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Weak central government, strong legal rights: the origins of divergent legal institutions in 18th-century Chinese and Japanese rice markets

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This paper examines the formation of legal institutions in Qing China and Tokugawa Japan with a focus on the rice market. In both countries in the 18th century, rice was the most important commodity. By the end of 18th century, Japan offered strong legal rights to rice market participants, while China managed the rice market with weak legal institutions. We develop a subversive regime game model to explain some of the social and political reasons behind this divergence. Supported by historical evidence from Qing China and Tokugawa Japan, we find that with lower suppression capacity and high risks of domestic threats to power, Edo Japan's central government (Bakufu) was more likely to enforce legal rights than Qing China's central government (Imperial Court). Japan's institutional configuration facilitated the growth of rice markets such as the Doujima market in Osaka, because participants did not need to invest as much in informal protections for their own rights. Moreover, our analysis suggests that a state's relative strength matters the most in determining its attitude toward legal rights, which further influences the state's stability and longevity.

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Introduction

Most economists agree that legal institutions are associated with economic development (Acemoglu and Johnson, 2005a; Hodgson, 2015; North, 2005; Rodrik et al., 2004), and can also help explain the great divergence (Rosenthal and Wong, 2011; North and Thomas, 1973). However, given a similar level of development, why did some countries offer strong legal institutions while others did not?

Both the establishment and maintenance of institutions requires costs (Chang, 2011). As stationary bandits, to use Olson's memorable phrase, ruling governments are treated as self-interested maximizers (Olson, 1993). Thus, when a central government creates an institution, we can expect that it will align with the government's interest. In historical contexts, informal institutions from social communities structured individual economic rights (Greif, 2006).[1] This is because even if the state has the capacity to establish formal institutions and understands the contribution of institutions to prosperity, such establishment is still not necessary unless institutional change can bring enough benefits to the central government (Aoki, 2007; Barzel, 2002). Therefore, only when governments are confronted with strong incentives, namely economic or political profits in the foreseeable future, do they create new institutions, including legal institutions. (Johnson and Koyama, 2017; Levi, 1988; Moselle and Polak, 2001; Salter and Hall, 2015). However, what are the strong incentives?

To answer the above questions, we introduce the predatory state theory to help us understand state institution-building. According to the predatory vision of the state (Vahabi, 2020), protection afforded by a predatory state is driven by promotion of predation. Governments offered protection under the following three circumstances: (1) Under a multiple-predatory system, to prevent revenue loss caused by capital flight or emigration; (2) To maximize the state's long-term revenue; (3) To maintain long-term political stability. Although this theory provides explanations for the establishment of formal institutions, it still needs to be considered within specific historical contexts. First, in many states, especially non-Western states, there is no interstate competition (multiple-predatory system) (Qian and Sng, 2021). Second, many non-Western states tended to keep taxes low, and some states even experienced decreasing revenue (Ohno, 1996; Pamuk, 2012; Sng and Moriguchi, 2014). Given these historical contexts, in most cases outside of early modern Europe, formal institutions (including legal institutions) tended to depend on governments' concerns for political stability or longevity more than maximizing state revenue.[2]

Destructive power is another important factor affecting political stability. Destructive power is determined by the internal power structure, and in turn, destructive power can also shape the power structure.[3] In following the studies of Bush and Mayer (1974), Umbeck (1981), Knight (1992), and Vahabi (2004, 2009, 2010), our assumption is that potential or real domestic power threats (conflict and rebellion), rather than other factors, play a key role in the establishment of legal institutions, especially in historical contexts lacking interstate competition. While many economic historians have analyzed the emergence of formal or informal institutions (e.g., Acemoglu et al., 2005b; Alston et al., 2012; Dye and Croix, 2020; Hodgson, 2017; Hoffman, 2015; North and Weingast, 1989; Piano and Salter, 2021; Rajan and Zingales, 2003), most of the literature solely focuses on Europe or neo-Europe cases. Few scholars have explored the emergence of formal institutions in pre-modern non-Western states.

We take domestic power threats as the starting point for analyzing the emergency of legal institutions in pre-modern Chinese and Japanese rice markets. Specifically, we focus on rice markets in Suzhou and Osaka, which were two of the largest rice markets at the time, and whether or not states offered legal rights for rice market participants. In this paper, legal rights refer primarily to the right of participants in the rice market to trade freely and to dispose of goods freely. Most importantly, when the above-mentioned rights are violated, the legal system can and does offer protection to the owners of goods.[4] The rice market is special in that rice was one of the most important commodities in pre-modern China and Japan and was closely tied to national security and national interest, so it can serve as a good index of the nation's general level of stability.

This article examines the emergence of legal institutions in Qing China and Tokugawa Japan during the 18th century. Our study contributes to the literature on the foundations of institutions of non-Western states through a comparison of how the Qing and Tokugawa central governments established different legal institutions for the rice market in response to different levels of domestic threats to their longevity. It also adds to the literature on the relationship between formal legal systems and informal social organizations, including Greif's and Tabellini's (2017) model to emphasis personal relations such as clans in imperial China, which could have contributed to weaker legal institutions. In our study, a weak legal system drives merchants to invest more in informal protections for individual and/or collective rights. Conversely, a strong legal system leads to the opposite scenario. We attribute the different performances of Chinese and Japanese rice markets to (at least partially) different institutions and different merchant behaviors. Our study also sheds light on state-building in economic history and political science. Many works on state-building borrow heavily from the early modern European experience, which emphasizes that interstate wars led to the enhancement of state capacity (e.g., Dincecco, 2011; Hoffman, 2015; Queralt, 2019). However, the different internal structures of European states also led to different paths to state-building during this period (Karaman and Pamuk, 2013). Furthermore, in some non-Western countries, the intrinsic political structure (especially the central-local relationship) rather than extrinsic war is an important determinant of state capacity, including legal capacity (Ma and Rubin, 2019). In the game theory literature on repressive regimes, there is also a focus on the two-layer interactions between the top government and individual dissension, rather than bringing in the perspective of central-local relationships. Karlins and Peterson (1993), for example, used an n-person assurance game to identify that raising individuals above the tipping point is significant for revolutions. Kiss et al. (2017) found that different information transmission methods influence the effectiveness of mobilization. In this paper, our findings can further enrich the understanding of state-building by offering a central-local relationship perspective in examining the cases of 18th century China and Japan through a three-layer model.

We argue that the capacity of real or potential domestic power threats (conflict and rebellion) to subvert the regime and the cost of state suppression of conflict or rebellion played important roles in determining how China and Japan adopted different levels of protection for rice market participants.[5] According to our subversive regime game model, the state enforced legal rights when the capacity of noncooperation or rebellion to subvert the current regime in the foreseeable future is high and the provision of legal protection mitigates the risk of losing power. Conversely, when the subversive capacity of conflict or rebellion is low and the state can suppress them at a lower cost, the state had no incentive to protect rice market participants' rights. The model helps us understand the motives for the Chinese and Japanese governments in establishing different legal institutions for rice markets and explains the impacts of different institutions on merchant

behaviors, as well as the decline of Chinese rice markets and the boom of Japanese rice markets in the 18th century.

Our article proceeds as follows. Section "Historical backgrounds" will overview the historical background of pre-modern rice markets in China and Japan. Section "The model" will apply our model to explain the reasons for the different legal institutions in Chinese and Japanese rice markets. Section "Empirical evidence" will present further historical evidence to illustrate our model's predictions. Section "Conclusion" marks the conclusion.

Historical backgrounds

In this section, we compare the structure of rice markets in Qing China and Tokugawa Japan, focusing in particular on the political environment, market development, trade participants, and the legal system, to motivate our theoretical model.[6]

Beginning in 1644, the Manchus spent the next hundred years gradually expanding their control from Northeast Asia to China proper and Taiwan by 1681, and present-day Xinjiang and Tibet by the mid-18th century (Meng, 2006; Hostetler, 2001; Millward, 1998; Perdue, 2005). As the surrounding territories were successively incorporated into the Qing empire in the 18th century, the frequency and scale of warfare declined significantly (Li, 2019; Ma, 2012). In Japan around the same time, after establishing the *Bakufu* (Shogunate) in 1603, the Tokugawa Shogunate eliminated the Toyotomi regime at the Battle of Osaka in 1615 and suppressed domestic Christianity in 1637, gaining control over the Japanese archipelago including the three main islands (Honshu, Kyushu, Shikoku) by the mid-17th century. As an island nation, Japan was isolated by the sea from territorial competition, and there were no major wars in Tokugawa Japan until the mid-19th century, except for two wars with the Ainu people in Hokkaido (Walker, 2001). From around 1650 to 1850, therefore, both Qing China and Tokugawa Japan enjoyed a long period of general political stability.

Political stability led to the development of domestic economies and the distribution of goods, among which rice was the most important commodity in both countries. In China, by the mid-19th century, the value of commodity grains accounted for nearly 40% of the value of total commodities, and nearly 50 million people depended on commodity grains for their livelihood (Wu, 1983; Wu, 1998).[7] In Tokugawa Japan, which was also an agrarian nation, rice was the main traded item in the market as the regime stabilized and commodity circulation expanded in the 17th century (Hayashi, 2000). By the 19th century, in Osaka, the largest commodity market, the value of commodity rice accounted for 38% of the total value of commodities (Shinbo and Saito, 1989).

