Capital Markets and Colonial Institutions in China

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Abstract

We ask whether the institutions introduced in Chinese Treaty Ports by Western powers from 1842 to 1943 had an impact on capital market development in China as evidenced by interest rates. We estimate annual interest rates for 205 prefectures throughout China over the years 1820-1911 by measuring carrying costs of grain. The key findings are: first, that interest rates in China rose during the 19th century, and were on the whole higher than they were in the 18th century. Second, difference-in-differences estimation shows that treaty port institutions lowered interest rates significantly, not only in the immediate vicinity of the treaty ports but more broadly. The magnitude of the decline was about 25%.

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1. Introduction

The First Opium War (1840-42) was a watershed in the history of China's trade relations. Up to that point, only one port in China, Canton, located in the southern province of Guangzhou, was open to European traders. At the conclusion of the Opium War, Britain and other Treaty Powers forced opened ports throughout China that had been previously closed to international trade and reduced tariffs on foreign goods imported in the country. Chinese institutions of trade and customs collection were also abolished and re-organized under British and Western management, and Western powers became the custodian of China's tariff revenues.

Foreign powers relinquished extraterritoriality in China only in 1943, one hundred years after the first British gunboats arrived. China was not completely colonized, but the Western presence was felt in wide-ranging areas, including in trade, foreign investments, manufacturing, property rights and security, governance, and the judiciary system. These effects were centered in the foreign concessions known as the Treaty Ports, but may also have spilled over to areas outside of the Treaty Ports. Although divergent interpretations exist with respect to the impact of foreign imperialism, there is little empirical evidence in the case of China over this period to support either view.[3] Some previous authors have emphasized the fact that the number of foreigners in residence was relatively small and confined to the foreign-controlled areas.[4] Recent research, however, have also shown potent long-run impacts that can be traced to the effects of colonization in other parts of the world, and the effects can be significant.

This paper shows the effects that the opening of treaty ports had on capital markets impacted not only treaty ports themselves but also neighboring areas outside of them. To see if the foreign take-over of treaty port institutions had a broader impact, we consider within a difference-in-differences analysis whether interest rates in regions that were

[3] Earlier generations of historians and economists had virtually no access to data and so their analysis was necessarily qualitative. See for example, Dernberger 1975, Hou 1965, Fairbank 1978, Feuerwerker 1983, Rawksi 1970, Remer 1926, Hsiao 1974.

[4] As of 1925, there were 15,247 British residents and 718 firms in China; there were 9,844 American residents and 482 firms; 3,739 Portuguese and 174 firms; 3,050 Germans and 518 firms; 2,576 French and 176 firms. Chinese Maritime Customs (*Foreign Trade of China, 1925).*

occupied by a Treaty Power were different from rates in regions that were not occupied. Our sample covers prefectures that were part of the Treaty Port system as well as those that were not.

Figure 1 gives our finding that interest rates were lower subsequent to Treaty Port openings. The lowering of rates of interest provides evidence that Western colonial institutions had risk-lowering impacts in Chinese capital markets. We also present evidence in this paper that even though the focus of extraterritoriality was to allow foreigner residents a familiar environment in which to carry on trade, the extent of foreign control in China went beyond the confines of international trade and coincides with a lowering of interest rates in nearby prefectures as well. There is a broad understanding that the security of collateral brought about by the British management of China's tariff revenue, upon which government loans relied, led to a decline in interest rates that China faced in international government loans. The fall over time can be attributed to the government debt being less risky than before. Our interest rate variable, however, derives from commodity futures pricing in domestic grain markets, a very general market with mostly domestic agents, rather than a clearly foreign-controlled asset such as foreign loans.

This adds to the evidence that the Treaty Port had broad effects, and were not confined to small foreign controlled areas where only foreigners resided. It is consistent with the picture of China in this era as one where Treaty Ports were areas in which foreigners could interact with Chinese under the protection of foreign rules and institutions. For example, in Shanghai, the international settlement (British and American) started as an area where only foreigners lived. The French concession had its own area, and then there was the Chinese quarter. Chinese residents were also allowed to live in the international settlement as of 1854 because of people fleeing the chaos of the Taiping Rebellion. Almost half of the people of Shanghai lived in the foreign settlement and the large majority was Chinese. (As of 1917, there were 800,000 Chinese living in the International Settlement. These were low income and low education Chinese. The Chinese made up 96% of the population. In 1935, the Settlement was less than 10% of the area of Shanghai, but 45% of the city's population (total 1.8 million))

The finding of treaty port effects is consistent with other work that has emerged regarding other parts of the world suggesting colonization has long-run effects (Acemoglu, Johnson, and Robinson 2001, Engerman and Sokoloff 2002, Nunn 2009, Steckel and Yoo 2010). In the specific case of China, initial evidence has recently emerged showing that similar effects might also exist, especially when viewed in the long-run. For example, Jia (2013) finds that prefectures grew faster in terms of population after becoming a Treaty Port. In Keller, Li, and Shiue (2013), we find not only was the volume of foreign trade increasing with the foreign presence in China (as measured by the number of residents and firms from particular countries), but also foreign direct investment during the Treaty Port period is associated with higher trade of China today, even after controlling for today's foreign direct investment presence in China.

The immediate and short-term effects of changes in institutions on growth have been more controversial. In the case of Britain, North and Weingast (1989) have argued that the institutions that evolved in Britain following the Glorious Revolution (1688) created a representative democracy in which the arbitrary powers of the crown were constrained, leading to an environment in which there was more security in property rights for private citizens. The increased credibility of the government thus lowered the costs of capital, and economic growth followed with the Industrial Revolution of the 1760s.

North and Weingast (1989) had relatively few data points to support their hypothesis, but authors have revisited their hypothesis with additional data on the costs of capital. Clark (1996) uses data on rates of return of farmland, finding no structural breaks around 1688 or the decades thereafter. Sussman and Yafeh (2006) do not have pre-1688 data, but they construct a novel measure of the costs of British debt by taking the ratio of government debt expenditures by total debt obligations. Using this and other proxies for government debt, one can see that the fall in average costs of debt, which was between 8-10% in the 1690's, took at least 50 years to fall by 5 percentage points. Sussman and Yafeh emphasize the relatively long lags and the shared interest rate dynamics between England and Holland, both features which suggest that improved government credibility alone will not immediately lower interest rates, especially if ongoing wars and other conflicts produce reasons for instability and greater risk.

Although the specific context matters, one of the ways in which colonization may impact an economy is in the manner in which risk is affected. When it is more difficult or lenders to collect on their loans, interest rates increase; the converse also holds. In Acemoglu and Johnson (2005), the authors point to the value of contracting institutions in investment and financial development. While there are many potential ways that a new institutional presence can affect risk, high interest rates generally signal greater risk, and potentially less stability in the economic system. In this sense, although writers disagree on when and where the necessary institutions emerged which allowed for this, there is relatively little disagreement that it is the ability to contract securely across time and space is a pre-condition for low interest rates (North and Weingast 1989; DeLong and Shleifer 1993; Acemoglu et al. 2001).

We make several departures from the existing literature that relates interest rates to institutional change. First, we analyze regional capital market development in China instead of developments at the national level. Even for a smaller country such as England, it is difficult to agree on the national interest rate for a historical period, as the alternative series of Clark (1996), Sussman and Yafeh (2006), and North and Weingast (1989) indicate. China's regional capital markets were not fully integrated yet in the 19th and early 20th century, which is one reason why increased commitment to secure corporate property law might show up in one region but not another. A general averaging of interest rates may obscure this regional pattern. We know that institutional change through treaty port openings came in some regions earlier than in others, and not at all in other regions. If the institutional transfer indeed had substantial effects, this should be reflected in systematic variation in regional interest rates.

Second, we obtain interest rates from a single source, with uniform method, and we are able to do this for the period before the first Treaty Port opening as well as after the openings. The method of using grain price variation over the harvest year to estimate interest rates has been employed for historical England and China (McCloskey and Nash 1984 and Shiue 2002, respectively). A disadvantage is that interest rates have to be estimated, as they are not directly observed. The main advantages are two-fold. First, grain

was a commodity that was purchased and stored by a large number of consumers throughout the economy, and so the rates that we are backing out are derived from the economy at large. Second, interest rates using a certain methodology for data collected in a similar fashion will more likely to yield comparable interest rates.

