THE LEGACIES OF FORCED FREEDOM: CHINA'S TREATY PORTS

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Abstract—This paper investigates the long-run development of China's treaty ports from the mid-eighteenth century until today. Focusing on a sample of prefectures on the coast or on the Yangtze River, I document the dynamic development paths of treaty ports and their neighbors in alternate phases of closedness and openness. I also provide suggestive evidence on migration and sector-wise growth to understand the advantage of treaty ports in the long run.

I. Introduction

THIS paper investigates the long-run development of China's treaty ports from the mid-eighteenth century until today. The case of China's treaty ports provides an interesting testing ground for history and development. First, treaty ports were forced to open as a result of treaties between China and Western countries after wars, and therefore the opening provides a quasi-natural experiment to study whether history is of importance for development. Second, China experienced alternate phases of closedness and openness from the nineteenth century until today, which I can exploit. This dynamic environment might help us better understand some mechanisms as to why history is of importance.

The treaty port system dates back to the late Qing dynasty of China, which is usually described as a dark and shameful period in Chinese history. One important feature of this period is that the Qing government signed many "unequal treaties" with Western countries. Along with these treaties, China conceded more than forty cities called "treaty ports" to Western countries from the 1840s to the 1910s. The Westerners established municipal authorities, factories, schools, police, and judiciaries in these ports. After a hundred years, in January 1943, China signed treaties with Britain and the United States to abolish extraterritoriality, and the treaty ports system ceased to exist.

If we simply compare the economic performance of treaty ports with other locations today, it seems obvious that treaty ports have developed better: many prosperous cities such as Shanghai, Guangzhou, and Tianjin have been treaty ports.[1] However, due to lack of data and selection concerns, little is known about the quantitative impacts of the treaty ports system on development.

To study the impacts of the treaty ports system, I construct a prefecture-level data set, encompassing the development paths of prefectures with treaty ports and a control group of prefectures with similar characteristics.[2] I mainly use population sizes from ten existing censuses in the years 1776, 1820, 1851, 1880, 1910, 1953, 1964, 1982, 1990, and 2000. I complement the results with GDP per capita from 1987 to 2007.

The major concern for identifying the effects of treaty ports is that Western countries might have chosen places better suited for economic development. I use the following strategies to relieve these selection concerns. First, my attention is restricted to 57 prefectures along the coast or along the Yangtze River. As explained in the background section, geography was the main selection criterion. Second, I conduct some placebo tests to check whether there were any systematic differences within the 57 prefectures based on observable characteristics. Third, I use differences-in-differences to carry out my estimation by exploiting the timing differences across waves of treaty ports, where I also allow for more flexible specifications similar to the event study strategy.

The strategy of comparing treaty port prefectures to control group prefectures along all observable dimensions—particularly within the subsample of 57 prefectures that are all similar in geographic attributes, being along the coast or the Yangtze River—follows the strategy advocated by Altonji, Elder, and Taber (2005).[3] Despite my effort to ensure that the treaty ports group and the control group are comparable, it is worthwhile pointing out that there might be potential unobserved characteristics that lead to an estimation bias. As a robustness check, I exploit the existence of historical customs stations (known as *Changguan* in Chinese) as an instrumental variable. The historical customs stations were established in the seventeenth century, some of which were established for military reasons and some to collect taxes from limited inland trade. As historians have noticed (Hamashita, 1989), the assignment of treaty ports was affected by the existence of historical customs stations. However, prefectures with historical customs stations did not necessarily develop better without the treaty ports system, as shown by two placebo tests. First, within the subsample of prefectures along the coast or the Yangtze River, the prefectures with historical customs stations did not grow faster

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[1] Hong Kong is also one of them, but it is excluded from the discussion in this paper due to its special status.

[2] Prefectures are the administrative level below provinces. A treaty port is a city in a prefecture.

[3] Altonji, Elder, and Taber (2005) use all of the variables in a given data set. Limited by historical data availability, I collect variables from different data sources. To the best of my knowledge, very few statistical studies using prefecture-level data from historical China exist. I include all the variables available at the current stage.

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before the treaty port system. Second, within the subsample of inland prefectures, the prefectures with historical customs stations did not grow faster after the treaty port system. The results from the IV strategy are consistent with those from the differences-in-differences strategy.

I find that prefectures with treaty ports grew faster in terms of population size after they had become open. After the Communist revolution in 1949, when all parts of China were closed to foreign influence, the two types of areas grew at similar rates. This finding is not surprising as the economy was heavily regulated and reducing regional differences was one of the most important political goals of the newly established government (Murphey, 1980). However, when China began to open up again after 1980, the places with treaty ports were among the first to take advantage of the new globalization opportunities, as shown by a higher population growth as well as faster growth of GDP per capita. In this paper, I denote the effect until the 1950s the short-run impact and the effect after the 1980s the long-run impact.

Many mechanisms can explain the short-run impact that population sizes grew faster in treaty ports after their opening. For instance, the Westerners built modern hospitals in treaty ports, which provided better public heath services. The Westerners also established factories, which provided more economic opportunities and attracted migrants. I do not attempt to disentangle all of these channels that might explain the short-run impact. Instead, I focus on mechanisms that might explain the long-run impact. To explain the long-run impact on population growth, I employ modern data on birth rates, death rates, and migration. I find the birth rates and death rates to be similar for prefectures in the subsample. However, migration into the treaty ports areas from other provinces plays an important role. This finding suggests that better economic opportunities in the treaty ports areas attract more people—not from their neighboring prefectures in the control group but from other areas of China. In terms of economic activities, I examine the growth of different sectors. I find the commerce and service sector to be the main driver of the long-run advantage of the treaty ports group.

This paper is clearly related to a broad literature on history and development. Nunn (2009) gives a thorough survey of the existing literature. Many studies in this line of literature have examined why history is of importance for long-run development outcomes. Existing explanations include geography and natural resources (Diamond, 1997; Sachs & Warner, 2001; Rappaport & Sachs, 2003), specific institutions such as legal systems (La Porta et al., 1997, 1998), and property rights (Acemoglu, Johnson, & Robinson 2001; Banerjee & Iyer, 2005), human capital (Glaeser et al., 2004; Easterly & Levine, 2012) as well as social norms (Tabellini, 2008; Nunn & Wantchekon, 2011). In this paper, the places studied share similar geographical features and all of them are accessible to trade, which suggests that geography is unlikely to be the main mechanism. From 1949 to 1978, formal Western institutions were basically abolished, but the former treaty ports still developed better once the country had been reopened. Hence, geography and tangible institutions are not likely to be the key mechanism. It is conceivable that human capital and social norms might have played a role in explaining the long-run impacts. But it is difficult to have convincing statistical evidence on these factors. Instead of examining these factors separately, I focus on more explicit measures of economic activities: the growth of different sectors. The finding regarding the commerce and service sector suggests a similar mechanism of path dependence as in Bleakley and Lin (2012), who document that portage sites in U.S. history have become cities whose industrial mix is still skewed toward service or commerce sectors.

The paper is organized as follows. Section II describes the historical background. Section III presents the data, the selection concerns, and some descriptive graphs as the motivation for the empirical estimation. Section IV presents the results for population growth from a differences-in-differences strategy and the results for GDP per capita from standard fixed effects estimations. Section V gives the estimation results using the existence of historical customs stations as an instrument. Section VI provides suggestive evidence on mechanisms of the long-run impact on population growth and GDP growth. Section VII concludes the paper.

II. Historical Background

In this section, I describe different phases of China's closedness and openness from the 1840s to today.

