Guns and Resources: War Extractions and Governance Paradigm Shifts

Shuo Chen, Xinyu Fan, Yongtao Li, and Yanfei Yin*

Abstract: How does the state choose between direct and indirect governance when faced with wartime mobilization needs? Using the 70-year Dzungar-Qing War (1688-1758) as an exogenous shock and a difference-in-differences strategy on prefecture-level panel data, we reveal that for the Qing empire, southern regions rich in war-related resources were more likely to shift from local autonomy to direct governance after the war broke out on northwestern borders. The paradigm shifts occurred more in regions where transportation was more convenient, whereas the shifted regions opened more factories, highlighting the demand for strategic resources as an important determinant of governance paradigm shifts.

Keywords: War; Strategic Resources; Direct Governance; Indirect Governance
JEL Codes: D74; H56; N45; P48

* Chen: Department of Economics, Fudan University, Shanghai, China, e-mail: cs@fudan.edu.cn; Fan: Cheung Kong Graduate School of Business, Beijing, China, e-mail: xyfan@ckgsb.edu.cn; Li: Department of Economics, Liaoning University, Shenyang, China, e-mail: li_yongtao1022@163.com; Yin: Department of Economics, Nanjing University, China, e-mail: njuyyf222@163.com. All remaining errors are our own.

1. Introduction

Direct and indirect governance are key topics of interest in development economics and economic history (Allen, 2011; Padró-i-Miquel and Yared, 2012; Acemoglu et al., 2013; Callen et al., 2018). Direct governance refers to the central government's control over local administration and taxation, while indirect governance refers to the high degree of local autonomy. The existing literature has examined the short- and long-term effects of different governance paradigms on political elites (Cheema et al., 2009), public goods provision (Chaudhary and Rubin, 2016), economic development (Bertocchi and Canova, 2002; Goldstein and Udry, 2008; Allen, 2011; Acemoglu et al., 2014), and state capacity (Acemoglu et al., 2016; Ali et al., 2019). However, studies on the determinants of governance paradigms remain scarce and largely qualitative, with the exception of discussions on state capacity, costs of repression, and resource endowments (Diamond, 1998; Scott, 2009; Iyer, 2010). This paper aims to fill this gap by empirically investigating how external wars affect governance paradigm shifts, using the 70-year Dzungar-Qing War (1688-1758) – the last Sino-nomadic conflict in imperial China – as an exogenous shock.

The Dzungar is a Mongolian tribe living in the Ili River basin in northwestern China. As the Dzungar regime expanded and threatened the northern border of the Qing Empire, a major war broke out between the two regimes in 1688. The war lasted 70 years and was the last war between the agrarian and nomadic regimes in Imperial China, ending with the victory of the Qing Empire. Despite the ultimate victory, the Qing rulers paid a huge price: in this war, they spent more than 100 million taels of silver, about three times the government's income in 1685 (Chen, 2013). On the battlefields, the Qing government also consumed large amounts of copper, iron, and other metal mineral resources to forge weapons and equipment (Shu et al., 1989), which forced the Qing rulers to extract these natural resources nationwide to support military expenditures.

During the same period, the Qing government carried out large-scale bureaucratization reforms in the southwestern provinces of China, changing the indirect governance in the localities, i.e., the autonomous *Tusi* system, to direct governance from the imperial court, thus strengthening the central control over local fiscal revenues and resources. The reform is known as "*Gaitu Guiliu*", which

translates to “replacing local *Tusi* leaders with imperial-assigned bureaucrats”. Interestingly, these reformed areas happened to be rich in strategic resources such as salt, copper, and iron ore – all of which were essential during wartime, and especially during the Dzungar War, since the seven-decade war required constant equipment and logistical support. In this context, were bureaucratization reforms – and the resulting paradigm shift in governance – driven by the demand for local resources to support warfare? We aim to provide empirical evidence for such a hypothesis.

To test the hypothesis, we construct a balanced panel of prefectural-level data for 1644-1911 based on a variety of historical sources, including a total of 19,832 observations for 74 prefectures in eight provinces, covering the major areas that underwent the bureaucratization reform. In particular, the outbreak of the Dzungar War in 1688 and the increasing needs for strategic resources due to enduring warfare (1688-1758) provides us with a unique opportunity to use a difference-in-differences strategy to examine the Qing central government’s motives in implementing the bureaucratization reform. Specifically, our dependent variable is the progress of the reform, proxied by the proportion of *Tusi* that underwent the reform over the total number of *Tusi* prior to the reform, in a given prefecture in a given year. On the other hand, we collect the data on local endowment of three essential strategic resources during wartime: iron, copper, and salt. A parallel trend analysis confirms that the regions rich in these resources experienced a similar pace of the bureaucratization reform compared to other regions prior to the Dzungar War, thus validating our difference-in-differences strategy.

The baseline results show that, after the outbreak of the Dzungar-Qing War, areas rich in strategic resources were more likely to undergo the bureaucratization reform - that is, to shift from indirect to direct governance. We also conduct robustness checks on two fronts: sample selection and model selection. In terms of sample selection, we show that our baseline results are not driven by specific prefectures or provinces. In addition, we use random assignments of strategic resources for a placebo test, to rule out the possibility that the baseline results are generated by chance. In terms of model selection, we include province-time fixed effects as well as prefecture-time trends to control for heterogeneous effects across provinces in different years. Moreover, we test the robustness of the results through adjusting for standard errors, by experimenting with the Conley standard errors using

a range of bandwidths for distance. Our baseline results remain robust throughout these checks.

Next, we rule out two important competing hypotheses: First, the bureaucratization reform was aimed at acquiring more natural resources for the empire, which happened to coincide in time with the Dzungar War. To address this concern, we examine two important resources that are less associated with warfare: mercury and sugar - commonly used in daily life but not on the battlefield. We find that bureaucratization reform did not accelerate in regions rich in mercury and sugar, ruling out the competing hypothesis that reform was driven by resource exploitation unrelated to the Dzungar War. Another competing hypothesis is that the Dzungar War may have weakened the state control over the locality, whereas conflict – especially inter-ethnic conflict – is more likely to occur in resource-rich areas. Thus, the Qing rulers implemented the bureaucratization reform to resolve local conflicts. To test this alternative hypothesis, we obtain information on conflict involving *Tusi* from *Qing Shilu* (*Veritable Records of the Qing Dynasty*) and re-estimate our results. We find no increase in conflicts in resource-rich areas after the Dzungar War, thus ruling out the alternative hypothesis.

In terms of mechanism, we argue that the bureaucratization reform facilitated the state's resource capture in response to the war. We find that regions that were convenient for transporting resources, i.e. regions with more river coverage, were more likely to undergo the bureaucratization reform during the Dzungar War, consistent with the state's demand for strategic resources. Also, using the subsample of Yunnan Province, we show that more copper factories were established after the Dzungar War, indicating greater exploitation of resources. Moreover, the number of new copper factory openings declined after the war ended. Taken together, the evidence suggests that the demand for strategic resources was an important reason for the government's paradigm shift in governance.

Our work contributes to three strands of literature. First, the paper contributes directly to the discussion on the trade-off between direct and indirect governance. Most existing studies focus on the effects of direct and indirect governance in the context of colonialism, finding that the direct governance by colonists may reduce the access to public goods in contemporary times (Iyer, 2010),

while the indirect governance can hinder economic development (Goldstein and Udry, 2008; Allen, 2011; Acemoglu et al., 2014), and state capacity (Acemoglu et al., 2016; Ali et al., 2019). However, research on the determinants of direct and indirect governance, especially quantitative research, is limited. Using the Dzungar War in the Qing dynasty as an exogenous shock, this paper quantitatively discusses how an external war affects the choice of direct and indirect governance to fill the gap of relevant researches.

More broadly, this study contributes to the large body of literature on war and state-building. According to the existing literature, external war forces the country to mobilize financial and human resources more effectively, thereby enhancing state capacity (Downing, 1992; Ertman, 1997; Hintze, 1975a, 1975b; Tilly, 1975, 1985, 1990). However, the existing literature on how to mobilize resources more effectively in the face of war is relatively vague. The results of this paper points to governance paradigm reforms for resource extraction as a novel channel that war affects state building. Moreover, this paper highlights that the war on the northern border reshaped the governance in southern regions, thus furthers our understanding of the understudied regional externality in state building.

Given our focus on militarily strategic resources such as copper, iron, and salt, we also contribute to the literature on the political resource curse, which claims that natural resource abundance tends to negatively affect a country's governance (Ross, 2015). The existing literature finds that local resource wealth leads to weak governance, including more civil war (Collier and Hoeffler, 1998; Le Billon, 2005; Harwell et al., 2011; Sorens, 2011), worse institutions (Bulte et al., 2005; Ross, 2008; Knack, 2009; Besley and Persson 2010; Wiens, 2013; Sala-i-Martin and Subramanian, 2013), and less democracy (Ross, 2001; Ramsay, 2011; Tsui, 2011; Andersen and Ross, 2014). However, this paper finds that central governments tend to implement direct governance in areas of strategic resource endowment in the face of war, which may be beneficial for state building compared to indirect governance (Acemoglu et al., 2016).[1] This implies a more complex dynamic relationship

[1] Cooper (2002) and Acemoglu, et al. (2016) pointed out that the colonists were only interested in ruling and extracting natural resources, not building the institutions and providing public goods required to develop the colony. Different from the colonists, under the rule of the Qing government, the local people could have access to public goods such as road construction and disaster relief.

between natural resources and governance (Sierra, 2020), which adds to our understanding of the political resource curse.

The rest of the paper is organized as follows. Section 2 provides a brief historical background of the Dzungar-Qing War and the bureaucratization reform. Section 3 introduces the data. Section 4 presents the empirical strategy and the baseline results. Section 5 explores the mechanism behind the baseline results. We conclude in Section 6.