The comparability advantage is essential. The reason is that interest rates tend to vary quite a bit, depending on which market one examines. Existing data on actual rates of interest tend to be highly scattered in nature, with each observation relating to different specific contracts between a certain borrower and lender. Risk, presence of collateral, insurance, cash or handling charges all matter quite a bit but the full terms of the contract are usually not observed. For example, rate on stocks in 1895 Dasheng cotton mill was 8%, with the long term contracts being higher at around 10.5%, and short term contracts varying anywhere from 6% to 14.5%, depending on the terms of collateral (Shiroyama 2004). Credit between Chinese and Western traders, on the other hand, was recorded in 19th century Canton at 10-15% per year, and 1% per month on short-term debt (Hao 1986). Qing Government loans from abroad were 8-9% in 1864-1886, and fell to 5.3-7% in 1886-1894. Pawnshop interest rates were perhaps around 2% per month in the 18th and 19th centuries, but only 0.4-0.8% per month on loans issues by native banks (*piaohao* 票号) in the 19th century for commercial loans and mortgages in the Yangzi Delta area (Li 2010, Li and van Zanden 2012). The sources of heterogeneity are not very comparable in these interest rates, since they arise from the terms of the specific contract.

Moreover, the existing data on interest rates are of limited usefulness because most of these data are not only scattered—with nearly no observations available for remote regions, but on the whole are available only from the period after Shanghai and other cities had already become designated Treaty Ports. This precludes any kind of difference-in-difference analysis of the sort that would enable us to identify a 'Treaty Port effect'. By contrast, by using an asset-pricing framework for a set of key commodities to calculate interest rates, we have a homogenous method of prediction that covers a long, and continuous, period of time. In this context, while there are many restrictive assumptions on the theory of storage, the researcher can also control for systematic differential trends by

using a large number of control variables and fixed effects. We describe this step in detail below.

The remainder of the paper is as follows. The following section 2 introduces the asset pricing framework with which we will estimate almost a century's worth of interest rates at a regional level, and explains how we will test for a treaty port effect using a difference-in-difference approach. We will also describe the data, discuss how in practice we arrive at our interest rates, and show basic patterns in interest rates across regions and over time. All regression results are presented in section 3. In section 4 we provide details on some of the institutional changes that took place in China during the treaty port era, in particular those associated with the establishment of Customs Houses in the treaty ports, as well as the formation of Western courts; they will be incorporated into the formal empirical analysis in a later draft of the paper. Section 5 closes with some concluding remarks.

2. Framework of Analysis and Data

2.1 Asset Pricing and the Theory of Storage

Given that the Chinese state did not borrow domestically and land price data for China is scarce, the most promising way to obtain a measure of the broad regional-time variation in interest rates is to estimate it from the price change in goods that were held over time. The theory of storage by Kaldor (1939) and Working (1949) provides the framework for our analysis of regional capital market development. Abstracting from the so-called convenience yield, which is not relevant here, intertemporal no-arbitrage with storage requires that

$$(1) \quad F_{t,T} = (1 + r_t + a_t)S_t + w_t,$$

where $F_{t,T}$ is the forward price for the commodity at time t for delivery at T, S_t is the spot price at time t, r_t is the interest rate on a risk-free asset from t to T, a_t is the risk-premium, and w_t is the cost of storage. This theory of storage is consistent with the alternative view of

futures pricing.[5]

Proxying $F_{t,T}$ by the spot price in period T, S_T, and defining $(r_t + a_t)$ as the risk-adjusted interest rate, equation (1) can be rewritten:

$$(2) \quad \frac{S_T - S_t}{S_t} = (r_t + a_t) + \frac{w_t}{S_t} = CCOST_t.$$

Equation (2) shows that conditional on storage costs, the risk-adjusted interest rate varies one for one with the percentage change in the commodity price. This is also an expression of the total cost of carrying grain from month t to month T, $CCOST_t$.

2.2 Empirical Framework

Within the conceptual framework, described above in equation (2), the first step towards assessing the interest rate, (r_t) is to calculate the carrying costs. As this will only give an upper bound of the interest rate, since the term $\frac{S_T - S_t}{S_t}$ includes costs of storage and other factors such as the ability to trade, or differences in risks that would vary among regions. In order to account for these other factors, which would potentially affect the rate of interest, we use fixed effects to pick up systematic regional differences, as well as differential trends. What remains is the interest rate for each prefecture for each year. The next section gives the regression framework. Below we describe how the $\frac{S_T - S_t}{S_t}$ term is calculated.

The Difference-in-Differences Approach

Our approach is a difference-in-differences estimation. The Treaty Port group is exposed to a treatment effect sometime during the Treaty Port era, which for our purposes are the years 1843 (first Chinese treaty ports opened) to 1911 (last year of our sample). During this time, prefectures in the Treaty Port group are at some point forced to host a Treaty Port, with its foreign trade and institutions, while this was not the case in the pre-Treaty Port era. The control group consists of the prefectures in which there never was a Treaty Port, and which were not exposed to the treatment either before or after the Treaty

[5] See Fama and French (1988) and Gorton, Hayashi, and Rouwenhorst (2007) for discussion. The latter extend advances in the theory of storage by Deaton and Laroque (1992) to include a futures market.

Port era. Because we observe both groups of prefectures both before and after the Treaty Port era, we can take the average difference between the control group and the treatment group. This removes biases in the second period comparison between the treatment and control group that could be the result of permanent differences between the Treaty-Port and Non-Treaty-Port groups, as well as biases from comparisons over time in the Treat-Port group that could be the result of trends.

For the usual reasons of omitted variables bias and endogeneity, we generalize the difference-in-differences approach to a regression framework, which allows us to condition for other factors. Under suitable conditions, the difference-in-difference estimates give the causal treatment effect. The basic estimated equation is:

$$CCOST_{igt} = \beta_0 + \beta_1(Treaty\_Port\_Opening_{it}) + \mu_t + \mu_{ig} + \varepsilon_{igt} \quad (3)$$

where subscript i = prefecture; g = grain; and t = year.

The controls include: prefectural fixed effects, which take out prefectural differences that are constant over time; grain fixed effects, which take out differences across grains and the quality of grains, that are constant over time; prefectural-grain fixed effects that take out differences that might be specific to prefectures and grains or the quality of grains specific to prefectures that are constant over time; time trends and decade fixed effects to pick up common trends over the entire period and common shocks that might occur within a sub-period of the Treaty Port era as a whole. The time trends include aggregate factors that would cause changes in the interest rate in the 19th century even in the absence of any policy or institutional changes.

To control for the effects of weather variation and costs of storage related to differences in geography, we control for storage cost differences across China. Precise measures on grain storage costs do not exist, but it is well-known that climatic conditions have a strong effect on storage costs because hot and very wet climates are more prone to spoilage. Therefore we employ regional weather data to control for storage cost differences (as in Shiue and Keller 2007). As the need for storage varies geographically depending on the availability of other consumption smoothing mechanisms, in particular trade. We

control for the latter by including relevant characteristics of the regional geography, such as coastal and river, versus inland location (Keller and Shiue 2007b).

While the list of controls is quite extensive, one might be still concerned that there are remaining sources of differences that have been left out. Although this is a possibility, to the extent that these sources of variation have not been taken, they should not affect the common trends, and it is the comparability that we are most concerned with here.

2.3 Data

This section describes the data used in this paper in more detail. We use information on grain prices, weather shocks, and treaty ports from 1820-1911. We also impute distances between treaty ports, using the linear distance between locations, based on historical locations of the cities and the prefectural capitals, given in Playfair (1910).

Institutional Change—Designating Treaty Port Cities

Institutional changes were introduced in steps. The first indication of change was the signing of the international treaties in which the China's ports became designated Treaty Ports. China signed 30 treaties with 16 extraterritorial countries from 1843 to 1918, and 8 treaties with Britain alone. In our analysis, we capture this announcement effect of which ports would become a Treaty Port by coding the dates and the locations of each port.

The dates of when specific cities were designated as Treaty Ports are specified in the relevant international treaties, and given in CMC (1938)[6]. The first CMC Treaty Ports were announced in 1842; the last were in 1907. By 1915, there were a total of 92 treaty ports, of which 44 were self-opened ports, and 48 were CMC ports with extraterritoriality rights of the Treaty Powers. In this next section we focus on the formal CMC ports. These cities, and the dates when they were established as Treaty Ports, are given in Table 1.

Prices

By the beginning of the early 18th century, an extensive network of grain price reports had become a standard and routine aspect of the Qing bureaucracy. The

[6] See p. 645 "List of Treaty Ports with Dates of Opening".

government did not set prices, but compiled voluminous price observations. All prices originally were collected at markets serving the county towns, where the county represented the lowest level of government. Equivalent to the county unit were less common designations—such as the department, autonomous department, or autonomous subprefecture. These county reports were made every ten days to a month (Chuan and Kraus, 1975), and included not only prices, but also reports on the crop harvest and notes on weather. These price reports were sent to the next higher administrative level, the prefecture, where prefectural officials summarized the county reports.

At the prefectural level, the highest and the lowest prices for each of the main crops of the prefecture were recorded. We do not know from which county a particular price came as the county level price records have, for the most part, been destroyed. Today, only the prefectural price summary reports are available. These give the highest and lowest prices in each prefecture, at lunar-monthly intervals. The prices were recorded in copper cash per *sheng* 升 and converted to silver taels (*kuping liang* 庫平兩 , a unit of 575.8 grains of silver per 1,000 fine) and bushels (shi 石). The price reports also record the cash-to-silver exchange rates used. Given the large variations in regional exchange rates, it is reasonable to assume that the local officials, the people who were most intimately familiar with local conditions, were the ones who originally made the conversions.