A. *1842: From Closedness to Forced Openness*

China, which means "Central Kingdom" in Chinese, was a self-sufficient agricultural society before the late Qing dynasty. Before the treaty system, Guangzhou was the only open port to Westerners, where trade was operated under the monopoly of a few merchants referred to as the "Thirteen Hongs" or the "Guangzhou Factories" (Morse, 1918).[4]

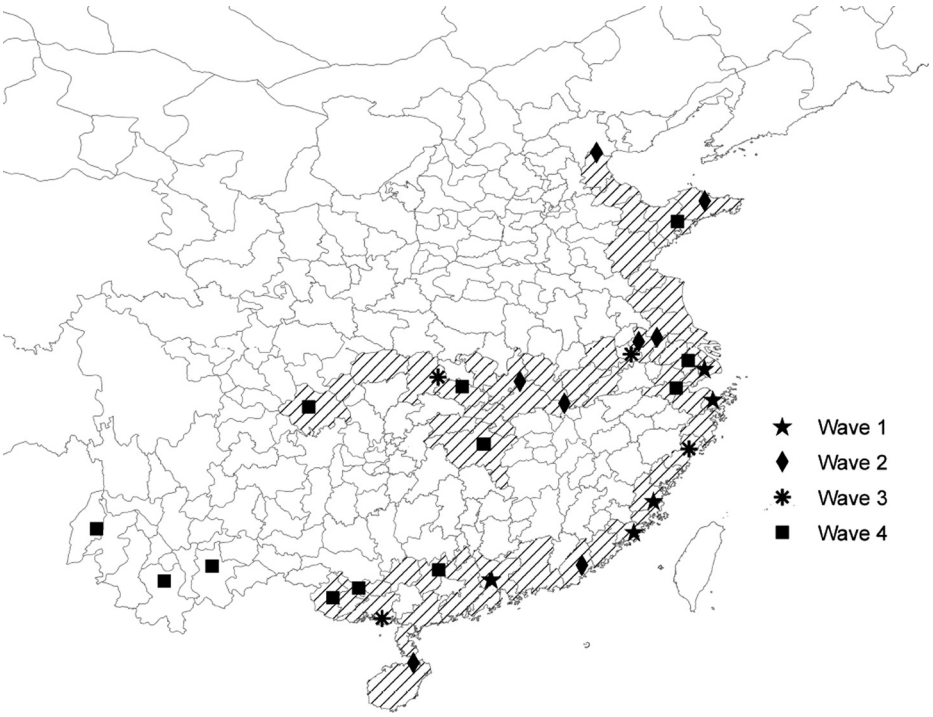
Partly due to the monopoly power, partly due to the trade disadvantages for Western countries,[5] open warfare between Britain and China broke out in 1839. China was defeated and forced to sign a treaty with Britain, the Treaty of Nanking, which was the beginning of a series of treaties in the following decades.

The Treaty of Nanking in 1842 established the concept of treaty ports. It named five cities—Guangzhou, Xiamen,

[4] In 1684, the Emperor Kangxi of the Qing allowed foreigners to trade with China in four cities, including Guangzhou. In 1686, Westerners were allowed to live in the area of the factories in Guangzhou, at the head of the Pearl River. In 1757, the Emperor Qianlong restricted Westerners to the port of Guangzhou.

[5] The only advantage for Britain in trade was in opium, which merchants smuggled from British India into China in defiance of Chinese prohibition laws. Recognizing the consequences of opium abuse, Lin Zexu, governor-general of Hunan and Hubei, embarked on an antiopium campaign where 1,700 opium dealers were arrested and 2.6 million pounds of opium were confiscated and destroyed. This led to the open warfare between China and Britain, that is known as the Opium War.

FIGURE 1.—GROWTH OF THE TREATY PORTS SYSTEM



Wave 1 was opened in the 1840s; wave 2 was opened in the 1860s; wave 3 was opened during the 1870s and the 1880s; wave 4 was opened in the 1880s and later. The dark areas are the prefectures in the subgroup. There are three prefectures with treaty ports not included in the benchmark estimation as they are not coastal prefectures.

Fuzhou, Ningbo, and Shanghai—where the British were permitted to establish themselves "for the purpose of carrying on their mercantile pursuits without molestation or restraint." Later refinements introduced most-favored-nation treatment, requiring the Chinese to extend any privileges to one country to other Western countries. Most importantly, the treaties signed by France and the United States in 1844 spelled out the concept of extraterritoriality, which implied that foreigners in China were governed by the law of their own country instead of Chinese law.

Figure 1 illustrates the growth of the treaty ports system, which historians usually categorize into four waves according to the time of the opening (Twitchett & Fairbank, 1978): wave 1 is from 1842, wave 2 from 1858 to 1864, wave 3 from the 1870s to the 1880s, and wave 4 from the 1890s to 1910.[6] The treaty ports in Tibet, Taiwan, and northeastern China are not included in this paper.[7] As shown in figure 2A in section III, the order of the waves did not depend on the economic development proxied by population sizes except for wave 1. Historical writings such as Fei (1991) present some qualitative differences within treaty ports. However, these differences are not easily quantified. This paper considers the group of treaty ports together, and the results can be taken as the average effects for the group.

B. *1949–1978: From Open to Closed Economy*

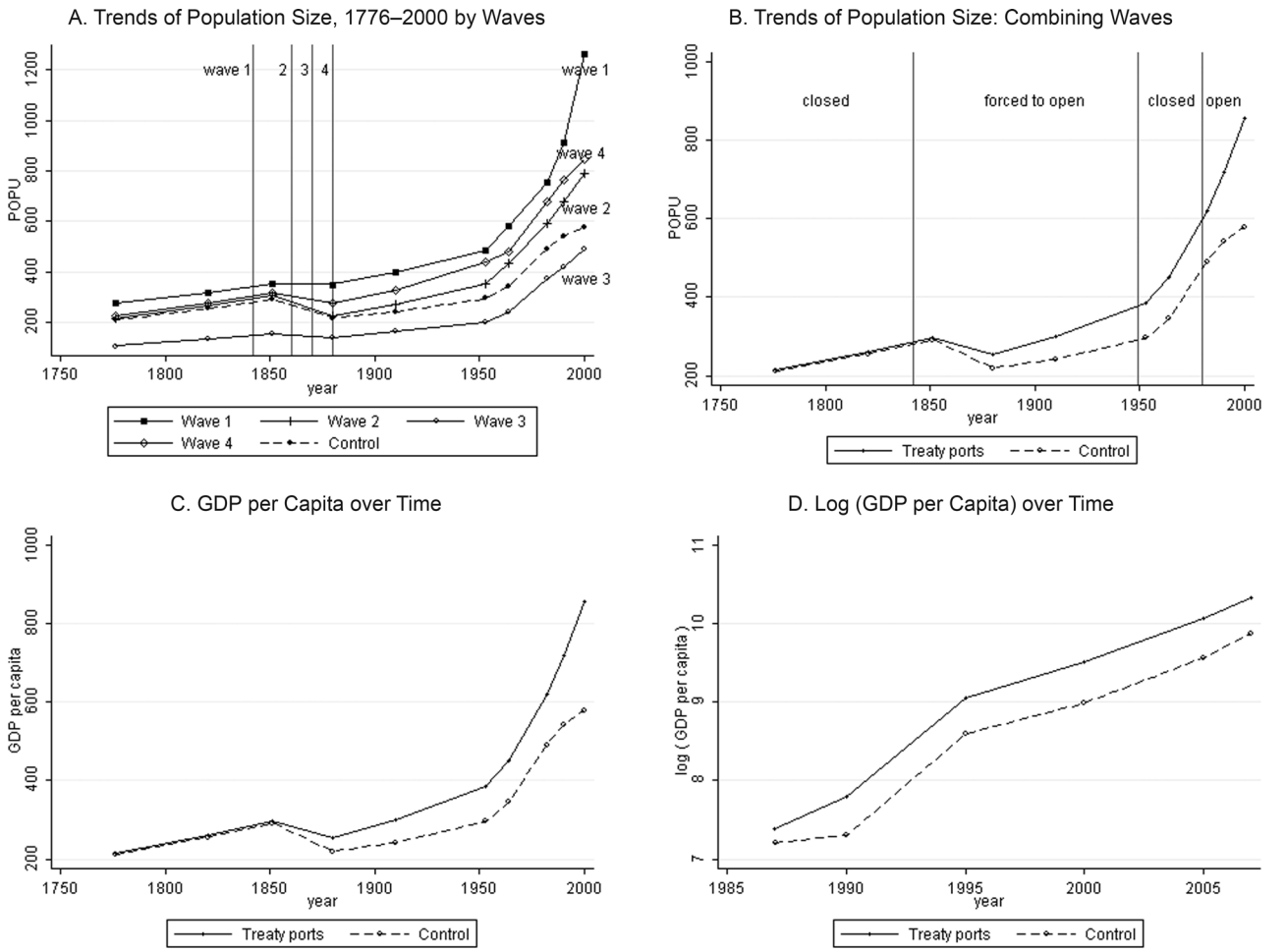
The People's Republic of China was established in 1949. Being concerned about the international environment toward the vulnerable new country, the leaders decided that China should depend on itself for its development, and the door of the country was once more closed. Besides, starting as a peasant-centered revolution, coming to power from rural bases against the cities, and ruling a country that was still 80% rural and agricultural, the new government took many steps to control and disperse the development of existing urban areas, especially treaty ports. These strategies included transferring plants from coastal cities inland during the 1950s and sending about 15 million urban youths to rural areas during the Cultural Revolution between 1966 and 1976 (Murphey, 1980).