2. Historical Background

2.1 *Tusi* and the Bureaucratization Reform

The Chinese history has long witnessed the co-existence of direct and indirect governance. The *Junxian* system, as a representative institution of direct governance, exhibited three main features. First, the appointment and dismissal of officials were directly determined by the emperor, and the officials had a term of office. Second, in terms of rights and benefits, local officials have only salaries and no fiefdoms. Finally, local governments must obey central mandates and were responsible for implementing central policies. The *Junxian* system was first established in China around the seventh century BCE. In 221 BCE, the Qin dynasty implemented the system nationwide. Since then, the *Junxian* system has been the dominant paradigm of governance in China.

In comparison, the *Tusi* system was a representative institution for indirect governance adopted in many ethnic regions in China. The local governors, i.e., *Tusi*, were appointed by the central government *de jure*, but were hereditary by local ethnic leaders *de facto*. A *Tusi* ruled the local regions, claimed the benefits from local produce, and was not subject to central government interference except for paying taxes to the imperial court regularly and sending troops to fight when necessary (Gong, 2012). The *Tusi* system was first established in the Yuan dynasty and was mainly adopted in southwest China, such as Yunnan and Sichuan. In the Qing dynasty, there were more than 1700 *Tusi* nationwide (Gong, 2012). Figure 1 illustrates the distribution of the regions governed by the *Tusi* system in the Qing dynasty.

[Insert Figure 1 here]

Under the *Tusi* system, the excessive discretion of local *Tusi* brought many governance challenges, such as local oppression, infighting between *Tusi* regions, and even sedition against the central government (Gong, 2012). Consequently, the central government started a bureaucratization reform in the *Tusi* region. The reform aimed to abolish the hereditary nature of the *Tusi* officials, and replace the native officials with professional bureaucrats, as in the large parts of the regime under the *Junxian* system.

In a nutshell, the reform indicated a shift from indirect to direct governance in three aspects. First of all, the local officials are appointed by the central government and no longer hereditary. Second, the *Tusi* leaders no longer have jurisdiction power over the local people, which also facilitates tax collections for the central government. Finally, the local resources are no longer owned by the *Tusi* officials. The central government has access to local resources as needed.

Before the Qing dynasty, the reform was small in scope and slow in progress. Systematic reforms accelerated in the early Qing dynasty and lasted until the end of the dynasty, with several largest waves occurred in the 18th century. For instance, the Qing dynasty initiated large-scale bureaucratization reforms in Yunnan, Guizhou, and Guangxi in 1726, and northwestern Sichuan in 1736 after quelling local revolts. Notably, the period also witnessed a large-scale warfare between the Qing Empire and the Dzungar. The next section thus briefly describes the Dzungar-Qing War and its impacts on governance paradigms.

2.2 The Dzungar-Qing War

The Dzungar is a Mongolian tribe located in the Ili River basin in northwest China. In 1646, the Dzungar pledged allegiance to the Qing Empire as a subordinate regime. With the growing strength, the Dzungar began to expand outward, and its territory once reached more than four million square kilometers, almost eight times the size of France. As the Dzungar regime expanded and threatened the northern border of the Qing Empire, the Qing rulers began to monitor the Dzungar regime and

strengthened border defenses. Initially, the Qing rulers used appeasement policies to avoid intensifying the conflicts with the Dzungar regime (Perdue, 2000). However, the 1688 war between the Dzungar and the Qing vassal states provided the pretext for the Dzungar War. Figure 2 shows the situation of the Dzungar War. The battle sites in the figure corresponds to the locations where the Qing dynasty and the Dzungar fought major battles (Zhaomodo and Ulan Butong). As shown, the battlefronts were distant from the *Tusi* regions. After a 70-year-long war and three emperors' imperial campaigns, the Qing Empire finally defeated the Dzungar regime, ending the war in 1758, preserving the unity and territorial integrity of the country.

[Insert Figure 2 here]

During the Dzungar War, the Qing Empire mobilized more than 300,000 troops in total (Chen, 2013). The considerable scale and duration of the war led to substantial military expenditures and increasing demand for mineral resources. The military expenditures included soldiers' salaries, purchase and transportation of supplies, and manufacture of weapons and equipment. Literature has shown that the Qing Empire spent more than 100 million taels of silver on the war, about three times of the government income in 1685 (Chen, 2013), which posed a great financial challenge to the empire. Regarding mineral resources, the outbreak of war led to the surged need for weapons and equipment, which then transformed into increased demand for copper, iron, and other metals.[2] During the reign of Emperor Kangxi (1662-1722) alone, more than 900 cannons were forged, of which 200 weighed more than 250 kilograms (Shu et al., 1989). During the manufacturing process of these cannons, 96 tons of copper was used, almost equivalent to a quarter of the production of the province of Yunnan, a major copper producer, in 1722 (Ma, 2017).

The outbreak of the Dzungar War forced the Qing government to solve the military expenses and the acquisition of mineral resources such as copper and iron by various means. In terms of covering military expenses, salt taxes and minting new coins were important sources of revenue. For salt taxes, the Qing government controlled salt production and sales and collected salt taxes by issuing

[2] In the early Qing Dynasty, weaponry was dominated by cold weapons, such as swords, spears, bows and arrows. Until the mid-19th century, these mainly steel-made weapons accounted for about half of the Qing army's equipment (Tong, 1997). In addition to cold weapons, firearms, especially cannons and muskets, made of copper and iron, were also used (Wang and Lu, 1998). In summary, copper and iron were the main raw materials for the manufacture of weapons and equipment in the early Qing Dynasty, which justifies their importance as strategic resources in wartime.

salt licenses (*yanyin*) to salt merchants (Ni, 2018). During wartime, the Qing government had to issue additional salt licenses to collect revenues (Chen, 2013).[3] For minting new coins, before the outbreak of the Dzungar war, the Qing government minted an average of 4.92 million strings of copper coins per year; in the seven decades after the outbreak of the War, this figure rose to 6.69 million strings (Yan, 2008).[4] Facing increasing demand for copper, the Qing government encouraged local exploitation of existing mineral resources in large quantities. For instance, in Yunnan province, copper production expanded more than tenfold from 1721 to 1758 (Ma, 2017).

The focus on salt, copper and iron ore resources due to the Dzungar War provides a new perspective for the understanding of the bureaucratization reforms carried out by the Qing rulers in the southwestern provinces of China during the same period. Specifically, southwestern provinces such as Yunnan and Sichuan were rich in salt, copper, and iron ore (Xia et al., 1986; Guo, 1999; Ji, 2013). Before the reform, local resources were owned by the *Tusi*; after the reform, local resource development was directly controlled by the central government. In order to seize local resources more conveniently, the Qing government may have accelerated the progress of the bureaucratization reform. Historical anecdotes are also consistent with this logic. A royal edict in 1732 recorded a robbery of a local copper factory in Sichuan, by local *Tusi*, that the imperial troops had to be sent to resolve the conflicts.[5] Moreover, in a report to the emperor in 1725, it was suggested that the emperor transformed the *Tusi*-governed Weiyuan prefecture into central-governed, and prioritized assigning bureaucrats to oversee the local salt resources.[6] Both the suggestions of the reform and the prioritization on salt resources pointed to a possible link between the war-related resources extraction and the inception of the bureaucratization reform. In the next section, we introduce how the data and variables are constructed in this paper to empirically examine such a link.

3. Data

[3] In the early Qing dynasty, about half of the military expenditures depended on salt revenues. As Yu Chenglong, the governor of Zhili, stated in a 1689 memo, "The reason for the large amount of new salt licenses added to Changlu (the name of a region) was that military expenditures required additional revenue" (Chen, 2013)

[4] During the Qing dynasty, copper coins were used extensively for military expenditures, construction, and taxation (Yan, 2008).

[5] *Qing Shilu*, Emperor Yongzheng, Volume 116.

[6] *Qing Shilu*, Emperor Yongzheng, Volume 31.

We construct a balanced panel of prefectural-level data for 1644-1911 based on a variety of historical sources, including a total of 19,832 observations for 74 prefectures in eight provinces. The main reason for conducting our empirical analysis at the prefectural level rather than at the county level is that a typical *Tusi* might rule over several counties, making it appropriate to conduct the analysis at the prefectural level (Gong, 2012). The following sections describe the details of data and variable constructions.

3.1 Bureaucratization Reform

Our dependent variable is the proportion of *Tusi* that underwent the reform over the total number of *Tusi* prior to the reform, in a given prefecture in a given year. We construct this variable in the following two steps. First, we manually digitized the *History of the Tusi System in China*, which systematically compiles the records of all *Tusi* of the Qing dynasty, such as location and ethical backgrounds, from the *Qing Shilu* (Veritable Records of the Qing Dynasty) and local gazetteers. Specifically, we extracted data on the names of the *Tusi*, the prefectures located, and whether and when they underwent the bureaucratization reform. In sum, we collect obtained information of 1,687 *Tusi*, distributed in 74 prefectures in eight provinces, including Yunnan, Sichuan, Guangdong, Guangxi, Hubei, Hunan, Gansu, and Guizhou.[7] Figure 3 illustrates the initial number of *Tusi* within the prefectures. On average, there were 22.80 *Tusi* per prefecture, with the largest number of 121 *Tusi* in Yazhou prefecture of Sichuan province. Based on the information, we calculate the proportion of *Tusi* that underwent the reform over the initial number of *Tusi* for a prefecture at any given year, where the initial numbers come from the records in the *History of the Tusi System in China*.

[Insert Figure 3 here]

3.2 Strategic Resources in the Qing Empire

[7] According to Gong (2012), there were 1,779 *Tusi* in the Qing dynasty. Our sample covers only 1,687 of them. The discrepancy mainly comes from that we did not count the *Tusi* in Tibet, where other economic variables are largely missing and the *Tusi* whose location cannot be determined.

In this paper, we focus on three military strategic resources: copper, iron, and salt. Among them, the data on the distribution of copper and iron ore come from the *History of Mining Development in Pre-modern China*. The book synthesizes sources in the *Draft History of the Qing Dynasty* (Qing Shigao), the *Veritable Records of the Qing Dynasty* (*Qing Shilu*), and various local records, and compiles the geographical distribution of copper and iron mines in the early Qing dynasty at the prefectural level.[8] We digitized this information to extract the distribution of copper and iron mines in each prefecture. The data on salt resources were obtained from *the Study on the Distribution and Changes of Salt Production Areas in Pre-modern China*. The book maps the distribution of salt-producing areas nationwide during the Qing dynasty. We used ArcGIS to synthesize the salt-producing areas to the prefecture level. Figure 4 shows the distribution of these strategic resources. Panel (A) shows the distribution of copper ore, Panel (B) shows that of iron ore, and Panel (C) shows that of salt. Moreover, Panel (D) shows two non-strategic resources during wartime, sugar, and mercury, as comparison.