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

would have also directly participated in wholesale markets, rather than in small retail markets.

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

Weather and Storage Costs

Weather data come from published data by the State Meteorological Society (1981). The original materials were based on more than 2,200 local histories and gazetteer writings, and "more than 2 million and two hundred thousand characters". The reference produces annual tables and maps of dryness and wetness in 120 regions, each region of which corresponds to one or two prefectures in the present administration of China. The degree of dryness and wetness in classified into 5 grades: grade 1 is very wet; grade 2 is wet; grade 3 is normal; grade 4 is dry; and grade 5 is very dry, normalized according to what is considered average for a particular region.

2.4 Interest Rates from Within-Year Grain Price Movements

There are over 225,000 monthly observations on prices that we analyze over the period 1820 to 1911. The geographic coverage in our current sample spans Heilongjiang in the north, to Guangdong in the south, Sichuan/Yunnan to the west, and Zhejiang/Jiangsu to the east—in total about 60% of the population of China is included. We have omitted the provinces northwest of Gansu, Shaanxi, and Shanxi because there were no Treaty Ports in those areas. In total there are 13 provinces (Anhwei, Fengtian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangsu, Jiangxi, Shangdong, Sichuan, and Zhejiang) and approximately 205 prefectures in our sample. In the great majority of cases, there are two observations on prices for each grain, each prefecture, for each month. Each prefecture typically will have anywhere from three to six types of grain, depending on what crops are

indigenous for that region. Wheat and barley are likely seen in the northern provinces, whereas rice is common in the central and southern provinces. Soybeans are also relatively commonly observed. Rice, when recorded, often consists of 3 types of grades: high quality, standard, and low quality. High and low prices are recorded, typically, also for each of the three gradations of rice quality.

This gives us around 19,000 annual interest rates. The first step in obtaining the interest rate is to calculate the cost of carry, $\frac{S_T - S_t}{S_t}$. We begin by identifying the months within the harvest year during which prices monotonically rise. We do this separately for each grain and for each province over the 91 years of the sample. For example, in Figure 2, the harvest cycle for rice in Sichuan province shows a monotonic price rise between month 11 and month 6. The harvest occurs sometime after the 6th month and prices immediately drop. The average monthly price increase between the peak and the trough is different for different provinces and different grains. We calculate the implied monthly carrying cost, and then annualize that figure, for each prefecture and each grain.

Figure 3 shows the carrying costs based on rice prices from 1820 to 1911, plotted at 10-year intervals. The average using all data for the 1820-1860 period is around 6%. Over the next decades, this figure rises. For comparison, and to reduce possible measurement error, we also give two different methods of calculating carrying costs that narrows the focus to the informative price data. The "Winsorized (90%)" employs only the middle 90% of the sample and thus drops extreme outliers. The "Winsorized (90%) & Positive" uses only the middle 90% and in addition drops observations in which there is no change in prices from month-to-month. This procedure would also tend to increase the calculated costs of carry, but would help ensure that we are producing more conservative estimates—that is, giving upper bounds to the interest rates. Of course if the percentage of observations in which there is zero price change is changing over time, this would bias the findings, but the percent of observations with no change (shown in Figure 4) is roughly the same over these decades so this does not seem to be a concern.

Figure 5 shows the comparison of results from three different types of grains: rice, soybeans, and wheat. Figure 6 gives the comparison for seven different provinces that

were all rice producing provinces. The fact that one can easily come up with interpretations that would seem to fit the historical events that occurred in these regions and decades indicates that there is informative content in the estimate. For example, the spikes in the interest rate observed in Figure 5 over the decades 1860-70 for the regions that planted soybean and wheat (the northern provinces) would be consistent with the famines that affected Henan and Shangdong. The relatively high carrying costs shown in Figure 6 for Guizhou is striking as well, but perhaps less so in light of its relatively isolated geographic position with respect to China's primary networks of trade which were based on the coast and the major rivers.

3. Regression Results

3.1 The impact of Treaty Ports on Capital Costs: Basic Results

We start with the minimal specification and introduce important controls step by step. When only the treaty port indicator is included which switches from 0 to 1 once a prefecture hosts a treaty port, the coefficient is significant at -0.027, see column 1 of Table 2. We can think of this as a mean difference: on average, the capital costs in prefectures where treaty ports are located are 2.7 percentage points lower in our sample.

A time trend enters with a positive coefficient, which is consistent with the upward trend seen in Figure 3 above (column 2 of Table 2). Interestingly the coefficient on Treaty Port becomes larger in absolute value, suggesting that if one does not take into account the overall trend one might underestimate the influence of treaty ports. We also see that allowing for a more flexible pattern with which capital costs can change over time, where the time trend is replaced with decade fixed effects, does not affect the results (column 3). This is a result that generally holds in our analysis; even allowing for fixed effects for each one of the 91 years in our sample does not change the results. We also introduce fixed effects for each type of grain, by which we mean the different price series for rice (the lowest, the highest, and the average price in the prefecture) from which the capital costs are computed.

We are concerned with differences across prefectures that are unobserved to us but that might affect the treaty port estimate. Fortunately we can address time-invariant differences across prefectures in our panel setting by including prefecture fixed effects, which means that identification of the treaty port estimate comes solely from changes in the capital costs in a given prefecture over time. When we allow for a separate fixed effect for each prefecture and by grain type, the treaty port coefficient is estimated at -0.028 (column 4). [7]

The coefficient is smaller (in absolute value) compared to before, and suggests that the fixed effects are both important and effective in dealing with omitted variables that cause endogeneity bias. Qualitatively the result is unchanged: there is evidence that treaty ports lower interest rates in the prefectures where they are located. Repeating the panel regression of column (4) for the sample of all grains yields the same qualitative finding albeit a somewhat lower (in absolute value) coefficient, of -0.021. This is probably mostly attenuation bias due to the higher measurement error in the non-rice grains; the data there is of lower quality.

3.2 Treaty Port Effects or Pre-Existing Trends?

The key assumption for difference-in-difference analysis to yield the true causal effect is that the treatment (treaty port) and control (no treaty port) groups are "similar" in so far as what is relevant for interest rate development over this period. The most important aspect of this is whether in the pre-treaty port period the prefectures are indeed similar. In particular, are those prefectures that experience relatively fast interest rate declines over the 1820 to 1911 period simply those that were already promising way before the Western powers came and established treaty ports? Was the choice of the British as to which treaty ports to pick endogenous to a sufficient degree to cause problems for our estimates?

[7] Grain by prefecture fixed effects means that if we have data on three types of rice prices for a given prefecture, there will be three separate fixed effects for this prefecture.

To some extent the mission of the British was to pick good locations for the Treaty Ports.[8] Thus, they paid attention to places where there was some possibility of ships to dock—so some natural endowment in harbor, and for exporting and importing. They also were interested in specific goods, for example, tea of Fujian, silks and porcelains from Jiangsu. Other treaty ports, however, were simply border stations, which were not entirely advantageous from a trade point of view—because they are close to borders, they are essentially closed off to economic activity on one side. Regardless of these considerations, the question is: is their choice correlated in important ways with capital market development?

We test for this by looking at population growth between 1776 to 1820, as well as the population level in 1820.[9] A plausible hypothesis on pre-existing trends is that high population growth between the years 1776 to 1820 is a sign of general "promise", and these are the areas that would have experienced relatively strong declines in interest rates over the Treaty Port era anyway, whether or not it was designated as a Treaty Port. In fact, these places may have been picked as Treaty Port by the Western powers because they were promising, so the following exercise sheds light as well on this type of endogeneity problem.

In column (1) we show the baseline result with a coefficient of -1.9% on the treaty port variable.[10] Adding the interaction of previous population growth with the Post-1842 indicator yields the same coefficient of -1.9%, and the population growth variable itself does not enter significantly (column (2)). Introducing analogously the population level of 1820 interacted with a Post-1842 indicator enters with a positive sign (column (3)). This says that prefectures that were relatively populous by 1820 experienced relatively high interest rates in the treaty port era. Importantly, the coefficient on the treaty port variable is not strongly affected, in fact the point estimate is now -2.2%, from -1.9% before. It means

[8] Otherwise Lord Palmerston, who was then the Foreign Secretary in London, would not have been so furious with Charles Elliot, who had just negotiated the terms of the agreement in which Hong Kong was ceded to Britain. Palmerston wrote back to Elliot immediately dismissing him from his post, saying that Hong Kong was just a barren rock with "nary a house on it" and would never become a good place to do trade.

[9] The population data is from Cao (2000), which gives population for the years 1776, 1820, 1851, 1880, 1910.