In both China and Japan, rice was primarily transported over water. Japanese rice shipments made use of maritime transport. In China, land transport was mainly restricted to short distances, while long-distance transport relied heavily on inland waterways or maritime transport. Since the development of long-distance trade, some markets with easy water access such as Suzhou and Hankou in China, and Osaka and Edo in Japan, developed into important central markets to collect and distribute rice. The rice market in Suzhou accounted for 20% of China's total rice trade, while the Osaka market accounted for 20–40% of Japan's total rice trade by volume (Deng, 2009; Miyamato, 1988). Facilitated by long-distance trade, the rice markets in both China and Japan were highly integrated by the 18th century (Bassion, 2007; Shiue and Keller, 2007).

In Qing China, while participants in the local rice trade were primarily merchants and farmers, merchants rather than farmers dominated the long-distance rice trade. However, brokers called *Yaren* played an important intermediary role in both the local

market and long-distance trade. The *Yaren* or *Guanya* (government-licensed market broker) first originated in the Tang Dynasty as an intermediary for the government to manage the market (Qiu, 2008). In the early Qing, *Yaren* acted as brokers under the management of local government officials. The local government mandated *Yaren* to participate in market transactions by offering commercial functions such as regulating price and quality or exchanging information to assist sellers and buyers, for which they received commissions (Mann, 1987; Yan and Li, 2013). In addition to its commercial functions, the *Yaren* system was also a conduit for transferring market information to the state, while their official sanction to manage the market and collect taxes created a power asymmetry between *Yaren* and other participants in the rice trade (Yamane, 1995).[8] More notably, beyond the 18th century, local governments not only oversaw the rice market through the *Yaren* system but also derived significant income from it.[9] Consequently, the *Yaren* was associated with the local government and operated in the grain market on its behalf, and we will refer this concept of local government authorized broker as *Lgb* in our following discussion.

In Tokugawa Japan, Daimyos (local lords) conducted most of the rice trade. During the Edo era, 80% of the commodity rice comprised the *Ryoushumai* (tax-rice) of Daimyos (Miyamato, 1988). Under the shogunate system, a Daimyo retained autonomous administrative, economic, and even military powers within his domain after swearing allegiance to the shogun (Miyamoto, 1978). This allowed a Daimyo to break up the intermediary organizations[10] in his domain by force, to collect rice directly from the farmers, to establish a uniform transportation route to the rice market by setting up docks and warehouses, hiring ships and professional traders, and to obtain more currency to meet finical expenditures with lower transportation costs (Miyamato, 1988).[11] In Osaka, the largest rice market in Japan, merchants purchased *Kome kitte* (rice securities that could be exchanged for rice) issued by Daimyos through bidding. These rice securities had limited redemption periods, and holders could trade them during the exchange period or exchange them for rice directly from *Kurayashiki* (Daimyo's warehouse where rice was stored) where these securities were issued, and then supplied rice to the demand side (Takatsuki, 2012).[12] Furthermore, Daimyos used the proceeds from the sale of rice as collateral to borrow money from merchants (Mori, 1970). In a nutshell, income from the sale of rice and borrowing against the proceeds of rice sales was a major component of Daimyos' income, and the stability of the rice market had a significant impact on the Daimyos' fiscal system.

The development of rice markets brought more commercial disputes. While the Tokugawa Shogunate removed commercial disputes from the judicial system for a time in the early 18th century[13], the disruption of commercial transactions forced the shogunate to permit commercial litigation again (Ohira, 2013). In China, there were provisions for commercial disputes in the Qing legal code and county magistrates also handled a vast number of commercial disputes (Huang, 1996; Fan, 2007). In both cases, disputes related to the rice market were an important part of commercial litigation.

In Qing China, the local government gave *Lgb* a large degree of freedom. Not only were *Lgbs* able to administer the rice market on behalf of the local government, but they were also able to participate and trade in the rice market themselves. Since *Lgbs* were both participants and administrators of the rice market, in the absence of constraints on *Lgb* behavior, there was a risk that they might embezzle merchant and farmer goods. *Lgb* could establish associations to take control of intermediary business or regulate the trade in order to satisfy their interests at the expense of merchants or farmers (Negishi, 1932; Chen, 1992). Although there were indeed some official legal codes designed to limit the

ability of *Lgb* to embezzle goods, most of the time, the government did not effectively enforce these legal provisions. Rice merchants and farmers had the option to pursue legal action when their goods were embezzled, but since the *Yaren* system operated under the authority of local governments and constituted a significant source of fiscal revenue, local magistrates generally favored resolving legal disputes through persuasive negotiation, encouraging both parties to reach a mutual settlement rather than relying solely on legal codes to uphold the rights of owners and quell competing claims.[14] Therefore, when disputes arose between *Lgb* and rice merchants or farmers, *Lgbs* were not only seldom punished but sometimes they were even sheltered by the magistrates.[15] This resulted in the fact that it was often the rice merchants and farmers rather than *Lgb* who suffered losses in commercial disputes (Chen, 2017; Deng, 2019; Fan, 1996). This can be illustrated by a case in the early 19th century. In Suzhou, some rice merchants made recourse to a magistrate's ruling after their goods were embezzled by local *Yaren*. While the magistrate declared that *Yaren* should not embezzle the rice merchant's goods in the future, he did not require the *Yaren* to compensate the merchants' losses.[16] In fact, illegal claims by the *Lgb* against the rice merchant were common in historical records until the mid-19th century (Wang and Tang, 1998). As the formal legal system did not offer protection for merchants' rights, Qing dynasty commercial books required merchants to be wary of the embezzlement of *Yaren* and suggested trading with familiar *Yaren*.[17] These historical observations indicate that the Qing government offered weak legal protections.

In contrast, by the end of the 18th century, the Tokugawa shogunate institutionalized protections for rice market participants' rights. After 1730, the Tokugawa shogunate recognized the legality of several rice markets, such as the Osaka Doujima rice market, and accepted commercial disputes related to rice trading. In Osaka, Daimyos issued rice securities more than the rice storage capacity in order to obtain more currency, which caused the problem of *kuu mai kitte* ("empty" rice securities that could not be exchanged for rice). This problem became more serious in the mid-18th century. In 1761 the Shogunate banned the issuance of non-exchangeable rice securities to protect the rights of rice buyers. Around 1800, in several legal cases about non-exchangeable rice securities, merchants resorted to lawsuits to protect their rights, and magistrate's rulings showed that the Shogunate offered legal rights to rice holders (Takatsuki, 2012).[18] The legal rights were not limited to Osaka rice market. While the forms of rice trading varied across Japan at the time, rice market participants' rights were respected by the government (Nakabayashi et al., 2020).

Before Western intrusion, both Japan and China enjoyed a long period of political stability and brought about the development of rice markets. While disputes related to rice market participants' rights were important parts of commercial litigation in both countries, in Qing China the enforcement for legal protections was weak.[19] In other words, the formal legal system did not offer real protections for rice market participants' rights. In contrast, the Tokugawa shogunate established a credible commitment to the legal system which offered legal rights to rice market participants.[20] In the following section, we will turn to our model that place these historical observations in one consistent and coherent framework of analysis.

The model

In this section, we model the relationship between a central government (Qing China and Edo Japan's central government), a mid-level agent (Chinese local government/Daimyo) and a lower-level participant in a market (merchant/farmer). The central

government needs the mid-level agent to help ensure stability of the market so that it can receive the profits of holding power[21], and the mid-level agent needs the lower-level participant to run the market but can also benefit from exploiting the lower-level participant through embezzlement.

In our model, the players face three key constraints:

(1) The central government sets a level of legal protection, subject to the constraint that a low level of legal protection discourages the lower-level participant from trading and deteriorates the market, and a high level of legal protection discourages mid-level agent from exploiting the lower-level participant.

(2) The mid-level agent chooses its action about whether to cooperate with the central government or not, subject to the constraint that not cooperating with the central government has associated costs.

(3) The lower-level participant chooses whether to fight against the mid-level agent's exploitation, subject to the constraint of fighting costs. If it chooses to fight, the top central government would also be affected.[22]

Setup. The model includes three players: A central government (R), who has the choice to determine the level of legal protection. A mid-level agent (M), who has the choice to decide whether to cooperate with the central government or not. A lower-level participant (P), who has the choice of whether to fight against the mid-level agent's exploitation.

When the mid-level agent decides not to cooperate with the central government, various problems can occur. If the mid-level agent has strong military power, he may rebel and overthrow the central government. If the mid-level agent has weak military power, he may use more indirect methods such as disobeying or distorting laws set by the central government. In either case, these approaches harm the central government's interest and can eventually result in overthrowing the central government or the central government losing control of the market. To simplify the model, we set the mid-level agent's action into a binary choice: $\gamma = 0$, meaning not cooperating with the central government, and $\gamma = 1$, meaning cooperating with the central government. Similarly, when the lower-level participant decides to fight embezzlement, although his target is the mid-level agent, the overall market stability enjoyed by the central government would be negatively influenced (e.g., through food riots), and we set the lower-level participant's action also into a binary choice: $\delta = 0$, meaning fighting embezzlement, and $\delta = 1$, meaning not fighting embezzlement.