[Insert Figure 4 here]

Table 1 summarizes the data sources and the descriptive statistics.

[Insert Table 1 here]

3.3 Suggestive Evidence

Before proceeding to the formal analysis, we provide some descriptive evidence to place our findings in context. Figure 5 illustrates the progress of bureaucratization reform in each prefecture before and after the Dzungar War. Specifically, Panel (A) shows the proportion of reformed *Tusi* in each prefecture by 1687, the year before the outbreak of the war. Panel (B) shows the proportion of reformed *Tusi* by 1758. By comparing the two panels in Figure 5 with Figure 4, we can find that before the Dzungar War, the progress of the reform was mostly unrelated with the presence of local resources, while during the war, the progress of the reform accelerated in prefectures rich in copper, iron, and salt. The difference thus suggests that the Dzungar War may have contributed to the

[8] We do not include the mines that were discovered subsequently, because the focus of our discussion is on how the distribution of strategic resources affected the governance paradigm shifts during the Dzungar War.

bureaucratization reform in Southwest China. Next, we empirically test this prediction.

[Insert Figure 5 here]

4. Empirical Strategies and Results

In this section, we empirically examine the impacts of the Dzungar war on bureaucratization reforms in southwest China. The section consists of four parts. In the first part, we introduce the DID approach used in the analysis, and verify the parallel trend assumption. The second part presents the baseline results. The third part carries out a series of robustness checks. Lastly, we rule out two alternative explanations.

4.1 Empirical Strategy

Our empirical strategy follows a standard DID approach. We compare the relative changes in the progress of the bureaucratization reform between the prefectures with strategic resource endowment and those without. The econometric specification takes the following form:

$$Y_{it} = \beta Resource_i \times Post_t + \varphi_i + \delta_t + \varepsilon_{it} \quad (1)$$

In the specification, where i corresponds to prefecture and t corresponds to year. Y_{it} refers to the proportion of reformed *Tusi* over the initial number of *Tusi* in year t for prefecture i. $Resource_{it}$ is a dummy variable that equals one if a prefecture has strategic resource and zero otherwise. We also use $Post_t$ as a dummy variable that equals one for the years after 1688 when the Dzungar war started. φ_i refers to prefecture fixed effects, and δ_t refers to time fixed effects. The results are clustered at the prefecture level. The existence of strategic resource mines is highly exogenous, thus no additional socioeconomic controls are included. β is the coefficient of interest, which captures the contribution of the outbreak of the war to the bureaucratization reform for regions rich in strategic resources.

The validity of our DID approach hinges on a parallel trend assumption that the bureaucratization

reform proceeded at similar paces in different regions should there be no Dzungar war. To test the assumption, we employ the following specification:

$$Y_{it} = \sum_{j=-10}^{10} \beta_j Resource_i \cdot Decade_t^j + \varphi_i + \delta_t + \varepsilon_{it} \quad (2)$$

where all variables are defined as in Equation (1). The only difference from Equation (1) is that in Equation (2), rather than interacting $Resource_i$ with a post-war indicator variable, we interact the treatment with each of the decade fixed effects (relative to 1688), treating the decade before 1688 as the reference group. The estimated vectors of β_j reveal the differences between the treated and control prefectures during each decade.

Figure 6 plots the estimates of Equation (2). As shown, the difference between the treated and control groups is constant over time and small in magnitude before the Dzungar War. After the Dzungar War, we observe an increase in the intensity of the bureaucratization reform in the first decade (1688-1697), the fourth decade (1718-1727) and the fifth decade (1728-1737), which is consistent with that the Qing Empire launched three large-scale wars in the Dzungar during these three decades (Gao, 1992; Li, 2007). Moreover, the most prominent increase took place in the fourth decade of the 70-year Dzungar War, which is again consistent with that the need for strategic resources surged after four-decade consumption of war.

[Insert Figure 6 here]

4.2 Baseline

We present the baseline results in Table 2. As shown in Column 1, the bureaucratization reform accelerated in regions rich in strategic resources. Moreover, when breaking down the resources by category, we find that the acceleration remained robust for all three major strategic resources, Iron (Column 2), Salt (Column 3), and Copper (Column 4). In all the columns, we have controlled for prefecture and time fixed effects, and the standard errors are clustered at the prefectural level.

[Insert Table 2 here]

Treatment Intensities. In the baseline, we use a dummy variable to identify whether the prefecture was rich in strategic resources. The level of resource endowment, however, might differ across prefectures, which consequently affects the urgency of the bureaucratization reform. Thus we lift the restriction of binary treatment and allow more flexible treatment intensity measure – the number of strategic resource mines in the prefecture to explore this possibility. We present the estimates in Table 3. As shown, more mines – regardless of copper, iron, or salt – lead to higher likelihood of bureaucratization reform, which strengthens our baseline results.

[Insert Table 3 here]

4.3 Robustness Checks

In this section, we conduct robustness checks on two fronts: sample selection and model selection. First, our results may be sensitive to sample selection. The large variation in the number of copper mines, iron mines, and salt mines across prefectures may make our results sensitive to the inclusion of specific prefectures. To address the problem, we remove one prefecture at a time from the regression and re-estimate Equation (1). We present the results in Appendix Figure 1, which shows that our baseline results remain robust. Moreover, we exclude all samples of a province at a time to test the sensitivity of our results to the choice of province. The results are presented in Appendix Figure 2, where our baseline continues to be robust. Second, our results may be accidental due to the presence of some prefecture-specific factors. To solve this problem, we scramble the samples and re-estimate Equation (1). Specifically, by randomly assigning the copper mines, iron mines, and salt mines 1,000 times, we re-estimated Equation (1) and plotted the density distribution function in Appendix Figure 3. As shown, the coefficients from the placebo test have a distribution close to a zero-mean normal distribution. Meanwhile, the estimated coefficient obtained from the baseline regression is located at the tail end of this distribution, which indicates that the baseline results are not randomly generated by chance, thus further demonstrating the robustness of our results.

Regarding model selection, we conduct robustness checks by adjusting for fixed effects and adjusting for standard errors. First, we address the possible endogeneity problem by adjusting for fixed effects. The distribution of copper, iron, and salt mines in each prefecture depends mainly on local natural conditions, and thus is exogenous. However, it is possible that some omitted variables, such as the particular local climatic conditions, affect both the distribution of strategic resources and the central government's decision to initiate bureaucratization reform. To address this problem, we further include province-time fixed effects as well as prefecture-time trends to control for heterogeneous effects across provinces in different years as well as effects brought about by prefectures that vary linearly over time. The results are presented in Appendix Table 1, and are consistent with our baseline. Second, we test the robustness of the results through adjusting for standard errors. In Appendix Figure 4, we experiment with the Conley standard errors using a range of bandwidths for distance (50, 100, 200, 500, 1,000, 2,000 km) and time (20, 100, 200, 268 years) cutoffs and plot the t-statistics derived from each of those combinations. We see that the *t*-statistics are consistent and significant at conventional levels regardless of how we adjust for standard errors.

4.4 Alternative Explanations

Our baseline results show that the Dzungar War accelerated the bureaucratization reform for regions rich in strategic resources. However, there are two competing explanations for the results, which we rule out in the following, respectively.

A key competing hypothesis to our baseline is that the bureaucratization reform aimed to acquire more natural resources for the empire, which happened to coincide with the Dzungar War in timing. To address this concern, we examine two important resources that are less related to warfare: mercury and sugar. Unlike copper and iron that were commonly used in both battlefield and daily life, mercury was often used in pigments and tomb preservatives (Xia et al., 1986), thus was not considered a strategic resources for war. Similarly, sugar is as important as salt as daily necessities, but it cannot generate sizeable income for the government. Therefore, if the competing hypothesis holds, we expect to find bureaucratization reform also accelerated in regions rich in mercury and sugar.

We empirically test the prediction and present the results in Table 4. Specifically, the data of mercury mines are retrieved from the *History of Mining Development in Pre-modern China*; and data of sugar are retrieved from the *History of Sugar*, which systematically recorded the origins of cane sugar in the Qing dynasty by combining various local sources. Figure 4 Panel (D) shows the distribution of mercury mines and sugar canes. As shown in Table 4, the number of mercury mines and the presence of sugar canes did not increase the likelihood of bureaucratization reform. Thus, we rule out the competing hypothesis.

[Insert Table 4 here]

Another explanation that may drive our baseline results concerns local conflicts. In the Qing dynasty, the exploitation of local resources often triggered inter-ethnic conflicts (Lin, 2014). After the outbreak of the Dzungar War, the Qing government turned its attention to the northwestern border areas, so the state control over the southwestern regions may have weakened. This could potentially lead to increased conflicts in the region, which in turn forced the Qing government to implement the bureaucratization reform to reclaim local control. If this explanation holds, we expect to see more local conflicts after the outbreak of the war. To test this prediction, we extract the data of conflict involving the *Tusi* also from the *Qing Shilu*.[9] We re-estimate the baseline using conflict as the dependent variable and present the results in Table 5. As shown, after the outbreak of the war, there were no more conflicts in the regions with strategic resource reserve, thus ruling out the alternative hypothesis.

[Insert Table 5 here]

5. Mechanism

[9] The data on conflict involving Tusi also come from the *Qing Shilu*. We obtain the digitized version of the record from *The Chinese Text Project* website (https://ctext.org), and construct our database as follows. First, we search for keywords indicating *Tusi* leaders, such as "*Tusi*", "*Tuguan*", and "*Tushoubei*". Next, we search for keywords indicating conflict, such as "*suppression*", "*attack*", and "*sending troops*". In sum, we extract a total of 800 records from the period of Emperor Shunzhi to Emperor Xuantong, among which the Emperor Qianlong's period has the most records about *Tusi* rebellion with 506 records. Second, we match the conflicts with the prefectures, by matching the conflict information with that in the *History of the Tusi System in China*. In this step, 613 records out of the above 800 records can be located. Lastly, we determine the time of the conflict by searching for the specific volumes of the *Qing Shilu*.

