Foreign Trade and Industrialization: Evidence from Early Republican China

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Abstract

Existing literature provides mixed evidence on the effects of foreign trade on industrialization in developing countries. Leveraging the unique historical setting of China during the Early Republican period (1908–1926), I distinguish between two opposing forces: competition and technology transfer. I exploit exogenous variation in foreign trade access induced by international political shocks for identification. I find that better access to foreign consumer goods discouraged domestic firm entry, while better access to foreign capital goods encouraged entry. The effects of foreign trade depend not on the overall level of access, but on the relative strength of these two forces. Domestic producers were all highly responsive to aggregate foreign trade access, but those in better institutional environments were more responsive to industry-specific signals. The interaction between competition and technology transfer shows a distinction. At the aggregate level, access to technology appears to have been the binding constraint, and producers were more responsive to one force when the other force was favorable. At the industry-specific level, however, competition became more important, and producers were more responsive to one force when the other force was less favorable.

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1 Introduction

For most late-developing countries, integration into the global market marks an important moment in their historical development. Classical economists argue that countries gain from interacting with other economies. Yet empirical evidence on the effects of foreign trade on industrialization in late-developing countries remains mixed. Compared with early-industrialized economies, where access to global markets expands demand for domestic industry, late-developing countries typically enter the global economy as importers of industrial goods. Therefore, the mechanisms through which foreign trade influences domestic industrial producers remain far less clear. This paper leverages the unique setting of China during the early Republican period (1908-1926) to study the effects of foreign trade on domestic industrial firm entry.[1] It develops a framework that can reconcile the mixed findings on the effects of foreign trade on industrialization in developing countries.

A long-standing view in the literature holds that foreign trade can promote industrialization by facilitating technology transfer (Melitz, 2003; Baldwin and Venables, 2015). Empirical evidence has documented positive effects of access to foreign trade in many developing countries (Coe et al., 1997; Borojo and Jiang, 2016). However, another equally well-established argument is the infant industry argument (Bardhan, 1970), which emphasizes that the competition brought by trade openness can suppress domestic industrial development. Empirical evidence supporting this argument is also substantial (Gandjon Fankem and Feyom, 2024; Topalova, 2010; Doan et al., 2016). This paper argues that the forces of technology transfer and competition operate simultaneously. Rather than relying on a single aggregate measure of foreign trade access, it is important to distinguish access to different types of foreign goods. In particular, access to foreign consumer goods tends to bring competition, as these goods directly compete with the outputs of domestic producers, whereas access to foreign capital goods may facilitate technology transfer by lowering the cost of adopting new technologies. The overall effects of foreign trade access therefore can vary substantially across regions, depending on their relative access to consumer goods versus capital goods. Meanwhile, the magnitude of the effect could vary with institutional quality, and the two forces, competition and technology transfer, could also interact in meaningful ways.

Studying the effects of foreign trade access on domestic industrial producers is challenging for

[1]The last imperial dynasty in Chinese history was the Qing dynasty (1644–1911), followed by the Republican period (1911–1949). However, the transition between the Qing dynasty and the Republic was relatively smooth. For convenience, this paper refers to the period from 1908 to 1926 as the early Republican period.

two reasons. First, a region's foreign trade access is usually endogenous to the activity of domestic producers in that region, making it difficult to establish a causal relationship. Second, trade in consumer goods and trade in capital goods often move together. A region that has good access to foreign consumer goods usually also has good access to foreign capital goods, making it difficult to separate the competition channel from the technology channel. The early Republican period in China (1908-1926) provides a compelling setting to study this question. After its defeat in the First Opium War (1839–1842), China was forced to open up to foreign trade under the Treaty Port system. However, the government maintained strict restrictions on private industrial firms until a series of reforms during 1904–1907. This gap of more than half a century meant that, by the time private industrial firms were allowed to enter, they faced a well-established foreign trade system that had been created through treaties between China and other countries and was largely independent of the activities of private firms themselves. Meanwhile, under the Treaty Port system, each port was associated with certain countries through treaties. The commodities available at each port were largely determined by the supplier countries of the port. This unique trade structure created significant differences in each region's access to foreign consumer goods and foreign capital goods.

Exogenous variation in foreign trade access across regions arose from international political shocks. During the Early Republican period, many global political shocks took place. These shocks, such as World War I, disrupted global supply chains. Although China was not directly involved in these events, they affected supplier countries differently. Given the established connections between ports and countries, ports were exposed to these shocks to varying degrees. Differences in exposure to these shocks across ports, combined with substantial internal trade costs arising from China's vast geography and underdeveloped modern transportation infrastructure, generated exogenous variation in regional access to foreign trade.

