NBER WORKING PAPER SERIES

THE ECONOMIC CONSEQUENCES OF THE OPIUM WAR

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Working Paper 29404
http://www.nber.org/papers/w29404

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
October 2021, Revised February 2023

This paper incorporates parts of the draft "Capital Markets and Colonial Institutions in China". Thanks to Ying Bai, Rui Esteves, Hanming Fang, Taylor Jaworski, Ruixue Jia, Tom Rawski, Gerard Roland, Kjetil Storesletten, Shang-jin Wei, Michael Zheng, and audiences at various workshops and conferences for comments. This paper supersedes the draft "Capital Markets and Colonial Institutions in China". We are particularly grateful to Ying Bai and Ruixue Jia who supported this project by providing 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 (Grant SES 1124426) is gratefully acknowledged. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

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JEL No. F63,G10,N25,O11

ABSTRACT

This paper employs new data to study the impact of Western colonial institutions on China's economy during the 19th century. It is shown that trade and legal institutions in the treaty port areas accelerated industrialization and increased capital market efficiency. The former was driven by technology transfer and market access gains at the ports, while the latter was due to increased security through extraterritorial legal rule at the consular courts. Furthermore, a geographic spillover analysis demonstrates that even though the number of foreign places was relatively small, the Western impact was substantial because it radiated far from the ports and affected most of the country. At the same time, the West's intervention harmed China's economy by increasing protest activity organized by secret societies, thereby reducing Qing state capacity. A picture emerges according to which the West's intervention had a major impact that is neither all-favorable nor all-unfavorable.

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1 Introduction

For nearly one hundred years, from 1842 until 1943, China was semi-colonized by Western countries. The Treaty of Nanjing in 1842 underscored China's defeat in the First Opium War and forced China to open dozens of cities to Western traders (so-called treaty ports), dramatically ending centuries during which China developed in relative isolation from the West. After the Opium War, the West turned China's trade policy on its head, abolished China's legal framework, and made other changes of broad scope. And yet, largely due to the lack of data the economic consequences of this transfer of Western institutions for China remain controversial. Taking a regional approach with treaty ports, customs stations, and consulates as entry points of Western influence, this paper employs an array of new data to study the economic consequences of the Opium War for China in the 19th century.

We consider three major ways in which Western institutions impacted China's economy. First, their influence on China's industrial development is assessed in terms of locally-owned industrial firms and advanced machinery. Second, the Western intervention's impact on the efficiency of capital markets is evaluated in terms of regional interest rates, given that grain price fluctuations over the harvest cycle reflect interest rates as part of storage costs (Hotelling 1931, Working 1949). Third, the impact on China's state capacity is evaluated using a machine-learning approach that extracts information on different types of popular protests from the dynasty's administrative record, the Veritable Records of the Qing (*Qing Shilu*).

A plausible hypothesis is that Western influence is highest in cities where Western forces had an immediate physical presence, and potentially weakening in regions geographically beyond. If the Western impact was relatively small, any effect would have been confined to the treaty port regions themselves. But this paper shows evidence to the contrary. Compared to regions without Western influence, interest rates in regions with direct Western influence are lower by more than a quarter and by almost ten percent even at distances of 450 kilometers. Western influence also led to gains in industrialization, with spillovers at distances of 300 kilometers from the ports. Overall, the results refute the idea that Western influence was limited. Rather, the West's impact was far-reaching, with spillovers well beyond the treaty ports.

The key concern that a non-random Western choice of regions would lead to bias is addressed by adjusting for the likelihood that a region would be selected by the West based on pre-sample characteristics.

Moreover, there is no evidence for differential pre-trends in regions with and without Western influence, nor that treatment variables were determined by the same unobserved characteristics that are favorable to economic performance. Likewise, robustness checks show that the results are not driven by non-Western countries such as Japan and Russia or by non-state actors such as missionaries.

In addition, this paper analyzes key mechanisms of the Western impact in China. First, industrial firm growth and machinery adoption was highest near the ports. Since these were the locations where most of the Western firms were present, the result points to technology diffusion through foreign direct investment. An additional finding is that the benefits to China's economy were larger and reached geographically further from those ports that accounted for more of China's foreign trade, especially exports. This suggests that foreign market access gains contributed to the benefits for China's economy.

In contrast to the concentration of industrial firm growth near treaty ports, lower interest rates in China were mostly related to the West's legal presence at their consulates, rather than the ports of trade. Had Western FDI into China led to a substantial increase in regional capital supply, one would expect to find treaty ports to be more important. The fact that consulates were more important suggests that China's capital markets benefited from lower transactional risk and increased security brought about by Western legal institutions. Further evidence comes from finding that reductions in interest rates are largest where Western extraterritorial rights were exerted to the strongest extent.

In contrast, we find a negative impact of Western influence on China's state capacity. Distinguishing militia activity from secret-society protests, Western presence is shown to increase secret-society protests in the vicinity of the treaty ports. Militia activity did not because Western soldiers stood ready to protect Western property (and lives) against armed activity. In contrast to the containment of militias, secret societies that flourished in China during the 19th century were not of immediate western concern. The rise in secret-society protests is a cost to China's economy, however, as it reflects the Qing's reduced state capacity to enforce its rules, which was weakened already by the intrusion of western institutions. Overall, Western trade and legal institutions had a positive impact on China's economy in lowering interest rates and spurring industrialization, at the same time when the West's intervention hurt China's economy by reducing its state capacity.

This paper makes several contributions. First, a large literature has considered the impact of the Western

intervention on China's economy starting with the Opium War. Conventional wisdom sees the Western presence typically as not very impactful (Dernberger 1975, Fairbank 1978, Feuerwerker 1983, and Murphey 1974). While in principle noting both positive and negative effects, a metaphor that aptly captures this view likens the treaty ports to "a fly on the back of an elephant" (Murphey 1974). The idea is that the structures of Chinese society were ultimately impermeable to change, and overall, Western influence was too trivial to matter one way or another.[1] By showing through our geographic spillover analysis that Western influence significantly affected much of China, this paper is one of the first to show that the West's intervention had large effects, in the sense that they permeated far beyond the treaty ports.

A large literature has established that institutions have a major impact on economic performance, and that in particular the transfer of Western institutions can have large economic benefits (North 1990, Acemoglu, Johnson, and Robinson 2005). In the case of late imperial China, the evidence to date is mixed. Case studies such as So and Myers (2013) point to positive effects from Western institutions but provide no systematic empirical analysis. Jia (2014a) documents that former treaty port areas today have higher GDP per capita but rules out Western colonial institutions as an explanatory factor. Using new data we show that Western institutions had a far-reaching impact on China's economy during the 19th century, and not all the impacts were of a positive nature. Our storage cost approach to capital markets is key for distinguishing general modernization from risk-lowering channels of institutions. Levine, Lin, Ma, and Xu (2022) provide support for the legal origins view of institutions by comparing the British and French concessions in Shanghai. Also finding a significant impact from legal institutions, we complement their work by analyzing specific extraterritorial practices in addition to legal origins. This paper also contrasts the West's economic impact on state capacity with its impact on institutional quality using information on protests from the *Qing Shilu* in one of the first applications of machine learning to Chinese historical data.[2] By showing that the West's intervention stimulated secret society protests we provide evidence that Qing state capacity suffered as a consequence of the West's intervention.

Third, we contribute to a large literature on the economic effects of colonialism (e.g., Acemoglu and Robinson 2017). This paper helps to bridge our understanding of how Western colonialist trade interests in China not only shaped past waves of globalization (Findlay and O'Rourke 2007, O'Rourke 2019) but

[1] More recent work points to the relatively small number of treaty ports to argue that Western influence in 19th century China was limited (So, Yip, Shiroyama, and Matsubara 2011).

[2] Work on state capacity includes Besley and Persson (2009), Acemoglu, Chaves, Osafo-Kwaako, and Robinson (2014), and Johnson and Koyama (2017).

were critical also during a period which marked the beginning of China's catching-up after the West had gained a major advantage (Broadberry 2021, Broadberry and Gupta 2006). Thus, while our emphasis on transport infrastructure parallels work on British railroad building in colonial India, the Dutch cultivation system in Java, and domestic trade flows in China (Donaldson 2018, Dell and Olken 2020, and Keller, Li, and Shiue 2017, respectively), the focus is on showing how China's trade history is key to its economic development in a setting of semi-colonization by multiple intervening foreign countries. Furthermore, while our causal identification approach is more similar in spirit to Dell and Olken (2020) than to the general-equilibrium analyses of Keller, Li, and Shiue (2017) and Donaldson (2018), we share with the latter a focus on contemporaneous rather than long-run outcomes. Finally, the documented shift of the most advanced regions from China's northern-inland to the southern-coastal is both in line with historical evidence (Pomeranz 1993, Allen, Bassino, Ma, Moll-Murata, and Van Zanden 2011) and consistent with a major long-run impact of Western colonialism in China.

The remainder of the paper is as follows. Section 2 gives context for our setting and provides an overview of channels of Western influence in China. Section 3 describes the data set, with additional information given in the Appendix. The estimation approach is given in section 4, which also discusses how we address various threats to identification. Our empirical findings on the consequences of the West's intervention on China's industrialization, capital markets, and state capacity are presented in section 5, accompanied by a discussion of the main mechanisms. Section 6 presents our results on spillovers, providing crucial evidence on the geographic extent of Western influence. Section 7 provides a concluding discussion including some avenues for future research. The Appendix contains additional information on the data as well as supplemental empirical results.

2 The Opium War as a Watershed

In the decades before the First Opium War, China developed in relative isolation from the West and limited Sino-Western trade to a single port, open for only part of the year, in the south of China at Canton (Guangzhou). British traders—who had the largest trade interests—gained increased access to China after provoking a war over the destruction of foreign opium, which had been brought to China without the consent of the Qing Emperor.[3] After China's defeat in the First Opium War, the Treaty

[3]China was ruled by the Qing dynasty from 1644 to 1911.

of Nanjing (1842) liberalized trade and opened four additional ports (Amoy (also known as Xiamen), Foochow, Ningbo, and Shanghai). In subsequent years additional ports were opened, which came to be known as treaty ports because they were opened by treaty.[4]

The immediate purpose of the treaties was to allow Western traders to better safeguard their employees and property while doing business in China (Fairbank 1978). Significant changes were introduced in especially two areas: trade policy and legal jurisdiction. Trade policies were tied to the opening of ports for foreign trade, with low tariff rates, as well as to the foreign-run customs houses, while legal jurisdiction was centered on consulates, where disputes involving foreigners were resolved through consular courts. Specifically, the channels we consider are the following:

Trade Policy–The immediate implication of the treaty port designation was that Western countries could legally trade at the port. Foreign ships transported the bulk of China's foreign imports and exports (CMC 1933), and the trading rights were later expanded to include the right to establish firms in China. By the year 1891 there were 345 British-owned firms in Chinese treaty ports (CMC 1933). The establishment of firms meant also that foreign residents and their families created organizations such as foreign municipalities, schools, and clubs.

Customs System–After the foundation of the Western-led Chinese Maritime Customs (CMC) Service in 1854 that took over the assessment and collection of customs duties, the first CMC customs house was opened in 1859 in Shanghai. The tariff revenue was transferred to the Qing court after deducting the CMC's costs of tariff collection, which improved the fiscal stance of Qing China (Horowitz 2006). The CMC was important because it supervised the locations where foreign trade actually took place, and therefore where Western trade interests were concentrated.

Legal Jurisdiction–The treaties stipulated that foreigners were subject to the legal jurisdiction of their own country rather than to Chinese laws (extraterritoriality). By 1847, 19 nations had extraterritoriality provisions with China. The consulate was key to the enforcement of foreign laws in legal disputes, because the court of first instance was typically the consular court, with the foreign consul as the judge. By the end of the 19th century there were 273 foreign consulates in our sample.[5]

[4]See Keller and Shiue (2022) for a broader discussion.

[5]Of these, eight were Russian and fifteen Japanese, the most important non-Western colonizers in China; our analysis below will account for this.

Figure 1 gives the regional dimension of Western influence in China by showing the location of CMC customs stations in the last year of our sample period (1899). Given the importance of waterways, Western influence is primarily found on China's coast, but also on the Yangzi and Pearl rivers, which would empty into the sea near Shanghai and Canton (Guangzhou), respectively. Moreover, customs stations are located further inland in certain areas, e.g. in China's southwest. In addition to geographic variation we exploit that foreign influence in China has grown over the sample period at several key dates (see Figure A.4).

Figure 1: Chinese Maritime Customs Stations

Notes: Shown are all ports with positive net foreign imports in the year 1899; source: CMC (n.d.).

CMC customs stations were established in many of the treaty ports, although they were absent in some of the smaller ones. Consulates were often located near treaty ports, and over time, trade and legal dimensions evolved to become more distinct, in particular with the foundation of the Western-led Chinese Maritime Customs Service (1854). As we show in section 6, treaty ports and consulates had separate effects on China's economy.

There is anecdotal evidence that the increase in foreign market access through new ports may have been a mechanism of Western influence, because of its effect on patterns of specialization, structural change, and efficiency gains.[6] Furthermore, treaty ports may have been the entry points for new local technological knowledge and western-style human capital. The lack of a medium of exchange and credit instruments was a serious weakness of China's financial system (Rawski 1989), and employees at Chinese banks in Shanghai that encountered Western banks may have borrowed ideas for financial instruments, increasing efficiency and security in the banking system. Organizational innovations were also imported into China – for example, the first stock exchange in China, the Shanghai Share Broker's Association, was introduced in 1891 by foreign business residents of China (Goetzmann, Ukhov, and Zhu 2007).

In addition, the West's intervention may have increased the supply of public goods. In contrast to the relatively low level of government-supplied functions in China during the 19th century, the Western-led Chinese Maritime Customs (CMC) service not only built and operated lighthouses and wharves, but also dredged the harbors, modernized the postal service, and monitored smuggling, in addition to its core function of collecting tariffs. A particularly important public good is security, as it reduces transactional risk. Treaty port areas may have provided an increased level of security from rebel and pirate activity through the presence of police and military units.

The introduction of Western law in China through extraterritoriality may have increased the incentives of Western firms to do business in China. The British company Jardine, for example, extended loans to Chinese merchants secured with stock deeds and titled property and extraterritorial rights in China made it possible to enforce contracts in ways familiar to British banking firms. Furthermore, treaty provisions included landholding rights that played a potentially important role in foreign settlements. Not only did this decrease the risk for Western residents but it benefited also Chinese property owners. 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, with one estimate suggesting that half of the cases did not involve foreign interests at all (Willoughby 1920).

[6] On foreign market access in 19th century Argentina, see Fajgelbaum and Redding (2021).

3 Data

Annual data at the prefectural level is critical for this analysis. This section introduces the data set, beginning with the three main sets of information that are original to this paper; additional information is given in the Appendix.

Qing Protests Information on the temporal and regional distribution of different forms of popular protests is employed to evaluate the impact of the West's intervention on Qing state capacity. It is based on the Veritable Records of the Qing Dynasty (*Qing Shilu*), which, in essence, contains a chronological compilation of information that had crossed the emperor's desk. The *Qing Shilu* is considered to be the most comprehensive source on protests in China (Hung 2013). It is also a vast source, with one well-known edition containing more than 1,200 volumes (Keller, Liu, and Shiue 2022). Its sheer size is one reason why instead of the typical approach in which trained humans go through the source and demark events as protests as they spot them we rely on a supervised machine-learning approach.

The advantages of this artificial-intelligence approach includes that it is not subject to human bias (e.g., definitions of individual researchers, changes in research teams, and focal points of established results), it can be tailored to better identify certain events, and it can be easily replicated. Using the well-known work by Chen et al. (1989) as the training sample, Keller, Liu, and Shiue (2022) show that a machine-learning approach classifying events in the *Qing Shilu* into protest or no protest achieves an overall accuracy above 90 percent.[7] Compared to earlier approaches using human classifiers, the machine-learning approach yields a higher number of protests.[8]

The overall number of protests in a given prefecture-year is further disaggregated using supervised machine-learning into different forms of protests. We distinguish *wuzhuang*, which are armed protests involving militias, including conflicts about high rent and taxation and other forms of violent protests, from *jieshe*, which are protests involving secret associations and sects (secret societies for short).[9] There are about 24,000 protests in our sample. Figure 2 shows the total number of these respective protests for each year

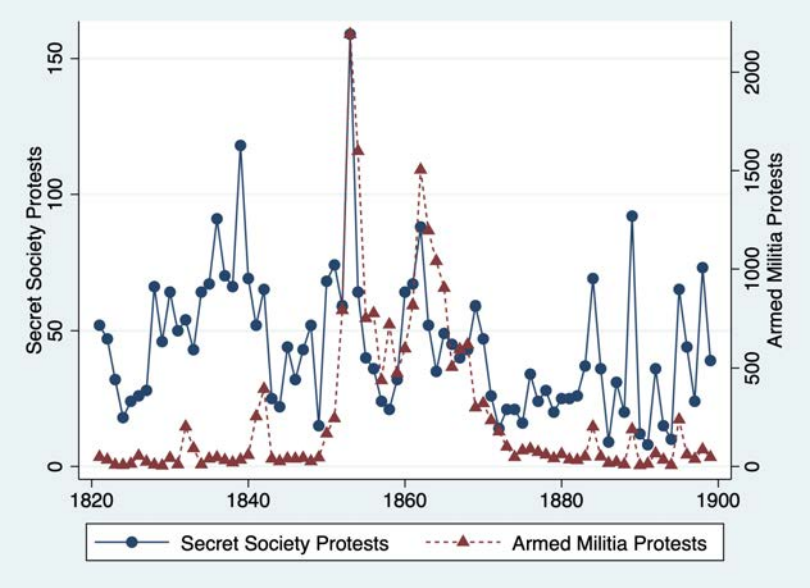
[7] Average accuracy is defined as $A = \frac{TP+TN}{TP+TN+FP+FN}$, where TP (TN) are True Positives (True Negatives), while FP (FN) are False Positives (False Negatives).

[8] The AI-identified protests are also correlated with events known to trigger protests, such as extreme weather and high grain prices (Keller, Liu, and Shiue 2022).