People's daily economic activities were strictly controlled in the centrally planned economy. Team accounting was used in the rural areas. Farmers were paid regardless of their production in the teams, which created serious incentive problems and low productivity. In urban areas, the national unified job allocation and wage system was employed. The central government set the general wage policies and determined both the wage structure and wage differentials, and these levels barely changed for nearly three decades. Production teams were largely disbanded during the agricultural reforms

[6] It usually took several years before the treaties were implemented (i.e., when foreign customs offices were established). In the empirical analysis, I use the year of implementation as the treatment year.

[7] Unlike the treaty ports studied in this paper, the treaty ports in northeastern China were controlled by Japan, and their interest did not lie in trade. This creates an interesting environment for studying the effects of colonial origins within treaty ports, which is not the focus of this paper.

FIGURE 2.—COMPARISONS OVER TIME



Population size in panels A and B is measured in 10,000. Panel A: This panel shows the population sizes over time by waves. Except for wave 1, the order of waves does not depend on the population sizes before the treaty system. Panel B: This panel combines different waves of treaty ports together. Here the treaty ports group includes all prefectures that finally became treaty ports.

of 1982 to 1985, and the rigid wage system was abolished around 1984 to 1985.

The closed economy led to significant economic stagnation. In 1978, the average, yearly income of a Chinese individual was 13.6% of the world average, and China was ranked 203 among the 206 countries in the world in terms of per capita income (World Bank, 1979).

C. 1980s–Today: From Closed to Open Economy

The Chinese government decided on large-scale economic reforms in 1978 and embarked on a policy of opening to the outside world in a planned way and step by step. Since 1980, China has established Special Economic Zones in Shenzhen, Zhuhai, and Shantou in Guangdong Province, and Xiamen in Fujian Province and designated the entire province of Hainan as a Special Economic Zone. In 1984, it opened fourteen coastal cities to overseas investment (nine of them were former treaty ports). Then, starting from the late 1980s, the state decided to expand the open areas to other parts of China.

Special Economic Zones usually refer to the five places noted and sometimes include the fourteen coastal cities. Wang (2013) finds that these zones have developed better than areas not designated as these zones. But she defines *Special Economic Zones* very broadly, including all places with economic and technological development zones. According to this definition, all 57 prefectures studied in this paper had become "special" economic zones in 1990. As a robustness check, I define the Special Economic Zones (SEZs) as those opened before 1985 and include the interactions of the SEZ dummies and the year dummies in my estimation. This does not vary the baseline results, as shown in table 4B.

III. Data, Selection, and Descriptive Graphs

In this section, I describe the data and discuss selection concerns and my strategies to deal with them. Then I present a few descriptive graphs for population growth and GDP growth in preparation for the empirical estimations in the next section.

A. Data

Here, I briefly describe the data. (Detailed definitions and sources of data are given in appendix A.) Since summary statistics can be seen when I compare the means of key variables

for different groups, I do not present a table for summary statistics separately.

For the outcomes from historical time until today, I use population sizes from existing censuses in the years 1776, 1820, 1851, 1880, 1910, 1953, 1964, 1982, 1990, and 2000. The population size data before 1953 are taken from Cao (2000). The census in new China from 1953 onward (National Bureau of Statistics, 2005) is conducted at the county level. I combined county-level data into prefecture-level data after considering different administrative boundary changes. I complement the results with GDP per capita from 1987 to 2007. Since this measure is an average number for a prefecture, I use the information for corresponding modern prefectures without further considering boundary changes.

I have also collected data on prefecture characteristics that might have affected the selection of treaty ports, including geographical variables, economic variables, natural resources, and political variables:

- Geographical variables: Dummies for whether a prefecture is on the coastal line and the Yangtze River, latitude and longitude. The information is taken from China Historical GIS Data.
- Economic variables: Population in 1776 and 1820 from Cao (2000) and prefecture-level land tax quotas in 1820 collected in Liang (1981).[8]
- Natural resources: Dummies for silk and tea production areas based on information from Perkins (1969) and Li (1957). Silk and tea were the most important export goods in this period.
- Political variables: Distance to the Grand Canal. The Grand Canal system (*Da Yun He*) totaled about 2,500 kilometers, with Beijing at its northernmost extension, Hangzhou at its southernmost point, and Luoyang at its westernmost point. Thus, it connected the political center of the empire in the north (especially since the Song dynasty, around 960 AD) with the economic and agricultural centers of central and southern China. With the canal, the control of a unified China became a possibility and the Grand Canal is acknowledged to be a significant element in imperial China's political stability, mainly through grain distribution. It does not serve to any considerable extent for Western countries in terms of trade in that period. The calculation is based on China Historical GIS Data.

Another set of data is modern information on birth rates, death rates, and migration, as well as output of different sectors. These data will be used to understand the long-run impacts in section 6.

B. Selection Concerns

A key issue in comparing treaty and nontreaty ports is to identify how treaty ports were assigned. If these ports were randomly assigned, it would be easy to compare their development paths. But, this is not generally true; there were indeed strategic considerations in choosing the treaty ports. For example, in his correspondence to John Bowring, chief superintendent of British Trade in China, Lord Clarendon wrote that the British aim was "to obtain access generally to the whole interior of the Chinese Empire as well as to the cities on the Coast: or failing this, to obtain free navigation of the Yangtze River and access to the cities on its banks up to Nanking inclusive" (Morse, 1918).

