University of Freiburg
Department of International Economic Policy
Discussion Paper Series
Nr. 37

Circle of Fortune: The Long Term Impact of Western Customs Institutions in China

Gan Jin

July 2018

ISSN 1866-4113

University of Freiburg
Department of International Economic Policy
Discussion Paper Series

The Discussion Papers are edited by:
Department of International Economic Policy
Institute for Economic Research
University of Freiburg
D-79085 Freiburg, Germany
Platz der Alten Synagoge 1

Tel: +49 761 203 2342
Fax: +49 761 203 2414
Email: iep@vwl.uni-freiburg.de

Editor:
Prof. Dr. Günther G. Schulze

ISSN: *1866-4113*
Electronically published: 17.07.2018

Circle of Fortune: The Long Term Impact of Western Customs Institutions in China*

Gan Jin†

July, 2018

Abstract

This paper studies the persistent impact of good institutions on economic development in China. By exploiting a British-driven institutional switch in part of China's customs stations in 1902, I find that counties that were more affected by the British customs institutions are also better developed today. Moreover, I show that the institutional switch was exogenous to the pre-colonial development, and I provide different estimation models to reveal a robust and causal relationship between good institutions and economic development.

Keywords: Institutions, Economic development, Treaty ports, Chinese Maritime Customs Service (CMCS), China

JEL Codes: N15, O10, P51

*I would like to thank Günther G. Schulze, Antonio Farfán-Vallespín, Krisztina Kis-Katos, James Kaising Kung, Volker Lindenthal, and the participants of the Annual International Conference of the Research Group on Development Economics (Göttingen), the International Symposium on Quantitative History (Kaifeng), and the European Historical Economic Society Conference (Tübingen) for helpful comments and suggestions.

†Department of International Economic Policy, Albert-Ludwigs-University of Freiburg, Freiburg, Germany. Email: gan.jin@vwl.uni-freiburg.de

1 Introduction

The persistence of good institutions has been widely acknowledged as one of the fundamental causes of economic development. Good institutions, which have characteristics such as property right protection (Acemoglu et al., 2001; Acemoglu and Johnson, 2004; Banerjee and Iyer, 2005), a higher bureaucratic capacity (Berger, 2009; Mattingly, 2015), or a complex structure (Michalopoulos and Papaioannou, 2013), can make a long-lasting impact on the economic performance of a country. This paper investigates such an institution in the history of China, the Chinese Maritime Customs Service (CMCS), and explains how it affects China's economic performance even today.

After the defeat in the First Opium War (1839-1842), China was forced to open up for international trade. The trade revenue in port cities was collected by two Chinese governmental agencies, the Native Customs agencies and the CMCS. While the former was an original Chinese agency, the latter was run by the British after 1861. Historians have shown that the CMCS had a better institutional quality on taxation and a better personnel management compared with the Native Customs agencies and therefore collected trade revenues more efficiently (Dai, 1989; Ren, 2004; van de Ven, 2014). In 1902, the CMCS expanded its tax regime so that each CMCS station took over the Native Customs agencies and their subordinate stations within a radius of 25 km. The takeover affected around 40% of the Native Customs agencies in China (Hamashita, 1989). The affected agencies were forced to establish stable rules, simplify taxation procedures, and dismiss corrupted employees required by the CMCS, and the reform led to a significant increase of customs revenues (China Imperial Maritime Customs, 1907).

The change of institutions provides a unique natural experiment to study the persistent impact of good institutions. One advantage of this study is that it reveals a clear source of differential economic development: it examines two governmental agencies that were located in one particular country and served the identical purpose but had fundamentally different institutional quality: the CMCS was characterized by centralization, transparency, and efficiency, whereas the Native Customs agencies suffered from ambiguous rules, clientelism, and corruption. Another advantage is that the impact of institutions can be clearly identified. Due to the fact that the CMCS took over only a part of the Native Customs agencies and that only these agencies experienced an institutional switch, the impact can be identified by comparing the Native Customs agencies under the CMCS rules to those under the Chinese rules. A third advantage is that the takeover was carried out on a basis of exogenous reasons: the CMCS took over Native Customs agencies and their subordinate stations only within a radius of 25 km around each CMCS customs station; I will show later that the CMCS did not deliberately choose the radius of 25 km to take better developed lands. This unique feature makes sure that the identification strategy is valid.

Following the insight of this natural experiment, I examine a sample of historical Chinese counties. I measure the intensity of a county's institutional switch from the Native Customs rules to the CMCS rules by the proportion of a county's land covered by the "CMCS circle"- a circular area around each CMCS customs station with a radius of 25 km. Economic development today is measured by average nighttime light intensity, which has been shown to be a good predictor of economic development (Henderson and Storeygard, 2012). As Figure 1 shows, I find a strong and positive relationship between the CMCS influence and economic development today.

[Figure 1 about here.]

This paper shows that such a relationship is not only strong and significant but also causal. By exploiting the historical natural experiment and carefully establishing the identification strategies, I find that a one standard deviation increase of the coverage by the CMCS circle (15 percentage point increase) leads to a 41% higher nighttime light intensity today. The robustness of the results are supported by several efforts. In order to have a sample of comparable observations, I only include neighbouring counties of the CMCS treaty ports. I also control for spillover and for agglomeration to address potential confounding factors. Spillover is captured by the distance to the nearest treaty port, whereas agglomeration is captured by the proportion of towns covered by the CMCS circle. Most importantly, I show that the setting up of a radius of 25 km was uncorrelated with the pre-colonial development of the affected counties: My empirical evidence provides that 1) counties with land captured by the CMCS circle did not have better agricultural potential, and 2) towns were not distributed more densely within the border of CMCS circles in the pre-colonial period.

My results are consistent in different estimation models. First, I run a placebo test and look at treaty ports where the CMCS did not establish customs stations. I find no differential performance here, which supports the uniqueness of the institutional impact of the CMCS. Second, I implement a difference-in-difference analysis and find that the CMCS had an impact beyond the impact of treaty ports on neighbouring counties. Finally, a spatial regression discontinuity (RD) analysis is conducted and the positive and significant results from it further reinforce the causality.

This paper follows the broad literature that examines the positive and persistent impact of institutions on economic development. Acemoglu et al. (2001) show that European settlers established good institutions in colonies that suffered less from an unfavorable disease environment, and that these institutions have persisted to affect the development until today. Easterly and Levine (2003) show that geographic endowment affects economic development only through institutions. Rodrik et al. (2004) show that it is the institutional quality, rather than geography or trade, that explains economic development.

The paper also adds an insight to natural experiments in economic history. By addressing historical natural experiments, researchers have found both positive (Berger, 2009; Feyrer and Sacerdote, 2009) and negative (Dell, 2010; Iyer, 2010) impacts of colonization. The experiment in this paper casts a clear institutional comparison between native and colonial origins and provides a highly exogenous shock based on the CMCS circles. Due to these features, my paper identifies the positive impact of Western institutions.

Last but not the least, my paper follows Jia (2014) and investigates the legacy of treaty ports in China. Jia (2014) finds that treaty port prefectures grow faster in terms of population and per capita GDP and that the impact goes through migration and commercial activities. This paper makes a further advancement and studies the specific institution in some of the treaty ports, the CMCS. My results complement Jia (2014) in a way that given an exogenous switch to good institutions, i.e. the institutions of treaty ports, even a county without a treaty port can achieve better long-run economic performance.

The remainder of the paper is organized as follows: Section 2 describes the historical background. Section 3 presents the data and the empirical strategy. Section 4 shows baseline results. Section 5 shows robustness checks. Section 6 tests endogeneities. Section 7 implements placebo tests. Section 8 tests alternative estimation models. Section 9 concludes.

2 Historical Background

2.1 Native Customs Agencies in Qing China

The Qing dynasty of China (1636 - 1912) was a politically and economically centralized regime. Apart from land tax and salt tax, customs duties were the most crucial part of the central governmental revenue (Wu, 1937). The Native Customs agencies, whose total number varied from 38 to 40 across the whole Qing period (Deng, 2007), levied the customs tax in different locations of China. Before the government forbade foreign trade in 1757, five of the Native Customs agencies also collected tariffs. Each Native Customs agency held a main station in a major city and controlled several sub-stations in nearby locations.

The central government and the Native Customs agencies had worked out a sophisticated system to secure the tax revenues. However, in the late Qing period, the system was becoming inefficient for several reasons (Qi, 2002). First, the tax code had never been clear to the tax payers. Each Native Customs agency, and sometimes each sub-station had its own tax rules, which varied by the type of the taxable goods and the ways they were measured. For example, the Native Customs agencies in Shanghai and Zhangjiakou explicitly reported taxes on contraband. The measurement of livestock was its value in some customs stations and its weight in others (Qi, 2002). Apart from that, the unwritten rules confused Chinese and Western merchants even more since the tax collectors had the rules "in the belly" (China Imperial Maritime Customs, 1907) and interpreted the tax code in their own way to collect more revenues (Qi, 2002).

Second, corruption was a huge issue in the Native Customs agencies. Due to the ambiguous rules, tax collectors had unchecked authorities to charge fees from the tax payers. The revenue from fees eventually went to the pockets of the superintendents, the governors of the Native Customs agencies. In some provinces, the amount of fees collected by the local Native Customs agencies even exceeded the amount of taxes (Qi, 2002). Moreover, persons with connections to Native Customs officials could act as middlemen and help their "clients" to avoid to pay certain fees - at a certain cost. Those who were unwilling to pay a middleman would be heavily charged by the tax collectors.