[9] Following Kuhn (1970), we define militias as organizations in which the participants are neither purely civilian nor soldier but their roles have elements of both. Our classification into *wuzhuang* and *jieshe* follows Chen et al. (1989).

during our sample period. Given their anti-Qing and religious motivations, secret society protests matter especially for Qing state capacity (see Appendix A.1).[10]

Figure 2: Protests in 19th Century China: Militia versus Secret Society



Notes: Source is Veritable Records of the Qing Dynasty (*Qing Shilu*) and Keller, Liu, and Shiue (2022).

We see that the total number of militia protests identified by this approach is larger than incidents involving secret societies. At the same time, secret societies were active throughout the 19th century, in contrast to militia protests which were concentrated in the middle of the century, and there are many periods during which secret society protests outnumbered armed militia protests. Furthermore, given the time pattern of secret society protests they do not seem to be primarily a response to the West's intervention in China with the Opium War. Summary statistics for these protest variables are shown in Table 1.

Interest Rates The second original data set of this study is annual information on interest rates at the prefectural level. In China for the 19th century, there are generally no comparable figures of regional interest rates.[11] To address this issue, we exploit cyclical fluctuations in the price of grain over the harvest cycle. This provides information on interest rates because in equilibrium the price of grain will reflect the local interest rate as part of storage costs.

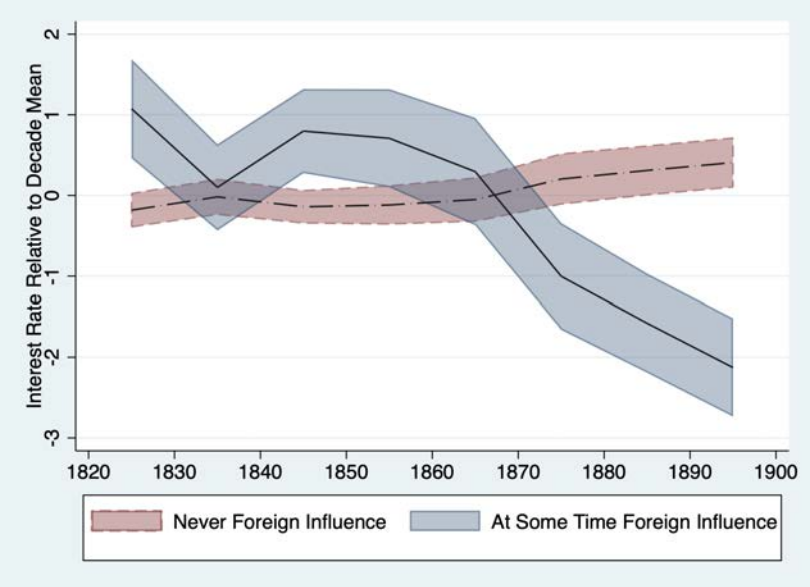
All else equal, a price of grain that rises by a lot per month of storage indicates high interest rates, while

[10] Ownby (1996) and Kuhn (1970) present broader perspectives.

[11] Individual rates for certain times and regions can be obtained from various sources, however, key characteristics such as risk, maturity, or collateral are typically unknown, and the rates are not comparable (Pomeranz 1993).

if the price of grain rises only by little the interest rate is low; see Figure A.1. A given interest rate is consistent with either high or low year-to-year grain price inflation, because the storage cost approach relies on within harvest-year price changes.[12] This storage cost approach has recently been validated by showing that the resulting interest rates yield similar findings as bank interest rates (Keller, Shiue, and Wang 2020), and using it also established that interest rates in Qing China were considerably higher than in England (Keller, Shiue, and Wang 2021).[13]

Figure 3: Regional Interest Rates by Foreign Influence



Notes: Shown is average interest rate by decade for (1) prefectures where foreign consulates were never established and for (2) prefectures that had foreign consulates between 1821 -1899. Consulate openings from year 1842 to 1897 (Figure A.4); 95 percent confidence intervals shown.

Broad geographic interest rate patterns show that over the 19th century, locations of relatively low costs of capital moved from China's northern inland to her coastal regions, especially in the south (see Figure A.3). Since the West was focused on coastal areas due to its trade interests, the shift in the locus of China's relatively low capital costs is consistent with the hypothesis that the West's intervention had a major impact. Interest rates were on average about 7.5% per year, see Panel B of Table 1. Over time, typical interest rates went from about 6 percent in the early years to about 9.5 percent in the final twenty years of the sample. This suggests a general increase in the cost of capital in China, consistent with a deteriorating security situation towards the end of the Qing.

[12]Furthermore, because locals account for the largest share of participants in these grain markets, the interest rates can be viewed as the typical risk-inclusive costs of capital that Chinese face in the region.

[13]The present paper goes beyond the data of Keller, Shiue, and Wang (2021) both in regional and in time dimension.

Figure 3 shows relative interest rates in two sets of prefectures: those that saw one or more foreign consulates be established, versus those that never had. Typical interest rates in the latter set of prefectures were close to the sample mean because such control regions are the majority. In contrast, regions that were eventually subject to foreign influence had similar or somewhat higher interest rates early on while by the end of the sample period their interest rates fell to about 2 percentage points below those in control regions. This is consistent with foreign influence having an interest-lowering effect relative to regions without foreign influence. Furthermore, if the overall trend of increasing Chinese interest rates would have been due to foreign influence, one would expect that the increase is stronger in regions with such influence than in regions without—however, Figure 3 shows the opposite.

Legal Extraterritoriality The third original data set employed in this paper concerns aspects of legal extraterritoriality that foreign countries implemented in China. It gives us the opportunity to compare the impact of the legal institutions of more than a dozen countries in the same economy, in this case China. In contrast, analyses in the legal origins tradition of La Porta, Lopez-de-Silanes, and Shleifer (2008) typically compare different source countries' legal institutions in different host countries (Levine, Lin, Ma, and Xu 2022 is a valuable exception). Extraterritorial legal institutions in China were primarily linked to the country's consulates in China, because the court of first instance was typically the consular court. Moreover, there were differences in the strength with which foreign countries exerted their rights of extraterritoriality in China. Our analysis quantifies foreign legal influence in China along four dimensions. These dimensions are (1) the consular court's scope of jurisdiction, (2) whether there was an effective right to appeal, (3) whether a foreign country operated prisons in China, and (4) whether foreign assessors were present at the trial when the foreigner is plaintiff. This analysis of the impact of extraterritoriality is based primarily on the *Report of the Commission on Extraterritoriality in China*, Commission on Extraterritoriality in China (1926). The resulting measure differs from the legal origins variable. For example, in terms of scope of jurisdiction, Spain–a country not of Anglo-Saxon legal origin–implemented in China the same policies as Britain, a country of Anglo-Saxon legal origins (see Appendix A.5 for more information).

Table 1: Summary Statistics

	N	Mean	Standard Deviation
Panel A: Industrial Development and Protest Samples (Prefecture by Year)			
Number of Industrial Firms	24,727	0.034	0.225
Capital Investment	24,727	0.152	0.919
Steam Engines	24,727	0.010	0.097
Machinery Adoption	24,727	0.019	0.156
Number of Treaty Ports	24,727	0.037	0.193
Number of Consulates	24,727	0.317	2.361
Number of Foreign Banks	24,727	0.021	0.169
Foreign Direct Investment	24,727	0.084	0.496
Missionaries	24,727	0.047	0.153
Number of Self-Strengthening Projects	24,727	0.017	0.125
Militia Protests	21,567	0.947	4.356
Secret Society Protests	21,567	0.163	0.607
Panel B: Interest Rate Sample (Prefecture-Grain by Year)			
Interest Rate	64,620	7.449	10.934
Treaty Port Indicator	64,620	0.053	0.224
Customs Station Indicator	64,620	0.041	0.199
Consulate Indicator	64,620	0.048	0.214
Treaty Port or Consulate Indicator	64,620	0.059	0.236
Mass Violence	64,620	0.820	1.537
Treaty Port Indicator (0, 150 km]	64,620	0.164	0.370
Treaty Port Indicator (150, 300 km]	64,620	0.323	0.468
Treaty Port Indicator (300, 450 km]	64,620	0.360	0.480
Treaty Port Indicator (450, 600 km]	64,620	0.440	0.496
Consulate Indicator (0, 150 km]	64,620	0.163	0.370
Consulate Indicator (150, 300 km]	64,620	0.323	0.468
Consulate Indicator (300, 450 km]	64,620	0.380	0.485
Consulate Indicator (450, 600 km]	64,620	0.424	0.494
Growth of High-End Human Capital	64,620	0.0003	0.005
Share of Foreign Exports	64,620	0.006	0.040
Share of Foreign Imports	64,620	0.006	0.054
Max. Extraterritorial Legal Influence	64,620	0.030	0.171

Notes: Panel A: Number of Industrial Firms, Capital Investment, Steam Engines and Machinery Adoption give the cumulative number operating in Chinese-owned firms in prefecture i and year t; Foreign Banks is measured by their headquarters; Foreign Direct Investment is the total number of foreign-owned firms, all in logs after adding one. Missionaries is the fraction of counties of prefecture i in year t with at least one Protestant missionaries. Panel B: Interest rate is derived from grain prices over the seasonal cycle as part of the costs of storage, see Appendix A; there are multiple interest rates for a given prefecture-year combination, one for each grain. Growth of High-End Human Capital is change in the prefecture's *jinshi* share between 1890/99 and 1855/64. Share of foreign exports and imports is the fraction of a customs station in all of China's foreign trade of the year 1882. Max. Extraterritorial Legal Influence is an indicator variable based on four specific legal practices, see Appendix section A.5.

Other Data We employ both indicator variables and the number of treaty ports, customs stations, and consulates in a prefecture as measures of foreign influence.[14] In addition, information on trade and legal characteristics is used to explore the mechanisms through which Western influence mattered in post-Opium War China. To do so, the share of China's foreign imports and exports that a particular port accounted for are both included in the analysis. Canton (Guangzhou), for example, accounted in 1882 for 19% of China's foreign exports, while Amoy (Xiamen) accounted for 8% of China's foreign imports (CMC n.d.).

Starting in the middle of the 19th century, a new type of firm emerged in China. Initially, they were not factory-style firms, but they were in trade and shipping industries. Because of their relation to the initial phase of industrialization, we refer to them as "Industrial" firms. Later firms were in the silk reeling, oil drilling, as well as mining industries. By the end of our sample period in 1899, there were 356 of such firms in 65 different prefectures. We also have information on these firms' capital investments, from Du (1991). Information on the diffusion of technology includes the number of industrial machinery and the number of steam engines (source: Chang 1988a, 1988b, 1989). By the end of our sample period, industrial machinery was employed in 26 Chinese prefectures, while steam engines were utilized in 13 prefectures. Shanghai accounted for 27% of the steam engines and 36% of the industrial machinery by the end of the 19th century. The role of Shanghai for the results is examined below.

We also use a measure of the growth of high-end human capital. While China's civil service examination had a long tradition of testing classical Chinese literature and poetry, in the course of the 19th century, Western schools served as model for reformers seeking to improve the civil service examinations, and both scientific and foreign topics proliferated in the civil service exams (Elman 2000). To identify Chinese regions that pivoted more strongly than others towards western-style human capital, we employ information on the change in a prefecture's top-level civil service exam graduate (*jinshi*) share between 1890/99 (the end of our sample period) and 1855/64 (the years immediately before westernization of the curriculum). A relatively high figure for this change in the *jinshi* share is indicative of relatively high growth of western-style high-end human capital. Information on *jinshi* by region comes from Zhu and Xie (1980).[15]

[14] Our analysis abstracts from Chinese ports that were opened unilaterally by China ("self-opened" ports) because given the underlying difference in origin, their implications for China's economy might be different; see Kung (2022) for an analysis. Information on the timing of treaty port openings and the opening of consulates is based on CMC (1938) and Yunglong (1986), respectively.

[15] For parts of the history of China's civil service examination, it was governed by a system of regional quotas. In order to obtain figures that are not determined by these quotas, we employ information on *jinshi* rank in the examination to focus on the top-1/8 ranked *jinshi*, for whom the quotas are generally not binding. See the Appendix for more information.

Information on foreign-owned banks and firms in China is used because both are closely related to the opening of the ports. In this sense, these variables can be considered mechanisms of Western influence. By the year 1899, there were 933 foreign firms in the treaty ports of China, more than double the number in the year 1882 (440 firms).[16] These foreign firms were a form of foreign direct investment (FDI) that might have affected the supply of capital in China. Our information on foreign firms in China comes from CMC (1933), while figures on foreign banks is drawn from Jiang (2014).

Protestant missionaries from Western countries were active in China in the 19th century (Bai and Kung 2015). The work of these missionaries was enabled by the treaties that opened the ports for trade, and consequently Protestant missionaries may have been a mechanism through which Western influence operated. Missionary activity in prefecture i and year t is measured by the fraction of counties that had at least one Protestant missionaries (based on Stauffer 1922). Finally, a potentially important alternative determinant of interest rates in China during the 19th century was mass violence. Because these incidents might impact local interest rates by affecting capital supply, demand, or risk premia, we include a province-level control variable from Chan (1983) in the interest rate regressions.

4 Estimation Approach

A difference-in-differences approach is used in which a measure of industrial development in prefecture i and year t, Y_{it}, is related to foreign influence, FOR_{it}, by estimating the following linear regression:

$$Y_{it} = \beta_1 FOR_{it} + \gamma' \Gamma + \delta_{p(i)t} + \mu_t + \theta_i + \varepsilon_{it}, \tag{1}$$

where Y_{it} is the number of industrial firms, their capital investment, the number of steam engines, and the number of pieces of industrial machinery (each in logs after adding one), while FOR_{it} is an indicator that equals one if there is at least one treaty port, foreign consulate, and customs station in prefecture i and year t. The terms θ_i and μ_t are prefecture- and year fixed effects, respectively. Equation (1) is the well-known two-way fixed effects model. The term $\delta_{p(i)t}$ are province-year fixed effects and the vector Γ includes other variables that might affect Y_{it}. We are interested in the parameter β, which under standard identification conditions gives the average sample difference in terms of Y_{it} that is caused by foreign influence.

[16] The number of Japanese firms increased in the last years of our sample period, after the First Sino-Japanese War (1894-95), but this does not have a major influence on our results.

The inclusion of prefecture fixed effects means that the approach allows for differences between prefectures that are constant over time as estimation of β is based on variation within prefectures over time. Province-year fixed effects pick up shocks to industrial development at the province-level, such as geographical advantages of coastal areas as transport technology changes, while μ_t captures national shocks.[17] Furthermore, to account for the effect of more persistent influences that cross province boundaries the vector Γ includes geo-trends, defined as decadal fixed effects for nine macro regions of China (3 x 3 regions based on latitude and longitude). Inverse-probability regression weight adjustment (IPWRA) is used to sharpen identification. The error ε_{it} in equation (1) is assumed to have mean zero. We account for possible heteroskedasticity by clustering at the prefecture level, which allows for arbitrary serial correlation of observations for the same prefecture. The analysis below also addresses possible spatial dependence by employing standard errors as in Conley (1999).

To analyze the effects of foreign influence on Chinese capital markets, the estimation equation is:

$$r_{igt} = \beta_1 FOR_{it} + \gamma' \widetilde{\Gamma} + \widetilde{\delta}_{p(it)t} + \mu_t + \theta_{ig} + \varepsilon_{igt}, \tag{2}$$

where r_{igt} is the interest rate in prefecture i and year t based on grain g. Equation (2) differs from equation (1) primarily in that now the cross-sectional dimension is prefecture-grain rather than prefecture, given that we employ interest rates based on all grains that are available in the prefecture (θ_{ig} are the associated fixed effects). Moreover, since climate affects grain storage costs and therefore our interest rates, equation (2) allows the province-year fixed effects to vary for each of the five weather conditions.[18]

Equations (1) and (2) are extended to study geographic dispersion by adding foreign influence at some distance away. Similar to Feyrer, Mansur, and Sacerdote (2020, 2017), James and Smith (2020), our approach is to form circular bands (or, donuts) at certain distances around prefecture i and to define geographic spillover variables based on treaty ports, consulates, or customs stations in each band. For the interest rate specification, equation (2), the specification becomes

$$r_{igt} = \beta_1 FOR_{it} + \sum_d \beta_{2l} \left[\sum_{j \neq i} 1_{ij}\{l = d\} \times FOR_{jt} \right] + \gamma' \widetilde{\Gamma} + \widetilde{\delta}_{p(it)t} + \theta_{ig} + \mu_t + \varepsilon_{igt}, \tag{3}$$

[17] National shocks μ_t are identified separately from $\delta_{p(i)t}$ because not all provinces are included in the sample in all years.
[18] The vector $\widetilde{\Gamma}$ also includes the Chan (1983) control variable of mass violence.

where d indicates a certain distance bracket in kilometers, such as four brackets of 150 kilometers width each, from zero to 600 kilometers, $d = \{(0, 150], (150, 300], (300, 450], (450, 600]\}$, and 1_{ij} is an indicator function on the distance between prefectures i and j. For example, the term in hard brackets in equation (3) can be the number of treaty ports in a particular distance band d surrounding prefecture i. As an alternative we also employ indicator specifications, such as whether in distance band d of prefecture i there is any open treaty port, that is, $1\left(\left[\sum_{j\neq i} 1_{ij}\{l = d\} \times FOR_{jt}\right] > 0\right)$. As before, the coefficient β_1 gives the causal impact of FOR_{it} on interest rates; however, to the extent that $\beta_{2l} \neq 0$ for any distance d in addition to a non-zero coefficient β_1, there is evidence that foreign influence affects prefecture i from some distance away.

A central identification assumption of this approach is that in the absence of treatment, outcomes in treatment and control regions would have followed parallel trends. An ideal setting for estimating causal effects would have treaty ports and consulates randomly allocated. The historical record shows, however, that actual locations were not random. The following seeks to gauge the impact of this on our empirical findings.

Balance Checks There are no differential pre-trends in terms of the industrial development variables because before 1842, as there were no steam engines–or industrial machinery, or industrial firms–in any region of China. Table 2 compares treatment and control regions in the pre-treatment period for other variables. Panel A shows that interest rates in regions that were eventually subject to foreign influence were similar to interest rates in other regions. The difference in average interest rates is not statistically significant.