In the previous section we found that the outbreak of the Dzungar War accelerated the bureaucratization reform in southwest China. This section continues to explore the mechanisms behind the acceleration. We argue that the surged demand for strategic resources leads to the likelihood of reforms. In the following, we validate the mechanism in two ways.

First, although data limitations prevent us from obtaining the production data directly, we expect the Qing government prioritizes areas with more convenient transportation, i.e., areas that were more convenient for the transportation of resources, if the reform was driven by the need for strategic resource. Given that the transportation of mineral resources relied heavily on water transportation, we divide the sample according to the median river length (km) and river density (km/km^2) in each region, the data of which are based on CHGIS. We expect that the reform was accelerated more significantly in regions with more river coverage in terms of length and density. We present the results in Table 6. As shown, the reform effort was more substantial in regions more convenient for resource transportation, which is consistent with our story.

[Insert Table 6 here]

Second, we look for direct evidence to evaluate the intensity of local resource exploitation. Among the provinces with wide *Tusi* presence, Yunnan was the most important copper-producing province (Xia et al., 1986). *Yunnan Tongzhi* (*The Comprehensive Records of Yunnan Province*) details the development of copper mines in Yunnan Province, including the location and establishment time of all copper factories. The subsample of Yunnan Province thus allows us to examine local strategic resources exploitation directly.[10] Specifically, if our story holds, we expect to see more copper factories after the Dzungar War. We re-estimate equation (1) with the opening of copper factories as a dependent variable, and present the results in Table 7. Columns 1-2 presents the results when the dependent variable is a dummy variable taking value of one if the prefecture opened new copper factories in the specific year – thus the extensive margin. Columns 3-4 presents the results when the dependent variable is the number of newly opened copper factories for a given prefecture in the

[10] The *Comprehensive Records of Yunnan Province* used in this paper was published in 1894, i.e., the source only provides information on copper factories up to 1894, so we exclude observations after 1894 in the subsequent analysis. In addition, when there are data inconsistencies between the *Records* and the *History of Mining Development in Ancient China*, we follow the latter to ensure our results are consistent with the baseline estimations. Appendix Figure 5 illustrates the sample format.

specific year – thus the intensive margin. We also control for prefecture-specific time trends in Columns 2 and 4. Across all columns, the results consistently show that after the outbreak of the Dzungar War, there was a significant increase in the development of copper mines in areas with copper resources, thus validating our mechanism.

[Insert Table 7 here]

Furthermore, we examine the temporal distribution of copper factory openings with reference to equation (2). If the Qing government indeed accelerated bureaucratization reforms engaged to exploit local copper resources, we expect increasing numbers of copper factories established during the war, but less so once the war was over. To test this hypothesis, we interact the treatment with period-specific fixed effects (a period indicates 20 years), treating the period before 1688 as the reference group. Figure 7 reveals the differences between the treated and control prefectures during each period. Three findings emerge. First, more copper factories were established after the outbreak of the war. Second, the openings experienced a surge during 1728-1747, which corresponded to the large-scale implementation of the bureaucratization reform. Third, the thriving of copper factories declined sharply after the end of the war. Taken together, the findings are consistent with the mechanism that wartime extraction was a key reason behind the bureaucratization reform.

[Insert Figure 7 here]

6. Conclusion

This paper empirically tests the relationship between external warfare and the choice of governance paradigms in the context of Dzungar-Qing War. Based on prefecture-level panel data from 1644-1911 and using a difference-in-differences approach, we find that prefectures with strategic resource had more likelihood to undergo the bureaucratization reform after the outbreak of the Dzungar war. Regarding the underlying mechanism, we find that the shifts occurred more in regions where transportation of resources was convenient, whereas the shifted regions opened more factories to exploit local resources during wartime, which then suggests that the demand for strategic resources was a key determinant behind the shift of governance paradigms. In a similar vein, the paper speaks to the resource mobilization needs as an additional reason that war influences state-building, and

confirms the efficiency gains in resource distribution for centralized governance structure in times of life and death.

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Figures and Tables

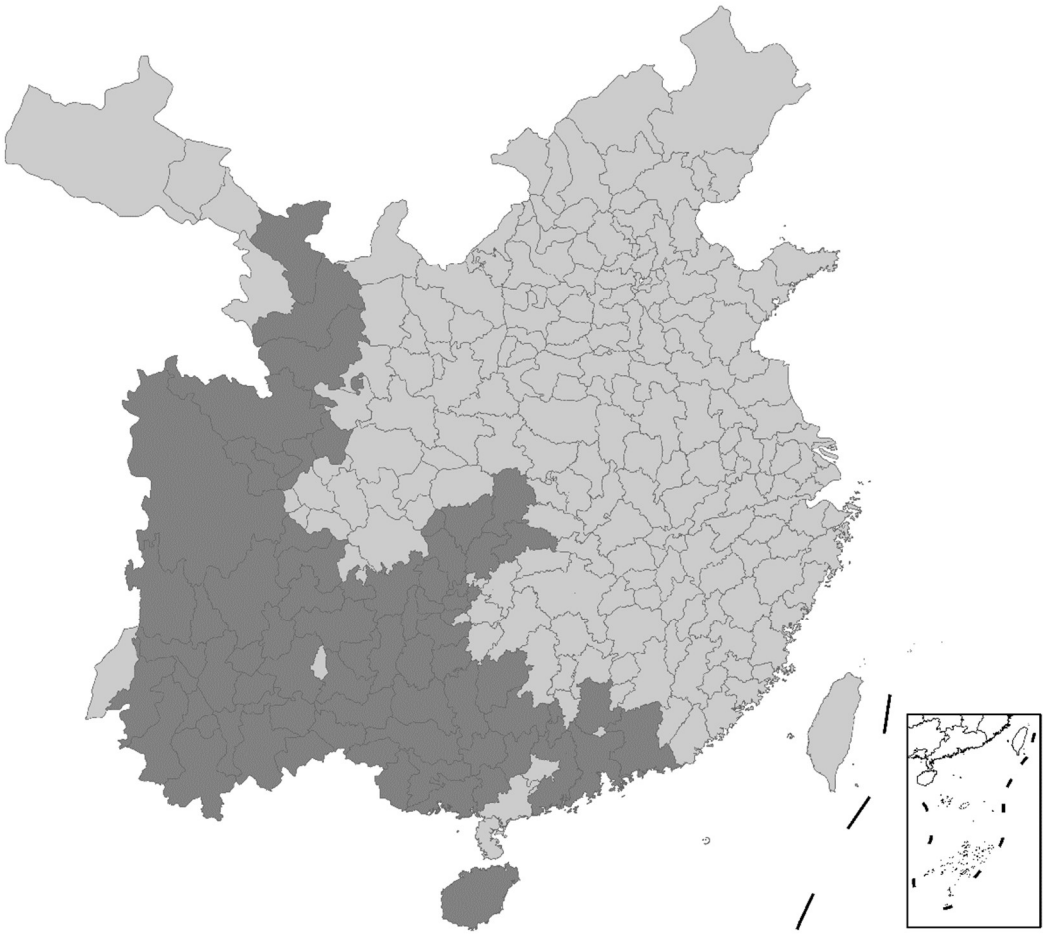


Figure 1. Distribution of areas under the *Tusi* system

Notes: The map is based on the territory of the Qing dynasty in 1820. The dark regions indicate the adoption of the *Tusi* system within the prefecture, and the light regions indicate the non-existence of *Tusi* or missing data (e.g. for the prefectures in the left bottom corner). The data is retrieved from *History of the Tusi System in China*, and the China Historical Geographic Information Database (CHGIS), Center for Historical Geography, Fudan University.

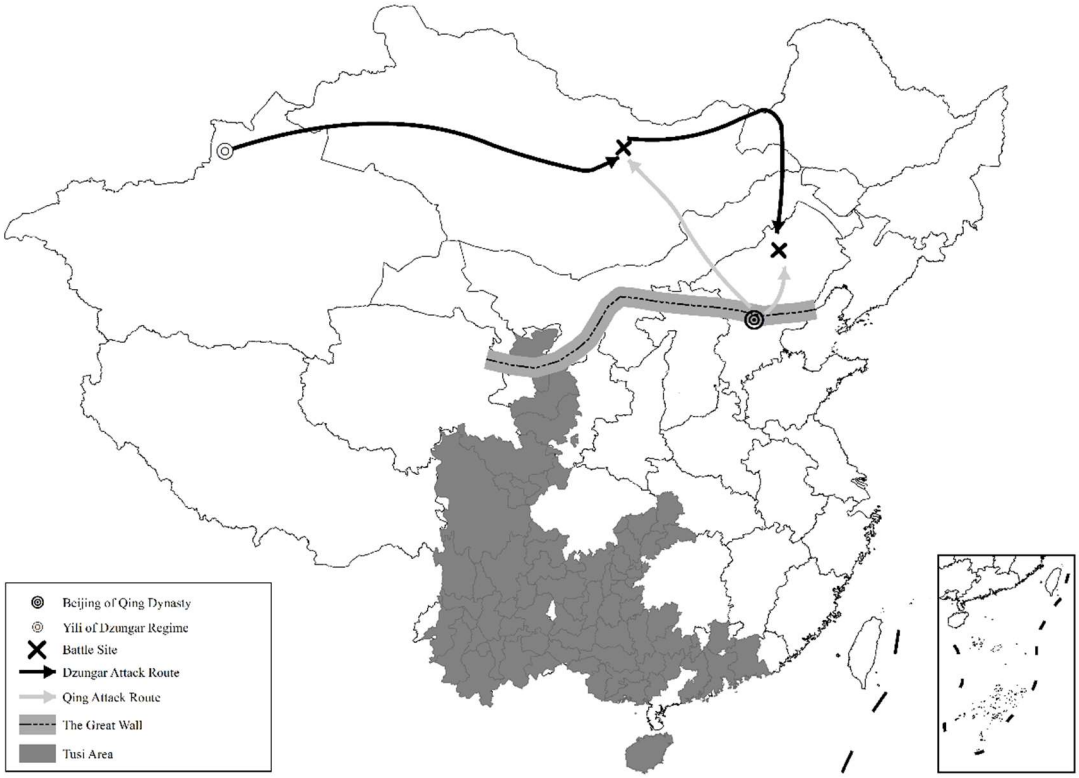


Figure 2. Impacted Areas of the Dzungar War

Notes: The crosses indicates the battle sites. And the shaded area are the *Tusi* areas. As shown, the Tusi areas are geographically distant from the battlefronts.

