The Economic Consequences of the Opium War*

Wolfgang Keller
University of Colorado and NBER

Carol H. Shiue
University of Colorado and NBER

March 9, 2021

Abstract

This paper studies the economic consequences of the West's foray into China after the Opium War (1840-42), when Western colonial institutions were introduced in dozens of so-called treaty ports. These institutions came in two forms, trade institutions centered on the Maritime Customs Service, and legal institutions associated with consular courts in China. The paper finds, first, that Western countries had a positive impact on China's economy over the 19th century. Regions with Western influence exhibited a higher rate of growth of modern firms and more investment into advanced machinery; moreover, Western influence brought down local interest rates by almost a quarter, with much of this due to Western institutions providing enhanced security and lower risk as opposed to additional capital. Second, both legal and trade institutions contributed to this; firm growth, investment, and technology adoption were closely affected by trade institutions while legal institutions played a stronger role for capital market performance. We also assess individual elements of extraterritorialty in China such as the scope of jurisdiction, appeal process, court proceedings, and sentencing. Third, we demonstrate that the geographic scope of influence went far beyond the immediate vicinity of treaty ports, customs houses, and consulates. With Western institutions affecting Chinese areas up to 400 kilometers away, they influenced during this period a large part, perhaps even the majority, of China.

*This paper incorporates material from the draft "Capital Markets and Colonial Institutions in China". Thanks to Ying Bai, Taylor Jaworski, Ruixue Jia, Gerard Roland, and seminar audiences at CEPR, CESI (Beijing), Cornell, Hong Kong Monetary Authority, Rutgers, NBER Summer Institute (DAE), SHUFE (Shanghai), Stanford, UC Merced, and UIBE (Beijing) for comments. Ying Bai and Ruixue Jia helped with the data. Kyle Butts, Xavier Gitiaux, Peiyuan Li, Yibei Liu, Nate Neligh, Austin Smith, and Tyler Bodine-Smith provided excellent research assistance. Support from the National Science Foundation (Grants SES 0453040 and SES 1124426)) is gratefully acknowledged.

1 Introduction

The First Opium War (1840-42) was a watershed in the history of China. Up to that point, only one port in China, Canton, located in the southern province of Guangdong, was open to European traders. After the Opium Wars, Britain and other Treaty Powers forced open ports throughout China that had been previously closed to international trade and reduced tariffs on foreign goods imported in the country. Chinese institutions of trade were abolished and re-organized under Western management, and Western powers became the custodian of China's tariff revenues. Western legal institutions were introduced in China in form of courts and legal practices, and foreigners were tried not according to China's laws but according to the laws of their country of origin (extraterritoriality). Little is known on what Western institutions meant for China's economy. In this paper, we study the impact of Western institutions over the period 1820 to 1900 by contrasting China's economic performance in regions in which Western institutions were present with those regions that were geographically far from Western influence.[1]

Foreign powers relinquished control in these areas in China only in 1943, one hundred years after the first British gunboats arrived. Over the century-long era of foreign intervention, there are accounts that Western presence permeated wide-ranging areas in China, affecting the handling of trade, foreign investments, manufacturing, property rights and security, governance, and the judiciary system. At the same time, China as a country was not colonized in the way that India, for example, was colonized by Britain, and it has been challenging to find out how far Western influence in China in fact went. We estimate the impact of Western influence on China's economy for a range of outcome variables ranging from capital markets to firm investment.

The paper finds, first, that Western countries had a positive impact on China's economy. Regions with Western influence exhibited a higher rate of growth of modern firms with their investment into advanced machinery as well as steam engines, and such regions also saw a disproportionate creation of modern Chinese banks. Furthermore, Western influence brought down local interest rates by almost a quarter, with much of this effect due to Western institutions providing enhanced security and lower risk as opposed to additional capital. Second, both legal institutions centered on the consular courts and trade institutions associated with the Western-led customs system played a role in this, and we find that firm growth, invest-

[1] Japan's influence in China started at the very end of the 19th century and its strategy was different from that of Western countries.

ment, and technology adoption were closely affected by trade institutions while legal institutions played a stronger role for banks and capital market performance. The analysis also assesses the importance of individual elements of extraterritorialty in China with respect to its scope, appeal process, court proceedings and sentencing. Third, we demonstrate that the geographic scope of influence went far beyond the immediate vicinity of treaty ports, customs houses, and Western consulates, with Western institutions affecting Chinese areas up to 400 kilometers away. According to our analysis, the West's foray into China after the Opium War influenced a large part, and perhaps the majority, of China.

While there is a substantial body of work on the economic impact of the West in the Americas, including Acemoglu, Johnson, and Robinson (2001), Engermann and Sokoloff (2002), much less is known on the consequences of Western influence in Asia. There is no general agreement whether the West's impact on China's economy was positive or negative, see the landmark work by Fairbank (1978), as well as Feuerwerker (1983), Murphey (1974), and So and Myers (2011). Recent work has shown that population grew disproportionately in the former treaty ports, especially after the year 1982 (Jia 2014), and that Western Protestant missionaries had helped to modernize China by the 1920s through setting up new schools and hospitals (Bai and Kung 2015). By shifting the focus on the impact during China's opening in the 19th century we examine the West's contemporaneous as opposed to long-run impact, and we extend the analysis of missionary activity by documenting a positive impact on China from the transfer of trade and legal institutions of Western states. In addition, our analysis unbundles the effect of institutions (Acemoglu and Johnson 2005) by exploiting China's relatively large size with the simultaneous presence of multiple Western colonizers to employ regional, within-country variation for isolating the impact of different forms of institutions.

Whether the impact of the West on China's economy was on the whole positive or negative, the conventional view is that it must have been limited because Western influence was highly concentrated in the treaty ports (Rawski 1970, Murphey 1974, Fairbank 1978, and Feuerwerker 1983). The view is echoed by more recent work noting that China's treaty port economy represented only a small portion–never more than 10%–of China's economy as a whole both in terms of space and total output (So 2011).[2] Our finding that by the late 19th century Western institutions affected a large part, and perhaps the majority,

[2] A colorful example is Murphey (1974) who writes "[t]he treaty ports were like a fly on an elephant; the fly could ultimately irritate its host enough to provoke a violent counter reaction, but not enough to change the elephant's basic nature"; page 39.

of China's economy, provides a new and very different perspective on this by accounting for geographic spillovers that radiated out from Western ports and consulates in China. The estimate of the West's impact on China's economy is larger because spillovers capture general effects of the diffusion of ideas from Western institutions in a way that other analysis does not. A major, transformative impact of the West's foray into China is important in revising existing perceptions that the economic impact of the Opium Wars and "unequal" treaties were small or harmful for China's development.

The remainder of this paper is as follows. The following section 2 (and Appendix) provides historical background and an overview of the data. Section 3 introduces our estimation approach and how it addresses various threats to identification. The main empirical results are found in section 4. We first show that Western state institutions rather than changes in capital supply lowered interest rates in China, and they also increased Chinese firm growth, investment, and the adoption of new technology. The next section shows that both legal and trade institutions contributed to this, with the former impacting relatively strongly Chinese capital markets and the latter having a larger effect on firm growth. The following section presents a more disaggregated analysis of the legal and trade mechanisms that were involved, before we conclude the empirical results section by estimating the geographic scope of Western influence in China through a spillover analysis. Section 5 presents a concluding discussion, while more information on the data sources as well as on the annual regional interest rate figures can be found in the Appendix.

2 Historical Background and Data

This section provides an introduction of the historical setting. This paper studies roughly eighty years towards the end of China's last imperial dynasty, the Qing (1644-1911). Our sample period are the years 1821 to 1900. A watershed in terms of exposure to Western institutions was the First Opium War, which concluded in the year 1842 with the Treaty of Nanjing. Thus, our sample period covers roughly two decades with relatively weak Western influence followed by six decades of stronger Western influence. The final years of the Qing dynasty are characterized by relatively poor data due in part to political turmoil, and we drop these years from our sample. While the start of our sample period is determined by the availability of capital market data, in some of our analysis we employ information going back to the 18th

century to extend the period during which Western influence in China was relatively low. [3]

2.1 The Run-up to the First Opium War and Treaty of Nanjing

Before the 19th century, three key ports directed China's trade coming from the West: Macau, Canton (now Guangzhou), and Hong Kong. Starting from the year 1684, and for more than 150 years after, the Qing managed Sino-Western trade through a merchant guild, or "Co-Hong". These merchants were appointed by the state to manage the Western trade. The official superintendent of maritime customs, known as the "Hoppo", collected duties on foreign trade through the Hong merchants. These revenues were sent directly to the imperial household. After 1757, and until 1842, all Western trade had to be conducted from Canton. The Canton System allowed British, Dutch, French, Austrians, Swedish, Spanish, Americans, and other traders to carry out trades with a member of the Hong merchants. In practice, this meant traders were required to live in special quarters, in buildings called "factories". The factories were located outside of the city along Canton Harbor and included space for warehouses and offices.

From the British trader's perspective, the Canton System was unsatisfactory. Western traders who came to China often represented companies or syndicates that were funded by wealthy landowners and entrepreneurs in an industrializing Europe, or from the United States. They wanted more interaction and more representation of their interests in China. These organizations were in some cases powerful enough to influence government politics at home.[4]

From the start of the Sino-Western trade, European traders sought access to Chinese markets not only to buy Chinese goods, but also to sell their own wares in what was they imagined to be an immense market. The problem, however, was not simply market access, but a lack of products that ordinary consumers in China could afford. As late as the 1830s, traders of one of the dominating trading houses at the time—Jardine, Matheson & Co.—reported that the Chinese native *nankeen* cotton cloth (named for Nanjing) was superior in quality and cost compared to Manchester cotton goods.[5] Thus, even though cotton was one of the core industries that was revolutionized by the British industrial revolution, it would

[3] For more information on the motives to engage in foreign trade between China and the West, which influenced both the structure of pre-1842 trade as well as the changes thereafter, the interested reader might consult Keller and Shiue (2020) on which the following draws.

[4] One prominent example of the close connection between merchant's interests and their political activity is the British East India Company (BEIC), which operated from 1600 until 1834. The expansion of foreign trade into Asia was a central aim of the British government and the BEIC.

[5] M. Greenberg, *British Trade and the Opening of China*, p. 2.

still be some time before machine produced textiles could compete with the low costs of labor production in China. By contrast, as industrialization spread from Britain to northwest Europe and its offshoots, wealthier classes in urban centers may have been better able to afford foreign imports and Chinese luxury goods. Not only did tea drinking become fashionable, but consumers were fascinated with chinoiserie and other Chinese decorative goods. Chinese craftsmen and manufacturers, for their part, also eagerly catered to custom-designed products for foreign markets.

The good that tipped the trade balance was opium. In 1773, 140,000 pounds of opium were imported into China from India; by the early 1820s, imports had grown ten-fold. Opium was illegal and yet openly smuggled, bought and sold on the watch of Qing merchants and officials alike. In the 1830's, 20-30 percent of government officials consumed opium, and the Daoguang Emperor (reign 1820-50) was himself an addict.[6] At first considered a foreign luxury good and a symbol of privilege and hospitality, opium became widely used throughout Chinese society. Early debates in the Qing court about the appropriate response to opium imports considered the pros and cons of legalization and taxation of the drug, as opposed to strict prohibition. Eventually, opium imports became a scapegoat for the failures of the government, social unrest, and the economic decline that characterizes the last third of the Qing Dynasty.[7]

In 1839, Qing Commissioner Lin Zexu was sent by Emperor Daoguang to end the opium problem through prohibition. Lin took the moral high ground on the matter of opium, eventually destroying a large cargo of opium when his entreaties to cease the opium trade were ignored. In response, British traders declared property damage and quickly resorted to military action. It was the new technology of the steam engine outfitted on British boats, however, that determined the outcome of the Opium Wars. Finally, European grievances about the restrictive conditions of the Canton System could be forcefully expressed in the form of the steamships that could deftly steer into the shallow harbor waters of Canton. British military forces took Canton, moved up the coast and along the Yangtze River, captured Shanghai, and eventually reached the Grand Canal, in effect threatening Peking itself.

China quickly surrendered, agreeing to sign the Treaty of Nanjing (1842), which stipulated that foreign

[6] P. C. Perdue, 'The First Opium War: The Anglo-Chinese War of 1839-1842', *MIT Visualizing Cultures*, 2011. https://visualizingcultures.mit.edu/opium_wars_01/ow1_essay01.html.

[7] More recently, Z. Wang, *Never Forget National Humiliation: Historical Memory in Chinese Politics and Foreign Relations* (New York, Columbia University Press, 2012) argues that after 1991, historical revisionism shifted from class struggle to struggle with outside forces, pp. 96-98.

trade was allowed at four additional treaty ports (Xiamen (Amoy), Fuzhou, Ningbo, and Shanghai).[8] Trade duties were limited to 5 percent *ad valorem* or less on all goods. Moreover, foreign nationals were given the right to reside and own property in designated treaty ports. In addition, foreigners in China would be subject to the legal jurisdiction of their own country rather than to Chinese laws (extraterritoriality). We discuss this feature of Western influence in greater detail below. The issue of the legality of opium in China was hardly worth even a mention in the Treaty of Nanjing. Indeed, the *coup d'etat* was not about making the opium trade legal in China. The real prize was about market access and the entry of foreign businesses into China's economy. [9] Finally, the Treaty of Nanjing stipulated that an indemnity had to be paid as compensation to Britain, and that Hong Kong was to become part of Britain.

2.2 Evolution of Western Influence in the 19th Century

We distinguish two main forms of Western institutional influence in China, namely legal and trade institutions. While clearly exerting their influence jointly, trade institutions were tied to the open port as such, as well as more specifically the foreign-run customs house, while legal institutions were centered on consulates because they administered extraterritorial jurisdiction through consular courts. The connection between trade and legal institutions is not surprising given that the instinct of initial treaty makers was to find security for the merchant's trade in the rule of law (Fairbank 1978, 216-217). In the first fifteen years after the Opium War, for example, British consuls were involved with the collection of customs duties.[10] Over time, trade and legal institutions evolved to become more distinct, in particular with the foundation of the Western-led Chinese Maritime Customs (CMC) Service in 1854 that took over the assessment and collection of customs. The following two sections provide an overview of the nature and potential effects of Western legal and trade institutions in China.

[8] In the case of Guangzhou (Canton), the Treaty of Nanjing expanded the more limited trading opportunities for Western countries afforded by the Canton system.

[9] This sentiment was voiced by the British Plenipotentiary Sir Henry Pottinger, who announced after Britain's victory over China in the First Opium War (1840–42) that China's potential for trade was so vast "that all the mills of Lancashire could not make stocking stuff sufficient for one of its provinces"; Chinese Maritime Customs (CMC), *Decennial Reports, Fifth Issue (1922–1931) vol. 1* (Shanghai, Statistical Department of the Inspectorate General of Customs, 2001a), p. 39.

[10] The consul acted an administrative capacity between the Chinese official (Taotai) and the Customs collection that were part of the treaties of 1842. The Chinese Customs Service was responsible for assessing and accounting for the tariff duties that were under the treaty and for enforcing the treaty trade regulations. Its staff would examine cargo, prevent smuggling, appraise goods, assess, collect, and account for duties, and it would compile the returns of trade, eventually taking on more wide-ranging activities. In principle, merchants who arrived at the Customs House after 1842 could trade freely so long as they paid the treaty tariff rates on their goods. However, this did not always happen and smuggling was difficult to control. Therefore, the British asked that the consul, an official who was to reside at each of the (initially) five open ports, ensured that the dues were paid.

2.2.1 Legal Institutions

Before 1842, the opportunities for friction between Chinese and Western traders were somewhat limited by the fact that this trade was tightly controlled and limited to one port, where only specially designated members of the Co-hong could interact with the foreign traders. Almost immediately after Britain opened the first additional ports of entry in 1842, there arose the need for British and other foreign residents to have a way of resolving property disputes and conflicts of interest both with Chinese agents as well as amongst Western traders themselves. After having rejected the legitimacy of the Chinese system of law and justice, there was a vacuum of legal administration in the case of disputes between foreigners and between foreigners and Chinese. To achieve their goal that foreigners in China would be subject to the jurisdiction of their own country rather than to Chinese laws (extraterritoriality), Western countries thus had to introduce certain legal institutions from their countries in China.[11]

Thus, already in the earliest of the treaties, the 1842 Treaty of Nanjing, the provision for extraterritorial rights included the stipulation that allowed the British Consular Service in China to handle cases involving British residents in China, and within a few years of the opening of the first Treaty Ports, Britain established the position of a Consul who represented the interests of the British citizen in China in judicial matters. A similar set of rights of extraterritoriality was made explicit in the American treaty of 1844 between the U.S. and China.[12] The treaty of 1844 for France, and the Treaty of 1847 with Norway and Sweden, substantially granted the same set of rights to these countries as well. By 1847, 19 nations had extraterritoriality provisions with China. By 1847, extraterritorial arrangements were negotiated and took effect between China and the United States, France, Sweden, and Norway. The Most Favored Nation clause, present in many of China's treaties, automatically granted to all Treaty Powers the rights which China was compelled to allow to any one nation, expanding the influence of the Treaty Powers as a block. It also made it unnecessary for each foreign country to sign new bilateral treaties as the powers of Treaty countries expanded.

Over time, China signed 30 treaties with 16 extraterritorial countries from 1843 to 1918, and 8 treaties

[11] On extraterritoriality in China, see also Quigley (1926), Report (1926), and Cassel (2012).

[12] Two key articles are Articles XXI and XXV: "Citizens of the United States who may commit any crime in China shall be subject to be tried and punished only by the Consul or other public functionary of the United States thereto authorized according to the laws of the United States" (Article XXI), and "All questions in regard to rights, whether of property or person, arising between citizens of the United States in China, shall be subject to the jurisdiction of and regulated by the authorities of their own Government" (Article XXV).

with Britain alone. In all, there were originally 19 states that negotiated extraterritoriality. They were, in chronological order or treaty establishment: Russia, Great Britain, the U.S. France, Sweden, Norway, the German Customs Union, Denmark, The Netherlands, Spain, Belgium, Italy, Austria-Hungary, Peru, Brazil, Portugal, Japan, Mexico, and Switzerland. Extraterritoriality was a long-standing situation for the majority of foreign powers during this semi-colonial era. By 1920, 16 states were still exercising those rights in China.[13] The influence of legal institutions from Western countries was centered on foreign consulates, because the first level of jurisdiction was a consular court where typically the consul himself served as judge.

The histories of foreign consular services in China reveal that there was a learning curve as Western nations tried to maneuver and establish new rules of engagement within China and with the nationals of other countries in China. Treaties marked the beginning of this process in which it was no longer the case that Westerners could consider themselves above the law. The Treaty of Nanjing of 1842 already marked a major change.[14] As a general rule, the laws that were applied in a case were those of the country of the defendant. Thus, the case of a British citizen accused of stealing from a Chinese national in Guangzhou would be brought before the British consular court. In addition, Chinese citizens could sometimes obtain redress against complaints towards a foreign citizen in the Mixed Court. In cases that involved a Chinese citizen and a US citizen, the Consul acted as an intermediary representative.[15]

Western legal institutions may have impacted Chinese economic performance in a number of ways. One is that it increased the incentives of Western traders to provide credit in China. Hao (1986) notes that interest rates were relatively low in the Treaty Ports because foreigners competed with each other to make loans to the Chinese. These loan offers were contingent on the security of capital. The British company Jardine extended loans to Chinese merchants secured with stock deeds and titled property—collateral that

[13]China abrogated the extraterritorial rights of Germany and Austria-Hungary in 1917 and suspended the rights of Russia in 1920.

[14]The explicit mentioning of extraterritoriality and Western jurisdiction in treaties with China came sometimes later. For example, example, US extraterritorial rights in China were explicitly granted only in the Sino-American Treaty of Tientsin of 1858, but this was only a formality. Even before Western courts were established in China, Western residents had rights of extraterritoriality from the beginning of the Treaty Port Era (starting in 1842) in which foreigners had the right to own property, trade and carry on manufacturing according to the laws of their own state rather than Chinese law.