Finally, the personnel policy of the Native Customs agencies did not improve efficiency (Ren, 2004). Most superintendents were selected by the emperor and his cabinet through an exam process, whereas other agencies were supervised directly by regional officials (Qi, 2004). There was hardly any personnel mobility within the Native Customs agencies. The higher-rank officials were usually family members or servants of the superintendents and lacking sufficient skills for the job. Skilled labour, however, was only lower ranked and had difficult time to be promoted.

2.2 The Chinese Maritime Customs Service

After being defeated in the First Opium War in 1840, China opened five cities as treaty ports: Shanghai, Xiamen, Fuzhou, Ningbo and Guangzhou, which allowed not only foreign trade but also the residence of foreigners. To secure the trade in China, Western powers required a corporation between the Chinese customs superintendents and the British consul to regulate the trade in the treaty ports. This system was never fully functional due to the uncooperativeness of other Western countries involved in the trade relations, piracy, and civil war. (King, 1964)

In 1853, an anti-Qing rebel group, the Small Sword Society, sabotaged Shanghai and disrupted the tariff agency. In 1854, a customs committee was founded in Shanghai by Westerners in order to restored the tariff collection. The committee had to be approved by Chinese officials, after which it autonomously collected trade revenues (van de Ven, 2014). Witnessed a boost of revenues collected by the committee in Shanghai, the Chinese government founded a central agency, the Chinese Maritime Customs Service in 1861 to apply the customs system in Shanghai to other treaty ports. A British consul was also appointed as the chief official (Inspector General, or IG) of the it.

The CMCS regulated the trade and collected taxes from Western merchants with steamships, whereas Chinese merchants travelling on traditional sailing vessels (junks) were regulated by the Native Customs agencies. Until 1900, China had opened 45 treaty ports (Yan, 1955), and the CMCS had established 33 customs stations in these ports (Hamashita, 1989). To tightly control all CMCS customs stations, every IG had established clear rules by regularly issuing circulars including tax rates adjustments, employment quotas alternations, and updates of regulations to all customs stations (van de Ven, 2014). The IG also received feedbacks. Customs commissioners, the head officials of CMCS customs stations appointed the IG, were required to submit reports to the IG every month reporting on local events, customs activities, and financial records.

The CMCS paid special attention to its personnel policies. It only recruited people in Western countries and required good family background, education, manners, and even appearance (van de Ven, 2014). The commissioners were also obliged to report all information on their employees to the IG. Personnel mobilities within the CMCS customs stations were secured by constant and transparent promotions, demotions and retirements. Employees were promoted basically on the basis of tenure and ability (van de Ven, 2014). In 1869, the IG established a regulation that clearly listed misdeeds of employees and the punishments. The list included disobedience, revealing confidential information, bribery, personal involvement in business activities, and so on. The reputation of the CMCS, which was characterized by its discipline and proficiency, soon became acknowledged by the Chinese emperor and Western powers; Western banks, for example, provided loans to the Chinese government secured by future tariff revenues (van de Ven, 2014).

2.3 Takeover of the Native Customs Agencies

In 1900, after the Boxer Rebellion, China was defeated by an alliance of eight Western countries [1], and the treaty signed afterwards, the Boxer Protocol, required China to pay 450 million HK.Taels [2] of silver (the amount of silver approximately equals to £67 million

[1]Great Britain, France, the United States, Japan, Russia, Germany, Italy, and Austria-Hungary

[2]HK.Tael was a currency measurement used by customs stations. It measures the weight of the silver. One HK.Tael of silver weights around 37g.

under the exchange rate at the time) to the allied countries (Spence, 1991). The alliance claimed that the Chinese government should issue bonds secured by the tariff revenues. Moreover, the CMCS should take over all Native Customs agencies in order to collect sufficient revenue for the collateral. This proposal was strongly opposed by the Chinese officials (Dai, 2000), and a compromise was eventually reached between China and the alliance in 1901: each CMCS station took over the Native Customs agencies, including sub-stations, within a radius of 50 Chinese miles (25 km). By doing so, an affected Native Customs agency was either completely possessed by the CMCS, or forced to give up some sub-stations to the CMCS. After the agreement was made, the CMCS officials soon carried out field investigations to the Native Customs stations within their range of influence. By 1902, most of the affected Native Customs agencies were officially possessed by the CMCS.

According to Wu (1937), 17 Native Customs agencies were affected by the CMCS. Evidence provided by Hamashita (1989) shows that 24 agencies were affected and 122 sub-stations were taken over. After the possession of these stations, the CMCS installed its own institutions to them in order to simplify procedures, dismiss incompetent or corrupted employees, and, most importantly, establish clear and written rules. The reform encountered obstacles at the beginning. The superintendent of Jiujiang threatened to strike, and a CMCS commissioner in Guangzhou complained that the local merchant network was too complicated. Nevertheless, the effect of the reform was prominent and immediate (Dai, 1989; Ren, 2004; van de Ven, 2014). For example, the Native Customs agency of Santuao employed 600 people and provided customs revenue up to 11,000 HK. taels per year before the takeover. In 1906, only 70 employees remained but the agency provided 80,000 HK. taels of revenue in a year (Dai, 1989). The revenue collected in the province of Fujian doubled after the institutional change in two Native Customs agencies, Min and Xiamen, and Chinese officials reported that "the reform of Native Customs was necessary and effective"

(Dai, 1989). Perticularly in Xiamen Native Customs agency, 90% of the employees were dismissed in 1902, and "a system of recording exactly the duty and fees was instituted". As a consequence, the reform in Xiamen "produced immediate results": from a yearly revenue of 24,484 HK. taels in 1901, it increased to 47,026 HK. taels in 1902 and to 67,644 HK. taels in 1906 (China Imperial Maritime Customs, 1907; Hamashita, 1989).

2.4 The Fall of CMCS

After the fall of the Qing dynasty in 1911, the Republic of China maintained all previous treaties concluded between the Qing government and Western countries. The CMCS therefore continued to collect tariffs and to provide collateral for further loans. In 1931, the government abolished all Native Customs agencies (Lian, 2004) and the CMCS was therefore the only agency that collected customs duties. The CMCS survived the Second Sino-Japanese War (1937-1945) and persisted until the foundation of the Peoples Republic of China in 1949.

3 Data and Empirical Approach

3.1 Sample

My dataset bases on historical counties in the late Qing period of China, which is accessible through the China Historical Geographic Information System version 5 (CHGIS, 2012) published by Harvard Yenching Institute. From the overall number of counties, those in Xinjiang, Tibet, Qinghai, Inner Mongolia, Uliastai (now Mongolia) and Gansu were excluded. They had a higher share of non-Han ethnicities, and therefore cultural and socioeconomic conditions were heterogeneous. Regions such as Tibet and Mongolia even had different ruling institutions during the Qing dynasty. The inclusion of these regions might confound the results. Due to data constraints, the counties in a part of Manchuria and all counties in Taiwan were also excluded. However, the remaining regions in my sample still cover 94% of the total population in China in 1820 (Cao, 2000).

In a next step, the location of treaty ports and CMCS stations is identified in accordance with Yan (1955), Hamashita (1989), and van de Ven (2014). As the paper is based on a county level analysis, I match 58 treaty ports to 55 counties and 36 CMCS stations to 36 counties. The sample of the CMCS stations is a sub-sample of the treaty port sample.

Finally, the baseline sample was constructed by selecting counties that 1) never contained treaty ports (regardless of holding a CMCS station) and 2) were adjacent to counties with CMCS stations. The first criterion makes sure that all counties in the sample were not in favour of the Western colonizers. Studies show that colonizers selected their destinations due to economic performance (Acemoglu et al., 2002), agricultural output (Iyer, 2010), or geographic location (Jia, 2014). Excluding the counties chosen by the Westerners avoids a selection bias. The second criterion secures the comparability of observations in the sample: all counties in the sample were closely connected to at least one CMCS station and should therefore have the similar opportunity to be affected by the CMCS institutions, given that other conditions are controlled.

According to these criteria, the baseline sample contains 192 counties. Figure 2 illustrates the baseline sample on a map of historical China. The following sections introduce the variables used in this study. The data source, the definition, and summary statistics of these variables are reported in Table 1.

[Figure 2 about here.]

[Table 1 about here.]

3.2 Economic Development

Economic development is measured by average nighttime light intensity for the period 2000 to 2010. The National Oceanic and Atmospheric Administration (NOAA) processed the data from weather satellites of the U.S. Air Force. By retrieving light intensity from 20:30 to 22:00 and addressing noises like fires or cloud coverage, NOAA has published the data of nighttime light intensity of the world since 1992. The data contains pixels that represent the light intensity of areas. The side-length of each pixel is 30 arc seconds, which corresponds to around 1 km at the equator. The scale of light intensity is from 0 to 63; 0 indicating unlit areas and 63 being the top code. Nighttime light intensity has been shown to reflect economic activities and economic development (Henderson and Storeygard, 2012). Additionally, it can be used in areas where economic indicators are difficult to obtain. For example, with the help of nighttime light intensity data, Michalopoulos and Papaioannou (2013) study the economic development in African ethnic homelands, Hodler and Raschky (2014) focus on the economic performance of subnational administrative units in 126 countries and Wahl (2017) studies the development of German cities. In this paper, I compute the average luminosity across all pixels in each county and then compute the average luminosity of each county between 2000 and 2010.

3.3 CMCS Institutions

My main independent variable indicates the impact of CMCS institutions on each neighbouring county; it is generated by a GIS technique. First, circle areas with a radius of 25 km around each CMCS station are drawn on the map of China. Then, for each neighbouring county in my sample, the proportion of area size covered by the circle areas is calculated. Lacking data on the exact location of Native Customs sub-stations, my measurement assumes that a higher coverage by a CMCS circle leads to more sub-stations taken over by the

CMCS. Figure 3 illustrates how the impact of CMCS varies among neighbouring counties.

[Figure 3 about here.]