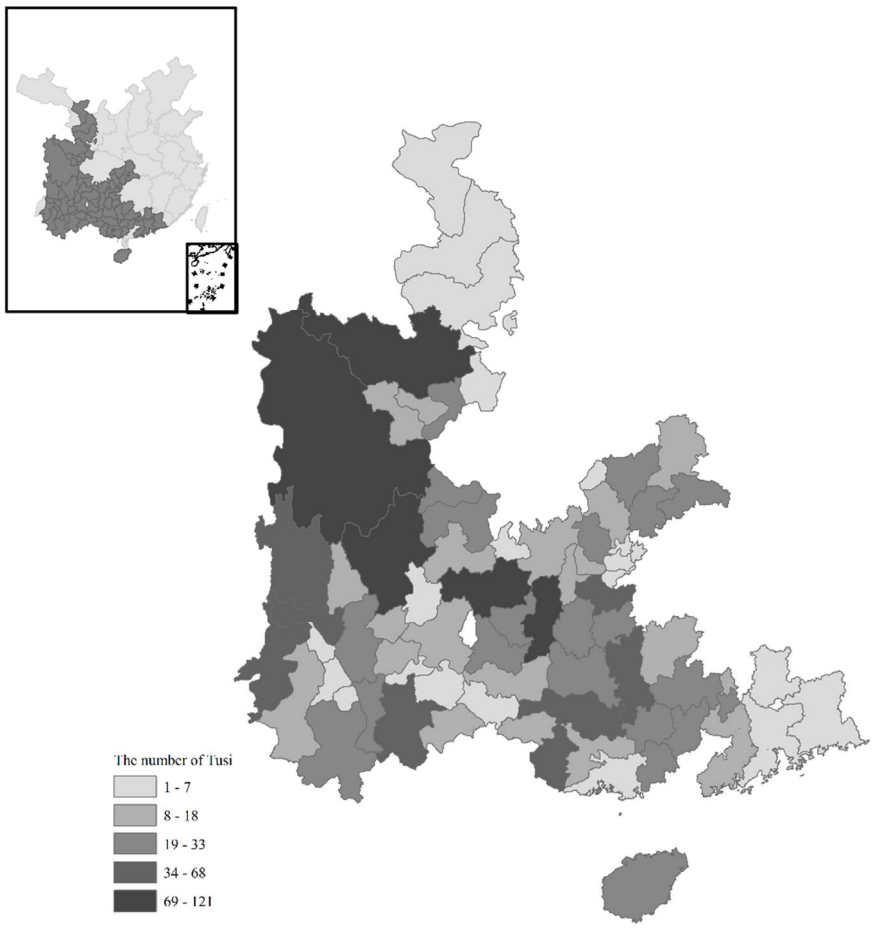


Figure 3. Distribution of *Tusi* by Prefecture

Notes: The map is based on the 1820 territory of the Qing dynasty, covering 74 prefectures in eight provinces of Yunnan, Sichuan, Guangdong, Guangxi, Hubei, Hunan, Gansu, and Guizhou during the Qing dynasty. where the darker the color represents the greater number of *Tusi* within the province. The data is retrieved from *History of the Tusi System in China*, and the China Historical Geographic Information Database (CHGIS), Center for Historical Geography, Fudan University.

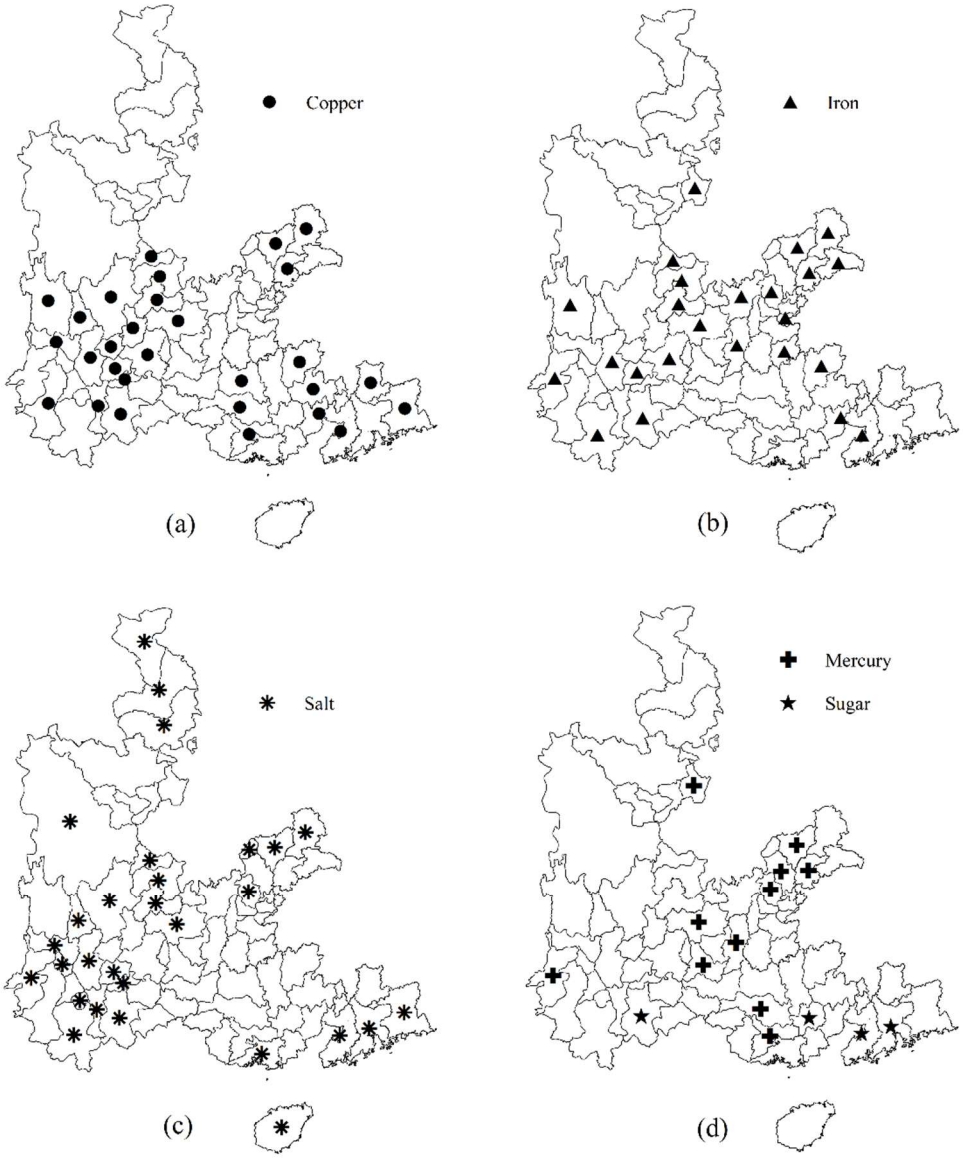


Figure 4. Distribution of Resources by Prefectures

Notes: The map is based on the 1820 territory of the Qing dynasty, covering 74 prefectures in eight provinces of Yunnan, Sichuan, Guangdong, Guangxi, Hubei, Hunan, Gansu, and Guizhou during the Qing dynasty. The data is retrieved from *History of Mining Development in Ancient China*, *Study on the Distribution and Changes of Salt Production Areas in Ancient China*, *A History of Sugar*, and the China Historical Geographic Information Database (CHGIS), Center for Historical Geography, Fudan University.