Panel B of Table 2 compares the two set of regions in terms of interest rate growth before the beginning of the Treaty Port Era. Differences in interest rate growth between treated and control regions are relatively small and not significant. Panel C extends the analysis by comparing population growth in the two sets of prefectures in more than four decades before our sample period begins (1776-1820). For both definitions of treatment, population growth in the treatment regions tends to be lower than in the control regions. The relatively low pre-sample growth in treated regions is consistent with Fairbank's (1978) assessment that Shanghai, which arguably became the most strongly Western-influenced Chinese city during the treaty port era, had been a relatively small city since the Yuan (1279-1368) period, with hardly any growth during

the early 19th century. At the same time, if the relatively strong pre-sample performance of treated regions extended into our sample period it would bias the results *against* finding a positive relative impact from Western influence.

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

	Years 1821-1842						Years 1776 - 1820		
	A. Interest Rate Level (%)			B.Interest Rate Growth			C. Population Growth		
	Treated	Control	Difference	Treated	Control	Difference	Treated	Control	Difference
Treaty Port	6.254	6.586	−0.332 [0.212]	0.130	0.196	−0.067 [0.142]	0.227	0.293	−0.065 [0.000]
Consulate	6.412	6.554	−0.141 [0.607]	0.169	0.189	−0.019 [0.678]	0.269	0.288	−0.019 [0.007]

Notes: Table gives means (growth) for the period 1821 to 1842 in panel A (B), and growth from 1776 to 1820 in panel C. Treaty Port and Consulate are defined as having ever at Treaty Port or Consulate, respectively. p-value of a test of equality in brackets. Population data from Cao (2000), interest rate data see Appendix A.2.

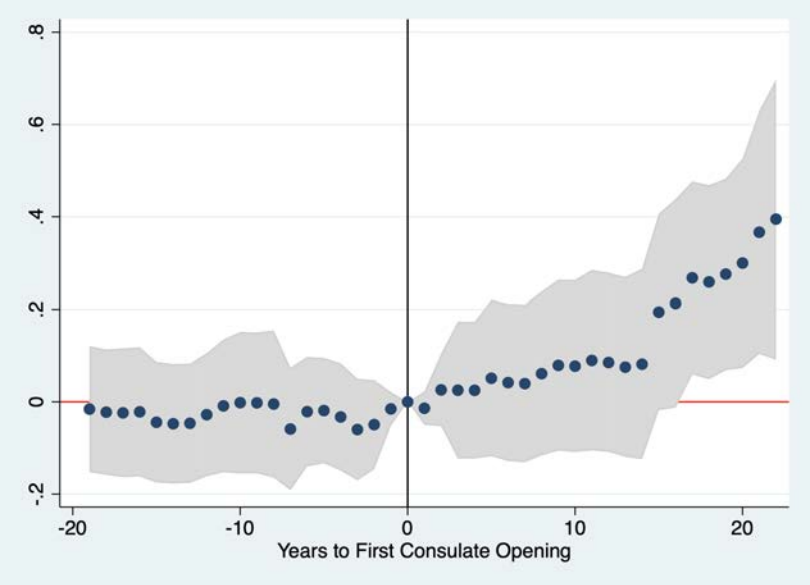
In sum, based on analyses going back to the 18th century, there is little evidence that the regions that were eventually subject to substantial foreign influence were the most promising regions of China. It is thus unlikely that the analysis below overestimates the impact of Western influence because the regions with eventual Western influence were favored already before the Opium War.

Event Study Evidence Equation (1) is generalized to an event-study framework, in which one can estimate one coefficient for each period υ relative to treatment time:

$$Y_{it} = \sum_{\upsilon} \beta_{\upsilon} \, 1\{t - \widetilde{FOR}_i = \upsilon\} + \beta' \Gamma + \delta_{p(i)t} + \mu_t + \theta_i + \varepsilon_{it}, \tag{4}$$

where the year when prefecture i receives a particular binary treatment is $\widetilde{FOR}_i$, and $\upsilon = t - \widetilde{FOR}_i$ is the year relative to treatment.

Figure 4: Number of Industrial Firms: Event Study



Notes: Figure shows estimates of β_l (equation (4)) for the number of industrial firms as Y_{it} and $\widetilde{FOR}_i$ as the year of first consulate opening in prefecture i. N = 24,727; 95% confidence intervals shown.

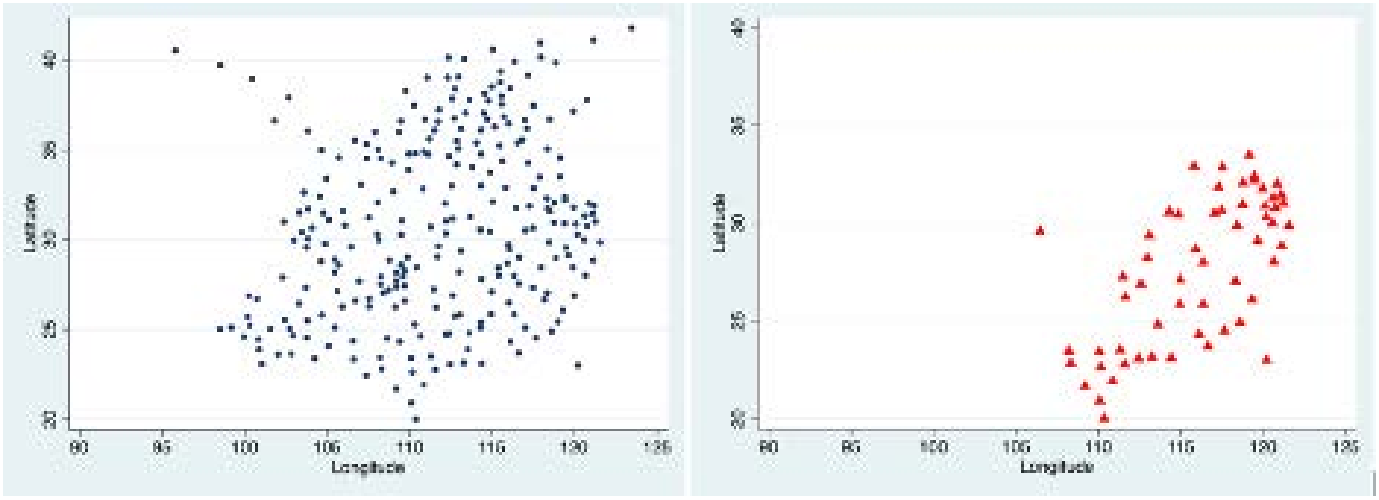
Figure 4 shows no evidence for differential trends for treatment and control regions before treatment. Before the first consulate opening, there is no clear trend in the β_v estimates, and coefficients are not significantly different from zero. Similar results are obtained for other outcome variables.[19] Figure 4 also shows that after treatment, the β_v estimates turn more and more positive.

Selection of Regions Inverse-probability weighted regression adjustment (IPWRA) is used as a first step to address non-random selection of locations of foreign influence. Our approach is based on the predicted probability that a prefecture would be treated based on information such as geography and pre-sample characteristics. The IPWRA adjustment ensures that our analysis places more weight on treatment and control regions that are relatively similar in terms of likelihood of being a foreign location. Among the important predictors is the North-South dimension, with a negative coefficient on latitude indicating that the West tended to select locations in the Southern part of China. Further, consistent with a market access motive, regions on the Northern coast were more likely than inland regions of the North, and location on the Yangzi river significantly increased the probability that a region would be chosen as well. These probit results are shown in Table A.3.

[19] See Figures A.5 to A.8 in the Appendix.

To address potential selection further, it is useful to examine certain subsamples of prefectures. First, based on the estimated probability that a given region would be a foreign location we focus on those regions that were most likely selected by foreigners. We separately estimate the likelihood that a prefecture is selected as a location for (1) a treaty port and (2) a consulate using the predictors of Table A.3, and then focus the analysis on those prefectures that are in the top third of both probabilities.

Figure 5: All Regions versus Likely Foreign-Selected Regions



Notes: Shown on the left are all prefectural capitals (N = 245) and on the right prefectural capitals that are in the highest third of both the predicted probability of having one or more treaty ports and having one or more consulates based on probit regressions with the independent variables reported in Table A.3 (N = 59).

Figure 5 shows the full sample of 245 prefectural capitals in the interest rate sample on the left, while the 59 prefectures most likely to have foreign influence are on the right; the latter tend to be located in the coastal South and East of China (right panel).[20] Furthermore, restricting the sample outright based on geographic criteria is another approach. Either of these leads to similar results as those obtained with the full sample (shown in Table A.4).

5 The Impact of the West on China's Economy

First, in terms of industrial development, column (1) in Table 3 shows that the number of Chinese-owned industrial firms in regions in which a treaty port is located is significantly higher than in regions without treaty ports. We estimate also positive effects from consulates and customs stations, see columns (2) and

[20]These 59 prefectures account for less than 1/3 of N = 245 because some prefectures are both in the top third probability of having at least one treaty port and in the top third probability of having one or more consulates.

(3), respectively. Given that many consulates are located near treaty ports, we include both variables simultaneously in the regression, although it is challenging to separate the respective effects. Results indicate that the number of industrial firms is more affected by treaty ports than by consulates (column (4)).

Defining a variable that is equal to one if either at least one foreign consulate or treaty port is located within a prefecture yields a the coefficient of about 0.13 (column (5)). This indicates that prefectures subject to foreign influence in form of at least one consulate or treaty port have on average 13% more industrial firms than prefectures not exposed to such influence. Positive effects are estimated from treaty ports and consulates on three other measures of industrial development, namely the firms' capital investment, advanced machinery, and steam engines (columns (6), (7), and (8), respectively). In each case, the positive effect is due more to treaty ports than consulates (not reported). In conclusion, Western influence has contributed to industrial development in China.

Turning to Chinese capital markets, results are given in columns (9), (10), and (11) of Table 3. The sample is now larger because as the dependent variable we employ prefectural interest rates based on prices of several different grains. Notice that the coefficient on the treaty port indicator is negative, indicating that capital costs are lower in prefectures with such Western influence than in prefectures without such influence (column (9)). Furthermore, the estimate yields a negative coefficient for consulates, and the consulate point estimate is in fact larger than the treaty port estimate (column (10)). These results suggest that regional capital costs in China were lowered through both Western trade and legal institutions.

Column (11) shows a coefficient of about -2.4 for the indicator variable of at least one consulate or treaty port in a prefecture. This is more than a quarter of the average interest rate in the sample (see Table 1). In contrast to the positive impact on industrial development and capital markets, we do not find that the treaty ports or consulates reduced the number of armed militia or secret society incidents (columns (12) and (13), respectively). In fact, the positive point estimate in column (13) suggests that if anything the West's intervention has increased the number secret society incidents in China (not significant).

Table 3: Areas of Western Influence in China

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Industrial Development								Capital Markets			Protests	
	Industrial Firms					Investment	Machinery	Steam Engines	Interest Rate			Militia	Secret Society
Treaty Port	0.161**			0.127**					−1.867**				
	(0.054)			(0.049)					(0.483)				
Treaty Port or Consulate					0.133**	0.494+	0.084*	0.049*			−2.365**	−0.194	0.194
					(0.048)	(0.258)	(0.033)	(0.021)			(0.438)	(0.193)	(0.163)
Consulate		0.145**		0.041						−3.142**			
		(0.054)		(0.051)						(0.459)			
Customs			0.269**										
			(0.083)										
Prefecture FE	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Province-Year FE	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y
Prefecture-Grain FE									Y	Y	Y		
Province-Year-Weather FE									Y	Y	Y		
N	24,727	24,727	24,727	24,727	24,727	24,727	24,727	24,727	64,620	64,620	64,620	21,567	21,567
R^2	0.439	0.436	0.458	0.439	0.435	0.431	0.429	0.424	0.227	0.229	0.228	0.651	0.335

Notes: Dependent variable given on top of column; estimation of equation (1) in columns (1) to (8), (12) and (13), and equation (2) in columns (9) to (11). Estimation by least squares except (12) and (13) by PPML (showing Pseudo R^2). Dependent variable in logs after adding one in columns (1) to (8). Treaty Port, Consulate, and Customs are indicator variables. Controls for geo-trends always included, for mass violence included in columns (9) to (11); IPWRA applied. Robust clustered standard errors at the prefecture level reported in parentheses, except in column (9) to (11) where clustering is at the prefecture-grain level. **/*/+ indicates significance at the 1/5/10 percent level.

Table 4 addresses a number of potential concerns. First, because least squares can be problematic in the presence of zeros we employ PPML, with similar results (column (1), Table 4).[21] Second, specifications excluding observations with Russian or Japanese consulates yield similar results, indicating that our results shed light primarily on a Western effect (Table 4, columns (2), (7), and (11)). Moreover, Shanghai, the most important treaty port, does not have an unduly large impact on the results (columns (3), (8), and (12)). Furthermore, results are similar to the corresponding findings in Table 3 when heterogeneous effects as in Borusyak, Jaraval, and Spiess (2021) are allowed for (Table 4, columns (5) and (9)). Inferences are unchanged when we employ heteroskedasticity-consistent spatial standard errors (Table 4, column (6)), and results are similar when we limit the sample to prefectures in China's coastal south that had the highest chance of being selected as foreign locations (Table 4, column (4)).[22]

The following sheds more information on mechanisms. Results on the impact of the West's intervention on China's industrial development are shown in Table 5 on the left. Foreign direct investment (FDI) enters with a positive coefficient, as does a measure of foreign-owned banks in the region (column (2)). The coefficient on FDI is evidence for positive externalities through technological learning, because the chance of learning how to establish and operate a locally owned industrial firm is relatively high in locations in which there is a large number of foreign-owned firms (FDI spillovers, e.g., Keller 2022). One explanation of the positive coefficient on foreign banks is that such lending institutions provide information useful for starting up industrial firms. Notice that accounting for regional FDI and foreign-owned banks fully accounts for the positive treaty port and consulate coefficient (compare columns (1) and (2)). Positive technology spillovers are part of the mechanism of Western influence on China's industrial development.

[21] See also Table 4, column (10) versus column (12) of Table 3.

[22] In column (6) we report standard errors using Conley's (1999) method, which allows for arbitrary dependence of observations below some distance threshold; here this is 450 kilometers, see the spillover analysis of section 5.

Table 4: Robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Industrial Firms						Interest Rate			Militia Protests		
	PPML	No JP, RUS	No Shang-hai	South Coast	BJS	Spatial s.e.	No JP, RUS	No Shang-hai	BJS	Least Squares	No JP, RUS	No Shang-hai
Treaty Port or Consulate	2.144**	0.088**	0.124**	0.141**	0.124**	0.274**	−2.701**	−2.392**	−2.362**	−0.006	−0.195	−0.170
	(0.702)	(0.034)	(0.045)	(0.048)	(0.043)	(0.024)	(0.479)	(0.448)	(0.384)	(0.045)	(0.210)	(0.192)
Prefecture FE	Y	Y	Y	Y	Y	Y				Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Province-Year FE	Y	Y	Y	Y	Y	Y				Y	Y	Y
Prefecture-Grain FE							Y	Y	Y			
Province-Year-Weather FE							Y	Y	Y			
N	24,727	24,414	24,648	8,374	24,727	24,727	63,329	64,243	64,620	21,567	21,277	21,488
R^2	0.743	0.445	0.420	0.454	0.437	0.434	0.230	0.229	0.228	0.579	0.652	0.651

Notes: Dependent variable given on top of column; estimation of equation (1) in columns (1) to (7), (11) and (12), and equation (2) in columns (8) to (10). Estimation by least squares except PPML shown in columns (1), (11), and (12), with Pseudo R^2. Dependent variable in logs after adding one in columns (1) to (7), (10). Treaty Port and Consulate are indicator variables. BJS stands for Borusyak, Jaraval, and Spiess (2021), JP and RUS stand for Japan and Russia, respectively. Controls for geo-trends included in columns (1) to (12), for mass violence included in columns (8) to (10); IPWRA applied except column (6). Robust standard errors reported in parentheses; clustered at the prefecture level in columns (1) to (5), (9), and heteroskedasticity-consistent spatial standard errors in column (6); clustered at prefecture-grain in columns (7) to (9). **/*/+ indicates significance at the 1/5/10 percent level.

Table 5: Mechanisms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Industrial Firms							Interest Rate		
TP or Consulate	0.133**	−0.049	0.124**	0.133**						
	(0.048)	(0.057)	(0.044)	(0.046)						
Customs					0.206**	0.160*	0.154*			
					(0.069)	(0.064)	(0.067)			
Consulate								−3.142**	−4.207**	−1.906*
								(0.459)	(0.474)	(0.753)
FDI		0.111**							0.345	
		(0.042)							(0.248)	
Foreign Banks		0.358**							2.438**	
		(0.090)							(0.593)	
Missionaries			0.054							
			(0.110)							
Self-Strengthening				0.934**						
				(0.205)						
Customs x Imports					2.721**		−0.716			
					(0.195)		(1.201)			
Customs x Exports						4.339**	5.232**			
						(0.508)	(1.894)			
Consulate x HC Growth										−0.342**
										(0.163)
Prefecture FE	Y	Y	Y	Y	Y	Y	Y			
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Province-Year FE	Y	Y	Y	Y	Y	Y	Y			
Prefecture-Grain FE								Y	Y	Y
Prov.-Year-Weather FE								Y	Y	Y
N	24,727	24,727	24,727	24,727	24,727	24,727	24,727	64,620	64,620	64,620
R^2	0.435	0.507	0.445	0.570	0.499	0.512	0.513	0.229	0.231	0.229

Notes: Dependent variable given on top of column; estimation of equation (1) in columns (1) to (7), and equation (2) in columns (8) to (10). Dependent variable in logs after adding one in columns (1) to (7). Treaty Port, Consulate, and Customs are indicator variables. Controls for geo-trends included in columns (1) to (10), for mass violence included in columns (8) to (10); IPWRA applied. TP stands for treaty port. Robust standard errors reported in parentheses; clustered at the prefecture level in columns (1) to (7), clustered at prefecture-grain in columns (8) to (10). **/*/+ indicates significance at the 1/5/10 percent level.

