citizens that people who dared to oppose to the regime would be punished severely. Therefore, the information about the literary inquisition cases could spread throughout the country and thus a literary inquisition case could have a deterrent effect on innovation at the national level. Undoubtedly, the literary inquisition could have a large negative effect on innovation in treatment prefectures. Moreover, it could also have a spillover effect on innovation in other regions where people acquired the information about the literary inquisition cases.

We now examine the potential spillover effect of the literary inquisition on innovation in the control prefectures which were not directly exposed to the literary inquisition cases. Intuitively, people in the control prefectures which were adjacent to the treatment prefectures were more likely to acquire the information about the literary inquisition cases occurred in their neighbors, and thus these cases may also have a non-negligible negative effect on innovation in these control prefectures. By contrast, given that people in control prefectures that were not adjacent to the treatment prefectures may not be

able to obtain the information about the literary inquisition cases that occurred far away, they might be much less affected by those cases. Therefore, we can compare the effects of the literary inquisition on innovation in treatment and adjacent control prefectures, and in treatment and non-adjacent control prefectures, respectively, to infer the potential spillover effect.

In practice, we construct two sub-samples to perform the DID analysis, namely, Sub-sample I, in which we include all treatment prefectures and their non-adjacent control prefectures, and Sub-sample II, which includes all treatment prefectures and their adjacent control prefectures. Given that the control prefectures that are not adjacent to the treatment ones may be largely unaffected by the literary inquisition, they serve as a better control group for the treatment prefectures. Similarly, given that the control prefectures that are adjacent to the treatment ones may also be affected by the literary inquisition to some extent, they do not form a perfect control group for the treatment prefectures. Therefore, if there exists a spillover effect of the literary inquisition on innovation, we expect that the DID estimator obtained from Sub-sample I would be larger (in absolute value) than that obtained from Sub-sample II.

We first estimate Equation (1) with the Sub-samples I and II constructed from the full sample which includes all prefectures and report the results in Columns (1) and (2) in Table 6. Both estimates are significant, and the estimate obtained from Sub-sample I (-0.044) is slightly larger (in absolute value) than that obtained from Sub-sample I (-0.041). However, the difference between the two estimates is not significant different from 0 (with the p value being approximately 0.82). Thus, the estimates obtained from the full sample do not present strong evidence of the spillover effect.

We then estimate Equation (1) with the Sub-samples I and II constructed from the matched sample in which treatment and control prefectures are more comparable and report the results in Columns (3) and (4) of Table 6. Again, both estimates are significant and the estimate obtained from Sub-sample I (-0.099) is larger (in absolute value) than that obtained from Sub-sample I (-0.063). Furthermore, the difference between the two estimates is nearly significant different from 0 (with the p value being approximately 0.11), which presents evidence of the spillover effect.

It should be stressed that if spillover effect exists, then the DID estimates present the lower bound of the deterrent effect of the literary inquisition on innovation in treatment prefectures. Specifically, if both treatment and control prefectures were affected by the literary inquisition, with the treatment prefectures being affected to a larger extent, then a significant DID estimator indicates that innovation in treatment prefectures decreased more sharply than that in control prefectures, which presents strong evidence of the treatment effect. In other words, if control prefectures were completely unaffected by the literary inquisition, the innovation in treatment prefectures would decrease to a larger extent and

the DID estimator would also be even more negative. Therefore, the potential spillover effect makes our estimates more reliable.

5. The Effect of the Literary Inquisition on the Economic Development in Qing China

We have shown that the literary inquisition may have stifled the spirit of innovation among citizens and thus significantly reduced the number of innovations in treatment prefectures, and we now further investigate the potential effect of the literary inquisition on the economic development of the Qing Dynasty of China, particularly in the long term.

Spirit of Innovation could be the fundamental motor of the economic development of a society. Therefore, if the literary inquisition hindered innovation, it may ultimately impede the economic development of a society. However, as mentioned earlier, the literary inquisition was implemented during the period of "the Kangxi-Qianlong Great ages" when China enjoyed high economic prosperity, and it seems that the literary inquisition did not immediately destroy the generally agricultural economy of China at the time. However, the literary inquisition could stifle the spirit of innovation among citizens and destroy the foundation of the society to make progress, and ultimately retard the long-term economic development of the country.

As shown earlier, China begun to decline in science and technology after 1700. However, China still enjoyed high prosperity during this period and begun to decline in economy after 1800. It seems China's decline in science and technology did not have a direct destructive effect on the economy, at least in the short term. Be that as it may, China's decline in science and technology may be fundamental determinant of the termination of China as a leading power in the world in the late Qing Dynasty. Specifically, if China's decline in science and technology induces that it missed the Industrial Revolution, then it would surely fall behind of Europe in economy in the industrial era. Therefore, we can largely explain China's ultimate decline in the economy in the late Qing Dynasty by proving that the literary inquisition led to China's decline in science and technology prior to the Industrial Revolution. However, how extreme expression controls affect the long-term economic development of a society itself is a fundamental and interesting issue. We now provide some suggestive evidence of the potential effect of the literary inquisition on the long-term economic development in the Qing China.

We use the land tax revenue at the provincial level to measure the economic performance of each province in the Qing Dynasty. As mentioned earlier, land tax was the primary source of revenue for the Qing government, and given that the tax rate was fixed, the total revenue of land tax reflected the agricultural output level. Therefore, land tax revenue could be a reliable economic development

indicator in the Qing Dynasty of China, where agriculture was the most important industry and agricultural output accounted for a large share of the total output.

