

Trafficking, Violence, and Revolution: The Evidence from Salt Charter System in Qing China

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PRELIMINARY AND INCOMPLETE

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Abstract

The accumulation of violence-related human capital, such as martial arts skills and military tactics education, is important for facilitating potential revolutions, which can impose checks on the government. However, it is unclear why people would choose to invest in this type of human capital during peacetime. In this paper we explore the Chinese salt charter system, which divided China into several salt districts with artificially created salt price differentials at borders. It created incentives for salt trafficking and violence-related employment opportunities, which in turn led to the accumulation of violence-related human capital among local residents. Using a special regression discontinuity design and the Difference-in-Discontinuity method, we analyze a local salt charter reform and find that the government's use of violence in cracking down on salt trafficking created a demand among salt traffickers to use violence to protect their cargo and avoid punishment. This ultimately led to a greater accumulation of human capital related to violence, as measured by the Wuju or martial arts examination results in the affected region. These accumulations may have contributed to the demise of the Qing dynasty, as the salt border regions were particularly active during the late Qing revolution.

Key words: Salt charter, Salt trafficking, Violence related Human capital, Rebellion

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1.Introduction

Rebellion and protests are considered a major force in dismantling and reshaping societies, (e.g., Knight 1991; Acemoglu and Robinson 2000; King and Pearce 2010; Dupas and Robinson 2012) Previous literature has discussed various aspects of rebellion, including coordination, the role of famine and hiding places in determining rebel decisions, and the rebels' cultural heritage. (Autor et al. 2020 ; Algan et al. 2017; Fetzer 2019; Ponticelli and Voth 2020 ; Cantoni et al. 2019; Manacorda and Tesei 2020 and Enikolopov et al. 2020) These analyses overlook an essential aspect of local rebellion: it is founded on mastery of violence, a form of human capital that must be accumulated before uprising. Rebellion and other violent acts necessitate not only physical training and weapon mastery, but also tactical planning and instant communication skills among participants. This explains why people with military backgrounds are frequently more successful in rebellions than civilians. This raises important questions: under what circumstances would individuals choose to accumulate such violence-related human capital, and what role did this accumulation play in the uprising? The previous literature does not adequately address these issues.

In this paper, we hypothesize that the cultivation of violence-related human capital has a strong correlation with its employment and job opportunities. In other words, people will invest in such a human capital accumulation when there are stable, long-term violent-related jobs in a region. In order to test this hypothesis, we examine a unique institution in Qing China, i.e. the salt charter system. Due to its low demand elasticity, salt tax has been viewed as an important source of tax revenue by Chinese rulers for the past thousand years. To facilitate the collection of salt tax, China's rulers divided the country into several salt districts and mandated that only salt produced in the region's salt fields and transported by chartered merchants could be used within those districts. However, the different distances to each district's respective salt fields resulted in a substantial price disparity across districts and an enormous incentive to smuggle salt from low priced district to high priced one for profits. In order to intimidate salt traffickers, the government imposes harsh punishments, typically exile and death. This fueled the salt traffickers' need for violence: By assembling larger and more heavily armed escorts, they were able to defeat government inspection teams and keep their lives and cargos. A plausible

hypothesis would be that the need for salt escort by traffickers has created a persistent demand for violence, which may alter the propensity of locals to choose human capital accumulation.

One major challenge is to find a convincing measure of the local population's tendency to accumulate violence-related human capital. Fortunately the results of Wuju (martial Keju) may suffice. The Wuju is a series of imperial examinations designed to select national military talent to serve as generals or high-ranking officials. The scope of the examinations, which included stone lifting, horseback riding, archery, and writing essays on military tactics, encompassed a variety of aspects of violence-related human capital, such as physical strength, weapon mastery, and military strategy. Similar to the Keju examinations, the selection process for Wuju was extremely stringent, with very few winners. However, just as the performance of a nation's athletes in the Olympic Games is positively correlated with the popularity of sport in that nation, it is plausible that the Wuju performance of a local area is a reflection of the average accumulation of the violence related human capital by the people of that area.

The salt district boundaries present an opportunity for regression discontinuity design (RDD). Those rulers who drew the boundaries of these salt districts did so primarily for two reasons: 1) to minimize transportation costs, and 2) to ensure that each district consumed all of its salt production in order to maximize salt tax revenue. As a result, salt district boundaries typically do not overlap with provincial boundaries, mitigating the concern that differentials across salt borders are caused by different provincial administration. In addition, because these salt districts were drawn specifically for salt-related regulation, it is unlikely that they are correlated to other administrative factors. As expected, there is a substantial price disparity at the boundary of the salt districts. For example, the salt price in Lianghua, the largest salt district and the focus of this study, was nearly double that of its neighboring salt districts. On the other hand, the border is smooth over a series of demographical and geographical features, including other consumable prices, altitude, ruggedness and population.

The influx of trafficked salt, which was cheaper and of higher quality than chartered salt, would displace chartered salt and reduce the government's salt revenue. As a result, only those officials on the high-priced side had the incentive to combat salt trafficking, usually in the form of setting up checkpoints and inspection team. In turn, on the high-priced side of the border, the government's hard stance on salt trafficking increases the demand for violent resistance

against the government among salt traffickers, thereby increasing the locals' desire for violence-related human capital accumulation. Therefore, we anticipate that on the high-priced side there will be more government checkpoints for salt trafficking, a greater likelihood of government-trafficker conflict, and a greater local accumulation of violence-related human capital, as reflected by higher Wuju achievements.

The following datasets make our research possible. Our information on Wuju is derived from various local chronicles (including prefectural, provincial and provincial chronicles). They provide comprehensive information on each Wuju (and Keju) achievers, including exam year, country of origin, and exam results. The information on the government's salt checkpoints comes from Qing Dynasty Salt Law General Records (盐法通志), which details the date each government anti-salt trafficking point in China was established, its precise location, and the number of soldiers assigned to the checkpoint. Local officials' private memorials to the emperor contained information about government-trafficker conflicts. In these records, local officials typically detail the number of participants, the weapons used by each side, and the government's victory or defeat.

The results of the RD regressions confirm our hypothesis. First, we observe that local governments had a greater incentive to combat salt trafficking on the high-price side of the boundaries. This indicates that there are an increasing number of government checkpoints and conflicts between government inspection teams and local traffickers. When salt trafficking is threatened by government inspections with a high probability of violent confrontation, we also find that local residents are more likely to accumulate violence-related human capital. This is evidenced by the fact that the Wuju has a greater number of excellent performers than other provinces in the same region. These findings are consistent with our interpretation that the driving force behind the accumulation of people's violence-related human capital was the violent demand of the local population to engage in confrontation in response to the government's crackdown on salt trafficking.

To further demonstrate that the changes in human capital accumulation are a direct result of the government's crackdown, we examine whether regions adjacent to salt trafficking routes exhibit a more pronounced response. It is reasonable to assume that governments are more likely to establish checkpoints in these regions and that there are more conflicts between

governments and traffickers in these regions. Moreover, the greater the escort need of traffickers, the greater the violence-related opportunities and, consequently, the greater the propensity to accumulate relevant human capitals. The information about salt trafficking routes comes from the work of Sacki (1987). To demonstrate that the formation of trafficking routes is exogenous and primarily driven by the need to avoid terrain obstacles, we use the ArcGIS to calculate the minimum cost routes between the salt field and each provincial capital in the salt region. We discovered that Toshio's routes overlap significantly with the calculated minimum cost routes. We find that checkpoints, government-trafficker conflicts, and the accumulation of violence-related human capital are all concentrated in these areas within 20 kilometers of the trafficking routes, demonstrating that the salt trafficking under the threat of government inspection was indeed the cause of the local accumulation of violence-related human capital.

We employ the difference-in-discontinuities regression to further establish the causal relationship between government inspection and local violence related human capital. We utilize an exogenous event: the 1792 liberalization reform in the Hedong salt district, which is located adjacent to the Lianghuai salt district to the north. The reform eliminated the local salt charter system and legalized individual salt transportation. The success of the reform significantly reduces the salt price in the Hedong salt district, resulting in a greater price disparity at the district boundary between Hedong and Lianghuai. This eventually increased the incentive for salt trafficking. The RD-DID regression results indicate that there were more government anti-trafficking checkpoints on the Lianghua side of the border after the 1792 reform. All at the same, reports of confrontations between the government inspection team and the salt trafficking team have increased. This is consistent with the hypothesis that a greater price differential at the border encouraged more salt trafficking, necessitating increased government enforcement efforts. On the other hand, anecdotal evidence suggests that the conflict escalated, as the trafficking team hired more people to escort the salt and was armed with far more advanced weapons than the government inspection team. In addition, we find that in the 30 years that followed this reform, local Wuju performance improved significantly on the Lianghua side of the border, particularly in those counties on the private salt route. This is evidence that government crack-downs creates a need for violence among local residents and encourages the accumulation of human capital related to violence.

What precisely were the channels through which local violence prompted individuals to engage in human capital accumulation? Here, there may be multiple hypotheses. The first hypothesis is that salt trafficking has increased the demand for human capital related to violence and provided incentives for individuals to acquire relevant skills and human capital. The second hypothesis is that the government hired more people to work in their inspection teams and checkpoints, thereby increasing demand. The third hypothesis is that the local people's violence stems primarily from their hatred of the government, as it is likely that their family members or friends were killed in the conflict or arrested and executed by the government. Our results suggest that the first channel is the most plausible for the increased local accumulation of violence related human capital.