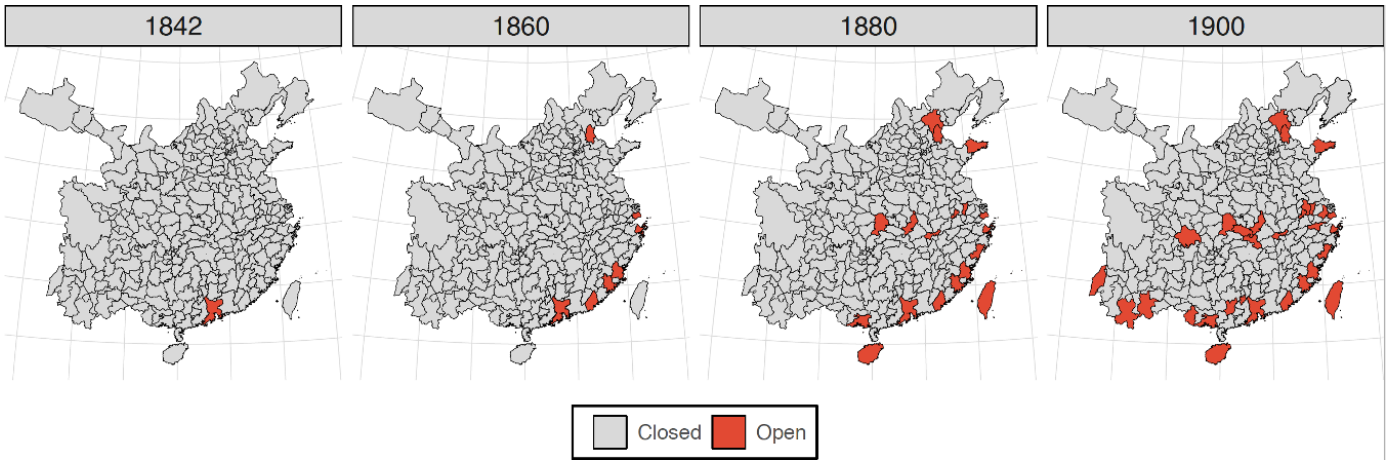
[15]The following clause is from the American Treaty: "The Chinese Government will not hold itself responsible for any debts which may happen to be due from subjects of China to citizens of the United States, or for frauds committed by them; but citizens of the United States may seek redress in law; and on suitable representation being made to the Chinese local authorities through the Consul, they will cause due examination in the premises, and take all proper steps to compel satisfaction". The paragraph continues: "... if citizens of the United States be indebted to subjects of China, the latter may seek redress in the same way through the Consul...".

was easy to recognize, and extraterritorial rights in China made it possible to enforce contracts should default occur.

Other evidence suggests the presence of Western legal institutions may have impacted China's economy. First, landholding rights in foreign settlements or concessions were set forth in treaty provisions. Since disputes related to property registered to foreigners would be heard in Western courts, many Chinese placed their land under foreign protection indirectly by leasing the property to foreigners, who would register the land with their consulates (Willoughby 1920, 696). Second, the link between Western business practices and courts may have changed traditional ways of contracting, leading to efficiency gains through the reduction of risk premia. Case studies from Kirby (1995) and Chung (2010) give suggestive evidence of how this might have taken place. Traditionally, Chinese businesses operated under a firm's name only. Often, there was no record of the nature of ownership among the owners. The Company Law of 1865 enacted in British Hong Kong required the registration of names of people who were owners. Those that did not register would not be recognized in court as having a legal basis. Over time, however, more and more Chinese businesses began registering their firms to certain owners to avail themselves of the advantages of using the courts to resolve disputes.

Our strategy employs multiple dimensions that are designed to distinguish regions of stronger versus weaker Western legal influence in China. First, there is the presence of a foreign consulate in a given region. The advantage of this measure is that consulates were the locations of Western courts, key to to the enforcement of legal disputes. By 1925, there were over 120 foreign consulates in China, including 46 British consular courts, 18 U.S., 35 Japanese, 4 Belgian, 17 French, 5 Italian, and 4 Dutch. Figure 1 describes the establishment of consulates in China during the sample period; prefectures in which at least one foreign consulate operated are shaded.

Figure 1: The Establishment of Foreign Consulates in China, 1842 to 1900

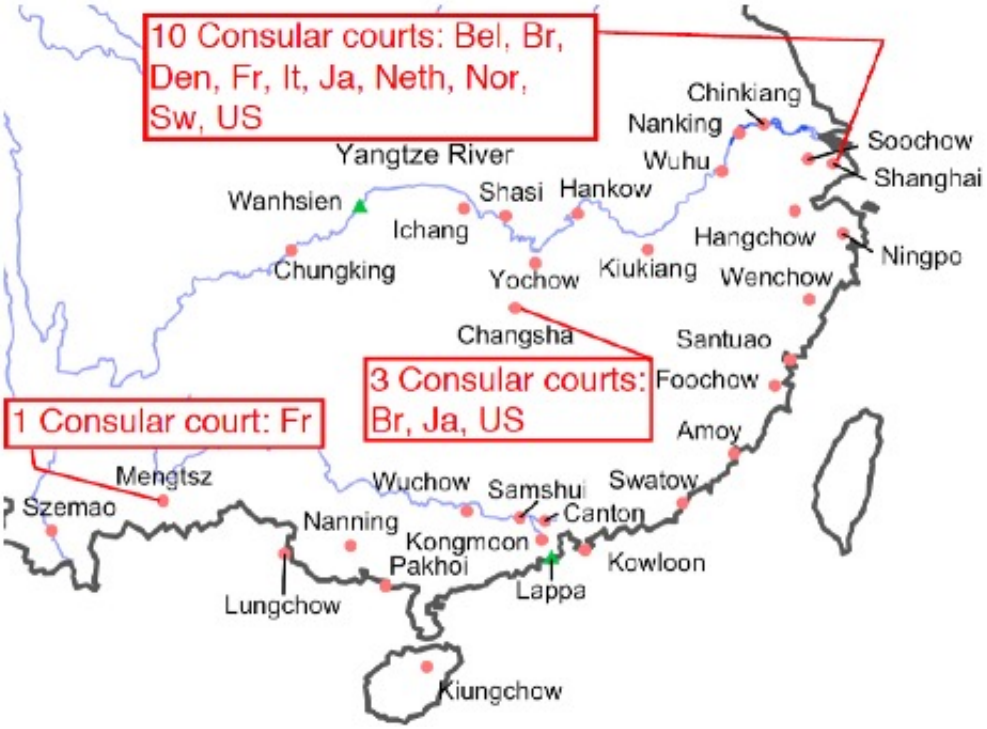


Notes: Authors' calculations, see text. Prefectural boundaries shown.

Figure 1 indicates that the number of Chinese regions that were subject to foreign legal influence grew over time. Corresponding to Figure 1, we employ an indicator variable equal to one if the region hosts a a consulate from any country, and zero otherwise. To account for the fact that in some regions, such as Shanghai, the number of foreign consulates was greater than in others (see Figure 2), we also employ the number of open consulates in some specifications below. Information on the opening of consulates is based on Yunglong (1986).

Next, we exploit information on consulates from individual foreign countries. British consulates, in particular, were comparatively plentiful and opened relatively early in China; see Table A.1 for the opening times of British consulates in various locations. Variation in legal institutions across Western countries is useful for at least two reasons. First, Western countries had occasionally a geographic focus on certain regions within China. For example, there was only one foreign consulate in the city of Mengzi (Yunnan province), which was French as Figure 2 indicates. The explanation for this is that Mengzi is located in relatively close proximity to French colonial interests in Indo-China.

Figure 2: Within-China Variation in the Origin of Western Institutions



Notes: Authors' calculations, see text.

There are also other reasons for the location of consulates from particular countries, including concentration on certain regions of China (e.g., Germany was highly present on the Shandong peninsula), or simply that latecomers had to make do with secondary locations in China. One reason why the uneven geographic spread of foreign consulates in China matters is that the impact of Western legal institutions in China may have been shaped by differences in legal origins (La Porta, Lopez-Silanes, and Shleifer 2008).

Beyond their legal origin, we have quantified the strength of foreign legal influence in China along four dimensions.[16] They concern (1) the consular court's scope of jurisdiction, (2) whether there was an effective right to appeal, (3) whether foreign assessors where present when the foreigner is plaintiff, and (4) whether a foreign country maintained prisons in China. These four dimensions cover key aspects of the legal system that allow us to assess the size of the legal 'footprint' that a particular foreign country had in China. The following provides an overview, with more details given in the Appendix.

[16]The following is based on Report (1926), Quigley (1926).

Scope of Jurisdiction The extraterritorial legal system that countries maintained in China differed in what cases it would consider. A first distinction would be whether a foreign country's legal system would consider only civil cases or also criminal cases. A second question is whether there are limits–in terms of the monetary value at stake in civil cases or the length of the sentence in criminal cases–to the cases that would be tried by the foreign country in China. The highest value for this legal dimension is assigned to countries that do not impose any limits to trials that would take in their system located in China. A country for which this was the case was Great Britain, which operated a Supreme Court of China starting in the year 1865. In contrast, the consular court of the Netherlands sent relatively serious cases to its court in Java. Based on this dimension, the US legal footprint in China was larger than the Dutch legal footprint.

Right to Appeal Our second dimension is whether the decision of the consular court can be appealed in China. For foreign countries where this is the case, we assign a relatively high value to this variable, both because there is recourse to the legal matter and because it was possible to take this action in China. A country where appeal was possible in China is, for example, the United States. In contrast, while decisions of a Portuguese consular court could in principle be appealed as well, the appeal had to go to the high judicial court of Goa, Portuguese India, with further appeals to be decided at the Supreme Court of Justice in Lisbon for a final decision. The need to travel to Goa (or even Lisbon) for an appeal reduces the feasibility of this legal instrument in the case of a Portuguese, compared to an US defendant. Being able to resolve an appeal without having to leave China reduces the costs of appeal. Consequently, the justice system of a country that allows for appeal in China has a higher local demonstration effect.

Foreign Assessors When the foreigner is the plaintiff, generally, the Chinese court has jurisdiction. Foreign countries with extraterritorial rights in China treated such cases in different ways.[17] One set of foreign countries would place their nationals exclusively under the jurisdiction of the Chinese court. For a second set of countries the settlement would be the result of mediation or arbitration by a Chinese official and the foreign consul, a method more in line with Chinese practice than that of the strict application of law by a regularly constituted court. Such a court would typically be referred to as a mixed court. Finally, a third set of countries would have a foreign assessor on behalf of the plaintiff present (this is

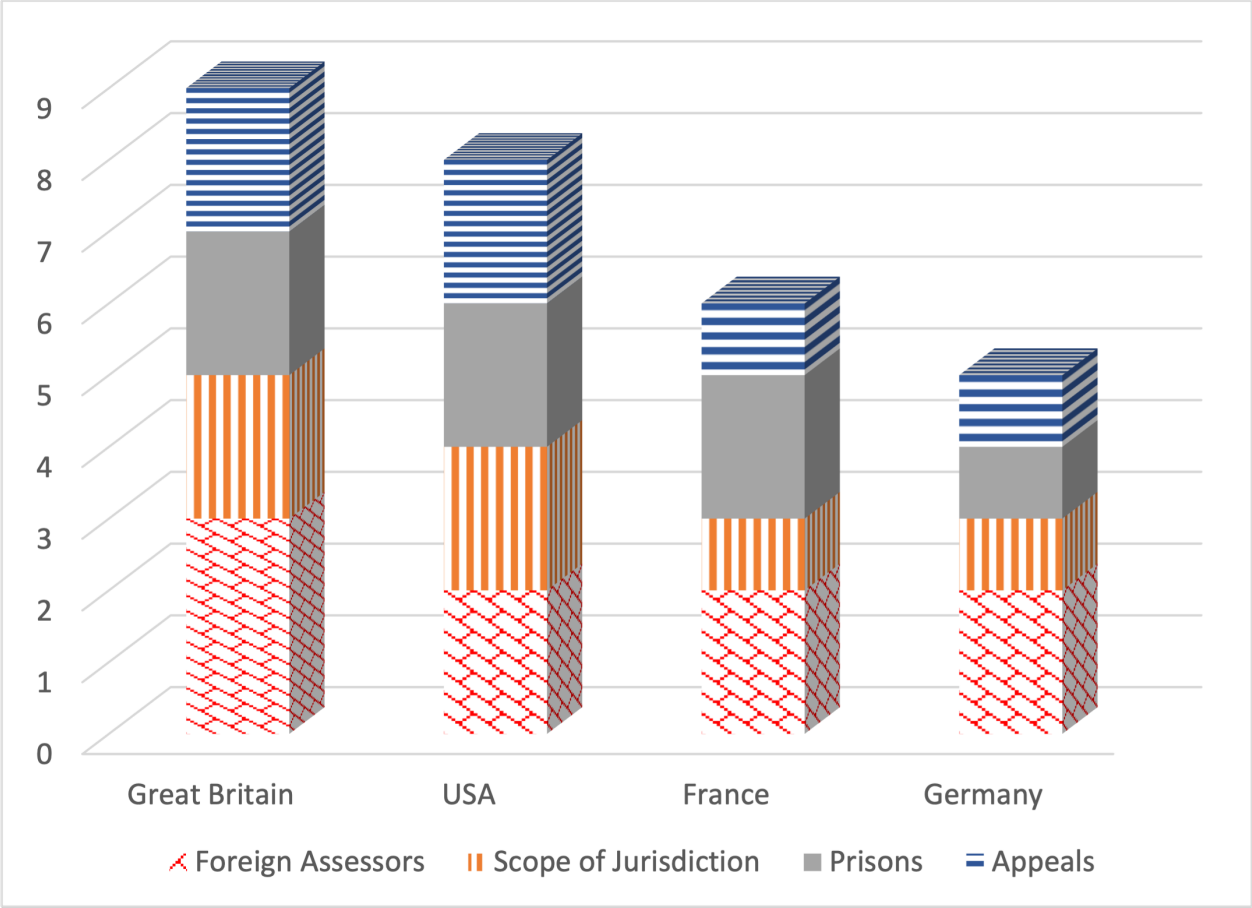
[17] On the following, see Quigley (1926).

Great Britain and the United States). The foreign assessor's job included to examine and cross-examine witnesses, as well as to protest against the proceedings. The presence of foreign assessors in Chinese courts is historically important because even foreign observers at the time regarded the proceedings in the mixed court as a being subjected to the partiality of the assessor and the magistrate for their own subject. The system where assessors act on behalf of the interests of foreign plaintiffs differs most strongly from the traditional Chinese legal system. They score the highest foreign legal influence in this dimension, followed by the countries pursuing mediation, and the lowest score for those countries relying on the jurisdiction of the Chinese court.

Prisons Given the scope, appeal process, and court proceedings of a foreign country's extraterritorial system in China, enforcement of the sentence is another important aspect because it demonstrates the commitment to carry out the sentence that has been decided upon by the court. In order to enforce the sentence that was reached in the foreign court, there would have to be some sort of prison facility. Since foreign countries determined that the conditions of Chinese prisons were extremely poor and inadequate for housing prisoners, foreign prisoners were either sent to foreign prisons in China, or to prisons outside of China. There were four foreign countries that operated their own prison facilities in China during the treaty port era. We assign a high score in this dimension to these four countries, with the remaining countries–who had to either sent their prisoners outside of China, or make arrangements with one of the four countries that had prisons in China to use those prisons–receiving a low score.

Figure 3 shows how the legal footprint of Western countries varied in China. A higher numerical value reflects a stronger foreign presence in China.

Figure 3: Legal Institutional Influence in China: Differences across Western Countries



Notes: Foreign Assessors scores whether a foreign country sends a foreign assessor to represent the plaintiff to a mixed court; Scope of Jurisdiction is whether a country tries criminal and civil cases in China without limits; Prisons indicates whether a country ran its own prison in China at some point; and Appeals scores whether a country allowed for appeals in China; shown is the score for year 1878. Based on Report (1926).

Figure 3 indicates that Great Britain and the US structured their legal institutions in China in a similar, relatively expansive way. The only difference is that by the year 1878, Great Britain sent foreign assessors to trials in which their nationals were plaintiffs, while the US did not. Compared to these Anglo-Saxon countries, Germany and France had more restrictions on the scope of jurisdiction and opportunities to appeal. A difference between France and Germany is that France operated a prison in China while Germany did not. Overall, our legal scoring reflects that Great Britain had a larger legal footprint in China as Germany, as indicated by the height of the countries' columns in Figure 3.

2.3 Trade Institutions

Treaty Ports Treaty ports were a key feature of Western influence in China during the sample period. Ports were opened through treaties (often called 'unequal') that established trading rights to Western countries. The first of these treaties was the Treaty of Nanjing, which concluded the First Opium War (1840-42); it opened the ports of Shanghai, Ningbo, Fuzhou, and Xiamen (Amoy) to foreign trade, in addition to expanding trading rights at Guangzhou (Canton). Additional treaty ports were opened in waves throughout the sample period. While the first treaty ports were located on China's southern and central coast, over time treaty ports were opened along China's entire seaboard, at its inland borders such as towards Russia and Indo-China, as well as inland along major rivers such as the Yangzi and the Pearl river.[18] The most-favored nations clause meant that any rights given by treaty to one foreign nation was extended to all foreign nations, and with the right to trade at a comparatively low tariff rate came the right of residency as well as the right to own and operate firms. While these were initially trading houses, over time it included trade-related services such as shipyards and repair facilities as well as, towards the end of the sample period manufacturing firms.

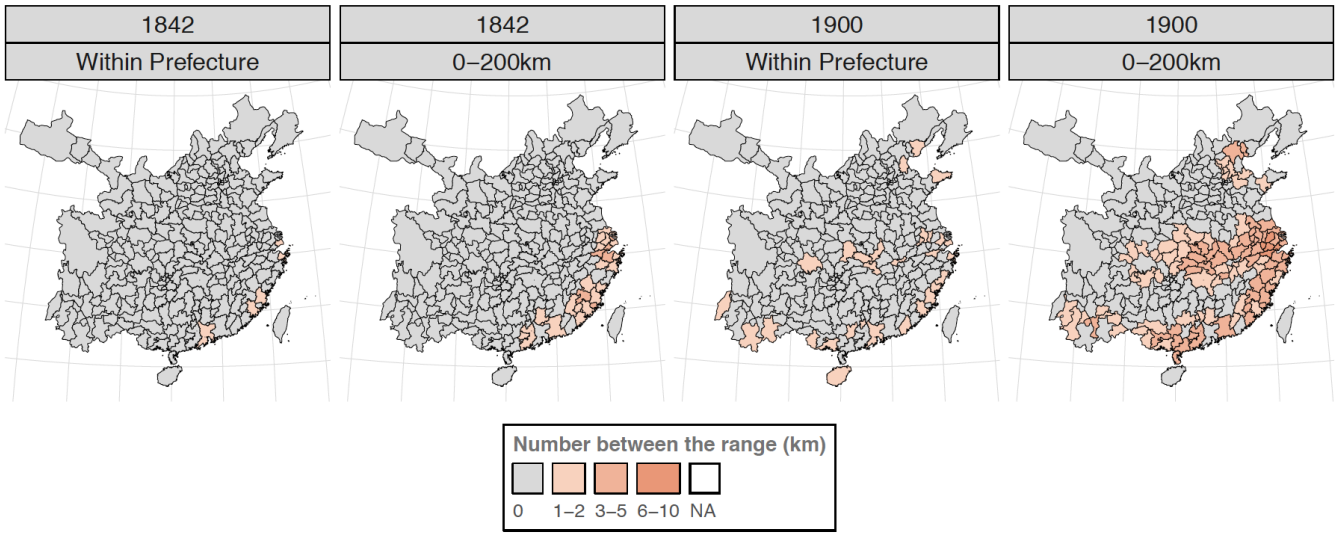
The last treaty ports were named in 1907, and in the end there were more than forty ports with special rights to the Treaty Powers (see Lyons 2003). The establishment of treaty ports may have affected China's economic performance in a number of ways. One channel is that treaty ports introduced new Western technology to China, which may have led to the diffusion of knowledge. Western technology included steam ships, which were used to conduct foreign trade, and which could be seen not only on China's coast but increasingly also at inland ports such as Wuhan (on the Yangzi river). Furthermore, treaty ports provided an increased level of security from rebel and pirate activity, because Western countries would make sure to protect their trading and property interests as well as livelihood through police and military units. It is well known that treaty ports generated positive security spillovers during the sample period as evidenced by an inflow of Chinese nationals into the treaty ports–especially the international settlement areas–whenever the surrounding region was exposed to rebel activity or civil war (e.g., the Taiping Rebellion, 1850-64). Also, the fact that there were more than forty Chinese ports allowing for Western trade that were not opened by treaty–so-called self-opened ports–is consistent with the hypothesis that Western trade brought benefits to the Chinese economy.