In contrast, there is no evidence that Protestant missionaries contributed to the increase in the number

of industrial firms in China during the 19th century, see column (3). There is a positive coefficient for self-strengthening projects (SSM), which provides evidence that this domestic policy response has been a mechanism (column (4)). Moreover, including the SSM variable does not reduce the size of the treaty port or consulate coefficient, indicating that Chinese industrial firm growth benefited from SSM projects even when they were not located directly in treaty port and consulate regions.

Next, we turn to the role of foreign market access. There are several key results, see columns (5) to (7). First, the interaction variables tend to enter with a positive coefficient (columns (5), (6)), which means that the impact on Chinese industrial firms is larger, the higher is the share of foreign trade transacted at a particular customs station. Second, foreign market access accounts for a sizable part of the overall effect, which can be seen by comparing the sizes of the customs coefficient with and without including the interaction variable (0.27 without, see Table 3, column (3), versus 0.15 to 0.21 in Table 5 with the interaction variable).

Third, exports are more strongly associated with industrial development than imports. Even though both export and import interaction variables are positive, the latter appear to be more important for industrial development. Indeed, when both export and import interactions are included simultaneously it is the exports, not the imports interaction that is positively correlated with industrial development (column (7)). It may reflect that foreign exports indicate a regional capability to produce goods that are competitive on world markets.

What about the Western impact on Chinese capital markets? Above results showed that the lowering of local interest rates is most strongly correlated to the presence of Western consulates. This could be due to a number of reasons. One is that interest rates fell because the West provided additional capital. While systematic figures on domestic capital are not available, FDI and foreign banks are measures of foreign capital that should be positively correlated with overall capital supply in a region. Notice that neither the FDI nor the foreign banks variable is negatively correlated with interest rates (column (9)). In contrast, the coefficient of the consulate variable remains significantly negative.[23]

If the West's effect on capital markets had operated primarily through additional capital from Western countries, one would expect that including FDI and foreign bank variables would move the treaty port and

[23]The somewhat larger coefficient on the consulate variable may reflect correlation between foreign banks and consulates.

consulate coefficients towards zero. Therefore, this suggests that the estimated interest-lowering effect is not primarily due to changes in capital supply relative to demand. An alternative explanation for lower interest rates is that the West influenced the efficiency of capital markets, in particular risk, which creates a wedge between capital demand and supply. It is consistent with the historical record that the West provided security spillovers at the ports of trade that also lowered risk in capital markets.

Overall, Table 5 indicates that the West's intervention benefited China's economy by improving foreign market access, by transferring new technology, and by generating security spillovers that increased the efficiency of capital market transactions. Further, the evidence is consistent with a significant endogenous domestic policy response through China's Self-Strengthening Movement.

6 The Spatial Extent of Western Influence

This section examines the geographic extent of Western influence in China by extending the estimation equation to include spillover terms, as described in equation (3). The first column of Table 6 reports the result with an indicator for either a treaty port or a consulate (as in Table 3, column (11)). We will refer to this specification as the no-spillover specification. We begin by adding separate indicator variables for treaty ports and consulates at distances larger than 0 and up to 150 kilometers from the prefecture.[24] Both variables enter with negative coefficients (column (2)). This indicates that the effect in column (1) is not the total effect. Rather, Western influence had a geographically dispersed effect of at least 150 kilometers beyond the ports themselves.

Another finding is that the coefficient on Treaty Port or Consulate is higher once the (0, 150 km] spillover variables are included, see columns (1) and (2), respectively. This indicates that the interest-rate lowering effect in the prefecture itself is stronger than the interest-rate lowering effect at distances between 0 and 150 kilometers.[25] Finally, based on these findings, the no-spillover specification of column (1) yields an underestimate of the interest-rate lowering effect, relative to regions without Western influence.

[24]These distance bands do not include treaty ports or consulates in the prefecture itself. Distance is measured between prefectural capitals.

[25]Without separate (0, 150 km] bands, the total effect must be captured by the Treaty Port or Consulate variable, and if the impact at distances between 0 and 150 km is lower than in the prefecture itself the coefficient of the former will be relatively low. By including a separate variable for the (0, 150 km] distance band the Treaty Port or Consulate coefficient can reflect the relatively strong effect in the prefecture itself.

Table 6: The Spatial Extent of Western Influence: Capital Markets

	(1)	(2)	(3)	(4)	(5)
Treaty Port or Consulate	−2.365**	−2.795**	−3.135**	−3.159**	−3.155**
	(0.438)	(0.460)	(0.451)	(0.452)	(0.452)
TP Indicator (0, 150 km]		−2.119**	−2.164**	−2.261**	−2.260**
		(0.492)	(0.481)	(0.485)	(0.487)
Consulate Indicator (0, 150 km]		−1.453**	−1.491**	−1.429**	−1.438**
		(0.454)	(0.442)	(0.438)	(0.443)
TP Indicator (150, 300 km]			−1.105*	−1.131*	−1.109*
			(0.479)	(0.477)	(0.473)
Consulate Indicator (150, 300 km]			−0.737	−0.792+	−0.834+
			(0.455)	(0.458)	(0.458)
TP Indicator (300, 450 km]				−0.767+	−0.808*
				(0.396)	(0.396)
Consulate Indicator (300, 450 km]				0.272	0.277
				(0.385)	(0.385)
TP Indicator (450, 600 km]					0.195
					(0.443)
Consulate Indicator (450, 600 km]					−0.535
					(0.416)
Year FE	Y	Y	Y	Y	Y
Prefecture-Grain FE	Y	Y	Y	Y	Y
Province-Year-Weather FE	Y	Y	Y	Y	Y
R-squared	0.228	0.233	0.234	0.234	0.234

Notes: Dependent variable is interest rate; estimation of equation (2). N = 64,620. TP stands for treaty port. Specifications include controls for geo-trends and mass violence; IPWRA applied. Robust standard errors clustered at the prefecture-grain level. **/*/+ indicates significance at the 1/5/10 percent level.

To assess the geographic scope of the Western effect on capital markets, columns (3), (4), and (5) add spillover variables at an increasing distance. At distances between 150 and 300 kilometers, treaty ports lower interest rates (column (3)). The Treaty Port or Consulate point estimate increases further, from -2.7 to -3.1, and also the spillover point estimates for distances between 0 and 150 km increase (in absolute values). This confirms that including spillover terms at higher distances tend to increase coefficients at lower distances. Column (4) shows that compared to regions without Western influence, treaty ports reduce local interest rates at distances of up to 450 kilometers and consulates lower interest rates at distances of up to 300 kilometers. The geographic scope of the treaty port effect to lower interest rates is

larger than the geographic reach of consulates, and above 450 kilometers no significant effects are estimated (column (5)). Our analysis shows that Western influence went far beyond the immediate vicinity of the ports. Furthermore, allowing for dispersed spatial effects yields a larger (relative) impact than would be obtained without allowing for geographic spillovers.

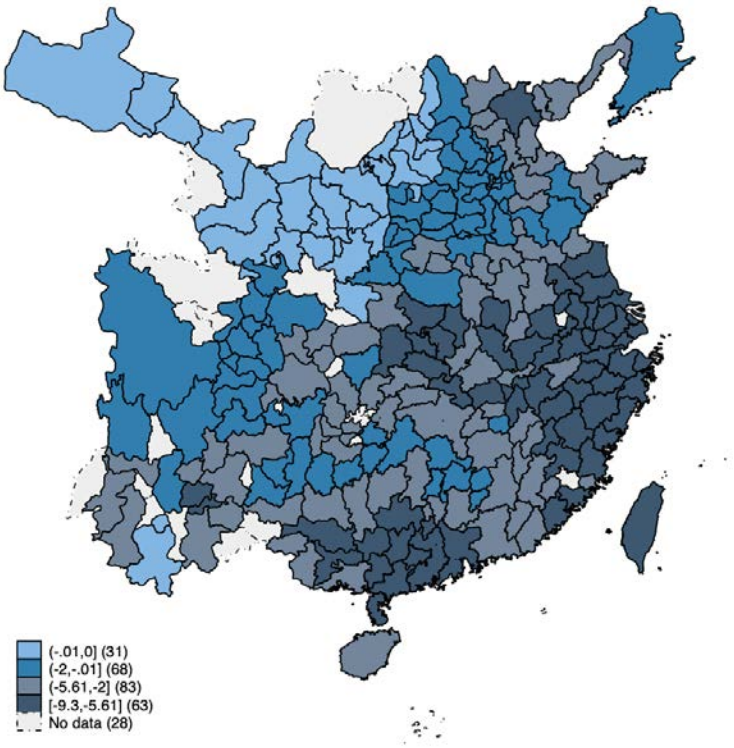
The coefficient patterns also yield further insights on the nature of the Western effect. We estimate spatial decay in the impact of Western influence on interest rates in China's regions. The effect is strongest at the port, it becomes weaker as distances increase, and it approaches zero at large distances (here, above 450 kilometers, column (5)). This is *not* the pattern that one would expect if the West's impact had led to a reallocation of resources. Notably, there is no pattern of treaty port prefectures benefiting at the expense of non-treaty port prefectures. For example, if the West's intervention had triggered the influx of capital from other regions, one would expect that the negative Treaty Port and Consulate coefficient is accompanied by positive coefficients in prefectures that are nearby. However, there is little evidence for such a mix of significant negative and positive coefficients that reallocation would imply.

Rather, the geographic decay in the interest-rate lowering effect is consistent with positive externalities that decline in distance. For one, capital market transactions become less frequent as distance increases. Costs rise because transportation, time, and food costs rise with distance, since in this setting transactions would typically be made in person. Given that, improvements leading to lower risk in a particular prefecture will benefit agents less and less who live at an increasing distance away. Furthermore, lower interest rates might lead to the diffusion of ideas as agents travel to these locations of low rates from elsewhere, bringing back new ideas to their points of origin. Generally, the diffusion of new ideas exhibits geographic decay because knowledge is not perfectly codifiable and its diffusion is facilitated by in-person demonstration (Jaffe, Trajtenberg, and Henderson 1993).

Plotting these effects on a map gives the geographic scope of Western influence in China. In Figure 6, the strength of the West's relative effect on regional interest rates is shown using different colors, with darker shades indicating stronger effects. The results are consistent with conventional wisdom that Western influence was relatively high in the coastal regions of China's Southeast and the Yangzi delta. However, the figure also shows that the West's influence reached well beyond coastal regions, in fact eighty-seven percent of all Chinese regions in the sample are significantly affected. Only a minority of regions, mostly in China's Northwest, experienced no Western influence. Furthermore, in a large fraction of regions the

West brought interest rates down by a quarter or more compared to unaffected regions.[26] Thus, the West's intervention in the aftermath of the Opium War affected most of China.

Figure 6: Western Influence and Chinese Capital Markets in the late 19th Century



Notes: Figure 6 gives predicted effects of the specification underlying Table 6, column (4) for the latest possible sample year (typically in the 1890s). First parentheses gives the range of the interest rate reduction (in percentage points), second parentheses reports the number of prefectures in the particular bin. Lightest color indicates no data.

Robustness of Geographic Spillover Findings A series of specifications shown in the Appendix indicate that these capital market spillover results are robust. Moreover, results are broadly similar for different subsamples, such as regions in China's South-East, China's inland regions, or the regions located on the Yangzi river. This indicates that the finding that the West's intervention reduced interest rates far from the ports' immediate locations is not driven by selection. The results are shown in Table A.4. Furthermore, while the exact rendition of Figure 6 depends on particulars, alternative spillover specifications show that the figure's main message is robust. Results from two alternative specifications are shown in the maps of Figures A.9 and A.10.

[26] In 146 out of 245 prefectures (a share of 60 percent), the predicted interest rate effect is larger than two percentage points, which is about one quarter of the typical interest rate level during our sample period.

Geographic Spillover Mechanisms To shed more light on the mechanisms behind the geographic spillovers, we extend equation (3) as follows:

$$r_{igt} = \beta_1 FOR_{it} + \sum_d \beta_{2l} \left[\sum_{j \neq i} 1_{ij}\{l = d\}\, FOR_{jt} \right] + \sum_d \beta_{3l} \left[\sum_{j \neq i} 1_{ij}\{l = d\}\, M_{jt}\, FOR_{jt} \right] + \Lambda + \varepsilon_{igt}, \quad (5)$$

where mechanism M_{jt} is a measure of prefecture j in year t, and $\Lambda \equiv \gamma' \bar{T} + \widetilde{\delta}_{p(it)t} + \theta_{ig} + \mu_t$. Equation (5) asks whether spillovers for a particular distance bracket d is related to a particular mechanism M_{jt}. We have shown that treaty ports and Western consulates had separate spillover influences on capital markets in China (Table 6). Now treaty port and consulate mechanisms are examined one at a time. Panel A of Table 7, on the left, considers exports as the mechanism. The null hypothesis is that the West's spillover influence in China is not related to a port's foreign exports share, that is, $\beta_{3l} = 0$ in equation (5) for any distance band l.[27]

In column (1) the specification with $\beta_{3l} = 0$ is shown. The pattern of coefficients confirms earlier results on geographic dispersion. Including interaction variables with $exports_i$ for all three spillover distance bands yields the results of column (2). The treaty port-export interaction variables come in with negative point estimates for each band. This means that for each of the distances, the extent to which treaty ports lower interest rates, compared to unaffected regions, tends to be increasing in the share of China's foreign exports that each port commands.

[27] We focus on exports as the trade mechanism due to the findings in Table 5; here, $M_{jt} = M_j$ since shares of foreign exports are for a single year, 1882. Results are similar if one uses the trade of the earliest year available, or the trade averaged over the sample period.

Table 7: Mechanisms of Geographic Dispersion

	(1)	(2)		(3)	(4)	(5)
					Max Legal Influence	Legal Origins
Panel A. Trade Mechanism			Panel B. Legal Mechanism			
Treaty Port Indicator	−2.983**	−3.069**	Consulate Indicator	−4.326**	−4.448**	−4.341**
	(0.483)	(0.470)		(0.504)	(0.515)	(0.508)
Number of TPs (0, 150 km]	−1.997**	−1.951**	Number of Consulates (0, 150 km]	−2.324**	−1.485**	−1.811*
	(0.281)	(0.287)		(0.296)	(0.317)	(0.877)
Number of TPs (0, 150 km] x Exports		−0.874	Number of Consulates (0, 150 km] x Extraterritoriality		−1.324**	−0.546
		(2.726)			(0.372)	(0.926)
Number of TPs (150, 300 km]	−1.011**	−0.878**	Number of Consulates (150, 300 km]	−0.723**	−0.551**	−0.551
	(0.185)	(0.222)		(0.182)	(0.179)	(0.562)
Number of TPs (150, 300 km] x Exports		−1.358	Number of Consulates (150, 300 km] x Extraterritoriality		−0.245	−0.182
		(1.918)			(0.192)	(0.189)
Number of TPs (300, 450 km]	−0.619**	−0.247				
	(0.155)	(0.207)				
Number of TPs (300, 450 km] x Exports		−5.255**				
		(1.681)				
R-squared	0.231	0.232	R-squared	0.232	0.233	0.232

Notes: Dependent variable is interest rate; estimation of equation (5). TP stands for treaty port. Exports is $exports_i$,the share of China's foreign exports in prefecture i in the year 1882. Max. Legal Footprint is an indicator variable based on maximal extraterritorial legal presence in a prefecture and year, see section A.4. Legal Origin is equal to one if prefecture i in year t has a British or US consulate, or both, and zero otherwise. Specifications include prefecture-grain fixed effects, year-province-weather fixed effects, geo-trends, and the mass violence control; IPWRA applied. Robust standard errors clustered at the prefecture-grain level. **/*/+ indicates significance at the 1/5/10 percent level.

Furthermore, the treaty port-export interaction variable for the distance band (300, 450 km] has a significant coefficient of -5.2. Quantitatively, with Guangzhou accounting for 19% of China's foreign exports, this means that if a prefecture is located between 300 and 450 kilometers from Guangzhou, it has an interest rate about one percentage point lower than prefectures for which Guangzhou is not in its 300 to 450 kilometers distance band. For a region that is between 300 and 450 km from China's largest treaty port, Shanghai, the interest rate is more than two percentage points lower than in other regions. At the same time, given that the linear treaty port spillover coefficient for the 300-450 km distance band is not significantly different from zero, the treaty port effect on capital markets at distances between 300 and 450 kilometers applies predominantly to larger ports.

Turning to legal mechanisms, the consulate specification yields the negative coefficients shown in column (3) of Table 7.[28] Our legal interaction variable is the product of having at least one consulate in a particular distance band multiplied with $MAXLEGAL_{it}$, defined as an indicator that prefecture i in year t is exposed to the maximum extraterritorial legal influence.[29] We find negative point estimates on interaction variables of up to 300 kilometers, and for the distance band (0, 150 km] it is significantly different from zero (column (4)). Quantitatively, a prefecture that is within 150 kilometers from another prefecture with maximum extraterritorial influence has on average 2.81 percentage point (-1.49 + (-1.32)) lower interest rate compared to regions unaffected by the West's intervention, and almost half of this is due to being exposed to maximum extraterritorial influence (-1.32/-2.81 = 0.47). We conclude that a particularly strong extraterritorial presence increases the geographic reach of Western legal influence in China.

The final specification replaces the maximum extraterritorial influence variable with a legal origins indicator along the lines of La Porta, Lopez-de-Silanes, and Shleifer (2008). Here, M_{it} is defined to equal to one if in prefecture i and year t there is either a British or an U.S. consulate, or there are consulates from both the USA and Britain; results are shown in Table 7, column (5). Although results are similar to the specification with $MAXLEGAL_{it}$, with legal origins none of the coefficients of the interaction variables for distance bands are significantly different from zero. Also, based on the countries' legal origin one would conclude that the scope of legal geographic dispersion is 150, not 300 kilometers (as shown in column (3)

[28] We limit this analysis to maximally 300 kilometers because legal spillovers based on consulate location do not go beyond 300 kilometers (Table 6).

[29] There are four dimensions in this extraterritorial variable–Appeals, No Limits to Jurisdiction, Prisons in China, and Presence of Assessors. See section A.5.

of Table 7).