3.4 Control Variables

Distance to the treaty port. In order to capture the spillover effect of treaty ports, I control for the distance to the nearest treaty port (regardless of holding a CMCS station). Counties close to treaty ports were more affected by foreign trade and foreign culture, which could be conducive to economic development. Meanwhile, as Figure 3 clearly shows, counties closer to a CMCS station also had a higher share of land covered by the CMCS circle. Controlling for the distance to the nearest treaty port hence avoids a typical omitted variable bias.

Agglomeration. I also control for the agglomeration in the surrounding of treaty ports with a CMCS station. Treaty ports grew faster than other Chinese cities during the twentieth century (Jia, 2014). Specifically, treaty ports with concession areas, a special area in treaty ports where Westerners enjoyed extraterritoriality and assembled their own councils, were the most urbanized cities in China at the time (Fei, 1991). Those cities provided better jobs, education, health care, and so on, which attracted more people and created a persistent agglomeration effect. Thus, the coverage of the CMCS circle might also reflect the impact of an urban expansion. In the absence of population data within historical cities, this paper measures agglomeration by the proportion of towns in each county covered by the CMCS circles in 1911[3].

Religion. I control for the impact made by Western missionaries. Becker and Woessmann (2009) show that a higher share of Protestants in a region led to a higher literacy rate and therefore to better economic development. Chen et al. (2014) and Bai and Kung (2015) also emphasize the role Protestantism played in human capital accumulation and

[3]the year of 1911 is the only year of the colonial period in China for which CHGIS provides data.

economic development in China. The religion data used in this paper come from Stauffer (1922). The impact of Protestantism is captured by the number of Protestant converts per 10,000 people in a county, while the effect of Catholicism is measured by the number of Catholic churches per 10,000 people.

Population density in 1820. The initial economic condition was controlled by the population density on the prefecture level in 1820[4]. The data come from Cao (2000), which is the only historical study that records population data on a prefecture level across the Qing dynasty.

Prefecture capitals. I control for whether a county was the capital of a prefecture since these cities were usually the economic center of the prefecture (Rozman, 1973) and were more developed in a prefecture.

Geography and locations. I control for the area size of the county since larger counties deployed more Native Customs sub-stations. I also control for whether a county was along the Yangtze river, the coast, or the Grand Canal. Coastlines and the Yangtze river (the most navigable rive in China) provide geographic advantage to transportation. The Grand Canal was the most important water way for grain transportation in China. These locations are related to both economic development and a denser distribution of Native Customs sub-stations. At last, I control for the average elevation, temperature, and precipitation in order to capture agricultural productivity and living conditions. Elevation data are generated by the digital elevation model from NASA's Shuttle Radar Topography Mission (SRTM). Temperature and precipitation data come from the Global Agro-Ecological Zones (GAEZ) database provided by Food and Agricultural Organization (FAO). All other unobserved geographic heterogeneities are captured by latitude and longitude.

[4]Prefectures are the administrative unit between county and province. I control for this level because population data on the county level do not exist for the Qing dynasty.

3.5 Baseline Regression

The county level regression equation is

$$Y_i = \alpha + \beta_1 CMCS_i + \beta_2 Town_i + \beta_3 Dis\_Port_i + \mathbf{X}_i\gamma + \delta_j + \epsilon_i \quad (1)$$

Y_i is the average nighttime light intensity of a county i in the period 2000-2010. $CMCS_i$ is the proportion of a county's land covered by the CMCS circle and captures the extent of institutional switch. $Town_i$ is the proportion of historical towns in county i covered by the CMCS circles. Dis_port_i measures the distance between county i and the closest treaty port. $\mathbf{X}_i$ contains all aforementioned socioeconomic and geographic control variables. δ_j is the province fixed effect in order to capture unobserved time-invariant province level heterogeneities and ϵ_i is the error term.

4 Results

The results in Table 2 reveal a positive and significant impact of good institutions on economic development. Column (1), for example, shows that the increasing CMCS coverage leads to higher nighttime light intensity today. As expected, a closer distance to treaty ports is conducive to economic development. However, the estimated coefficient of agglomeration, measured by the proportion of towns covered by the CMCS circle, is not significant. This suggests that agglomeration might not play a role in this analysis. In terms of magnitude, a one standard deviation increase in CMCS coverage (15 percentage point increase) increases the average nighttime light intensity by 31% ($e^{1.823\times 0.15} - 1 \approx 0.314$). As for other control variables, the coefficient of *Protestant* is positive but not significant. One reason could be that Protestantism was already well established in the sample regions due a shorter distance to treaty ports. A higher pre-colonial population density, being located along the coastal line, or the status of a prefecture capital are also positively and significantly correlated with development today.

In column (2), I control for more geographic factors and the impact of the CMCS institutions is even stronger. The coefficient of $CMCS$ increases to 2.282 and becomes significant at the five percent level. The effect is also substantial in magnitude: a one standard deviation increase in CMCS coverage leads to 0.342 log points (around 41%) more nighttime light intensity today. Given the mean value of light intensity (in log) is 1.32, the effect of institutions explains more than one quarter of the overall nighttime light in the sample regions. Coefficients of socioeconomic controls remain almost stable in column (2). For example, a one standard deviation decrease in the distance to treaty port leads to a 13% increase in nighttime light intensity. Geographic factors play a role: longitude and temperature show significant coefficients in column (2).

Next, I switch $CMCS$ into a dummy variable which equals to one if a county was affected by the CMCS circle at any time and zero otherwise[5]. The last two columns in Table 2 are consistent with previous findings. In column (3), counties affected by the CMCS institutions have a 30% higher nighttime light intensity. When more geographic conditions are controlled for in column (4), the estimated coefficient of $CMCS$ drops to 0.259 but remains significant at the ten percent level.

[Table 2 about here.]

[5] I also code counties that fall within the fifth conditional quintile of CMCS coverage (coverage ratio between 0 and 0.019) as zero, because coverage within this range is too little to make a reasonable impact.

5 Robustness Checks

5.1 Outliers

To exclude the possibility that the result is driven by certain treaty ports, columns (1)-(4) in Table 3 drop outlier regions in the sample. To start with, Shanghai is located at the estuarine zone of the Yangtze river and took the geographic advantage after the establishment of treaty port. The city held the first CMCS station and the first (and also the largest) concession area in China. Due to the surge of foreign trade and a massive inflow of Western settlers and foreign capital, Shanghai soon became one of the most important metropolis in Asia (Fei, 1991). Today, the city has the highest GDP and the second largest population in the country. Due to aforementioned reasons, I drop all counties in prefectures that fell under Shanghai's 25 km circle, i.e., all counties in Songjiang Fu and Taicang Zhou, from the sample. The estimated coefficient of $CMCS$ only goes up to 2.601 and remains significant.

Second, similar situation can also be applied to Tianjin, a city that prospered due to its vital position on the Grand Canal in pre-colonial time. After 1900, Tianjin leased concession areas to nine western countries (including Japan) and became the city with the most concession areas in China. In column (2), I drop all counties in prefectures in Tianjin's 25 km circle (all counties in Tianjin Fu and Shuntian Fu) and the exclusion hardly affects the baseline results.

Third, Guangzhou is taken into consideration as it was the only port in China that allowed foreign trade between 1757 and 1842. After the establishment of treaty ports, its trade volume was exceeded by Shanghai, but the city remained the second largest treaty port in China between 1867 and 1895 in terms of trade volume (van de Ven, 2014). In column (3), I drop all counties in the prefecture affected by Guangzhou's 25 km circle

(Guangzhou Fu). The coefficient of $CMCS$ decreases to 2.000 but remains statistically significant. Even if all counties affected by the aforementioned treaty ports - Shanghai, Tianjin, and Guangzhou - are simultaneously excluded from the sample, the results are still unaffected (not shown in this table).

I then examine the "first wave treaty ports", i.e., the first five treaty ports that opened in 1842. These cities were not only prosperous before the Western presence (Jia, 2014) but also traded through Native Customs agencies before 1757. It is hence possible that the five cities reformed faster after the takeover by the CMCS due to their experience in trade regulations. In column (4), I drop all counties in prefectures within the 25 km circles of the "first wave treaty ports" (apart from Shanghai and Guangzhou, I also drop counties in Tongan Fu, Zhangzhou Fu, and Ningbo Fu). The coefficient, however, goes up to 2.895 and becomes significant at the one percent level. This suggests that the baseline results only underestimate the impact of CMCS institutions, and the impact could be stronger for treaty ports that were less important than the "first wave treaty ports".

5.2 Protestantism and Pre-colonial Development

I examine whether Protestantism amplified the impact of the CMCS. Bai and Kung (2015) show that Protestantism stimulated modern urbanization through human capital accumulation. The knowledge brought by the Western missionaries, including English and mathematics, could improve the productivity of Chinese CMCS employees. I thus expect that counties with more Protestant converts gained more from the institutional impact of the CMCS in the long run. In column (5), I add an interaction term of $CMCS$ and $Protestant$. The coefficient of the interaction term, however, is insignificant. This suggests that the institutional impact of the CMCS was independent of Protestantism and its consequent human capital accumulation.

Next, I examine whether pre-colonial development altered the impact of the CMCS institutions. My first measurement of pre-colonial development is the dummy variable of being a prefecture capital. The other measurement is the prefecture level population density in 1820. In column (6) and (7), I interact $CMCS$ with $Capital$ and $Density$, respectively. In column (6), the result shows that being a prefecture capital did not contribute the institutional impact of the CMCS. Column (7), however, shows a significant reduction of the CMCS impact when population density is getting larger: given the CMCS coverage fixed, one standard deviation change in log level prefecture population density (0.76) reduces the impact of the institution by 0.54 log point. One possible explanation is that prefectures with a higher population density had a more complicated trade network that made the CMCS less effective to regulate. Another explanation is that higher population density was correlated with more redundant bureaucracy and more ruling elites that impeded the institutional switch. This evidence also highlights the conclusion from column (4) that the impact of the CMCS was stronger in less developed treaty ports.