The game is a one-shot game in the following steps:

Step 1: The central government learns its type. Nature determines the central government's type θ of continuing to hold effective control over the market when facing noncooperation by the mid-level agent, and $1-\theta$ of not. $\theta \in [0,1]$ is determined by various factors in history, such as a nation's political economy, power, military strength, approval rating, etc. Stronger central government power, stronger central government military strength, and strong popular approval would all lead to higher θ, because the central government would be less likely to be overthrown by a rebellion and lose control of the rice market. We assume that the central government is able to perfectly observe his type as private information, reflecting the fact that only the central government knows how much strength it really holds in the market. The mid-level agent, on the other hand, cannot directly know θ, and can only guess θ, with a guess of the central government's θ which we label as θ_{guess}. In the real history, the mid-level agent would guess

a central government's θ by observing the central government's political strength, economic strength, military strength, approval rating, etc., so we may assume that the higher the real θ, the higher the θ_{guess}, and θ_{guess} follows some distribution around θ (We are not specifying the distribution because we want to more closely fit the history—guessing the central government's strength can follow different patterns). This θ_{guess} points to the mid-level agent's belief on θ, and depending on this belief, he takes different actions. The central government will 100% effectively control the market if the mid-level agent cooperates with the central government.[23]

Step 2: Central government chooses the level of legal protection. Given its type θ, the central government chooses its level of legal protection $a \in [0,1]$ it would like to offer. When $a = 1$, the central government offers the strongest level of legal protection and guarantees of participants' rights, and when $a = 0$, the central government does not offer legal protection of any kind at all.

Step 3: The mid-level agent acts. Then, the mid-level agent, based on its guess of the central government types θ_{guess} and the central government's level of legal protection a, decides to cooperate or not, namely γ.

Step 4: The lower-level participant acts. Based on the central government's level of legal protection a, the lower-level participant decides whether to fight against embezzlement of their goods. Notice here we are not assuming that the lower-level participant, through fighting, can completely eliminate the mid-level agent's embezzlement profit. Instead, it can only partly fight off embezzlement, given its relative strength z. It is more natural to assume that the lower-level participant, through ways such as forming business cooperation or bribery, can only partly decrease the amount being embezzled, since the two are different so large in terms of the strength of power. Moreover, not only does the fighting action affects mid-level agent's payoff, but also from the larger picture, such fighting negatively affects the central government's payoff. Such a setting is closer to the historical fact that many food riots can also negatively influence central government's stable control of the market in history.

Structural variables. In this section, we introduce structural variables to be discussed in this paper. For clarity, all variables' explanations are based on the scenario of the rice market, while in Section "Empirical Evidence", extensions of the variables beyond the context of rice market will also be discussed.

Cost of friction (f): When the mid-level agent decides not to cooperate with the central government, both the central government and the mid-level agent suffers from the cost of friction f. This f can be measured by the central government's military scale and the respective nation's geographical scale. A large military owned by the central government gives higher pressure to the disobedient mid-level agent, thus being a cost for the mid-level agent. Simultaneously, however, a large military requires higher maintaining costs, including more army provisions and more military spending, thus being a cost for the central government too. Similarly, when a nation has large territory, it is harder for the disobedient mid-level agent to overthrow the central government, but simultaneously it costs the central government more military spending, as it has a large territory to protect. Qing China, for example, compared with Edo Japan, has a higher f, due to its larger military scale and larger territory.

Cost of exposure (k): When the mid-level agent decides to not cooperate with the central government, he exposes himself to a risk of k. This k can be measured by the relative power of the mid-level

agent compared with the military scale of the central government. When the mid-level agent has higher relative power, he faces lower cost of exposure, as it is more likely that he can overthrow the central government. Edo Japan's Daimyos, for example, would have a higher k compared with local governors in Qing China.

Success reward (X): The mid-level agent can enjoy the benefit from toppling the current central government's control on the rice market. This reward can be in the form of taxation – that all taxes that used to be collected in the rice market by the central government can now be collected by mid-level agent himself instead. X in Qing China, for example, would be higher than X in Edo Japan, due to the larger territory and population in Qing China.

Cost of fighting embezzlement (c): c is the cost it takes for the lower-level participant to fight embezzlement by the mid-level agent. Specifically, c is high when it takes a huge cost for the lower-level participant to fight against the mid-level agent's embezzlement, and c is low when it takes minimum cost for the lower-level participant to fight against the mid-level agent's embezzlement. For example, in the case of Qing China, we can measure c by the cost of building clubhouses (*huiguan*) in the nation[24] as a percentage of the lower-level participant's income in the rice market. We suppose $c \in [0,1]$, where 1 means extremely high cost and 0 means no cost at all.

Embezzlement willingness and ability measure (e): The willingness and ability held by the mid-level agent to embezzle goods owned by the lower-level participants. We suppose $e \in (0,1)$, where 1 means total embezzlement and 0 means zero embezzlement.

Lower-level participant's strength (z): A measurement on the strength of the lower-level participant where $z \in [0,1]$. $z = 1$ means that the lower-level participant is extremely strong and can completely eliminate embezzlement, and $z = 0$ means that the lower-level participant is extremely weak so that he cannot decrease any embezzlement at all.

Stability reward (ψ): ψ is the reward the central government can enjoy when the market is stable by holding the position of power and reaping a reward ψ from maintaining its ruling position. It is similar to the traditional holding office reward in revolutionary game literatures, such as (Ginkel, 1999). The reward can be whittled away through an offer of legal protections, uncooperative action by the mid-level agent, or fighting action by the lower-level participant.

Endogenous variable. The only endogenous variable, and the key variable in this paper, is the level of legal protection (a).

Legal protection (a): We suppose the level of legal protection follows $a \in [0,1]$, where $a = 0$ means not offering legal protection at any kind, and $a = 1$ means offering the strongest level of protection. Historically, an example of $a = 0$ can be the Maghreb merchants, who traded long distances in the Mediterranean reduced their trading costs by hiring agents in the trading region in the 11th century. However, this came with the risk that the agents might embezzle the merchants' goods. The Maghreb merchants established an informal group known as the Merchants' Union since at the time the formal legal system was unable to adequately defend the commodities of the merchants. Within the Union, the merchants protected their interests by imposing multilateral penalties to prohibit bad reputations from engaging in future trade, and the agents were willing to sacrifice their immediate interests (embezzling the merchants' goods) for the long-term interest. An example of $a = 1$ can be the case of the 18th century of England when Lord Mansfield was the Lord Chief Justice of England. He established a set of very clear general principles which effectively protected the rights of merchants through a series of commercial litigations judgement—judgements since then have systematic principles to follow, rather than

being determined arbitrarily. Individual merchants could fully protect their rights from infringement through legal means, without the need for any assistance from private institutions.

Players' payoffs. In this section, we study the payoffs of the three players.

Central government's payoffs. If the mid-level agent cooperates with the central government and the lower-level participant does not fight, the central government maintains control of the market, offering a legal protection level of a. The central government's payoff is $U_R = \psi - a$.

If the mid-level agent cooperates with the central government but the lower-level participant fights, the central government maintains control of the market, but needs to lose a cost dealing with the lower-level participants' fighting. The stronger the lower-level participant, the larger the cost is. We define the central government's payoff as $U_R = \psi - a - z$.

If the mid-level agent does not cooperate with the central government, and the lower-level participant does not fight, but the central government is able to hold control of the market successfully, the central government receives a frictional cost f. The payoff is $U_R = \psi - f$. Here a is not included in the payoff because when the mid-level agent does not cooperate with the central government, he is essentially refusing the central government's offer of legal right, so the two sides have not reached an agreement, and the central government does not lose the offer payoff a, since no such legal right protection is successfully established. Similarly, a is not included in the following payoffs due to this reason.

If the mid-level agent does not cooperate with the central government, and the lower-level participant fights, but the central government is able to hold control of the market successfully, the central government receives a frictional cost f, and also the fighting cost z. The payoff is $U_R = \psi - f - z$.

If the mid-level agent does not cooperate with the central government, and this causes the central government to lose control of the market, the central government's payoff is $U_R = -f$ if the lower-level agent does not fight, and $U_R = -f - z$ if the lower-level agent fights.

Notice that in our case, we have assumed that only the mid-level agent's uncooperative actions can cause the central government to lose control of the market. This is because historically, the lower-level participants' fighting strengths are limited in the rice market. Bribery or business coalition might be able to work when P wants to protect his profit from being embezzled but can hardly rewrite the whole system of the market. Even the largest food riots in China have not successfully alter the system of the rice market.

Thus,

$$U_R = \begin{cases} \psi - a \text{ if } \gamma = 1 \text{ and } \delta = 1 \\ \psi - a - z \text{ if } \gamma = 1 \text{ and } \delta = 0 \\ \psi - f \text{ if } \gamma = 0 \text{ and } \delta = 1 \text{ and ruler holds control} \\ \psi - f - z \text{ if } \gamma = 0 \text{ and } \delta = 0 \text{ and ruler holds control} \\ -f \text{ if } \gamma = 0 \text{ and } \delta = 1 \text{ but ruler loses control} \\ -f - z \text{ if } \gamma = 0 \text{ and } \delta = 0 \text{ but ruler loses control} \end{cases}$$

Mid-level agent's payoffs. When the mid-level agent cooperates with the central government and the lower-level agent does not fight, he benefits from legal protection due to increased amount of trade, but also loses certain benefits of embezzlement. Thus, M receives $U_M = a + (1-a)e$.[25] If instead the lower-level participant fights, M further loses $z(1-a)e$, and receives $U_M = a + (1-z)(1-a)e$.