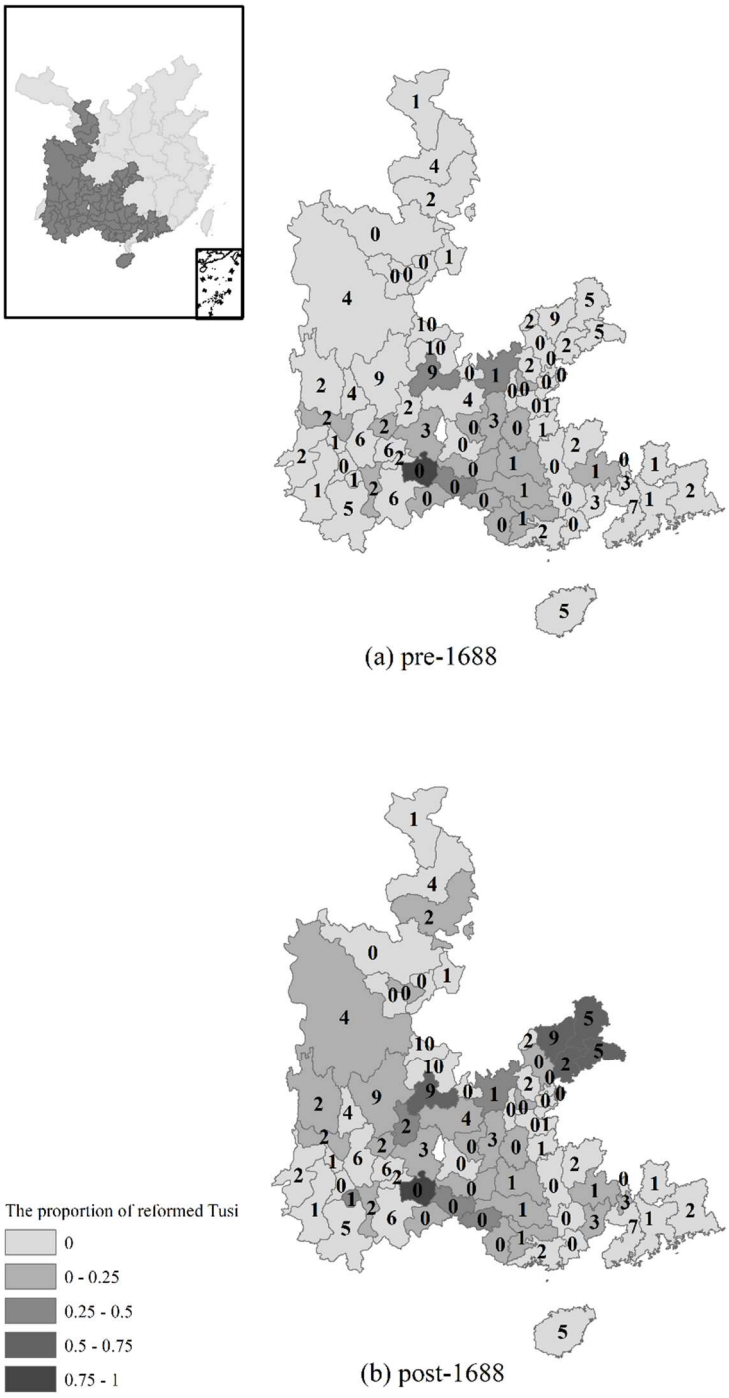


Figure 5. Reform Intensity before and after the Dzungar War (这个图例中的文字改为 The Proportion of Reformed *Tusi* areas)

Notes: The map is based on the territory of the Qing dynasty in 1820, covering 74 prefectures in eight provinces of Yunnan, Sichuan, Guangdong, Guangxi, Hubei, Hunan, Gansu, and Guizhou during the Qing dynasty, where the darker the color indicates the higher percentage of *Tusi* in the province that underwent conversion. The numbers in the map indicate the sum of the number of copper mines, iron mines, and salt mines.

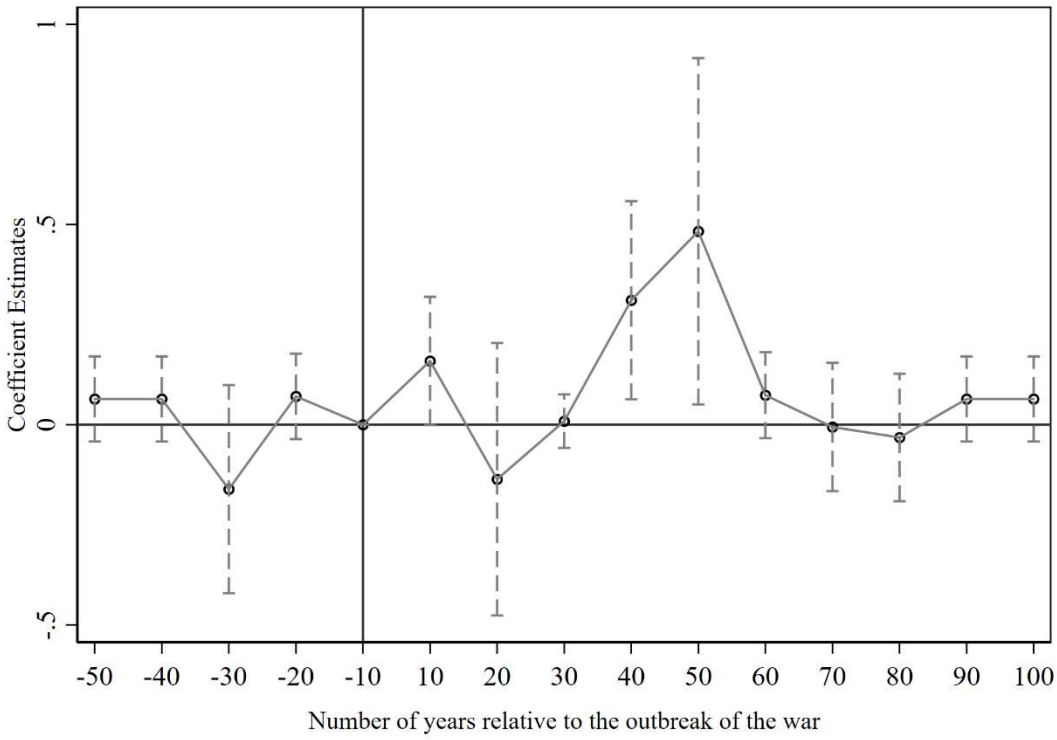


Figure 6. Parallel Trend Test

Notes: The figure depicts the differences in the strength of the bureaucratization reform between the prefectures with strategic resource distribution and those without before and after the Dzungar War. The dependent variable is the proportion of reformed *Tusi* over the initial number of *Tusi* in the prefecture in a given year. The horizontal axis labels the year relative to the outbreak of the war. The markers and capped lines represent the ordinary least squares estimators and 90% confidence intervals based on standard errors clustered at the prefecture level. The solid vertical line represents the 1688 treatment date, and the periods are grouped every ten years relative to 1688 (i.e., represents the 1678–1687 period, represents the 1688–1697 period, etc.). The reference groups are the years a decade before 1688. The regression controls for prefecture fixed effects and year fixed effects.

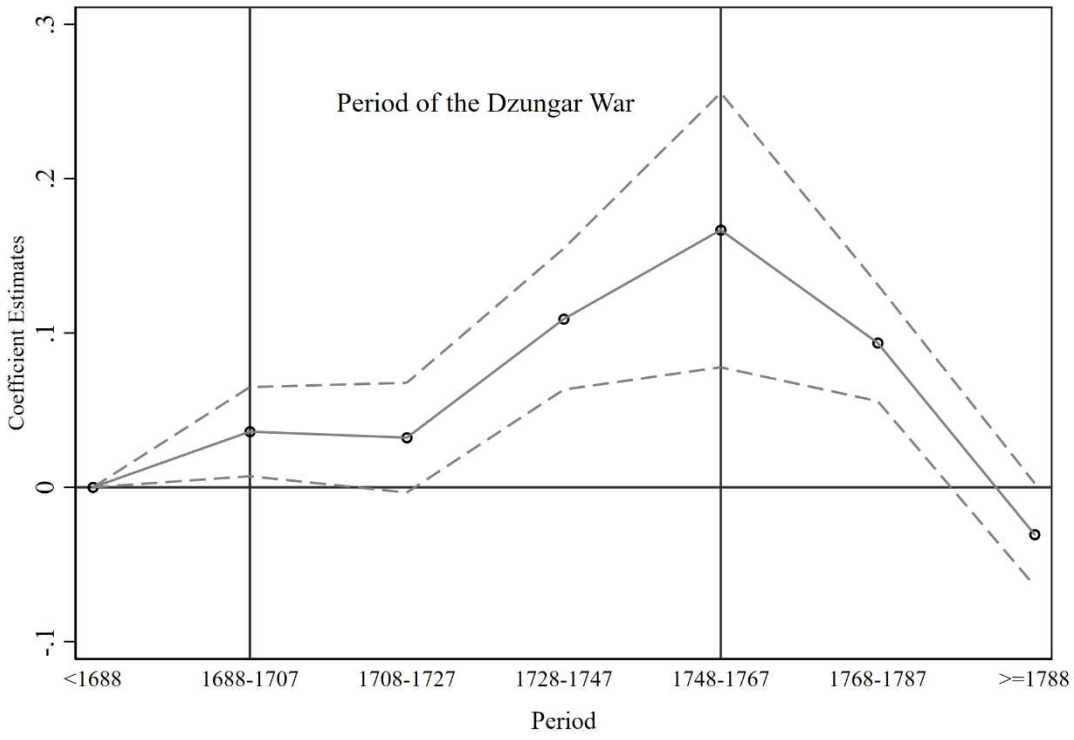


Figure 7. Mechanism: Temporal Distribution of Copper Factory Openings

Notes: The figure depicts the differences in the strength of the resource grabbing between the prefectures with copper distribution and those without after the Dzungar War. The dependent variable is the number of new copper factories in a prefecture in a given year. The horizontal axis labels the year relative to the outbreak of the war. The markers and capped lines represent the ordinary least squares estimators and 95% confidence intervals based on standard errors clustered at the prefecture level. The solid vertical line represents the period of the Dzungar War (1688-1758), and the periods are grouped every twenty years relative to 1688 (i.e., represents the 1688–1707 period, represents the 1708–1727 period, etc.). The reference groups are the period before 1688. The regression controls for prefecture fixed effects, year fixed effects and prefecture-specific time trend.

Table 1 Summary Statistics

Variable	Source	No. of Obs.	Mean	Std. Dev.
Dependent Variable				
Proportion of Reformed *Tusi* (%)	1	19,832	0.038	1.090
Conflict involving *Tusi*	6	19,832	0.062	0.464
Copper Factories	5	5,628	0.024	0.181
Independent Variable				
Existence of Copper Mines	2	19,832	0.392	0.488
Number of Copper Mines	2	19,832	0.662	1.017
Existence of Iron Mines	2	19,832	0.324	0.468
Number of Iron Mines	2	19,832	0.581	1.040
Existence of Salt Mines	3	19,832	0.392	0.488
Number of Salt Mines	3	19,832	0.905	1.472
Number of Mercury Mines	2	19,832	0.176	0.446
Sugar-producing Regions	4	19,832	0.054	0.226
River Length (km)	7	19,832	652.207	496.859
River Density (km/km^2)	7	19,832	0.033	0.013

Data Sources:

1. *History of the Tusi System in China* (2012)
2. *History of Mining Development in Ancient China* (1986)
3. *Study on the Distribution and Changes of Salt Production Areas in Ancient China* (2013)
4. *A History of Sugar* (2009)
5. *Yunnan Tongzhi*
6. *Qing Shilu*
7. *The China Historical Geographic Information Database (CHGIS)*

Table 2. Baseline Results

Dependent Variable	Bureaucratization Reform			
	All	Iron	Salt	Copper
	(1)	(2)	(3)	(4)
Resource×Post	0.087**	0.083***	0.051*	0.051*
	(0.038)	(0.031)	(0.029)	(0.030)
Prefecture FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES
Observation	19,832	19,832	19,832	19,832

Notes: The dependent variable is the proportion of reformed *Tusi* over the initial number of *Tusi* in the prefecture. *Resource* is an indicator that equals one if the prefecture has strategic resources. *Post* is an indicator that equals one in and after 1688. Regressions are clustered at the prefecture level. ***, **, and * denote 1%, 5%, and 10% significance levels, respectively.