As discussed earlier, we construct a panel data of land tax revenue during the period of 1670–1820, and the observation is at the provincial level with a decadal time interval. The treatment is a province's first exposure to the literary inquisition case. We employ an event-study analysis framework to identify the dynamic effects of the literary inquisition on land tax revenue and estimate the following equation:

$$LandTax_{pt} = \sum_{\tau} \beta_{\tau} literary\ inquisition_{p\tau} + Treat_p \times After1790_t + \theta X_p \times \gamma_t + \lambda_p + \gamma_t + \epsilon_{pt}\ , \quad (4)$$

where $LandTax_{pt}$ is the land tax revenue in province p in time t, $literary\ inquisition_{p\tau}$ is a set of indicator variables that equal 1 if it has been τ years since the first literary inquisition case, where $\tau \in \{\ -20, -10, 0,\ 10,\ 20, 30, 40, 50, 60, 70, 80, 90, 90+\}$. The reference groups are 20 years before the first literary inquisition case. Other variables are similar to these in Equation (2). Again, β_{τ} is the parameter of interest.

Figure 8 visualizes the estimate results of Equation (4). Evidently, before the literary inquisition ($t < 0$), the estimates of β_{τ} are very close to 0 and not significant. By contrast, after the literary inquisition ($t > 0$), the estimates begin to decrease and become significantly negative 30 years later and continue to decrease thereafter. Such results indicate that the literary inquisition may have a nonnegligible negative effect on the land tax revenue in the treatment provinces, particularly in the long term.

Table 7 reports the estimates of β_{τ} in Equation (4). From 30 years after the literary inquisition, the estimates become significantly negative and continue to decrease. The significant estimates range from -0.25 to -0.77, suggesting that the literary inquisition reduced the land tax revenue in the treatment prefectures by 0.25–0.77 or by 9.9–25.3 in percentage. Such estimates indicate that the negative effect of the literary inquisition on land tax revenue is modest, particularly in the short term.

We also have the cross-sectional data on land tax revenue for all prefectures in 1820, and thus we further examine the correlation between the occurrence of the literary inquisition and the land tax revenue in 1820 at the prefectural level by estimating the following equation:

$$\ln\left(Landtax1820_p\right) = \beta_1 LiteraryInquisition_p + \gamma X_p + \alpha_s + \epsilon_p, \quad (5)$$

where $Landtax1820_p$ is the land tax revenue in prefecture p in 1820, $LiteraryInquisition_p$ is a dummy that equals to 1 if prefecture p was ever exposed to the literary inquisition, X_p is a set of

prefectural-level control variables, α_s is a province fixed effect, ϵ_p is an error term, and β_1 is the estimate of interest.

Table 8 reports the estimate results from the full sample and matched sample (obtained in Section 4.3), respectively. For the full sample, Column (1) of Table 8 presents that the estimate of β_1 is significantly positive if we control the province fixed effect in the regression, indicating that prefectures exposed to the literary inquisition were generally more developed and had a higher level of land tax revenue. However, as we gradually add control variables in the regression, Columns (2) and (3) show that the coefficient becomes smaller and insignificant. Such results indicate that the occurrence of literary inquisition is endogenous and treatment and control prefectures were generally incomparable, and thus identifying the causal effect of the literary inquisition on land tax revenue based on the OLS estimates from the full sample is difficult.

We thus further use the matched sample in which treatment and control prefectures are similar to obtain the estimates that might be interpreted as the causal effect. Column (4) of Table 8 presents that the estimate (without controls) becomes very small and insignificant, indicating that treatment and control prefectures did not show significant difference in land tax in 1820, and thus the endogeneity seems not a problem for the matched sample. Furthermore, as we control the time interval between treatment prefectures' first exposure to the literary inquisition and 1820 in the regression (Column (5)), the estimate becomes significantly negative, and the result remains similar when we add more controls in the regression (Column (6)). Such results present suggestive evidence that the literary inquisition may have a negative effect on land tax revenue in affected prefectures.

6. Conclusion

The "Kangxi-Qianlong Great Ages" was considered as one of the pinnacles of imperial China during which the country enjoyed high prosperity and became the leading power of the world. However, the Qing regime also implemented extreme thought control (the literary inquisition) on citizens and created a terrifying atmosphere of society at the time. Such extreme expression control may have made the society lose vitality and creativity and thus destroyed the foundation of the country to make progress. Our study suggests that the literary inquisition may have stifled the spirit of innovation of society and led to China's decline in science and technology in the short term, and ultimately led to its decline in the economy in the long term. Such findings seem surprising yet reasonable and thought-provoking, leading us to reevaluate the "Kangxi-Qianlong Great Ages" in the context of Chinese history.

Although this study focuses on the destructive effects of expression controls on spirit of innovation, such controls could harm society in many other ways. For instance, the government could

easily screen off all the criticisms on them by imposing strict restrictions on free expression, and thus they have no incentive to improve their work to make citizens satisfied. Consequently, the governance would remain at a low level. Evidently, for an authoritarian regime, working hard to please citizens needs more effort than simply forbidding them to complain. Therefore, it is not surprising that restrictions on free speech are common in those regimes.

It is not surprising that extreme expression controls could have such destructive effects on society. However, we should be cautious to interpret the findings in this paper. Although expression controls in authoritarian regimes are common, extreme practices such as the literary inquisition in the Qing China are rare and have vanished in the modern world. Free speech controls nowadays are generally mild, with the goal of making citizens supportive of the regime by keeping them in ignorance. Although such mild expression controls would surely affect society negatively and bring about undesirable outcomes, their effects may not be the same to that of extreme policies such as the literary inquisition. How such mild controls on free expression affect society in the short and long terms, whether they also have a destructive effect on innovation and economic development, remains an unanswered question and needs further study in the future.

References

Ai, Suzhen and Zhenghai Song. 2003. *Zhongguo kexue jishu shi: nianbiao juan (Science and Technology in China: Chronological Volumes)*. Beijing: Science Press.

Bai, Ying, and Ruixue Jia. 2016. "Elite Recruitment and Political Stability: The Impact of the Abolition of China's Civil Service Exam." *Econometrica* 84 (2): 677-733.

Becker, Sascha O., Francisco J. Pino, and Jordi Vidal-Robert. 2021. "Freedom of the Press? Catholic Censorship during the Counter-Reformation." Working Paper.