When the mid-level agent decides to not cooperate with the central government, but was punished so that the mid-level agent loses chances to continue embezzling, he suffers the frictional and exposure cost, and has $U_M = -f - k$. Here because he has lost the chance to continue embezzling, no terms regarding the embezzlement e are included in his payoff.

When the mid-level agent decides to not cooperate with the central government, and such action successfully causes the central government to lose control of the market (e.g., was not successfully punished), the mid-level agent gains the success reward X. Thus, $U_M = X - f - k$. Notice that the $(1-a)e$ embezzlement gain is not explicitly included in the utility function because gaining X means new rules in the market are going to be designed by the mid-level agent, so the original embezzlement measurement does not work again.

So, we have,

$$U_M = \begin{cases} a + (1-a)e \text{ if } \gamma = 1 \text{ and } \delta = 1 \\ a + (1-z)(1-a)e \text{ if } \gamma = 1 \text{ and } \delta = 0 \\ -f - k \text{ if } \gamma = 0 \text{ but ruler holds control} \\ X - f - k \text{ if } \gamma = 0 \text{ and ruler loses control} \end{cases}$$

Lower-level participants' payoffs. If the lower-level participant decides to fight, he could pay the cost of fighting as well as a lower cost of embezzlement dependent on his strength, and if he decides not to fight, he will face the full cost of embezzlement. We are not assuming that the lower-level participant can easily fight against the mid-level agent to completely eliminate embezzlement —it is more reasonable historically to assume that lower-level participants have used tactics like bribery or coalition to mitigate the mid-level agent's embezzlement. Note that we are dealing with the case where the lower-level participant stays in the market for certain, because historically, they are merchants that have to trade their goods for a living.

This gives the utility of $U_P = \begin{cases} a - c - (1-z)(1-a)e \text{ When fighting} \\ a - (1-a)e \text{ When not fighting} \end{cases}$

Summarizing the payoffs above, we have the following game tree.

Results and nash equilibrium study. In this section, we give results and equilibria of the model. For specific proof, please refer to Appendix 1.

Results are below:

Result 1 Lower-level participants fight against embezzlement when the legal protection level is low.

Result 2 A high level of legal protection makes the mid-level agent have the best response to cooperate.

Result 3 When the frictional cost f and exposure cost k is higher, the central government is more likely to not offer any legal protection.

Result 4 A Strong central government (with high θ, f, k) is more likely to hold power in the rice market than a weak central government, even without offering legal protections.

Perfect Bayesian Nash Equilibria are below:

(1) If $c \geq ez$, ($a = 0$, cooperate, not fight | M believes that $\theta \geq 1 - \frac{f+k+e}{X}$)

(2) ($a \in \left[\max\left(1 - \frac{c}{ez}, 0\right), \frac{(1-\theta_{guess})X - f - k - e}{1-e}\right]$, not cooperate, not fight | M believes that $\theta \leq 1 - \frac{1 - \frac{c}{ez} + \frac{e}{z} + f + k}{X}$)

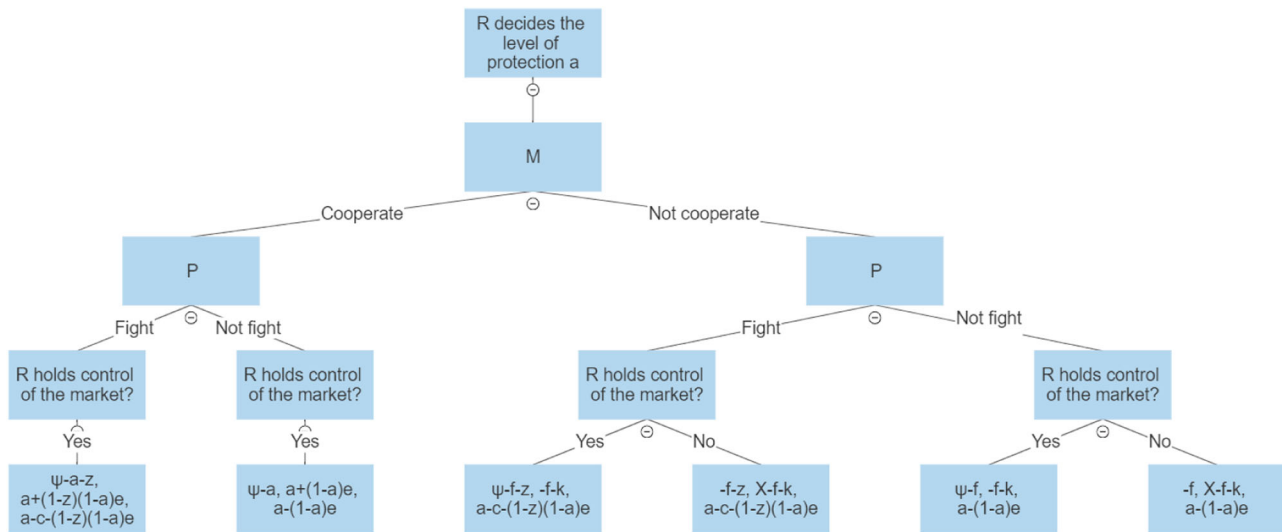(3) If $c \leq ez$, ($a = 0$, cooperate, fight | M believes that $\theta \geq 1 - \frac{f+k+e(1-z)}{X}$)

Fig. 1 Game Tree.

(4) If $c \leq ez$, $(a | a \leq 1 - \frac{c}{ez}$ & $a \leq \frac{(1-\theta_{guess})X-f-k-e+ze}{1-e+ze}$, not cooperate, fight | M believes that $\theta \leq 1 - \frac{f+k+(1-z)e}{X})$

Empirical evidence

Our model predicts that strong central governments (equivalent to central government with higher θ, k and f in the model) are less likely to offer legal protections (Result 3 & 4) than weak central governments (equivalent to central government with weak θ, k and f in the model). Moreover, a high level of legal protection leads to more participation and cooperation of the mid-level agent in the market (Results 1 & 2).[26]

In the following section, we turn to historical empirical evidence to support our model. We first discuss the strengths and weaknesses of Qing China and Tokugawa Japan with respect to Result 3 observed in Section "Historical backgrounds", and then support Results 1 and 2 through historical examples of rice merchant behavior and rice market performance (Fig. 1).

Governments: strong or weak. Based on the Weberian definition of the state - holding a monopoly on the legitimate use of force in its territory (Linz and Stepan, 1996)—we measure the strength of the government by the degree of monopoly over force and the scale of domestic threats to power. A government that has a complete monopoly on force and faces lower domestic threats is considered a strong central government, while in contrast, a government that does not have a complete monopoly on force and faces higher domestic threats is considered a weak central government.

In pre-modern China and Japan, a central government's monopoly on force was primarily reflected in its control of the military. In Qing China, the military was highly centralized and consumed nearly 60% of the Qing government's annual expenditure. At its peak in the mid-18th century the size of the Qing military reached 800,000 men, making it the largest military force in the world (Chen, 1992; Luo, 1984, Ding, 2003; Elliott, 2000). This therefore corresponds to a high friction cost (f) in the model.[27]
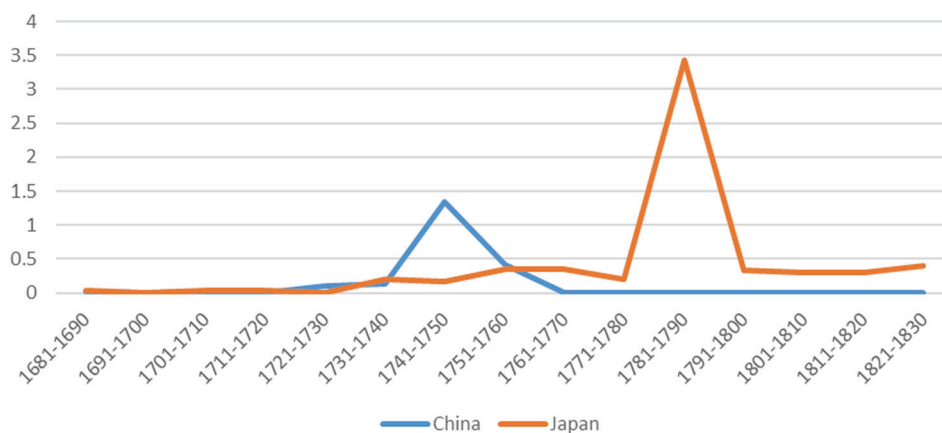
Compared to the Qing, the Tokugawa Shogunate's military power was much smaller. In Tokugawa Japan, Edo Bakufu had control over 30,000 troops in its dominions, which was about 5% of the total military in Japan (Koike, 2017). Although Edo Bakufu's military power was stronger than any other single Daimyo, some powerful Daimyos could also rival it, such as the lord of Kaga, who was able to mobilize an army of 20,000 soldiers.