Industrial Development and Protest Spillovers We have seen above that the West's intervention has had a positive impact on China's industrial development in the prefecture in which treaty ports are located. Based on a specification analogous to equation (3), we now ask whether there is evidence for geographic industrial development spillovers. Table 8 shows these results on the left.

Table 8: Spillovers on Industrial Development and Protests

	(1)	(2)	(3)	(4)	(5)	(6)
	Industrial Firms		Militia Protests		Secret Society Protests	
Treaty Port or Consulate	2.145**	2.145**	−0.185	−0.232	0.221	0.242
	(0.702)	(0.702)	(0.196)	(0.225)	(0.155)	(0.160)
Treaty Port or Consulate (0, 150 km]	−0.195	−0.071	−0.107	−0.153	0.411**	0.425**
	(0.209)	(0.230)	(0.147)	(0.143)	(0.124)	(0.124)
Treaty Port or Consulate (150, 300 km]		0.533+		−0.158		0.056
		(0.322)		(0.217)		(0.119)
N	24,727	24,727	21,567	21,567	21,567	21,567

Notes: Dependent variable given on top of column; estimation of equation (1) using PPML. All specifications include prefecture fixed effects, geo-trends, and year-province fixed effects. Robust standard errors clustered at prefecture level in parentheses. **/*/+ indicates significance at the 1/5/10 percent level.

We begin by adding an indicator for any treaty ports or consulates for distances up to 150 kilometers from the prefecture's capital; the coefficient is imprecisely estimated and close to zero, see Table 8, column (1). Including a spillover term for distances between 150 and 300 kilometers yields a positive coefficient, indicating that the number of industrial firms in a prefecture increases when a treaty port or consulate is located in this range, relative to prefectures for which this is not the case. Beyond 300 kilometers we do not estimate positive spillover coefficients.

It is worth keeping in mind that the regional distribution of industrial development in China during the 19th century was sparse compared to interest rates which vary more smoothly across space (see Figure A.3). The number of cases where there is variation in the number of industrial firms in the distance band (0, 150 km] is small, making it difficult to estimate this coefficient. However, we find similar results for our other measures of industrial development, and taken together, the results indicate that geographic

spillovers for industrial development reached not as far as spillovers for Chinese capital markets.

Protest Spillovers The remaining results of Table 8 show evidence on spillovers of the West's intervention on different types of protests. We have seen in Table 3 that the presence of treaty ports or consulates has not significantly reduced the number of protests, and in the case of secret society incidents it tended to increase their number. Including spillover terms, we find that Western presence in terms of treaty ports or consulates at distances of up to 300 kilometers tends to reduce militia protests, although not significantly so (Table 8, columns (3) and (4)).

At the same time, Western presence increases secret society protests at distances of up to 150 kilometers (columns (5) and (6)). These results are consistent with the idea that while the protection of Western lives and property through Western troops may have tended to reduce militia protests, the West's intervention also encouraged other forms of protests. Furthermore, the finding of a positive estimate for distances of up to 150 km is in line with anecdotal evidence that the West's intervention pushed secret societies out of the ports and into the immediate surroundings of the ports.

Our interpretation of the increase in secret society protests is that it reflects the West's intervention's negative impact on Qing state capacity. Thus, while the Western invasion naturally eroded the Qing's legal capacity, these secret society spillovers provide econometric evidence that even though China's economy benefited from technology transfer and security spillovers, the West's intervention also had a negative impact on China's economy by reducing the government's state capacity. In sum, Western colonialism in China generated both positive effects (new technology, more efficient capital markets) and negative state capacity effects.

7 Conclusions

This paper has examined the economic consequences of China's defeat in the Opium War. While previous Western analysts argued that the impact of the Western presence in China was small and limited to treaty ports, we find large impacts that go well beyond the ports. These findings also weaken perspectives that would claim the impact of the Opium War (1839-42) only benefited Western nations and dealt great economic harm to China.

We showed that Western involvement increased the flow of international goods, foreign firms, and new technologies into China. Comparing regions with treaty ports to those that were not directly influenced by the West, we find regions with greater Western influence exhibited a higher rate of growth of industrial firms and greater investment into advanced machinery as well as steam engines. These results are robust to the concern that Western nations simply picked the most promising regions. Our interpretation, based on econometric analysis, is that the treaty port regions in China developed the way they did because of Western influence.

Furthermore, Western influence brought down local interest rates substantially, with much of this effect due to enhanced security and lower risk. Importantly, we find that lower risk and increased security reduced interest rates even beyond the cities designated as treaty ports, and created geographic spillovers. The impact was strongest in treaty ports and the immediate geographic vicinity of Western influence, where interest rates were lower by more than 25 percent. Moreover, even at distances of 450 kilometers, the opening of a treaty port reduced interest rates by almost 10 percent. These estimates are for affected regions relative to unaffected, however, we do not find evidence for major regional reallocations. Once the geographic spillovers of Western influence are taken into account, there is little doubt that the West's foray into China after the First Opium War influenced a large part of China.

The paper also identified some of the major mechanisms. Both legal institutions centered on consular courts and trade institutions played a role. Legal influence had a strong but more geographically limited impact, whereas trade influence reached further into China away from the ports. While China had traded in Asia for centuries, access to trade with Europe and the United States, the most advanced economies at the time, had been restricted. These constraints limited the flow of new ideas, new security arrangements in banking, FDI, and technologies—factors that lead to economic development and yet were lacking in

China at the time. Loosening the constraints on international trade led to a shift in China's economy from inland to coastal regions, where new goods entered and exited. Furthermore, important though as imports may have been, Chinese exports to foreign destinations were even more strongly associated with Chinese industrial development than were imports.

We also present evidence that the West lowered the capacity of the Qing state's coercive power to control protests and may simultaneously have encouraged banditry. While the Qing may have experienced some of these problems anyway, the West's intervention raised the challenge to the Qing's legal capacity. An important question for future research is to examine the net impact of colonial interventions on different forms of state capacities.[30] Another pressing question is the extent to which the size of the West's impact on China's capital markets, as evidenced by lower interest rates, is related to broader trends in comparative development. Although China had in many ways been a flourishing economy well into the 18th century, by the early 19th century its capital market development had fallen substantially behind that of the leading Western economies. The large impact of Western influence after the Opium War on China's capital markets may have been so large precisely because other aspects of the China's economy were functioning at a relatively high level.

The changes after the Opium War would appear to foreshadow China's performance during the opening-up after the reforms initiated by Deng Xiaoping in 1978, which created more open borders, among other policy changes. During this era, China managed per-capita growth rates upwards of 5% per year for several decades. In the early 1980's fourteen coastal cities were designated as Economic and Technical Development Zones (ETDZs), where trade is prioritized and foreign firms are given preferential treatment. Such seemingly unorthodox institutional innovations seem less novel in light of the country's history of organizing economic activity into foreign and domestic zones during the Treaty Port Era, and indeed, all fourteen of these ETDZs were former treaty ports or cities in the immediate vicinity of former treaty ports. Carrying the argument one step further, these considerations suggest that China's modern trade history begins with the Opium War, pre-dating the 1978 openness reforms by more than a century. Additional work on these topics is left to future research.

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A Data

A.1 Qing Protests

Information on Qing protests may shed additional light on the impact of the West's intervention on China's economy through its effect on the Qing's state capacity. State capacity has been noted as important reason why some countries have succeeded to develop their economies while others have not (see, among others, Besley and Persson 2011, Acemoglu and Robinson 2012, Bardhan 2016, and Johnson and Koyama 2017). At a minimum, state capacity is seen to have legal and fiscal dimensions–the ability of a state to enforce its rules across the entirety of the territory, and the ability to garner enough tax revenues to implement its policies– but military and political capacity are seen as elements of state capacity as well.

State capacity figures prominently in research showing that institutions are critical determinants of economic growth (North 1990, Acemoglu, Johnson, and Robinson 2005, and Greif 2006). In the Chinese context the implications are not straightforward. On the one hand, the transfer of Western institutions might have benefited China's economy because it upgraded the quality of China's institutions. On the other, that same intervention might have harmed China's economy because it reduced the capacity of the Qing state. Information on popular protests may help to separately identify these two channels.

There are several primary sources on events relating to state capacity, ranging from gazetteers (historical accounts produced by local observers) to national compilations such as the Editing Committee fo China's Military History (Chan 1983, Chen et al. 1989, Zhang et al. 2007, Hung 2013, Miller 2013, and Jia 2014b). Following Keller, Liu, and Shiue (2022), we focus on the administrative records of the Qing Dynasty (*Qing Shilu*) because it is the most comprehensive source (Hung 2013). The flip side of the fact that the *Qing Shilu* is the administrative record of the dynasty is that what is counted as a "protest" has to be viewed through the lens of the Qing rulers. During the 19th century, for example, the Qing government did not interfere when militiamen, typically organized by local gentry, settled local disputes or defended villagers from bandits. Qing rulers could reserve its regular army (the Banners and the Green Standard Army) for other matters. Such implicitly pro-Qing militia activity would typically not be mentioned in the *Qing Shilu*. Because our analysis exploits only within-prefecture variation on protests and includes province-

year fixed effects to account for trends in the reporting, and the basic outlook of the *Qing Shilu* did not change, this should have a limited impact on our results.

Our analysis focuses on two forms of protests that are distinguished by Chen et al. (1989), called *wuzhuang* and *jieshe*, respectively. *Wuzhuang* protests are incidents that involve armed uprisings and struggles. The armed group would typically be a militia–that is, part-time civilian, part-time soldier–that is originally formed by clansmen and farmers to protest, for example, high rents charged by landlords or high taxes demanded by the government, or other issues. Some *wuzhuang* protests arose from fluctuations in population pressure and harvest quality. From the point of view of the Qing *wuzhuang* protests matter because food riots, for example, might reduce the dynasty's power and legitimacy. At the same time, Qing rulers would not fundamentally view those involved as criminals or bandits, as these protests are primarily related to class conflicts and living conditions.

Jieshe protests, on the other hand, involve secret activities such as associations and sects (*jieshe shejiao*). Among those are, for example, the White Lotus and the Heaven and Earth societies. In addition to anti-Qing secret society chapters, they include brotherhoods, roving bands, triad pirates, and amalgamations of alienated and embattled groups that subscribed to religious messianistic movements (Kuhn 1970, Ownby 1996). From the government's perspective, these individuals would be seen as rebels, bandits, criminals, or simply enemies. The relevance of these *jieshe* protests for Qing state capacity is immediate.

The origin of secret societies lies centuries before the West's intervention in China. Specifically, the White Lotus rebellion with major uprisings in Shandong and Henan provinces in 1775 is the re-emergence of the anti-Mongol revolt of the 14th century that led to the founding of the Ming Dynasty (1368-1644). Being ethnically Manchurian and foreign to the Han, the Qing rulers naturally feared anti-Mongol sentiment in China's population. Secret societies and brotherhood organizations grew out of informal cultural organizations–groups of people pooling money for a wedding, or for some financial expense on a revolving credit system–but offered a ready-made organizational structure for rallying against the government.

Secret societies gained in importance in the 18th and 19th century due to population growth and high inflation, increased social mobility, and geographic dislocation. To some extent, secret societies filled a void left behind by the Qing state that provided fewer and fewer local public goods, to another extent the growth of secret societies and brotherhoods was stimulated by the incompetence of Qing troops, and

secret societies also blossomed because Qing punishments of suspected secret society activity was harsh.

For example, when rural Henan was scourged by tens of thousands of what the Qing referred to as the "bandits" of the Red Spears (early 20th century), Qing government troops failed to suppress the "bandits" within short order, and, by most accounts committed even greater atrocities than the criminals they set out to capture. An example of draconian Qing punishments is that Qing officials would burn the houses of an entire village on suspicion of one rebel (Ownby 1996). This motivated destitute local villagers and largely defenseless farmers to turn to magical charms and superstition to fortify themselves in their fights; convincing themselves they were invulnerable, the militiamen formed a "surprisingly" potent local force (Chen et al. 1989, Kuhn 1970). According to Kuhn (1970), if one takes as the central indication of state capacity that the state has a monopoly on the use of coercive physical force, that monopoly had slipped away because of local militarization in the border regions of China in the early 19th century, and the state monopoly on the use of force was also lost by the 1850s in the river valleys of China.

While secret societies, broadly defined, were active in China for centuries before the First Opium War, there is evidence that the West's intervention stimulated their activity (on the following, see Kuhn 1970). The opening up of Shanghai as a treaty port meant that some trade shifted out of the previous entry point in Canton. As thousands were thrown out of work in the Canton area, this led to a proliferation of gangs in Guangdong and Guangxi provinces, and by the 1850s the south was scourged by roving bandits. Suppression by the British forced these formerly seacoast (triad) pirates to migrate inland from the Pearl River delta, where they joined forces with the Taipings for a period of time. Movement and geographic dislocation also stimulates secret society and brotherhood growth because members of these organizations provide each other mutual aid in times of need. Reduced state capacity in maintaining control, whether because of weak coercive power or diminished public goods provision, increased incentives for illegal collective action with low risk to the protestors.

Our data draws on work by Keller, Liu, and Shiue (2022). That paper adopts a supervised machine learning approach to classify each entry of the *Qing Shilu* into one that describes a protest event, versus one that is not a protest event. They begin with the 775 verified protest-related entries listed in the seminal work by Chen et al. (1989), which is combined with an equal number of entries from the *Qing Shilu* that are not protest-related. To increase the size of the training data, Keller, Liu, and Shiue (2022) hand-read additional entries from the *Qing Shilu* to obtain more than 1,200 additional protest-related entries.

Training a Naive Bayes Classifier using 4/5 of this combined data set, they examine the performance of the approach by using the remaining 1/5 of the data set for out-of-sample testing.

Let T stand for true, F for false, P for positive, and N for negative. Then, average accuracy is defined as

$$A = \frac{TP + TN}{TP + TN + FP + FN},$$

average precision is defined as

$$Pr = \frac{TP}{TP + FP},$$

and average recall is defined as

$$R = \frac{TP}{TP + FN}.$$

Employing a Naive Bayes classifier yields an average accuracy of A = 90.1%, average precision of Pr = 89.3%, and average recall of R = 94.3%. For the breakdown of protests into *wuzhuang*, *jieshe*, and other type of protests, Keller, Liu, and Shiue (2022) find a Perceptron classifier with term-frequency times inverse document-frequency (tf-idf) feature extraction to yield best results, with an average accuracy of A = 81.4%.

In addition to the location, the *Qing Shilu* specifies for each incident a particular month, and if an incident extends over several months this will be noted as well. The empirical analysis in this paper is based on the 23,929 protest-months for the period 1821 to 1899 identified by Keller, Liu, and Shiue (2022), of which 20,418 are *wuzhuang* protests (85%). As indicated in Figure 2, armed militia protests were concentrated in the middle of the 19th century. If one excludes the years 1850 to 1868, 65% of the protests are armed militia and 35% secret society incidents.

Overall, the number of militia protests based on this work was highest in Henanfu (central-northern Henan province), although there is broad regional variation, with prefectures both in the north (such as Zhili), coastal south (such as Fujian), and south-west (such as Yunnan) experiencing substantial numbers of militia protests. The highest number of secret society protests are found in Shuntianfu, in Zhili province, the prefecture that includes the capital Beijing. Other areas with relatively high secret society protests include parts of Henan, Hunan, and Fengtian (Liaoning) provinces. These findings are consistent with the available evidence.

A.2 Regional Interest Rates, Storage Costs, and Grain Prices

In the storage cost approach, the interest rate in a given region and year is obtained from the gradient of the price movement over the harvest cycle. The gradient is informative because optimal storage requires that the price compensates for the storage costs of holding the commodity, of which the interest rate is a part. This goes back to Hotelling (1931), Kaldor (1939), Working (1949), as well as Samuelson (1957), and has been employed by McCloskey and Nash (1984) to estimate medieval interest rates in England. An advantage of the storage cost approach is that it can be applied whenever high-frequency data on stored commodities (including but not limited to grain) is available, and grain prices tend to be available before consistent and comparable interest rates are available. The following gives an overview of the approach, with additional information in Keller, Shiue, and Wang (2020).

Consider a merchant in region i at time τ who can buy $Q_{i\tau}$ units of grain from a farmer at price $P_{i\tau}$. The merchant can store the grain for one period and sell it at time $\tau+1$ at a price $P_{i\tau+1}$. Instead of buying the grain, they can also invest the outlays of buying the grain ($P_{i\tau}Q_{i\tau}$) in a risk-free asset and receive $(1+\varrho_{i\tau})$ times $P_{i\tau}Q_{i\tau}$ at time $\tau+1$, where $\varrho_{i\tau}$ is the rate of return on a risk-free asset. The merchant and the farmer would contract on an agreement that specifies the merchant's purchase price from the farmer $P_{i\tau}$ as well as the price at which the farmer buys back the grain from the merchant, $F^j_{i\tau+1}$, where j denotes the particular transaction. The price $F^j_{i\tau+1}$ 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 of the risk-free rate, which is due to the fact that if the merchant does not buy grain from the farmer they have an income of no less than $(1+\varrho_{i\tau})\,P_{i\tau}Q_{i\tau}$ at time $\tau+1$, whereas if the merchant 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 τ and $\tau+1$ does not perform as expected. We denote the interest rate inclusive of risk factors by $r^j_{i\tau}$, where $r^j_{i\tau} \geq \varrho_{i\tau}$. Third, grain does not store perfectly but is subject to spoilage (mold, mice, etc.). Per-unit storage costs are denoted by $c_{i\tau}$. The benefit of storage is the value of the marginal unit of grain storage, which is often called convenience yield. We denote the convenience yield by $b_{i\tau}$. Given $b_{i\tau}$, $c_{i\tau}$, and $r^j_{i\tau}$, as well as the current price $P_{i\tau}$, for the merchant to be indifferent between storing and the alternative

investment, the price $F^j_{i\tau+1}$ in the contract between merchant and farmer would have to be

$$F^j_{i\tau+1} = P_{i\tau}\left(1 + r^j_{i\tau} + c_{i\tau}\right) - b_{i\tau}, \tag{6}$$

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

To apply this approach, some assumptions are needed. First, we do not observe the risk specific to each transaction; consequently, the superscript j is dropped and we assume that price observations reflect the average level of risk, $r_{i\tau}$. Second, since we do not observe the forward price $F^j_{i\tau+1}$; we assume that it is equal to the spot price of grain in period $\tau+1$, that is $F^j_{i\tau+1} = P_{i\tau+1}$. Finally, we assume that the unobserved convenience yield $b_{i\tau}$ is equal to zero. The implications of these assumptions for the storage cost approach are discussed in Keller, Shiue, and Wang (2020).