[18] See Keller, Li, and Shiue (2011) for more details.

In our empirical analysis, we capture any treaty port effect by coding an indicator variable to equal one in the year that a prefecture included a treaty port, and zero otherwise. The dates of when specific cities were designated as Treaty Ports are specified in the relevant international treaties, and given in CMC (1938).[19] Our analysis focuses on the ports that were opened by treaty (self-opened ports are excluded).[20]

We will also examine the geographic scope of the foreign influence in China. Figure 4 illustrates our approach. On the left panel, there are five shaded prefectures, one each for the five treaty ports that were opened with the Treaty of Nanjing (from south to north: Guangzhou, Xiamen, Fuzhou, Ningbo, and Shanghai). In the next panel, we have shaded those prefectures that are located within two hundred kilometers of one of the five open treaty ports of the year 1842, and also indicated if a given prefecture is located within 200 kilometers of more than one of the five 1842 treaty ports.[21]

Figure 4: Treaty Ports and Geographic Spillovers



Notes: Authors' calculations, see text.

The two panels on the right of Figure 4 repeat this analysis for the year 1900. Including both the same-region effect and the (0, 200) spillover variable into the regression, it is possible to estimate whether the influence from treaty ports in China reached up do a distance of 200 kilometers.[22] Furthermore, by

[19] See "List of Treaty Ports with Dates of Opening", p.645, and also Brunero (2004).

[20] In some cases, a single prefecture included multiple treaty ports; accounting for the number of treaty ports does not lead to a major change in our results.

[21] The distance calculation is based on the capitals of each of the prefectures.

[22] A similar approach has been employed to estimate the geographic dispersion of the recent fracking boom in the US, see Feyrer, Mansur, and Sacerdote (2017).

including a series of distance bands (rather, donuts) it is possible to assess the geographic scope of the foreign influence effect in China.

Customs System Initially, it was envisioned that Chinese customs officials would levy the duties and collect the tariff revenue as specified by the treaties. As became clear, however, the existing Chinese customs system did not have the resources to handle the increase of foreign trade at the treaty ports. In addition, the turmoil of occasional rebel activity and especially the Taiping rebellion meant that tariffs were frequently unassessed and revenue not collected. During one of these episodes in the 1850s, then, the Shanghai consuls from several foreign countries proposed that China's maritime customs system would be run under Western leadership and organization. The Chinese Maritime Customs (CMC) service was founded in 1854, headed by a foreign inspector-general, and the first CMC customs house was opened in 1859 in Shanghai. Although Chinese in name, the CMC Service was built up under British direction and eventually took over from the Chinese the supervision and assessment of duties. The CMC operated continuously between 1859 and 1948 to assess tariffs and record the quantity and value of shipped goods of both foreign and domestic origin. The CMC would run China's maritime customs operations and transfer the tariff revenue it collected to the Qing court after deducting its cost of tariff collection.

Table 1 gives the dates at which the Customs House was established for each of the Treaty Ports.

Table 1: Opening of Customs Operations in Different Treaty Ports

Date	Location	Date	Location
1854	Shanghai	1897	Sanshui
1861	Ningbo		Wuzhou
1861	Fuzhou	1898	Yuezhou
1862	Xiamen	1899	Sanduao
1859	Guangzhou		Wusong
1864	Niuzhuang		Jinan
1863	Zhifu		Zhoucun
1861	Zhenjiang		Weifang
1860	Shantou	1900	Tengyue
1876	Qiongzhou	1902	Qinhuangdao
1899	Nanjing	1904	Jiangmen
1861	Tianjin		Changsha
1862	Hankou	1907	Nanning
1861	Jiujiang		Shengjing
1877	Yichang		Dandong
	Wuhu		Dadonggou
	Wenzhou		Xinmintun
	Beihai		Tieling
1889	Longzhou		Tongjiangzi
	Mengzi		Fakumen
1890	Chongqing		Fenghuang
1896	Shashi		Liaoyang
	Suzhou		
	Hangzhou		
	Simao		

Notes: From Keller, Li, and Shiue (2011).

Treaty ports and customs houses are distinct, first of all, in that not all treaty ports ended up hosting a CMC customs house. Moreover, there was a time lag between the treaty port date and the opening of the CMC customs house, because it took time to set it up. For example, the customs houses of Ningbo and Fuzhou began operating in 1861, while the Xiamen (Amoy) CMC customs house opened in 1862 (all three ports were open since 1842 per the Treaty of Nanjing). Compared to the treaties that opened the ports as such, CMC customs houses can be thought of indicating trade institutions in a more narrow sense. This is were the bulk of foreign trade actually took place, and where Western trade interests were concentrated. Furthermore, over time the CMC took over more and more responsibilities, such as building and operating lighthouses, dredging the harbors, fighting pirates and smugglers, as well as setting up and running China's postal and money order system. Below we employ CMC shipping statistics from the annual *Returns to Trade* to examine the role of the composition of trade by foreign country.[23]

At the macro level, the operation of China's custom system by the Western-led CMC meant that the

[23]We employ tonnage data by ship's flag of foreign country for the year 1899, as well as year 1865 if applicable.

effectively became the international custodian of China's single largest source of government revenue. Even though much of this revenue was used to pay collection costs and war indemnities, the reliability of the CMC was instrumental in establishing the international credibility of public finance in China. The net tariff revenues were considered credible collateral in international loans, and this decline in the risk of default of Chinese government loans resulted in a significant decline in interest rates on China's foreign loans.

At the regional level, the designation as a treaty port implies certain foreign rules as well as the provision of security, while CMC customs houses may lead to different (or additional) foreign influences. For one, CMC employees typically saw their role as being part of China's public administration, and the CMC was formally reporting to China's foreign secretary. In particular, the CMC was not the formal arbiter of conflicts and did not exercise authority over disputes amongst traders. In later years, the CMC's inspector-general was asked at times to represent China's interests in negotiations with foreign countries.[24] Our main measure of influence through the customs system is an indicator variable that equals one if a prefecture includes at least one CMC customs house, and zero otherwise. We will also employ detailed CMC trade statistics on the composition of trade at a given customs house by foreign country.

2.4 Other Data

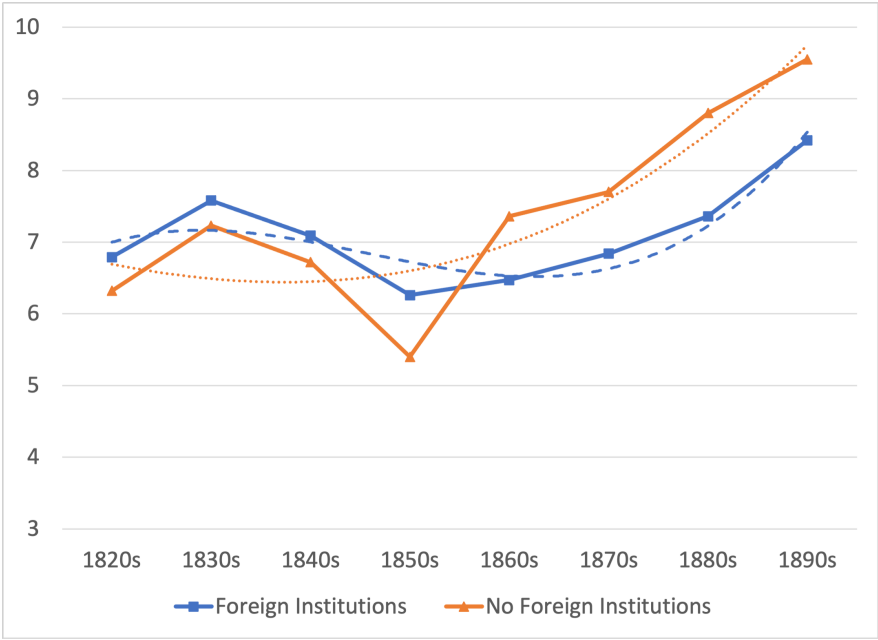
Regional Interest Rates Annual interest rates at the level of the prefecture are obtained employing a storage model together with monthly grain price data. Between harvests, the evolution of the price of a stored commodity–such as grain–will reflect the interest rate because the latter part of the cost of storage. A key advantage of this approach over utilizing other interest rates is that grain-price based interest rates are relatively plentiful and consistent across regions and over space. In contrast, interest rates from contracts or other historical source for the sample period are relatively scarce and therefore not comparable due to the specifics regarding borrower, lender, type of loan, maturity, risk, and other factors. See Appendix A for a description of this method, as well as Keller, Shiue, and Wang (2019) who show that interest rates based on the storage cost approach are similar to bank interest rates across historical regions. Appendix B gives more information on our grain price data. We employ historical weather data at the regional level to improve our measure of local interest rates. Figure A.3 in Appendix C describes

[24]CMC employees were also highly skilled, often being graduates of some of the best universities of the world. They also had knowledge of the Chinese language.

the weather data. Monthly prices of grains are obtained from Chinese Academy of Social Sciences (2009), the weather data comes from State Meteorological Society (1981).

Figure 5 shows interest rates during our sample using a simple binary treatment indicator, namely whether there was ever a foreign institution in form of treaty port or consulate in a particular region.

Figure 5: The Evolution of Chinese Interest Rates in Exposed vs. Non-Exposed Regions



Notes: Shown are average annual interest rates in percent for regions that ever had a treaty port, a CMC customs station, or a foreign consulate, versus regions that did not. Authors' calculations, see text.

Figure 5 indicates that while interest rates in treaty port regions before the middle of the 19th century were somewhat higher than in regions without treaty ports, they followed broadly the same trends. The main difference over the eighty years of our sample period is that regions exposed to foreign influence did not experience the same increase in interest rates as elsewhere in China. In particular, while regions exposed to foreign influence witnessed interest rate levels higher than the pre-Opium War only by the 1890s, elsewhere in China interest rates edged higher than the pre-Opium War maximum already by the 1860s. While interest rates in regions with foreign influence did not fall in absolute terms, the differential evolution of interest rates shown in Figure 5 is consistent with a positive effect of foreign influence on

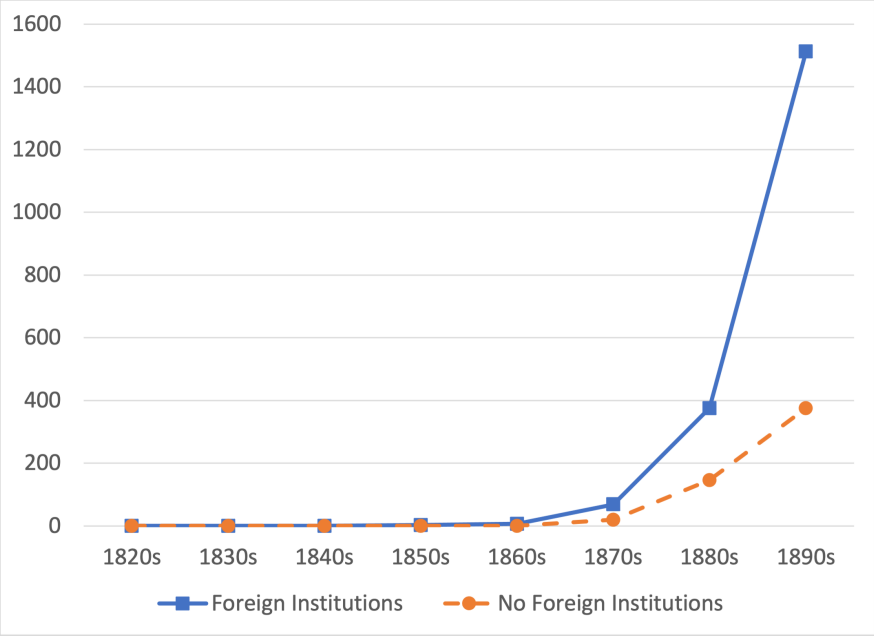
Chinese capital markets.[25] Moreover, Figure 5 suggests that it took some time from the opening of the first treaty ports in 1842 until the full impact of foreign influence materialized. That is consistent with the historical record that foreign influence in China grew over time both in terms of the regions affected and in terms of its nature (e.g., inland regions along major rivers, and the creation of the Western-led customs system, respectively).

Chinese Banks, Firms, and Advanced Technology In addition to local interest rates, we estimate the impact of foreign influence in China in terms of a number of other outcome variables. The first measure is Chinese banks in a prefecture and year. It gives the number of new ("modern") banks from the Shanxi network that exist in a prefecture and a given year (source: SUFE 1990, Mu 2001). Shanxi banks accounted for the large majority of modern Chinese banks at this time. The creation of modern Chinese banks could be a reflection of local capital market development as captured by regional interest rates.

Our second measure is the number of "modern" Chinese firms by region and year. In addition, we have information on the firm investment, the number of steam engines, as well as advanced machinery by region and year. The source of this data is Chang (1992). Figure 6 compares the total number of "modern" Chinese firms in regions exposed versus not-exposed to foreign Western influence.

[25] This is in line with the finding that while the population of treaty port regions tended to decline between 1850 and 1900, the population of other Chinese regions declined even more strongly (Jia 2014).

Figure 6: Chinese Firm Growth in Exposed vs. Non-Exposed Regions



Notes: Shown are the total number of "modern" Chinese firms for regions that ever had a treaty port, a CMC customs station, or a foreign consulate, versus regions that did not. Source: Chang (1992).

While modern firms do not exist in the early years of our sample period anywhere in China, a difference starts emerging in the 1850s, and by the end of the 19th century the number of modern Chinese firms in regions with foreign influence is more than four times the number in regions without foreign influence (1,513 versus 375, respectively). Moreover, because prefectures with foreign influence are in the minority overall, this understates the difference in the proliferation of modern Chinese firms: on a per-prefecture basis, there are 19 times as many modern Chinese firms in regions with foreign influence, compared to without, by the end of the 19th century. Figure 6 is consistent with the hypothesis that Western influence in China increased the rate of modern firm growth.

Capital Supply, Protestant Missionary Activity, and Population Data China's economic performance, in particular the development of its capital market, might have been affected by an infusion of foreign capital that accompanied the transfer of foreign institutions. We account for this, first, by controlling for foreign direct investment in China, measured as the number of foreign-owned firms in each region for a given year (source: CMC 1933). Second, we include in the analysis the number of foreign banks in a given region and year, from Jiang (2014). We also employ Stauffer's (1922) figures to account for the activities of Chinese missionaries in China. We also employ population data at the prefectural

level for the years 1776 and 1820 from Cao (2000).

3 Estimation Approach

We employ a difference-in-differences estimation approach in which interest rates in regions exposed to Western influence are compared to interest rates in regions that were not subject to Western influence. The following equation is estimated by OLS

$$r_{igt} = \beta_1 For_{it} + \beta' X + \mu_t + \theta_{ig} + \varepsilon_{igt}, \tag{1}$$

where For_{it} is a measure of foreign presence in prefecture i in year t, such as the indicator variable of opening of customs shown in Figure 4; μ_t and θ_{ig} are year and prefecture by grain fixed effects, respectively, and X is a vector of additional variables, including weather in prefecture i and year t to account for variation in physical storage costs, c_{igt}. The fixed effects θ_{ig} account for unobserved differences across prefectures that are constant over time, while μ_t controls for shocks that are common to all regions. Our main interest lies in β_1 which estimates the impact of foreign influence on local interest rates. We assume that the error term ε_{igt} is mean zero and well-behaved and allow for heteroskedasticity. The presence of prefecture by grain fixed effects means that identification comes exclusively from within-region changes during the sample period.

We employ a similar estimation strategy for a number of other outcome variables, z_{it}

$$z_{it} = \beta_1 For_{it} + \beta' \tilde{X} + \mu_t + \theta_i + u_{it}, \tag{2}$$

where z_{it} is alternatively (1) the number of modern Chinese banks, (2) the number of modern Chinese firms, (3) the level of modern firms' investment, (4) the number of steam engines, and (5) the adoption of advanced machinery. The term $\tilde{X}$ is a vector of control variables.[26]

A key identification assumption for both equations 1 and 2is that in the absence of treatment (i.e., foreign influence), the outcome variables in the set of regions that were exposed and in the set of regions that

[26]Note that equation 2 is estimated at the prefecture by year level (no subscript g for grain).

were not exposed would have followed parallel trends. While Figures 5 and 6 do not show strong evidence for differential pre-trends, the following performs a set of additional checks, see Table 2.

Table 2: Pre-Treatment Characteristics of Treated versus Control Regions

	A. Interest Rate Level			B. Population Growth			C. Interest Rate Growth		
	Treated	Control	Difference	Treated	Control	Difference	Treated	Control	Difference
Treaty Port	6.254	6.586	−0.332 [0.212]	0.227	0.293	−0.065 [0.000]	0.130	0.196	−0.067 [0.142]
Consulate	6.412	6.554	−0.141 [0.607]	0.269	0.288	−0.019 [0.007]	0.169	0.189	−0.019 [0.678]

Notes: Table gives means (growth) for the period 1821 to 1842 in panel A (C), and growth from 1776 to 1820 in panel B. Treaty Port and Consulate are defined as having ever at Treaty Port or Consulate, respectively. p-value of a test of equality in brackets.

Panel A shows that interest rates in regions that were eventually subject to foreign influence were similar as interest rates in other regions. The difference in average interest rates is typically not statistically significant as the p-values indicate.

Panel B of 2 shows results for pre-treatment population growth in the prefectures. We see that for both definitions of treatment, population growth in the treatment regions tends to be lower than in the control regions. This shows that regions that were eventually subject to substantial foreign influence were not necessarily promising regions in the sense of high population growth before the Opium War. This lack of evidence for positive selection is consistent with Fairbank (1978) noting that Shanghai, which arguably became the most strongly Western-influenced Chinese city, had been a relatively small *hsien* (county or district) city since the Yuan (1279-1368) period, and that Shanghai's population hardly changed between 1813 and 1852.