We conclude that the accumulation of human capital resulting from violence may have significant implications for the regime change. During critical times, such as the eve of a revolution, people with such human capital may have a greater incentive to take up arms than those without. In the ten years preceding the Xinhai Revolution, widespread discontent with the Qing government led to a large number of local uprisings. We discovered that there were, in fact, more uprisings on the high-price side of the salt district border, and that this phenomenon was more pronounced when it was closer to the salt trafficking routes. Therefore, we demonstrate that the accumulation of human capital related to violence is useful in times of critical change.

Our paper relates to several important literature. The first is the literature concerning violence and uprising. This literature has recently received a great deal of attention. They are focusing primarily on the factors that influence the decision to revolt and the resulting consequences. Coordination between protesters (Cantoni et al. 2019), the memory of previous riots (Miao et al. 2023), social media (Manacorda and Tesei 2020 and Enikolopov et al. 2020), and the disappearance of trade opportunities (Cao and Chen 2022) are some of the violence-related factors studied in this literature. Our paper departs from the literature by focusing on the decision of violently related human capital accumulation, as opposed to the decision to riot. Our paper is connected to this literature by showing that the mastering of violence has great impact on resident's decision to go rogue, especially at the eve of the revolution.

Our paper is also related to the human capital literature. This literature emphasizes the significance of human capital accumulation for economic growth. (Gennaioli et al 2013, Valencia, 2019) This literature refers to human capital mainly in the sense of people's abilities to write, learn, communicate, and comprehend. In our paper, we discuss a completely different concept of the accumulation of human capital: Human capital associate with violence. We demonstrate that this human capital is important because it imposes checks on incumbents and aids in the eventual overthrow of existing regimes. Therefore, our conclusion is consistent with the entire body of research, which highlights the positive role of human capital.

Our paper is also related to the literature on state capacity, as the salt tax is an important tax collection method. In this regard, our paper is similar to Ardent (1975) and Sánchez De La Sierra (2020), who discussed the relationship between the formation of the tax collection system and the local resource. A key takeaway from our paper is that the ways of collecting tax, when multiple choices are available, is an importance choice. As the poor choice of taxation would have serious negative ramification for the regime.

2 Institutional backgrounds

2.1 The Salt District in the Qing China

China had been taxing salt as a significant source of state revenue for 2600 years. Due to China's large population and relatively inelastic demand for salt, the government was able to gain enormous financial strength from this. Since the Ming and Qing dynasties, China has progressively refined its salt tax collection system. In order to maximize tax revenue from the flow of salt, the rulers subdivided China into salt districts, each of which corresponded to a salt-producing region. Each salt zone only permitted the use of salt from its own salt-producing region. Transport and sales of salt were delegated to small number of merchants with state charters. These merchants were monitored closely. They were required to purchase salt at a fixed price, in the quantities specified in the charter, and transport it at a fixed time and along a fixed route to the place of sale, where it would be sold at an official price. These privileged merchants were the ones who paid the salt tax, either in form of direct salt tax in normal time or compelled donation when the state was in desperate need of funds.

To maximize tax revenue, salt districts are apportioned so that larger salt districts correspond to salt fields with greater salt production. Since the Lianghuai salt field is the most productive in China, its Lianghuai salt district is the largest, encompassing more than seven provinces. However, a significant adverse effect is that the greater the area, the greater the distance to the source, which raises transport costs and salt prices. Due to the different transport costs, it is common for there to be a price difference between these two sides of the salt zone, and in extreme cases, the price difference could be substantial. For instance, the price of salt in the Lianghuai Districts is essentially double that of other salt-producing regions.

To ensure that the charter system is operational and that regulations are enforced, the government employed a multitude of strategies. These included the government's use of dozens of checkpoints in various locations, particularly where rivers were dense or overland routes were required, to check on incoming and outgoing pedestrians to prevent the trafficking of unchartered salt. During the Qing Dynasty, a total of 859 anti-smuggling checkpoints were established. In addition, the government had anti-smuggling inspection teams that patrolled the area to prevent the passage of salt convoys. The purpose of these inspections was not only to prevent the trafficking of smuggled salt, but also to prevent chartered merchants from smuggling salt using their convoys. Those apprehended by government forces were subject to extremely severe punishments. They were typically sentenced to 300 rods or exile, and many received death sentences.

This system is highly problematic. The first problem is that salt may be unavailable to local people in some regions. Due to the high cost of transporting salt over long distances, the local price of salt exceeds the population's purchasing power. On the other hand, the cross-border price differential is so large, and private salt sales are so lucrative, that government inspection efforts were not even close to being able to prevent them. According to some documents, more than forty percent of people's salt consumption now originates from traffickers.

On the other hand, the government's crack-downs of private salt has prompted traffickers to employ a variety of methods to avoid arrest by the government. These include the possibility of bribing government officials, the use of small roads (also at great expense), and the simplest method is to use armed guard to escort their salt convoys. This entailed employing up to 200 men as escorts for the teams. These would vastly outnumber the government patrols, which

consisted of approximately fifty men. Moreover, their weapons were frequently far more advanced than those of government patrols. While an increasing number of government patrols were using bows and arrows, they were already employing firearms and cannons. The enormous revenue generated from the sale of private salt made it possible for them to easily pay for such a large number of men and so many weapons.

2.2 Wujū in Qing China

Inherited from the Ming dynasty, the Qing dynasty's Wujū, or military examination was intended to select individuals with military tactics and martial skills for the state. It was held every three years at the same time as the Keju, or the civil service examination. In exceptional circumstances, such as the coronation of the Emperor or his birthday, an additional examination was held for celebration. Similar to the Keju, there are three levels of examinations in Wujū, namely the provincial examinations, the national examinations, and the imperial court examinations. Each province holds and administers provincial examinations, with a relatively stable number of quotas for top performers to advance to the national examination, which is held six months later in the capital. The winner of the national examination will take the Imperial Court examinations, which determine only the order of the winners.

The winners of the final examination are given the titles of Martial Zhuangyuan, Martial Bangyan, and Martial Tanhua. In addition to receiving great honors, such as being decorated in red and boasting in the streets, the winners of these examinations were immediately given official positions, such as the Martial Zhuangyuan receiving the First Class Imperial Guard and the Martial Bangyan and Tanhua receiving the Second Class Imperial Guard. After that, these individuals had better promotion prospects than others. Although the social status of military officers during the Qing Dynasty was always lower than that of civil officials, such generous conditions still enticed many individuals, particularly those with relevant military training, to participate in the Wujū examinations. As a result, competition was fierce, with an average of 40 candidates per province per year qualifying for the national examination, but thousands applying to take the examinations.

The examination consists of two components: a written examination and a martial arts examination. The written examination consisted of three essays based on questions extracted

from seven classics on military tactics. The essays required not only a comprehension of the texts, but also direct experience leading an army into battle. In the later Qing dynasty, the written test was gradually reduced due to the quality of the examiner, but familiarity with the military tactics was still emphasized. The examination's focus was the martial arts examination, which was divided into the skills tests, such as mounted and foot archery and the tests of strength, such as hard bow drawing, sword dance, and stone lifting. Those who had engaged in extensive training or military activities were therefore advantaged in Wujia exam.

2.3 The 1792 Hedong reform (课归地丁) that abolished local salt charter system

The aggressive Hedong reform of 1792 abolished the local salt charter and salt taxation system. The previous official salt system, including the merchant's charter and officials in charge of administration and inspection, was eliminated, and private transport of salt was permitted. The tax losses were offset by an increase in land and poll taxes. The reform was motivated primarily by the fact that the government salt charter at the time was unsustainable. First, the high government salt tax led to high salt prices and widespread discontent among the local populace. In addition, the region's frequent flooding destroyed the salt ponds, rendering solar salt impossible. This supply-side restriction further increases the price of salt. As a result, salt was unavailable in numerous locations, necessitating a reform of the charter system.

After the restrictions imposed by the government salt charter were lifted, many private individuals began transporting salt. This enormous transport capacity stimulated supply, leading to a rise in salt production. This resulted in a significant reduction in the price of salt². In contrast, the government's revenue did not decrease as a result of the additional tax collected by the more efficient poll and land tax system. Government changed its mind in 1806 and restarted selling salt charter for profit, but once liberalization had gained momentum, it was difficult to stop. Numerous pieces of evidence suggest that a substantial private salt trade existed in this region until the year 1830 at which point a comparable reform in the Lianghuai district was implemented and ultimately led to a reduction in the price disparity.

² For instance, the salt price of Xi'an and Tongzhou was down by 2 Wen, an 20% decrease of their pre-reform price. (Chinese bookstore, 2008)

This reform had a substantial effect on the administration of other salt districts, especially its neighbor Lianghua district. As mentioned earlier, the salt prices in the Lianghua district were the highest due to its vast size and high transportation costs. Prior to 1792, the price disparity at the Liangtse-Hedong border was already substantial, and the reform will only make it worse and provide stronger incentive for salt trafficking. Numerous anecdotal reports suggest that after the Hedong 1792 reform, the Lianghuai salt administrators employed a large number of officials and soldiers on the district's border with the Hedong district in order to conduct crackdowns³. This would likely increase government-trafficker conflict and the local populace's propensity to amass human capital related to violence.

3. Data sources

The paper's data comes from multiple data sources. The source of information for Wuju achievers is local gazetteers. Wuju achievers are recorded in local chronicles, including county, prefectural, and provincial chronicles, due to the significance of their accomplishments. In these local chronicles, the following information is clearly presented: the achiever's name, the examination year, and the ranking. When the same information is recorded by multiple sources, such as county and provincial chronicles, we prioritize using provincial chronicles over prefectural chronicles, which are preferred over county chronicles. This is because chronicles at higher levels are more likely to be error-free. We searched for information on achievers in the eight provinces that overlap the Lianghuai salt area: Jiangsu, Zhejiang, Guangdong, Guangxi, Sichuan, Guizhou, Shanxi, Henan, and Shandong.