A first step in dealing with the selection concern is to focus on a subgroup of prefectures on the coastal line and Yangtze River. As illustrated in figure 1, most of the treaty ports lie along the coastal line or the Yangtze River. The dark area in figure 1 covers the 57 prefectures in my sample.[9]

The motivation for focusing on this subgroup of prefectures is that given the geographical characteristics or accessibility to trade, there is some randomness in assigning the treaty ports. For instance, reflecting on the assignment of treaty ports, a report from the China Imperial Customs (operated by the British) in 1880 said that "in some places the new ports were in the wrong place; instead of Kiukiang, for instance, the treaty port should have been at Huk'ou, at the exit from the Poyang Lake" (China Imperial Customs, 1931). As shown in figure 2A, the order of waves did not depend on population sizes. This also suggests that foreign powers did not have detailed knowledge about all treaty ports except for a couple of places such as Shanghai in wave 1. As a robustness check, I drop wave 1 in some of the specifications.

Although all places in the sample are close to the coast or the Yangtze River, there might still be another concern, and it not easy to measure precisely: whether a port is sufficiently deep for trading and naval ships and whether it would or would not freeze during the winter. However, this is not a particular threat to the comparison for the following reasons. First, a comprehensive study of China's geography and geology by the French geographer Louis Richard (1908), first published in 1905 in Shanghai and translated into English in 1908, provides detailed information about China's geology. It does not appear from that information that nontreaty port locations in my sample are particularly unsuitable to serve as ports. For example, regarding the coastal line, Richard argues that "from Zhejiang to the Gulf of Tongking, it is very steep, indented and studded with numerous islets. It is here and along Shandong, that the finest and deepest bays are found, and facilities afforded for opening well protected and promising ports. Since the treaty ports along the coast and their neighbors are close to each other, they share similar

[8] I also check information on provincial-level imperial exam graduates per 10,000 inhabitants in the 1840s from Jiang (2007) as another proxy for economic development. The information is not complete, but the two groups are also close in this dimension based on available data.

[9] The names of the fifty-seven prefectures are listed in appendix B. Three treaty ports in the Southwest were not included in the analysis because they are not on the coast or on the Yangtze River.

TABLE 1.—SELECTION OF TREATY PORTS

	(1) All	(2) All	(3) Coast/Yangtze	(4) Coast/Yangtze
Coastal	0.451***	0.450***		
	(0.058)	(0.074)		
Yangtze	0.436***	0.426***		
	(0.068)	(0.084)		
Population in 1776		0.000	0.002	0.002
		(0.001)	(0.005)	(0.006)
Population in 1820		−0.000	−0.001	−0.002
		(0.001)	(0.004)	(0.005)
Silk		0.017		0.054
		(0.073)		(0.184)
Tea		0.068		0.054
		(0.056)		(0.162)
Land tax in 1820		0.000		0.000
		(0.000)		(0.001)
Distance to Grand Canal		−0.005		−0.013
		(0.011)		(0.029)
Longitude		−0.008		−0.023
		(0.010)		(0.034)
Latitude		−0.010		−0.019
		(0.008)		(0.021)
Affected by Taiping Rebellion		−0.046		−0.056
		(0.075)		(0.207)
p-value of joint significance				0.90
Number of observations	186	184	57	57
R^2	0.33	0.36	0.00	0.06

The table reports results for the selection of treaty ports from linear probability models. The results are robust to logit and probit. The *p*-value is the value from an *F*-test of the joint significance of covariates. Significant at ***1%, **5%, *10%.

advantages.[10] Second, although cities in the control group did not become treaty ports, some of them have ports opened by the Qing government, such as Funing Fu and Yuezhou Fu, and many of them have ports of call, such as Anqing Fu, Chizhou Fu, and others.

A second step to relieve the selection concerns is to check whether the prefectures with treaty ports differ from the control group before the treaty ports system. Given the prefecture characteristics I have noted, I carry out a few tests on the selection of treaty ports. The results from linear probability regressions are presented in table 1. If I take all 186 prefectures into consideration,[11] the coefficients on the coastal line and the Yangtze River are significant in column 1 and these are the only two significant variables, when all characteristics are included in column 2.[12] The other variables besides the dummies for coast and the Yangtze River are jointly insignificant. The population sizes before the treaty system are of no importance, as shown in column 3, if the sample is limited to the subgroup of 57 prefectures along the coastal line and the Yangtze River. In fact, within these prefectures, none of the above-mentioned characteristics is of importance, as presented in column 4. The *p*-value from the joint significance of these characteristics is around 0.9. These results are robust to logit and probit specifications.

Table 2 reports the means by prefecture-level characteristics for both the full sample and the subgroup. The differences are dramatic between the treaty ports group and the rest in the full sample. However, within the subsample, the treaty ports group and the control group have balanced characteristics. To employ a differences-in-differences model within the subsample, I assume that the unobservable sources of endogenous heterogeneity are additive.

Because I have data on population sizes before the treaty system, I can employ the event study strategy by normalizing the periods based on different waves. Below I present some descriptive graphs, which motivate the estimation results in section IV.

C. *Descriptive Graphs for the Subgroup*

Figure 2A illustrates the trends of the prefecture-level population size in 1776, 1820, 1851, 1880, 1910 and 1953, 1964, 1982, 1990 and 2000 by waves. The dramatic decrease in the population is due to a deadly civil war between 1851 and 1864, the Taiping Rebellion.[13]

From figure 2A, except for wave 1, the treaty ports group did not grow faster than the control group before it became

[10] Modern GIS data on China Bathymetry lines show that the bathymetric depth along the coast is around 20 meters for both the treaty ports and their neighbors.

[11] There were more than 186 prefectures in China, but I include only central China in this regression, for which information is available.

[12] One reason I do not use propensity score matching as the identification strategy in the latter regressions is that only geographical features are of importance for the propensity score.

[13] Besides the Taiping Rebellion, some other historical events also led to a population decrease, including bubonic plague in Yunnan around the period from 1871 to 1893; drought in Shaanxi, Shanxi, and Henan from 1876 to 1880; and a Muslim rebellion in Shaanxi, Gansu, and Xinjiang from 1862 to 1873. But these places do not belong to the fifty-seven prefectures I consider in the identification.

TABLE 2.—COMPARISONS OF PREFECTURE CHARACTERISTICS

Sample	(1) All Treaty Ports	(2) All The Rest	(3) All *t*-Value	(4) Coast/Yangtze Treaty Ports	(5) Coast/Yangtze Control Group	(6) Coast/Yangtze *t*-Value
Population in 1776	198.91	139.06	2.96***	214.98	228.37	0.14
	(129.93)	(100.22)		(129.49)	(121.27)	
Population in 1820	240.76	170.83	2.89***	260.03	277.90	0.11
	(152.98)	(120.79)		(152.48)	(151.16)	
Silk	0.37	0.13	3.15***	0.42	0.42	0.03
	(0.49)	(0.33)		(0.50)	(0.50)	
Tea	0.47	0.31	1.85*	0.38	0.35	0.74
	(0.51)	(0.46)		(0.50)	(0.49)	
Land tax in 1820	162.60	141.90	0.77	181.34	207.26	−0.17
	(143.66)	(147.47)		(144.13)	(155.33)	
Distance to Grand Canal	7.34	7.14	0.25	5.94	5.29	0.75
	(6.38)	(5.44)		(5.10)	(4.98)	
Longitude	113.87	111.80	1.71*	115.20	116.26	−1.07
	(6.50)	(5.53)		(5.03)	(3.79)	
Latitude	27.84	30.86	−3.17***	28.41	29.72	−1.22
	(4.99)	(4.81)		(5.13)	(4.18)	
Affected by Taiping Rebellion	0.40	0.26	1.61	0.42	0.54	−0.45
	(0.50)	(0.44)		(0.50)	(0.51)	

The table reports the means of available variables for the treaty ports group and two comparison groups. It shows that the differences in these variables are significant in the full sample but not in the subsample.

treaty ports. However, divergence sets in after the treaty ports became established. The figure also illustrates that the order of waves did not depend on the size of the prefectures.