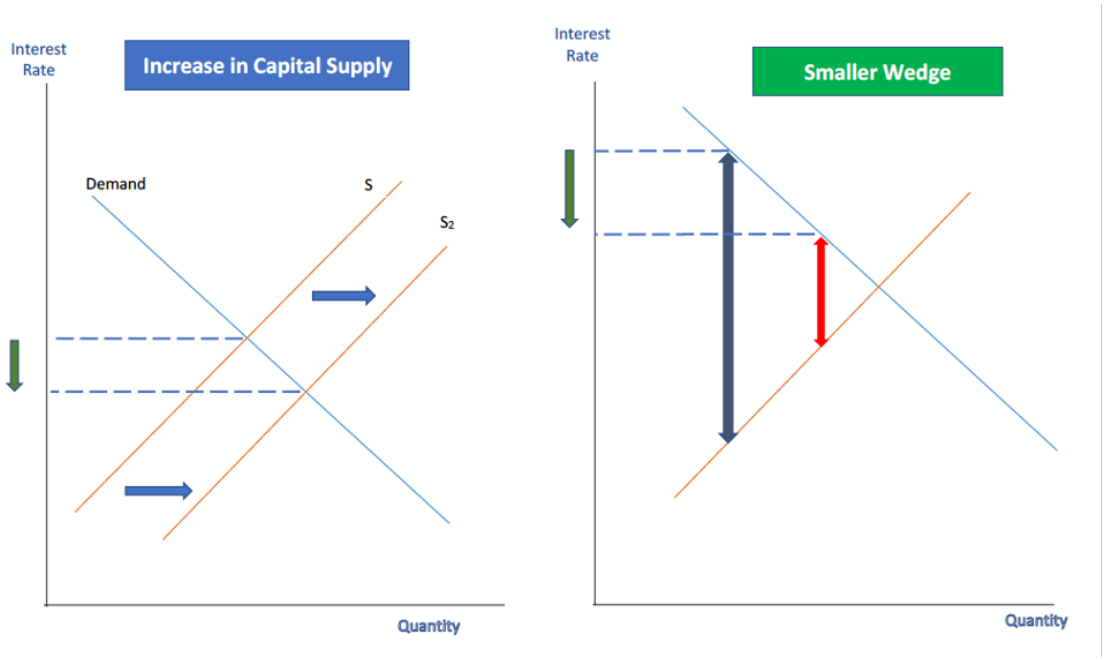
Finally, we compare the two set of regions in terms of interest rate growth during the pre-Opium War sample period (Panel C). It turns out that the differences in typical interest rate growth between treated and control regions are relatively small and not significant. Overall, the results in Table 2 show little evidence that pre-trends favored those Chinese regions that were eventually subject to Western influence over the 19th century. In the regression section below we will expand on this analysis.

4 Empirical Results

4.1 Capital Supply, Foreign Institutions, and Interest Rates

We begin by asking whether the evolution of interest rates in China is primarily affected by changes in quantities or changes in risk factors. In particular, an introductory economics class will tell us that a lower interest rate can be the result of increased supply or the result of a smaller risk factor, or wedge; see Figure 7.

Figure 7: Quantity versus Wedges in the Market for Capital



To understand the role of changes of capital supply in China, the following introduces measures of foreign capital that were transferred to China during the sample period. They are, first, foreign direct investment (FDI), measured as the number of foreign-owned firms in the region, and second, the number of foreign banks, which may be an additional proxy for an increased capital supply from abroad. Table 3 shows the results.

Column (1) in Table 3 indicates that more FDI is associated with lower interest rates, and the same is true for regions in which more foreign banks are located, see column (2). Among these two measures of increased capital supply, the FDI variable appears to be somewhat more important (column (3)), but generally the evidence for a capital supply effect (right side of Figure 7) is relatively weak. Moving to the

Table 3: Interest Rates, Capital Supply, and Institutions

	(1)	(2)	(3)	(4)	(5)
FDI	−0.326*		−0.373+	0.196	
	(0.155)		(0.193)	(0.207)	
Foreign Banks		−0.414	0.166	0.455	
		(0.369)	(0.452)	(0.466)	
Foreign Institutions				−2.558**	−2.101**
				(0.445)	(0.364)
Year Fixed Effects	Y	Y	Y	Y	Y
Prefecture-Grain Fixed Effects	Y	Y	Y	Y	Y
Weather Fixed Effects	Y	Y	Y	Y	Y
N	64,627	64,627	64,627	64,627	64,627

Notes: Dependent variable is interest rate; estimation by OLS. FDI is the number of foreign firms, Foreign Banks is the number of foreign banks, and Foreign Institutions is an indicator variable equal to one if a region has at least one treaty port or consulate in this year, and zero otherwise. Robust standard errors clustered at the prefecture-grain level in parentheses. **/*/+ means significant at the 1%/5%/10% level.

wedge explanation, including the Foreign Institutions variable measure yields a negative and significant coefficient at about -2.6 (column (4)). This is initial evidence that foreign influence has contributed to lower interest rates in China by lowering the risk factor (right side of Figure 7). How important is this effect in economic terms? To obtain a back-of-the-envelope estimate we drop the insignificant foreign bank and firm variables (which are correlated with Foreign Institutions), and re-estimate to obtain a Foreign Institutions coefficient of -2.1. Since the foreign institution variable is an indicator variable and the average interest rate is about seven percent (see Figure 5), this suggests that foreign institutions bring down interest rates by around a quarter.

4.2 The Impact of Foreign Institutions on Interest Rates: Robustness

The results of Table 3 are consistent with a significant impact of foreign institutions lowering Chinese interest rates. This section addresses a number of important further issues, see Table 4 for the results.

A first concern is that local interest rates are affected by time-varying factors across China's relatively large territory, because such effects would not be covered by prefecture fixed effects. To address geographic shocks we control flexibly for geographic trends in the specification.[27] Column (2) in Table 4 shows that

[27]We split our sample into a grid with 3 x 3 = 9 cells by longitude and latitude, and estimate a separate coefficient for each cell by decade.

Table 4: The Impact of Foreign Institutions on Interest Rates: Robustness

	(1)	(2) Geo-Trends	(3) IPWRA	(4) Max	(5) Min	(6) Rice	(7) Not Rice	(8) Aggregate
Foreign	−2.101** (0.382)	−1.547** (0.380)	−2.153** (0.467)	−1.989** (0.586)	−2.308** (0.711)	−2.527** (0.606)	−1.466* (0.726)	−2.239** (0.824)
Pref-Grain FE	Y	Y	Y	Y	Y	Y	Y	
Prefecture FE								Y
Geo-Trends		Y	Y	Y	Y	Y	Y	Y
IPWRA			Y	Y	Y	Y	Y	Y
N	64,627	64,627	64,627	32,376	31,720	30,316	34,311	15,327
R^2	0.159	0.171	0.163	0.164	0.167	0.198	0.152	0.217

Notes: Dependent variable is interest rate; estimation by OLS. Foreign is an indicator variable equal to one if a region has at least one treaty port or consulate in this year, and zero otherwise. All regressions include year and weather fixed effects. Robust standard errors clustered at the prefecture-grain level in parentheses (prefecture level in column (8)). FE stands for fixed effects. **/*/+ means significant at the 1%/5%/10% level.

the role of such geo-shocks is limited.

Next, we address the fact that locations of foreign influence were not randomly selected. An overriding desire to pick locations where interest rates where expected to fall is unlikely given the historical record, and the analysis of pre-trends above confirms this (see Table 2). Rather, the key characteristic foreigners had in mind when choosing locations was mostly good waterway access, which was important to support the desired trade. We employ inverse probability weighted regression adjustment (IPWRA) to address this issue. To do so we run a probit regression of whether a prefecture hosted during the sample period a foreign institution (treaty port, customs, or consulate) on the prefecture's 1776 population, population growth 1776-1820, waterway access variables, as well as geographic location (longitude, latitude).[28] The predicted value of Foreign Institution of this regression is used to construct regression weights that adjust for the differential probability that a given prefecture would come to host a foreign institution. We find that IPWRA leads to qualitatively the same results (Table 4, column (3)). Furthermore, we show in the Appendix that our results are not driven by the broad set of regions all over China in the control group; findings are no less strong when we focus on South-Eastern regions that were most likely picked by Westerners as treaty ports and consulate locations (section E.2).

Given that the storage cost approach benefits from multiple indicators of local interest rates for a given

[28]The waterway access variables are location on Northern Coast, Southern Coast, Grand Canal, in the Yangzi Delta, and on the Yangzi or Pearl River.

prefecture-year, we have so far employed all available interest rates for a given prefecture-year combination. This includes interest rates computed from all different types of grains (such as rice, millet, and wheat) as well as interest rates that are obtained from both the highest and the lowest prefectural grain price in a given month. The next set of specifications examines the role of these factors for our results.

First, results are quite similar using either the highest or the lowest grain to compute interest rates, as shown in columns (4) and (5) of Table 4, respectively. The impact of foreign institutions is larger using rice price data than non-rice data (millet, wheat, and sorghum), as shown in columns (6) and (7), respectively. This could be due to a number of factors. One is that interest rates based on rice prices might contain less measurement error as rice was the most important grain in China during this time. More generally, classical measurement error might bias the coefficient towards zero as we employ smaller samples by focusing on certain types of grains. Furthermore, a focus on rice-based interest rates amounts to concentrating on China's central and southern region, where rice was grown, so it could be that the impact of foreign institutions there was stronger. At the same time, even for interest rates not based on rice prices we estimate a sizable coefficient that is significant at standard levels (Table 4, column (7)).

Finally, when we reduce the number of interest rates to one for each prefecture-year combination by computing the average interest rate from all available measures (different grains, highest and lowest price), we estimate a coefficient of -2.239 (column (8)). This is reassuringly similar to the corresponding point estimate of -2.215 in column (3), and indicates that employing multiple interest rates does not have a major influence on our results.[29]

Inference We have also considered a range of alternative assumptions on the error term, as this might affect inferences. Our analysis encompasses two-way clustering as well as spatial Conley (1999) standard errors, see Table A.2. We estimate that foreign institutions have significantly lowered Chinese interest rates under a range of assumptions including quite conservative ones.

4.3 Foreign Institutions, Chinese Firm Growth, and Investment

While the previous section has examined the impact of foreign institutions on interest rates, here we focus on their impact on the creation and investment of Chinese firms. See Table 5 for results.

[29]The results also confirm that the multiple interest rates for a given prefecture-year combination are strongly correlated

Table 5: The Impact of Foreign Institutions on Chinese Firms

	(1) Banks	(2) Firms	(3) Investment	(4) Steam Eng's	(5) Adv. Machinery
For. Institutions	0.233**	0.218**	0.155**	0.085*	0.168*
	(0.091)	(0.054)	(0.052)	(0.039)	(0.072)
N	15,442	15,442	15,442	15,442	15,442
R^2	0.727	0.419	0.160	0.420	0.445

Notes: Dependent variable given on top of column, in ln(x+1); estimation by OLS. For. Institutions is an indicator variable equal to one if a region has at least one treaty port or consulate in this year, and zero otherwise. All specifications include prefecture and year fixed effects, as well as geo-trends. IPWRA is applied. Robust standard errors clustered at the prefecture-level in parentheses. **/*/+ means significant at the 1%/5%/10% level.

We begin by asking whether foreign influence contributed to the development of a modern Chinese banking system. The results show that foreign institutions have a positive impact on the number of modern Chinese banks (column (1)). Next, we see that foreign influence also led to more modern Chinese firms, and there is also evidence that foreign influence raises capital investment (columns (2) and (3), respectively).

We have also information on the proliferation of steam engines and other advanced machinery in China during the sample period. According to our results in Table 5, foreign institutions have a positive impact on the adoption of steam engines and advanced machinery (columns (4) and (5), respectively). Quantitatively, if a region hosts a treaty port the effect of this on the number of modern firms in the region is about four times the average number of modern firms per region in China, and it increases the number of modern firms by about 70% of the standard deviation of the number of firms.

Overall, we find that foreign influence has accelerated the creation of modern Chinese firms and their investment activities during the 19th century. This broadens the evidence that foreign influence has increased Chinese economic performance beyond our findings on the impact of foreign influence on Chinese interest rates above in an important way.

4.4 Which Foreign Institution is Most Important?

Our analysis so far has not distinguished the type of foreign institution in a particular region of China. This section examines the impact of several different foreign institutions in order to see whether we can identify their relative importance. Table 6 shows the results.

with each other.

Table 6: Trade, Legal, and Other Foreign Influences

	(1)	(2)	(3)	(4)	(5)	(6)
Treaty Port	-1.674^{**}				1.856^{**}	
	(0.548)				(0.671)	
Customs		-1.548^{**}				0.858
		(0.595)				(0.556)
Consulate			-3.149^{**}		-4.555^{**}	-4.782^{**}
			(0.478)		(0.622)	(0.575)
Prot. Missionary				-0.286		
				(0.981)		
R^2	0.163	0.162	0.165	0.162	0.165	0.165

Notes: Dependent variable is interest rate; estimation by OLS. Treaty port is an indicator variable that the region has one or more treaty ports; Customs is an indicator variable that the region has one or more CMC customs stations, and Consulate is an indicator variable that the region has one or more consulates; Prot. Missionary is the fraction of counties in the region that have Protestant missionaries. All regressions include year, prefecture-grain, and weather fixed effects, as well as geo-trends. IPWRA applied. N = 64,627. Robust standard errors clustered at the prefecture-grain level in parentheses. **/*/+ means significant at the 1%/5%/10% level.

We begin with the indicator treaty port variable. Opening a treaty port in a region leads to an average decline in the interest rate of about 1.7 percentage points (Table 6, column (1)). Operating customs leads to a decline of the local interest rate of about 1.5 percentage points, see column (2). Since the set of regions that hosted customs operations is a subset of the open treaty ports, this suggests that while the customs system is important some part of the impact of foreign institutions in the region is due to other elements of treaty ports. Furthermore, the results show that one or more foreign consulates lowers local interest rates by about 3.1 percentage points (column (3)). Since all three variables are indicator variables, these results provide evidence that the impact from consulates is somewhat higher than that from treaty ports or their customs systems.

In addition to these institutions, we also consider the influence of Protestant missionaries for local economic development. We see that regions with strong Protestant missionary activity tend to have lower interest rates, although not significantly so (column (4)). We conclude that during the 19th century, legal and trade institutions had a stronger impact on local capital markets than Protestant missionaries.

Next, we include the treaty port variable together with the consulate indicator. The consulate coefficient is now -4.6 versus -3.1 when included by itself, while the treaty port variable has a positive sign (see column (5)). This suggests that legal influence associated with consulates was stronger than the impact of

trade institutions, and the point estimates in column (5) reflect the positive correlation between locations in which consulates and treaty ports were present (correlation of 0.8). Similar results are obtained when consulate and customs variables are included in the same specification (column (6)). We will return to separating the impacts of trade and legal institutions when analyzing the geography of these effects, see section 4.6 below. We have also considered to account for the number of foreign consulates in a region, finding that this is not superior to the consulate indicator variable (see Table A.4).

We have seen above that the influence of foreign institutions has stimulated the creation of modern Chinese banks, firms, and their investments (Table 5). Here we ask whether different forms of foreign institutions matter for these impacts, see Table 7. The impact on Chinese banks seems to come roughly equally from both trade and legal institutions, see column (1). In contrast, trade but not legal institutions impact the growth of modern firms in China, see column (2). Furthermore, trade institutions have also a relatively important positive impact on firms' investment and the machinery they employ (columns (3), (4), and (5)).

Table 7: Foreign Trade, Courts, and Chinese Firms

	(1) Banks	(2) Firms	(3) Investment	(4) Steam	(5) Adv. Machinery
Treaty Port	0.181	0.251**	0.207*	0.147*	0.181+
	(0.113)	(0.078)	(0.090)	(0.066)	(0.095)
Consulate	0.132	0.066	0.039	−0.027	0.047
	(0.093)	(0.058)	(0.061)	(0.050)	(0.071)
R^2	0.730	0.434	0.163	0.430	0.453

Notes: Dependent variable is given on top of column; in form ln(x+1); estimation by OLS. Steam is the number of steam engines. Treaty port is an indicator variable that the region has one or more treaty ports and Consulate is an indicator variable that the region has one or more consulates; All regressions include year and prefecture fixed effects, as well as geo-trends. IPWRA applied. N = 15,442. Robust standard errors clustered at the prefecture level in parentheses. **/*/+ means significant at the 1%/5%/10% level.

The relatively strong role of legal institutions for bank creation may be because legal institutions play a relatively central role in capital market transactions, in line with the relatively strong impact of legal institutions on local interest rates we have seen above. At the same time, a reason why domestic firm growth is more strongly affected by treaty ports rather than foreign consulates could be learning spillovers from foreign firms that are located in treaty ports.[30] Overall, our findings on the relative importance of specific institutions for certain aspects of China's economic performance in Tables 6 and 7 are in line what

[30]See Keller (2010) on the evidence of such FDI spillovers in contemporaneous settings.

one might have expected.

4.5 Mechanisms of Legal and Trade Institutions

This section seeks to examine further how foreign institutions exerted their influence by exploiting variation across China's regions as well as across foreign countries. We begin with the impact of legal institutions centered on consulates.

4.5.1 Legal Institutions

Legal Origins La Porta, Lopez-de-Silanes, and Shleifer (2008) have employed cross-country analysis to study the economic consequences of differences in the historical origin of legal systems. Along these lines, we distinguish the impact of legal institutions in China from countries with four different legal origins: English, French, German, and Scandinavian.[31] Table 8 shows the results.

Introducing the four legal origins indicator variables separately as well as jointly, there is evidence that English legal origin has a stronger interest rate-lowering effect than German or French legal origins (columns (1) to (4) and column (5), respectively, Table 8). This is consistent with the findings of a primacy of English legal origins by La Porta, Lopez-de-Silanes, and Shleifer (2008). At the same time, we continue to estimate a negative consulate coefficient, which provides evidence that legal institutions matter independent of legal origins; see columns (6) and (7).[32]

Dimensions of Extraterritoriality This section seeks to link the influence of legal institutions to particular aspects of extraterritoriality that foreign countries implemented in China. Consider the score of country c's legal institutions in dimension d at time t, S^d_{ct}, where the dimensions d = *Appeals, Prisons, Scope, Assessor* are discussed in section 2.2.1 above. For each dimension, let $S^{max,d}$ indicate the maximal value of the score, and let $I^{d,max}_{it}$ be an indicator variable that region i in year t has consulates from all foreign countries that have the highest score in terms of dimension d, and zero otherwise. A value of $I^{d,max}_{it}$ equal to one indicates that this region is exposed to a particularly large legal influence in terms of dimension d. For example, there is one country with the highest score on the Assessor dimension in the

[31] In the present case, of English origin are Great Britain and the US; of German origin are Germany (including consulates from Prussia, Saxony), Austria, and Japan, while Norway, Sweden, and Denmark are of Scandinavian origin. All other countries having consulates in China have a system of French legal origin.

[32] The latter specification addresses correlation among the right hand side variables.

Table 8: Impact of Legal Origins

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
English Legal Origins	-4.560^{**}				-6.183^{**}	0.035	
	(0.607)				(0.789)	(1.558)	
Only English Legal Origins							-3.069^{**}
							(0.619)
French Legal Origins		0.360			2.236*	3.989^{**}	
		(0.686)			(0.951)	(0.970)	
Only French Legal Origins							−1.331
							(1.220)
German Legal Origins			−0.209		1.335	1.399	
			(0.700)		(0.892)	(0.873)	
Scandinavian Legal Origins				−0.580	−0.771	-1.859^{+}	
				(0.818)	(1.018)	(1.012)	
Treaty Port	1.693*	-1.795^{**}	−1.60*	−1.489*	1.915^{**}	2.641^{**}	2.158^{**}
	(0.660)	(0.678)	(0.652)	(0.657)	(0.687)	(0.643)	(0.661)
Consulate						-7.201^{**}	-3.702^{**}
						(1.591)	(0.653)

Notes: Dependent variable is interest rate; estimation by OLS. Specifications include indicator variables for consulates of a particular legal origin. Treaty port is an indicator variable that the region has one or more treaty ports, and Consulate is an indicator variable that the region has one or more consulates. Only English (French) Legal Origin is an indicator variable that a region has one or more consulates from a country of English (French) legal origin but no consulates from countries with other legal origin. All regressions include year, prefecture-grain, and weather fixed effects, as well as geo-trends. IPWRA applied. N = 64,627. Robust standard errors clustered at the prefecture-grain level in parentheses. **/*/+ means significant at the 1%/5%/10% level.

late 1870s, namely Great Britain. A region that has a British consulate in the late 1870s has the value $I_{it}^{d,max} = 1$ for d = Assessor, and zero otherwise. Recall from Figure 3 that there is substantial variation in these dimensions of extraterritorialty even for countries that have the same legal origin.

Table 9 reports results from specifications that add the indicator variable $I_{it}^{d,max}$ to equation (1) in columns (1) to (4). All specifications include the Treaty Port and Consulate variables so that the specifications identify an additional effect associated with a particular legal dimension.