The information regarding salt district and salt price for each district is extracted from Qing Dynasty Salt Law General Records (盐法通志, General Records hereafter), a book detailing all aspects of the Qing China salt charter. It provides information at the county level regarding the coverage of each salt district. For example, Lianghua district contains 249 counties between the years 1645 and 1665, with names of all counties listed. Notice that the salt district is dynamic and constantly changing. Counties were often reclassified as a different

³ For instance, Cheng Wang, a Imperial Censor, described to the emperor in his confidential memorials that chartered salt sales in Lianghuai district was decreased due to the influx of private salt from Hedong district and suggested the emperor to coordinate with local officials to set up checkpoints. (Veritable Records of High Emperor, Volumn 1466)

salt district. In the early Qing, as a result of alterations to the local salt policy, there are more shifts in salt districts than in later period. The General Records contain specific information regarding each alteration to the salt district, including which counties are added or subtracted. As for prices, General Records is equally exhaustive: not only does it provide salt prices for each district, but it also details significant price changes in each district.

The information regarding checkpoints is derived from the General Records, which contain details regarding the time of establishment, location, and total number of soldiers at each checkpoint. The government-trafficker confrontation details come from confidential memorials sent to the emperor by ministers. They are confidential in the sense that, in most cases, a third party cannot view their content, thereby reducing the minister's incentive to lie. On these memorials, ministers would typically record the number of soldiers and weapons on each side, as well as the outcome of the conflict. In a memorial submitted to the emperor by a Mian Fu in 1825, for instance, the local minister described a meeting with a salt trafficker at Anyi County in Shanxi Province. They discovered that they were completely dominated by the salt traffickers, who had gun, firecracker, shield, spear, sword, and other weapons. They were also outnumbered by salt traffickers by a ratio of 1 to 4. In anticipation of a loss, the government inspection team retreated. There were also descriptions of the victory of the government. In Shusheng Zhang's narrative to the emperor in 1873, for instance, he wrote that they were able to capture the notorious salt bandits and obtain both guns and salt smuggled. Eventually, these salt smugglers were paraded or beheaded.

Our data on local uprisings during the late Qing Dynasty is derived from digitized newspapers published at the time. Our dataset contains 11 newspapers, ranging from the most influential *Shen Bao* (also translated as *Shenjiang Xinbao*), *Dagong Bao* to the relatively smaller *Minli Bao*, *Shi Bao*. In general, these newspapers meticulously documented the time, place, and cause of local revolts, as well as the number of participants and the ultimate outcome.

4 Identification strategy

To mitigate the concern of omitted variables that may arise from comparing the Lianghuai salt district with its neighboring districts that may have vastly different geography and

demographics, we utilize a regression discontinuity approach. Specifically, we focus on a narrow band of areas within 70 miles of the salt district borders, with the areas within the Lianghuai district as the treatment group and the areas outside the Lianghuai district as the control group. Since both groups are located in close proximity to the border, they are assumed to be homogeneous with respect to factors that may influence decisions related to violence-related human capital, such as population, geographical ruggedness, clan, and other social factors. The continuity of the salt boundary helps to automatically control for these factors.

We demonstrate that the assumption of homogeneity is not violated at the salt border. This is because the creation of the salt district was an independent decision made solely to maximize salt tax revenue, and was not correlated with administrative or geographical boundaries, such as provincial borders or physical terrain. To verify this, we analyzed various factors such as local altitude, ruggedness, population, and social and cultural features, and found no significant differences across the border. Another requirement for regression discontinuity is that the salt price should not be continuous across the border. We expect that, on the Lianghuai side of the border where local residents were compelled to consume salt produced from salt fields located further away, the price would be significantly higher than the other side of the border. Panel A of Figure 4 and Pane A of Figure I confirms this by showing a discontinuity point at the border, with Lianghuai salt prices significantly higher than the other side.

We therefore conduct the regression of discontinuity of the following form:

$$H_{cd} = \alpha + \beta Lianghuai_{cd} + f(Dist_{cd}) + f(Dist_{cd}) * Lianghua_{cd} + \varepsilon_{cd}$$

$$s. t. -h < Dist_d < h$$

Where H_{cb} is the outcome variable of interest for county-level observation c in district d along segment b of the salt district boundary. The $Lianghuai_{cd}$ is an indicator variable that equals 1 if county c of the district d is at the Lianghuai side of the border and 0 if otherwise. $Dist_{cd}$ measure the distance between then county to the border d (positive if in Lianghuai side and negative if not in Lianghuai side). $f(Dist_{cd})$ is the RD polynomial, which controls for smooth functions of geographic location. Various forms will be explored. h is the estimated MSE-optimal bandwidth following Calonico, Cattaneo, and Farrell (2018). The standard error is

clustered at the border level to deal with the potential spatial correlation of the error term, as suggested by Cameron and Miller (2015).

To provide further causal evidence, we explore an augmented “difference-in-discontinuities” specification, which investigate within county changes before and after the 1792 liberation reform conducted in Hedong district. In particular, we estimate the following model:

$$H_{cdt} = \alpha_1 Lianghuai_{cd} + f(Dist_{cd}) + f(Dist_{cd}) * Lianghua_{cd} + \alpha_1 Lianghuai_{cd} * Post_t \\ f(Dist_{cd}) * Post_t + f(Dist_{cd}) * Lianghua_{cd} * Post_t + \varepsilon_{cdt} \\ s. t. -h < Dist_{cd} < h$$

Where $Post_t$ is a dummy variable that equals 1 if $t > 1792$ and 0 otherwise.

Our assumption is that the reform should only affect one side of the border and not the other. This is likely to be the case in our study. The price differential across the Hedong-Lianghuai border is higher, which increases the incentive for salt trafficking. Hedong officials have no incentive to control the trafficking, as the outward transportation of salt will only increase the local demand for salt, and thereby increasing salt revenue. However, officials in Lianghuai have a strong incentive to prevent the inward transportation of salt, as it would compete with the chartered salt and jeopardize salt revenue. Consequently, the higher incentive for Lianghuai officials to inspect salt transportation resulting from the reform will have a significant impact on the local residents' decision to resort to violence.

5 Empirical results

5.1 The RD results

The baseline results are presented in Panel A of Table III. Our study shows that the local government established more checkpoints in the Lianghuai district near the border, as demonstrated by both Panel A of Figure 7 and Panel A of Table III. This suggests that the government had a strong incentive to interdict salt trafficking and prevent locals from consuming illegally trafficked salt. The increased checkpoints were aimed to maintain the market share of chartered salt, thereby sustaining the government's tax revenue. Furthermore, our analysis indicates that a county on the Lianghuai side of the border had 2.09 more

checkpoints than the other side, with an economically significant difference of 1.43 times the standard deviation of the number of local checkpoints (1.46).

We also find a notable surge in the incidence of conflicts between government inspection teams and salt traffickers. This observation is confirmed by both Figure 6 and the regression discontinuity (RD) results. Notably, the economic analysis indicates that the total number of reported confrontations in the Lianghuai salt district is 0.63 higher than the other side of the border. This suggests that as the government intensifies its efforts to inspect salt and enforce regulations, it is likely to face a greater number of confrontations with local salt traffickers.

From the perspective of salt traffickers, an increase in the number of checkpoints and inspections poses a threat to their cargo, safety, and profits. As a result, they are more likely to resort to violence to protect their interests, leading to increased demand for violence-related human capital. This, in turn, would encourage the accumulation of such human capital among the local population, with potentially significant implications. Specifically, we expect to observe a greater tendency toward violent human capital accumulation on the Lianghuai side of the border, given the higher intensity of inspections and checkpoints in that area. Our findings reported in Table III confirm this hypothesis and suggest that an increase in the demand for violence-related human capital can indeed drive the accumulation of such capital within a given population.

In this study, we employ the difference between local Wuju achievers and Keju achievers as a proxy for the local tendency to accumulate human capital related to violence. We use this approach to account for the influence of local economic conditions on the examination results. According to existing literature, the Keju and Wuju examinations entail significant opportunity costs, as candidates must devote considerable time to preparation and are unable to engage in agricultural activities simultaneously. Given that most candidates come from relatively affluent families, local economic development tends to encourage greater participation in the exams. However, we use the difference between Wuju and Keju examinees to offset the economic impact on individuals' choices.

To address concerns that our findings may be driven by unobserved factors at the salt district border, we conducted a heterogeneity test. Specifically, we investigated how a county's distance from the salt trafficking routes affected its tendency towards violence. Historical

evidence suggests that traffickers typically use specific routes, as these routes offer the most efficient means of transportation while minimizing costs. Deviating from these established routes often incurs significant transportation costs, particularly for land transportation and when transporting large quantities of cargo. We obtained information on these salt routes from the work of Tomi Saeki, a Japanese scholar and expert on Qing China's salt administration. This analysis helps to further bolster our findings and increase the robustness of our results.

Our hypothesis posits that counties located near the salt trafficking routes would have higher levels of government checkpoints, confrontations between government officials and traffickers, and a greater tendency towards violence. To test this hypothesis, we divided our sample into two subsamples based on their proximity to the salt routes. This distance was selected as it represents the maximum distance that horses could cover in one day, making it a crucial measure of geographical accessibility. We found that our results confirmed our hypothesis, with counties located closer to the transportation routes exhibiting higher levels of government checkpoints, confrontations, and violence tendencies compared to those farther away.