Therefore, it was difficult for the Edo Bakufu to defeat a combination of even two or three powerful Daimyos with his own army alone, signifying a low friction cost (f) in the model. Moreover, the Daimyos, holding strong military power, would also face lower cost of exposure (k), because it would need fewer efforts recruiting armies, and the shogunate's ability of punishing rebellions would also be weaker compared with its Qing China counterpart.[28]

The geographical differences between China and Japan also affected the suppression capacity. China under the Qing Dynasty (1644–1911) controlled a landmass of 13.4 million square kilometers, which was more than 30 times the size of Tokugawa Japan. The distance from Beijing to Suzhou was over 1000 kilometers, whereas the distance from Edo to Osaka was only 520 kilometers. The vast hinterland of Qing China was thousands of kilometers from the sea, while in Japan no region was more than 120 km away from the sea, which offered a cheaper transport system (Tan, 1982; Kikuchi, 2011). The larger territory and higher cost of transportation made overthrowing the regime more costly in China than in Japan, which is why rebellions in Qing China were confined to a certain region and hardly threatened the central government. Such a difference in geographic scale also contributed to a higher friction cost (f) in Qing China compared with Edo Japan.

In the rice market, both the Qing central government and the Tokugawa Shogunate faced potential or real threats to power. These power threats came mainly from the low-level and mid-level rice market participants. Figure 2 shows that number of food riots in China and Japan peaked in the mid-to-late 18th century and then declined, with Japan's number of food riots per million population more than two times than that of China. The comparatively active food riots in Japan demonstrated Edo Bakufu's lower θ compared with θ of Qing Emperor's.[29] Furthermore, although number of food riots fell over time in both regimes, food riots almost completely disappear in China after 1770, while in Japan they continued at an average rate of 3 or 4 per year.[30] It is also worth noting that food riots in Qing China were mostly small-scale, short-term, and even the large food riots were limited to a few hundred people and to a single county or city (Wong, 1982). In contrast, in Tokugawa Japan, food riots were large-scale and long-term, with thousands or even tens of thousands of participants in large food riots, and thus more destructive. For example, in 1787, the food riots paralyzed the Edo government (Fukaya, 1979). This significant difference in

Fig. 2 Number of food riots in Qing China and Edo Japan per million population. [31] Source: Cao (2001), Fukao et al. (2017). Harada (1982), Horichi (2011) and Kito (2000).

Table 1 The change of *kokudaka* in Tokugawa Japan.			
Japan Combined		**Edo Shogunate Region**	
Year	**Koku**	**Year**	**Koku**
1644-1651	23,617,595	1702	4,005,623
1697-1720	25,910,642	1730	4,481,056
1716-1736	26,432,946	1757	4,482,900
1831-1834	30,558,918	1838	4,192,042
		1863	4,075,743
Source: Kikuchi (1986), Murakami (1973) and (1982).			

the number and scale of food riots between Qing China and Edo Japan further implies a lower θ in Edo Japan compared with Qing China.

Table 1 records scattered series of *Kokudaka* revenues in Japan, which increased from the mid-17th century to mid-19th century, in contrast to the Shogunate's *Kokudaka* which peaked in the mid-18th century and then declined.[32] Bakufu's share of all *kokudaka* also declined from 17 percent in the early 18th century to under 14 percent in the early 19th century. As noted in Section "Historical backgrounds", Daimyos were major participants in the rice market and heavily relied on rice trading to meet finical expenditures, with some Daimyos deriving nearly 90% of their currency income from trading rice (Kusumoto, 1989; Takatsuki, 2012). Since *Kokudaka* can represent the economic and military strength of Daimyos, the total Daimyos' *Kokudaka* was also five to six times larger than Bakufu's (Katsu, 1968; Kikuchi, 1986), which enabled Daimyos to become a potential power threat against Bakufu in the rice market, corresponding to a lower θ in the model.

In contrast, in China the local government did not pose much of a threat to the Qing central government. While Chinese local governments did exert control over the rice market through Lgb management, their economic and political influence ultimately originated from the Qing central government. Consequently, local governments were more susceptible to central government regulation and oversight. Even the power of governors in early and mid-Qing China was much weaker than that of the central government (Guy, 2010). The Qing government prevented local officials from establishing close ties with other local powers (e.g., clans) by frequently transferring local officials (a magistrates' term of office in a locality was often one to three years) and by prohibiting officials from serving as magistrates in their home-towns. Furthermore, local governments in China had little control over military mobilization, and most of their taxes had to be transferred to the central government (Ch'u, 1962). Unlike Daimyos, local governments in China lacked military and financial capability to be independent of the central government (Zhou, 2021). Thus in the case of Qing China, we can see fewer actions challenging the status quo of the rice market, and thus we can witness a more stable and higher θ compared with the Edo Japan case mentioned above. In short, Qing government had absolute dominance and control of both the local government and the *Yaren* system it used to manage the rice market,[33] corresponding to a higher θ in the model.

From the discussions above, we are able to see that by the 18th century, the Qing central government monopolized the use of force by controlling the nation's military power, faced fewer and smaller food riots (higher θ in the model), and had dominance over mid-level agents (higher θ in the model), making it a strong central government (higher f and higher k in the model). In contrast, Daimyos in Edo Japan maintained control of their own army, and thus the Bakufu could not monopolize the use of force. The Bakufu also faced more powerful food riots (lower θ in the model) and significant danger of being replaced by some Daimyos either militarily or commercially in the rice market (lower θ in the model), signifying the Shogunate was a relatively weak central government (lower f and lower k in the model).

Our model's results match the historical reality in which a strong central government like the Qing central government offered weak legal institutions, while a weak central government like the Edo Bakufu offered strong legal institutions. The logic here is simple: Stability of the rice market significantly influences the income of all Daimyos. Any Daimyo who embezzled merchants would not only face merchants boycotting the rice sold by that Daimyo, but also would lead to merchants' loss of confidence in the whole rice trade process and the whole rice market in Japan. This would lead to a more destabilized rice market, so that the income of all Daimyos would decrease, which would increase Daimyos' tendencies towards rebellion. The cost of providing legal protection for participants in the rice market
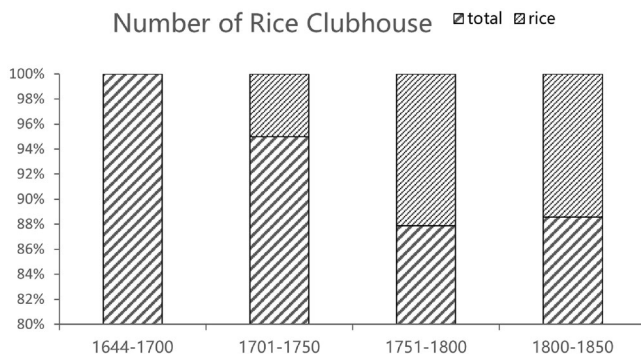
Fig. 3 Rice clubhouse in Suzhou. Source: Wang and Tang (2019).
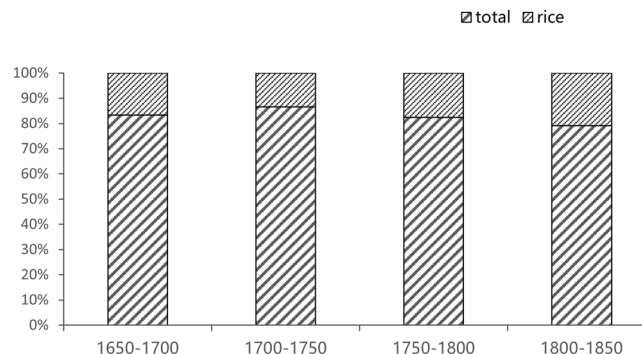

Fig. 4 Rice clubhouse foundations during the Qing dynasty. Source: Peng (1995).

was relatively small compared to the cost of suppressing a rebellion. Therefore, Edo Bakufu chose to create stable rice markets to meet the interests of both the Daimyos and the masses. On the contrary, the Qing Empire faced fewer food riots and lower risk of rebellion, and it was less costly for the Qing government to suppress sporadic food riots than providing long-term legal protections for rice market participants. As North (1994) points out—while stronger states are more able to ensure property rights, an overly powerful state may threaten the security of private ownership in the absence of constraints. Edo Bakufu offered legal rights to rice market participants, whereas the Qing central government preferred to suppress rebellion by military power rather than offering legal rights to mitigate the risk of power threats.

Merchants: succumb or fight. After the 17th century, *Huiguan* (clubhouses) emerged and grew throughout China, becoming the main informal institution in which merchants invested (Ho, 2017). Clubhouses would take a certain amount of members' business income to fund its operations, and in return, it would offer protections for members' economic interests (Qiu, 1990). However, as clubhouses were not recognized by the legal system, they preferred to resolve commercial disputes through informal means such as negotiation. In the rice market, clubhouses were an important means for merchants to fight against *Lgb*. For example, in the early 18th century, rice merchants from the Dongting region established clubhouses to counter the long-standing embezzlement of *Lgb*. The clubhouse gradually replaced the formal legal system to effectively resolve disputes between merchants and *Yaren* (Fan, 1996). As Fig. 3 illustrates, in Suzhou, the largest rice market at that time, the number of rice clubhouses rapidly increased in the 18th century.[34] Furthermore, Fig. 4 also shows that, before mid-19th century, a number of rice clubhouses were established nationwide, not merely in Suzhou. In the Yellow River and Huaihe regions, the volume of rice trade decreased significantly, while in Suzhou, the decrease was less significant due to the existence of clubhouses. In the absence of legal rights, Qing rice merchants depended more on regional and collective networks of trust. The Dongting merchants, for example, were a regional-based business group.