We see that regions with consulates from countries that have a strong appeals process do not have significantly lower interest rates, versus the presence of a foreign consulate in general (see column (1), Table 9).[33] Consistent with an additional interest rate-lowering effect, the coefficient on legal scope is negative, although not significantly so (column (2)).

[33] As before, the Treaty Port coefficient is positive, reflecting the correlation between treaty port and consulate locations.

Table 9: Legal Mechanisms of Extraterritoriality

	(1)	(2)	(3)	(4)	(5)	(6)
Appeals	1.962^{**}					
	(0.749)					
Scope		-0.414				
		(1.027)				
Prisons			-1.939^{*}			
			(0.940)			
Assessors				-1.363^{+}		
				(0.726)		
Max 4 Dimensions					-3.178^{**}	
					(0.715)	
Sum Legal Max						-1.855^{**}
						(0.556)
Treaty Port	1.996^{**}	1.801^{**}	1.671^{*}	1.783^{**}	1.962^{**}	1.972^{**}
	(0.690)	(0.687)	(0.680)	(0.670)	(0.652)	(0.653)
Consulate	-5.740^{**}	-4.453^{**}	-4.199^{**}	-4.108^{**}	-2.570^{**}	1.922
	(0.830)	(0.697)	(0.681)	(0.684)	(0.577)	(1.978)

Notes: Dependent variable is interest rate; estimation by OLS. Treaty port is an indicator variable that the region has one or more treaty ports, and Consulate is an indicator variable that the region has one or more consulates. All regressions include year, prefecture-grain, and weather fixed effects, as well as geo-trends. IPWRA applied. N = 64,627. Robust standard errors clustered at the prefecture-grain level in parentheses. **/*/+ means significant at the 1%/5%/10% level.

Regions with consulates from countries that operated their own prisons in China had significantly lower interest rates than other regions, as shown in column (3).[34] This suggests that demonstrating that a country's national who was sentenced for wrongdoing would be imprisoned in China was an important aspect of the foreign country's legal influence in China. Finally, we find that the policy of certain foreign countries to always send assessors to assist their nationals in the Chinese or mixed court was important. Regions with such legal institutions had interest rates that were about two percentage points lower than in other regions of China, and this is on top of the broader consulate effect which lowers interest rates by about 1.4 percentage points (see Table 9, column (4)).

An alternative definition of maximal legal influence is that a region included at least one consulate with the highest score, from whatever foreign country, for each of the four legal dimensions. This variable is denoted by *Max 4 Dimensions* in Table 9, and we see that regions exposed to such strong legal influence in

[34]These countries are Japan, France, Great Britain and the United States.

all four dimensions have interest rates that were about three percentage points lower (column (5)). Finally, we define the variable *Sum Legal Max* as number of dimensions for which there is maximal legal influence in the region from at least one consular court; this variable ranges from 0 to 4. The specification yields a coefficient of -1.8 to this variable (column (6)). This means that on average, every additional dimension of maximal legal influence in a region lowers the local interest rate by 1.8 percentage point. This finding is important because it indicates that not only do region subject to foreign legal influence have lower interest rates, but the stronger the legal influence is, the better is the local economic performance in the sense of lower interest rates.

Another important finding is that once we have modeled the degree of extraterritorial rights of foreign countries, there is no longer a general effect from legal institutions; rather, the Consulate coefficient is insignificant, see column (6). This means that we have successfully unpacked the legal institutions effect. Our analysis goes beyond the legal origins explanation because countries with the strongest extraterritorial rights in China do not include only countries of English but also of other legal origins. Consistent with this, we show that even though some foreign countries were more present in China than other countries, the legal institutions effect shown in Table 9 is not due any single particular country (see Table A.5).

4.5.2 Trade Institutions

This section seeks to better understand the nature of the trade institutions effect by using figures on trade at the level of each port and foreign country. Table 10 shows the results. We begin by asking whether regions with CMC ports whose trade focuses on particular foreign countries exhibit a significantly different economic performance from other regions. To do so we define for the countries that traded most with China during the sample period a variable that interacts the customs variable with an indicator, I_{ic}, that a particular port hub for foreign country c, where hub is defined as the port being in the top tercile of port shares for country c

$$Customs_{it} \times I_{ic}.$$

Importantly, this indicator variable I_{ic} indicates a concentration of country c's foreign trade with China in region i relative to country c's overall share of China's foreign trade. For example, across all ports over the 19th century, Britain accounts for about two thirds of all imports, and I_{ic} is equal to one for $c =$

Great Britain for regions whose ports have a British share of more than 76% of all China imports. We see that if a port has a relatively high import share from Britain this leads to lower interest rates (Table 10, column (2)). There is also evidence that regions with a disproportionately large share of US trade have lower interest rates (see column (3)). Care has to be taken in interpreting these results however since the (overall) customs coefficient is now positive, which may reflect the correlation between the regressors.

Table 10: Trade Mechanisms

	(1)	(2)	(3)	(4)	(5)
Customs	-1.548^{**}	-0.985	2.206^{*}	1.568^{+}	-0.312
	(0.595)	(0.527)	(0.895)	(0.903)	(0.659)
British Hub		-2.415^{**}	-3.654^{**}	-2.301^{+}	
		(1.362)	(1.076)	(1.361)	
US Hub			-4.536^{**}	-3.094^{**}	
			(1.013)	(0.881)	
German Hub				-0.763	
				(1.235)	
French Hub				-6.792^{**}	
				(1.985)	
Russian Hub				5.309^{**}	
				(1.374)	
Low Trade Share					-4.775^{**}
					(1.028)

Notes: Dependent variable is interest rate; estimation by OLS. Customs is an indicator variable that the region has one or more CMC customs houses. All regressions include year, prefecture-grain, and weather fixed effects, as well as geo-trends. IPWRA applied. N = 64,627. Robust standard errors clustered at the prefecture-grain level in parentheses. **/*/+ means significant at the 1%/5%/10% level.

Accounting as well for German, French, and Russian trade hubs, we obtain negative coefficients for the US, France, and (marginally) the UK, while the Russia Hub coefficient is positive (column (4)). This is consistent with a stronger positive impact from US and French compared to Russian institutions, although it could also reflect to some extent regional heterogeneity given that Russia's trade, for example, is concentrated towards its own border with China.

We have also examined whether the impact of trade institutions varies depending on the volume of trade. Ports such as Shanghai and Canton account for more than 10% of China's foreign imports, while other ports account for substantially less than 1%. Employing an indicator variable for ports that are in the lowest quartile in the share of China's foreign imports, we estimate that CMC customs houses in such regions lead

to significantly lower interest rates compared to other regions (column (5)). This is consistent with the hypothesis that foreign trade institutions are particularly important in improving the performance of local capital markets in treaty ports that are not particularly large and do not have many foreign consulates.

4.6 The Geographic Scope of Foreign Institutions

In this section we examine the geographic scope of foreign institutional impact in China. Our approach, illustrated in Figure 4 above, is to form circular bands (or, donuts) at certain distances around locations of foreign influence in China, and include these terms to our estimating equation:

$$r_{igt} = \beta_1 CON_{it} + \beta_2 \left[CON_0_200\right]_{it} + \beta_3 \left[CON_200_400\right]_{it} + \beta' X + \theta_{ig} + \mu_t + \varepsilon_{igt},$$

where CON_{it} indicates at least one foreign consulate in region i and year t, while $\left[CON_0_200\right]_{it}$ is an indicator for at least one foreign consulate in the distance bracket from 0 to 200 kilometers, $\left[CON_200_400\right]_{it}$ is for the distance bracket from 200 to 400 kilometers, etc. Table 11 shows the results.

We see that a consulate in the first distance bracket, from zero to 200 kilometers, leads to a significantly lower interest rate in addition to the consulate in the prefecture itself (column (1)). Furthermore, the coefficient on the (0, 200) distance bracket is comparable in size to that of the prefecture with the consulate itself. Adding the (200, 400) distance bracket yields a coefficient of about -0.8 (Table 11, column (3)). This decay of the interest rate effect with geographic distance is plausible not only because capital market transactions become less frequent with geographic distance since distance is an important barrier to the mobility of people, but also because because the diffusion of ideas that can be pinned to foreign consulates is well-known to be geographically localized. [35] For consulates at distances between 400 and 600 km, the point estimate is smaller again than at the previous distance bracket, and the impact on local interest rates is not significant anymore (column (4)).

The following columns show analogous results on the geographic scope of the treaty port effect on local capital markets. At a distance between zero and two-hundred kilometers, a treaty port lowers interest rates on average by about 2.5 percentage points (column (4)). Note that this point estimate is larger

[35] See Jaffe, Henderson, and Trajtenberg (1993) and Keller (2002) on geographic localization of technology diffusion.

Table 11: Geographic Spillovers

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Consulate	-3.317^{**}	-3.323^{**}	-3.323^{**}				-4.356^{**}		
	(0.498)	(0.472)	(0.499)				(0.633)		
Consulate [0,200]	-2.893^{**}	-2.946^{**}	-2.957^{**}				-1.993^{**}	-2.216^{**}	
	(0.369)	(0.376)	(0.377)				(0.443)	(0.443)	
Consulate [200, 400]		-0.780^{**}	-0.765^{**}				-0.269	-0.243	
		(0.276)	(0.274)				(0.300)	(0.295)	
Consulate [400,600]			-0.358						
			(0.335)						
Treaty Port				-2.100^{**}	-2.111^{**}	-2.111^{**}	1.210^{+}		
				(0.573)	(0.575)	(0.575)	(0.680)		
Treaty Port [0,200]				-2.518^{**}	-2.588^{**}	-2.585^{**}	-1.182^{**}	-1.001^{*}	
				(0.382)	(0.387)	(0.394)	(0.438)	(0.437)	
Treaty Port [200, 400]					-0.933^{**}	-0.939^{**}	-0.840^{*}	-0.836^{*}	
					(0.302)	(0.297)	(0.336)	(0.335)	
Treaty Port [400, 600]						0.043			
						(0.331)			
Treaty Port or Consulate								-2.508^{**}	-2.365^{**}
								(0.490)	(0.482)
Treaty Port or Consulate [0,200]									-2.987^{**}
									(0.373)
Treaty Port or Consulate [200, 400]									-0.969^{**}
									(0.295)

Notes: Dependent variable is interest rate; estimation by OLS. Consulate is an indicator variable equal to one if region has at least one foreign consulate, zero otherwise. Treaty Port is an indicator variable equal to one if a region has at least one treaty port, zero otherwise. Variables with number range [x,y] are indicator variables for concentric distance bands of [x,y[kilometers, see text. All regressions include year, prefecture-grain, and weather fixed effects, as well as geo-trends. IPWRA applied. N = 64,627. Robust standard errors clustered at the prefecture-grain level in parentheses. **/*/+ means significant at the 1%/5%/10% level.

(in absolute value) than the point estimate in the treaty port location itself (2.1, versus 2.5). This is the opposite of the case of legal institutions (see column (1)), and suggests that the impact of trade institutions is more geographically diffuse than that of legal institutions. Adding treaty ports at a distance between 200 and 400 kilometers to the specification, we obtain a point estimate of -0.93 at this distance, indicating that a treaty port at a distance of up to 400 km away lowers local interest rates on average by close to one percentage point. As in the case of legal institutions, we do not estimate a significant interest-rate effect from treaty ports at a distance range of 400 to 600 kilometers (column (6)).

An important implication of these results in Table 11 is that a simple place-based approach that contrasts regions that have foreign institutions with regions that do not have such institutions–such as the case of consulates in Figure1 –overestimates the extent to which treated and control regions are exposed to a different levels of foreign influence. Because the impact of foreign influence exhibits geographic decay, this is particularly true for adjacent regions. Furthermore, notice that the point estimates for a given distance are quite stable as additional distance bands are included. This indicates that that spatial effects of foreign influence are captured relatively well by this donut approach.

And yet, these results are preliminary because they do not account for the fact that often treaty ports and consulates were located in the same regions. Thus, the estimate of -0.78 for consulates at distances of 200 to 400 kilometers in column (2), for example, is likely to pick up as well the influence of treaty ports at distance of 200 to 400 kilometers away. To separate the respective effects we include separate indicator variables for consulate and treaty port, as before, and also separate spillover variables for both consulates and treaty ports at different distances. This yields a coefficient of -4.4 on consulates, while the treaty port indicator is positive at 1.2, see column (7). This reflects the fact, also noted above, that the correlation between treaty port and consulate locations makes the own-prefecture effect challenging to estimate.

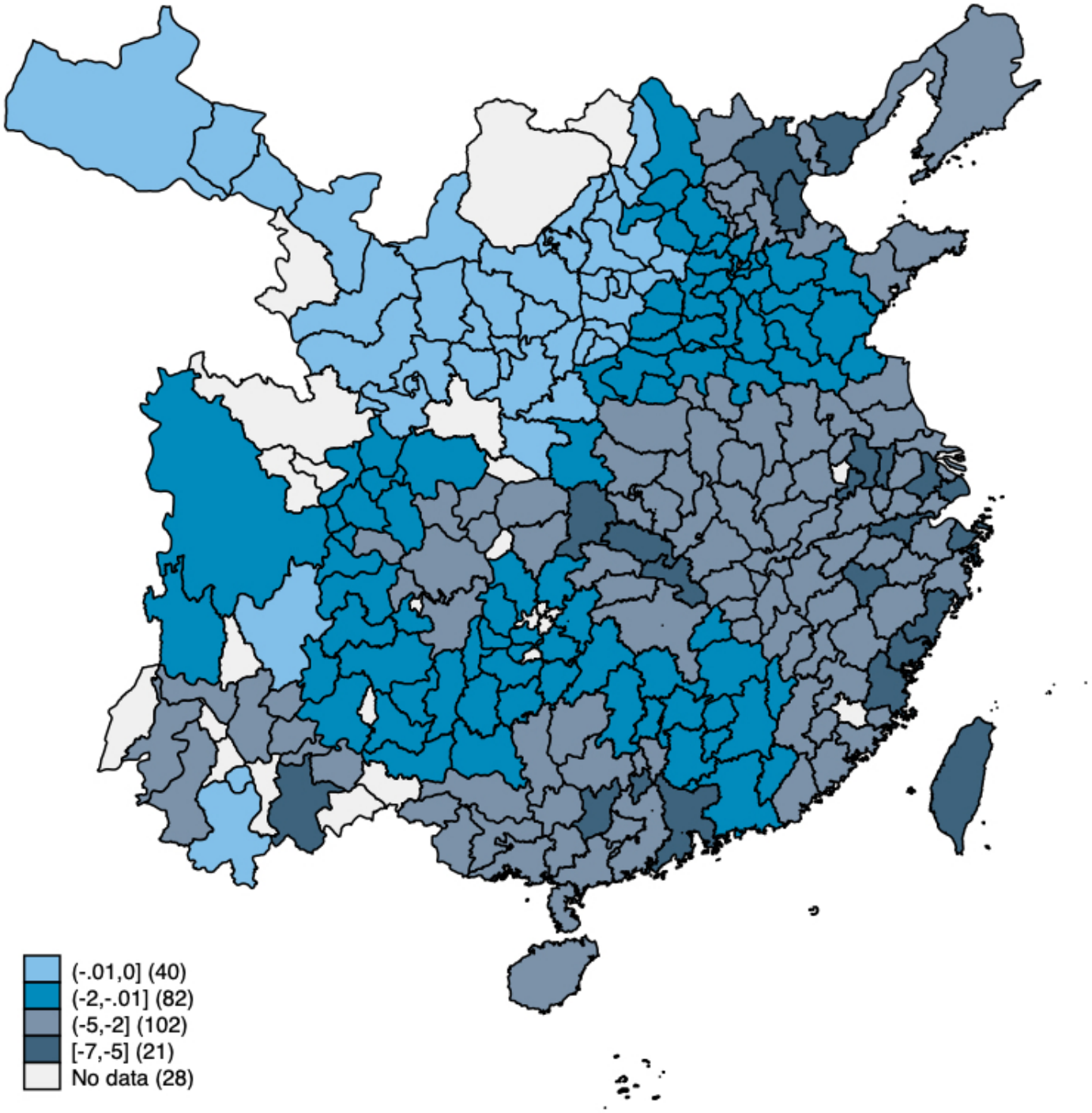
To address this issue we define another indicator variable which is equal to one if a region has either at least one consulate *or* a treaty port in a given year, and zero otherwise. Column (8) in 11 shows that this variable comes in with a coefficient of -2.5, between the results for treaty ports and consulates included individually (-1.7 and -3.1, respectively, see Table 6. If a region is home to either a treaty port or at least one foreign consulate, this lowers local interest rates by 2.5 percentage points. In addition, up to a distance of 200 kilometers, a treaty port lowers interest rates by about 1 percentage point while a consulate reduces interest rates by more than 2 percentage points (column (9)). For distances between 200

and 400 kilometers, treaty ports reduce local interest rates by another 0.8 percentage points, in contrast to consulates for which we do not estimate an effect at 200 to 400 km distances (column (8)). These results suggest that while the impact of legal institutions is stronger than that of trade institutions, the latter has a geographically further reach of up to 400 kilometers. The individual effects can be estimated because as distance from the treaty port and consulate location increases there is more and more variation in treaty port versus consulate location.

We have also employed a treaty port or consulate indicator variable at distances zero to 200, and 200 to 400 kilometers. Our findings are consistent with earlier findings, see column (9). Furthermore, these results are broadly confirmed for a range of alternative specifications, including standard errors adjusting for spatial correlation as well as geographic subsamples (see Table A.6).

Projecting the results of specification (8) on a map of China yields the following Figure 8.

Figure 8: The Impact of Western Institutions on Chinese Capital Markets



Notes: Figure gives predicted effects of the analysis underlying Table 11, column (8) for the late 19th century. First parentheses gives the range of the interest rate reduction (in percentage points), second parentheses reports the number of prefectures in the particular interest rate reduction bin.

Figure 8 indicates the foreign influence on China's economy using different colors, with darker colors

indicating stronger influence. The findings are in line with conventional wisdom that Chinese regions with high foreign influence include the coastal regions of the Southeast, the Yangzi delta, as well as the area around Beijing. In these areas, the combined impact of trade and legal institutions can bring down local interest rates substantially, in some cases by five percentage points or more.