Blasutto, Fabio, and David De La Croix. 2021. "Catholic Censorship and the Demise of Knowledge Production in Early Modern Italy." Working Paper.

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

Cantoni, Davide and Noam Yuchtman. 2013. "The Political Economy of Educational Content and Development: Lessons from History." *Journal of Development Economics* 104: 233-244.

Cao, Shuji. 2001. *The Population History of China*, Vol. 5. Shanghai: Fudan University Press.

De Chaisemartin, Clément, and Xavier D'Haultfoeuille. 2020. "Two-Way Fixed Effects Estimators with Heterogeneous Treatment Effects." *American Economic Review* 110 (9): 2964-96.

Drelichman, Mauricio, Jordi Vidal-Robert, and Hans-Joachim Voth. 2021. "The Long-Run Effects of Religious Persecution: Evidence from the Spanish Inquisition." *Proceedings of the National Academy of Sciences* 118 (33): e2022881118.

Ford, Guy. 1935. *Dictatorship in the Modern World*. Minneapolis, MN: University of Minnesota Press.

Guo Chengkang, Tiejun Lin. 1990. *Qingchao wenziyu (The Literary Inquisition in the Qing Dynasty).* Beijing: Qunzhong Press.

Fu, Zhengyuan. 1993. *Autocratic Tradition and Chinese Politics*. Cambridge, UK: Cambridge University Press.

Jones, Peter M. 2017. *Industrial Enlightenment: Science, Technology and Culture in Birmingham and the West Midlands, 1760–1820.* Manchester, UK: Manchester University Press.

Liang, Fangzhong. 1981. *Zhongguo lidai hukou, tiandi, tianfu tongji (Historical Statistics of Population, Land and Taxation in China)*. Shanghai: Shanghai People's Publishing House.

Lin, Justin Yifu. 1995. “The Needham Puzzle: Why the Industrial Revolution Did Not Originate in China.” *Economic Development and Cultural Change* 43 (2): 269-292.

Lunt, Mark. 2014. “Selecting an Appropriate Caliper Can Be Essential for Achieving Good Balance with Propensity Score Matching.” *American Journal of Epidemiology* 179 (2): 226-235.

Pearsall et al. 2007. *The New Oxford English-Chinese Dictionary*. 3rd ed. Shanghai: Shanghai Foreign Language Education Press.

Phelps Edmund S. 2013. *Mass Flourishing: How Grassroots Innovation Created Jobs, Challenge, and Change.* Princeton, NJ: Princeton University Press.

Qingdai wenziyu dang (zengding ben) (Archives of the Literary Inquisition Cases (Updated Edition)). Shanghai: Shanghai Bookstore Publishing House, 2011.

Qingdai wenziyu dang ji (Archives of the Literary Inquisitions Cases (Collected Volumes)). Shanghai: Shanghai Bookstore Publishing House, 1934.

Rozman, Gilbert. 2015. *Urban Networks in Ch'ing China and Tokugawa Japan.* Princeton, NJ: Princeton University Press.

Shuntarō Itō, Zhenhuan Jiang and Guanxiong Ge. 1984. *Shijie kexue jishu shi nianbiao (Concise Chronology of the World History of Science and Technology)*. Harbin: Harbin Institute of Technology Press.

Wakeman, Frederic E. 1985. *The Great Enterprise: The Manchu Reconstruction of Imperial Order in Seventeenth-Century China,* Vol. 1. Oakland, CA: University of California Press.

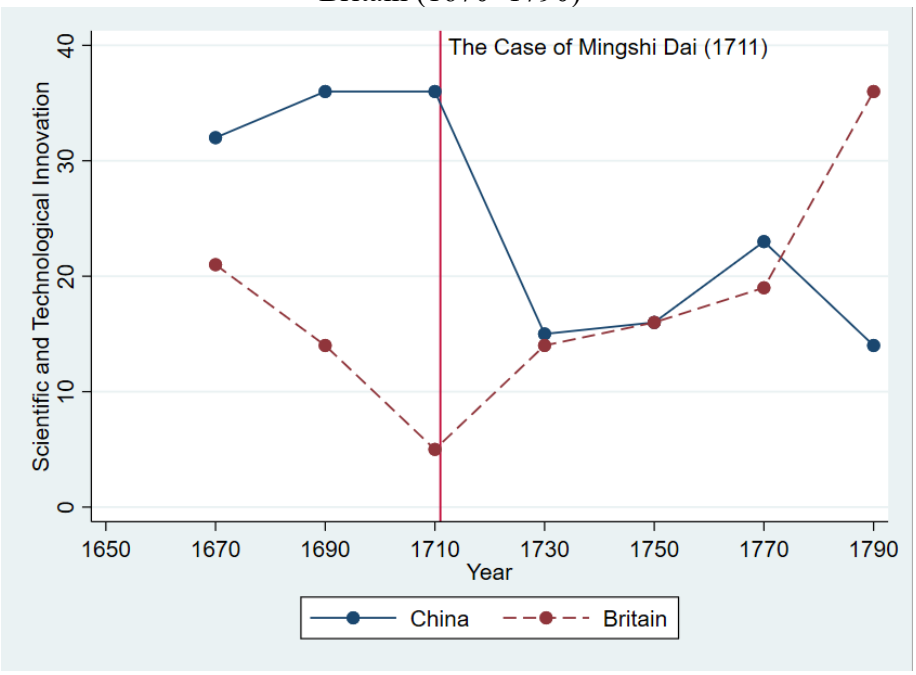
Wang, Fan-Sen. 2002. “Political Pressures on the Cultural Sphere in the Ch’ing Period.” *The Cambridge History of China. Ed. by William J. Peterson* 9. Part II: 606-648.

Wang, Yeh-chien. 1973. *Land taxation in Imperial China, 1750-1911*. Cambridge, MA: Harvard University Press.

Xue, Melanie Meng. 2021. “Autocratic Rule and Social Capital: Evidence from Imperial China.” Working Paper.