This additional analysis helps to address concerns about the potential endogeneity of the salt routes. By calculating the minimum cost routes between the salt field and the capital of its destination province, the authors provide evidence that the salt routes are largely determined by exogenous geographical factors rather than endogenous strategic considerations. The fact that the minimum cost routes overlap with the real trafficking routes to a large extent supports this argument. Furthermore, we find that their results are robust to using counties' distance towards the minimum cost routes, which provides additional confidence in their findings.

5.2 The Difference-in-Discontinuity results

It is possible that our cross-section results may not be completely convincing. Our results on government crackdowns and local violent tendencies were affected by a number of factors and it is almost impossible to exhaust all possibilities that may contribute to our results and to show that they are continuous at the boundaries. So we go further and conduct the RD-DID tests, which introduce some exogenous shocks that affect only the treatment groups and leave the control group intact. By comparing the changes of both sides of the border before and after

the exogenous shock, we are able to deduce the impact of the shock on the local residents. The assumption is that most other factors that may affect our results were subtracted in this Difference-in-Difference practice as they are not comove with the exogenous shocks.

Our hypothesis predicts that the 1792 reform in Hedong salt district would lead to an even stronger government crackdown on salt trafficking and as a response, a stronger tendency among the local population to accumulate violent-related human capital. By using the Difference-in-Discontinuity methodology, we are able to test this hypothesis by comparing the changes in government crackdowns and local violent tendencies on both sides of the border before and after the reform.

This is because the reform lowered local salt prices, created a greater price differential at the Hedong- Lianghuai border, and increased the incentive for salt trafficking. On the other hand, the government in Hedong district had little direct incentive to crack down on salt trafficking. The government actually benefited from the outflow of salt as it would stimulate local demand for salt, thereby increasing the government's tax revenue. Therefore, this helps to ensure that the exogenous shock we use in our Difference-in-Discontinuity analysis is unlikely to be confounded by changes in government behavior or policy from the control group.

We conducted a subsample analysis by dividing the sample into two groups based on their proximity to the salt routes. The results of our Difference-in-Discontinuity analysis are presented in Table V. Consistent with our hypothesis, we find that regions closer to the salt routes were more affected by the 1792 reform. These regions exhibited a higher number of government checkpoint establishments, greater confrontation between government inspection teams and traffickers, and a strengthened propensity of local residents to accumulate violent-related human capital. In contrast, areas further away from the salt routes, served as a control group. did not exhibit such effects.

One potential concern with our Difference-in-Discontinuity results is that they may be capturing a pre-existing trend of high tendency of accumulating violence-related human capital in the Lianghuai district than in Hedong district. To address this concern, we conduct a falsification test using a series of cross-sectional regression discontinuity analyses. The results, presented in Panel 3 of Figure 9, show that the Wuju-Keju difference was relatively stable in the years leading up to the 1792 reform, and only began to increase after the reform was

implemented. This suggests that the observed increase in violence-related human capital accumulation was indeed a response to the exogenous shock of the 1792 reform, rather than a pre-existing trend. Additionally, the fact that it took several years for the local population to react to the reform is consistent with the idea that military training and the accumulation of violent-related human capital may take time.

5.3 The Channel

An essential question that arises is how the government crackdowns have contributed to the accumulation of military skills and violence-related human capital. While this paper focuses on the increased demand for escorts by local salt traffickers, there may be other possible channels that need to be explored. Hence, we consider the two most probable channels in this discussion.

One possible explanation for the accumulation of military skills and violence-related human capital is the local government's requirement for such skills during crackdowns and increased government employment. However, the issue with this explanation is that the total number of people required for the checkpoints and inspection teams was limited due to the local government's financial capacity. In contrast, salt traffickers, with their huge profits from the cross-border salt price gap, were able to employ a large number of people and equip them with advanced weapons. Historical evidence suggests that more than 40% of Lianghuai's salt consumption was supported by traffickers. According to Wang (1989)'s estimates, during the six decades of the Qianlong reign, the salt merchants of the Lianghuai Salt Area made a profit of 90.11 million taels. Salt traffickers, on the other hand, made even higher profits because they did not have to pay the high salt tax. This was enough for them to buy all sorts of weapons, such as guns and swords, to fight the government. In addition, the scale of salt traffickers is enormous. Large-scale salt traffickers could number in the thousands, and small-scale salt traders could number two or three hundred⁴. In contrast, the number of government employees

⁴ The figures are from *Continuation of the Imperial Classic of the World*, edited by Kang Sui Sheng (Volume 50) and *An Invitation to the Officials to Set the Salt Law* by Zengfang Wang.

in the inspection team and checkpoints is relatively small⁵. There are around 10-20 people at each checkpoint, and some checkpoints are even patrolled by only six employees.

Another explanation for the accumulation of violence-related human capital could be the desire for revenge against the government. When the government intensified its crackdowns, more people were arrested, executed, or killed during conflicts. This may have led friends and relatives of those affected to seek revenge against the government, motivating them to acquire more military skills and violence-related human capital. However, we conducted a test to rule out this possibility. We identified counties where people were arrested or killed in confrontations between the government and salt traffickers and removed them from our analysis. We then re-estimated our baseline results and the result reported in Table IV were similar to the original results. This suggests that the desire for revenge did not play a significant role in motivating people to accumulate violent-related human capital.

5.4 The impact on revolution

We also consider the long-term implications of the accumulation of violence-related skills. It is reasonable to assume that those who have mastered such skills are more likely to lead a successful revolution in case of a loss of legitimacy of the ruling regime. The possession of violence-related human capital, including military tactics and weapon training, increases the chances of success in an uprising and lowers the risk of being apprehended in the event of failure. To test this hypothesis, we examine the actions of residents at the salt border during the decade preceding the Xinhai Revolution, which led to the overthrow of the Qing dynasty. As previously mentioned, our local revolution data is based on a comprehensive dataset that includes influential newspapers in China during that period.

The RD results reported in Table VII suggest that the counties on the Lianghuai side of the border have a significantly higher likelihood of experiencing at least one revolution during the last decade of Qing's rule. The estimated effect size is substantial, with the difference potentially as large as 3.87, which is 1.62 times the mean level, 2.39. To further investigate this hypothesis, we examine the granularity of the dataset, which includes information on the

⁵ It is from the volume of Salt business, Financial and Economic section of Confidential memorials,

reasons for protests in each revolution. Using this information, we categorize the protests as being against the government or not. A typical uprising against the government is like: The farmers of Haicheng County, Fujian Province, protested against the county officials' squeezing, and gathered thousands of people on March 20, 1902, to destroy the county office.. Our analysis reveals that the regions on the Lianghuai side of the border also experienced a higher number of protests against the local government, providing additional evidence that individuals equipped with military skills and tactics are more likely to rise up against an expropriative regime.

6. Conclusion

In this article, we discuss a very important question: why people accumulate violence-related human capital during peacetime. These accumulations are crucial because they involve constraining government behavior through uprisings. Our hypothesis is that when violence-related employment opportunities arise, people will correspondingly accumulate violence-related human capital. We use a unique Chinese system to study this problem, which is the division of salt zones in Qing China. In order to maximize their tax revenue, the Qing rulers divided China into several salt district, artificially creating price differentials among those districts. This price differential has created an incentive for salt trafficking and for the government to protect its tax revenue through anti- trafficking crackdowns. As a result, those salt traffickers use violence, such as hiring more people and using more advanced weapons, to defend their goods and evade punishment. This pursuit of violence and the increase in violence-related employment opportunities ultimately lead to the motivation of locals to accumulate violence-related human capital, measured by the local Wuju or martial arts exams.

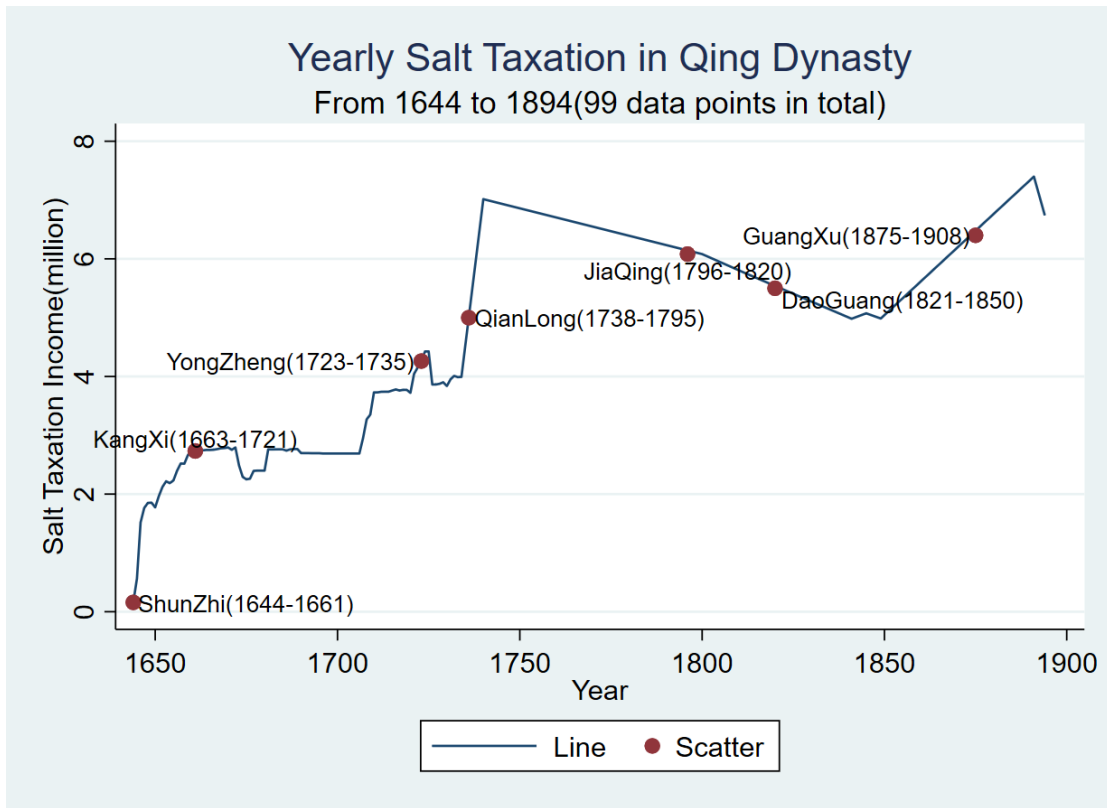
We find that this accumulation of violence-related human capital may be related to many important historical events, such as the 1911 Revolution that overthrew the Qing dynasty. We find that in the eve the revolution, there were more uprisings in the salt district border areas, particularly on the side with higher salt prices, where there were more accumulations of violence-related human capital. Many of these uprising actions were aimed at opposing the local government and its policies. Our findings indicate that some of the government's