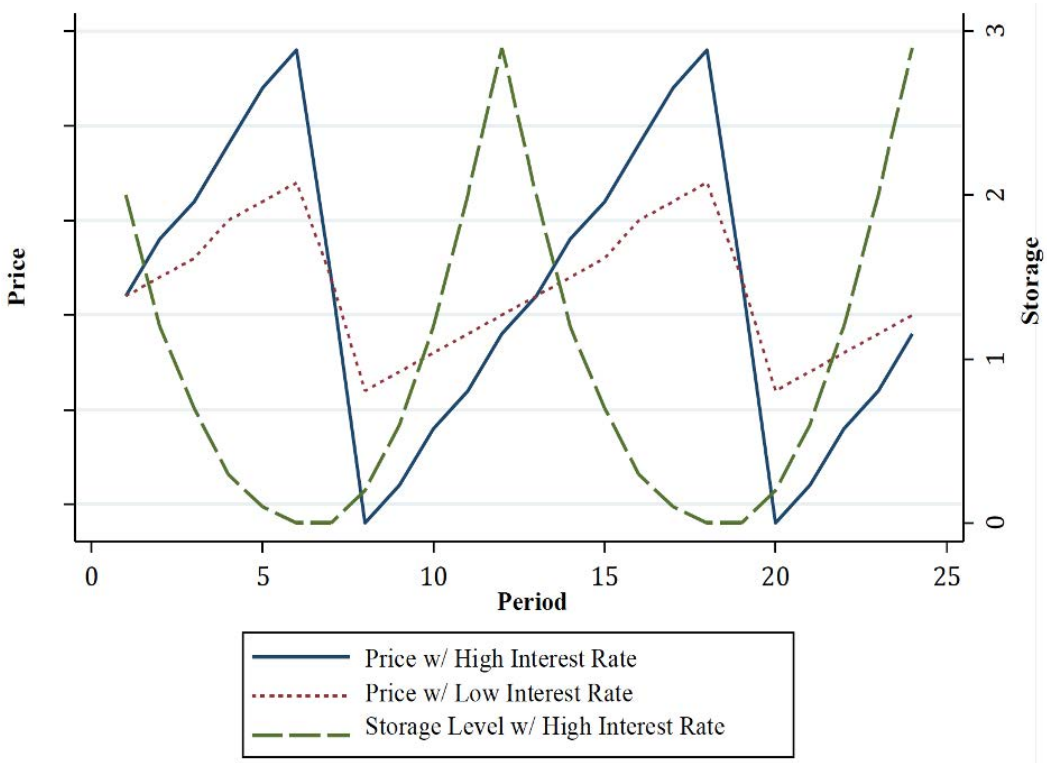
Under these circumstances, equation (6) can be rewritten as

$$\hat{p}_{i\tau} \equiv \frac{P_{i\tau+1} - P_{i\tau}}{P_{i\tau}} = r_{i\tau} + c_{i\tau}. \tag{7}$$

Equation (7) shows that in a storage equilibrium the rate of grain price change is equal to the risk-inclusive interest rate $r_{i\tau}$ plus storage costs, $c_{i\tau}$. The term $\hat{p}_{i\tau}$ in equation (7) is referred to as the carry cost of grain. We use historical weather records to address variation in physical storage costs, see below.

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

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



Notes: From Keller, Shiue, and Wang (2021).

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 effect of dampening price fluctuations.

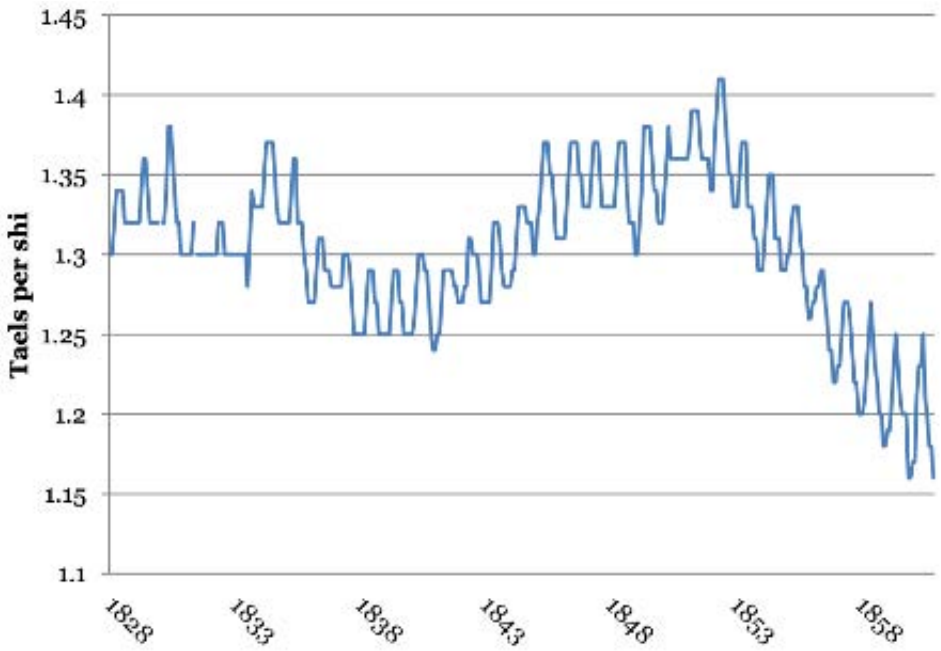
Figure A.1 shows a second price series, denoted with a dotted line. Notice that it has lower amplitude and is flatter than the first price series. This second price series is for a lower interest rate than the first series, with all else equal. Key is that the steeper the increase of the price within the harvest year, the higher is the interest rate. This is the basis for our approach of computing interest rates from grain prices. Note that grain price inflation from one year to the next does not affect this approach. Even though the underlying interest rates for the two price series in Figure A.1 are different, the two series have the same rate of grain price inflation, which is zero because from one year to the next the price in a given period remains at the same level.

Grain prices are influenced also by factors other than interest rates. To the extent that these factors

are noise that introduces classical measurement error, this can be addressed by employing relatively large samples. In particular, we employ interest rates derived from all grains for which prices are available in each prefecture and year. Another concern is omitted factors. All our interest rate regressions include prefecture, year, and province-year fixed effects that are allowed to vary by climate conditions to capture differences in physical storage costs (see below).

While it is well-known anecdotally that Chinese farmers at this time engaged both in grain storage and in buying and selling grain forward, one might still be concerned that the framework of optimal grain storage is inappropriate. Figure A.2 shows thus three decades of monthly grain prices for the prefecture of Guilin as an example. The price pattern is cyclical, not unlike those of the optimal storage model shown in Figure A.1. It is also apparent that the gradient of the price change over the seasonal cycle varies from year to year, consistent with the gradient providing information on the interest rate. Figure A.2 also shows changes in the price level, however, interest rates based on the storage cost approach depend only on percentage price changes within the harvest year (Figure A.1).

Figure A.2: Cyclical Movements in the Price of Grain



Notes: Monthly rice price in Guilin prefecture, 1828 - 1860; from Keller, Shiue, and Wang (2021).

Going one step further, the approach has recently been validated by showing that grain-price based interest rates using the storage cost approach yield similar results as bank interest rates (Keller, Shiue, and Wang

2020). The storage cost approach has also been employed to compare capital market development in different countries. In particular, in the late 18th and early 19th century capital market development in Britain was substantially higher than in China (Keller, Shiue, and Wang 2021), with important implications for explaining the so-called Great Divergence (Pomeranz 2001).

Grain Prices By the beginning of the 18th century, an extensive network of grain price reports had become a routine aspect of the Qing bureaucracy. The government did not set prices, but it did compile price reports. Prices originally were collected at markets serving the county towns, where the county represented the lowest level of government. Price reports at the county level were made every ten days to a month (Chuan and Kraus 1975), and sent to the next higher level of administration, the prefecture, where prefectural officials summarized the county reports. Today the prefectural prices are the most disaggregated data available. Prefectural price reports 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. Our source is the Chinese Academy of Social Sciences (2009), where the price series start in the year 1821.

Historical analysis and empirical studies both suggest that this data is 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 and across provinces. These statements would have been illogical if people did not regard the prices to be reliable and comparable from region to region. Moreover, the price data was not only useful to Qing officials as an early warning system of areas of potential food crises, but another practical use of the price records was that the government was a major buyer of grain, and thus desired to know where prices were relatively low. Studies that have employed the Qing grain price data include Chuan and Kraus (1975), Wang (1992), Shiue (2002), and Shiue and Keller (2007).

This study employs monthly data for 14 different grain price series to compute the average within-harvest year price gradient shown in Figure A.1. Our final interest rate sample covers 245 prefectures in 20 provinces of China during the period 1821 to 1899. The coverage and quality of the grain price data deteriorates towards the end of the Qing dynasty (in 1911), which is in part why we choose 1899 as the final year of our sample. Regionally, the sample covers the major centers of residence and economic

activity (Xinjiang province is missing). We employ all available monthly price data in our analysis. There is information on up to four types of grain in a prefecture, depending on what crops are indigenous for that region as well as data availability.[31] Millet and sorghum are likely seen in the northern provinces, whereas rice is common in the central and southern provinces. Wheat is grown in many parts of China. Rice, when recorded, comes in 3 grades: high quality, standard, and low quality, and for one province (Zhejiang) our rice data is for early-ripening rice. The sample of grain price records is unbalanced, and there is less coverage in some of the Northern areas of China; at the same time, our analysis of the available data gives no reason to believe that this systematically affects our results.

We compute the carry cost of grain, equation (7), as the average monthly price gradient for each grain, prefecture, and year. We restrict the sample in a number of ways. First, we drop months for which the one-month price change is typically negative-which may occur at harvest time–since these months do not aid in the estimation of the storage price gradient. Second, we focus on the central 98 percent interval of one-month price changes to reduce the impact of outliers. This yields N = 64,620 observations which vary by prefecture, year, and the grain on which the interest rate is based.

Physical Storage Costs We employ historical weather data to separate carry costs into the components of physical storage cost and risk-inclusive interest rates, see equation (7). Physical storage costs depend on weather because grain storage is sensitive to climatic conditions, and in particular extreme weather is associated with higher storage costs for grain. Weather data come from State Meteorological Society (1981). This source gives annual tables and maps of dryness and wetness in 120 regions, each region of which corresponds to one or two prefectures in 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. For each of the prefectures and for each year, we take the weather, coded 1 to 5, of the nearest weather station of the 120 regions to be the weather of this prefecture in a given year. Table A.1 shows mean carry costs by climatic condition:

[31] Using multiple observations for a given prefecture-year combination strengthens the analysis because the storage cost approach performs better with larger sample size (see Keller, Shiue, and Wang 2020). Instead of multiple interest rate observations for a given prefecture and year, we have also experimented with the mean of all available interest rates, finding similar results.

Table A.1: Weather Conditions and Grain Storage Costs

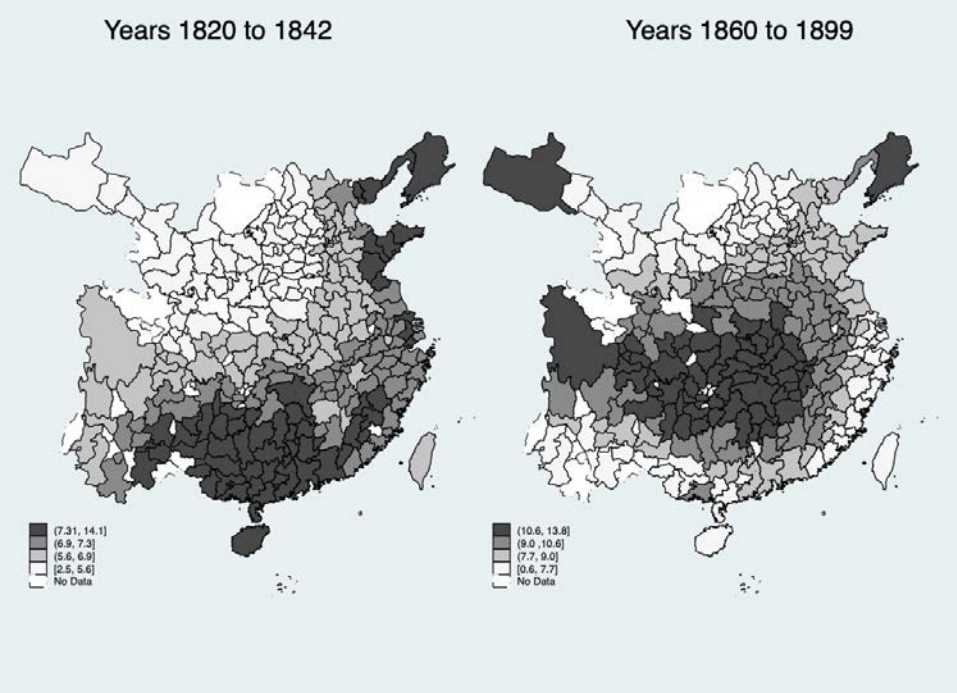
Weather Condition	Carry Costs		
	N	Mean	Standard Deviation
Very Wet	6,630	7.856	11.677
Wet	17,538	7.187	10.582
Normal	23,753	7.227	10.877
Dry	12,976	7.450	10.629
Very Dry	3,723	9.368	12.319
All	64,620	7.449	10.934

Notes: Authors' calculations.

Table A.1 confirms the sensitivity of grain storage costs to extreme weather. While the means for moderate weather conditions are about 7.2 to 7.4 percent per year, for Very Wet weather the mean is closer to 8 percent and for Very Dry weather the mean is above 9 percent per year.

There is a considerable amount of variation in these interest rates, both from one year to the next and between regions. The reason for that is measurement error due to shocks and other factors that remain in the data. Interest rate figures based on the storage cost approach are best suited for capturing broad differences in capital markets in relatively large samples, as is the case in the present difference-in-differences analysis over 80 years. Broad geographic interest rate patterns for periods before and after the Opium War are shown in Figure A.3.

Figure A.3: Broad Geographic Interest Rate Patterns



Notes: Interest rates predicted by a third-order polynomial in latitude and longitude, controlling for weather, using years 1821 to 1842 on the left, and years 1860 to 1899 on the right side of the figure.

We see that in the pre-Opium War years it was primarily the northern-inland regions of China in which interest rates, and hence the costs of capital, were relatively low, while interest rates in coastal areas, especially in the south, were relatively high (left panel of Figure A.3). By the end of the 19th century, the primary locus of relatively low capital costs had shifted to the coastal areas (right panel). This is consistent with a major impact of the West's intervention in China, which was concentrated in coastal areas due to the West's trading interests.

A.3 Information on China's Industrial Development

Our first variable is the number firms that belong to the industrial sector, broadly defined. Many firms were in the silk-reeling sector (about one third), but also in sectors auxiliary to manufacturing, in particular energy production (oil drilling, mining), as well as in trade and shipping. Importantly, these firms were Chinese-owned (on foreign-owned firms, see below). By the year 1899 there were 356 such industrial firms in China, with Songjiang prefecture (including Shanghai) accounting for 92, Guangzhou for 71, and Hangzhou for 15. Other prefectures with a sizable share of industrial firms are Dengzhou and Taibei. In

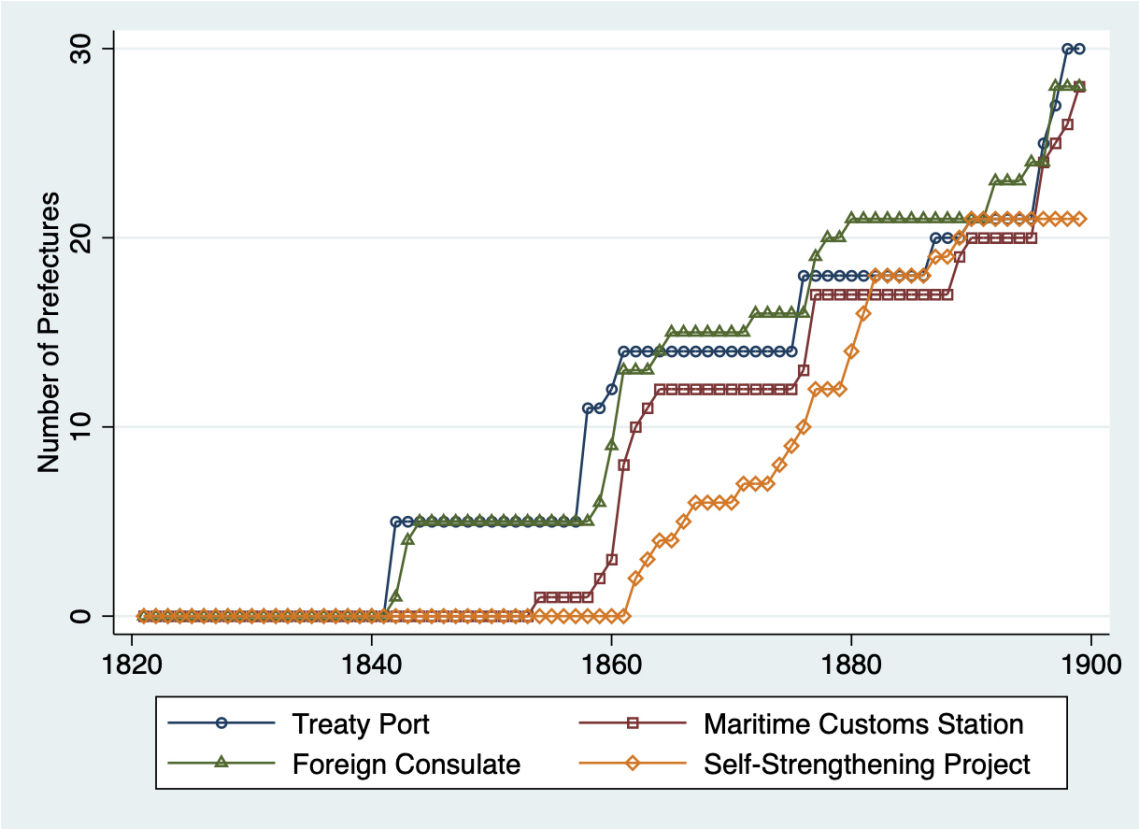
addition to the number of these Chinese firms, we know their capital investment. Songjiang and Dengzhou firms account for more than 30% of capital investment each, but also Wuchang and Shunde prefectures account for more than 5%. The source of this information is Du (1991).