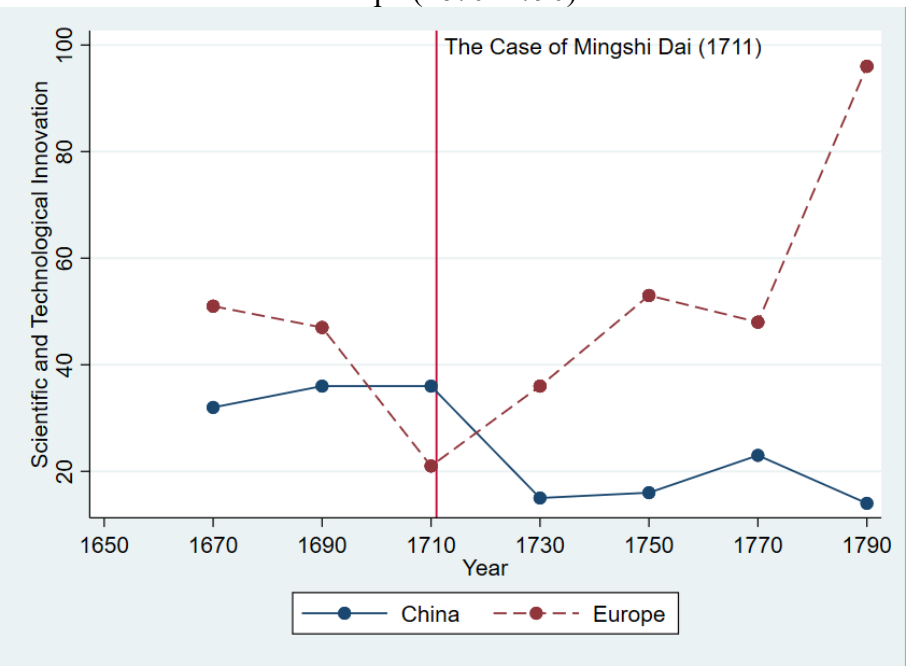
Yan, Chongnian. 2016. *Kang xi di da zhuan (The Biography of the Emperor Kangxi).* Beijing: Zhonghua Book Company.

Figure 1: The Number of Scientific and Technological Innovations in China and Britain (1670–1790)



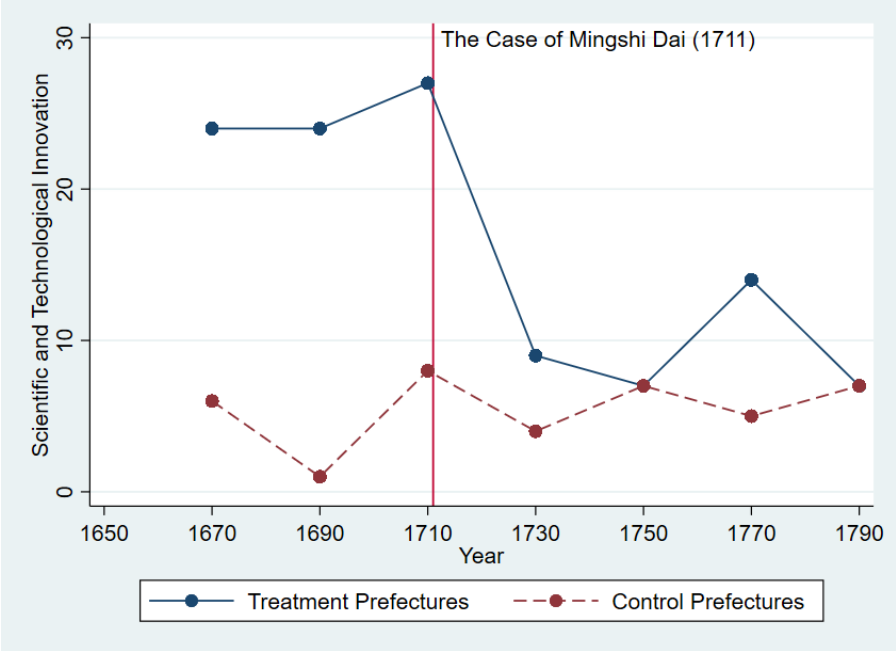
Note: The data on scientific and technological innovation in China and Britain are from Ai and Song (2003) and Jiang and Ge (1984), respectively. In both books, the authors record important events in scientific and technological activities in history, including innovations in science and technology. On the basis of these recordings, we collect the data on innovations in science (e.g., mathematics, physics, chemistry) and technology (e.g., agriculture, medicine) in China and Britain during 1670 and 1790.

Figure 2: The Number of Scientific and Technological Innovations in China and Europe (1670–1790)



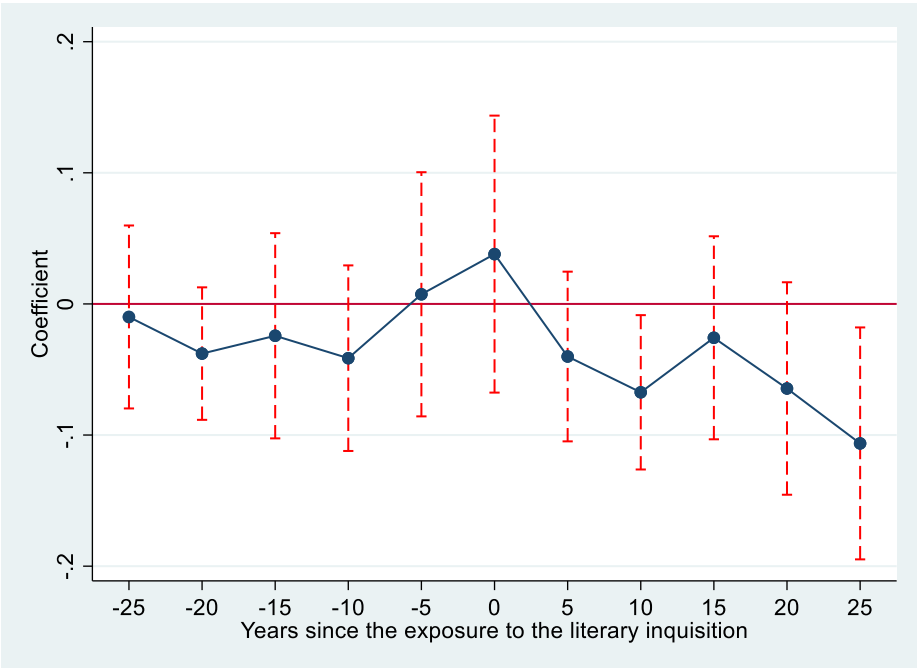
Note: Similar to Figure 1, the data on scientific and technological innovation in China and Europe are from Ai and Song (2003) and Jiang and Ge (1984), respectively.