ineffective tax collection methods have indirectly fostered revolutions by causing local people to accumulate violence-related human capital, leading to their own downfall.

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Figure 1. Salt Revenue



Note: The annual fiscal income of Qing was around 30 million taels of silver.

Figure 2. The salt district border and province border

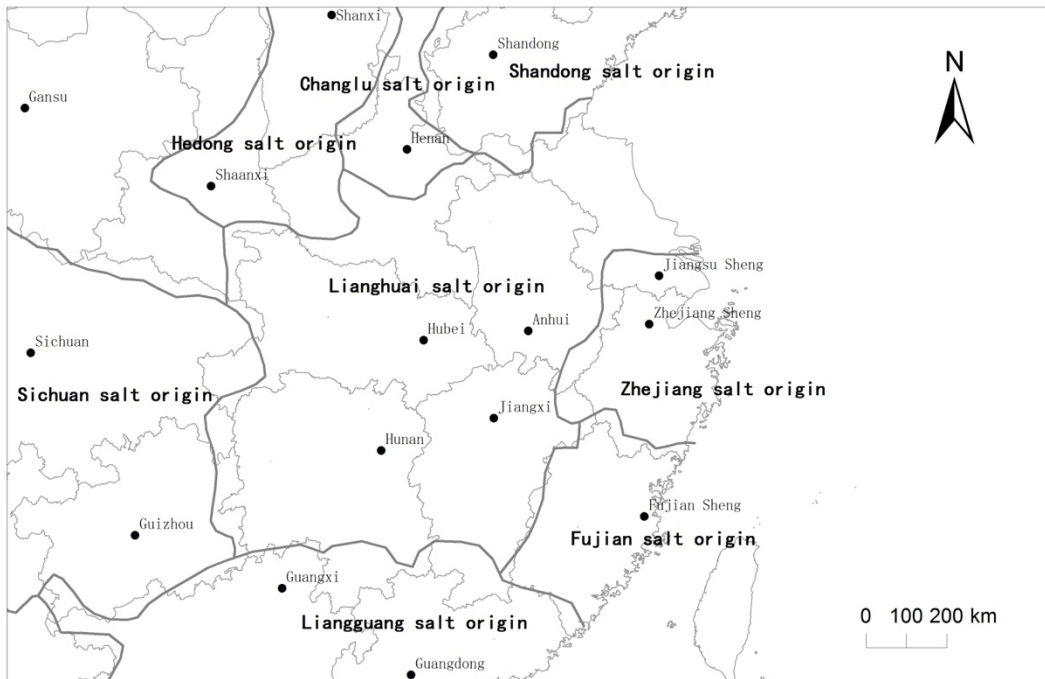


Figure 3. The Salt District and Salt Price

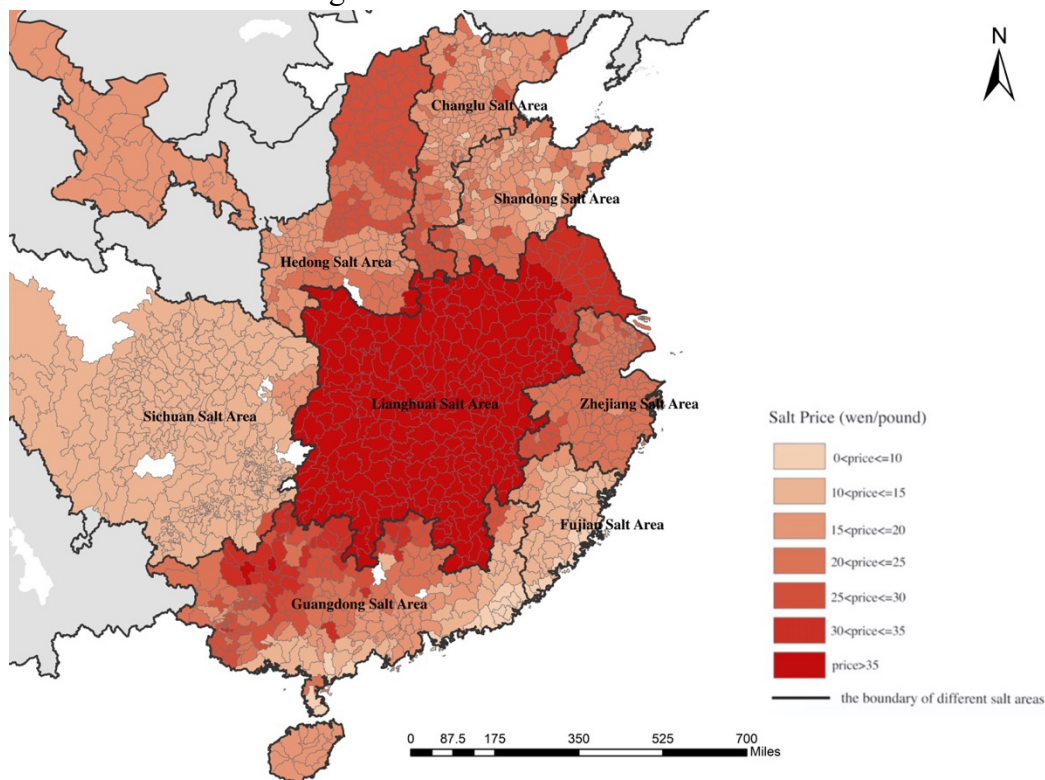
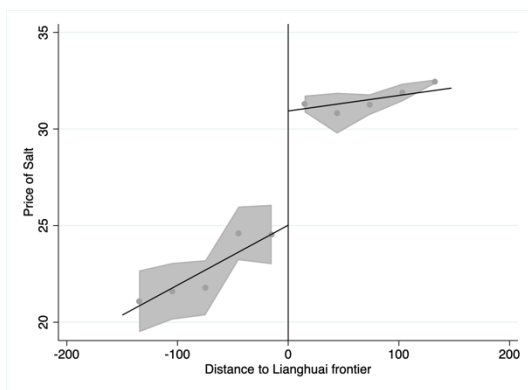
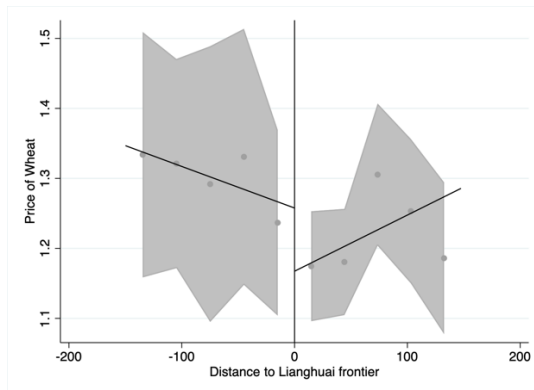


Figure 4. RD Plot: Prices of Salt and Stable Food at the District Border

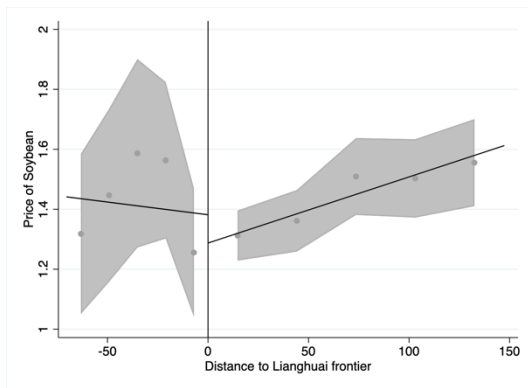
Panel A. Salt



Panel B. Wheat



Panel C. Soy



Panel D. Rice

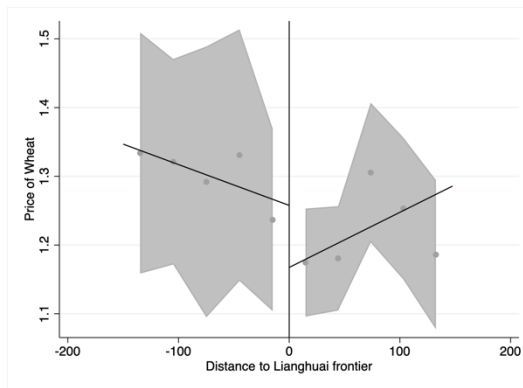
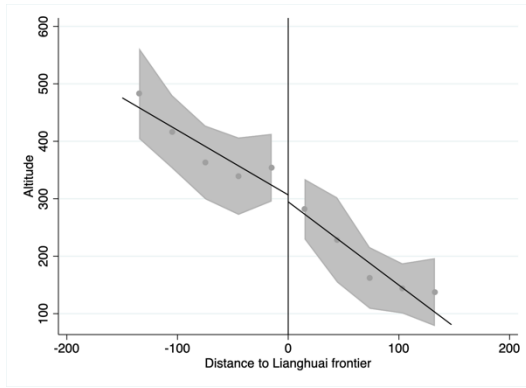
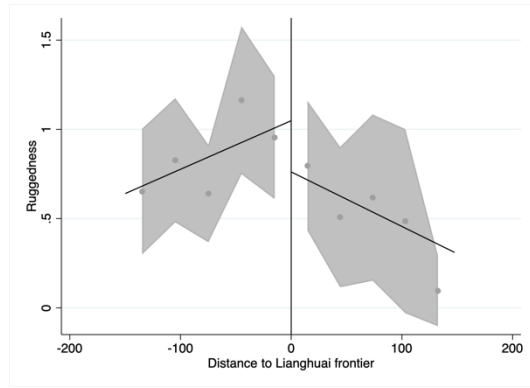