Figure 2B combines the four waves. The trends are similar to those in figure 2A. One can observe that treaty port places are, on average, larger than the control group between 1953 and 1982. However, there was little difference in terms of changes in size between 1953 and 1982, and the trends started to differ between 1990 and 2000.

Figures 2C and 2D plot the GDP per capita and the log of GDP per capita over time since 1987. To make the results easier to read, I report only selected years. The change in the log of GDP per capita can be taken as growth of GDP per capita. The main message is that both groups started with a very low level of GDP per capita. Although the treaty ports group grew faster, it took some time for the difference in levels of GDP per capita to become significant.

IV. Differences-in-Differences Estimates

In this section, I estimate the growth differences of treaty ports in terms of population sizes and GDP per capita. The results show that the treaty ports group on average grew faster after opening up. However, it grew at similar rates as the control group when China was closed to foreign influence between the 1950s and the 1980s.

A. *Population Growth, 1776–2000*

First, I use a differences-in-differences strategy, exploiting the timing differences across the four waves. Because the length of time between two censuses is unevenly distributed, I use annual population growth as the dependent variable. The annual population growth in prefecture i during time t ($G_{i,t}$) is calculated from population size at census year t ($Popu_{i,t}$) and the previous census year $t - N$ ($Popu_{i,t-N}$): $G_{i,t} = \frac{1}{N}\left(\frac{Popu_{i,t}-Popu_{i,t-N}}{Popu_{i,t-N}}\right)$. This way, the length of time between two censuses is taken into account. The mean of $G_{i,t}$ is 0.9%, and the standard deviation is 1.2%.[14] To facilitate the reading of the results, I multiply $G_{i,t}$ by 100 in the estimations. Thus, the coefficient can be interpreted as percentage points.

The baseline differences-in-differences specification is as follows,

$$G_{i,t} = \beta \text{Treatyport}_{i,t} + \sum_i \gamma_i \times I_i + \sum_{t=1820}^{2000} \rho_t \times I_t + \sum_{t=1820}^{2000} \upsilon_t X_i \times I_t + \varepsilon_{i,t}, \quad (1)$$

where $\text{Treatyport}_{i,t}$ is a dummy variable equal to 1 if prefecture i is a treaty port at time t. I_i and I_t are prefecture and year fixed effects. $X_i \times I_t$ are prefecture-specific characteristics interacted with year fixed effects. X_i includes the observables discussed above: dummies for silk and tea production areas, distance to the Grand Canal, longitude, latitude, prefecture-level land taxes in 1820, and whether a prefecture was affected by the Taiping Rebellion.

β can be interpreted as the difference in population growth rates of the treaty ports group relative to the control group. The results are presented in table 3. Standard errors are clustered at the prefecture level. Column 1 shows the OLS results. Columns 2 and 3 show the results with and without controls, controlling for fixed effects. Column 4 shows the results after dropping wave 1. These results show that the population growth rate of the treaty ports group is about 0.3% higher, which is around 30% of the mean of the growth rate (0.9%).

[14] In order not to lose observations for one period, the growth rate in the first year of observation (1776) is assumed to be the same as in the second year of observation (1820). However, the main results are robust to dropping the first year of observation.

TABLE 3.—BASELINE RESULTS FOR POPULATION GROWTH

	(1) Annual Growth	(2) Annual Growth	(3) Annual Growth	(4) Annual Growth
Treaty ports	0.829***	0.325**	0.363***	0.314**
	(0.105)	(0.152)	(0.127)	(0.137)
Prefecture and year FE		Yes	Yes	Yes
Controls × Year FE			Yes	Yes
Dropping wave I				Yes
Number of observations	570	570	570	520
R^2	0.09	0.71	0.82	0.85

The table reports the baseline results from the differences-in-differences regressions. Controls include dummies for silk and tea production areas, distance to the Grand Canal, longitude, latitude, prefecture-level land taxes in 1820, and whether a prefecture was affected by the Taiping Rebellion. Standard errors are clustered at the prefecture level. Significant at ***1%, **5%, *10%.

To validate the identifying assumption that the trends are parallel for the treaty ports group and the control group absent the treaty system, I employ a strategy similar to the event study as follows:

$$G_{i,t} = \sum_{\tau\in\{-3,-2,0,1,2+\}} \beta_\tau Treatyport_{i,\tau} + \sum_i \gamma_i \times I_i + \sum_{t=1820}^{2000} \rho_t \times I_t + \sum_{t=1820}^{2000} \upsilon_t X_i \times I_t + \varepsilon_{i,t}. \quad (2)$$

Here, $Treatyport_{i,\tau}$ is a set of five dummy variables that equal 1 if τ periods have passed since the opening of i, where $-3 \le \tau \le 2+$, where $2+$ refers to two periods or more. One period before the treaty ports system is left as the comparison group. If the coefficients β_{-3} and β_{-2} are not significantly different from 0, the parallel trends assumption is likely to hold.

The results are presented in table 4A. Columns 1 and 2 show the results with and without controls. Column 3 shows the results after dropping wave 1. The results from column 1 are also shown in figure 3. As they show, the growth rates of the two groups did not differ before the treaty ports system, but the divergence took place after the treaty ports system. It takes time for the effect to become significant. On average, two periods after opening implies a length of about fifty years.[15] Thus, the treaty ports group grew significantly faster fifty years after their opening.

In the previous specification, I examine the average effect one or two periods and more after the introduction of the treaty ports system. This specification cannot show the effects in different phases after 1949. To estimate these different effects in different phases, I focus on the data between 1953 and 2000 and run a fixed-effects specification as follows,

$$G_{i,t} = \sum_{t=1953}^{2000} \beta_t Treatyport_i \times I_t + \sum_i \gamma_i \times I_i + \sum_{t=1964}^{2000} \rho_t \times I_t + \sum_{t=1964}^{2000} \upsilon_t X_i \times I_t + \varepsilon_{i,t}, \quad (3)$$

where the year 1964 is left as the comparison group.

[15] For example, for wave 1, the observation of two periods is 1910, about sixty years after the implementation of the treaties; for wave 4, the observation of two periods is 1953, about forty years after the implementation of the treaties.

The results are presented in table 4B. These results show that the advantage of treaty ports disappeared between the 1960s and 1980s, finding that is consistent with historical writings (Murphey, 1980). However, after the reopening of the country, the treaty ports group once more grew significantly faster, as shown by the difference in population growth between 1990 and 2000.[16]

B. GDP per Capita since 1987

To complement the results with population growth, a similar model using annual GDP data since 1987 is estimated as follows:

$$\ln \text{GDPpercapita}_{i,t} = \sum_{t=1988}^{2007} \beta_t Treatyport_i \times I_t + \sum_{t=1988}^{2007} \mu_t SEZ_i \times I_t + \sum_i \gamma_i \times I_i + \sum_{t=1988}^{2007} \rho_t \times I_t + \sum_{t=1988}^{2007} \upsilon_t X_i \times I_t + \varepsilon_{i,t}. \quad (4)$$

The year 1987 is left as the comparison group. Instead of showing the effects year by year, I focus on selected years: 1990, 1995, 2000, 2005, and 2007. To take modern industrial policies into consideration, I also include the interaction of Special Economics Zones and year fixed effects.