Figure 3: The Number of Scientific and Technological Innovations in China, Treatment and Control Prefectures (1670–1790)



Note: The data on scientific and technological innovation in China are from Ai and Song (2003).

Figure 4: The Dynamic Effects of the Literary Inquisition on Scientific and Technological Innovation



Note: Figure 4 visualizes the dynamic effects of the literary inquisition on innovation, using the groups 30 years prior to the literary inquisition as the reference. The solid line connects the estimates and the dashed line indicates the 95% confidence intervals.

Figure 5: The Distribution of the Weights Attached to the DID Estimator in the Baseline Regression

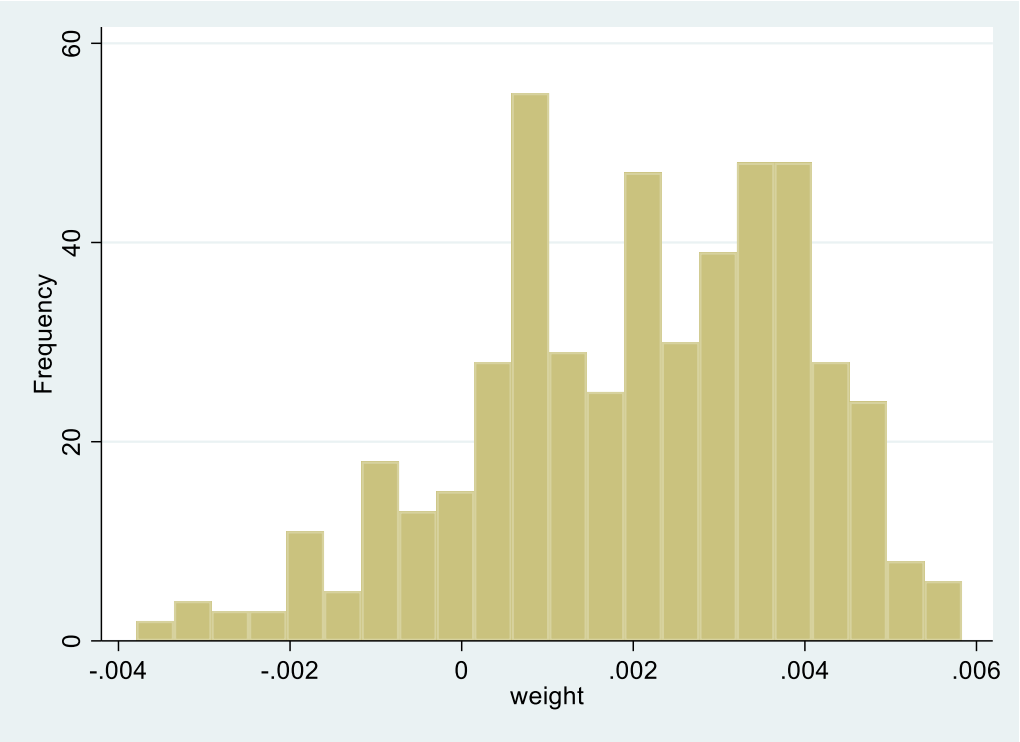
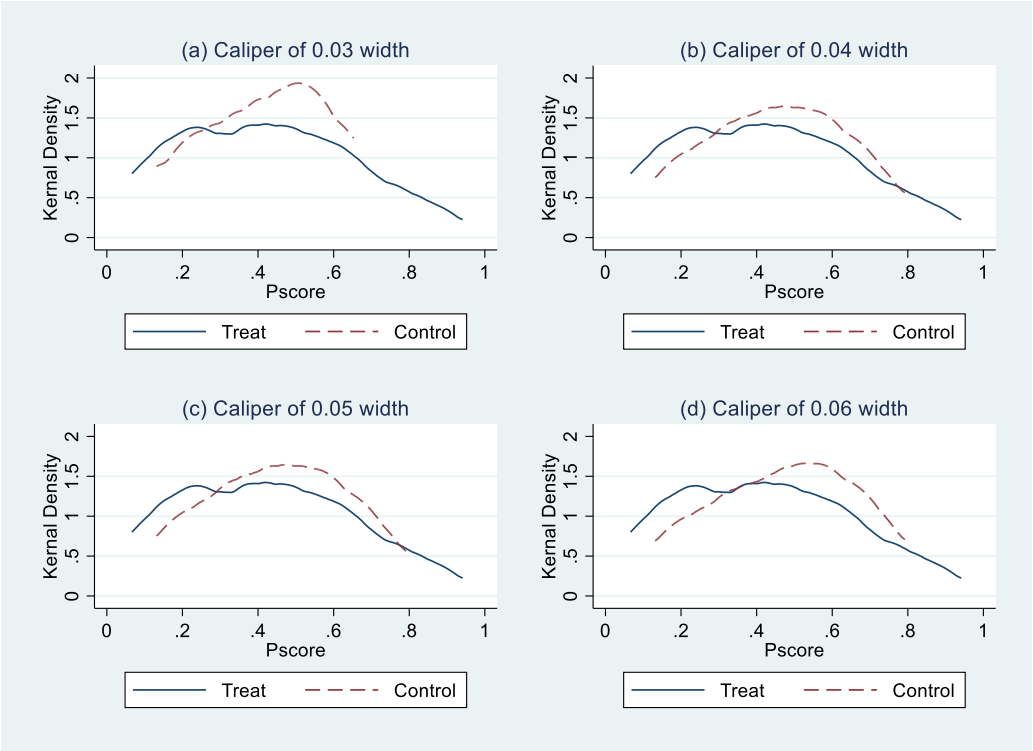
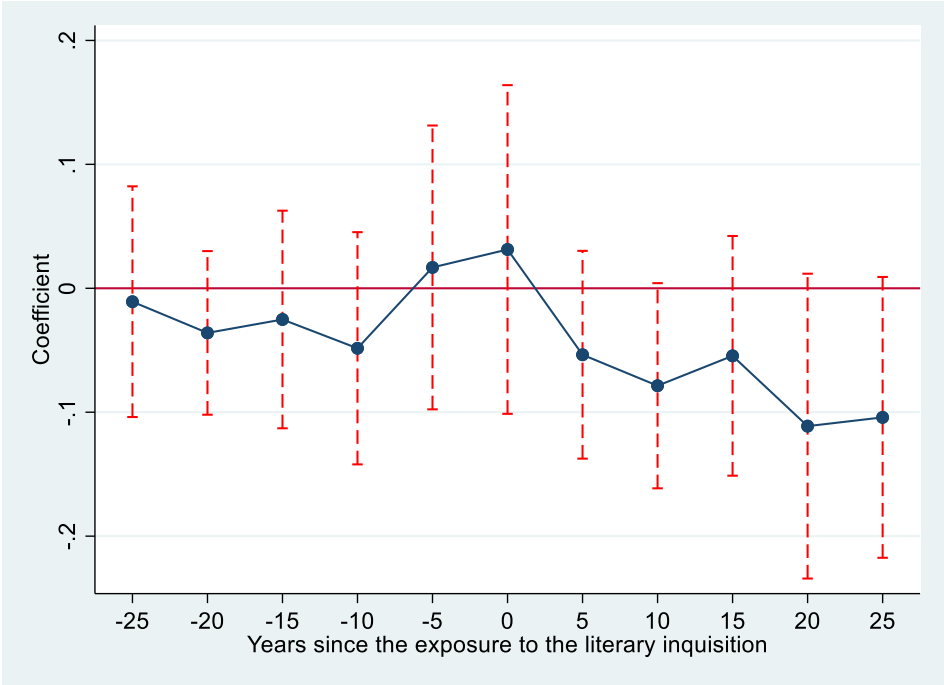