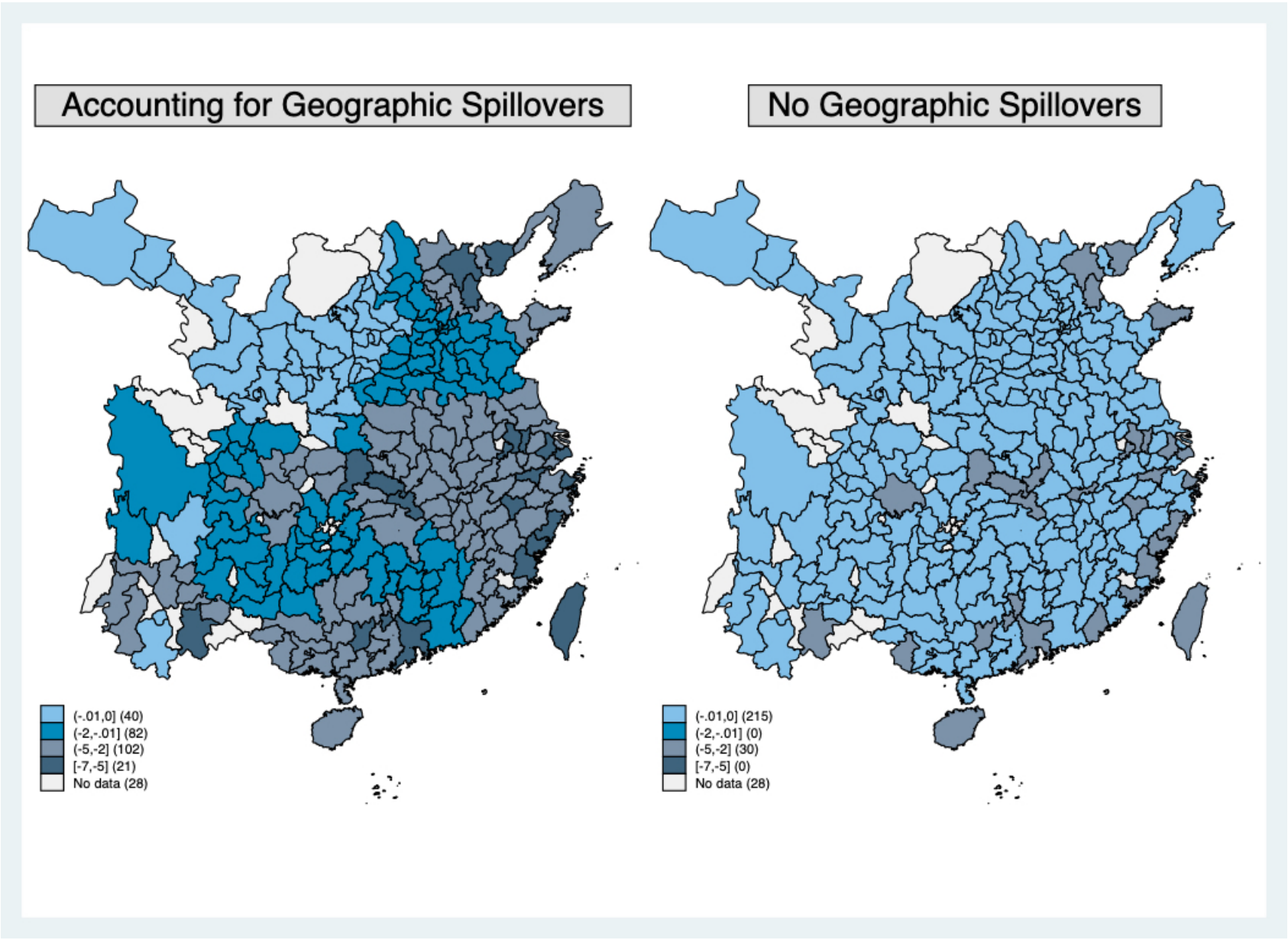
At the same time, Figure 8 shows that foreign influence has gone well beyond these areas. In fact, only 16% of all Chinese regions–40 out of 245 prefectures in our analysis, mostly in China's North and West–have not been significantly affected.[36] According to Figure 8, most of China's regions have been exposed to Western influence, and for 60% of the regions the influence was with upwards of two percentage points relative to an interest rate average of roughly eight percent–see Figure 5–quantitatively important.

It is worth noting that these findings are based on employing a particular regional level of aggregation, prefectures, and these can be sizable. At the same time, accounting for regional population differences would not weaken our findings because China's Northwest is not disproportionately populated. Particulars of the spillover regression–for example employing specification (9) instead of (8) in Table 11, or one-hundred versus two-hundred kilometer spillover bands–influence the rendering of Figure 8 but they do not change its main message.

This is because the finding that Western institutions indeed affected large parts of China is the result of estimating spatial spillovers rather than conducting the traditional point-based analysis. This is best seen by comparing our spillover analysis with a point-based analysis side by side, see Figure 9.

[36]These calculations do not account for a number of regions not included in our analysis due to data limitations.

Figure 9: Western Influence in China: The Role of Spatial Spillovers



Notes: Left panel gives predicted effects of the analysis underlying Table 11, column (9) for the late 19th century. Right panel gives prediction for the late 19th century when only the *Treaty Port or Consulate* variable (Table 11, column (9)) is included but not the spillover variables. First parentheses gives the range of the interest rate reduction (in percentage points), second parentheses reports the number of prefectures in the particular interest rate reduction bin.

The left side of Figure 9 shows our results based on specification (9) of Table 11. While in a given region the impact of Western institutions can differ depending on whether we estimate separate spillover effects for trade versus legal institutions or not, Figure 9 confirms that the overall impact is similar either way (compare left panel of Figure 9 with Figure 8).

On the right side in Figure 9 we see the results from a more traditional point-based analysis, which allows Western institutions to have an impact only in the particular region where it is located. Then, as the figure indicates, one might easily adopt the conventional view that Western influence in China was limited because it was present in only a handful of typically isolated locations. Abstracting from spatial spillovers, the large majority of China, 88% of all regions, is not subject to Western influence (right side of Figure 9). This is the first way the point-based approach underestimates the influence of Western countries in China during the 19th century. Second, abstracting from geographic spillovers also underestimates Western influence in the treaty ports and consulate locations themselves. As Figure 9 shows, the point-based approach (on the right) appears to underestimate the Western impact in regions such as Guangdong and Shanghai because it does not factor in the reinforcing effects from areas of foreign influence in surrounding areas.

Overall, once the geographic scope of foreign influence on Chinese capital markets in the 19th century is taking into account, undoubtedly one finds that the effects went far beyond the treaty ports and consulate locations.

5 Conclusions

This paper has studied the economic consequences of the West's foray into China after the Opium War (1840-42), when Western institutions were introduced in dozens of cities, including treaty ports. We have shown that Western countries had a positive impact on China's economy. Regions with Western influence exhibited a higher rate of growth of modern firms with their investment into advanced machinery as well as steam engines, and such regions also saw a disproportionate creation of modern Chinese banks. Furthermore, Western influence brought down local interest rates by almost a quarter, with much of this effect due to Western institutions providing enhanced security and lower risk as opposed to additional capital.

Both legal institutions centered on the consular courts and trade institutions associated with the Western-led customs system played a role in this, and we find that firm growth, investment, and technology adoption were closely affected by trade institutions while legal institutions played a stronger role for banks and capital market performance. The analysis also assesses the importance of individual elements of extraterritorialty in China with respect to its scope, appeal process, court proceedings and sentencing, finding the latter two of particular importance.

We demonstrate that the geographic scope of influence went far beyond the immediate vicinity of treaty ports, customs houses, and Western consulates. Both trade and legal institutions exerted their positive influence in Chinese areas up to 400 kilometers away from the ports and courts. While the results depend to a certain degree on the specifics of the analysis, there is little doubt that the West's foray into China after the Opium War influenced a large part, and perhaps the majority, of China.

The positive economic consequences of the Opium War that we have estimated do not represent the full economic effect on China, because our outcome measures are not something as broad as Gross Domestic Product. Moreover, the positive impact through raising modern firm growth might have been accompanied by the negative effect of declining traditional firms, and we do not capture the latter. Could the net impact on China's economy have been negative? Recall that the cost of capital has increased in China during most of the 19th century. One may be tempted to attribute that to the Western intrusion of China, however, as Figure 5 shows, regions with strong Western influence were to some extent able to buck this trend. This is inconsistent with the hypothesis that Western influence caused the deterioration of Chinese capital markets. The net impact on China's economy was positive.

References

[1] Abadie, Alberto, Susan Athey, Guido Imbens, and Jeffrey Wooldridge (2017), "When Should You Adjust Standard Error for Clustering?", NBER working paper # 24003.

[2] Acemoglu, Daron, Simon Johnson, and John Robinson (2001), "The Colonial Origins of Comparative Development: An Empirical Investigation," American Economic Review, 91(5): 1369–1401.

[3] Acemoglu, Daron, and Simon Johnson (2005), "Unbundling Institutions", Journal of Political Economy Vol. 113(5): 949 – 995.

[4] Bai, Ying, and James Kung (2015), "Diffusing Knowledge while Spreading God's Message: Protestantism and Economic Prosperity in China, 1840-1920", Journal of the European Economic Association Vol. 13(4): 669-698.

[5] Brunero, Donna (2004), Britain's Imperial Cornerstone: The Chinese Maritime Customs Service, 1854-1949. New York: Routledge Curzon.

[6] Cassel, Par Kristoffer (2012), Grounds of Judgment: Extraterritoriality and Imperial Power in Nineteenth Century China and Japan. Oxford Scholarship Online.

[7] Chang, Yu-fa (1992), *Jindai Zhongguo Gongye Fazhan Shi, 1860-1916*. A History of Modern Chinese Industrial Development: 1860-1916. Laureate Press, 1992

[8] Chinese Academy of Social Sciences (2009), *Qingdai Daoguang zhi Xuantong jian liangjiabiao* [Grain price tables for the Qing era between Daoguang to Xuantong], 23 volumes, Guilin: Guangxi shifan daxue chubanshe.

[9] Chinese Maritime Customs (CMC; 1933), "Decennial Reports", various decades, Statistical Department of the Inspectorate General of Customs, Shanghai, 1933.

[10] Chinese Maritime Customs (CMC, n.d.), *Returns To Trade*, annual publication, Statistical Department of the Inspectorate General of Customs, Shanghai, various years.

[11] Chinese Maritime Customs (CMC; 1938), Documents Illustrative of the Origin, Development, and Activities of the Chinese Maritime Customs Service, Vol. 2 Inspector General's Circulars. Shanghai: Statistical Department of the Inspectorate General of Customs.

[12] Chuan, Hang-Sheng, (1969), "The Inflow of American Silver into China from the Late Ming to the Mid-Ch'ing Period", The Journal of the Institute of Chinese Studies of the Chinese University of Hong Kong, 2, 61-75.

[13] Chung, Stephanie Po-yin, (2010), "Chinese Tong as British Trust: Institutional Collisions and Legal Disputes in Urban Hong Kong, 1860s-1980s", Modern Asian Studies, 44(6): 1409-1432.

[14] Coates, P.D. (1988), China Consuls: British Consular Officers, 1843-1943. New York: Oxford University Press.

[15] Conley, Timothy G. (1999), "GMM estimation with cross sectional dependence", Journal of Econometrics 92(1): 1-45.

[16] Dernberger, Robert F. 1975. "The Role of the Foreigner in China's Economic Development", in China's Modern Economy in Historical Perspective, edited by Dwight H. Perkins. Stanford: Stanford University Press.

[17] Engerman, Stanley and Kenneth Sokoloff (2002), "Factor Endowments, Inequality, and Paths of Development Among New World Economies," NBER WP 9259.

[18] Fama, Eugene and Kenneth French (1988), "Business Cycles and the Behavior of Metals Prices," Journal of Finance 43: 1075-1093.

[19] Fairbank, John (1978), "The Creation of the Treaty System" in The Cambridge History of China, Vol. 10 Late Ch'ing, 1800-1911, Part I, edited by Denis Twitchett and John K. Fairbank.

[20] Fetzer, Thiemo (2020), "Conley Spatial HAC Standard Errors for Models with Fixed Effects", http://www.trfetzer.com/conley-spatial-hac-errors-with-fixed-effects/, accessed September 8, 2020.

[21] Feuerwerker, Albert (1983), "The Foreign Presence in China", in The Cambridge History of China, Vol. 12, Republican China 1912-1949, Part 1. Edited by John K. Fairbank and Denis Twitchett.

[22] Feyrer, James, Erin Mansur, and Bruce Sacerdote (2017), "Geographic Dispersion of Economic Shocks: Evidence from the Fracking Revolution", American Economic Review.

[23] Hao, Yen-p'ing (1986), The Commercial Revolution in Nineteenth-century China: The Rise of Sino-Western Mercantile Capitalism. Berkeley: University of California Press.

[24] Hou, Chi-ming (1965), Foreign Investment and Economic Development in China 1840-1937. Cambridge, MA: Harvard University Press.

[25] Hsiao, Liang-lin (1974), China's Foreign Trade Statistics, 1864-1949. Cambridge, MA: East Asian Research Center Harvard University.

[26] Jia, Ruixue (2014), "The Legacies of Forced Freedom: China's Treaty Ports", *Review of Economics and Statistics*.

[27] Jiang Jianqing (2014), *Jindai Zhongguo Yinhangye Jigou Renmin Da Cidian*, Dictionary of modern Chinese banking organizations and people, Shanghai Classics Publishing House, 2014.

[28] Kaldor, Nicholas (1939), "Speculation and Economic Stability," *Review of Economic Studies* 7: 1-27.

[29] Keller, Wolfgang (2010), "International Trade, Foreign Direct Investment, and Technology Spillovers", Chapter 19 in *Handbook of the Economics of Innovation*, B. Hall and N. Rosenberg (eds.), Elsevier North-Holland Publishers.

[30] Keller, Wolfgang (2002), "Geographic Localization of International Technology Diffusion", *American Economic Review* 92(1): 120-142.

[31] Keller, Wolfgang, Ben Li, and Carol H. Shiue (2011), "China's Foreign Trade: Perspectives from the Past 150 Years", *The World Economy* vol. 34(6), pages 853-892.

[32] Keller, Wolfgang, and Carol H. Shiue (2020), "Foreign Trade and Investment", Chapter 12 in *The Cambridge Economic History of China*, Vol. 2, Part 2, 1800-1950, D. Ma and Richard von Glahn (eds.), Cambridge University Press, forthcoming.

[33] Keller, Wolfgang, Carol H. Shiue, and Xin Wang (2020), "Capital Market Development in China and Britain, 18th and 19th Century: Evidence from Grain Prices", forthcoming, *American Economic Journal: Applied Economics*.

[34] Keller, Wolfgang, Carol H. Shiue, and Xin Wang (2019), "Capital markets and grain prices: assessing the storage cost approach", *Cliometrica*, published Dec 6, 2019.

[35] Kirby, William C. (1995), "China Unincorporated: Company Law and Business Enterprise in Twentieth Century China", Journal of Asian Studies 54(1): 43-63.

[36] La Porta, R., F. Lopez-de-Silanes, and A. Shleifer (2008), "The Economic Consequences of Legal Origins", Journal of Economic Literature Vol. 46 (2): 285-332.

[37] Lyons, Thomas P. (2003), China Maritime Customs and China's Trade Statistics, 1859-1948. Trumansburg, NY: Willow Creek Press.

[38] McCloskey, D., and J. Nash (1984), "Corn at Interest: The Extent and Cost of Grain Storage in Medieval England", American Economic Review Vol. 74(1): 174-187.

[39] Mu, Wenying (2001), Jinshang Shiliao Yanjiu, Historical Study of Shanxi Merchants, Shanxi People's Press, 2001.

[40] Murphey, Rhoads (1974), "The Treaty Ports and China's Modernization", in The Chinese City between Two Worlds, Mark Elvin and G. William Skinner (eds.), Stanford University Press.

[41] North, Douglass and Barry Weingast (1989), "Constitutions and Commitment: The Evolution of Institutions Governing Public Choice in Seventeenth-Century England", Journal of Economic History 49(4): 803-832.

[42] Nunn, Nathan (2009), "The Importance of History for Economic Development," Annual Review of Economics, vol. 1(1): 65-92.

[43] Pomeranz, Ken (2000), The Great Divergence, Princeton University Press.

[44] Quigley, Harold Scott (1926), "Extraterritoriality in China", The American Journal of International Law, Vol. 20(1), pp. 46-68.

[45] Rawski, Thomas G. (1970), "Chinese Dominance of Treaty Port Commerce and its Implications, 1860-1875," Explorations in Economic History, 7(4), pp. 451-473.

[46] Remer, Charles F. (1926) The Foreign Trade of China, Shanghai: Commercial Press.

[47] Report (1926), Report of the Commission on Extraterritoriality in China, Peking, September 16, 1926. Government Printing Office, Washington, D.C.

[48] Scully, Eileen P. (2001), Bargaining with the State from Afar. New York: Columbia University Press.

[49] Shiroyama, Tomoko, (2004), "Companies in Debt: Financial Arrangements in the Textile Industry in the Lower Yangzi Delta, 1895-1937". In M. Zelin, J. K. Ocko, and R. Gardella, eds., Contract and Property in Early Modern China. Stanford: Stanford University Press.

[50] Shiue, Carol H. (2002), "Transport Costs and the Geography of Arbitrage in Eighteenth Century China", The American Economic Review, 92(5): 1406-1419.

[51] Shiue, Carol H., and Wolfgang Keller (2007), "Markets in China and Europe on the Eve of the Industrial Revolution", American Economic Review 97(4), pp.1189-1216.

[52] So, Billy K. L. (2011), "Modern China's Treaty Port Economy in Institutional Perspective: An Introductory Essay", Chapter 1 in *The Treaty Port Economy in Modern China*, Billy K. L. So and Ramon H. Myers (eds.), Institute of East Asian Studies, University of California-Berkeley.

[53] So, Billy K. L. So and Ramon H. Myers (2011), *The Treaty Port Economy in Modern China*, Billy K. L. So and Ramon H. Myers (eds.), Institute of East Asian Studies, University of California-Berkeley.

[54] State Meteorological Society (1981), *Zhongguo jin wubai nien hanloa fenbu tuji* [Collected Maps of Droughts and Floods in China in the Past Five Hundred Years], Beijing: Dit chuban she.

[55] Stauffer, Milton T. (1922), *The Christian Occupation of China*, China Continuation Center, Shanghai.

[56] SUFE (1990), Shanxi University of Finance and Economics, Shanxi Piaohao Shiliao, Historical Materials of Shanxi Bank, Shanxi Economy Publishing House, 1990.

[57] Sussman, Nathan and Yishay Yafeh (2006), "Institutional Reforms, Financial Development and Sovereign Debt: Britain 1690–1790", Journal of Economic History 66, 4: 906-935.

[58] Thomson, H.C. (1902), China and the Powers: A Narrative of the Outbreak of 1900. Longmans, Green, and Company.

[59] Willoughby, Westel W. (1920), Foreign Rights and Interests in China. Baltimore: The Johns Hopkins University Press.

[60] Working, Holbrook (1949), "The Theory of the Price of Storage," American Economic Review 39(6): 1254-62.

[61] Yoo, Dongwoo, and Richard E. Steckel (2016), "Property Rights and Financial Development: The Legacy of Japanese Colonial Institutions", Journal of Institutional Economics.

[62] Yunlong, Shen (1986), (ed.), Qing ji zhong wai shi ling nian biao (Tables of Chinese and Foreign Diplomates in the late Qing). Taibei: Wen Hai Chubanshe.

A The Storage Cost Approach to Capital Markets

This section gives an overview of our approach to employing high-frequency grain prices to obtain local interest rates. In a nutshell, the interest rate in a given region and year is obtained as the gradient of the local grain price. This method goes back to Kaldor (1939) and Working (1944) and has been employed in an influential paper by McCloskey and Nash (1984) to estimate medieval interest rates in England. It has been validated by showing that grain-price based interest rates and bank rates yield similar results on the local capital market performance across regions in another 19th century economy, the United States (Keller, Shiue, and Wang 2019). Recently, applying the storage cost approach has revealed that comparative capital market development is a plausible reason for the Great Divergence (Pomeranz 2000) by showing that by the end of the 18th century, Britain had a major advantage over China in this respect (Keller, Shiue, and Wang 2020). Details on the storage cost approach can be found in Keller, Shiue, and Wang (2019).

Consider a merchant living in region i at time t who can buy Q_{it} units of grain from a farmer at price P_{it}. The merchant can store the grain for one period and sell it at time t+1 at a price P_{it+1}. Instead of buying the grain, the merchant can also invest the costs of buying the grain ($P_{it}Q_{it}$) in a risk-free asset and receive $(1 + \varrho_{it})$ times $P_{it}Q_{it}$ at time t+1, where ϱ_{it} is the rate of return on a risk-free asset. The merchant and farmer would contract on an agreement that specifies the merchant's purchase price from the farmer P_{it} as well as the price at which the farmer buys back the grain from the merchant, F^j_{it+1}, where j denotes the particular transaction. The price F^j_{it+1} at which the merchant will store grain, depends on the costs and benefits of grain storage.