How did these clubhouses emerge and grow so rapidly in a short period of time? Result 2 in our model provides an explanation. When legal protections were not offered, such as the case in Qing China, the mid-level agent (local government, represented by *Lgb*)'s would be more willing to embezzle, and our model shows that market participants would become more likely to invest in their own ways of rights protections. The

establishment of these clubhouses provided merchants with the ability to cooperate and resist *Lgb* embezzlement.[35]

An exact opposite situation developed in Edo Japan. Here, merchants preferred to invest in business models rather than informal institutions.[36] Some large merchants ensured continued profitability and expansion through improving employment system, and some merchant families speculated by keeping abreast of rice prices (Takatsuki, 2012; Yasuoka, 1988). Effective legal rights also led to the emergence of individual investors, of whom the most famous one was Honma Munehisa, who was an active investor in the 18th century rice market. Born in Sakata, a city in east of Honshu, Honma first rose up through the local rice market, after which he moved on to speculate in the rice markets of Osaka and Edo, where he also achieved great success with his skillful investments because of his excellent investment skills he was hired as an economic adviser by shogun in his late years (Satou, 1972). It shall also be noticed that being a speculator in the rice market of Osaka and Edo, Honma Munehisa had cut off ties with his family, meaning that he achieved his success entirely as an individual investor rather than backing by family or community, which was unimaginable in a rice market without well legal protections for rice market participants' rights.

Honma's case was unlikely in the rice market of Qing China. During the Qing dynasty, successful merchants were known as *red-top* merchants, and the *red-top* was the hat of officials. As the words imply, in Qing China, successful merchants relied heavily on political power. As property emanated from political power, which forced merchants to seek custody under political power such as establishing private relationship with local magistrates or top bureaucrats (Fan, 2007).[37] Like the establishment of clubhouses, keeping private relationship with officials was an also important part of the investment in informal protections for merchants.[38]

Rice market: growth or decline. While the rice markets in both Qing China and Tokugawa Japan developed in the 18th century, the rice market in Suzhou began to decline in the late 18th century. According to Fig. 5, the rice trade in Suzhou peaked in the mid-18th century and tailed from then on. By the early 19th century, the volume of rice trade in Suzhou was only half of what it had been at its peak. Rice trade in the Huaihe and Yellow River basins also decreased significantly.

By contrast, as shown in Fig. 6, in Osaka, the volume of rice trade increased steadily from the early 18th century and peaked in the early 19th century. Furthermore, the volume of rice trade in the early 19th century was more than two times the volume of rice trade in the early 18th century.
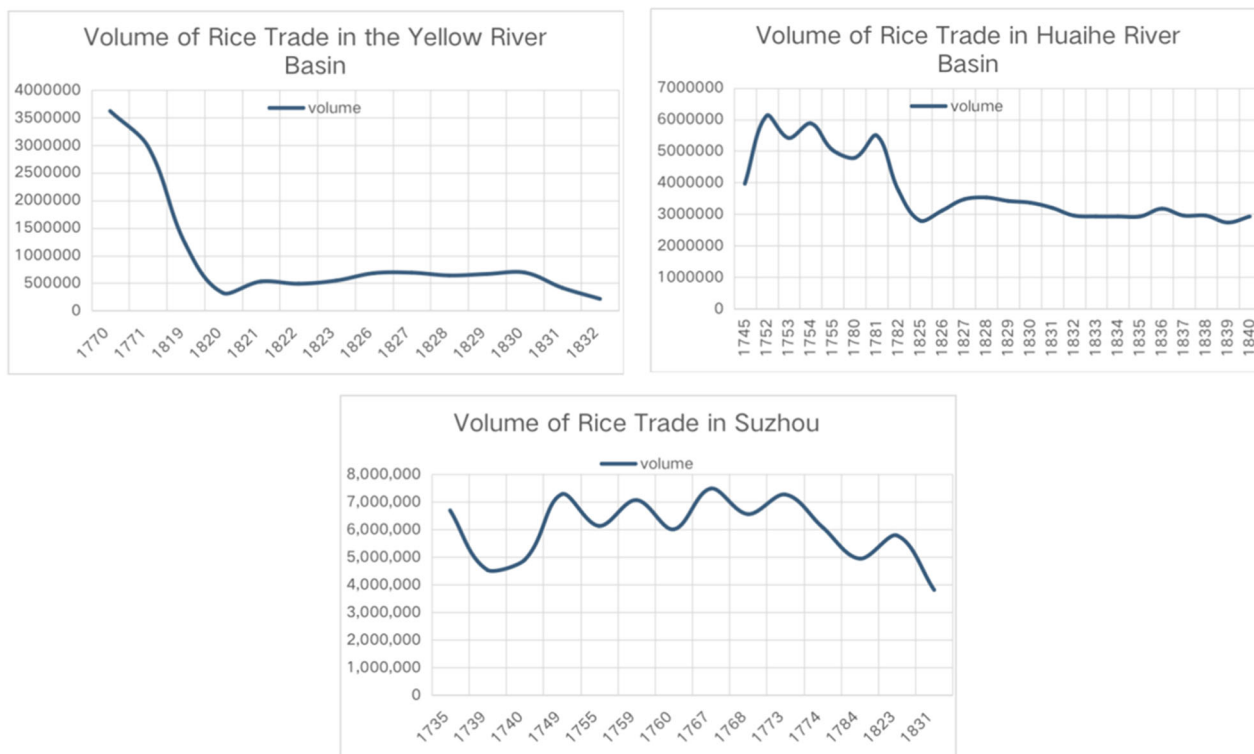
Fig. 5 Volume of rice trade (in *Shi* of unhusked grain) in three regions of China. Source: Liao (2007), Deng (1994).
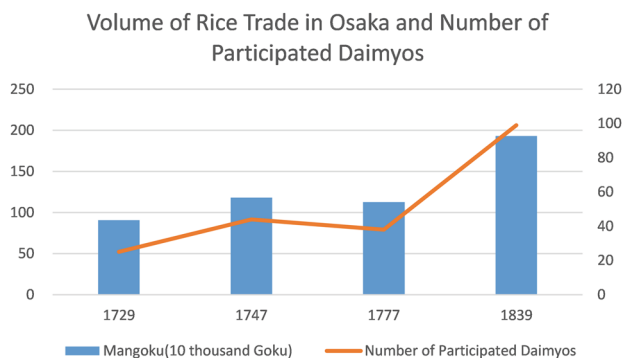
Fig. 6 Volume of rice trade in Osaka. Source: Miyamoto (1988).

Not only in Suzhou, but also throughout China, the trade in rice declined from its peak in the mid-18th century to a full-scale decline in the early 19th century (Cheung, 2008; Deng, 2009). In Japan, however, rice markets developed further after the mid-18th century, with the continuous development of regional rice markets and even the emergency of trading rice futures in some markets (Hayashi, 2000). In terms of rice market integration, according to Fig. 7, Yao's and Zheng's (2016) research shows that since the late 18th century, rice markets were more nationally integrated in Japan than in China, the rice market in west Japan was also more integrated than in the most developed Yangtze delta, and results are still robust even accounting for weather shocks, public storage and political events.

While many factors led to the differences in rice market performance between China and Japan, our model offers one possible institutional explanation. In contrast to centralized Qing China, during the Edo era, the Daimyos enjoyed a high degree of autonomy, making the Tokugawa Bakufu in Japan more decentralized. Many scholars (e.g., Arze et al., 2016; Faguet, 2014; Xu, 2011) have argued that decentralization was more conducive to the provision of public services and even economic development. Moreover, the decentralized Tokugawa Bakufu was more effective in implementing policies that offered legal protections for the rice market participants. Because Daimyos dominated Japan's rice trade since the 18th century, Daimyos' finical system became increasingly dependent on rice markets (Ito, 2014). Legal protections supported the stable rice market (as shown in the likelihood of cooperation in the model), which in turn enabled Daimyos to obtain currency in a sustainable manner. In the end, Daimyos preferred to engage in rice market transactions for long-term benefits rather than for short-term benefits through embezzlement, decreasing e in the model and further enhances market's stability. As Fig. 6 illustrates, the number of Daimyos participating in the Osaka rice market by the early 19th century was nearly four times the number of Daimyo in the 18th century. By contrast, in Qing China, because the weakness of formal legal protection, merchants had to invest in informal institutions to protect their own rights. As discussed in the famous research of Field (2007), in the absence of clear property rights, urban dwellers were forced to stay at home in order to assert their assets, which in turn affected their participation in the labor market. In Qing China, rice merchants faced a similar problem, as they had to invest more in protecting their rights. Such a high investment cost limited their participation in the rice market and thus partially resulted in the decline of the rice market.[40]