5.3 GDP per capita

Finally, I use GDP per capita as an alternative dependent variable. GDP per capita has been widely used as a proxy of economic development; it has the advantage that it captures development more directly than nighttime light intensity. The drawback in this case, however, is that today's GDP per capita needs to be matched to historical county borders. I obtain data on per capita GDP in 2000 from NBS (2001) and match it to the historical counties considering border changes. In column (8), the coefficient of $CMCS$ is 1.803 and significant at the five percent level. In terms of magnitude, a one-standard-deviation change in CMCS coverage leads to about 30% increase of GDP per capita in 2000, and the coefficient is significant at the five percent level.

[Table 3 about here.]

6 Endogenous Border

CMCS may prefer to levy taxes in richer areas, because these places supported more residents and economic activities and therefore brought higher revenue to the CMCS. An endogeneity problem occurs if the CMCS deliberately set up the border to deprive richer counties and if these counties are still prosperous today, in which case the baseline estimation might not capture the impact of institutions.

To investigate whether the CMCS targeted richer counties in the first place, I regress pre-colonial economic conditions on the CMCS coverage and control variables. I measure the pre-colonial development by agricultural suitability indices of various crops as the Chinese economy was still dominated by agriculture during the Qing period. The indices are from Food and Agricultural Organization (FAO), UN. Specifically, I test six agricultural products. Fox-millet is drought-resistant and has been typically grown in the northern part of China. Rice is water-dependent and typically grown in the southern part. Maize and sweet potatoes are the main crops from the "New World" adopted in China. At last, tea and sugar cane are typical cash crops in China.

[Table 4 about here.]

The results in Table 4 show that a county's coverage by the CMCS influence is uncorrelated with its agricultural suitability. The conclusion still holds after controlling for other socio-economic and geographic factors.

Another exercise to examine the pre-colonial differences is to compare economic performance on both sides of the CMCS circles in the pre-colonial period. If differences had already existed, then the CMCS circle coverage may not solely identify institutions. To address this issue, I construct a ring level sample: For each CMCS circle I have drawn on the map of China, an inner ring area and an outer ring area are generated based on the border of the CMCS circle. The width of each ring is 3 km; i.e., the outer ring area expands from 25 km to 28 km beyond the CMCS circle, and the inner ring area from 22 km to 25 km within the CMCS circle.

The ring areas directly adjacent to the CMCS circles allow me to compare economic performance across the CMCS circles prior to the Western presence. If the inner ring areas outperformed outer ring areas, it is likely that the CMCS established the border to include better developed areas. Economic development prior to the Western presence is measured by the number of human settlements in 1820 located in a ring area, normalized by the size of the ring area [6]. We regress the normalized number of towns on a dummy variable, *Inner*, which equals to one if a ring area is an inner ring and 0 for outer ring. The first column in Table 5 shows no significant coefficient for inner ring indicator. Columns (2)-(5) adds more control variables at the port level. Again, the inner ring areas were completely indifferent with the outer ring areas in terms of pre-colonial development. To sum up, the results from Table 4 and Table 5 support the arguments that the distance of 25 km was not set intentionally, and therefore the endogeneity of the CMCS variable is unlikely to be a concern.

[Table 5 about here.]

7 Placebo Test

The results in Table 2 may capture characteristics that were common in all treaty ports such as better access to maritime transportation, a better environment to start a business,

[6] Apart from the fact that inner and outer ring areas have a different size, state borders and coastlines also affect the size of the ring areas.

or a better protection against wars. In order to exclude these possibilities, I examine treaty ports without CMCS stations for comparison. These ports had the same access to foreign trade, but the trade was completely organized by the Native Customs agencies. If the CMCS coverage only captured common characteristics of treaty ports, non-CMCS ports should also make a long-lasting impact on the neighbouring counties.

To examine this possibility, I construct a new sample for a placebo test. I identify 36 treaty ports (in 32 different counties) without the presence of the CMCS stations. The placebo sample is then assembled by including all neighbouring counties around these ports. I also drop the counties adjacent to a CMCS treaty port in order to exclude outliers. In a final step, I draw "placebo circles" with a radius of 25 km around the non-CMCS ports and calculate the coverage ratio by the placebo circle for each neighbouring county in my placebo sample. The placebo estimation is as follows:

$$Y_k = \alpha + \beta_1 Placebo_k + \beta_2 Town_k + \beta_3 Dis\_Port_k + \mathbf{X}_k \gamma + \delta_j + \epsilon_k \quad (2)$$

In Equation 2, $Placebo_k$ indicates a county k's coverage ratio by the placebo circles. The variable $Town_k$ measures the proportion of towns of a county k covered by the placebo circles. Dis_Port_k measures the distance between county k and the nearest non-CMCS treaty port. All the other variables are defined the same way as done in the baseline estimation.

If the baseline results from Table 2 also reflect characteristics other than institutions, β_1 could be significantly different from zero. The results from Table 6, however, show that the placebo treatment is completely unrelated to economic development today. Adding more control variables or switching the placebo coverage into a dummy variable does not alter the insignificance of the placebo effect. This exercise thus reveals that treaty ports without a CMCS station did not have such a far-reaching impact on their neighbouring counties and one major reason could be the lack of good institutions.

[Table 6 about here.]

8 Alternative Estimation Models

8.1 Difference-in-Difference Analysis

In this section, I discover the impact of CMCS institutions on top of the treaty ports effect by a difference-in-difference analysis. The new sample for this approach includes the neighbouring counties of both CMCS and non-CMCS treaty ports. I employ circle areas with a radius of 25 km around both types of treaty ports and calculate the circle coverage size of each neighbouring county.

Then, the following variables are generated for each county in this sample:

$$Circle = \frac{\text{Size of area covered by any circle}}{\text{County size}}$$

$$C\_Cover = \frac{\text{Size of area covered by CMCS circle(s)}}{\text{Size of area covered by any circle}}$$

The second variable equals to 1 if a county is only covered by a CMCS circle and 0 if it is only covered by a circle of a non-CMCS treaty port [7]. The interaction term of the two variables is:

$$Circle * C\_Cover = \frac{\text{Size of area covered by CMCS circle(s)}}{\text{County size}}.$$

[7] I also define the value as 0 if the county had never been covered by any circle.

The difference-in-difference regression equation is as follows:

$$Y_m = \alpha + \beta_1 Circle_m + \beta_2 Circle * C\_Cover + \beta_3 Town_m + \beta_4 Dis\_Port_m + \mathbf{X}_m \gamma + \delta_j + \epsilon_m \quad (3)$$

Y_m is the outcome variable of county m. As mentioned before, $Circle_m$ is the share of area covered by any 25 km radius circle in relation to the total county size. The coefficient β_1 therefore captures the general effect of being influenced by the treaty ports. C_Cover is the share of area covered only by CMCS circles in proportion to the total area covered by any circle. The interaction term $Circle_m * C\_Cover_m$ is the variable of interest in this section and reveals the impact of the CMCS institutions beyond the general impact of treaty ports.

I start by testing the endogeneity of the CMCS coverage as done in section 6. Specifically, I test whether the interaction term, i.e., the coverage ratio of a county by CMCS circles, is significantly correlated with pre-colonial development measured by agricultural suitability indices. Then, I proceed by examining the long-term differential economic performance caused by the CMCS institutions. In the end, I take a similar placebo test as done in section 7. I switch the variable C_Cover_m by its placebo counterpart, P_Cover_m, which measures the size of area covered by circles of non-CMCS treaty ports normalized by the total size covered by any circle. The interaction term is also changed accordingly.

[Table 7 about here.]

Columns (1)-(6) in Table 7 show that the pre-colonial development measured by agricultural suitability indices is unrelated to the CMCS takeover. These findings are consistent with what had been discussed earlier in section 6. Once the endogeneity problems are tackled, column (7) identifies the impact of the CMCS institutions beyond the influence of treaty ports. Given the extent that a county was affected by treaty ports, a one standard deviation increase of the CMCS circle coverage (0.474) can improve the nighttime light intensity today by around 0.8 log point, which accounts more than half of the standard deviation of the nighttime light intensity. The coefficient is also statistically significant. Column (8) runs the placebo test. Again, the small and insignificant coefficient of P_Cover_m confirms my argument that it is the institutions of CMCS that drives the result.

8.2 Regression Discontinuity

This section uses regression discontinuity design to further justify the causality. Ideally, the institutional impact of the CMCS can be identified by comparing today's economic performance in areas closely located on both sides of the circle boundary. Such a RD estimation requires that observations are made on a very low administrative level, e.g. a village or community level, so that the sample contains a meaningful amount of observations on both sides of the border. Publicly available data in China, however, do not support such a detailed geographic reference. I therefore follow Dell (2010) and expand the RD border to a larger degree. The RD border in this analysis is the joint border of all counties affected by CMCS circles. Counties inside the border are the treated counties and had Native Customs agencies that shared CMCS institutions whereas counties outside the border maintained the original Native Customs agencies.

[Figure 4 about here.]

Figure 4 gives an example of the RD border and the treated group in this RD analysis. The treated counties were the ones that affected by the CMCS circles, and the borders of which jointly form the RD border used in this analysis. The sample in this analysis hence includes counties located on both sides of the RD border, and I exclude counties with treaty ports.