Additional information on industrial development in 19th century China comes in form of the number of steam engines and the number of industrial machinery in a prefecture for a given year. During the sample period, firms in about 10% of the sample's prefectures had adopted industrial machinery, and about 5% of prefectures had steam engines. By the end of the 19th century, Songjiang prefecture had the largest number of steam engines, followed by Ningpo and Wuchang prefectures. Songjiang prefecture accounts for about one third of all steam engines and close to 40 percent of all industrial machinery during the sample period. Given the prominence of Songjiang we examine robustness by dropping this prefecture, finding similar results (Table 4). Information on China's industrial development is available for up to 313 prefectures, from Chang (1989, 1988a,b).

A.4 Measures of Foreign Influence

Figure A.4 summarizes the evolution of foreign influence in China based on the number of regions that were locations of (1) treaty ports, (2) CMC customs stations, or (3) foreign consulates. The timing of treaty port openings and the establishment of consulates is similar while customs stations are typically opened somewhat later.

Figure A.4: Evolution of Foreign Influence



Notes: Figure shows for different years the number of prefectures in which treaty ports, customs stations, foreign consulates, and self-strengthening projects were located. Authors' computations.

Our information on the timing of treaty port openings is based on CMC (1938). We abstract from Chinese ports that were opened unilaterally by China ("self-opened" ports) because given the underlying difference in origin their implications for China's economy might be different. Information on the opening of foreign consulates is based on Yunglong (1986). The year for customs station openings is the year in which they were announced by the CMC, even if it could take some time until the new station would be reporting annual trade in the CMC's *Returns to Trade* publication.

A.5 Extraterritoriality in China

This section summarizes key aspects of legal extraterritoriality in China.[32] 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 (Canton), where only specially designated members of the

[32]See Quigley (1926), Commission on Extraterritoriality in China (1926), and Cassel (2012).

Chinese Co-hong merchant guild could interact with foreign traders. Almost immediately after the first additional ports of entry were opened 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 had to introduce certain legal institutions from their countries in China.

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.[33] By 1847, 19 nations had extraterritoriality provisions with China. They were, in chronological order or treaty establishment: Russia, Great Britain, the U.S., France, Sweden, Norway, the German Customs Union (later: Germany), Denmark, The Netherlands, Spain, Belgium, Italy, Austria-Hungary, Peru, Brazil, Portugal, Japan, Mexico, and Switzerland. The influence of legal institutions from foreign countries was centered on foreign consulates, since the first level of jurisdiction was a consular court where typically the consul himself served as judge.

There was a learning curve as Western nations tried to maneuver and establish new legal 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. 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. There were also so-called Mixed Courts, see below.

Several channels through which extraterritoriality might have affected China's regions' economic perfor-

[33]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).

mance, relative to regions not affected, have been noted in the text. Another is that Western legal influence increased the incentives of Western traders to provide credit in China. Hao (1986) argues 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. Furthermore, 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, see case studies from Kirby (1995) and Chung (2010).

Our analysis exploits information on consulates from more than a dozen individual foreign countries. Variation in extraterritorial legal influence in China emerged for several reasons. Table A.2 illustrates this based on the ports of Mengtze, Wuhu, and Shanghai. First, foreign legal influence arrived in some regions of China earlier than in others. For example, the first consulate in the area of Wuhu, located in central China on the Yangzi river, opened in 1877 whereas in Mengtze the first consulate opened only in 1892. Second, the number of foreign consulates varied considerably across regions. Table A.2 indicates that in the year 1892, the number of consulates in Shanghai was more than three times the number of consulates in Wuhu. It may be that extraterritorial foreign legal influence in China increases in the number of consulates, and our analysis accounts for this possibility.

Table A.2: Determinants of Extraterritorial Legal Influence in China

Area	Province	Year of First Opening	Country of First Opening	Number of Consulates in 1892	Foreign Countries of Origin
Mengtze	Yunnan	1892	France	1	France
Wuhu	Anhui	1877	Britain	5	Britain, Norway, Sweden, USA, Austria-Hungary
Shanghai	Jiangsu	1843	Britain	16	Austria-Hungary, Belgium, Brazil, Britain, Denmark, France, Germany, Italy, Japan, The Netherlands, Norway, Portugal, Russia, Spain, Sweden, USA

Notes: Authors' calculations.

Third, while some areas eventually had consulates from most if not all foreign countries with active colonial policies during the 19th century, in other parts of China there were only consulates from particular

foreign countries. For example, the single foreign consulate in the city of Mengtze (Yunnan province) was French. This is likely related to the fact that Mengtze was located in relatively close proximity to French colonial interests in Indo-China. Whatever the reason that consulates of foreign countries were not uniformly distributed across China, it matters for aggregate extraterritorial influence because foreign countries exerted different levels of extraterritorial rights in China. We also account for the role of non-Western countries in China. Japan and Russia were the most important non-Western countries, and we present analysis when observations with consulates from these countries are dropped. Results are similar, see Table 4.

The legal origins view holds that institutions matter according to the legal tradition in the country of origin, and that Anglo-Saxon origin is particularly beneficial (La Porta, Lopez-Silanes, and Shleifer 2008). In the case of China, extraterritorial legal practices of foreign countries depended not only on legal origins but also on China-specific factors. For example, the scope of jurisdiction of a foreign country's court in China depended on whether that country operated a higher-ranking court in relative geographic proximity to China. Our analysis quantifies foreign legal influence in China along four dimensions, based on information given in the *Report of the Commission on Extraterritoriality in China*, Commission on Extraterritoriality in China (1926), as well as Quigley (1926) and Willoughby (1926). The dimensions are (1) the consular court's scope of jurisdiction, (2) whether there was an effective right to appeal, (3) whether a foreign country operated prisons in China, and (4) whether foreign assessors were present at the trial when the foreigner is plaintiff. The following provides a brief description of these dimensions.

A.5.1 Scope of Jurisdiction

The extraterritorial legal system that countries would maintain in China differed in terms of the cases that would be considered. A first distinction is 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 in China. The highest value for this legal dimension is assigned to countries that do not impose any limits to trials. A country for which this was the case was Britain, which operated a Supreme Court of China. In contrast, the consular court of the Netherlands sent relatively serious cases to its court in Java. Based on this dimension, then, the British legal influence in China was larger than Dutch legal influence. Our

empirical analysis distinguishes consulates of countries with limited jurisdiction from those that had no limits. The countries belonging to the latter group are Britain, Sweden, the USA, and Spain.

A.5.2 Right to Appeal

The 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 at all and because it was possible to take this action in China. For example, while the decision of the Portuguese consular court in China could in principle be appealed, the appeal had to go to the high judicial court of Goa (Portuguese India), with further appeals going to the Supreme Court 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. Being able to resolve an appeal without having to leave China reduces the costs of appeal, and we postulate that countries allowing for appeal in China had a higher extraterritorial influence in China. Our empirical analysis distinguishes consulates from countries that placed considerable *de jure* or *de facto* limits on the right to appeal, and those that did not. The two countries that placed virtually no limits on the right to appeal in China are Britain and the USA.

A.5.3 Prisons

The decision of a foreign country to operate a prison in China quantifies an aspect of legal enforcement. It may be important for a country's extraterritorial legal influence in China because it demonstrates the commitment to carry out sentences that have been decided upon by the court. In order to enforce a prison sentence, there would typically have to be some sort of prison facility. Since foreign countries determined that the conditions of Chinese prisons were extremely poor and inadequate, foreign prisoners were either sent to foreign-operated prisons in China, or to prisons outside of China. Our empirical analysis distinguishes between countries that operated prisons in China at some point during the Treaty Port Era from those countries that did not. The four countries in the former group are Britain, France, Japan, and the USA. Consulates from these four countries are coded as having the highest extraterritorial influence in this dimension.

A.5.4 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. One approach was to place the foreign national exclusively under the jurisdiction of the Chinese court, a practice that was adopted by one set of countries. A second possibility was that the settlement would be the result of mediation or arbitration by a Chinese official and the foreign consul. Such a court would typically be referred to as a mixed court, and this practice was followed by another set of foreign countries. The extraterritorial legal influence of countries following the second option was larger than that of the countries that placed their nationals under the jurisdiction of the Chinese court.

A third way of treating cases in which the foreigner was the plaintiff was to have a legally trained foreign assessor on behalf of the plaintiff present the case at the trial. Part of the job of the foreign assessor was to examine and cross-examine witnesses, as well as to protest, if need be, against the court proceedings. Because the system in which assessors act on behalf of the interests of foreign plaintiffs differs most strongly from the Chinese legal system, it corresponds to the largest extraterritorial legal influence in this dimension. Our empirical analysis distinguishes court proceedings with foreign assessors from those without. It was British and U.S. policy to routinely send assessors to the court after the years 1876 and 1880, respectively. Before these dates, Britain and the United States followed the practice of mixed court proceedings. We therefore code British and U.S. consulates as having the maximal extraterritorial influence in a prefecture after the years 1876 and 1880, respectively.

Our empirical analysis employs a simple indicator variable for maximal extraterritorial legal influence, which is equal to one if in region i in year t there is a consulate from a country that has the largest extraterritorial influence in China in all four dimensions, (1) no limits on the jurisdiction, (2) the right to appeal, (3) operation of prison, and (4) presence of foreign assessors. We have explored other ways of quantifying the size of the extraterritorial legal influence in China, finding qualitatively similar results.

A.6 Additional Data

Foreign Market Access We evaluate the role of foreign market access for our results by employing information on the share of each region in China's foreign exports and imports in the year 1882. Shanghai

accounts for the largest share of both exports and imports (45% and 69%, respectively). Another important port is Guangzhou, with a share of 19% of foreign exports and 6% of foreign imports. An example of a relatively small port is Ningpo, which despite being among the earliest treaty ports accounts by the year 1882 for less than 0.1% of either China's foreign imports or exports. Results are robust to employing trade shares for other years during the Treaty Port Era, or the average across all years during 1842-1899. Information on trade shares comes from CMC (n.d.).

Self-Strengthening Movement We employ information on thirty-six self-strengthening projects that were part of the so-called Self-Strengthening Movement (SSM for short), a set of reforms initiated following China's military defeats in the Opium Wars. The projects were primarily in the areas of military technology and shipbuilding, but industrial and mining projects were also common. These projects were placed in 21 different prefectures. The largest number of self-strengthening projects existed in Wuchang, Guangzhou, Songjiang, and Lanzhou prefectures. Information on the projects of the Self-Strengthening movement comes from Qian and Tan (1995), as reported by Elleman and Paine (2019).[34]

Figure A.4 shows the timing of the SSM. It is widely thought that the SSM sought to implement Western ideas (see Kuo and Liu 1978). As such, the existence of the SSM is initial evidence for the influence of Western ideas, and the evolution of SSM between 1862 and 1895 is consistent with the hypothesis that it was a reaction to Western influence.

Growth of Modern Human Capital Information on graduates of the top-level (metropolitan) civil service examination –called *jinshi*– , including their origin and their rank in the exam, comes from Zhu and Xie (1980). The *jinshi* examinations were generally held every three years, and in a typical examination year, about 200 men became *jinshi*. At times there were quotas for the number of *jinshi* that a region would receive, at least at lower (county, prefecture, and province) levels, however, once a candidate would have passed the lower level exams to arrive at the metropolitan exam, his rank in the examination would be unconstrained. Our measure of human capital growth is based on the top one-eight ranks of the *jinshi* distribution, for which any quota effect would be relatively minor.

We construct annual regional stocks of *jinshi* for the entire Ming-Qing period using the method of straight-

[34]For one project in the year 1874 we only know the province, Yunnan, and code this to be located in the capital city. This does not qualitatively affect our results.

line depreciation, where the depreciation term Δ_{st} is given by

$$\Delta_{st} = \begin{cases} 1 - \delta \times (t - s) & s < t < s + \frac{1}{\delta} \\ 0 & otherwise \end{cases}, \tag{8}$$

where s is the exam year, $t = \{1371, 1372, ..., 1904\}$, and δ is the depreciation rate, given by one over the number of years left on the job after becoming *jinshi*. Starting in the year 1371 has the advantage that mismeasurement in the initial stock of human capital plays a negligible role by the 19th century. The term Δ_{st} is the share of *Jinshi* that are still alive of the newly-coined *jinshis* of exam year s. The stock of *jinshi* at time t, K_t, is then given by

$$K_t = \sum_{s=1371}^{t} I_s \times \Delta_{st}, \tag{9}$$

where I_s is the number of new *Jinshis* that were appointed in examination year s.[35] Consistent with the historical evidence, we assume 30 as the number of years that a person would be alive after becoming *jinshi*, but results are broadly similar for other assumptions. The *jinshi* share of Suzhou prefecture, for example, was traditionally high, and counted in the period of 1855-64 for just above 5% of all *jinshis* in the sample, compared to more than half of all prefectures which had not a single *jinshi*.

The analysis exploits the fact that the civil service exam curriculum was substantially westernized after the Taiping Rebellion (1850-64). By the turn to the 20th century, so-called policy questions were given ahead of traditional topics ("Four Books" and "Five Classics"), and examinees had to write five essays on policy questions, compared to only three on the "Four Books" and "Five Classics" together (Elman 2000). Furthermore, among the topics for topics for policy questions were Foreign Relations, Astronomy, Mathematics, Sciences, State Finance, Military Systems, Commercial Systems, and Foreign History, among others (Elman 2000). We therefore employ the change in a prefecture's share of between the average of the years 1890 to 1899 and the average of the years 1855 to 1864 as an indicator of the growth of high-end western-style human capital. The prefecture with the highest increase in this *jinshi* share over these thirty-five years is Guangzhou (including the treaty port Canton). This is in line with the hypothesis that

[35] For example, assuming that *jinshi* would be alive for 20 years after appointment, if 100 *jinshi* would be appointed in year 1371, in the following year 1372 the stock of *jinshi* would be 95, and by the year 1392 none of the 100 *jinshi* of the 1371 cohort would still be around. Additionally, if 100 new *jinshis* were appointed in year 1374, the *jinshi* stock would be 185 in 1374, consisting of 85 persons who received *jinshi* degrees in 1371 and 100 new *jinshis* of 1374.

western-style human capital grew relatively strongly in centers of commercialization exposed to western influence.

Protestant Missionaries Protestant missionary activity increased after the First Opium War in 1842, and by the end of the 19th century, Protestant missionaries were present in more than half of our sample prefectures. The measure of missionary activity in a particular year is the share of counties of a prefecture in which one or more Protestant missionary is present. Prefectures with the highest densities of Protestant missionaries are Xinghua and Quanzhou, located in Fujian province, followed by Shaoxing prefecture in Zhejiang and Yingkou in Liaoning. Information is based on Stauffer (1922).

Foreign Banks Our measure of foreign banks in China is a count of both headquarters as well as branch offices. By the end of the 19th century there were 49 such foreign banks, located in 15 different prefectures. Prefectures with the largest number of foreign banks in 1899 were Songjiang, Taiwan, and Tianjin prefectures, with 10, 7 and 6 foreign banks, respectively. Information on foreign banks comes from Jiang (2014).

Foreign Direct Investment Foreign direct investment is measured by the number of foreign-owned firms. In the year 1872, there were 345 of these. Many of the early ones were related to foreign trade, followed by firms related to ship repair and other trade support services. Larger numbers of manufacturing firms emerged in the final quarter of the 19th century. By the year 1899 there were 925 foreign-owned firms in China, located in 17 different prefectures. The largest number of them was British, followed by firms from Germany, the United States, and France. By the end of the 19th century, more than half of all foreign firms were located in Songjiang prefecture (which includes Shanghai), followed by Tianjin, Guangzhou, and Fuzhou prefectures. In four percent of the cases, the number of foreign-owned firms before the year 1872 is estimated by linear extrapolation. Information on these foreign firms comes from CMC (1933).

Mass Violence Data on mass violence comes from Chan (1983) who identifies 6,580 incidents over the period based on official Qing records. This variable at the province-year level is a composite measure based on riots of more than 5 participants, the extent of subsequent government action, as well as property damage.

B Additional Empirical Results

B.1 Selection of Regions

Table A.3 shows results underlying our inverse probability weighted regression adjustment (IPWRA).

Table A.3: Foreign Locations: Where?

	Coefficient	Standard Error
Latitude	-4.76^{**}	0.95
Longitude	-1.50	3.06
Population in 1776	0.65^{**}	0.18
Population Growth 1776 - 1820	0.19^{*}	0.08
Northern Coast	3.00^{**}	0.57
Southern Coast	0.28	0.38
Grand Canal	-0.43	0.47
Yangzi Delta	0.64	0.50
Yangzi River	0.72^{*}	0.33
Pearl River	-0.45	0.64

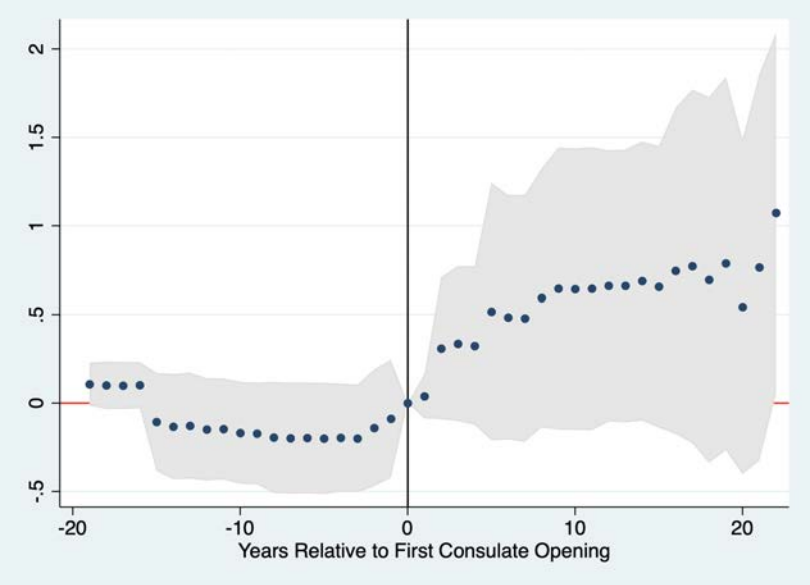
Notes: Dependent variable is one if a prefecture ever had one or more treaty ports or consulates, and zero otherwise. N = 245. Estimation by probit regression. Latitude, Longitude, and Population in 1776 in logs. Coastal and waterway access variables are indicators. Standard errors are heteroskedasticity-consistent. **/* indicates significance at the 1/5 percent level.