Figure 6: Propensity Score Matching: Varying Caliper Width



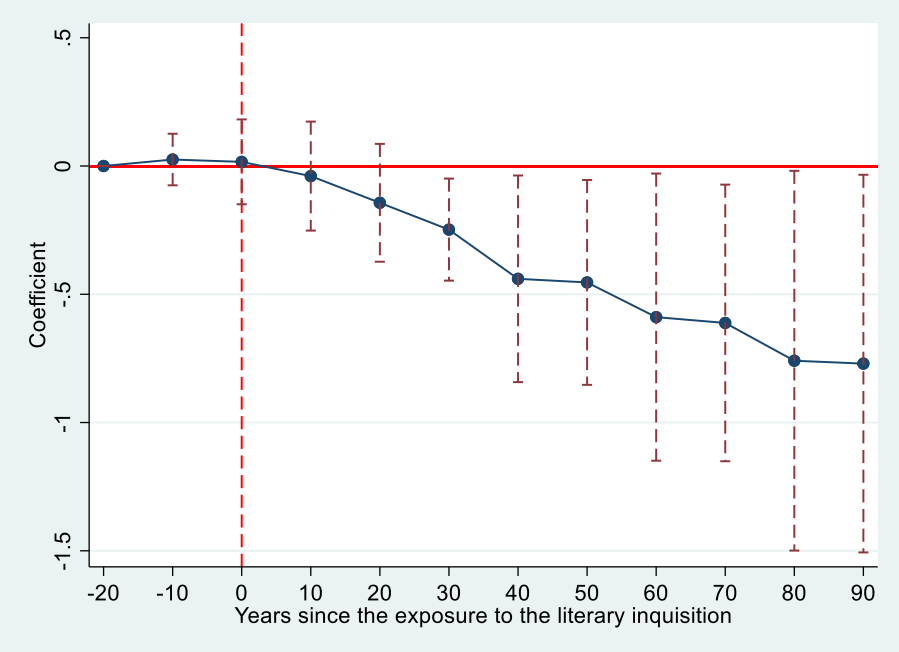
Note: Figure 6 shows the distribution of the propensity scores for treatment and control prefectures.

Figure 7: The Dynamic Effects of the Literary Inquisition on Scientific and Technological Innovation (the Matched Sample)



Note: Figure 7 visualizes the dynamic effects of the literary inquisition on innovation with the matched sample, using groups 25 years prior to the literary inquisition as the reference. The solid line connects the estimates and the dashed line indicates the 95% confidence intervals.

Figure 8: The Dynamic Effects of the Literary Inquisition on Land Tax Revenue (Provincial Level)



Note: Figure 8 visualize the dynamic effects of the literary inquisition on land tax revenue, using the groups 20 years prior to the literary inquisition as a reference. The solid line connects the estimates and the dashed line indicates the 95% confidence intervals.