[10] We employ a broader sample of interest rates compared to Table 2 because we do not have 18th century population figures for all prefectures; the results do not depend on this.

that accounting for size differences across prefectures in the pre-sample period does not wipe out but if anything strengthens the result that treaty ports bring down interest rates. Thus, there is no evidence that the observed declines in interest rates in treaty port prefectures are due pre-existing trends that have to do with population, or the growth of population.

We have also examined the question of pre-existing trends by looking directly at the trend in interest rates in the pre-Treaty Port era. For each prefecture, the average growth of its interest rate between 1820 and 1841 is computed, and then interacted with our post-1842 indicator variable. Column (4) shows that prefectures experiencing relatively high interest rate growth in the pre-Treaty Port era also had relatively high interest rates in the Treaty Port era. This result indicates that differences in trends across prefectures do exist to some extent. At the same time, there is no evidence that these trend differences explain our finding of a negative coefficient on the treaty port variable; its estimate is unchanged at -1.9%, see the results in column (4) of Table 3.

Moreover, the same general pattern is also obtained when we consider interest rates based on rice, wheat, and soybean, as documented in the right part of Table 3. There is no evidence to suggest that our results are due to differential trends across prefectures. This supports the view that we are estimating treatment effects in our analysis.

3.3 Separating capital costs from storage costs: weather data

The above conceptual framework demonstrated that the carrying cost between one harvest and the next covers the costs of capital, risk, and storage costs. To verify that the results are not driven by unobserved changes in storage costs that happen to coincide with Treaty Port openings, we use data on annual regional weather patterns. From historical and agronomical studies we know that storage costs are especially high in periods of extreme wetness, because grain stores best in dry conditions. We use the weather data, which is based on weather stations in China, and map those available stations to our sample of prefectures. As a baseline, the first column repeats the result for the sample

where we have weather data; opening up of treaty port brings down carrying cost by -2.8%, with similar effects if we use all grains.

Column (2) of Table 4 adds weather indicators as identified in the Chinese data: these are the 5 categories, from Very Wet to Very Dry, where Very Wet is the omitted category in column (2). All coefficients on the other weather indicator variables are negative and significant. As expected, Very Wet weather has the highest carrying costs, 5.6% (the constant)—consistent with the interpretation that storage costs are high when the weather is very wet. Notably, the coefficient on the treaty port coefficient is unchanged.

Column (3) in the same table summarizes the same results in a different way. Here, the weather variable is redefined a dummy that is 1 when Very Wet, and 0 otherwise. We see that interest rates are on average 1.3 percentage points higher in Very Wet weather. The average for the other types of weather was only 4.3%. Thus, while storage costs affect the size of the carrying costs we are estimating and can be explained well by weather differences, the mean differences in storage costs do not explain our Treaty Port effect finding.

To check for the possibility that storage costs might have come down at just the same time that the treaty ports were opened—such as might happen if the foreign presence introduced new storage technology, we interact the Very Wet dummy with an indicator for the treaty port era, which we take to be post-1842. This new variable is included on the right hand side of the regression, and shown in column 4. The interaction is significantly negative, indicating that High Wetness has less of a storage-cost-raising effect in the post 1842 era. The linear coefficient on Very Wet goes from 1.3% to 2.5%, also consistent with the idea that High Wetness had a stronger storage-cost raising effect early on in the sample. This is consistent with a general improvement in storage technology. Importantly, however, the inclusion of the [Very Wet x Post-1842] interaction leaves the Treaty Port coefficient virtually unchanged. This shows that the change-in-storage costs effect is largely orthogonal to the treaty port effect that we are estimating.

Another concern might be that using a Post-1842 dummy for all treaty port openings is too crude. Here, instead of using a simply dummy for before and after, we use

the actual date of the treaty port opening for each treaty port to allow for a change in storage costs. Results for this new variable are shown in column 5. There is no change in the interpretation. In fact there is no evidence for storage cost changes at the time of treaty port openings; the interaction [Very Wet x Treaty Port] is insignificant.

Overall, we can conclude that while storage costs are important in explaining variation in the cost of carry at a given point in time as well as changes over time, there is no evidence that the lowering of interest rates after the opening of Treaty Ports has anything to do with storage costs, or how they changed over time. Finally, as we have noted the mapping of prefectures to weather stations is not a 1:1 match. We use the nearest 39 stations (in the rice sample) to 57 stations (in the all grains sample) to map out the entire configuration of prefectures that we study, so there are fewer weather stations than prefectures in our sample. As a conservative approach to inference, we therefore cluster by weather station. We have done this and the treaty port effect continues to be significant.

3.4 Do Treaty Ports bring Better Institutions or Simply More Integrated Trade?

Our interest rates are derived from a model of storage and grain price data. In this context, increases in interregional trade is something that needs to be considered because storage and interregional trade served as substitutes for each other already in the 18th century (Shiue 2002), and one would expect that to be the case in the 19th century as well. Is interregional trade the reason why we observe the Treaty Port effect? A priori, it is unclear whether interregional trade would be increasing upon the establishment of a Treaty Port. The initial idea of English traders was not only to buy Chinese luxury goods, but also to sell cotton textiles, stockings, and other British goods to the Chinese.[11] Contemporaries also recognized that China might start to produce manufactures for her

[11] Thus Lord Elgin's famous remark to the merchants of Shanghai, made in 1860: "The expectations held out to British manufacturers at the close of the last war between Great Britain and China, when they were told that a new world was open to their trade, so vast that all the mills in Lancashire could not make stocking-stuff sufficient for one of its provinces, have not been realized; and I am of the opinion that when force and diplomacy shall have done all they can legitimately effect, the work which has to be accomplished in China will be but at its commencement."

own needs as well for export.[12] It is clear that the English were hoping not only to sell to the consumers in the ports, but also consumers beyond the ports. Foreign traders, however, relied on compradors to move the goods from the ports, to the city, to the areas beyond. Whether or not there was success in doing so is not clear (Rawski 1970). But if there were more goods moving interregionally, then it might be possible that there was also more grain moving interregionally.

Given that Treaty Port opening means trade in domestic goods to be exported, and foreign goods to be imported, one would expect that the general trading activity in a port increases once it is open for foreign trade, including domestic interregional grain trade. Specifically, if Treaty Port opening means that there is more interregional grain trade, then that might explain why within a harvest year grain prices do not rise as much as they did before. Grain prices not rising as much could equate to lower interest rates. This increase in interregional trade would still be a 'treaty port effect', but it would be less so an institutional type of effect—such as might be attributed to greater security, or lower risk—but rather it would simply mean there is more interregional trade.

To get at this difference, we introduce additional variables on the right hand side of the regression that capture the likelihood that a prefecture experienced more interregional trade as a consequence of Treaty Port openings. Since low cost transport in China at the time was still mostly by ship on water, the variable captures whether a certain prefecture is located on a significant waterway—in particular, the Yangzi river, the Pearl river (around Canton), and the greater Yangzi Delta. Every prefecture is given a 0/1 variable depending on whether it is on a major river (and its tributaries), and that variable is multiplied by a post-1842 indicator variable. This picks up whether places that were having low-cost access to interregional trade experienced significantly lower interest rates in the treaty port era.

If the treaty port effect is predominantly more interregional trade in grain, we would expect the Treaty Port coefficient to fall drastically while the Yangzi_river,

[12] "An awakened China, like an awakened Japan, will mean a competing China, producing and manufacturing within her own borders sufficient, not only for her own needs, but for export also." (Thompson, 1902).

Yangzi_delta, and Pearl_river coefficients are negative and significant. From the results, given in Table 5, the Treaty Port coefficient does not change much. It is -0.025 for the rice prefectures before additional controls for interregional trade are included, and with them the treaty port coefficient is -0.026 (Yangzi_river), -0.027 (Yangzi_delta), and -0.023 (Pearl river). If we include controls for all three shipping regions, the treaty port estimate is the same as without any interregional trade controls (column (5)). Qualitatively similar results are found for the all grains sample (Table 5, right side).

Notably, the waterway access controls do not have the same sign: the Yangzi_river and Yangzi_delta regions have a positive sign (if anything), while the Pearl_river is negative. Thus, there is some evidence that part of the declining interest rate is due to an effect of interregional trade, but only for the Pearl River area. In general, it does not appear that the decline in interest rates upon Treaty Port opening is much related to an increase in interregional grain trade, but other factors, including institutional explanations, are more plausible.

3.5 Treaty Ports: Islands in the Big China Sea?

The existing literature, even if it is predominantly qualitative as opposed to quantitative, takes on two views on the West's impact on China: one view is that Western imperialism was destructive, and certainly not conducive for economic development—this would include the implication that the Western presence did not lower costs of capital and interest rates. The contrasting view is that Western influence was either neutral, because it didn't have many consequences, or that it would have had good effects, but the effects were quite constrained because of the overwhelming stasis within the Chinese society. An added component to this type of argument is that because foreign concessions in the Treaty Ports were relatively tiny parts of a huge country, they cannot possibly have had major effects on China overall.