My empirical analysis draws on newly digitized trade data from the Chinese Maritime Customs (CMC). The CMC was an international institution responsible for collecting trade duties under the Treaty Port system and therefore maintained high-quality records of foreign trade. The first dataset documents trade flows between provinces and ports, detailing the distribution of foreign trade activity within China. The second dataset records commodity-level imports *at each treaty port* and *from each country*, covering hundreds of commodities. I use this dataset to identify

differences in commodity availability across ports, and in particular to distinguish between imports of consumer goods and capital goods.

In a competitive market, the arrival prices of imported goods determine equilibrium market prices whenever imports are present. Domestic industrial firms rely on capital goods to produce consumer goods. Thus, the arrival price of foreign consumer goods determines firms' revenues, while the arrival price of capital goods determines their costs. Prospective firms form expectations about market prices based on a region's foreign trade access. Firms choose to enter a region when they expect consumer goods prices to be high and capital goods prices to be low. The empirical task is to construct "price-like" measures of regional foreign trade access.

I construct an innovative measure of foreign trade access—the expected arrival price. This measure combines the competitive price index (Junz and Rhomberg, 1973) with the internal trade costs proxied by the geographic distance. The competitive price index captures differences in commodity availability across ports driven by global political events. Each year for each region, I estimate one expected arrival price for consumer goods and one for capital goods. The higher the expected arrival price of consumer goods, the less intense the competition domestic producers face. The higher the expected arrival price of capital goods, the higher the cost of technology for domestic producers. Importantly, I construct two levels of expected arrival prices. The first is the aggregate expected arrival price, calculated using the bundle of all foreign goods. This measure captures the broad economic environment that producers faced. I also construct industry-specific expected arrival prices, calculated using bundles of industry-specific consumer goods and capital goods. These specific arrival prices capture the production margins that were directly relevant to prospective producers in the industry.

At the aggregate level, I find that better access to foreign consumer goods decreased domestic firm entry by increasing competition, while better access to foreign capital goods increased domestic firm entry by lowering the cost of technology. In particular, a 1% decrease in the expected arrival price of foreign consumer goods, which is equivalent to lowering tariffs on all consumer goods by 1%, would decrease firm entry by 3%. By contrast, a 1% decrease in the expected arrival price of foreign capital goods would increase firm entry by 2.3%. Areas were all responsive to aggregate foreign trade access regardless of their distance from treaty ports. Finally, I include the interaction between the expected arrival prices of foreign consumer goods and foreign capital goods. The results

show that, at the aggregate level, access to technology was the binding constraint and domestic producers became more responsive competition when technology was sufficiently accessible.

For industry-specific foreign trade access, competition still had a negative effect on industry-specific firm entry, and cheaper technology still encouraged firm entry, but the patterns were still different. First, domestic producers closer to treaty ports, who benefited from spillovers from the advanced institutions in treaty ports, were more responsive to industry-specific foreign trade access. This suggests that while all producers responded to aggregate market incentives shaped by foreign trade access, producers in better institutional environments were better able to identify and respond to the precise signals most relevant to them. Moreover, I find a positive interaction between the industry-specific expected arrival prices of foreign consumer goods and foreign capital goods. This reflects the actual entry decision-making process: when one margin was unfavorable, producers were pushed closer to the threshold at which entry became unprofitable, making changes along the other margin more important.

Recent studies examining the historical impact of foreign trade on economic development focus primarily on early industrialized economies (Chan, 2025; Jaworski and Keay, 2022). They find that increased exposure to foreign trade benefited local manufacturers by expanding access to world markets for their industrial products. The impact of foreign trade on producers in developing countries was fundamentally different, as these countries were typically importers of industrial goods. The effects of foreign trade can therefore vary significantly across regions, depending on whether the competition effect or the technology transfer effect dominates.

This study also contributes to the literature on the drivers of industrialization in developing countries. Existing studies highlight factors, such as public infrastructure (Tang, 2014), legal institutions (Gregg, 2020), property rights (Haber et al., 2003), and knowledge codification (Juhász et al., 2024). This paper identifies foreign trade as another important driver. Global supply chains, trade institutions, geography, infrastructure, and internal political order all together shaped each region's access to foreign trade, which in turn affected domestic industrial producers through market forces.

Many economists have been interested in China because of its rich history and its current economic importance, yet the Early Republican period remains relatively understudied. This period was an important transition both politically and economically, and many subsequent developments

in the 1930s and 1940s can be traced back to it. Rawski (1989) emphasizes that China experienced significant economic growth during this period, highlighting the expansion of the private sector and the importance of foreign trade. Among the few pioneering quantitative studies of this period, Mitchener and Yan (2014) and Liu (2020) show that World War I played an important role in facilitating China's industrialization by creating new opportunities for exports. This paper complements and extends this literature in two ways. First, as Rawski (1989) points out, an important feature of China's economy during the Early Republican period was its domestic orientation: many firms, especially those outside port cities, sought to satisfy demand in surrounding markets rather than primarily targeting overseas markets. I therefore focus on import substitution, rather than export-led industrialization. Second, while existing studies emphasize how international shocks affected opportunities for domestic producers by expanding export demand, these shocks could also disrupt access to imported industrial inputs. This margin was also important because many capital goods used in mechanized production were difficult for Chinese producers to manufacture domestically. By distinguishing between competition and technology transfer, this paper highlights the complex mechanism through which foreign trade access shaped China's early industrialization.