Figure 5. RD Plot: County-level Characteristics at the District Border

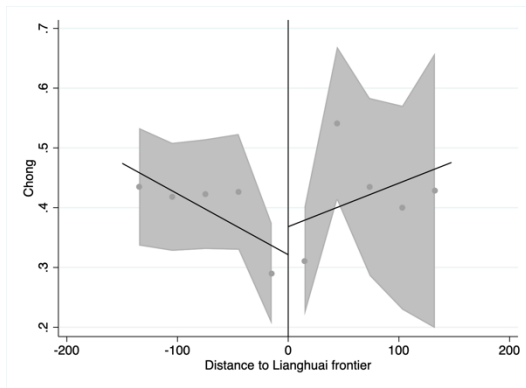
Panel A. Altitude



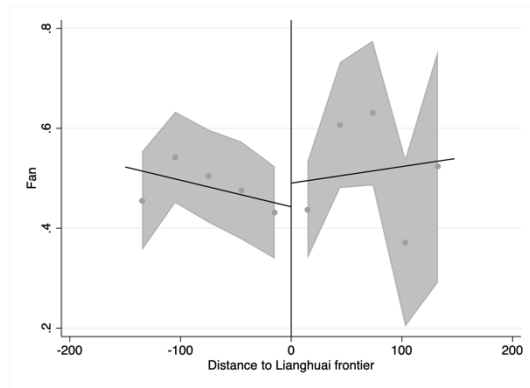
Panel B. Ruggedness



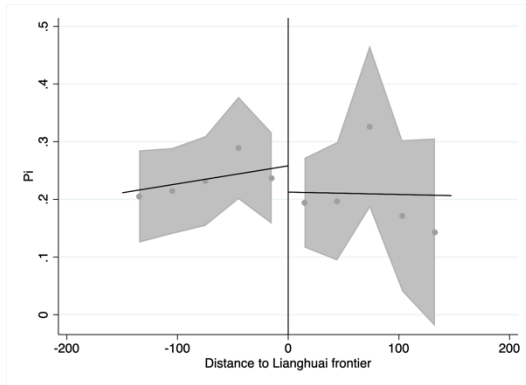
Panel C. Chong (Transportation hub)



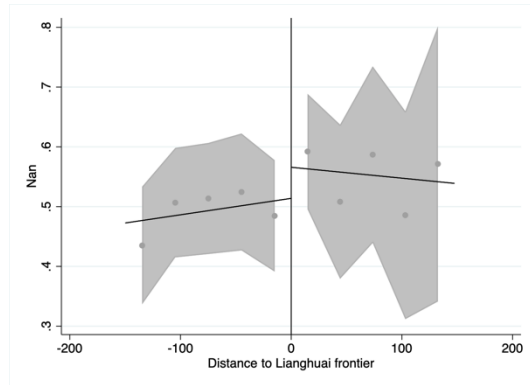
Panel D. Fan (Complex administration)



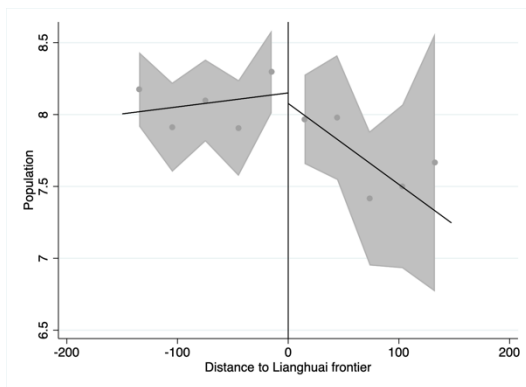
Panel E. Pi (Delay in tax payment)



Panel F. Fan (Higher crime rate)



Panel G. Population



Panel H. Length of waterway

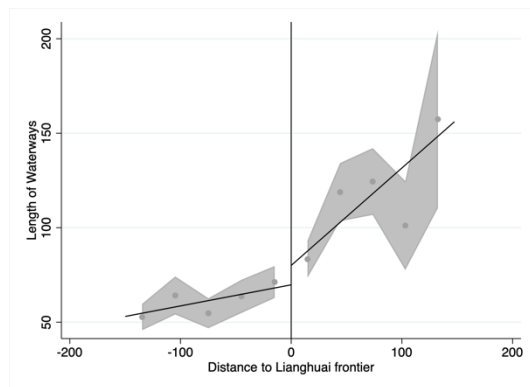
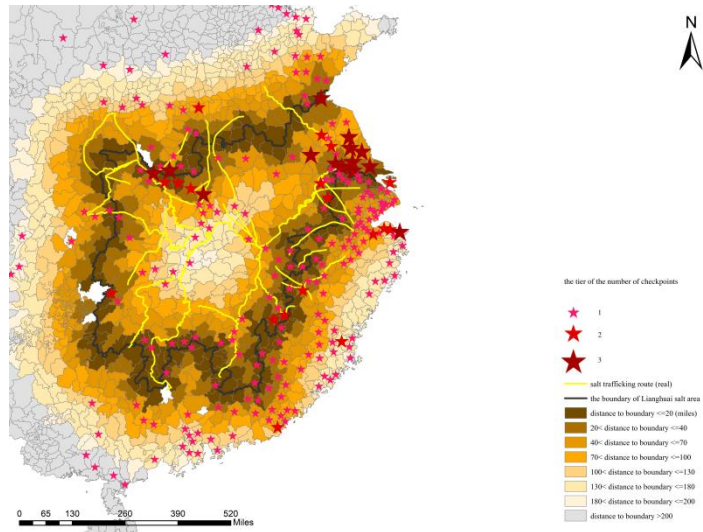
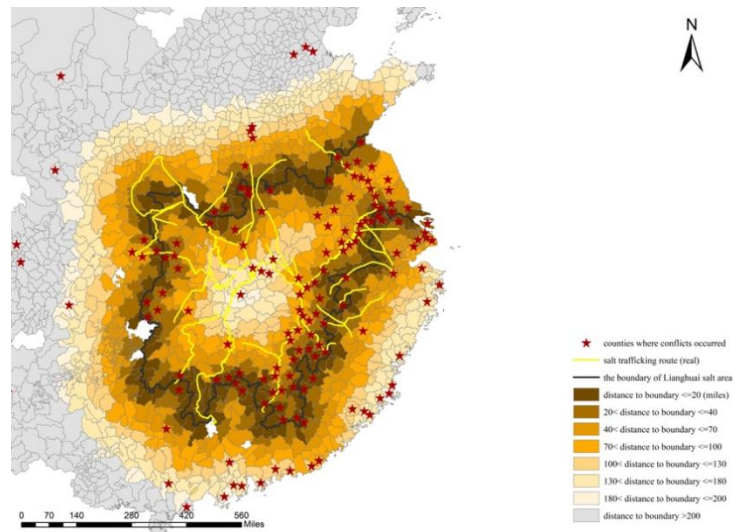


Figure 6. Geographical Distribution of Checkpoints and Government-Trafficker Conflicts and Wuju performer

Panel A Checkpoints



Panel B. Conflicts



Panel C. Wuju-Keju

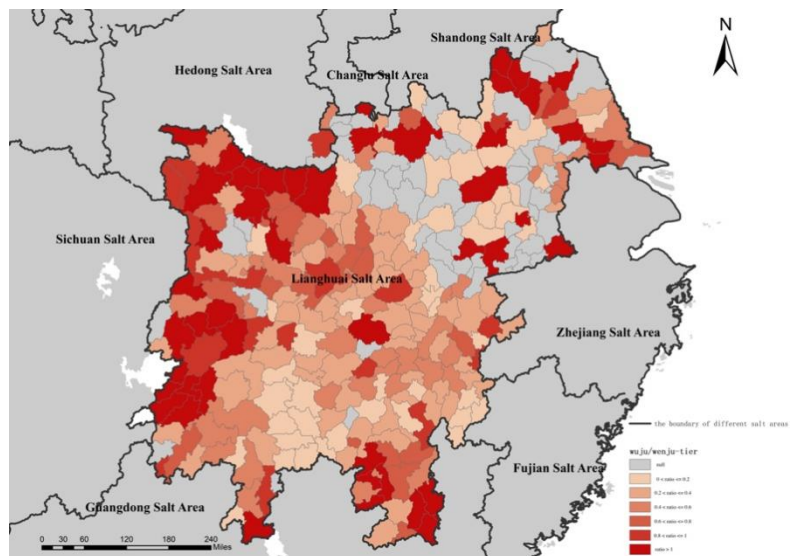


Figure 7. RD Plot: Checkpoints, Conflicts and Wuju Relative Performance at the District Border