The results so far do not support the first view, since Treaty Port openings led to lower interest rates, which generally boosts investment. Now we consider the second view, by looking at Treaty Port effects beyond the Treaty Port port itself. The analysis is still at the level of the prefecture, and we examine whether the opening of a Treaty Port

affected interest rates in prefectures other than the Treaty Port prefectures themselves. To do so we have used latitude and longitude to GIS-map geographic areas around each of the Treaty Ports.

With this we are interested in whether there is a geographic pattern of interest rate declines that is due to Treaty Port openings. There are a number of potential reasons why this might be true. For example, if the lower interest rates have to do with improved contract enforcement due to new/better courts in the treaty ports, then this would matter more for people near to the Treaty Port than to people far away from the Treaty Port, because traveling to the city to get a contract enforced entails costs (transport, lodging, food, opportunity costs, and other costs) and those are rising in distance to the Treaty Port. Further, a geographic pattern would already be plausible if there are general equilibrium effects from treaty port openings on the Chinese capital market, together with some spatial frictions.

In addition, if indeed interest rates go down in the Treaty Port itself, and capital markets are not strongly segmented, then there might arise observable effects on neighboring prefectures. It would not be implausible for the Treaty Port opening to have the effect of reallocating capital (and risk) across China, so that the gains for the Treaty Port come at the expense of non-Treaty Port areas, which see an increase in interest rates.

The benchmark estimate for this sample is in Table 6, column (1): interest rates fall by 2.5 percentage points. The first variable we consider simply gives a count of the number of treaty ports within a 200km radius of the center of each prefecture. For a Treaty Port prefecture, this will always be at least equal to 1, but the count will be higher if additional Treaty Ports are nearby. More importantly, this can be above 0 for a non-Treaty Port prefecture, namely if 1 or more if Treaty Ports are nearby.

The coefficient for this new variable is -0.021 (column (2)), somewhat smaller than the own-Treaty Port effect, but still a significant and still sizable effect. One would expect that whatever mechanism underlies our treaty port estimate, almost certainly there will be decay with geographic distance because the costs of moving people, goods, knowledge, or also enforcement are rising with distance. From this perspective it makes sense that the

own-treaty port coefficient is larger (in absolute value) than the more diffuse effect over 200 kilometers of space.

We also distinguish between prefectures that may have a Treaty Port itself from those that only have nearby Treaty Ports in a 200km range. Think about a donut which forms a ring at 20 to 200 kilometers of distance around a treaty port. We find a coefficient of -0.02 for the ring area, while in the immediate vicinity of the treaty port the coefficient is -0.025 (column (3) in Table 6). This confirms that our finding of lower interest rates beyond the treaty port itself is not simply a reflection of the treaty port effect itself.

Extending the previous analysis, we now focus on the subset of prefectures that *never* became hosts to treaty ports. We simply drop all observations for prefectures that eventually became treaty ports from the sample. For the Rice sample, the number of observations goes down from 9,865 to 8,388. This is like estimating the effect of "colonialism" in areas that are not "colonialized"—they are only geographically in the same area. The rationale for doing this is that perhaps the areas in the geographic vicinity are just 'similar' to the Treaty Port prefectures in some dimension—perhaps they have similar crop seasons, weather, long-run trends, and therefore it looks like they are both affected by activities in the treaty ports--but are not really.[13] Dropping the Treaty Port prefectures would seem to deal with the problem as best as possible.

The results are presented in column (4) of Table 6. We find that prefectures that have treaty ports at a distance between 20 to 200 kilometers have lower interest rates by 2.3 percentage points. These are prefectures that do not themselves host a treaty port, and moreover, the coefficient is not identified from variation between eventual-treaty ports and never-treaty ports because the former are not part of the sample. The coefficient is solely identified from variation over time for prefectures that never became treaty port prefectures. The effect is sizable, in fact it is statistically indistinguishable from the coefficient in column (3) when treaty port prefectures are included in the sample. This provides additional support that we have estimated a treatment effect. Moreover, these

[13] This is a version of Manski's (1993) 'reflection problem'.

findings are also consistent with the kind of geographic pattern that one would expect from general equilibrium effects in the capital market.

Our findings for the sample of all grains parallel the results we obtain based on rice prices, see columns (5) to (8) in Table 6. We now turn to some concluding remarks.

4. Institutional Changes: A Micro View

4.1 The Chinese Maritime Customs Service

As mentioned above, institutional changes were introduced step-wise. Now that we have seen that cities that were designated as Treaty Ports were systematically different from non-Treaty Ports, we can consider the further impact of other institutional variables. A second institutional change that had wide ranging impacts was the Chinese Maritime Customs Service (CMC).

Although Chinese in name, the service was built up under British direction and eventually took over from the Chinese the supervision and assessment of duties. The CMC operated continuously between 1859 and 1948 to assess tariffs and record the quantity and value of shipped goods of both foreign and domestic origin. It was generally thought that the British run CMC was a much more reliable operation compared to the native customs inspectors. In 1928, when China's land tax was turned over to the provincial governments the CMC still presided over customs revenues, effectively becoming the international custodian of China's single largest source of government revenue. Even though much of this revenue was used to pay indemnities, the CMC was instrumental in establishing the international credibility of public finance in China.

The establishment of the Customs House of the CMC service in each port generally followed by a few years the date at which a port became a treaty port. However, there is variation in when the CMC service actually started in each location. For example, by the Treaty of Nanjing, 4 ports became Treaty Ports as or 1842—these were Shanghai, Ningbo, Fuzhou, and Xiamen. This meant that foreign traders could not be prevented from trading in these cities. However, there were always lags in time between when the port changed

status, and when the Customs officers could actually begin to inspect vessels passing through the port, and the dates were different for different locations. Thus, Customs was established in 1854 in Shanghai, 1861 in Ningbo and Fuzhou, and 1862 in Xiamen even though all 4 ports technically became Treaty Ports at the same time. This adds an additional dimension of variation that allows us to see if the function of the CMC went beyond the effect of adding a new Treaty Port. Table 7 gives the dates at which the Customs House was established for each of the Treaty Ports.

After the British took control of the Chinese Maritime Customs Service, the revenues from this source were considered secure collateral. The security of revenue from this system was so credible that China was able to use the tariff revenue as collateral. As noted above, this has been linked to the significant decline in interest rates that the government had to pay on foreign loans. By 1928, when the land tax was returned to the provinces, foreign powers essentially became the custodian of China's largest single source of government revenue.

The authority of the Chinese Maritime Customs Service (CMC) was also felt in additional areas, as it gradually inserted itself into other functions that were not traditionally held by the customs office—including in areas related to postal delivery, money orders between Treaty Ports, lighthouse maintenance, and the policing of trade routes. This particular institution, however, dealt on the whole with matters related to the organization of trade. It did not have any authority over the disputes that might have arisen amongst traders.

4.2 Consular Courts

The third set of institutions that we consider is based on the courts and consular services that were introduced into China. Prior to 1842, the opportunities for friction between Chinese and Western traders were somewhat limited by the fact that this trade was tightly controlled and limited to one port, where only specially designated members of the Co-hong could interact with the foreigners. Almost immediately after Britain succeeded in opening the first additional ports of entry in 1842, there arose the need for British and other foreign residents to have a way of resolving property disputes and

conflicts of interest both with Chinese agents as well as amongst Western traders themselves. This was not because China lacked a system of law and justice, but rather because Westerners variously found the system inconvenient, humiliating, and overly harsh or unjust in its mode of administration. Thus, already in the earliest of the treaties, the 1842 Treaty of Nanjing, which concluded the first Opium War, the provision for extraterritorial rights were allowed for by the Britain Consular Service in China, which would handle cases involving British residents in China.

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, which also describes the Consul in terms of having the authority of a court: "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). By Article XXV: "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." The treaty of 1844 for France, and the Treaty of 1847 with Norway and Sweden, substantially granted the same set of rights to these countries as well.

From the histories of the consular service, there was learning curve involved, especially in the initial years when the Consular service was first formed, but what appears to be critical is that the treaties marked the beginning of the establishment of new rules of engagement for both Chinese and Western residents. No longer was it the case that Westerners could consider themselves above the law. If prior to 1842 the foreigner ignored Chinese laws, the consular courts attempted to ensure that there was a framework of legality that would allow familiar rules of conduct to continue. In addition, Chinese citizens could obtain redress against complaints towards a U.S. citizen in the Mixed Court. In cases that involved a Chinese citizen and a foreign citizen, the Consul acted as an intermediary representative, as is clear in the following clause, which is from the American Treaty: "The Chinese Government will not hold itself responsible for any debts which may

happen to be due from subjects of China to citizens of the United States, or for frauds committed by them; but citizens of the United States may seek redress in law; and on suitable representation being made to the Chinese local authorities through the Consul, they will cause due examination in the premises, and take all proper steps to compel satisfaction The paragraph continues: "…if citizens of the United States be indebted to subjects of China, the latter may seek redress in the same way through the Consul…".