I apply a single dimension semi-parametric RD approach that limits the sample to counties within 21 km, 22 km, 23 km, and 24 km to the RD border. The RD analysis requires that other relevant factors vary smoothly at the RD border, so that counties just within the border are comparable to those just outside the border. To test this identifying assumption, I examine the cross-border differentials of a variety of factors including agricultural suitability, elevation, temperature, precipitation, and the number of Protestant converts. Table 8 shows the test results.

[Table 8 about here.]

In Table 8, I regress dependent variables of interest on the treatment dummy $Treat$, which equals to one if a county is located within the RD border. The results are presented by four different bandwidths. The dependent variables include agricultural suitability indices for fox millet, maize, rice, sugar cane, sweet potato, and tea as well as Protestant converts per 10,000 people, elevation, temperature, and precipitation. The results show that being located within the RD border is uncorrelated with most of my dependent variables except for rice suitability, elevation, and temperature. In the second column of each bandwidth, I therefore run the same regression conditional on the running variable, the distance to the RD border, and find no significant correlation between being treated and any other dependent variables any longer[8]. This means that my running variable captures unobserved heterogeneities well.

The RD regression equation is as follows:

$$Y_n = \alpha + \beta_1 Treat_n + f(DisBorder_n) + \beta_2 Town_n + \beta_3 Dis\_CMCS_n + \mathbf{X}_n \gamma + \delta_j + \epsilon_n \quad (4)$$

Y_n is the log level of average nighttime light intensity between 2000 and 2010. $Treat_n$

[8]The variable *temperature* is no longer significant after controlling for the quadratic or the cubic form of the running variable. The results are not shown in the table.

equals to 1 if a county n was located within the RD border. $f(DisBorder_n)$ is a cubic form polynomial of the running variable, distance to the RD border. Dis_CMCS_n is the distance to the nearest CMCS port and $\mathbf{X}_n$ a vector of control variables, which are the same as in Equation 1. δ_j is the province dummy and ϵ_n the error term. The regression results are shown in Table 9.

[Table 9 about here.]

Results in Panel A of Table 9 reveal a significant causal relationship between the CMCS institutions and economic development today. Although the size of the coefficient diminishes as the bandwidth gets larger, the treatment effect of the CMCS still doubled the nighttime light intensity today for counties within the RD border. To improve the robustness of the RD results, I re-estimate Equation 4 by its placebo counterpart, and I define the placebo RD border as the joint border of counties affected by the placebo circles. The placebo treatment *Placebo* equals to 1 if a county is located within the placebo RD border. In Panel B, none of the coefficient of *Placebo* is significant and the magnitude is also small or even negative, which is once again a consistent placebo result.

9 Conclusion

This paper identifies the long-term impact of the CMCS institutions on the economic performance of Chinese counties. By addressing a unique natural experiment in the history of China and constructing a data set of the neighbouring counties of treaty ports, I mitigate, if not completely solve, the selection problem of treaty ports and other potential endogeneity problems. My OLS estimation shows that counties affected by the CMCS institutions are better developed today: a one standard deviation increase of CMCS coverage leads to around 41% increase of nighttime light intensity. This paper also explicitly shows that the switching of institutions was uncorrelated with pre-colonial development. At last, the results are robust to different estimation models: both a difference-in-difference model and a RD model show that it is the institutional quality provided by the CMCS that made the significant impact on China's regional development today. In general, my results support the "settler institutions" argument from Acemoglu et al. (2002). Western powers, especially the British, brought good institutions to China and the legacies lasts until today.

For future research, it would be relevant to further disentangle the institutional impact of the CMCS. Corruption, which is proved to be detrimental to economic development (Mauro, 1995; Gyimah-Brempong, 2007; Johnson et al., 2011; Kis-Katos and Schulze, 2013), might have decreased in the affected Native Customs stations due to the anti-graft feature of the CMCS. The demand for highly qualified workforce might have fostered the human capital accumulation in areas with CMCS-possessed Native Customs stations. Trust, an important cultural factor that is conducive to economic development (Guiso et al., 2006; Tabellini, 2010), could be easily established due to clear rules. All these factors are particularly important for future research.

References

Acemoglu, D. and Johnson, S. (2004). The rise of Europe : Atlantic trade , institutional change and economic growth. *The American Economic Review*, 95(3):546–579.

Acemoglu, D., Johnson, S., and Robinson, J. A. (2001). The colonial origins of comparative development: An empirical investigation. *American Economic Review*, 91(5):1369–1401.

Acemoglu, D., Johnson, S., and Robinson, J. A. (2002). Reversal of fortune: Geography and institutions in the making of the modern world income distribution. *The Quarterly Journal of Economics*, 117(4):1234–1294.

Bai, Y. and Kung, J. (2015). Diffusing knowledge while spreading god's message : Protestantism and rconomic prosperity in China , 1840-1920. *Journal of the European Economic Association*, 4(13):669–698.

Banerjee, A. and Iyer, L. (2005). History, institutions and economic performance: The legacy of land tenure systems in India. *The American Economic Review*, 95(4):1190–1213.

Becker, S. O. and Woessmann, L. (2009). Was Weber wrong? A human capital theory of Protestant economic history. *Quarterly Journal of Economics*, 124(2):531–596.

Berger, D. (2009). Taxes, Institutions and Local Governance: Evidence from a Natural Experiment in Colonial Nigeria. University of Essex, Colchester.

Cao, S. (2000). *History of population in China, volume 5*. Fudan University Press, Shanghai.

Chen, Y., Wang, H., and Yan, S. (2014). *The Long-term effects of Protestant activities in China*. Peking University, Beijing.

CHGIS (2012). Harvard Yenching Institute, Cambridge,MA.

China Imperial Maritime Customs (1907). *Native customs trade returns*. Statistical Department, Inspectorate General, Shanghai.

Dai, Y. (1989). The seizure of Native Customs in Late Qing period. *History Study*, 6:95–108.

Dai, Y. (2000). Inquiries into the centeral and local government finance in late Qing-A study on modern customs. *China Economic History Research*, 4:57–71.

Dell, M. (2010). The persistent effects of Peru's mining mita. *Econometrica*, 78(6):1863–1903.

Deng, Y. (2007). Native Customs in early Qing period of China. *Studies in Qing History*, 2:54–64.

Easterly, W. and Levine, R. (2003). Tropics, germs, and crops: How endowments influence economic development. *Journal of Monetary Economics*, 50(1):3–39.

Fei, C. (1991). *The History of Chinese Concession Areas.* Shanghai Academy of Social Sciences Press, Shanghai.

Feyrer, J. and Sacerdote, B. (2009). Colonialism and modern income: Islands as natural experiments. *The Review of Economics and Statistics*, 91(2):245–262.

Guiso, L., Sapienza, P., and Zingales, L. (2006). Does culture affect economic outcomes. *The Journal of Economic Perspectives*, 20(2):23–48.

Gyimah-Brempong, K. (2007). Corruption, economic growth, and income inequality in Africa. *Economics of Governance*, 3:183–209.

Hamashita, T. (1989). *Studies on the Chinese modern rconomic history-custom finance and treaty port market network in the late Qing.* Kyoko Shoin, Tokyo.

Henderson, J. V. and Storeygard, A. (2012). Measuring economic growth from outer space. *American Economic Review*, 102(2):994–1028.

Hodler, R. and Raschky, P. A. (2014). Regional favoritism. *Quarterly Journal of Economics*, 129(2):995–1033.

Iyer, L. (2010). Direct versus indirect colonial rule in India: Long-term consequences. *Review of Economics and Statistics*, 92(4):693–713.

Jia, R. (2014). The legacies of forced freedom: China's treaty ports. *The Review of Economics and Statistics*, 96(4):596–608.

Johnson, N. D., LaFountain, C. L., and Yamarik, S. (2011). Corruption is bad for growth (even in the United States). *Public Choice*, 147(3):377–393.

King, J. K. J. (1964). *Trade and Diplomacy on the China Coast: The Opening of the Treaty Ports, 1842-1854.* Harvard University Press, Cambridge, MA.

Kis-Katos, K. and Schulze, G. G. (2013). Corruption in southeast Asia: A survey of recent research. *Asian-Pacific Economic Literature*, 27(1):79–109.

Lian, X. (2004). Treaty ports and inland area: A case study on Native Customs and inland tax in Xiamen and Quanzhou. *Archives of Republic of China*, 4:109–113.

Mattingly, D. C. (2015). Colonial legacies and state institutions in China: Evidence from a natural experiment. *Comparative Political Studies*, 50(4):434–463.

Mauro, P. (1995). Corruption and growth. *The Quarterly Journal of Economics*, 110(3):681–712.

Michalopoulos, S. and Papaioannou, E. (2013). Pre-colonial ethnic institutions and contemporary African development. *Econometrica*, 81(1):113–152.

NBS (2001). *China Statistical Yearbook for Regional Economy for the Year 2000*. China Statistics Press, Beijing.

Qi, M. (2002). Inquries on Native Customs in Late Qing period. *Studies in Qing History*, 4:104–111.

Qi, M. (2004). *A Study in Qing's Native Customs*. University of Inner Mongolia Press, Huhehaote.

Ren, Z. (2004). Inquries into the customs superintendent in late Qing period. *Historical Archives*, 4:83–92.

Rodrik, D., Subramanian, A., and Trebbi, F. (2004). Institutions rule: The primacy of institutions over geography and integration in economic development. *Journal of Economic Growth*, 9(2):131–165.

Rozman, G. (1973). *Urban networks in Ch'ing China and Tokugawa Japan*. Princeton University Press, Princeton, New Jersey.

Spence, J. D. (1991). *The Search For Modern China*. WW Norton Co., New York.

Stauffer, M. T. (1922). *The Christian occupation of China: A general survey of the numerical strength and geographical distribution of the Christian forces in China*. China Continuation Committee, Shanghai.