We distinguish three types of costs. First, there is the opportunity cost related to the risk-free rate, which captures the fact that if the merchant does not buy grain from the farmer he has an income of no less than $(1 + \varrho_{it}) P_{it}Q_{it}$ at time t+1, whereas if he stores the grain for one period, then no interest is earned. Second, when the merchant stores the grain the potential income is tied up in the granary and subject to risk. In particular, by storing grain the merchant faces the risk that the grain market between t and t+1 does not perform as expected. We denote the interest rate inclusive of risk factors by r^j_{it}, where $r^j_{it} \geq \varrho_{it}$. Third, grain does not store perfectly but is subject to spoilage (mold, mice, etc.). Per-unit storage costs are denoted as c_{it}. The benefit of storage is the value of the marginal unit of grain storage, which is usually

referred to as convenience yield. We denote the convenience yield by b_{it}. Given b_{it} , c_{it}, and r^j_{it}, as well as the current price P_{it}, for the merchant to be indifferent between storing and the alternative investment, the price F^j_{it+1} in the contract between merchant and farmer would have to be

$$F^j_{it+1} = P_{it}\left(1 + r^j_{it} + c_{it}\right) - b_{it}, \tag{3}$$

or, the price specified in the contract has to be such that risk-inclusive interest and storage costs net of convenience yield are covered.

To apply this approach empirically we make a number of assumptions. First, we do not observe the transaction-specific risk for each contract; consequently, the superscript j is dropped and it is assumed that we capture the average level of risk, r_{it} (with $r_{it} \geq \varrho_{it}$). Second, since we do not observe the price F^j_{it+1} in the contract we assume that it is equal to the spot price of grain in period t+1, that is $F^j_{it+1} = P_{it+1}$. Finally, we do not observe the convenience yield, and we assume that b_{it} is zero.

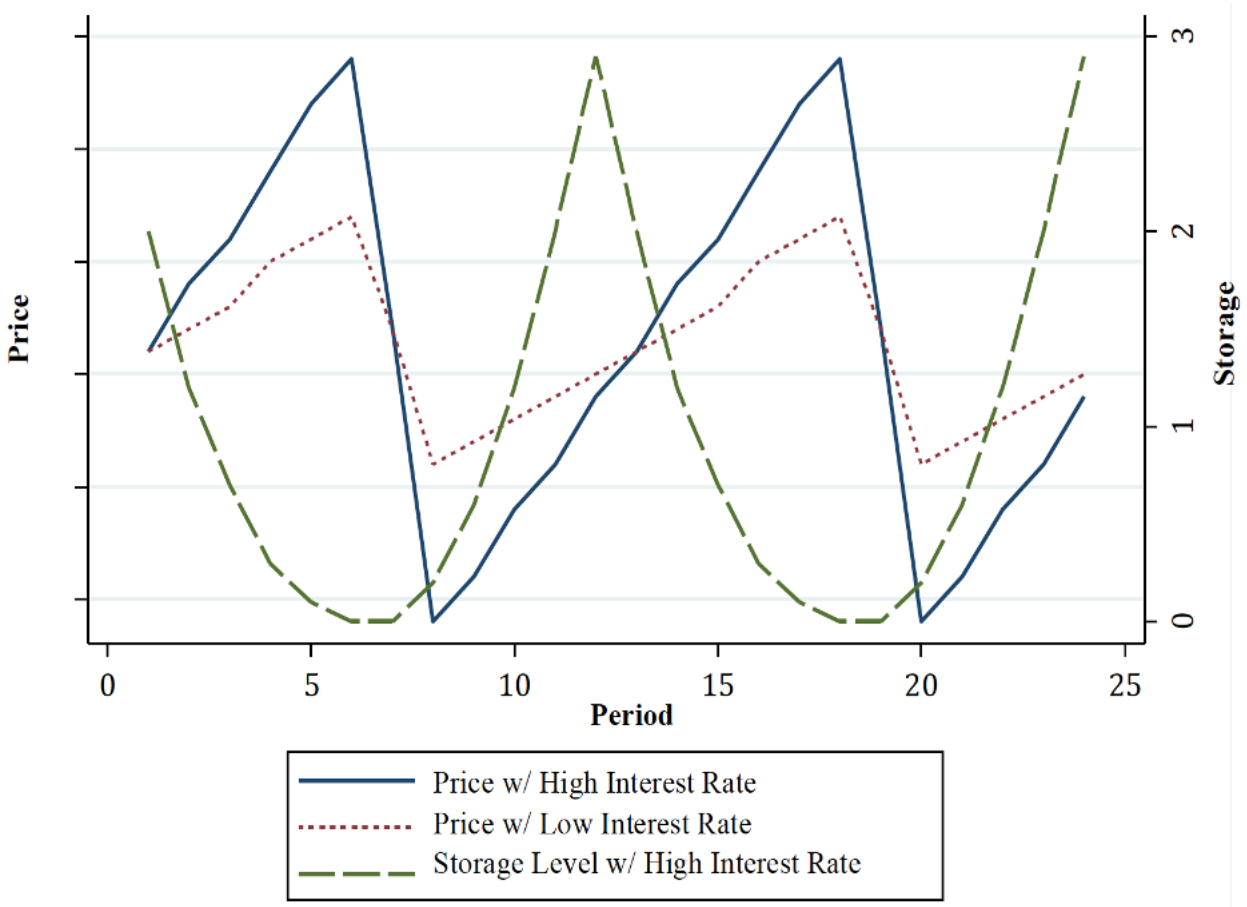
With these assumptions, equation (3) can be rewritten as

$$\hat{p}_{it} \equiv \frac{P_{it+1} - P_{it}}{P_{it}} = r_{it} + c_{it}. \tag{4}$$

Equation (4) shows that in a storage equilibrium the rate of grain price change is equal to the risk-inclusive interest rate r_{it} plus grain-specific storage cost factors, c_{it}. The term $\hat{p}_{it}$ in equation (4) is often referred to as the carry cost of grain.

To characterize the relationship between grain storage and interest rates we employ a standard model of equilibrium commodity storage (see Williams and Wright 1991). The equilibrium storage and pricing behavior of the model is shown in Figure A.1. Beginning with the first price (solid line) we see that upon arrival of the new grain from the harvest, the price falls, reaching a first minimum in period 8. This is the beginning of the new harvest year. The price rises until period 18 when the maximum is reached, and the cycle repeats itself.

Figure A.1: Interest Rates and Grain Prices in a Storage Model



Between period 8 and period 12, storage level and price rise together, while after period 12 the price increase is accompanied by declining storage. The last unit of stored grain is withdrawn just before the new harvest arrives. The new grain supply causes a fall in price; in this way, storage has the consequence of dampening price fluctuations. Figure A.1 shows a second price series, denoted with a dotted line. Notice that it has lower amplitude and is flatter than our earlier price series. This second equilibrium price is computed for a lower interest rate than in the first case, with all else equal. The key result is that the steeper the increase of the price within the harvest year, the higher is the interest rate that agents face. This is the basis for the approach of inferring interest rates from grain prices. In principle, the approach can be applied to other storable commodities. What makes grain particularly attractive in this context is that the see-saw price pattern of Figure A.1 is more discernable for grain than for other commodities given that grain is typically harvested only once per year; furthermore, grain price data (but not prices of

other commodities) is available regionally for our sample at a high-frequency level.

B Grain Price Data

By the beginning of the early 18th century, an extensive network of grain price reports had become a standard and routine aspect of the Qing bureaucracy. The government did not set prices, but compiled voluminous price observations. All prices originally were collected at markets serving the county towns, where the county represented the lowest level of government. Equivalent to the county unit were less common designations—such as the department, autonomous department, or autonomous sub-prefecture. These county reports were made every ten days to a month (Chuan and Kraus 1975), and included not only prices, but also reports on the crop harvest and notes on weather. These price reports were sent to the next higher administrative level, the prefecture, where prefectural officials summarized the county reports. At the prefectural level, the highest and the lowest prices for each of the main crops of the prefecture were recorded. We do not know from which county a particular price came as the county level price records have, for the most part, been destroyed. Today, only the prefectural price summary reports are available. These give the highest and lowest prices in each prefecture, at lunar-monthly intervals. The prices were recorded in copper cash per sheng and converted to silver taels (kuping liang) and bushels (shi). The price reports also record the cash-to-silver exchange rates used. Given the large variations in regional exchange rates, it is reasonable to assume that the local officials, the people who were most intimately familiar with local conditions, were the ones who originally made the conversions.

Historical analysis and empirical studies both suggest that the data on prices are generally of high quality. There are countless examples in the documentary evidence in which government officials refer to the grain prices to infer regional supply and demand, or compare price levels within provinces or across different provinces. These statements by contemporaries would have been completely illogical if people did not regard the prices to be in comparable units of currency from region to region. The price data was not only useful as an early warning system of areas of potential crises to Qing officials, but another practical use of the price records was that the government was a major consumer and purchaser of rice, and thus desired to know where prices were relatively low. According to Wang (2003), the prices collected were wholesale prices, and this is a plausible conclusion as these would have been more easily observable to government

officials. The government would have also directly participated in wholesale markets, rather than in small retail markets. In addition to the regular price reports, a dual system of reporting existed which was less well-known and less systematic, but which nevertheless helped to maintain the accuracy of the regular reporting system. Our own empirical studies have related the grain prices to independently collected information, such as weather shocks (based on historical gazetteer data), and the costs of transportation (based on distance and the location of waterways), and they show that the grain prices are consistent for the 18th century (Shiue 2002, Keller and Shiue 2007).

We use monthly data for 22 different grain price series to compute the within-harvest year price gradient shown in Figure A.1. Our final sample covers regions in 20 provinces and about 240 prefectures of China during the period 1821 to 1900. The sample covers the major centers of residence and economic activity (Xinjiang province is missing). There is information of up to six types of grain in a prefecture, depending on what crops are indigenous for that region and data availability. Wheat and barley are likely seen in the northern provinces, whereas rice is common in the central and southern provinces. Soybeans are also relatively commonly observed. Rice, when recorded, often consists of 3 types of grades: high quality, standard, and low quality. High and low prices in each prefecture and month are recorded, typically, also for each of the three gradations of rice quality. In the main analysis we employ the series on the highest and the lowest price in the prefecture for all available grain types. Using multiple interest rate observations for a given prefecture x year combination improves the analysis given idiosyncratic shocks affecting particular grain prices. The text shows that results are similar when we employ the average of all prefectural interest rate measures.

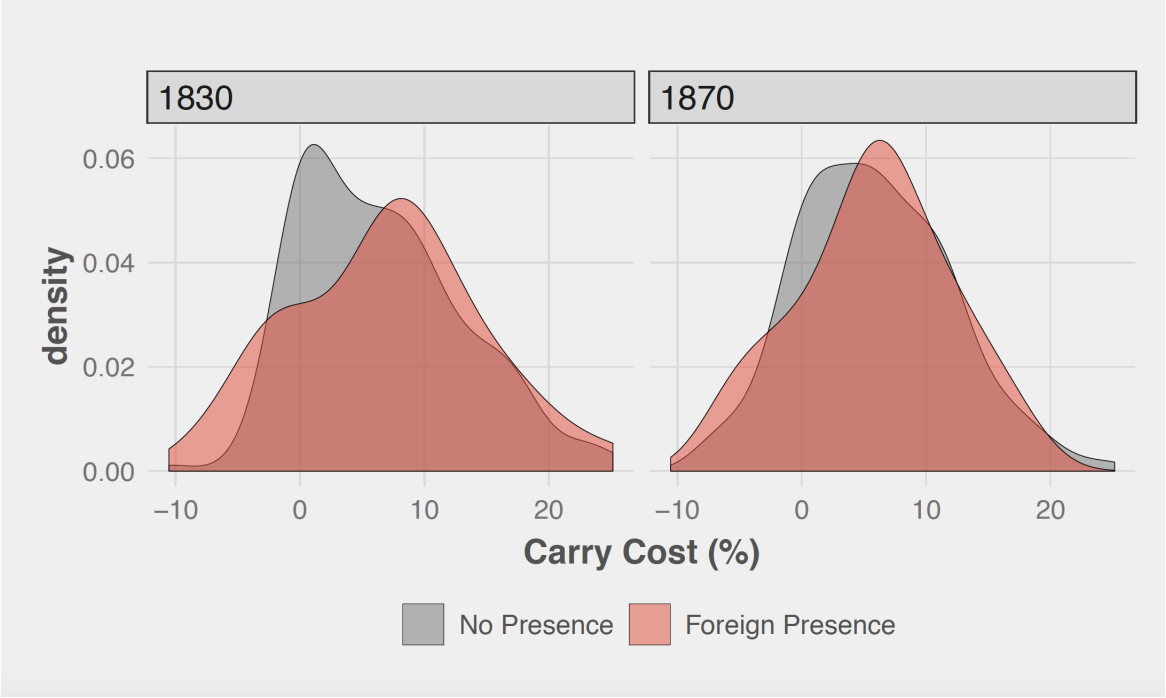
To compute the average price gradient for a given prefecture and year (see Figure A.1), we restrict the sample in a number of ways. First, we drop months for which the one-month price change is typically negative; such months, for example because the harvest comes in, do not help to estimate the price gradient. Second, we focus on the central 98 percent interval of one-month price changes to reduce the impact of outliers.[37]

Taking the average of these one-month price changes yields N = 58,449 carry costs, $\hat{p}_{it}$ (see equation 4) which vary by prefecture, year, and grain. These carry costs can be seen as estimates of interest rates inclusive of risk and physical storage costs. They average about 8% per year in China during this period.

[37] See Keller, Shiue, and Wang (2019) for additional discussion.

Our interest lies in whether there was a difference in interest rates between regions affected by foreign presence, or not. Figure A.2 shows the distribution of carry cost estimates by whether in a given region there was ever a Western foreign presence in any form.

Figure A.2: Regional Carry Costs over Time by Foreign Presence



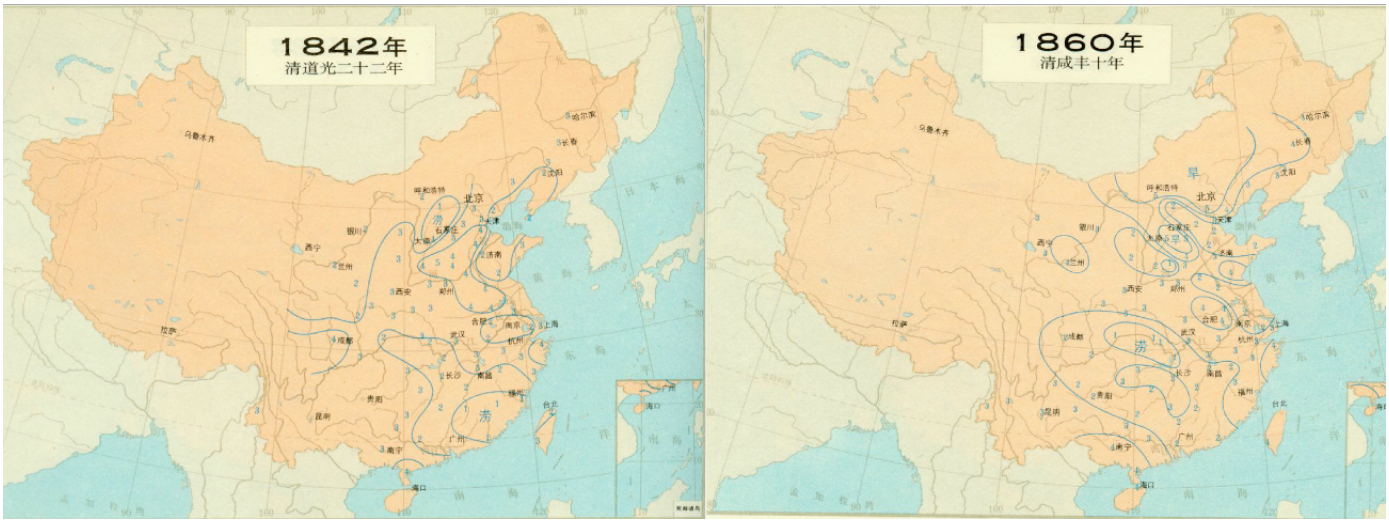
The distributions of Figure A.2 show that in a given region and year, carry cost estimates based on the storage cost approach can take on a wide range of values (also negative, when grain prices secularly fall). At the same time, in our approach we will exploit within-region variation using annual carry cost measures. Taking difference between prefectures and over time, as well as a relatively large sample, existing research indicates that the storage cost approach accurately reflects differences in capital market performance. Figure A.2 also provides evidence that regions with foreign presence experienced a decline in interest rates over time compared to regions without foreign presence (notice the leftward shift in the mode of the Foreign Presence distribution).

C Weather Data

The storage costs of grain are highly sensitive to climatic conditions, and we employ historical weather data to assess the role of physical storage costs. Weather data come from published data by the State

Meteorological Society (1981). The original materials were based on more than 2,200 local histories and gazetteer writings, and "more than 2 million and two hundred thousand characters". See Figure A.3 for the historical information on weather for two sample years in form of contour maps.

Figure A.3: Historical Weather Information for 1842 and 1860



The reference produces annual tables and maps of dryness and wetness in 120 regions, each region of which corresponds to one or two prefectures in the present administration of China. The degree of dryness and wetness in classified into 5 grades: grade 1 is very wet; grade 2 is wet; grade 3 is normal; grade 4 is dry; and grade 5 is very dry, normalized according to what is considered average for a particular region. We exploit the fact that extreme weather is associated with higher storage costs for grain. For each of our prefectures and for each year, we take the weather, 1 to 5, of the nearest weather station of the 120 regions to be the weather of this prefecture in a given year. Adjusting the results for physical storage cost differences related to weather shocks reduces our sample because we do not have weather observations for the entire sample. All regressions reported in the paper account for physical storage costs at the prefecture x year level by including a fixed effect for each of the five weather levels.

D Legal Institutions: Supplemental Information

D.1 Opening of Consulates

Table A.1 shows the opening of British consulates in China.

Table A.1: Opening of British Consulates in China

Date	Location	Date	Location
1843	Xiamen	1877	Wuhu
	Guangzhou	1896	Hangzhou
	Shanghai		Suzhou
	Huangpu	1897	Sanshui
1844	Fuzhou		Shashi
	Ningbo		Simao
1860	Shantou		Wuzhou
	Tianjin	1899	Tengyue
1861	Yantai	1900	Nanjing
	Zhenjiang		Yuezhou
	Hankou	1902	Chengdu
	Jiujiang		Yunnanfu
	Yingzi (Yingkou)	1904	Kashi
	Tainan		Jiangmen
1862	Dagu	1905	Changsha
	Danshui	1906	Fengtian
1864	Dagou		Jinan
1867	Luoxing	1908	Andong
1869	Qilong	1910	Harbin
1876	Haikou	1913	Dajianlu
1877	Chongqing	1919	Qingdao
	Yichang	1930	Weihaiwei
	Beihai		
	Wenzhou		

D.2 Dimensions of Legal Influence in China by Foreign Country

Although all foreign countries had the desire to exercise extraterritoriality, there were differences in the degree to which different countries were interested in, and able to carry out those practices. In addition, individual countries also had their own (different) laws to begin with, so there was an additional source of heterogeneity in the application of extraterritoriality in China.

D.2.1 Limits to Jurisdiction

When the extraterritorial foreigner is the defendant or the accused, the court of the nationality of the foreigner has jurisdiction. The question of jurisdiction has to do with the power of the consul or the consular court in deciding civil and criminal cases. Cases that appear in court may range from relatively minor disputes involving smaller amounts of money and less serious infractions to more major disputes over large amounts of money or serious crimes. One clear indication of the competence of the consul

and consular court is thus whether the cases that they can decided upon has been curtailed to relatively non-contentious cases or disputes that involved less than a pre-specified amount of money. In addition, the question of jurisdiction may vary and depend on whether the case is a civil or a criminal one. Consuls were not necessarily trained lawyers or judges, they may have been given the right to decide over smaller cases, or only certain cases, while more serious cases were considered their beyond their jurisdiction. The jurisdiction of the consul and consular court (which was often presided over by the consul himself plus a few other members of the staff) was thus in part based on the competence of the consul, and the rights to which each country endowed this person. Based on these considerations, distinctions can be made. For example, in the case of Portugal, consuls sit alone on decisions less than $400 Mexican currency, and in cases over that amount the consul presides with three assessors. For criminal cases in Portugal, the consul sits alone on cases that do not surpass $2,000 (Mexican) in fines, and the consular courts can decide on cases more serious than that, but not all—the specific exceptions are more crimes involving more lengthy imprisonment, expulsion, or exile. In these cases, the cases have to be sent to the judicial court in Macao. In our coding, Portugal is described as being able to hear both civil and criminal cases, but there is a limitation to the power of jurisdiction of Portuguese courts in China. In contrast, the consul and consular court of Belgium has jurisdiction in civil matters in China, with the consul having full jurisdiction in cases involving less than 100 francs, but all persons committing criminal offenses are sent to Brussels to be tried by the assizes of the Province of Brabant. In our coding, we measure this by giving a code indicating that only civil cases are heard. Both Belgium and Portuguese consular courts had more limited jurisdiction than Great Britain, where provincial courts existed in each consular district in China, and in addition the British Supreme Court was presided over by two trained judges and a professional staff giving it unlimited jurisdiction over all civil and criminal cases. In all, only two countries--Britain and the United States—ever established special courts with professional staff members. France and Italy each had a special judge rather than a full staff.