Extraterritoriality was legitimized in the Sino-American Treaty of Tientsin of 1858, but this was only a formality. Even before Western courts were established in China, Western residents had rights of extraterritoriality from the beginning of the Treaty Port Era in which foreigners had the right to own property, trade and carry on manufacturing according to the laws of their own state rather than Chinese law. The Most Favored Nation clause, present in many of China's treaties, automatically granted to all Treaty Powers the rights which China was compelled to allow to any one nation, expanding the influence of the Treaty Powers as a block. It also made it unnecessary for each foreign country to sign new bilateral treaties as the powers of Treaty countries expanded.

Table 8 gives the list of British Consular Courts and the dates of their establishment. An interesting aspect of the British consular courts was that some of the consulates were established in areas that were not Treaty Ports. By 1925, there were over 120 foreign consulates in China, including 46 British consular courts, 18 U.S., 35 Japanese, 4 Belgian, 17 French, 5 Italian, and 4 Dutch. We also have a list of the locations and the number of judges that sat on Chinese modern courts as of 1926 (Report of the Commission, 1926).

Anecdotal evidence suggests that the protection of trade and the decline in interest rates may be directly related. According to Hao (1986), low interest rates in the Treaty Ports came about in part due to foreign competition to make loans to the Chinese in order to cultivate business. However, this competition was possible only if capital was relatively secure. The security of Jardine's loans to the Chinese merchants came about because collateral such as stock deeds and titled property was easy to recognize and simple to handle.

Other, more scattered anecdotal reports suggest the presence of foreign institutions mattered, and may even have had spillover effects into Chinese society in other markets. For instance, landholding rights in foreign settlements or concessions were set forth in treaty provisions. Since disputes related to property registered to foreigners would be heard in Western courts, many Chinese, in order to place their land under foreign protection leased them to foreigners, who would register the property to their consulates (Willoughby 1920, 696).

The linking of courts and Western business practices may have changed traditional ways of contracting, and this may be linked to reductions in risk. Case studies from Kirby (1995) and Chung (2010) give suggestive evidence of how this might have taken place. Traditionally, Chinese businesses operated under a firm's name only. Often, there was no record of the nature of ownership among the owners. Company Law of 1865 enacted in British Hong Kong required the registration of names of people who were owners. Those that did not register would not be recognized in court as having a legal basis. Over time, more and more Chinese businesses begin registering their firms to certain owners in order to avail themselves of the advantages of using the courts to resolve disputes.

5. Concluding Remarks

We are interested in the legacy of colonial institutions in China in the area of capital market development. To this end we have shown that the detailed price data that is available for China can be employed to yield long-run series of annual interest rate estimates at the regional level that in themselves yield a number of new insights. Most importantly, we document that over the course of the 19th century interest rates rose considerably in China. We conduct a number of checks that our figures pass, for example they reflect very well the increase in storage costs during periods of very wet weather in specific regions of China.

Our empirical analysis shows that treaty ports lowered interest rates in China relative to what they would have been in the absence of these areas of foreign colonial

power. This result is obtained in a difference-in-difference framework exploiting only within-prefecture variation in interest rates over time. We have verified that our result is not due to pre-existing trends or other fundamental differences between treaty port areas versus non-treaty port areas that would invalidate our control group approach. In addition, there is little evidence that the flatter profile of within-harvest year price changes in treaty port areas is due to a higher level of inter-regional trade.

Finally, we present evidence that the interest-rate lowering impact of treaty ports in China extended beyond the immediate surroundings of the treaty port to distances of at least 200 kilometers. This constitutes the first quantitative evidence that we are aware of that Western colonial institutions may have had a broader influence on China than what is given by the boundary of the foreign concessions in the treaty ports.

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Table 1. Year of Treaty Port Opening

Year of Opening	Treaty Port		Year of Opening	Treaty Port
1842	Shanghai		1897	Sanshui
	Ningbo			Wuzhou
	Fuzhou			Tengyue
	Xiamen		1902	Jiangmen
	Guangdong		1903	Changsha
1858	Niuzhuang			Moukden
	Zhifu		1907	Hailar
	Zhenjiang			Qiqihar
	Shantou			Aihui
	Qiongzhou			Harbin
	Nanjing			Kuanchengzi-Changchun
1860	Tianjin			Jilin
1861	Hankou			Ningguta
	Jiujiang			Nuichen
1876	Yichang			Sanxing
	Wuhu			Sinmintun
	Wenzhou			Tieling
	Benhai			Tongjiangzi
1887	Longzhou			Fakumen
	Mengzi			Fenghuangcheng
1890	Chongqing			Liaoyang
1896	Shazhi			
	Suzhou			
	Hangzhou			
	Simao			

Table 2: The Impact of Colonial Institutions on Carrying Costs

	Rice				All Grains
	(1)	(2)	(3)	(4)	(5)
Treaty Port	-0.027**	-0.037**	-0.037**	-0.028**	-0.021**
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
Trend		0.045**			
		(0.004)			
Decade FE	N	N	Y	Y	Y
Grain FE	N	N	Y	N	N
Grain x Prefecture FE	N	N	N	Y	Y
Observations	10,030	10,030	10,030	10,028	16,465
Root MSE	0.096	0.095	0.093	0.071	0.094

Notes: Dependent variable is annualized carrying cost as described in the text. Estimation method is least squares. Robust standard errors in parentheses.

** p<0.01, * p<0.05, + p<0.1

Table 3: Treaty Port Effect or Differential Trends?

	Rice				All Grains			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treaty Port	-0.019**	-0.019**	-0.022**	-0.019**	-0.011**	-0.011**	-0.015**	-0.011**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Post 1842		-0.006	-0.035**	-0.008*		-0.018**	-0.047**	-0.012**
		(0.005)	(0.007)	(0.003)		(0.006)	(0.008)	(0.003)
Population Growth 1776-1820		-0.002				0.027		
x Post 1842		(0.017)				(0.022)		
Population Level 1820			0.006**				0.007**	
x Post 1842			(0.001)				(0.001)	
Interest Rate Growth 1820-1841				0.134*				-0.024
x Post 1842				(0.061)				(0.043)
Constant	0.047**	0.047**	0.047**	0.049**	0.035**	0.035**	0.035**	0.036**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	11,012	10,200	10,248	10,691	19,840	18,638	18,698	19,463
R-squared	0.434	0.443	0.441	0.433	0.263	0.264	0.264	0.257

Notes: Dependent variable is annualized carrying cost as described in the text. Estimation method by least squares. All specifications include decade fixed effects and grain by prefecture fixed effects. Robust standard errors in parentheses. ** p<0.01, * p<0.05, + p<0.1

Table 4: Separating capital costs from storage costs: weather data

	Base	Weather Categories	High Storage Costs 0/1	Treaty Port Era Effects	
	(1)	(2)	(3)	(4)	(5)
Treaty Port	-0.028**	-0.028**	-0.028**	-0.027**	-0.029**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Wet		-0.017**			
		(0.004)			
Normal		-0.011**			
		(0.004)			
Dry		-0.008+			
		(0.004)			
Very Dry		-0.016**			
		(0.006)			
Very Wet			0.013**	0.025**	0.011**
			(0.004)	(0.007)	(0.004)
Very Wet x Post 1842				-0.018*	
				(0.008)	
Post 1842				-0.002	
				(0.004)	
Very Wet x Treaty Port Open					0.030
					(0.018)
Constant	0.044**	0.056**	0.043**	0.043**	0.044**
	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)
Observations	8,221	8,221	8,221	8,221	8,221
R-squared	0.337	0.338	0.338	0.338	0.338

Notes: Dependent variable is annualized carrying cost as described in the text. Estimation method is least squares. All specifications include decade fixed effects and grain by prefecture fixed effects. Robust standard errors in parentheses. All data is for rice. ** p<0.01, * p<0.05, + p<0.1

Table 5: Carrying Costs, Storage, and Trade

	Rice					All Grains				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Treaty Port	-0.025**	-0.026**	-0.027**	-0.023**	-0.025**	-0.017**	-0.019**	-0.019**	-0.016**	-0.017**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)
Post 1842		-0.001	-0.001	0.002	0.002		-0.001	0.001	0.004	0.002
		(0.003)	(0.003)	(0.003)	(0.003)		(0.003)	(0.003)	(0.003)	(0.003)
Yangzi River x Post 1842		0.007+			0.001		0.011**			0.008*
		(0.004)			(0.004)		(0.003)			(0.003)
Yangzi Delta x Post 1842			0.021**		0.017*			0.009*		0.001
			(0.008)		(0.008)			(0.004)		(0.005)
Pearl River x Post 1842				-0.028**	-0.027**				-0.041**	-0.039**
				(0.002)	(0.002)				(0.002)	(0.002)
Constant	0.060**	0.060**	0.060**	0.060**	0.060**	0.059**	0.059**	0.059**	0.059**	0.059**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	10,052	10,052	10,052	10,052	10,052	16,528	16,528	16,528	16,528	16,528
R-squared	0.480	0.481	0.481	0.482	0.482	0.389	0.389	0.389	0.390	0.390