This paper proceeds as follows. Section 2 introduces the relevant historical context. Section 3 describes the data on foreign trade and industrial firm entry. Section 4 presents the empirical framework and results. Section 5 concludes by discussing their implications.

2 China's Foreign Trade and Industrialization during the Early Republican Period

2.1 The First Wave of Large-Scale Industrialization: the Private Sector

Industrialization became an important subject of policy debate after China's defeat in the First Opium War (1839–1842). During 1850 to 1930, China began to industrialize despite significant social, economic, and political challenges. In the second half of the nineteenth century, China first attempted industrialization through a government-led path centered on military modernization, known as the Self-Strengthening Movement (1861–1895). However, the Qing government at the time had little interest in large-scale industrialization, fearing that it would undermine the long-established agrarian economy. It therefore strictly controlled machinery imports and limited

private industrial initiatives (Goetzmann and Koll, 2005). Although a few industrial companies existed, they were typically state-owned or controlled by individuals with connections to high-ranking officials in the Qing government.

A turning point came at the turn of the twentieth century. After its defeat in the First Sino-Japanese War in 1895, China was forced to allow foreign countries to establish factories within its territory. Recognizing that the spread of industrialization in China had become unavoidable, the Qing government introduced a series of reforms between 1904 and 1907. These reforms, most notably the 1904 Company Law, marked a shift in the government's attitude toward modern private sector.[2] From this point on, the private sector gradually became the leading force of China's industrialization.

The Qing dynasty collapsed in 1911 and was followed by the establishment of the Republic of China.[3] The transition from the Qing dynasty to the Republic was relatively smooth. Political instability began only in late 1915, when Yuan Shih-kai, the first president of the Republic, attempted to proclaim himself emperor of China. Beginning in 1916, China experienced more than a decade of national disintegration, during which the central government was weak and provinces were controlled by regional military governors, or warlords. China was not reunified until 1926–1928, when the Nationalist Party launched the Northern Expedition under the leadership of Chiang Kai-shek.

Political instability and the absence of a strong central government also meant that market incentives began to play a major role in directing investment during the early Republican period (Rawski, 1989). Thousands of private industrial firms emerged. These firms relied on imported capital goods and engaged in mechanized production, which distinguished them from traditional Chinese handicraft shops and contributed to the first wave of large-scale industrialization in modern China's history.

2.2 China's Foreign Trade: The Treaty Port System

During most of the Qing dynasty, emperors imposed strict restrictions on foreign interactions, limiting foreign trade to a few Chinese specialties through one or two ports. A turning point came

[2]The reform wave around 1904–1907 included the 1904 Company Law, the abolition of the imperial examination system in 1905, the 1906 Bankruptcy Law, the establishment of the Hubu Bank in 1905, later renamed the Great Qing Bank in 1908, and the promulgation of the Bank Law in early 1908. Although the enforcement of these reforms was less certain, they all signaled a changing attitude toward the modern private sector.

[3]For convenience, I refer to the full sample period in this paper, 1908–1926, as the early Republican period, although the first few years fall in the final years of the Qing dynasty.

in the 1840s. After the First Opium War (1839–1842), China and Britain signed the Treaty of Nanking, under which China was forced to open five ports–Shanghai, Ningpo (Ningbo), Canton (Guangzhou), Amoy (Xiamen), and Foochow (Fuzhou)–to foreign trade. These ports became the so-called "treaty ports." In the following decades, China signed additional treaties with several countries, including Britain, France, Japan, Russia, Germany, and the United States. By the turn of the twentieth century, nearly fifty treaty ports had been established. Although no new treaty ports were established after the collapse of the Qing in 1911, these treaty ports remained in operation throughout the early Republican period.

Under the treaty port system, China was forced to maintain mostly flat tariff rates of less than 5% until 1929, when the Chinese government regained the authority to set tariffs (Bo et al., 2022). China's tariff rates were much lower than those in almost all major economies at the time. For example, in 1913 the average tariff on manufactured imports was 20% in France, 13% in Germany, 44% in the United States, and 28% in Argentina. By 1925, tariffs were 21% in France, 20% in Germany, and even Britain had implemented a 5% tariff. The United States and Argentina maintained high tariffs of 37% and 29%, respectively.[4]

The exceptionally low tariff rates meant that foreign goods from other countries could enter China freely. However, the nature of the Treaty Port system created differences in commodity availability across ports. Since these ports were established through treaties between China and foreign powers, each port was naturally embedded in a set of international connections. As a result, each port was more closely connected to certain foreign suppliers than to others.