Tabellini, G. (2010). Culture and institutions: Economic development in the regions of Europe. *Journal of the European Economic Association*, 8(4):677–716.

van de Ven, H. (2014). *Breaking with the past: The Maritime Customs Service and the global origins of modernity in China*. Columbia University Press, New York.

Wahl, F. (2017). Does European development have Roman roots? Evidence from the German Limes. *Journal of Economic Growth*, 22(3):313–349.

Wu, Z. (1937). *The history of Chinese taxation*. Shangwu Press, Shanghai.

Yan, Z. (1955). *Selected statistic materials of modern China economy*. Ke Xue Presses, Beijing.

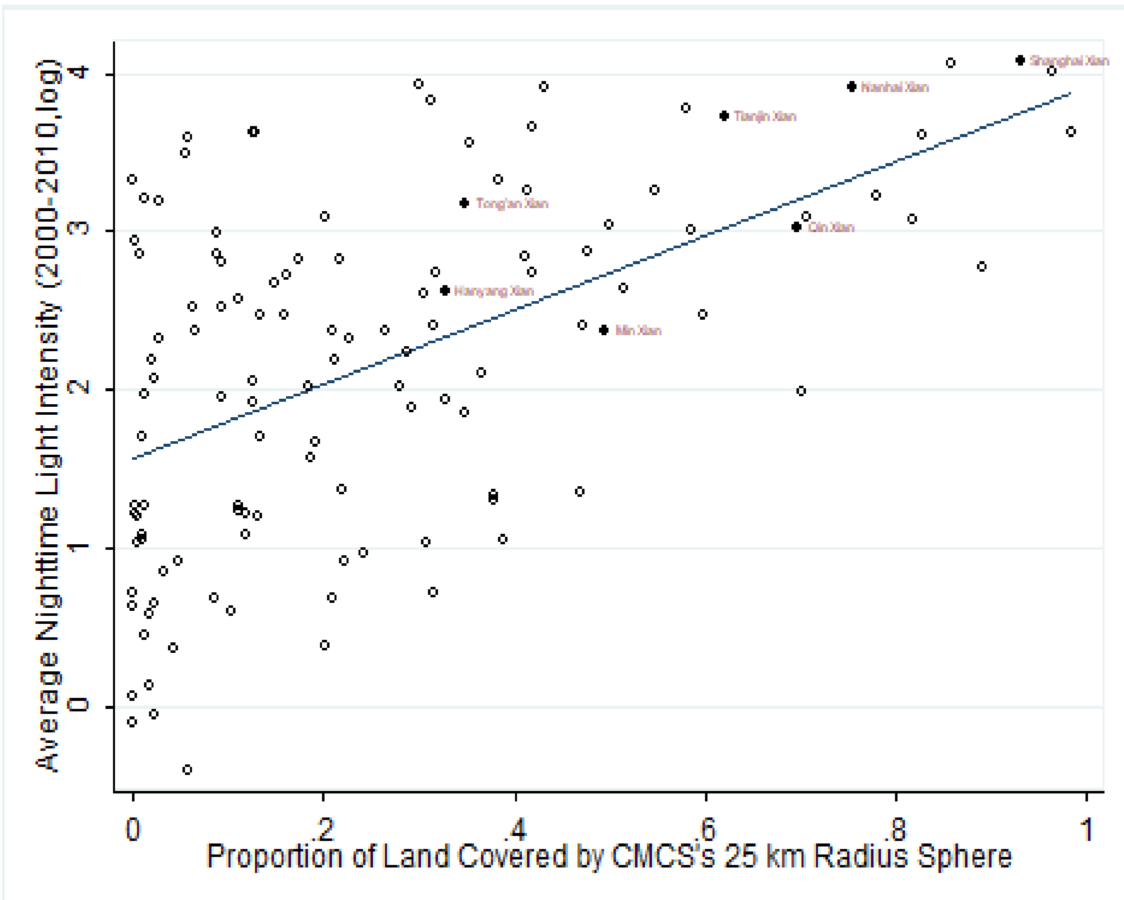

Figure 1: Correlation between CMCS Influence and Economic Development Today

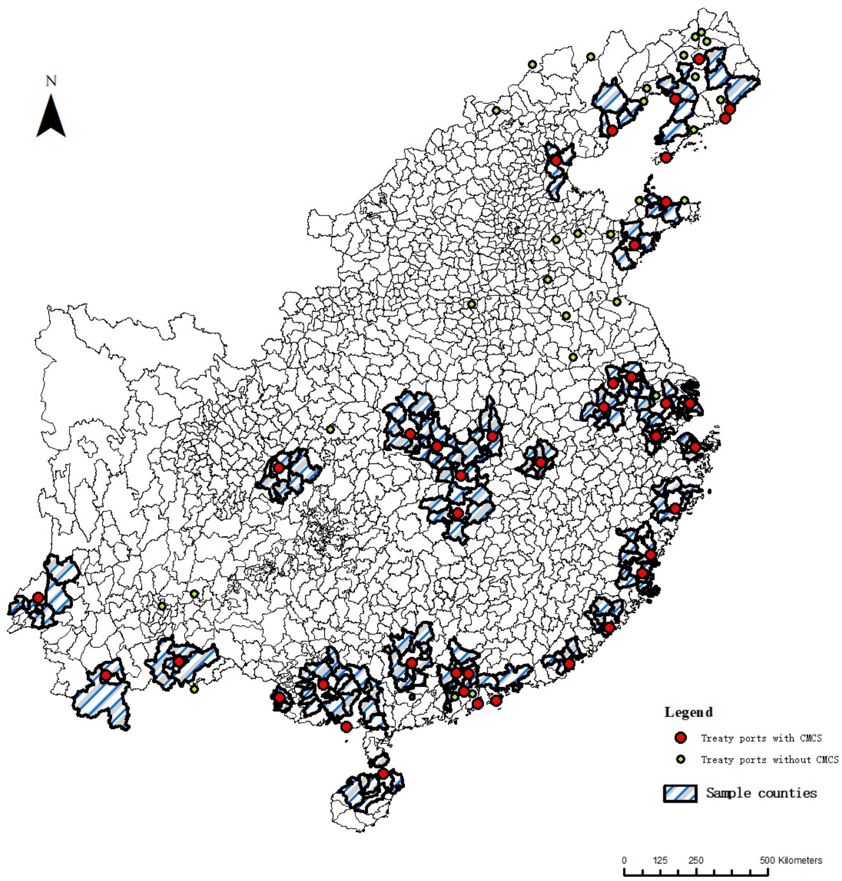

Figure 2: Treaty Ports and Sample Counties

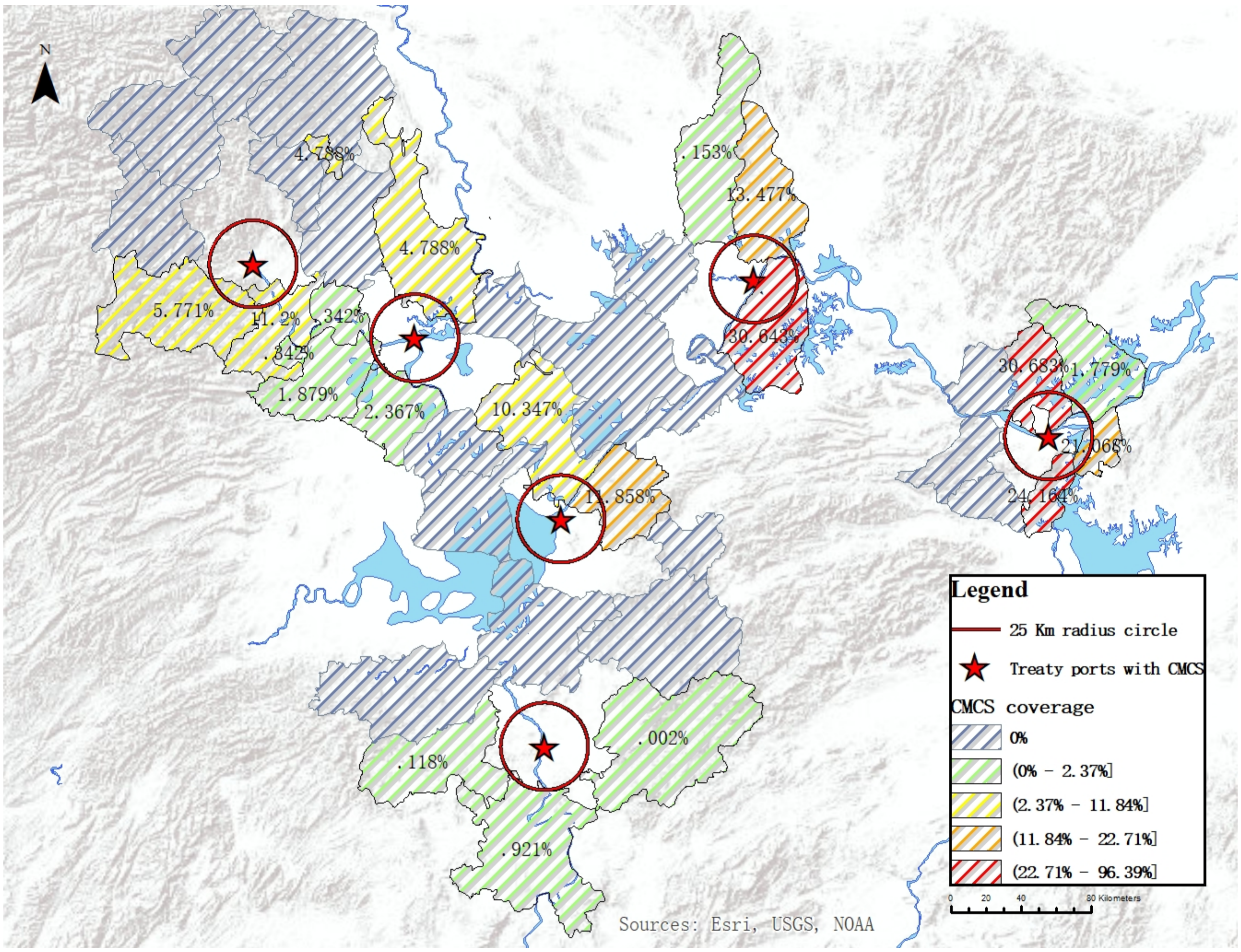

Figure 3: Example of CMCS Coverage

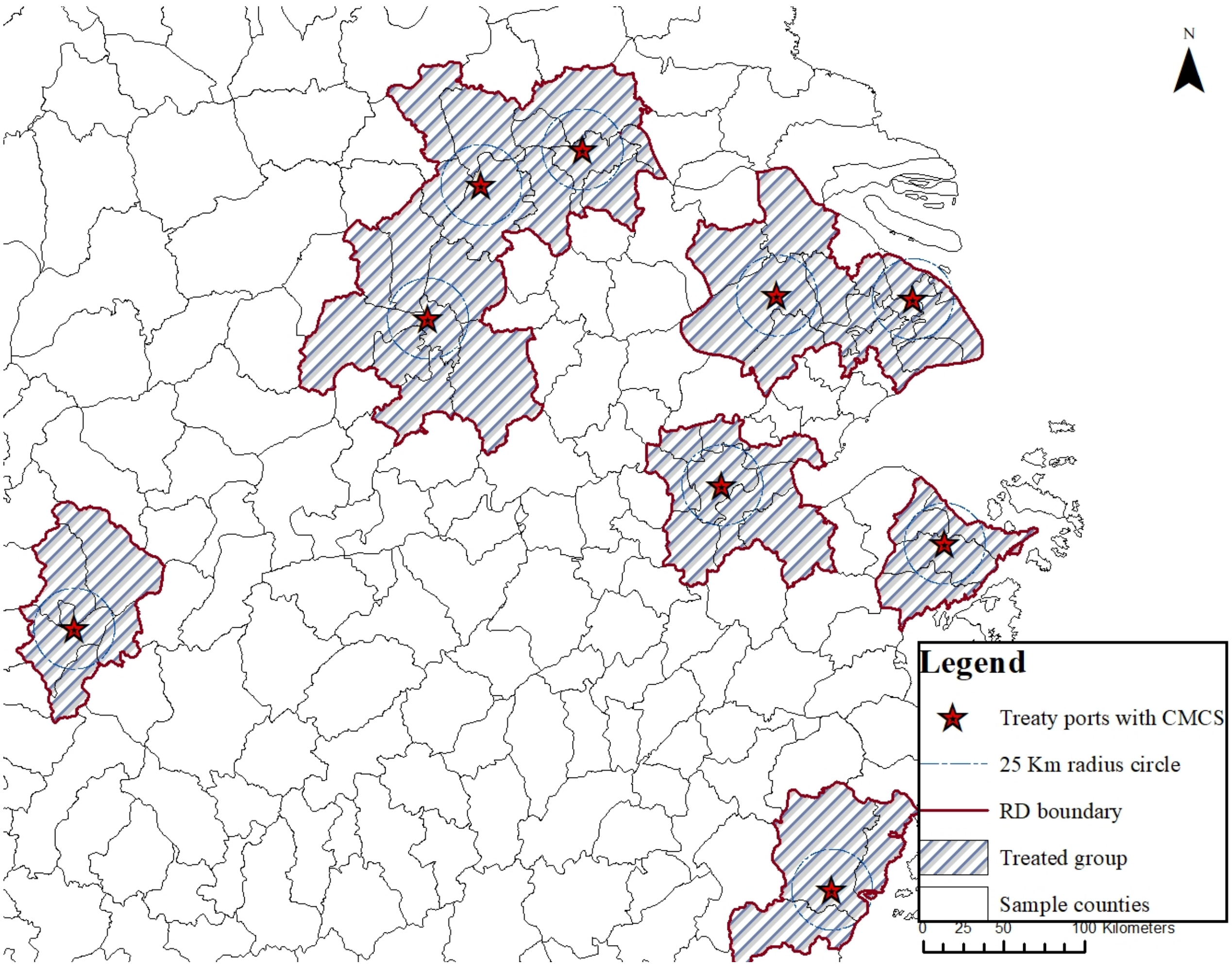

Figure 4: Regression Discontinuity Analysis

Table 1: Descriptive Statistics

Variable	Definition	Source	Mean	St.d	Obs
Light	Average light intensity 2000-2010 (in log)	A	1.32	1.21	192
Convert	Number of Protestant converts per 10,000 people in 1920	B	11.26	19.57	182
Catholic	Number of Catholic Stations per 10,000 people in 1920	B	2.89	4.46	182
Density	Prefecture level population density in 1820 (in log)	C	8.74	0.76	182
CMCS	Ratio of land covered by CMCS tax regime	D	0.09	0.15	192
Town	Ratio of towns affected by CMCS tax regime	D	0.09	0.17	192
Dis_port	Distance to the nearest treaty ports (in log)	D	2.96	1	192
Size	County area size (in log)	D	7.48	0.79	192
Capital	Prefecture Capital (0/1)	D	0.12	0.33	192
Yangtze	Yangtze River (0/1)	D	0.17	0.38	192
Coastal	Coastal line (0/1)	D	0.24	0.43	192
Canal	Grand Canal (0/1)	D	0.06	0.23	192
Latitude	Latitude in degree	D	28.47	5.34	192
Longitude	Longitude in degree	D	114.30	6.10	192
Elevation	Elevation in meter	E	286.21	415.10	192
Temperature	Average temperature	F	17.47	3.85	192
Precipitation	Average precipitation	F	1315.89	329.87	192

Sources:
A:NOAA
B:Stauffer1922
C:Cao2000
D:CHGIS V.5
E:CGIAR-CSI
F:FAO, UN

Table 2: Baseline Results

Dependent Variable: Average nighttime light intensity (in log)				