Notes: Dependent variable is annualized carrying cost as described in the text. Estimation method is least squares. All specifications include decade fixed effects and grain by prefecture fixed effects. Robust standard errors in parentheses. ** p<0.01, * p<0.05, + p<0.1

Table 6: Treaty Port Spillovers and Capital Markets

	Rice				All Grains			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treaty Port	-0.025**		-0.024**		-0.017**		-0.015**	
	(0.003)		(0.003)		(0.003)		(0.003)	
No. of Treaty Ports within 200 km		-0.021**				-0.010**		
		(0.002)				(0.002)		
No. of Treaty Ports in (20km, 200km) ring			-0.020**	-0.023**			-0.009**	-0.011**
			(0.003)	(0.003)			(0.002)	(0.003)
Constant	0.060**	0.060**	0.060**	0.063**	0.059**	0.060**	0.060**	0.060**
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
Observations	10,052	9,865	9,865	8,388	16,528	16,321	16,321	13,521
R-squared	0.480	0.483	0.483	0.482	0.389	0.388	0.388	0.392

Notes: Dependent variable is annualized carrying cost as defined in the text. Estimation method is least squares. All specifications include decade fixed effects and grain by prefecture fixed effects. Robust standard errors in parentheses. ** p<0.01, * p<0.05, + p<0.1

Table 7. Customs House Establishment

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

Table 8. British Consular Courts

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

Map 1. Treaty Ports

Reprinted from Lyons (2003).

Figure 1. Interest Rates Before and After Treaty Port Opening

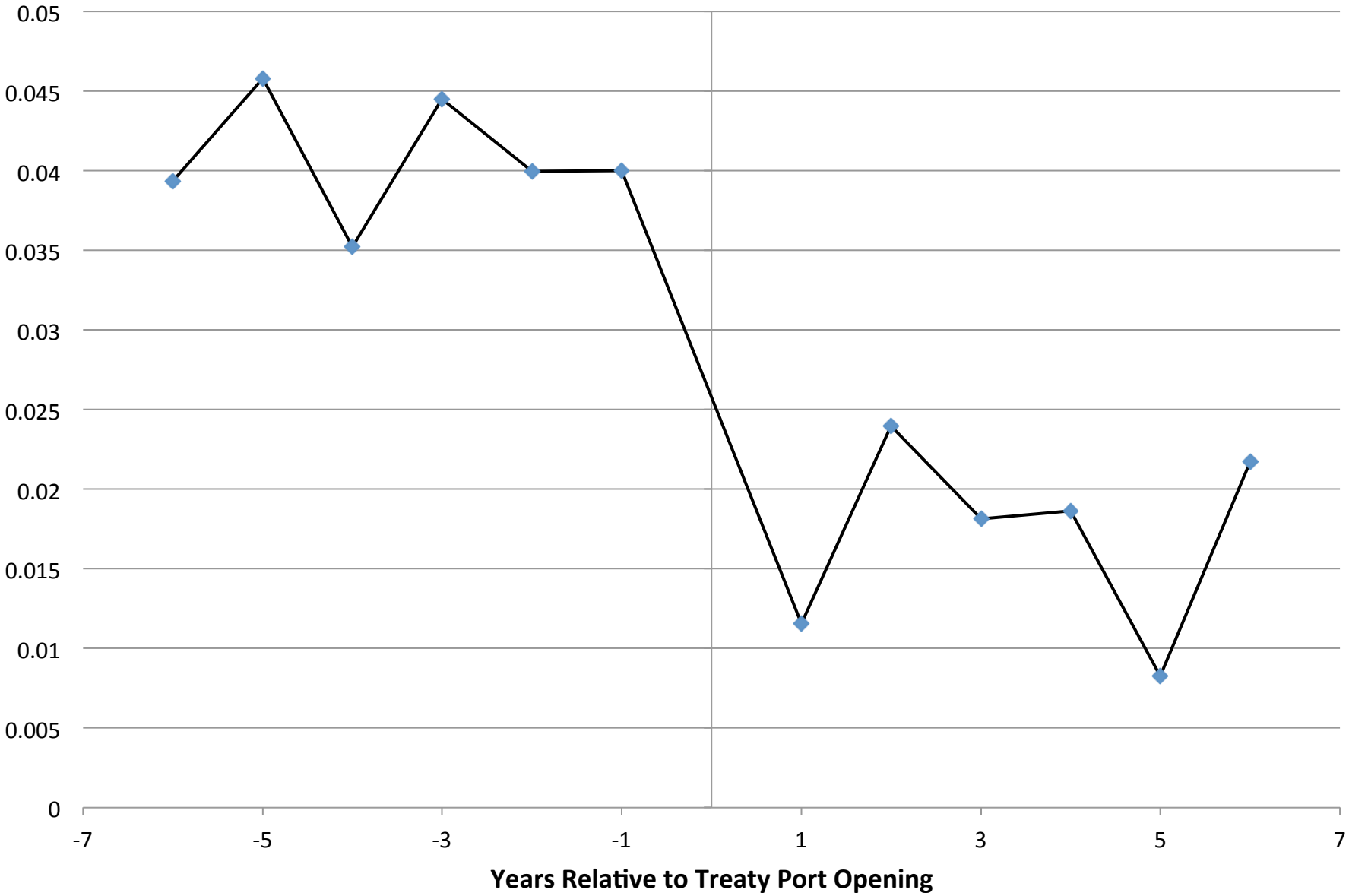

Figure 2. Sichuan Province – Harvest Cycle for Rice

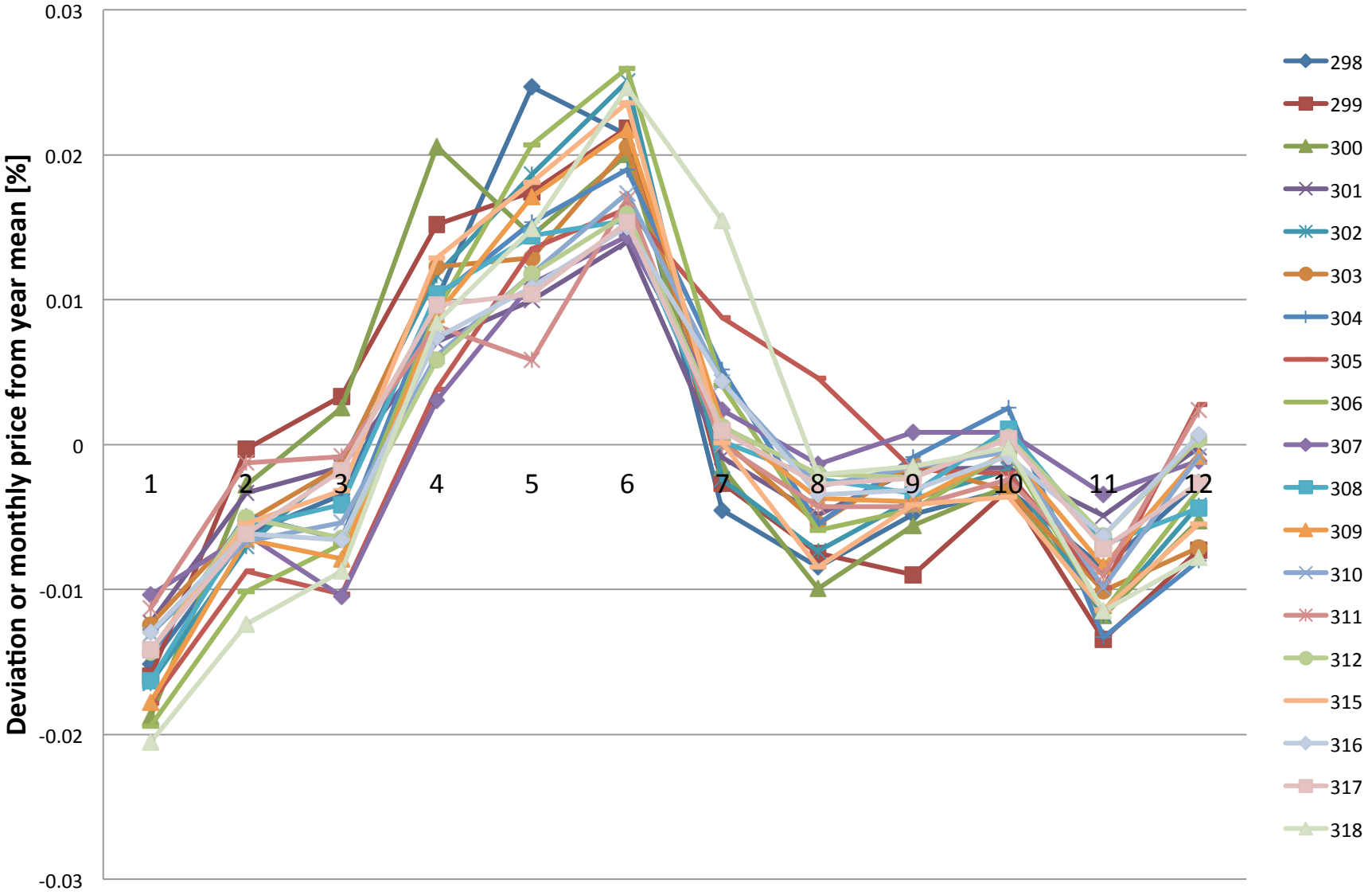

Figure 3. Interest Rates in China, 1820 to 1911:
Carrying Cost based on Rice Prices