The results are presented in table 5. Columns 1 to 3 report the results for the log of GDP per capita, whereas columns 4 to 6 report the results for the level of GDP per capita. Columns 1 and 2 show the results with and without controls, and column 3 shows the results after including the interactions of SEZs and year fixed effects ($SEZ_i \times I_t$). The results in columns 1 to 3 imply that the growth of GDP per capita has been steadily higher in treaty ports since 1990, with a magnitude varying between 20% and 40%. Consistent with this finding, the results in columns 4 to 6 show that the difference in the levels of GDP per capita between the two groups has become larger over time.

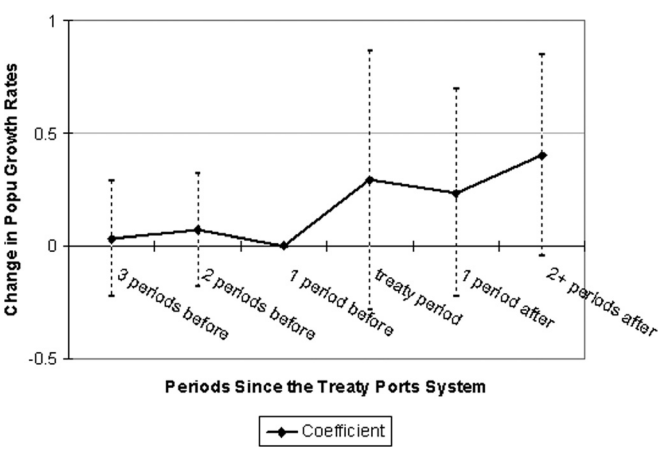
[16] Note that the coefficient of TreatyPort × Year2000 measures the effect on population growth between 1990 and 2000.

TABLE 4.—THE DYNAMIC IMPACTS

	(1) Annual Growth	(2) Annual Growth	(3) Annual Growth
	A: Comparison with One Period Before Opening		
Three periods before	0.033	0.112	0.140
	(0.128)	(0.090)	(0.101)
Two periods before	0.069	0.136	0.166
	(0.126)	(0.090)	(0.102)
Treaty period	0.291	0.394*	0.316
	(0.287)	(0.216)	(0.241)
One period after	0.234	0.282	0.461**
	(0.230)	(0.223)	(0.228)
Two or more periods after	0.401*	0.447**	0.374*
	(0.223)	(0.182)	(0.197)
Prefecture and year FE	Yes	Yes	Yes
Controls × Year FE		Yes	Yes
Dropping wave 1			Yes
Number of observations	570	570	520
R^2	0.71	0.80	0.84
	(1) Annual Growth	(2) Annual Growth	(3) Annual Growth
	B: Comparison with the Year 1964		
Treatyport × Year1953	0.222	0.287	−0.006
	(0.411)	(0.402)	(0.325)
Treatyport × Year1982	−0.152	−0.206	−0.251
	(0.374)	(0.341)	(0.372)
Treatyport × Year1990	0.485	0.442	0.103
	(0.440)	(0.403)	(0.458)
Treatyport × Year2000	1.047**	1.048**	0.666*
	(0.412)	(0.407)	(0.343)
Prefecture and year FE	Yes	Yes	Yes
Controls × Year FE		Yes	Yes
Dropping wave 1			Yes
Number of observations	285	285	260
R^2	0.80	0.85	0.88

Panel A: This panel reports results from the event study regressions. The coefficients can be interpreted as changes in population growth of the treaty ports group (relative to the control group) compared to one period before the treaty ports system. Controls include dummies for silk and tea production areas, distance to the Grand Canal, longitude, latitude, prefecture-level land taxes in 1820, and whether a prefecture was affected by the Taiping Rebellion. Panel B: This panel reports results from the fixed effects regressions for data between 1953 and 2000. Controls include dummies for silk and tea production areas, distance to the Grand Canal, longitude, latitude, prefecture-level land taxes in 1820, and whether a prefecture was affected by the Taiping Rebellion. Standard errors are clustered at the prefecture level. Significant at ***1%, **5%, *10%.

FIGURE 3.—DYNAMICS OF POPULATION GROWTH BEFORE AND AFTER THE TREATY PORTS SYSTEM



The horizontal axis measures periods since the treaty period. The average length of one period is about thirty years. The points connected by the solid line indicate changes in population growth of the treaty ports group (relative to the control group) compared to one period before the treaty ports system, which is displayed as an effect of 0 to aid the visual analysis. See column 1 in table 4A for the numbers of these point estimates. The bounds are given from the 95% confidence intervals, where standard errors are clustered at the prefecture level.

V. Using Historical Customs Stations as Instrument

This section draws on the existence of historical custom stations as an instrumental variable for treaty ports. The validity of the instrument requires a strong first stage and the exclusion restriction to hold. First, I show that having a historical customs station affected the likelihood of becoming a treaty port. Second, I document that there is no significant relationship between having a customs station and population growth without the treaty system, thus suggesting that the exclusion restriction is likely to hold. Finally, I compare the second-stage results with those from the differences-in-differences estimations.

Forty-three custom stations, known as the native customs, were established in the seventeenth century. Some of them were established for military reasons and some to collect taxes from limited inland trade. Figure 4 shows the locations of native customs and the treaty ports.

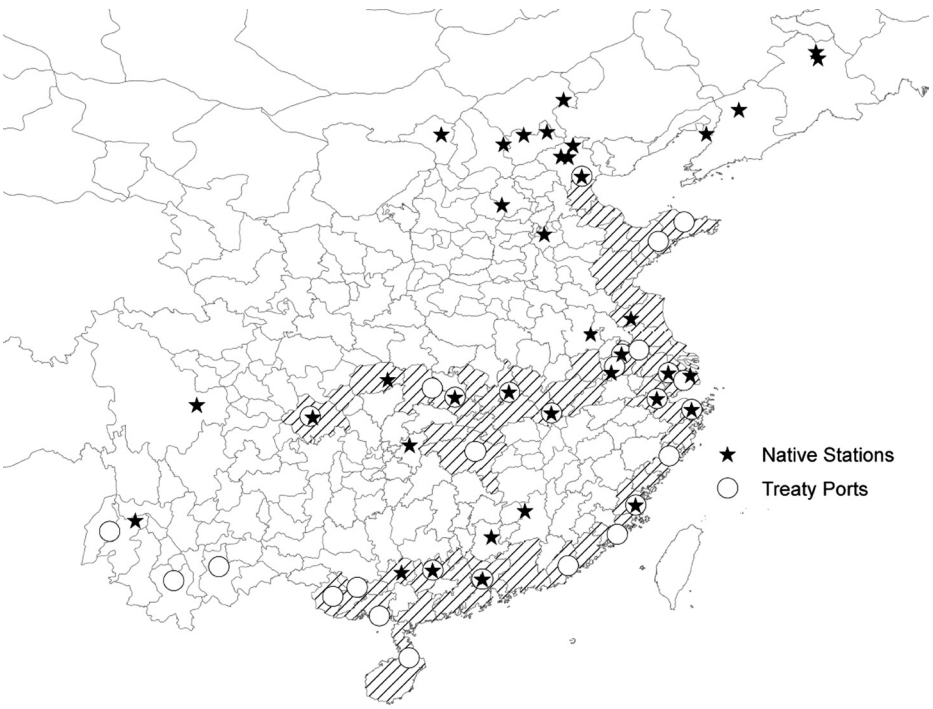
Many of these historical custom stations were located inland. However, those located along the coast or on the Yangtze River tended to become treaty ports later. This relationship has been noticed by historians such as Hamashita (1989), who finds that foreign customs in the treaty ports