	(1)	(2)	(3)	(4)
CMCS(coverage ratio)	1.823*	2.282**		
	(1.005)	(0.942)		
CMCS(dummy)			0.263**	0.259*
			(0.131)	(0.135)
Town	-0.970	-1.180	0.211	0.358
	(0.789)	(0.761)	(0.404)	(0.400)
Dis_Port	-0.202***	-0.126*	-0.157**	-0.0890
	(0.0677)	(0.0668)	(0.0788)	(0.0815)
Protestant	0.00264	0.00214	0.00239	0.00190
	(0.00246)	(0.00214)	(0.00265)	(0.00233)
Size	-0.345***	-0.236**	-0.342***	-0.248**
	(0.106)	(0.102)	(0.107)	(0.106)
Density	0.855***	0.664***	0.871***	0.709***
	(0.101)	(0.121)	(0.104)	(0.124)
Canal	0.256	0.164	0.302*	0.231
	(0.169)	(0.133)	(0.169)	(0.141)
Yangtze	-0.0575	-0.123	-0.0716	-0.136
	(0.118)	(0.122)	(0.123)	(0.127)
Coast	0.467***	0.285**	0.483***	0.310**
	(0.141)	(0.135)	(0.139)	(0.134)
Capital	0.581***	0.492***	0.527***	0.442***
	(0.137)	(0.122)	(0.139)	(0.129)
Catholic	-0.00488	-0.00646	-0.00342	-0.00485
	(0.00851)	(0.00900)	(0.00856)	(0.00920)
Latitude		0.132		0.125
		(0.135)		(0.136)
Longitude		0.0994***		0.0923**
		(0.0364)		(0.0365)
Elevation		0.000472		0.000547
		(0.000829)		(0.000840)
Temperature		0.338**		0.338*
		(0.169)		(0.171)
Precipitation		-0.000144		-3.27e-05
		(0.000505)		(0.000504)
Constant	-0.844	-21.81**	-1.175	-21.26**
	(1.126)	(8.993)	(1.222)	(9.174)
Observations	172	172	172	172
R-squared	0.788	0.816	0.789	0.816
Province Dummies	YES	YES	YES	YES

Notes: County level regressions with province fixed effects. Robust standard errors in parenthesis
*** p<0.01 ** p<0.05 * p<0.1

Table 3: Robustness Checks

	Dropping Shanghai	Dropping Tianjin	Dropping Guangzhou	Dropping wave 1
	(1)	(2)	(3)	(4)
CMCS	2.601**	2.308**	2.000**	2.895***
	(1.022)	(0.956)	(0.968)	(1.096)
Observations	166	168	167	145
R-squared	0.799	0.814	0.830	0.810
Province Dummies	YES	YES	YES	YES
Control Variables	YES	YES	YES	YES
	Interact Protestant	Interact capital	Interact density	GDP per capita
	(5)	(6)	(7)	(8)
CMCS	2.156**	2.316**	6.364***	1.803**
	(0.936)	(0.945)	(2.162)	(0.801)
CMCS*Protestant	0.0242			
	(0.0189)			
CMCS*Capital		0.818		
		(1.133)		
CMCS*Density			-0.713**	
			(0.350)	
Protestant/Capital/Density	0.001	0.416**	0.697***	
	(0.002)	(0.185)	(0.124)	
Observations	172	172	157	157
R-squared	0.817	0.817	0.760	0.760
Province Dummies	YES	YES	YES	YES
Control Variables	YES	YES	YES	YES