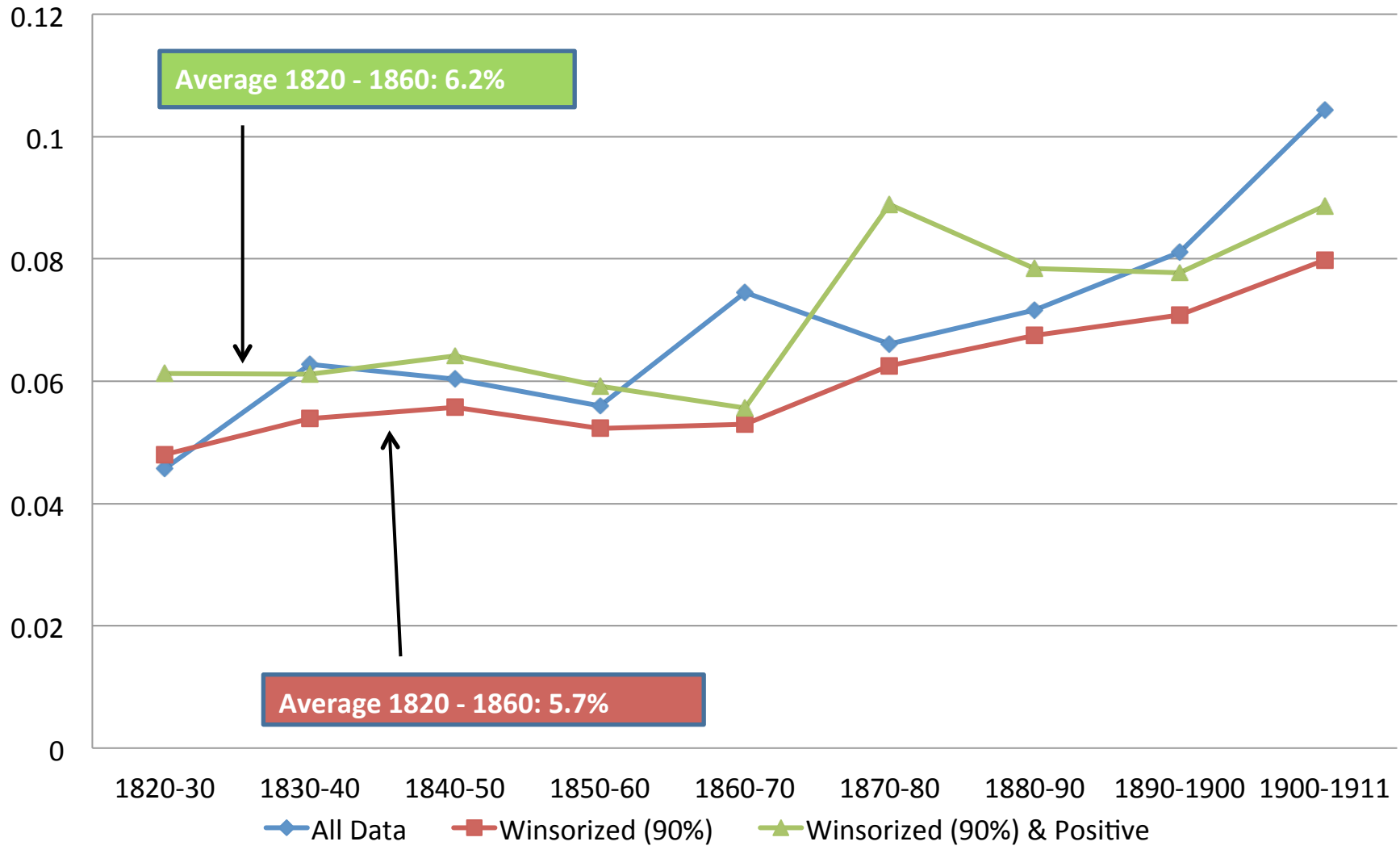

Figure 4. Fraction of Within-Harvest Year Price Changes > 0
Over time, for Rice (high price)

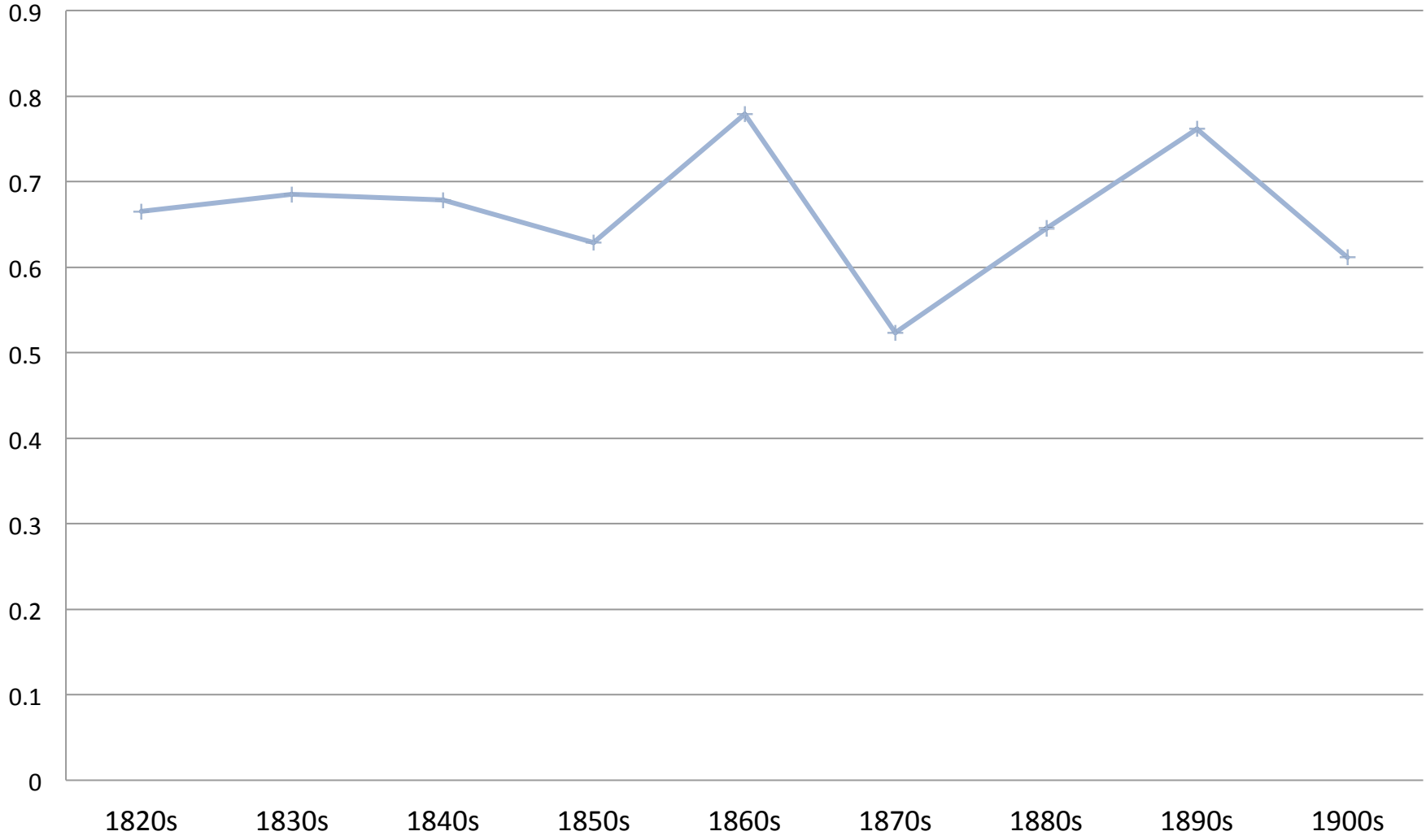

Figure 5. Carrying Costs in China, 1820 - 1911
Evidence from Different Grains

Figure 6. Carrying Costs in China by Province and over Time