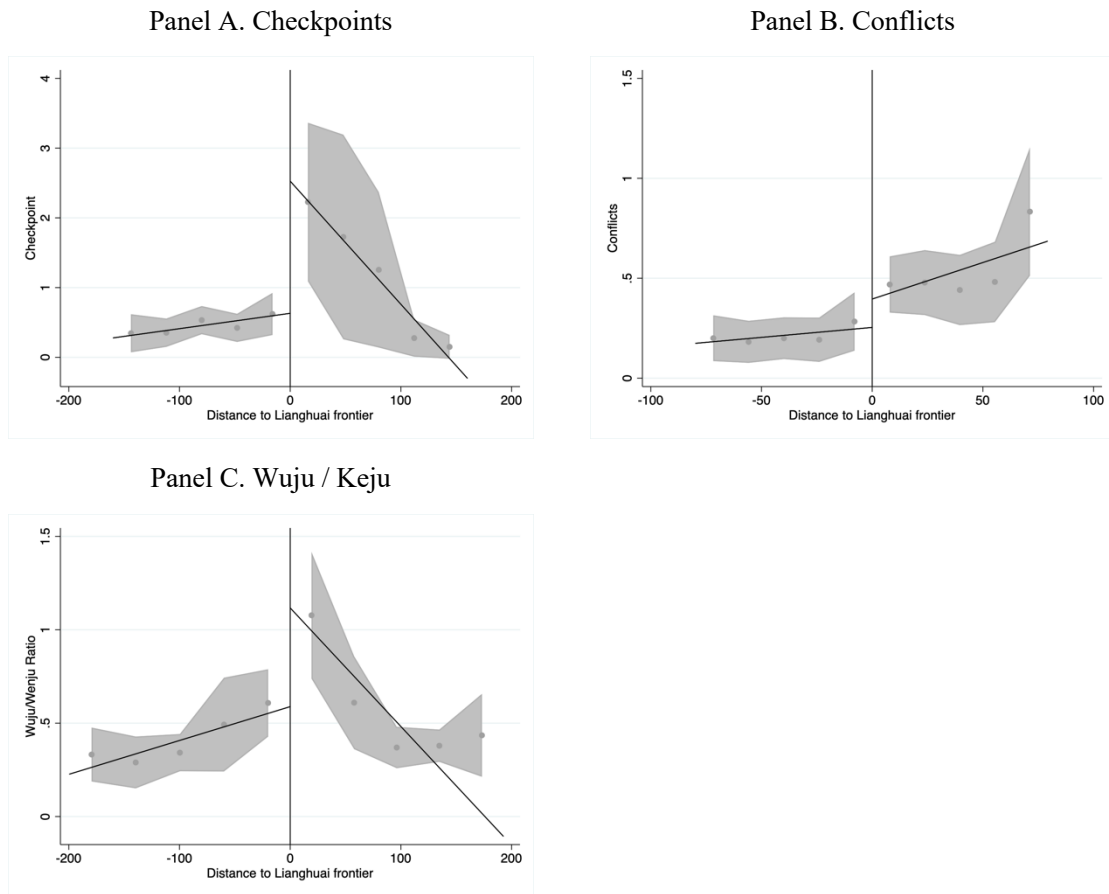


Figure 8. The Salt Trafficking Routes: Archived and Calculated

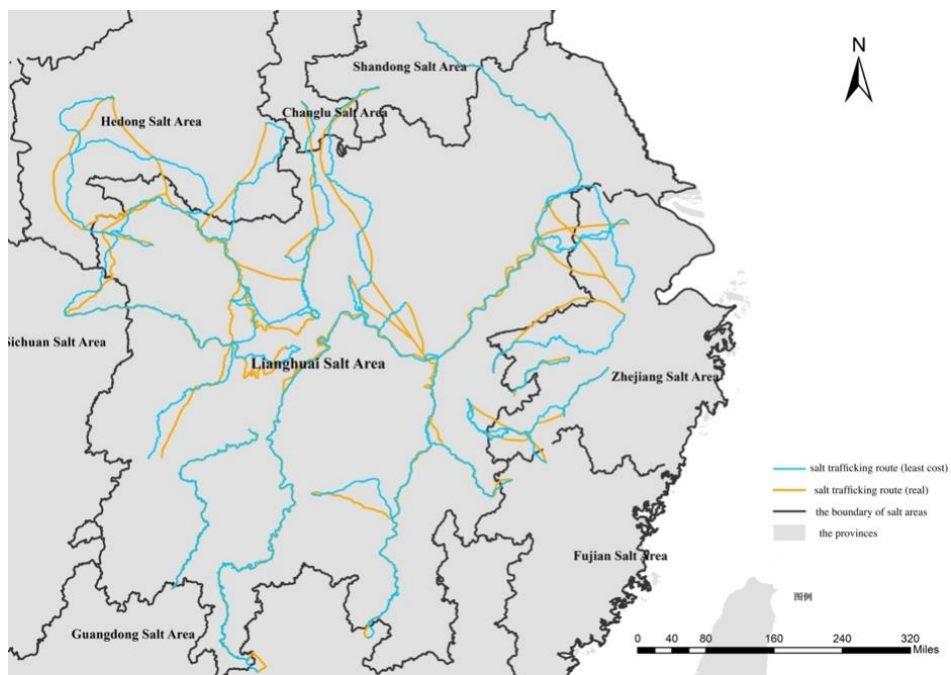
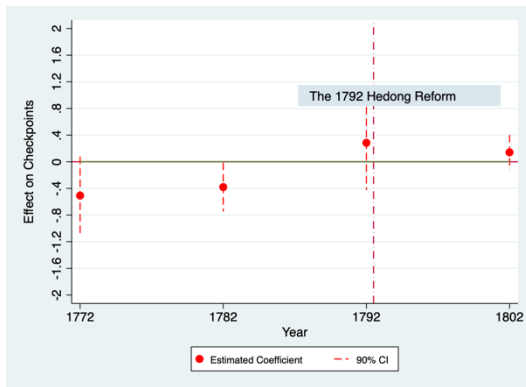
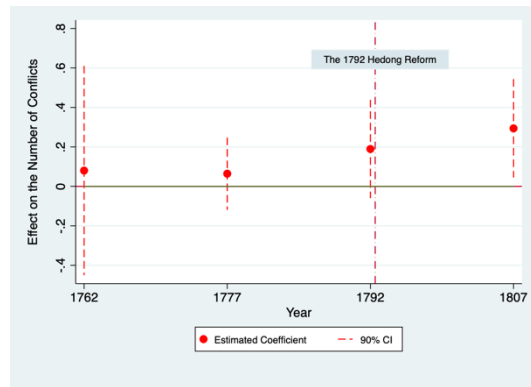


Figure 9. Falsification test

Panel A. # of Checkpoints



Panel B. # of Conflict



Panel C. Wuju/Keju



Note: Each dot represents a separate RD estimate with Lianghua-Hedong border counties with the last 15 years of observations before the marked year.

Figure 10. The Geographical Distribution of Pre-Xinhai Riots

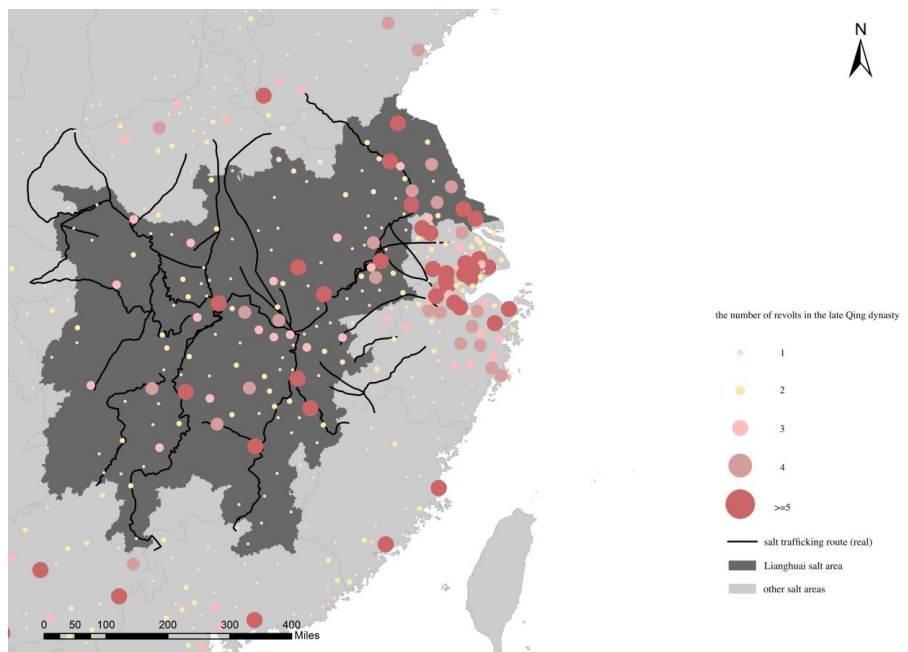


Table I The Prices of Commodities at the Salt District Border

	(1)	(2)	(3)
Panel A: Salt			
Border	6.93*** (1.67)	7.04*** (1.62)	6.99*** (1.58)
Obs.	1078	1078	1078
Panel B: Rice			
Border	-0.05 (0.22)	-0.08 (0.20)	-0.01 (0.22)
Obs.	105	105	105
Panel C: Wheat			
Border	-0.03 (0.15)	-0.01 (0.15)	-0.04 (0.11)
Obs.	373	373	373
Panel D: Soy			
Border	0.02 (0.26)	0.04 (0.28)	0.10 (0.28)
Obs.	304	304	304
kernel	Triangle	Epanech	Uniform

Notes: Each cell in the table represents a separate RD regression. The running variable is the distance between a county and the salt district border, where positive (Negative) distance means the counties are located at the Lianghuai (other) side. The positive coefficients of Panel A indicates that Lianghuai district has higher salt price. The discontinuities at the salt district border are estimated using local linear regressions and MSE-optimal bandwidth proposed by Calonico, Cattaneo, Titiunik (2014) for different kernel weighting methods. Standard errors clustered at the monitoring station level are reported below the estimates. * significant at 10% ** significant at 5% *** significant at 1%.