We see that on average, regions in China's south had a higher probability of to be a treaty port or consulate location than northern regions, and similarly for regions with more population. Within the north of China, foreign locations tended to be more on the coast than inland, and they were also significantly more likely along the Yangzi River. These results are in line with the historical evidence.

B.2 Pre-Trend Analysis

This section shows event study plots analogous to Figure 4 for other variables. We begin with capital investments, see Figure A.5.

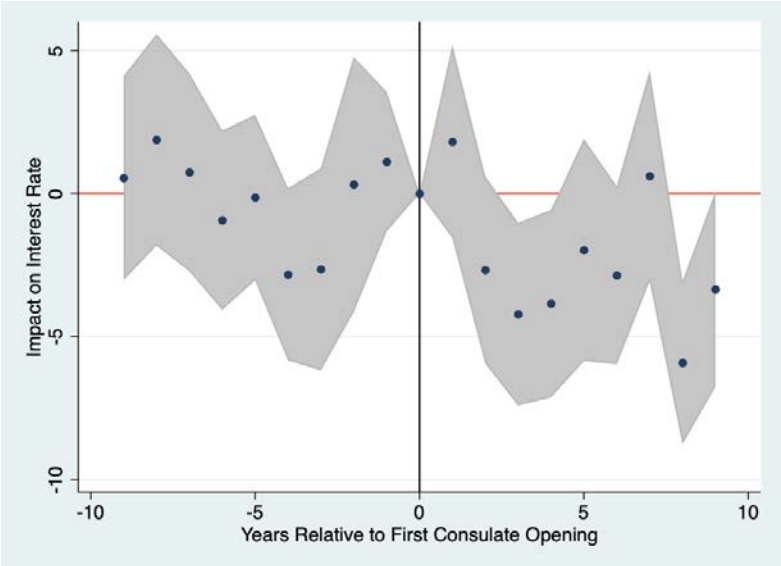
Figure A.5: Capital Investments: Event Study



Notes: Figure shows estimates of β_l in equation (4) for capital investment of Chinese industrial firms as Y_{it} and the year of first consulate opening in prefecture i as event E_i; N = 24,727; 95% confidence intervals shown.

As shown in Figure A.5, there is no evidence for significantly differential pre-trends in the case of capital investments. Next, we turn to interest rates, see Figure A.6.

Figure A.6: Event Study for Regional Interest Rates

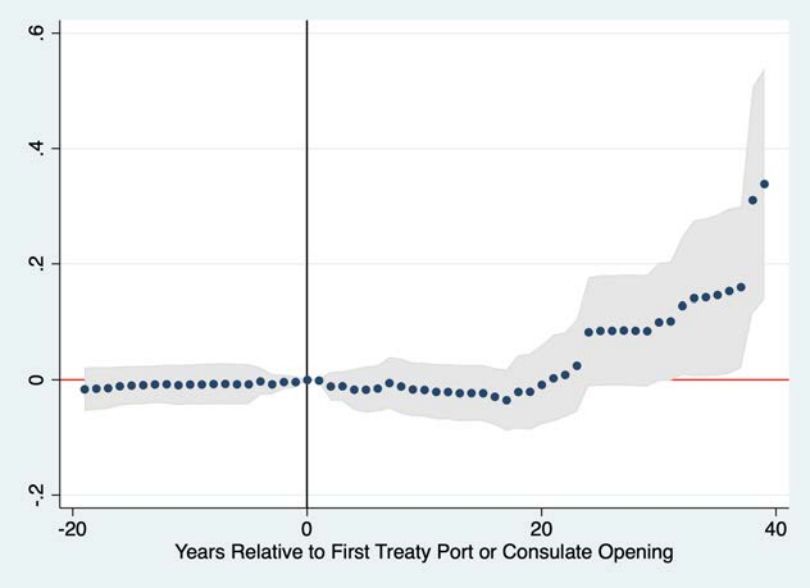


Notes: Figure shows estimates analogous to β_l (equation 4) for interest rates; event E_i is the year of first consulate opening in prefecture i; N = 64,420; 95% confidence intervals shown.

Figure A.6 shows no evidence that interest rates were significantly different in the years before the arrival of

Western influence in a prefecture. The relatively large confidence intervals indicate that, here, idiosyncratic factors play a larger role than for the measures of industrial development.

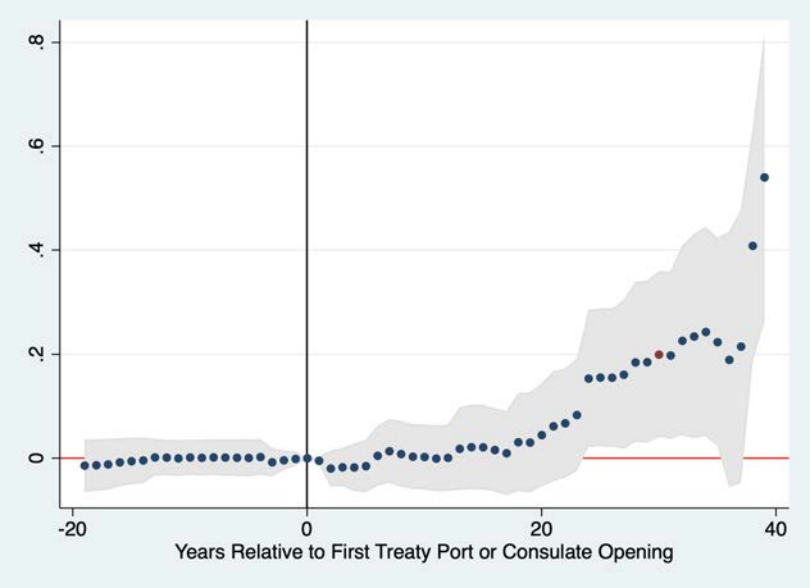
Figure A.7: Event Study for the Number of Steam Engines



Notes: Figure shows estimates of β_l in equation (4) for steam engine adoption of Chinese firms as Y_{it} and the year of first consulate or treaty port opening in prefecture i as event E_i; N = 24,727; 95% confidence intervals shown.

Finally, Figure A.8 shows event study results on the number of pieces of industrial machinery.

Figure A.8: Industrial Machinery Adoption: Event Study Results



Notes: Figure shows estimates of β_l in equation (4) for machinery adoption of Chinese firms as Y_{it} and the year of first consulate or treaty port opening in prefecture i as event E_i; N = 24,727; 95% confidence intervals shown.

There is no evidence for significantly different pre-trends for either steam engine or industrial machinery adoption (Figures A.7 and A.8, respectively). Overall, these results of no different pre-trends parallel the findings in the text.

B.3 Capital Market Spillovers: Robustness

Table A.4 presents results on capital market spillovers for several alternative specifications. For one, given the importance of potential selection, we compare spillover results for the full sample with those for a number of subsamples. We begin by describing the different samples. Results in column (2) are for the sample of south-eastern prefectures that have both a probability of having at least one treaty port and at least one consulate in the top third of the distribution, based on the predictors shown in Table A.3. Next is the sample of prefectures that were relatively unlikely to have treaty ports or consulates, denoted by Inland sample, see column (3). The sample Water Access includes all prefectures located on the main sources of water access in China, which is the northern and southern coast, the Pearl and Yangzi rivers, as well as the Yangzi delta (column (4)). In column (5) the sample is regions on the southern coast and the Yangzi river, while only Yangzi river prefectures are considered in the specification underlying column (6)). As noted at the bottom of Table A.4, the number of prefectures is reduced from 245 in the full sample to 33 prefectures (or, 13%) in the Yangzi river sample. If selection is an important factor for the empirical results, focusing on a smaller sample in a specific part of China should yield very different results from those for the full sample.

Results for the different samples share some common features. First of all, we estimate uniformly a negative coefficient for Treaty Port or Consulate in the prefecture itself, indicating that the West's intervention has lowered interest rates in the immediate surroundings of the treaty port or consulate locations. Second, point estimates for the spillover terms at distances of up to 450 kilometers are negative, typically significant at standard levels. Third, there is no evidence that the West's intervention has lowered interest rates in some areas at the expense of higher interest rates in other areas, in the sense that we do not find significantly positive dispersion coefficients. Third, as discussed in the text, there is evidence that the West's impact declined in geographic distance from the ports. In particular, the Treaty Port or Consulate coefficient is

the largest estimate in all samples, and beyond that the absolute size of the estimate tends to decline with distance. There are some exceptions, especially when the sample is relatively small, and there is evidence for less decay of Western influence with geographic distance in China's South-East.

Table A.4: Geographic Spillovers on Capital Markets: Robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		South-East	Inland	Water Access	S. Coast and Yangzi	Yangzi River	Spatial s.e.	Alt. Distance
Treaty Port or Consulate Indicator	−3.394**	−2.285**	−3.019**	−2.000**	−2.026**	−4.265**	−2.369**	−3.385**
	(0.460)	(0.627)	(0.694)	(0.714)	(0.753)	(1.026)	(0.449)	(0.481)
# Treaty Ports + Consulates (0, 150]	−1.170**	−1.414**	−0.914**	−0.764**	−0.406+	−0.126	−1.082**	
	(0.155)	(0.249)	(0.227)	(0.232)	(0.217)	(0.411)	(0.170)	
# Treaty Ports + Consulates (150, 300]	−0.487**	−0.925**	−0.237+	−0.290+	−0.319+	−0.780*	−0.525**	
	(0.101)	(0.188)	(0.143)	(0.154)	(0.187)	(0.315)	(0.113)	
# Treaty Ports + Consulates (300, 450]	−0.276**	−0.925**	−0.117	−0.325*	−0.393*	−0.387+	−0.246**	
	(0.076)	(0.155)	(0.093)	(0.135)	(0.162)	(0.228)	(0.083)	
# Treaty Ports + Consulates (0, 100]								−1.683**
								(0.257)
# Treaty Ports + Consulates (100, 200]								−0.821**
								(0.125)
# Treaty Ports + Consulates (200, 300]								−0.335**
								(0.112)
# Treaty Ports + Consulates (300, 400]								−0.251*
								(0.121)
# Treaty Ports + Consulates (400, 500]								0.082
								(0.087)
Number of Prefectures	245	59	175	65	51	33	245	245
N	64,620	20,055	42,607	20,583	16,478	9,503	64,620	64,620

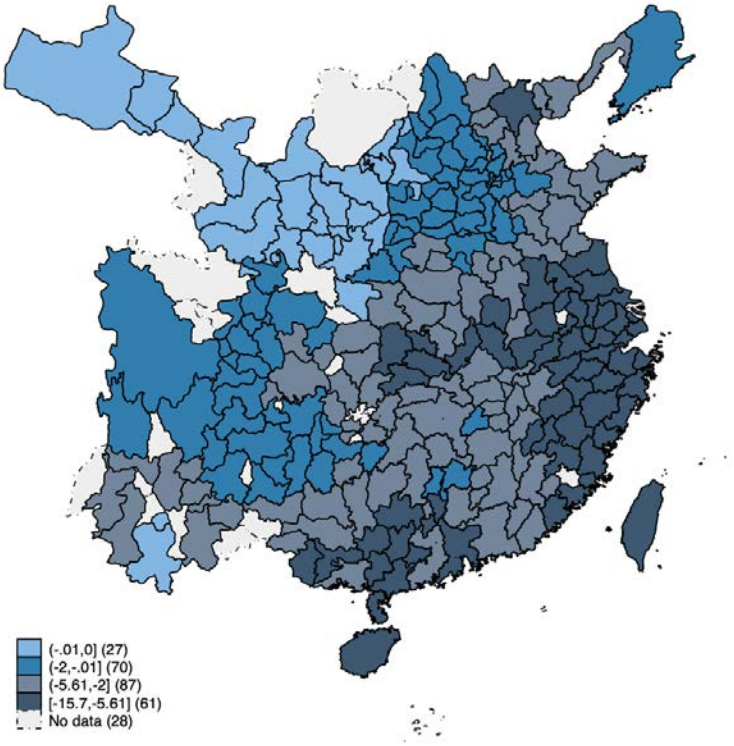
Notes: Dependent variable is interest rate; estimation of equation (3). South-East is sample of prefectures in the top 1/3 of the predicted probabilities of having (1) at least one treaty port and (2) at least one foreign consulate ever in the 19th century, as shown in Figure 5; Inland is the sample of prefectures in the lower 2/3 of the predicted probability of having a least one treaty port and at least one foreign consulate ever in the 19th century; Water Access includes all prefectures located on the northern or southern coast, along the Yangzi or Pearl river, as well as in the Yangzi delta; S. Coast and Yangzi includes all prefectures located on the southern coast and the Yangzi river; and Yangzi River includes all prefectures located on the Yangzi river. Inland plus South-East samples fall short of full sample (column 1) due to singleton observations that are dropped in the estimation with fixed effects. All specifications include year fixed effects, prefecture-grain fixed effects, and province-weather-year fixed effects. Controls for geo-trends and mass violence included. Distance bands in kilometer. Robust standard errors clustered at prefecture-grain in parentheses, except for column (7) where spatial standard errors (Conley 1999) are reported. IPWRA applied except in column (7). **/*/+ indicates significance at the 1/5/10 percent level.

Overall, based on results in Table A.4 for different sample cuts and restricted samples, the role of sample selection for the findings is limited.

Spillover results with spatial-dependence consistent standard errors are shown in column (7) of Table A.4, and inferences do not change. The final specification of Table A.4 adopts an alternative definition of distance bands, based on 100 kilometers instead of 150 kilometer brackets (see column (8)). Results turn out to be similar (compare with column (1)). First, the Treaty Port or Consulate coefficient is now about -3.39, as before. Second, point estimates in the geographic vicinity of Western influence, between 0 and 200 kilometers, are negative, not a mix of negative and positive, which is consistent with the the hypothesis that reallocation plays a limited role. Third, coefficients for successive bands are declining in distance, as before. Finally, consistent with a geographic scope of the West's intervention in China of 450 kilometers, we estimate an interest-rate lowering effect for 400 but not for 500 kilometers (see column (8)). Overall, the results of Table A.4 are consistent with earlier results.

In addition, as alternatives to the map with predicted interest rate effects in Figure 6, we present the maps in Figures A.9 and A.10. The first of these shows results for spillovers in 150 kilometer bands for a definition of foreign influence that combines treaty ports and consulates, as in Table A.4, column (1). Results are broadly similar to those presented in Figure 6. In particular, 89% of our sample prefectures are affected by the West's intervention, and 60% of the prefectures are estimated to experience lower interest rates of two percentage points or more, relative to areas without Western influence. Furthermore, the geography of the interest rate effects is similar to that in Figure 6 as well.

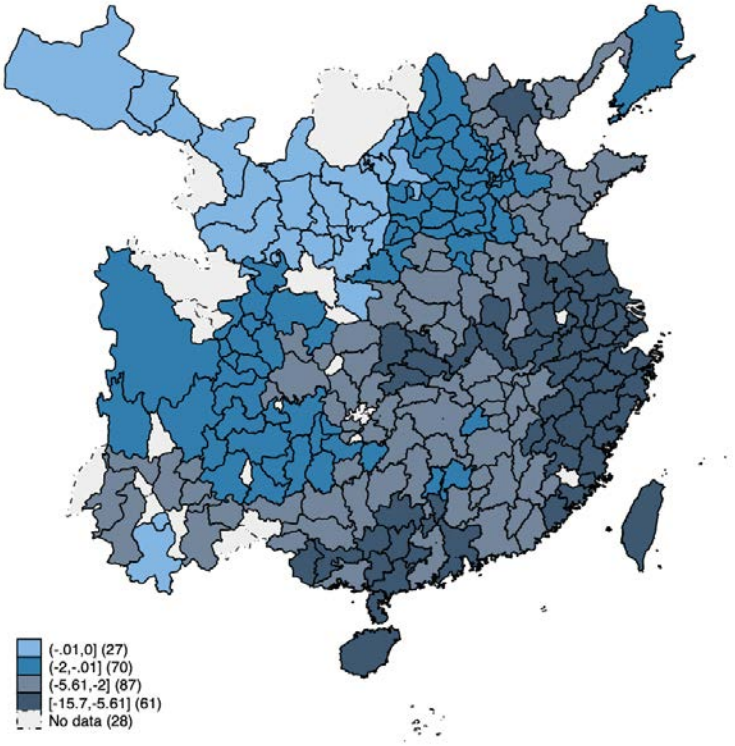
Figure A.9: Western Influence with Combined 150 Kilometer Bands



Notes: Figure gives predicted effects of the analysis of equation (3), Table 6, column (10) for the latest possible year in each prefecture (, typically in the 1890s). First parentheses gives the range of the interest rate reduction (in percentage points), second parentheses reports the number of prefectures in the particular bin.

In Figure A.10 we show the predicted effects employing 100 kilometer bands, as in column (8) of Table A.4. Now, 83% of the sample prefectures are significantly affected, and the share of prefectures in which the West's intervention is estimated to have lowered interest rates by two percentage points or more, compared to other regions, is 47 percent.

Figure A.10: Western Influence with 100 Kilometer Distance Bands



Notes: Figure gives predicted effects of employing 100 kilometer distance bands, as in column (8) of Table A.4, for the latest possible year in each prefecture (typically in the 1890s). First parentheses gives the range of the interest rate reduction (in percentage points), second parentheses reports the number of prefectures in the particular bin.