Notes: County level regressions. The dependent variable in column 1-7 is average nighttime light intensity (log), in column 8 GDP per capita 2000 (log). Column 1 drops all counties in Songjiang Fu and Taicang Zhou, column 2 all counties in Tianjin Fu and Shuntian Fu, and column 3 drops all counties in Guangzhou Fu. Column 4 drops all counties in Guangzhou Fu, Tongan Fu, Zhangzhou Fu, Fuzhou Fu, Ningbo Fu, Songjiang Fu, and Taicangzhou. Columns 5 to 7 control for an interaction term of $CMCS$ and Protestant converts per 10,000 people, prefecture capital dummy, and population density in 1820, respectively. All the other control variables are the same with Table 2. The constant is not shown in the table. Robust standard errors in parenthesis.
*** p<0.01 ** p<0.05 * p<0.1

Table 4: Testing Endogenous Border on Geography

VARIABLES	Fox millet	Maize	Rice	Sugar	Sweet potato	Tea
	(1)	(2)	(3)	(4)	(5)	(6)
CMCS	0.0576	0.104	-0.818	-1.393	-0.213	-0.710
	(1.472)	(0.649)	(0.708)	(2.044)	(2.702)	(2.778)
Constant	-29.17*	15.55***	6.847	-29.57**	-8.047	-36.95*
	(17.51)	(5.534)	(8.773)	(14.11)	(20.28)	(19.10)
Observations	172	172	172	172	172	172
R-squared	0.611	0.593	0.789	0.954	0.826	0.878
Province Dummies	YES	YES	YES	YES	YES	YES
Control Variables	YES	YES	YES	YES	YES	YES

Notes: County level regressions with province fixed effects. Control variables are the same with Table 2. Robust standard errors in parenthesis.
*** p<0.01 ** p<0.05 * p<0.1

Table 5: Testing Endogenous Border on Pre-Treatment Development

Dependent Variable: Town Density					
	(1)	(2)	(3)	(4)	(5)
Inner	0.000558	0.000546	0.000547	0.000610	0.000575
	(0.00153)	(0.00154)	(0.00153)	(0.00156)	(0.00158)
Ring Size (log)	0.00153	0.00142	0.00143	0.00204	0.00170
	(0.00324)	(0.00383)	(0.00318)	(0.00339)	(0.00422)
Prefecture Capital		0.000135			-0.000264
		(0.00188)			(0.00199)
Treaty			0.00302		0.00304
			(0.00314)		(0.00321)
Latitude				-0.000403	-4.12e-05
				(0.00112)	(0.00112)
Constant	0.00476	0.00535	0.00384	0.0177	0.00399
	(0.0193)	(0.0223)	(0.0185)	(0.0424)	(0.0399)
Province Dummies	YES	YES	YES	YES	YES
Observations	82	82	82	82	82
R-squared	0.451	0.451	0.459	0.453	0.459

Notes: Ring level regressions with province fixed effects. Each observation is either an inner ring area or an outer ring area around a CMCS treaty port. $Inner$ is a dummy variable which equals to one if a ring area is an inner ring. $RingSize$ is the log form of the ring size. $Prefecturecapital$ equals to one if the port of the underlying ring is a prefecture capital. $Treaty$ equals to one if the underlying port of the ring was opened by treaties with Western countries. Latitude is the latitude of port.
*** p<0.01 ** p<0.05 * p<0.1

Table 6: Placebo Test

Dependent Variable: Average nighttime light intensity (in log)				
	(1)	(2)	(3)	(4)
Placebo(% coverage)	1.181	1.481		
	(1.012)	(1.157)		
Placebo(dummy)			0.0367	-0.0130
			(0.184)	(0.184)
Town	-0.369	-0.608	0.508	0.528
	(0.711)	(0.953)	(0.338)	(0.418)
Dis_port	-0.112	-0.144	-0.131	-0.191
	(0.101)	(0.115)	(0.120)	(0.134)
Constant	0.282	-6.313	0.448	-6.471
	(1.215)	(13.75)	(1.224)	(14.17)
Observations	77	77	77	77
R-squared	0.868	0.891	0.867	0.889
Province Dummies	YES	YES	YES	YES
Socioeconomic Controls	YES	YES	YES	YES
Geographic Controls	No	YES	No	YES

Notes: County level regressions with province fixed effects. Sample contains neighbouring counties of treaty ports without CMCS. Control variables are the same with Table 2. Robust standard errors in parenthesis

*** p<0.01 ** p<0.05 * p<0.1

Table 7: Difference-in-Difference Analysis

	Testing for endogeneity						Main results	
Dependent Variable	Fox millet	Maize	Rice	Sugar	Sweet potato	Tea	Nighttime light internsity	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Circle	-0.840	0.119	-2.172	-0.314	-0.962	0.200	0.928***	1.448***
	(0.557)	(0.255)	(1.649)	(0.477)	(1.229)	(0.536)	(0.345)	(0.556)
Circle*C_Cover	0.239	0.131	1.184	-1.299	0.622	0.00598	1.687*	
	(1.378)	(0.709)	(2.030)	(2.514)	(2.890)	(2.674)	(0.884)	
Circle*P_Cover								0.0534
								(0.838)
Observations	249	249	249	249	249	249	249	249
R-squared	0.632	0.583	0.805	0.940	0.846	0.907	0.811	0.811
Province Dummies	YES	YES	YES	YES	YES	YES	YES	YES
Control Variables	YES	YES	YES	YES	YES	YES	YES	YES

Notes: County level regressions. Columns (1)-(6) regress agricultural suitability indices on variables of interest and control variables, so as to test whether CMCS is correlated with pre-colonial development. Column (7) shows the main diff-in-diff result, whereas column (8) shows the placebo test. *Circl* is the size of the area covered by any 25 km radius circle, normalized by the total county size. C_Cover is the size of the area covered only by 25 km radius circles around CMCS treaty ports, normalized by the total area covered by any circle. The interaction term, $Circle * C\_Cover$ therefore indicates the coverage of a CMCS circle normalized by total total county size. P_Cover is the coverage of placebo circle, i.e. 25 km radius circle from treaty ports without CMCS, normalized by the total area covered by any circle. In columns 1-8, control variables are the same with Table 2. In column 9 control variables are the same with Table 6. The constant is not shown in the table. Robust standard errors in parenthesis.

*** p<0.01 ** p<0.05 * p<0.1

Table 8: Testing Discontinuity at the RD Border

	<21 km of RD border			<22 km of RD border			<23 km of RD border			<24 km of RD border		
	Inside/Outside:85/153			Inside/Outside:89/165			Inside/Outside:83/177			Inside/Outside:94/183		
	Treat	Treat*	Obs.	Treat	Treat*	Obs.	Treat	Treat*	Obs.	Treat	Treat*	Obs.
Fox millet	-13.64	487.5	238	-23.39	423.2	254	-100.7	702.7	270	-124.8	783.8	277
Maize	18.75	357.3	238	19.11	281.4	254	-57.23	568.3	270	-75.28	625.3	277
Rice	459.0*	442.3	238	468.9**	394.7	254	500.9**	252.7	270	508.1**	218.8	277
Sugar cane	0.170	-306.4	238	38.71	-414.1	254	54.69	-421.9	270	65.14	-436.7	277
Sweet potato	-158.7	-322.2	238	-83.53	-554.1	254	-102.5	-448.4	270	-77.09	-528.9	277
Tea	-200.9	-418.4	238	-174.5	-481.3	254	-190.1	-383.4	270	-164.4	-471.7	277
Protestant	4.771	9.545	225	4.624	9.345	240	4.427	9.201	254	4.259	9.514	261
Elevation	-84.38***	-185.8	238	-91.48***	-142.0	254	-92.56***	-122.7	270	-90.73***	-125.6	277
Temperature	-1.183	-1.183	238	-1.557	-1.557	254	-1.900	-1.900	270	-2.056*	-2.056*	277
Precipitation	7.007	33.47	238	16.94	7.580	254	24.85	-21.48	270	29.30	-43.67	277

Notes: County level regressions. The table is divided into four three-column groups, and the bandwidths used for each group are 21 km, 22 km, 23 km, and 24 km respectively. In each group, $Treat$ shows the bi-variate regression coefficients of the variable Treat, which equals to one if a county is located within the RD border. $Treat*$ shows the coefficient of the same variable conditional on the distance to the RD border. The dependent variables for each row are suitability for fox millet, maize, rice, sugar cane, sweet potato, and tea and elevation, temperature, and precipitation. Robust standard errors clustered at the prefecture level in parenthesis.
*** p<0.01 ** p<0.05 * p<0.1

Table 9: RD Analysis

Dependent Variable: Average nighttime light intensity (in log)				
	<21 km of border	<22 km of border	<23 km of border	<24 km of border
	(1)	(2)	(3)	(4)
		Panel A. Baseline Sample		
Treat	1.007**	0.997**	0.808*	0.840*
	(0.497)	(0.484)	(0.463)	(0.440)
Observations	221	235	246	251
R-squared	0.799	0.796	0.790	0.790
Control Variables	YES	YES	YES	YES
Province Dummies	YES	YES	YES	YES
		Panel B. Placebo Sample		
Placebo	0.135	-0.133	-0.0619	-0.146
	(0.450)	(0.387)	(0.403)	(0.371)
Observations	165	174	181	187
R-squared	0.843	0.843	0.846	0.845
Control Variables	YES	YES	YES	YES
Province Dummies	YES	YES	YES	YES

Notes: County level regressions. In the first three columns, the sample only includes counties that located less than 21 km from the RD border. This threshold is 22, 23, and 24 km in successive columns. In Panel A, the RD border is generated by counties that were affected by CMCS treaty ports. In Panel B, the RD border is generated by counties affected by treaty ports without CMCS. Control variables are the same with Table 2. Robust standard errors clustered at the prefecture level in parenthesis.
*** p<0.01 ** p<0.05 * p<0.1