Table 1: Summary Statistics

Variables	Variables Definition	Sources	Obs.	Mean	S.D.
	(a) Prefecture level				
1700-1800					
#Innovation	The number of scientific and technological innovations	1	5240	0.0177	0.1798
Literary Inquisition	Whether prefecture was exposed to the literary inquisition	2	5240	0.0933	0.2909
Quota	The quota of the prefectural-level civil examination [1]	4	262	96.1374	62.5527
Coastal	Whether a prefecture is situated on the coast	4	262	0.1336	0.3409
Main river	Whether a prefecture includes one or more major rivers[2]	4	262	0.6183	0.4867
Small city	City with a population between 30,000 and 70,000	5	262	0.1985	0.3996
Middle city	City with a population between 70,000 and 300,000	5	262	0.1221	0.3281
Large city	City with a population of 300,000 and above	5	262	0.0382	0.1920
Area	Area of the prefecture (unit: km^2)	4	262	15434.05	17843.1
North	Whether a prefecture is in northern China (latitude > 26.9)	4	262	0.7290	0.4453
1820					
Landtax1820	Land tax revenue in 1820 (unit: silver tael)	3	261	114564.4	133197.1
Literary Inquisition	Whether prefecture was ever exposed to the literary inquisition before 1820	2	261	0.2529	0.4355
Pop1820	Population in 1820	6	261	130.236	117.5848
PopGrowth	Population growth rate during 1776–1820 (unit: %)	6	261	-0.0002	0.0069

(*Continues*)

Table 1-*Continued*

Variables	Variables Definition	Sources	Obs.	Mean	S.D.
	Province level				
1670-1820					
LandTax	Land tax revenue (unit: million silver taels)	3	222	1.4690	1.0875
Literary Inquisition	Whether a province was ever exposed to the literary inquisition	2	18	0.8333	0.3835
LandArea	The farmland area (unit: million acres)	5	222	35.4950	24.1727
Quota	The quota of the entry-level civil examination	4	18	1399.333	435.9985
Coastal	The proportion of prefectures on the coast (unit: %)	4	18	0.1542	0.2147
Main river	The proportion of prefectures with one or more major rivers (unit: %)	4	18	0.6122	0.1754
Small city	The proportion of prefectures with 30,000 - 70,000 population (unit: %)	5	18	0.2125	0.1240
Middle city	The proportion of prefectures with 70,000 - 300,000 population (unit: %)	5	18	01316	0.0753
Large city	The proportion of prefectures with 300,000 or more population (unit: %)	5	18	0.0405	0.0510
Area	Area of the province (unit: km^2)	4	18	224651.1	143343.7
North	The proportion of prefectures with latitude > 26.9 (unit: %)	4	18	0.7383	0.3960

Note: 1. In the Qing Dynasty, for the entry level of the civil examination, all 262 prefectures were assigned specific quotas that determined the number of candidates succeeding in the exam and entering the elite class. 2.Major rivers are those ranked as first- and second-order streams in Chinese river hierarchy.

Source

1. Ai and Song (2003).

2. Qingdai wenziyu dang(Zengding Ben) (2011).

3. Liang (1981).

4.Bai and Jia (2016).

5.Rozman (1973).

6.Cao (2001).

Table 2: The Effect of the Literary Inquisition on Innovation (Two-Way Fixed Effect Estimates)

	Dependent Variable: # Innovations			
	(1)	(2)	(3)	(4)
Literary Inquisition	-0.0494***	-0.0446***	-0.0468***	-0.0440**
	(0.0171)	(0.0172)	(0.0180)	(0.0174)
Prefecture FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Treat × After 1790	Yes	Yes	Yes	Yes
Province FE × Time FE	No	Yes	Yes	Yes
Coastal × Time FE	No	No	Yes	Yes
Main river × Time FE	No	No	Yes	Yes
North × Time FE	No	No	Yes	Yes
Area × Time FE	No	No	Yes	Yes
Small city × Time FE	No	No	No	Yes
Middle city × Time FE	No	No	No	Yes
Large city × Time FE	No	No	No	Yes
Quota × Time FE	No	No	No	Yes
Observations	7336	7336	7336	7336
R-squared	0.012	0.093	0.111	0.149

Note: Control variables include $Treat_p \times After1790_t$ ($Treat_p$ is a dummy indicating whether prefecture p was ever exposed to the literary inquisition, $After1790_t$ is a dummy that equals 1 when observations were after 1790), Coastal (whether a prefecture is situated on the coast), Main river (whether a prefecture includes one or more major rivers), North (whether a prefecture is in northern China), Area (the area of prefectures), Large city (city with a population of 300,000 and above), Middle city (city with a population between 70,000 and 300,000), Small city (city with a population between 30,000 and 70,000), Quota (the quota of the prefectural-level civil examination). Standard errors in parentheses are clustered at the prefecture level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3: The Effect of the Literary Inquisition on Innovation (DID_M Estimator)

	Dependent Variable: # Innovations				
	Relative time to the exposure to the literary inquisition				
	t = -20	t = -15	t = -10	t = -5	t = 0
Literary Inquisition	0.0163	-0.0295	0.0748	0.0434	-0.1059**
	(0.0331)	(0.0403)	(0.0419)	(0.0499)	(0.0535)
Observations	2621	2621	2621	2621	2621

Note: We control the same variables in the regression in Column (4) of Table 2 in all regressions. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Balance of the Sample: Matching Covariates

	(a) Before Matching				
	Treatment Prefectures		Control Prefectures		
Variables	Obs.	Mean	Obs.	Mean	Diff in Mean
Quota	66	136.18	196	82.653	53.527***
Coast	66	0.21212	196	0.10714	0.105**
Major river	66	0.66667	196	0.60204	0.065
Small city	66	0.22727	196	0.18878	0.0385
Middle city	66	0.24242	196	0.08163	0.161***
Large city	66	0.09091	196	0.02041	0.071**
Area	66	13710	196	16015	-2305
North (latitude > 26.9)	66	0.86364	196	0.68367	0.180***
Foxtail millet suitability	66	2.9998	196	2.8351	0.165
Rice suitability	66	2.4051	196	1.8522	0.553***
Sweet potato suitability	66	2.4641	196	2.6758	-0.212
Basin fragmentation	66	0.6038	196	0.61001	-0.006
	(b) After Matching				
	Treatment Prefectures		Control Prefectures		
Variables	Obs.	Mean	Obs.	Mean	Diff in Mean
Quota	58	121.05	42	124.5	-3.45
Coast	58	0.2069	42	0.24138	-0.034
Major river	58	0.63793	42	0.55172	0.086
Small city	58	0.25862	42	0.24138	0.017
Middle city	58	0.18966	42	0.18966	0
Large city	58	0.06897	42	0.05172	0.017
Area	58	13618	42	13734	-116
North (latitude > 26.9)	58	0.84483	42	0.86207	-0.017
Foxtail millet suitability	58	2.8934	42	2.8736	0.020
Rice suitability	58	2.3498	42	2.2585	0.091
Sweet potato suitability	58	2.5247	42	2.4283	0.096
Basin fragmentation	58	0.62107	42	0.56267	0.058

Note: This table reports differences between prefectures which experienced the literary inquisition and those that did not regarding their pre-treatment covariates.