Table II. County Characteristics at the Salt District Border

	(1)	(2)	(3)
Panel A: Altitude			
Border	-66.56 (74.74)	-83.75 (78.31)	-97.15 (84.88)
Obs.	819	819	819
Panel B: Ruggedness			
Border	-0.02 (0.57)	0.10 (0.60)	0.22 (0.74)
Obs.	819	819	819
Panel C: Population			
Border	-0.26 (0.65)	-0.27 (0.66)	0.37 (0.45)
Obs.	683	683	683
Panel D: River length			
Border	-1.03 (11.99)	-0.04 (12.18)	1.37 (17.17)
Obs.	800	800	800
Panel E: Chong (Transportation hub)			
Border	0.10 (0.15)	0.04 (0.14)	0.04 (0.15)
Obs.	804	804	804
Panel F: Nan (Complex administration)			
Border	-0.03 (0.17)	-0.01 (0.16)	-0.00 (0.16)
Obs.	804	804	804
Panel G: Pi (Delay in tax payment)			
Border	-0.09 (0.09)	-0.12 (0.10)	-0.06 (0.10)
Obs.	804	804	804
Panel H: Fan (Higher crime rate)			
Border	-0.01 (0.13)	-0.02 (0.14)	-0.04 (0.14)
Obs.	804	804	804
Province FE absorbed	Y	Y	Y
kernel	Triangle	Epanech	Uniform

Notes: Each cell in the table represents a separate RD regression. The running variable is the distance between a county and the salt district border, where positive (Negative) distance means the counties are located at the Lianghuai (other) side. The discontinuities at the salt district border are estimated using local linear regressions and MSE-optimal bandwidth proposed by Calonico, Cattaneo, Titiunik (2014) for different kernel weighting methods. Standard errors clustered at the monitoring station level are reported below the estimates. * significant at 10% ** significant at 5% *** significant at 1%.

Table III. The Government Crackdowns and Violence Tendencies at the Salt District Border

	(1)	(2)	(3)
Panel A: # of check points			
Border	2.09** (0.91)	2.00* (1.00)	2.40** (0.86)
Obs.	859	859	859
Panel B: # of Conflict			
Border	0.63** (0.30)	0.58** (0.32)	0.62** (0.25)
Obs.	489	489	489
Panel C: Wuju / Wenju			
Border	0.84* (0.42)	0.84* (0.41)	0.93** (0.41)
Obs.	874	874	874
Province FE absorbed	Y	Y	Y
kernel	Triangle	Epanech	Uniform

Notes: Each cell in the table represents a separate RD regression. The running variable is the distance between a county and the salt district border, where positive (Negative) distance means the counties are located at the Lianghuai (other) side. The discontinuities at the salt district border are estimated using local linear regressions and MSE-optimal bandwidth proposed by Calonico, Cattaneo, Titiunik (2014) for different kernel weighting methods. Standard errors clustered at the monitoring station level are reported below the estimates. * significant at 10% ** significant at 5% *** significant at 1%.

Table IV. Heterogeneity Test: The Impact of Distance to Trafficking Routes

	Close to Trafficking Routes			Faraway from Trafficking Routes		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: # of check points						
Border	1.93*	2.07**	1.87**	-0.07	0.15	1.53
	(1.00)	(0.88)	(0.84)	(3.03)	(3.10)	(3.35)
Obs.	460	460	460	399	399	399
Panel B: # of Conflict						
Border	1.29***	1.42***	1.65***	0.39	0.45	0.53
	(0.52)	(0.60)	(0.62)	(0.27)	(0.28)	(0.28)
Obs.	191	191	191	298	298	298
Panel C: Wuju / Wenju						
Border	1.78*	1.92	2.54**	-0.07	-0.04	0.27
	(0.97)	(1.27)	(1.42)	(0.39)	(0.39)	(0.42)
Obs.	231	231	231	643	643	643
Province FE absorbed	Y	Y	Y	Y	Y	Y
kernel	Triangle	Epanech	Uniform	Triangle	Epanech	Uniform

Notes: Each cell in the table represents a separate RD regression. The running variable is the distance between a county and the salt district border, where positive (Negative) distance means the counties are located at the Lianghuai (other) side. The discontinuities at the salt district border are estimated using local linear regressions and MSE-optimal bandwidth proposed by Calonico, Cattaneo, Titiunik (2014) for different kernel weighting methods. Standard errors clustered at the monitoring station level are reported below the estimates. * significant at 10% ** significant at 5% *** significant at 1%.

Table V: The Difference in Discontinuity: The impact of 1792 Hedong Reform

	Close to Trafficking Routes			Faraway from Trafficking Routes		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: # of check points						
Border * Post 1792	0.43*** (0.09)			0.04 (0.04)		
Obs.	2810			2904		
Panel B: # of Conflict						
Border * Post 1792	0.07*** (0.02)	0.06*** (0.02)	0.05*** (0.01)	-0.04 (0.03)	-0.04 (0.04)	-0.04 (0.04)
Obs.	12139	12139	12139	10931	10931	10931
Panel C: Wuju / Wenju						
Border * Post 1792	2.69** (1.18)	2.74** (1.17)	3.14*** (1.18)	-2.34 (2.26)	-2.38 (2.57)	-2.72 (2.48)
Obs.	1293	1293	1293	343	343	343
Province FE absorbed	Y	Y	Y	Y	Y	Y
kernel	Triangle	Epanech	Uniform	Triangle	Epanech	Uniform

Notes: Each cell in the table represents a separate RD regression. The running variable is the distance between a county and the salt district border, where positive (Negative) distance means the counties are located at the Lianghuai (other) side. The discontinuities at the salt district border are estimated using local linear regressions and MSE-optimal bandwidth proposed by Calonico, Cattaneo, Titiunik (2014) for different kernel weighting methods. Standard errors clustered at the monitoring station level are reported below the estimates. * significant at 10% ** significant at 5% *** significant at 1%.

Table VI: The Channel Analysis: Excluding Counties with Traffickers Arrested or Killed

	Close to Trafficking Routes			Faraway from Trafficking Routes		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: # of Conflict						
Border	1.29*** (0.47)	1.19*** (0.41)	1.76*** (0.65)	0.36 (0.27)	0.23 (0.30)	0.01 (0.36)
Obs.	141	141	141	255	255	255
Panel B: Wuju / Wenju						
Border	1.78* (1.00)	1.93 (1.30)	1.73 (1.44)	-0.05 (0.40)	-0.01 (0.40)	0.23 (0.39)
Obs.	223	223	223	629	629	629
Province FE absorbed	Y	Y	Y	Y	Y	Y
kernel	Triangle	Epanech	Uniform	Triangle	Epanech	Uniform

Notes: Each cell in the table represents a separate RD regression. The running variable is the distance between a county and the salt district border, where positive (Negative) distance means the counties are located at the Lianghuai (other) side. The discontinuities at the salt district border are estimated using local linear regressions and MSE-optimal bandwidth proposed by Calonico, Cattaneo, Titiunik (2014) for different kernel weighting methods. Standard errors clustered at the monitoring station level are reported below the estimates. * significant at 10% ** significant at 5% *** significant at 1%.

Table VII: The Impact of Local Violence Accumulation on Pre-Xinhai Riots

	Close to Trafficking Routes			Faraway from Trafficking Routes		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: # of All Riots						
Border	3.87** (1.34)	4.13*** (1.62)	2.47* (1.44)	-1.61 (1.72)	-1.36 (1.71)	-2.39 (2.57)
Obs.	127	127	127	251	251	251
Panel B: # of Riots against Government						
Border	3.91** (1.17)	4.32** (1.34)	3.77** (1.23)	-2.08 (1.32)	-1.89 (1.45)	-3.26* (1.92)
Obs.	127	127	127	251	251	251
Panel C: # of Riots for Non-Government Reasons						
Border	-0.17 (0.11)	-0.18 (0.12)	-0.29 (2.00)	0.38 (0.27)	0.38 (0.27)	0.42 (0.27)
Obs.	127	127	127	251	251	251
Province FE absorbed	Y	Y	Y	Y	Y	Y
kernel	Triangle	Epanech	Uniform	Triangle	Epanech	Uniform

Notes: Each cell in the table represents a separate RD regression. The running variable is the distance between a county and the salt district border, where positive (Negative) distance means the counties are located at the Lianghuai (other) side. The discontinuities at the salt district border are estimated using local linear regressions and MSE-optimal bandwidth proposed by Calonico, Cattaneo, Titiunik (2014) for different kernel weighting methods. Standard errors clustered at the monitoring station level are reported below the estimates. * significant at 10% ** significant at 5% *** significant at 1%