TABLE 5.—RESULTS FOR GDP PER CAPITA

	(1) Log (GDP per Capita)	(2) Log (GDP per Capita)	(3) Log (GDP per Capita)	(4) GDP per Capita	(5) GDP per Capita	(6) GDP per Capita
Treatyport × Year1990	0.208*	0.192*	0.192*	1,094	1,117	1,030
	(0.119)	(0.100)	(0.101)	(1,532)	(822)	(847)
Treatyport × Year1995	0.210	0.202	0.212	4,066**	3,672***	3,283**
	(0.162)	(0.125)	(0.127)	(1,936)	(1,218)	(1,419)
Treatyport × Year2000	0.307*	0.322***	0.331***	7,620***	7,639***	7,028***
	(0.158)	(0.114)	(0.112)	(2,537)	(1,762)	(1,986)
Treatyport × Year2005	0.338*	0.399***	0.413***	15,345***	16,277***	15,008***
	(0.177)	(0.130)	(0.131)	(5,082)	(3,537)	(3,776)
Treatyport × Year2007	0.311*	0.382***	0.395***	18,887***	20,913***	19,171***
	(0.181)	(0.133)	(0.134)	(6,641)	(4,578)	(4,847)
Prefecture and year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls × Year FE		Yes	Yes		Yes	Yes
SEZs × Year FE			Yes			Yes
Number of observations	291	291	291	291	291	291
R^2	0.96	0.98	0.91	0.96	0.98	0.91

The table reports results from the fixed effects regressions on GDP per capita. Controls include dummies for silk and tea production areas, distance to the Grand Canal, longitude, latitude, prefecture-level land taxes in 1820, and whether a prefecture were affected by the Taiping Rebellion. Columns 3 and 6 present the results including the interactions between Special Economic Zones (SEZs) and year fixed effects. Standard errors are clustered at the prefecture level. Significant at ***1%, **5%, *10%.

FIGURE 4.—LOCATIONS OF HISTORICAL CUSTOMS STATIONS AND TREATY PORTS



Source: Hamashita (2003).

Historical customs stations were established long before the treaty ports system. The figure shows that many of these stations did not exist solely due to the geographical advantage for trade. However, prefectures on the coast or on the Yangtze River were more likely to have a treaty port if they had a historical customs station.

usually inherited the bureaucratic structure of the historical custom stations and argues that the Westerners took the customs stations into consideration when deciding the location of treaty ports. One similar speculation is that these customs stations might have been more likely to be mentioned and recommended when making decisions on treaty ports.

One concern when using the existence of historical custom stations as an instrumental variable is that prefectures with these stations would have developed better even without becoming treaty ports. To deal with this concern, I carry out two placebo tests to see whether having a customs station itself predicts economic development. The results are presented in table 6. As columns 1 to 3 show, having a historical customs station was not related to pretreaty population sizes (the log of population sizes in 1776 and 1820) or population growth between 1776 and 1820. This is because many of these stations were established for military reasons, and inland trade was limited. Another placebo test is to focus on the subsample of inland prefectures and check whether prefectures with customs stations grew faster. The results are presented in column 4 of table 6, which show that inland prefectures with customs stations did not grow faster.

TABLE 6.—PLACEBO TESTS ON HISTORICAL CUSTOMS STATIONS

Sample	(1) Coast/Yangtze log (population in 1776)	(2) Coast/Yangtze ln (population in 1820)	(3) Coast/Yangtze Growth 1776–1820	(4) Inland Growth 1910–1953
Historical stations	0.045	0.035	−0.023	−0.356
	(0.152)	(0.151)	(0.039)	(0.399)
Controls	Yes	Yes	Yes	Yes
Number of observations	57	57	57	127
R^2	0.48	0.49	0.42	0.24

Columns 1 to 3 report the impact of having a historical customs station on population growth before the treaty ports group. Column 4 reports the impact of having a station within the inland prefectures. Controls include dummies for silk and tea production areas, distance to the Grand Canal, longitude, latitude, prefecture-level land taxes in 1820, and whether a prefecture was affected by the Taiping Rebellion. Significant at ***1%, **5%, *10%.

TABLE 7.—IV ESTIMATION RESULTS FOR AVERAGE GROWTH, 1910 AND 2000

	(1)	(2) First Stage	(3) Reduced Form	(4) IV Results
Historical stations	0.440***	0.446***	0.286**	
	(0.134)	(0.146)	(0.137)	
Treaty ports				0.642*
				(0.322)
Controls		Yes	Yes	Yes
Number of observations	57	57	57	57
R^2	0.16	0.20	0.31	0.23

The table reports results using the existence of historical customs stations as an instrument for having a treaty port. Controls include dummies for silk and tea production areas, distance to the Grand Canal, longitude, latitude, prefecture-level land taxes in 1820, and whether a prefecture were affected by the Taiping Rebellion. Significant at ***1%, **5%, *10%.

Given that the exclusion restriction is likely to hold, I perform the first-stage regression for the IV strategy as follows:

$$\text{Treatyport}_i = \pi_0 + \pi_1 \textit{HistoricalStations}_i + \gamma \text{X}_i + \varepsilon_i, \tag{5}$$

where X_i are the same control variables as in the differences-in-differences specification.

The second-stage regression for the IV strategy is

$$\text{G}_i = \pi_0' + \pi_1' \widehat{\textit{Treatyport}}_i + \gamma' \text{X}_i + \varepsilon_i, \tag{6}$$

where G_i is annual population growth after the treaty system and $\widehat{\textit{Treatyport}}_i$ is the result from the first-stage regression.

Table 7 presents the estimation results using the existence of historical customs stations as an instrumental variable for the average annual growth rate between 1910 and 2000. Columns 1 and 2 show the correlation between becoming a treaty port and having a customs station, with and without controls. The magnitude is around 0.44. Column 2 is also the first stage of the IV strategy. Column 3 presents the reduced-form result: having a historical customs station increased the annual growth rate by about 0.28%.

Column 4 reports the IV estimation result: the annual population growth rate of the treaty ports group is about 0.64% higher between 1910 and 2000. Given that the mean of the annual population growth rate in this period is about 1.56%, the magnitude is also about one-third of the mean. This magnitude is comparable to the results from the differences-in-differences specifications.

VI. Understanding the Long-Run Impact

In this section, I present some suggestive evidence on the channels for the long-run impact. First, to explain the long-run impact on population growth, I examine birth rates, death rates, and migration separately. Second, to understand the long-run impact on GDP growth, I examine the growth of different sectors over time.

A. *Birth, Death, Migration, and Population Growth*

To explain the difference in population growth, I consider birth rates, death rates, and the log of the size of the moving-in population. Since migration information is available only for the census in 1990 and 2000, I focus on the outcomes in the two censuses and employ a fixed-effects model similar to the specification in equation (3). To check whether the results of the population growth difference are due to the reallocation of population between treaty ports and their neighbors in the control group, I also divide the moving-in population into two groups: moving in from other provinces and moving in from the same province.