Equilibria: Qing China and Edo Japan. In this section, we look at the historical materials that match Qing China and Tokugawa Japan with the Perfect Bayesian Nash Equilibria in Section "Results and Nash equilibrium study". The historical materials
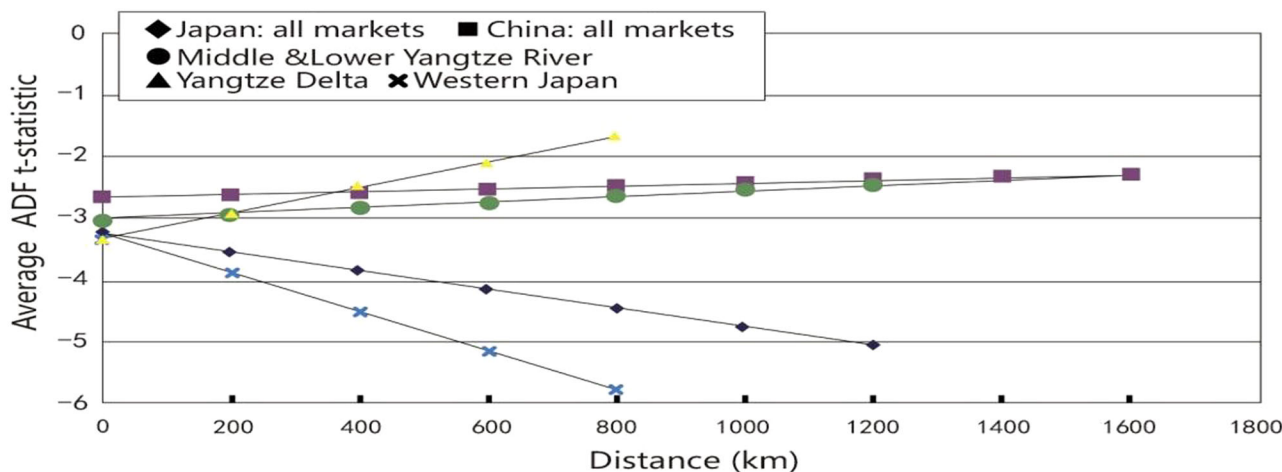
Fig. 7 Cointegration for Japanese and Chinese Rice Market. Source: Yao and Zheng (2016)[39].

show that the situation in Qing China matches equilibrium (3), and the situation in Tokugawa Japan matches equilibrium (2).[41]

Qing China: The situation in Qing China matches equilibrium (3), which is:

If $c \leq ez$, $(a = 0$, cooperate, fight | M believes that $\theta \geq 1 - \frac{f+k+e(1-z)}{X})$

As we have introduced in the previous sections, *Yaren* (local government brokers, or *lgb*) embezzlement was quite prevalent. *Lgb* could establish associations to take control of intermediary business, regulating trade in order to satisfy their interest despite the losses of merchants or farmers, signifying a high e (embezzlement willingness and ability) in Qing China (Negishi, 1932; Chen, 1992).

Facing *lgb*'s embezzlement, merchants in Qing China defended their interests by establishing clubhouses, which consisted of groups of merchants in the same industry or in the same region. They formed rules and regulations to maintain the functioning of the clubhouse, which in turn defended the interests of the members in case of disputes between them and others. For example, the Dongting merchants set up the *Dongting Clubhouse*, whose funds mainly came from the donations of the members, and the members elected 15 people as the directors to maintain the operation of the clubhouse, and the statute of the clubhouse also clearly expressed that the members enjoy the right of protection of the clubhouse, but also bear the responsibility of maintaining the clubhouse and the obligation to pay the funds. This is also the reason why in the 18th century, in Suzhou, when the rice merchants of the Dongting and the *Yaren* had disputes, the *Dongting Clubhouse*, rather than individual merchants, would step forward and appeal to protect the rights and interests of the members. (Fan, 1996; Tang, 1993) These clubhouses like the *Dongting clubhouse* increased the merchants' strength (z in the model) by bringing the individual merchants' power together. Moreover, for each individual merchant, a clubhouse was cheap to fund since there are many contributors to this clubhouse, signifying a low c in the model.

The local government in Qing China also believed in the strength of the central government. As we have discussed in Section "Governments: Strong or weak", a strong central government of Qing China made the local government to refrain from taking actions against the central government, signifying that the local government had the belief that the central government was strong enough, signifying the belief part of M believing $\theta \geq 1 - \frac{f+k+e(1-z)}{X}$ in the model.

Bringing the discussion, we see that a low c, high z, high e and high θ in Qing China matches the parameters in equilibrium (3). The equilibrium infers that Qing China's central government would not offer any legal protections, the local government would not act against the central government, and the merchants would fight against the *lgb*'s embezzlement, all of which completely matches the historical facts.

Edo Japan: The situation in Edo Japan matches equilibrium (2), which is:

$(a \in \left[\max(1 - \frac{c}{ez}, 0), \frac{(1-\theta_{guess})x - f - k - e}{1-e}\right]$, not cooperate, not fight | M believes that $\theta \leq 1 - \frac{1 - \frac{c}{ez} + f + k}{X})$

In 1730, the Shogunate established the *komekatanengyouji*(米方年行司) in Osaka to manage the rice market and receive lawsuits from rice merchants, thus bringing the rice market under the control of the Shogunate and preventing irregularities in the rice market through judicial means, so that the rice merchants could rely on the formal institutions of the state to protect their rights. For example, in 1791, when 54 rice merchants appealed to the Shogunate for the timely delivery of rice by the Chikugo Daimyo, the Shogunate intervened in the dispute and required that the Chikugo Daimyo deliver all of the rice in warehouse to the merchants, and reimburse the merchants for any shortfalls in the form of cash afterwards, thus settling the dispute within 20 days. (Takatsuki, 2012). The establishment of *komekatanengyouji* illustrates the legal protection a offered by the Shogunate, and reimbursed merchants did not need to fight against the embezzlement, because they were protected by the Shogunate.

Daimyos, on the other hand, lost the embezzlement income they could have enjoyed, and naturally tended to not cooperate with the Shogunate. As we have discussed in Sections "Governments: Strong or weak" and "Merchants: Succumb or fight" about Daimyo's relative power compared with the Shogunate, the relative power of Daimyo to Shogunate is much stronger compared to the case in Qing China, illustrating the belief that M has regarding $\theta \leq 1 - \frac{1 - \frac{c}{ez} + \frac{e}{z} + f + k}{X}$. In the short term, Daimyo could also enjoy the stability of the rice market brought by the legal institutions, but as we have seen in the long term, Edo Bakufu was overthrown by armies of Choshu and Satsuma, namely the Satcho Alliance, showing Daimyo's uncooperativeness.

Brining the discussion together, historical facts concerning the legal protection offered by Tokugawa Shogunate, Japanese

merchants' enjoyment of the legal protection, and Daimyo's uncooperative action in the long term all correspond well with the model result.

Conclusion

This paper examines the reasons why the pre-modern Chinese and Japanese governments provided different levels of legal protection for rice markets. According to our model, under the Japanese shogunate system, Daimyos had a high capacity for subversion against the shogunate regime by launching rebellions. The Tokugawa Shogunate had an incentive to provide strong legal institutions for the rice market to ensure that the Daimyos had a stable financial income and thus mitigate the risk of rebellion, as Daimyos' financial income was highly dependent on the sale of rice. In contrast, under the more highly centralized Qing government, neither the local government nor the merchants had the ability to subvert the regime, and the government had no incentive to offer legal protections for the rice market.

Our model also offers insight into the different business behaviors of Chinese and Japanese merchants. With ample legal protections, Japanese rice merchants participated in smaller units of market transactions and had stronger individualism than Chinese rice merchants. In the absence of legal protection, Chinese rice merchants tended to form territorial groups and participate in the market in larger trading units, being more collectivist. Such lower legal rights contributed to the deterioration in Qing China's amount of rice trade, as seen in the stagnation in Suzhou rice market.

In this regard, our paper sheds new light on studies of the rice trade by examining the significance of legal protections. We argue that the difference in levels of legal protection being offered by the two nations' central governments was by no means a random event. Instead, it was determined by the two nations' level of centralization and further foreshadowed the two nations' different paths of development in the late 19th century. Additionally, because our study focuses on only two parameters in a pre-modern time period, extending our approach to study other parts of the world and different time periods, e.g., contemporary, may offer more insights about how power shaped not only legal institutions but also other political structures or political events.[42]

Data availability

We hereby declare that all data presented in this article are reliable and accurate. Each data point has been explicitly marked with its respective source directly beneath the corresponding chart. Anyone interested in accessing the original data can refer to the provided sources to obtain the raw information. Furthermore, upon request, we are more than willing to provide the organized data files that we have prepared. These files contain the data used in the article, ensuring transparency and facilitating further analysis or verification by interested parties.

Notes

1 In some historical contexts, because of political instability or lack of enforcement, the state was unable to establish formal institutions even it wanted to do so. See Cai et al. (2020).

2 We assume all governments are interested in maintaining the continuity of power, the difference is the methods used to achieve it. For example, while western governments rarely created new institutions driven by social welfare, the Qing government, such as under Emperor Yong Zheng's reign, treated social welfare as a means of consolidating power.

3 For example, in nondemocratic countries, disenfranchised poor can overthrow the regime through revolution. The threat of revolution pushes governments to democratize. See Acemoglu and Robison (2001).

4 It should be noted that while economic rights such as property rights are recognized and enforced partially by the government (Barzel, 1997), actual property rights can still exist in the absence of enforcement of state authority (Eggertsson, 1990). But in this article, we only focus on legal rights, which are formal institutions afforded by the government.