D.2.2 Right to Appeal

The right of appeal is another important difference across countries, and our second indicator is whether the decision of the consular court can be appealed. Countries allowed right of appeal for certain types of cases, typically those that involve more serious cases or cases of higher value. Because these differences

are relatively slight, we focus on another difference in the rights of appeal, and that is whether or not the appeal can be heard in China. Belgium and Portugal are both examples of countries where appeals are possible, but the appeal cannot be made in China. Appeals to decisions of the consular court for Belgium are made to the final court of appeal in Brussels, and in the case of Portugal, appeals may be made only in the high judicial court of Goa, Portuguese India. Further appeals on the question of law and procedure may be made only at the Supreme Court of Justice in Lisbon, whose decision then is final. By contrast, the full court of the three judges, which presided over the British Supreme Court for China, exercised the same powers as the court of appeal in England. In certain instances of civil matters of great interest to public importance appeals could be made to the Privy Council of London, but in criminal matters there was no appeal to the Privy of London, except by leave of the Privy Council. From these and other examples, the key difference that appears in matters of appeals is whether or not the appeal could be heard in China or whether it could only be appealed by taking the case abroad to a higher court of the home country.

One expects that the greater the legal presence of the courts of one's nationality, the more protections for the rights of that group, and less uncertainty about the security of one's position in China with respect to property and personal security. For instance, if a British national is accused of a serious crime, the case is heard in the British consulate court, and the accused could appeal the decision without having to return to Britain. Being able to resolve an appeal without having to leave China reduces the costs of appeal. If the appeal has to be taken to a distant court in a separate country, we consider that equivalent to weaker rights of appeal.

D.2.3 Foreign Assessors

When there is adjudication of claims and complaints of foreigners against Chinese, that is, when the foreigner is the plaintiff or complainant, then the Chinese court has jurisdiction. Some countries had the right to have a foreign assessor represent the interests of the foreign plaintiff or complainant in the Chinese court. When the foreign party is allowed to have an assessor present, then the case is referred to as a "mixed case" and the court is a "mixed court". The foreign assessor was not necessarily trained in law, but was present in order "to examine and cross-examine witnesses" and to "protest against the proceedings in detail]" (Quigley, 1926). The role of the foreign assessor in the Chinese court thus was part of the

policy of extraterritoriality in China. The presence of foreign assessors in Chinese courts is historically important because even foreign observers of the time regarded the proceedings in the mixed court as a being subjected to the partiality of the assessor and the magistrate for their own subject.

The variations arise regarding the use of assessors in mixed cases. Great Britain and the United States had the right of being represented by assessors at trials of Chinese courts in which their nationals are plaintiffs. This right was reciprocal, but in general the Chinese did not exercise their right to have a Chinese assessor present in the foreign court. In the case of Brazil, Mexico, and Japan, the rule of exclusive jurisdiction is applied on both sides, so no foreign assessor or arbiter is present in either the civil or the criminal cases. For the remainder of countries, the largest group, civil cases involving a foreign plaintiff are heard jointly by the foreign consul and the Chinese officials, whereas criminal cases are dealt with in the Chinese court, without foreign assessors present. The resolution of the civil cases is thought to be one of mediation and more in accordance with Chinese practice.

D.2.4 Prisons

Beyond the decision of the court, prison facilities are another measure we take as indication of the completeness with which a country locates its legal presence into China. It relates the commitment to carry out the sentences that have been decided upon by the court. In order to enforce the sentence that was reached in the foreign court, there would have to be some sort of prison facility. Since foreign countries determined that the conditions of Chinese prisons were extremely poor and inadequate for housing prisoners, foreign prisoners were either sent to foreign prisons in China, or to prisons outside of China, where this usually depended on the length of the sentence. Only four powers had prisons in China: the United States, Britain, France, and Japan. All the other counties had to either sent their prisoners outside of China, or make arrangements with one of the four countries that had prisons in China to use those prisons.

E Additional Empirical Results

E.1 The Impact of Foreign Institutions: Alternative Assumptions on the Error Term

The following set of results considers alternative assumptions on the error term, see Table A.2. The first column repeats the result from Table 4, column (3) for convenience. Standard errors are clustered at

the cross-sectional level, the prefecture-grain combination. The following two sets of results implement two-way clustering. Our specifications all include year fixed effects, which would eliminate any dependence that affects all observations in a given year in the same way. However, if the form of dependence is more complicated, perhaps due to China's relatively large size, and it is not addressed by including geo-trends, a second dimension of clustering on year might be advisable. As seen from column (2) in Table A.2, this leads to quite similar inferences.

Table A.2: Alternative Assumptions on the Error Term

Standard Errors	(1) Pref-Grain	(2) Pref-Grain, Year	(3) Prefecture, Year	(4) Prefecture	(5) Spatial	(6) Spatial	(7) Spatial
Foreign Institutions	-2.153^{**}	-2.153^{**}	-2.153^{*}	-2.153^{*}	-1.537^{**}		
	(0.467)	(0.570)	(0.903)	(0.932)	(0.412)	(xx)	(xx)
IPWRA	Y	Y	Y	Y			
No. of clusters	1,098	1,098; 79	245; 79	245			
Distance cutoff (km)					1,000	700	400

Notes: Dependent variable is interest rate; estimation by OLS. Foreign Institutions is an indicator variable equal to one if a region has at least one treaty port or consulate in this year, and zero otherwise. All regressions include year and weather fixed effects, as well as prefecture-grain fixed effects and geo-trends. N = 64,627. Standard errors in columns (1) to (4) are robust and clustered at the level given in the column header; standard errors in columns (5) to (7) are Conley-spatial standard errors. **/*/+ means significant at the 1%/5%/10% level.

One might also consider clustering at the level of the prefecture, instead of the prefecture-grain combination. On the one hand, foreign influence varies by prefecture and year. On the other hand, the impact of foreign influence need to be the same in the south versus the north of China, using interest rates based on rice prices versus millet prices, respectively. Columns (3) and (4) show that clustering at the level of the prefecture instead of prefecture-grain combination leads to higher standard errors, although the foreign institutions coefficient remains significantly negative at a 5% level.

The remaining three columns in Table A.2 provide standard errors that are robust to spatial correlation, based on the work of Conley (1999) as implemented by Fetzer (2020). The three sets of results differ in their assumption on the distance over which spatial correlation is allowed for; they are given in the lower part of Table A.2. It turns out that accounting for possible spatial correlation does not strongly affect our inferences.

While it has recently been emphasized that the choice of assumption on standard errors should be based

on substantive information (Abadie, Athey, Imbens, and Wooldridge 2017), in the present case there is more than one set of plausible assumptions. In this situation, it is reassuring that we estimate a significant interest-rate lowering effect from foreign institutions under a range of plausible assumptions on the error structure.

E.2 Selection

The specifications in Table A.3 address remaining selection concerns. Columns (1) and (2) show for comparison again the baseline impacts of foreign institutions on local interest rates and domestic modern firms as shown in the text. Using a richer IPWRA adjustment by employing cubic instead of only linear terms for latitude and longitude yields the results shown in columns (3) and (4). The treaty port spillover effect at a distance of up to 200 kilometers is now somewhat larger (in absolute value) than before, with -1.4 versus -1 (columns (3) and (1), respectively). Overall, we find that the results are robust to including a richer geography to the regression adjustment.

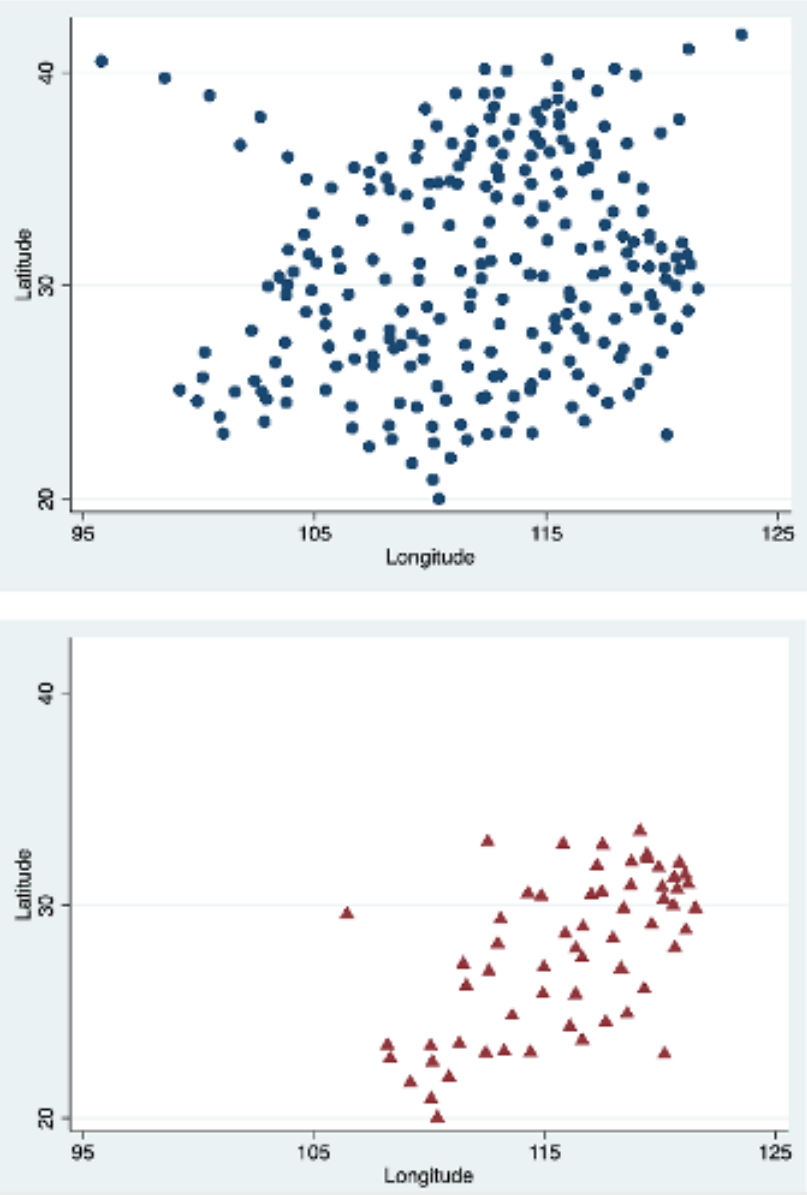
One might be concerned that the IPWRA approach does not go far enough to address the fact that treaty ports and consulate locations were not chosen randomly by Western countries. In particular, given Western interest in foreign trade, locations that are far inland were presumably not in the running. To account for this, we have limited the sample to those regions of China that were among the most likely to be chosen as treaty ports or consulate location (as determined by a probit regression). Figure A.4 illustrates this approach.

Table A.3: Accounting for Sample Composition

	(1)	(2)	(3)	(4)	(5)	(6)
			Alternative IPWRA		South-East Regions	
	Int. Rate	Dom. Firms	Int. Rate	Dom. Firms	Int. Rate	Dom. Firms
Treaty Port or Consulate	−2.395**		−2.537**		−1.847**	
	(0.507)		(0.605)		(0.624)	
Consulate		0.064		0.096		0.130
		(0.058)		(0.064)		(0.095)
Consulate [0,200]	−2.206**		−2.051**		−2.898**	
	(0.452)		(0.487)		(0.626)	
Consulate [200, 400]	−0.225		−0.243		−1.174*	
	(0.300)		(0.321)		(0.512)	
Treaty Port		0.245**		0.214*		0.175+
		(0.082)		(0.086)		(0.092)
Treaty Port [0,200]	−0.989*		−1.430**		−2.876**	
	(0.447)		(0.481)		(0.447)	
Treaty Port [200, 400]	−0.827*		−0.791*		−2.500**	
	(0.334)		(0.345)		(0.662)	
Linear Geography	Y	Y			Y	Y
Cubic Geography			Y	Y		
N	64,627	15,385	64,627	15,385	19,717	3,886

Notes: Dependent variable is given at top of column; estimation by OLS. Consulate is an indicator variable equal to one if region has at least one foreign consulate, zero otherwise. Treaty Port is an indicator variable equal to one if a region has at least one treaty port, zero otherwise. Variables with number range [x,y] are indicator variables for concentric distance bands of [x,y[kilometers, see text. Specifications (1), (3), and (5) include year, prefecture-grain, and weather fixed effects, as well as geo-trends, specifications (2), (4), and (6) include year, prefecture, and weather fixed effects, as well as geo-trends. IPWRA applied, with weight based on linear latitude and longitude in columns (1), (2), (5), and (6) and cubic latitude and longitude in columns (3) and (4). Robust standard errors clustered at the prefecture-grain level (columns (1), (3), and (5)) and prefecture level (columns (2), (4), and (6)) in parentheses. **/*/+ means significant at the 1%/5%/10% level.

Figure A.4: Full Sample and Restricted Sample of Regions



On top of Figure A.4 we have the latitude and longitude of the 245 regions that are included in the full sample, whereas on the bottom of the figure are the roughly one quarter of all regions that are most likely to be chosen by Western countries as treaty ports or consulate locations.[38] Clearly, regions on the coast and in the south-east were more likely chosen by Western countries than other regions, and focusing on the roughly sixty regions in the lower panel of Figure A.4 is a way to address the selection concern.

[38]These regions are in the top tercile of predicted probability to have at least one treaty port and at least one foreign consulate. The correlation between predicted and actual treaty port location is about 0.5.

Results for key specifications using this more limited sample are shown in columns (5) and (6) of Table A.3. The impact of Western institutions on the number of modern Chinese firms now comes more from both legal and trade institutions, whereas before the effect of trade institutions was stronger (column (6)). We also see evidence for stronger geographic spillover effects from both trade and legal institutions at distances of up to 400 kilometers (column (5)). The coefficient for legal institutions is now considerably larger (in absolute value) and significant at standard levels, while the treaty port effect at these distances is about three times as large (-2.5 instead of -0.8). Overall, this analysis indicates that our results are not driven by including Chinese regions that were relatively unlikely to be chosen as locations for their activities by Western countries.

E.3 Alternative Measures of Foreign Consulates in China

Table A.4 shows a number of different specifications based on alternative measures of foreign consulates. We see that irrespective of the specific measure of consular activity it leads to lower regional interest rates (columns (1) to (3)).

Table A.4: Alternative Measures of Foreign Consulate Activity

	(1)	(2)	(3)	(4)	(5)
Consulate	−3.149**				−4.701**
	(0.478)				(0.914)
Number of Consulates		−0.115**		0.118	
		(0.038)		(0.063)	
Log Number of Consulates			−1.077**	−1.166**	0.990*
			(0.239)	(0.425)	(0.482)
R2	0.165	0.162	0.163	0.163	0.165

Notes: Dependent variable is interest rate; estimation by OLS. Consulate is an indicator variable that a region has one or more consulates from any country. Log Number of Consulates as ln(x+1). All regressions include year and weather fixed effects, as well as prefecture-grain fixed effects and geo-trends. IPWRA applied. Robust standard errors clustered at the prefecture x grain level. N = 64,627. **/*/+ means significant at the 1%/5%/10% level.

At the same time, accounting for the number of consulates is not preferred to the consulate indicator variables, as seen from the R^2 in columns (1) to (3). In direct comparisons, we see that the consulate indicator variable is best able to explain the interest-rate lowering effect of foreign legal institutions (columns (4) and (5)). Even if the sheer number of consulates does not improve the explanation, the paper shows that

accounting for particular dimensions of legal extraterritoriality associated with consulates from different countries does.

E.4 Legal Institutions: The Role of Individual Countries

Table A.5: Maximum Legal Influence: Role of Individual Countries

	Country														
	AUS	BEL	BRA	DEN	FRA	GER	ITA	JP	MX	NL	NOR	POR	RUS	SPA	SWE	US	UK
Max Legal Influence	*-2.12*	*-1.80*	*-1.81*	*-2.14*	*-1.66*	*-2.20*	*-1.81*	*-1.51*	*-1.78*	*-2.24*	*-1.68*	*-1.98*	*-1.92*	*-1.87*	*-1.69*	*-1.95*	*-2.33*
Country	1.24	0.09	0.89	*3.05*	*2.31*	*2.19*	0.54	-1.00	-0.83	*2.66*	-0.42	*1.94*	*2.96*	*1.44*	-0.40	0.98	*3.37*

Notes: Dependent variable is interest rate. Table shows OLS results for Max Legal Influence and an indicator for a consulate from a particular Country. Country shown at column top. Coefficient on Max Legal Influence without additional regressor is -1.24 (robust s.e. 0.40). Coefficients that are significantly different from zero at a 10% level or below are in italics. AUS Austria-Hungary, BEL Belgium, BRA Brazil, DEN Denmark, FRA France, GER Germany, ITA Italy, JP Japan, MX Mexico, NL Netherlands, NOR Norway, POR Portugal, RUS Russia, SPA Spain, SWE Sweden, US United States of America, UK Britain. Specifications also include indicator for consulate from any country (results not shown); N = 58,449. All specifications include year, prefecture x grain, and area-by-decade fixed effects, and apply IPWRA.

E.5 Geographic Spillovers: Robustness

Table A.6 shows alternative specifications in the estimation of the geographic scope of foreign institutions effects. They confirm the finding in the text that the impact of foreign institutions went far beyond the immediate vicinity of treaty ports and foreign consulates.

Table A.6: Geographic Spillovers: Alternative Specifications

	(1)	(2) No IPWRA	(3)	(4) Spatial S.E.	(5) Interest Rate Max	(6) Interest Rate Min	(7) Interest Rate Rice
Consulate or Treaty Port	−2.508**	−1.986**	−1.848**	−1.848**	−2.301**	−2.715**	−3.040**
	(0.490)	(0.401)	(0.392)	(0.421)	(0.620)	(0.748)	(0.655)
Consulate [0, 200]	−2.216**	−2.032**			−1.138*	−3.262**	−2.965**
	(0.443)	(0.465)			(0.553)	(0.677)	(0.604)
Treaty Port [0, 200]	−1.001*	−0.923+			−1.399**	−0.664	−1.032+
	(0.511)	(0.473)			(0.535)	(0.690)	(0.600)
Consulate [200, 400]	−0.243	−0.525+			−0.212	−0.241	−0.458
	(0.295)	(0.305)			(0.426)	(0.411)	(0.422)
Treaty Port [200, 400]	−0.836*	−0.043			−1.003*	−0.691	−0.974*
	(0.335)	(0.335)			(0.476)	(0.483)	(0.454)
Consulate or Treaty Port [0,200]			−2.691**	−2.691**			
			(0.335)	(0.382)			
Consulate or Treaty Port [200, 400]			−0.526*	−0.526+			
			(0.249)	(0.314)			
N	64,627	64,627	64,627	64,627	32,376	31,720	30,316

Notes: Dependent variable is interest rate; estimation by OLS. All regressions include year and weather fixed effects, as well as prefecture-grain fixed effects and geo-trends. IPWRA applied in column (1), (4), (5), and (6). Robust standard errors clustered at the prefecture x grain level, except in column (4) which uses Conley (1999) spatially adjusted GMM standard errors, with a distance cutoff of 400 kilometers. **/*/+ means significant at the 1%/5%/10% level.