Table 5: The Effect of the Literary Inquisition on Innovation (the Matched Sample)

	Dependent variable: # Innovations			
	(1)	(2)	(3)	(4)
Literary Inquisition	-0.0604***	-0.0533***	-0.0588***	-0.0620***
	(0.0213)	(0.0200)	(0.0209)	(0.0210)
Prefecture FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Treat × After 1790	Yes	Yes	Yes	Yes
Province FE × Time FE	No	Yes	Yes	Yes
Coastal × Time FE	No	No	Yes	Yes
Main river × Time FE	No	No	Yes	Yes
North × Time FE	No	No	Yes	Yes
Area × Time FE	No	No	Yes	Yes
Small city × Time FE	No	No	No	Yes
Middle city × Time FE	No	No	No	Yes
Large city × Time FE	No	No	No	Yes
Quota × Time FE	No	No	No	Yes
Observations	2800	2800	2800	2800
R-squared	0.019	0.195	0.231	0.311

Note: We control the same variables in the regression in Column (4) of Table 2 in all regressions. Standard errors in parentheses are clustered at the prefecture level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6: The Spillover Effect of the Literary Inquisition on Innovation

	Dependent variable: # innovations			
	Full Sample		Matched Sample	
	Sub I	Sub II	Sub I	Sub II
	(1)	(2)	(3)	(4)
Literary Inquisition	-0.0441**	-0.0414**	-0.0985**	-0.0632***
	(0.0214)	(0.0168)	(0.0405)	(0.0242)
Prefecture FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Treat × After 1790	Yes	Yes	Yes	Yes
Province FE × Time FE	Yes	Yes	Yes	Yes
Coastal × Time FE	Yes	Yes	Yes	Yes
Main river × Time FE	Yes	Yes	Yes	Yes
North × Time FE	Yes	Yes	Yes	Yes
Area × Time FE	Yes	Yes	Yes	Yes
Small city × Time FE	Yes	Yes	Yes	Yes
Middle city × Time FE	Yes	Yes	Yes	Yes
Large city × Time FE	Yes	Yes	Yes	Yes
Quota × Time FE	Yes	Yes	Yes	Yes
Observations	4060	5124	1848	2576
R-squared	0.267	0.187	0.369	0.325

Note: We control the same variables in the regression in Column (4) of Table 2 in all regressions. Standard errors in parentheses are clustered at the prefecture level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 7: The Dynamic Effects of the Literary Inquisition on Land Tax Revenue (Provincial Level)

	Dependent Variable: Land Tax Revenue		
Time	(1)		(2)
-10	0.0253	50	-0.454**
	(0.0476)		(0.189)
0	0.0162	60	-0.589**
	(0.0784)		(0.265)
10	-0.0393	70	-0.612**
	(0.101)		(0.256)
20	-0.143	80	-0.759**
	(0.109)		(0.351)
30	-0.248**	90	-0.770**
	(0.0943)		(0.349)
40	-0.440**		
	(0.191)		
Province FE	Yes		Yes
Decade FE	Yes		Yes
$Treat_p \times After1790_t$	Yes		Yes
Land area	Yes		Yes
Coastal × Decade FE	Yes		Yes
Main river × Decade FE	Yes		Yes
North × Decade FE	Yes		Yes
Area × Decade FE	Yes		Yes
Small city × Decade FE	Yes		Yes
Middle city × Decade FE	Yes		Yes
Large city × Decade FE	Yes		Yes
Quota × Decade FE	Yes		Yes
Observations	222		222
R-squared	0.819		0.819

Note: Control variables include $Treat_p \times After1790_t$ ($Treat_p$ is a dummy indicating whether province s was ever exposed to the literary inquisition, $After1790_t$ is a dummy that equals 1 when observations were after 1790), Land area (the field area of province), Coastal (the proportion of coastal prefectures in the province), Main river (the proportion of prefectures includes one or more major rivers in the province), North (the proportion of northern prefectures in the province), Area (the area of the province), Large city (the proportion of large cities in the province), Middle city (the proportion of middle cities in the province), Small city (the proportion of small cities in the province), Quota (the sum of the quotas of the prefectural-level civil examination in the province). Standard errors in parentheses are clustered at the province level, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 8: The Correlation between the Occurrence of the literary inquisition and the Land Tax Revenue in 1820 (Prefectural Level)

	Dependent variable: ln(Land tax in 1820)					
	Full Sample			Matched Sample		
	(1)	(2)	(3)	(4)	(5)	(6)
Literary Inquisition	0.739***	0.675*	0.556	-0.0580	-0.786**	-0.506**
	(0.167)	(0.355)	(0.376)	(0.177)	(0.349)	(0.248)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
$T1820_p$	No	Yes	Yes	No	Yes	Yes
$Pop1820_p$	No	No	Yes	No	No	Yes
$PopGrowth_p$	No	No	Yes	No	No	Yes
Baseline Controls	No	No	Yes	No	No	Yes
Observations	261	261	258	99	99	99
R-squared	0.518	0.637	0.750	0.574	0.760	0.870

Note: Control variables include $T1820_p$ (the time interval between treatment prefectures' first exposure to the literary inquisition and 1820), $Pop1820_p$ (population size in 1820), $PopGrowth_p$ (population growth rate during 1700 and 1820), and baseline controls same to those in Table 2.

Robust standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$