5 We do not deny that other factors such as culture, ideology, elite conflict, etc. also influenced institution-building in Qing China and Tokugawa Japan. In this study, we only emphasize the impact of domestic power threats (conflict and rebellion) on the establishment of legal institutions in rice markets, which is a factor that has been often overlooked.

6 For a more comprehensive comparison of pre-modern China and Japan, see also Sng and Moriguchi (2014).

7 It is worth noting that rice was grown in central and southern China and throughout Japan, and wheat was traded mainly in northern China. In this paper, the national market in Qing China refers to the rice market, not wheat market.

8 *Yaren*, under supervision of Chinese local governments, supervised the merchants to prevent tax evasion, and submitted collected taxes to the government. In addition to collecting taxes, *Yaren* were also responsible for registering information on both sides of the transaction, which was used by the government to maintain social order (Such as evidence to investigate crimes). At the same time, *Yaren* were also required to check the trafficking of prohibited goods (e.g., iron, lead, copper, etc.). See Yan and Li (2013).

9 According to Liu (2003), local governments increased revenue by issuing licenses to *Yaren* and charging fees, and *Yaren* also tended to gift money to local governments to secure their backing.

10 These intermediary organizations mainly consisted of *goushou* (tycoon), who have better ability to transport commodities and obtain market information and maintained some military power to ensure the security of commodity transportation. In the early Edo period, Daimyos had to rely on these tycoons to transport rice for sale because they had difficulty in obtaining market information and had no ability to transport goods. See Miyamoto (1988).

11 In addition to regular expenses, the alternate attendance system (*Sankin Kotai*) required Daimyos to alternate between living in Edo for a year and living in their own domain for a year. The annual processions of Daimyo to Edo were expensive. Furthermore, the cost of maintaining mansions in Edo and the consumption of goods or services by Daimyos and their retainers were also very high.

12 As the issue of *Kome kitte* did not coincide with the market entry of rice, prices could fluctuate depending on the weather and other factors. To avoid this risk, in the late 17th and early 18th centuries, the rice futures market was gradually developed. See Takatusuki (2012).

13 One important reason was the Shogunate's desire to cut down administrative expenses and leave civil litigation to local communities. However, at the economic center of Osaka at that time, commercial disputes were often accepted by the shogunate. See Takatsuki (2012).

14 Shiga refers to this form of ruling as "situation, reason and law", which rarely relied on or cited any specific codes and also lacked enforcement. For more on Qing civil adjudication, see Shiga (1984).

15 During the Qing Dynasty, local governments with limited funds and civil litigation were not a major part of magistrates" assessment; Therefore, local magistrates were reluctant to devote excessive administrative resources to civil litigation. See Ch'u (1962).

16 Because only a small number of Qing dynasty litigation files currently exist, it is difficult for us to gain a comprehensive understanding of the litigation related to *Yaren*'s embezzlement. However, case studies have demonstrated that it is quite common that the rights of merchants and farmers were difficult to be protected in commercial disputes with *Yaren*. For example, among the 17 surviving lawsuits between *Yaren* and merchants in the local archives of Ba County (now Chongqing), few of them resulted in the protection of merchants' interests, and even if merchants won, merchants often had difficulty in getting their all goods back. For more details, see Zhou (2021).

17 For example, in a commercial book, the *Yaren* is described as follows "牙主真誠, 則客商陰受其福；牙主欺詐, 則客商受累無窮。邇來牙行欺偽者多, 誠實者少 (If the Yaren is honest, then the business of merchants will be naturally smooth, and if the Yaren is deceitful, then the business of merchants will be dragged down. However, there are many fraudulent Yaren but few honest Yaren)." See Bian (2020).

18 It is also noted that the magistrate protects the rights of rice securities holders not only in commercial disputes between rice merchants and Daimyos, but also in commercial disputes within rice merchants. See Takatsuki (2012).

19 There were provisions for commercial disputes in the Qing legal code, but these provisions placed more emphasis on maintaining the stability of the market or society rather than on protecting the rights of asset owners. In many legal cases, the local

20 magistrates would sacrifice individual rights in order to maintain the ruling order. See Zhou (2021).

20 There is no evidence to suggest that the Qing government was weaker in its enforcement than the Tokugawa government. Sometimes, the bureaucracy could efficiently put the Emperor's wishes into practice. For example, in 1768, after the Qianlong emperor ordered the arrest of witchcraft practitioners, provincial officials arrested large numbers of suspected practitioners in a short time, and the widespread arrests did not end until the witchcraft was disproven (Kuhn, 1990).

21 Although this model can also explain profits from taxation or economic growth, in this paper, we focus on the profits from holding power given historical contexts.

22 As the rice market proceeds in an agent manner, the top-level central government cannot directly exploit the lower-level participants, so we are only considering the mid-level agent exploiting lower-level participants here.

23 Note that this is not to say that the lower-level participant's fighting action does not influence the central government. When the lower-level participant fights, the central government receives a negative payoff. The reason that we are not assuming that the mid-level agent's fighting action can overthrow the central government's control of the market is because his main fighting target is still the mid-level agent, rather than the central government, and the strength of power between the central government and the lower-level participant differs by too much.

24 In this paper, we use the number of clubhouses (*huiguan*) to measure the extent of fighting action by the lower-level participant. Further discussions of *huiguan* are given in Section "Empirical Evidence".

25 Here we have simplified the model by assuming M fully enjoys the legal protection benefit (*a*), to avoid including too many parameters. Adding in a proportional variable to define M only enjoy part of the legal protection benefit is also possible but should not change the result significantly.

26 The model also predicts that, even without offering strong legal institutions, strong central governments will still remain in power longer and more likely than weak central governments (Result 4). For details, see Appendix 2.

27 According to Qing legal code, local commanders had to apply to their superiors before moving their troops, who then reported the matter to the central government, which in turn reported to the emperor. Only after receiving the Emperor's approval could a local commander move his troops. If a local commander moved his troops without the emperor's permission, he would be punished by caning or even exile.

28 For example. When the shogunate suppressed the Shimabara rebellion (1637), its dispatched troops were repeatedly defeated by the rebel force, and eventually shogunate had to rely on the military power of Daimyos to suppress the rebellion. And some of Daimyos involved in the suppression were able to mobilize tens of thousands of troops in a short period time. For more details, see Kanda (2005).

29 Between 1781 and 1789, food output in Japan decreased as the climate deteriorated due to volcanic eruptions, leading to a massive famine (Temmei famine). This famine contributed greatly to the increase in food riots nationwide. For more details about Temmei famine, see Kikuchi (1997).

30 After the mid-18th century, the Qing government increased the penalties for those involved in food riots. This may have contributed to a significant reduction in food riots during the Qing dynasty (Fan and Luo, 2011).

31 Population data in Qing China and Edo Japan are comparatively limited so we employ linear interpolation.

32 In Edo era, *Kokudaka* refers to total government revenues, expressed in terms of *koku* of rice, where 1 *koku* is roughly 180 liters volume. In this system, the output of crops other than rice and seafood was converted into the output of rice of the same economic value as those products.

33 Precisely because *Yaren* were subordinate to the Qing government, their existence was also highly dependent on government decisions. For example, in 1763, top bureaucrats had discussed the abolishment of the *Yaren* system. See, Lv (1991).

34 Merchants secure the interests of individual or group traders through joint petitions, and some merchants sell grain directly through clubhouse to avoid embezzlement by *Lgb*.

35 People also choose to rely on the formal legal system to protect their rights when legal codes can offer protections for property. For example, because Qing legal codes were more protective of common property rather than individual property, this may account for the increase in clan-controlled common property (Greif and Tabellini, 2017).

36 It should be noted that in some commodity transactions without legal protections for individual rights, Japanese merchants also preferred to invest in informal protections for their rights. For example, Mitsuda (2021) shows that the *Hino Dai Toudan* of Omi merchants was similar to the clubhouse and would intervene to defend the interests of its members when they were involved in commercial disputes.

37 Even in today's China, merchants still need to maintain good private relationships with the government in order to secure their property rights more effectively, but they also face the risk of expropriation by the central government. See, Shum (2021).

38 Merchants maintained private relationships mainly through gifting money to officials. Although the exact amount was elusive, according to the research of Chang (1962), in the early 19th century, foreign trade merchants donated around 500,000 taels of silver per year to officials or the government, essentially half of the legal tariff amount.

39 An augmented Dickey-Fuller test (ADF) tests the null hypothesis that a unit root is present in a time series sample, when the ADF is used in the test, is a negative number. The more negative it is, the stronger the rejection of null hypothesis.

40 As we have stressed, this is a theoretical explanation, and more empirical research is necessary in the future.

41 In Appendix 2, we provide historical examples of equilibrium (1) and equilibrium (4).

42 Moreover, bringing signaling into the game to study whether a weak central government has incentive to disguise itself as a strong central government could be an interesting direction for further research.

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Author contributions

These authors contributed equally to this work: RW, QZ. RW, and QZ, acting as equally contributing and corresponding authors, worked collaboratively on composing the initial draft of the paper, actively contributing to its development and organization. MN played a crucial role in refining the manuscript by providing comprehensive editing, rigorous reviewing, and making necessary revisions.

Competing interests

The authors declare no competing interests.

Ethical approval

This study does not involve any human participants.

Informed consent

This study does not involve any human participants.

Additional information