Table 3. Treatment Intensities

Dependent Variable	Bureaucratization Reform			
	All	Iron	Salt	Copper
	(1)	(2)	(3)	(4)
Resource×Post	0.017***	0.044***	0.016*	0.033**
	(0.006)	(0.013)	(0.009)	(0.014)
Prefecture FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES
Observation	19,832	19,832	19,832	19,832

Notes: The dependent variable is the proportion of reformed *Tusi* over the initial number of *Tusi* in the prefecture. *Resource* is the number of strategic resources in the prefecture. *Post* is an indicator that equals one in and after 1688. Standard errors in parentheses are clustered at the prefecture level. ***, **, and * denote 1%, 5%, and 10% significance levels, respectively.

Table 4. Alternative Explanation: Non-strategic Resources

Dependent Variable	Bureaucratization Reform		
	Mercury	Sugar	All
	(1)	(2)	(3)
Resource×Post	0.041	-0.013	0.048
	(0.029)	(0.017)	(0.033)
Prefecture FE	YES	YES	YES
Time FE	YES	YES	YES
Observation	19,832	19,832	19,832

Notes: The dependent variable is the proportion of reformed *Tusi* over the initial number of *Tusi* in the prefecture. *Resource* is an indicator that equals one if the prefecture has resources. *Post* is an indicator that equals one in and after 1688. Regressions are clustered at the prefecture level. ***, **, and * denote 1%, 5%, and 10% significance levels, respectively.

Table 5. Alternative Explanation: Conflict

Dependent Variable	Conflict			
	All	Iron	Salt	Copper
	(1)	(2)	(3)	(4)
Resource×Post	0.001	0.010	0.007	-0.030
	(0.028)	(0.029)	(0.032)	(0.025)
Prefecture FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES
Observation	19,832	19,832	19,832	19,832

Notes: The dependent variable is the number of conflicts involving *Tusi* in the prefecture. *Resource* is an indicator that equals one if the prefecture has strategic resources. *Post* is an indicator that equals one in and after 1688. Regressions are clustered at the prefecture level. ***, **, and * denote 1%, 5%, and 10% significance levels, respectively.

Table 6. Mechanism: Convenience of Transportation

Dependent Variable	Bureaucratization Reform			
	>= median length	< median length	>= median density	< median density
	(1)	(2)	(3)	(4)
Resource×Post	0.089**	0.067	0.064**	0.101
	(0.044)	(0.049)	(0.025)	(0.065)
Prefecture FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES
Observation	9,916	9,916	9,916	9,916

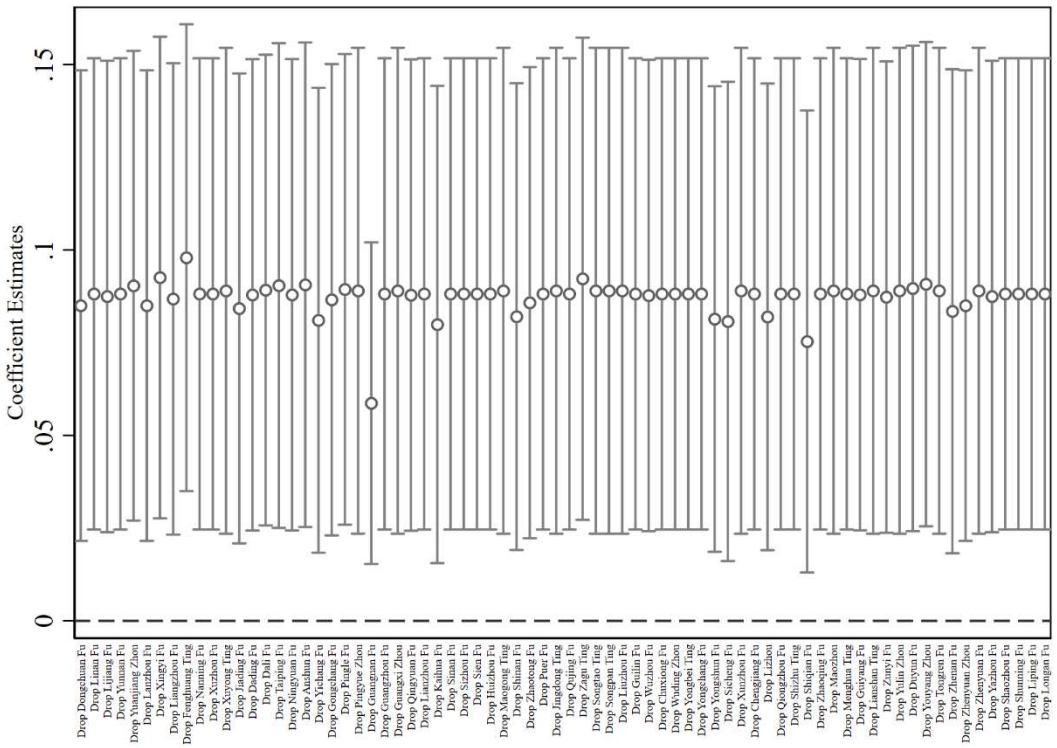
Notes: The dependent variable is the proportion of reformed *Tusi* over the initial number of *Tusi* in the prefecture. *Resource* is an indicator that equals one if the prefecture has copper, iron, or salt mines. *Post* is an indicator that equals one in and after 1688. Regressions are clustered at the prefecture level. ***, **, and * denote 1%, 5%, and 10% significance levels, respectively.

Table 7. Mechanism: Establishment of Copper Factory

Dependent Variable	Copper Factory			
	Presence of factory	Presence of factory	Number of factory	Number of factory
	(1)	(2)	(3)	(4)
Resource×Post	0.043***	0.094***	0.051***	0.116***
	(0.007)	(0.014)	(0.009)	(0.019)
Prefecture FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES
Prefecture-specific Time Trend	NO	YES	NO	YES
Observation	5,271	5,271	5,271	5,271

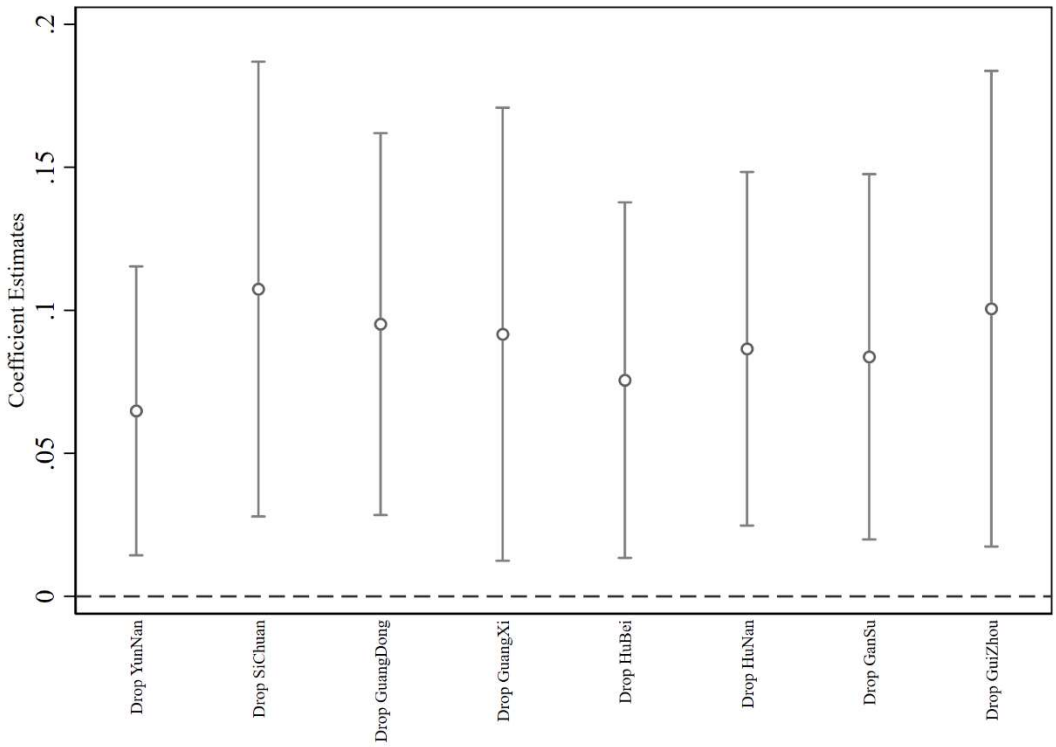
Notes: The dependent variable is the presence of new copper factories and the number of new copper factories in a prefecture in a given year, respectively. *Resource* is an indicator that equals one if the prefecture has copper mines. *Post* is an indicator that equals one in and after 1688. Regressions are clustered at the prefecture level. ***, **, and * denote 1%, 5%, and 10% significance levels, respectively.