The results are presented in Table 8. Panel A shows the results for birth rates and death rates. The differences in birth rates and death rates are not significant after controlling for fixed effects. However, as shown in panel B, the moving-in population from other provinces increased dramatically for the treaty ports group. The increase in these migrants is more than 100% higher than that in the control group. This finding suggests that better economic opportunities in treaty ports attract migrants from other places. In contrast, the increase in the moving-in population from the same province is not significantly different for the two groups of prefectures. This

TABLE 8.—EXPLAINING THE LONG-RUN IMPACT ON POPULATION

A: Birth/Death Rates	(1) Birth	(2) Birth	(3) Death	(4) Death
Treaty ports	−1.051	−3.462	−0.084	0.098
	(1.199)	(3.043)	(0.248)	(1.198)
Prefecture and year FE		Yes		Yes
Number of observations	114	114	114	114
R^2	0.01	0.88	0.01	0.59
B: Log(Moving-in Population)	Other Provinces	Other Provinces	Own	Own
Treaty ports	0.909***	1.446*	0.726***	0.195
	(0.265)	(0.775)	(0.218)	(0.372)
Prefecture and year FE		Yes		Yes
Number of observations	114	114	114	114
R^2	0.10	0.98	0.09	0.95

The table reports the impact of having a treaty port on birth rates, death rates, and the log of the moving-in population sizes. Migrate: "Other Provinces" refers to the log of the moving-in population sizes from other provinces. Migrate: "Own" refers to the log of the moving-in population sizes from the same province. Significant at ***1%, **5%, *10%.

TABLE 9.—EXPLAINING THE LONG-RUN IMPACT ON GDP PER CAPITA BY SECTORS

	(1) log (Agriculture)	(2) log (Industry)	(3) log (Commerce/Service)	(4) Agriculture	(5) Industry	(6) Commerce/Service
Treatyport × Year1990	−0.174	0.253	0.219	−88	510	672
	(0.160)	(0.208)	(0.142)	(101)	(961)	(700)
Treatyport × Year1995	−0.160	0.074	0.271	−303	1,974*	2,395**
	(0.190)	(0.247)	(0.179)	(183)	(1,107)	(950)
Treatyport × Year2000	−0.134	0.098	0.346*	−256	3,378**	4,498***
	(0.178)	(0.250)	(0.176)	(180)	(1,415)	(1,285)
Treatyport × Year2005	−0.176	0.150	0.319*	−417*	7,642**	8,119***
	(0.194)	(0.287)	(0.188)	(221)	(2,987)	(2,419)
Treatyport × Year2007	−0.210	0.115	0.272	−498*	9,090**	10,295***
	(0.194)	(0.284)	(0.199)	(250)	(3,786)	(3,247)
Prefecture and year FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	290	291	291	291	291	291
R^2	0.90	0.94	0.96	0.86	0.76	0.76

The table reports the impact of having a treaty port on the output per capita by sectors. Standard errors are clustered at the prefecture level. Significant at ***1%, **5%, *10%.

finding rejects that the results on population growth divergence are due to a simple reallocation of population between the treaty ports group and its neighbors in the control group.

B. Industrial Mix and GDP Growth

To examine economic activities that lead to the observed GDP growth divergence, I run a similar regression as in equation (4) for different sectors. The data stem from statistical year books, where economic activities are divided into three sectors: the primary sector (agriculture, forestry, and fishing), the secondary sector (light industry and heavy industry), and the tertiary sector (commerce and service).

The results are presented in table 9. Columns 1 to 3 show the results for log of output per capita for each sector, whereas columns 4 to 6 show the results for levels of output per capita. As shown, the main driver of the economic growth advantage of the treaty ports group comes from the commerce and service sector. Since this sector is labor intensive and creates demand for labor, this finding is also consistent with the previous finding on migration from other provinces.

VII. Conclusion

This paper contributes to a large literature on history and development by constructing a data set for understanding the long-run development of China's treaty ports. Focusing on a sample of prefectures on the coast or on the Yangtze River, I find that population sizes grew much faster in the treaty ports group after it became open to foreign trade and Western institutions. However, when all parts of China were closed to foreign influence between 1949 and 1978, all prefectures in the sample grew at similar rates. After China once more began to open up after the 1980s, these treaty ports were among the first to take advantage of the new globalization opportunities, as shown by the increase in GDP per capita.

Then I use modern data to provide suggestive evidence on possible channels behind these findings. The results suggest that treaty ports have better survival rates and attract migrants due to more economic opportunities. Moreover, among different economic activities, the commerce and service sector is the main driver of the long-run advantage of the treaty port group.

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APPENDIX A

Data Description and Sources

Population sizes for 1776–1953. Population of a prefecture in 10,000 (Cao, 2000).

Population sizes for 1953–2000. Population of a prefecture in 10,000 (China Population Census Data). The original data are provided at the county level. The prefecture-level data are aggregated from the county-level information after considering boundary changes.

Coastal. The indicator of being on the coastal line (CHGIS).

Yangtze. The indicator of being on the middle or lower Yangtze River (CHGIS).

Silk, tea. The indicator of being a silk or tea production area (Li, 1956; Perkins, 1969).

Land tax in 1820. Land tax in taels (unit for silver) (Liang, 1980).

Longitude, latitude. In degrees (CHGIS).

Distance to Grand Canal. Minimum distance of a prefecture to the Grand Canal in 10,000 meters (calculated from CHGIS).

Taiping Rebellion. The indicator of being affected by the Taiping Rebellion (Luo, 1991; Cao, 2000).

Historical Customs Station. The indicator of having a historical customs station (Hamashita, 1989).

GDP per capita. In RMB (China City Statistical Yearbooks, 1988 to 2008).

Birth rates, death rates. Birth rates and death rates per 1,000 individuals (China Population Census Data).

Moving-in population. Calculated from China Population Census Data.

Output per capita by sector. In RMB (China City Statistical Yearbooks, 1988 to 2008).

APPENDIX B

The Fifty-Seven Prefectures in the Subgroup

With treaty ports: Changsha Fu, Chaozhou Fu, Chongqing Fu, Dengzhou Fu, Fuzhou Fu (FZ), Guangzhou Fu, Hangzhou Fu, Hanyang Fu, Jiangning Fu, Jingzhou Fu, Jiujiang Fu, Laizhou Fu, Lianzhou Fu, Nanning Fu, Ningpo Fu, Qiongzhou Fu, Quanzhou Fu, Songjiang Fu, Suzhou Fu, Taiping Fu (AH), Taiping Fu (GX), Tianjin Fu, Wenzhou Fu, Wuzhou Fu, Yichang Fu, Zhenjiang Fu.

Without treaty ports: Anlu Fu, Anqing Fu, Changde Fu, Changzhou Fu, Chizhou Fu, Funing Fu, Gaozhou Fu, Hai Zhou, Huai'an Fu, Huangzhou Fu, Huizhou Fu, Huzhou Fu, Jiaxing Fu, Kuizhou Fu, Leizhou Fu, Luzhou Fu, Qingzhou Fu, Shaoxing Fu, Taicang Zhou, Taizhou Fu, Tong Zhou, Wuchang Fu,[17] Wuding Fu, Xinghua Fu, Xunzhou Fu, Yangzhou Fu, Yizhou Fu, Yuezhou Fu, Zhangzhou Fu, Zhaoqing Fu, Zhong Zhou.

[17] Note that Wuchang Fu should be counted as a treaty port in the modern period, as it was merged with Hanyang Fu to be the city of Wuhan. Dropping it does not vary the main results.