Appendix Figures and Tables



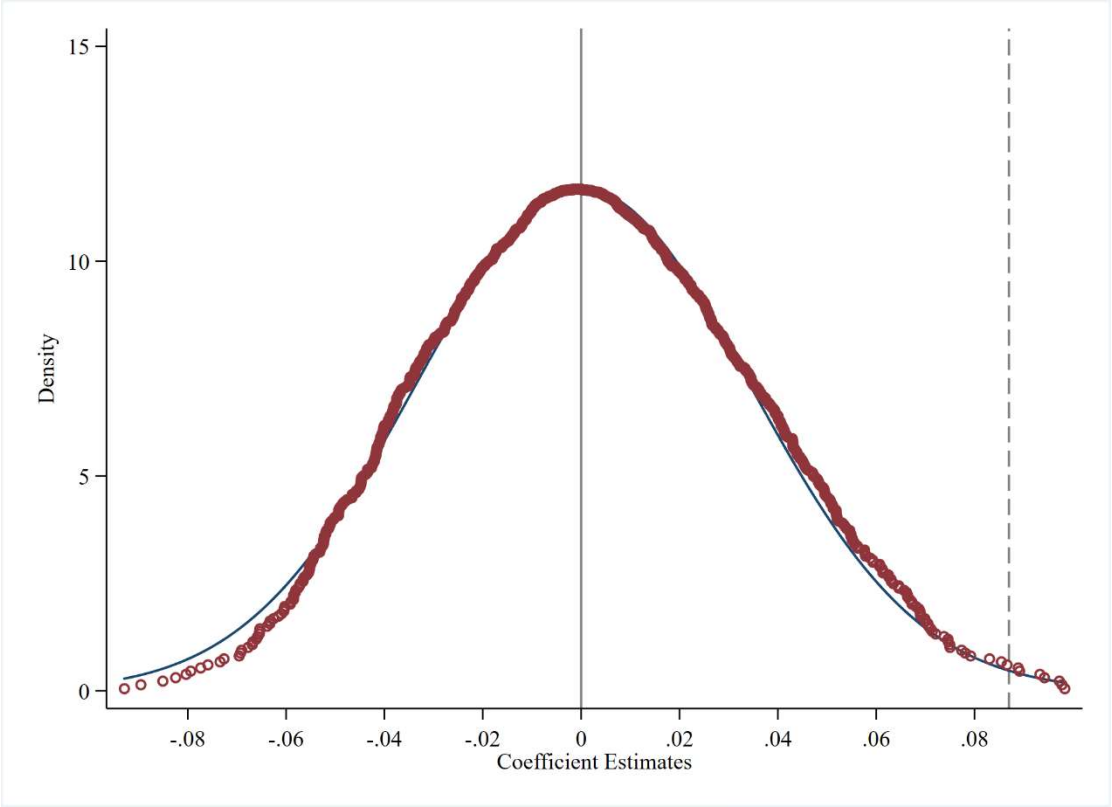
Appendix Figure 1. Subsample Analysis: Dropping One Prefecture

Notes: this figure shows the baseline regression results after sequentially dropping one prefecture. The hollow circles indicate the estimated coefficients and the solid line indicates the 90% confidence interval. The regressions include prefecture fixed effects, time fixed effects, and clustering at the prefecture level.



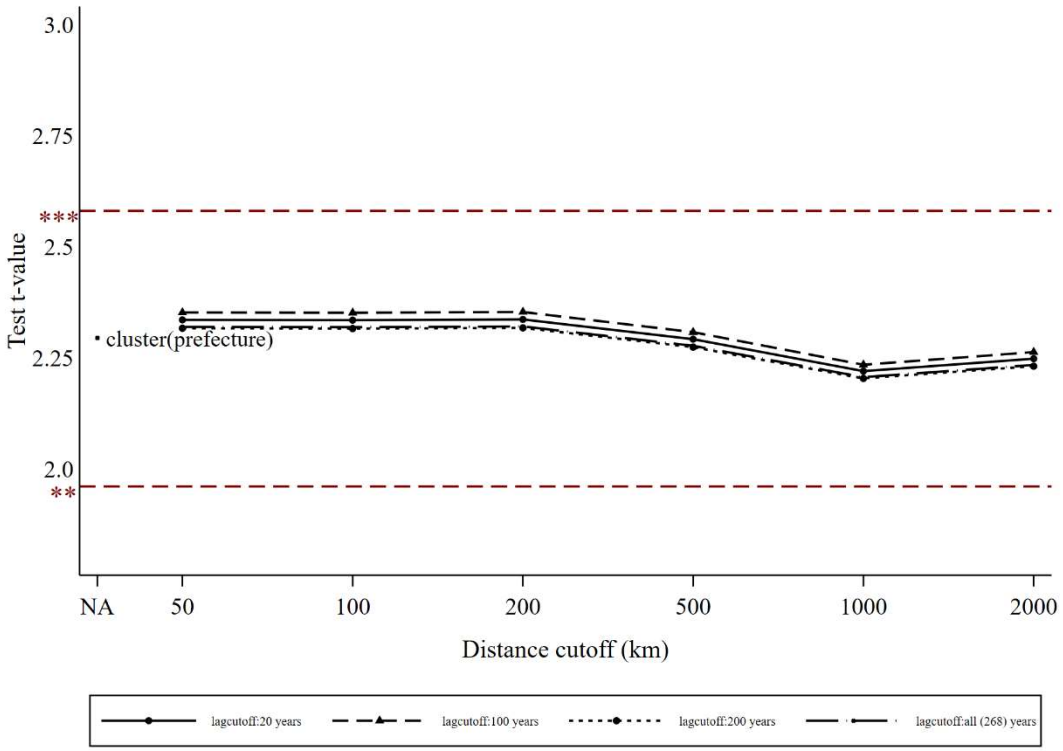
Appendix Figure 2. Subsample Analysis: Dropping One Province

Notes: this figure shows the baseline regression results after sequentially dropping one province. The hollow circles indicate the estimated coefficients and the solid line indicates the 90% confidence interval. The regressions include prefecture fixed effects, time fixed effects, and clustering at the prefecture level.



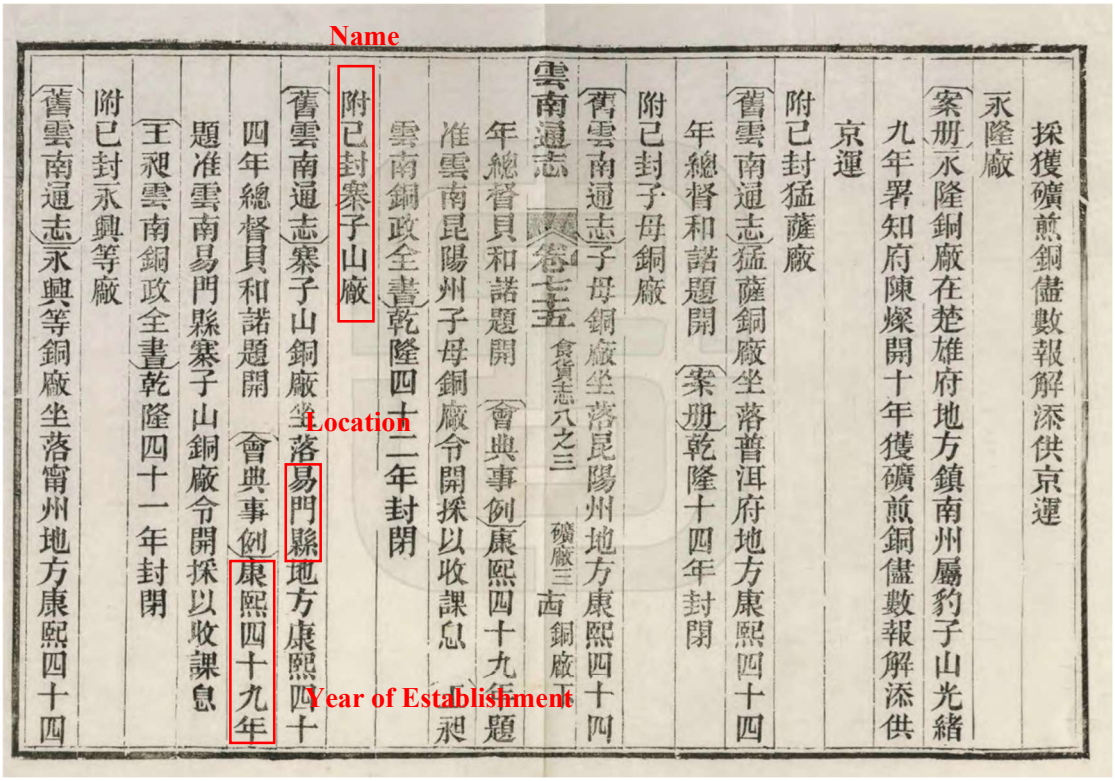
Appendix Figure 3. Random Assignment of Strategic Resources

Note: this figure shows the regression results for randomly assigning copper, iron ore and salt mines distributions for 1,000 times. The hollow circles indicate the estimated coefficients and the dashed line indicates the estimated coefficient of the baseline regression (0.087).



Appendix Figure 4. Adjusting for Standard Errors

Notes: The figure depicts the test t-values calculated using different methods and parameters for standard errors. The isolated dots represent t-values calculated using standard errors clustered at the prefecture level. The connected lines represent the t-values calculated using Conley standard errors with different combinations of distance and time cutoffs. Specifically, the horizontal axis displays different distance cutoffs (50, 100, 200, 500, 1000, 2000km), whereas the markers' shapes identify different time cutoffs (20, 100, 200, and 268 years). The dashed horizontal lines mark the t-values of conventional levels of significance (* 0.10, ** 0.05, *** 0.01).



Appendix Figure 5. An Example of *Yunnan Tongzhi*

Notes: This figure shows the format of the data about the copper factory information in the *Yunnan Tongzhi*. The red box in the figure specifies the names, locations, and the year of establishment of the factory.

Appendix Table 1. Adjusting for Fixed Effects

Dependent Variable	Bureaucratization Reform		
	All	All	All
	(1)	(2)	(3)
Resource×Post	0.086*	0.113*	0.089*
	(0.045)	(0.065)	(0.050)
Prefecture FE	YES	YES	YES
Time FE	YES	YES	YES
Province-Time FE	YES	NO	YES
Prefecture-Time Trend	NO	YES	YES
Observation	19,832	19,832	19,832

Notes: The dependent variable is the proportion of reformed *Tusi* over the initial number of *Tusi* in the prefecture. *Resource* is an indicator that equals one if the prefecture has copper, iron, or salt mines. *Post* is an indicator that equals one in and after 1688. Regressions are clustered at the prefecture level. Regressions are clustered at the prefecture level. ***, **, and * denote 1%, 5%, and 10% significance levels, respectively.