It is important to note that, in addition to serving as gateways for foreign trade, treaty port cities were themselves distinct from other Chinese cities. Foreigners resided in these port cities: foreign investors established factories, foreign banks opened branches, and in many of them, foreign powers established concessions. Treaty port cities benefited from more Westernized legal systems, police forces, and administrative structures (Keller and Shiue, 2022). For these reasons, they have often been characterized by scholars as "semi-colonies." At the same time, these institutional advantages also contributed to faster economic growth in treaty port cities (Jia, 2014; Liu and Zhang, 2023).

[4] *Power and Plenty*, pp. 403 and 444.

2.3 Foreign Trade Access: the Trade Institutions and the Internal Trade Costs

Under the Treaty Port system, treaty ports served as the exclusive entry and exit points for foreign trade. All imports had to pass through these designated ports. If a region wanted to obtain imported goods, it had to trade with one or more treaty ports.

However, treaty ports differed significantly in the number of commodities available at them. Treaty ports were opened through treaties between China and different countries, and they naturally embedded stronger connections with some countries than with others. When countries exported goods to China, they primarily shipped them through ports with which they had connections. As a result, ports differed in their major supplier countries, and these countries differed in their industrial specialization and strength. Moreover, the early Republican period witnessed disruptions to global supply chains caused by major political shocks, such as WWI. Although China did not directly participate in these events, supply shocks were unevenly transmitted across regions through the Treaty Port system. For example, Russia dominated several ports in northeastern China after the Treaty of Aigun in 1858. When the Russian Revolution broke out in 1917, the number of commodities available at these ports declined substantially.

The differences among treaty ports were important because of internal trade costs. China's vast geography and underdeveloped modern transportation meant that internal trade costs were never negligible (Keller et al., 2017). Regions faced different costs when transporting goods from different treaty ports. During the early Republican period, the weak central government was unable to make meaningful progress in modern transportation, so internal trade costs remained high. In this paper, I use geographic distance as a proxy for internal trade costs. This proxy is exogenous, captures China's vast geography, and is economically reasonable in a setting where modern transportation remained poorly developed.

3 Data

3.1 Trade Data

The main trade dataset used in this study is drawn from the trade reports of the Chinese Maritime Customs (CMC). The CMC was an international institution responsible for monitoring trade under the Treaty Port system. Founded in 1854 in Shanghai by foreign consuls, it gradually established

stations at most treaty ports. Its primary responsibility was to ensure that China met the indemnity payments imposed after military defeats in the late Qing period, a role it continued to perform until World War II. As part of its operations, the CMC collected and published detailed trade data on the value and quantity of imports, exports, re-exports, inland transit, and other categories for each treaty port. The data are generally considered to be of high quality, as senior CMC staff were highly trained graduates of institutions such as Cambridge, Harvard, and Yale, and were accountable to both foreign bondholders and the Chinese treasury (Keller et al., 2011).

The currency used in the CMC reports is the Hai Kwan tael (HK. Tls.). The CMC trade reports provide exchange rates between the Hai Kwan tael and several foreign currencies, including the U.S. dollar. I convert all values into U.S. dollars and then deflate them to constant 1907 U.S. dollars using U.S. inflation rates.[5]

The first part of the trade dataset consists of annual port-level commodity imports reported in the **Analysis of Foreign Trade** section of the CMC trade reports. For each year from 1904 through 1926, it records the quantity and value of every imported commodity for *each treaty port* and for *each source country*.

I classify all commodities into either consumer goods or capital goods, primarily following the classification provided in the CMC trade reports and carefully verifying it manually. In general, consumer goods are products that can be consumed directly, including textiles, processed foods, and convenience goods such as candles and matches. Capital goods, by contrast, are inputs used to produce consumer goods and include machine parts, equipment, chemical materials, and other key industrial inputs.

The first important observation is that treaty ports differed in terms of the commodities available at each port. Figure 1 illustrates the treaty port system in 1920. The dots represent treaty ports, with darker color indicating a wider variety of commodities available at each port. Some ports traded more than 300 commodities, while others traded fewer than 100.

A second observation is that treaty ports differed not only in their overall commodity coverage, but also in their coverage by commodity type. Figure 2 shows commodity coverage by type at selected ports in 1920, measured as the percentage of consumer goods or capital goods items available at each port relative to the total number of imported items in the group. For large

[5]The Consumer Price Index is retrieved from the Federal Reserve Bank of Minneapolis: https://www.minneapolisfed.org/about-us/monetary-policy/inflation-calculator/consumer-price-index-1800-

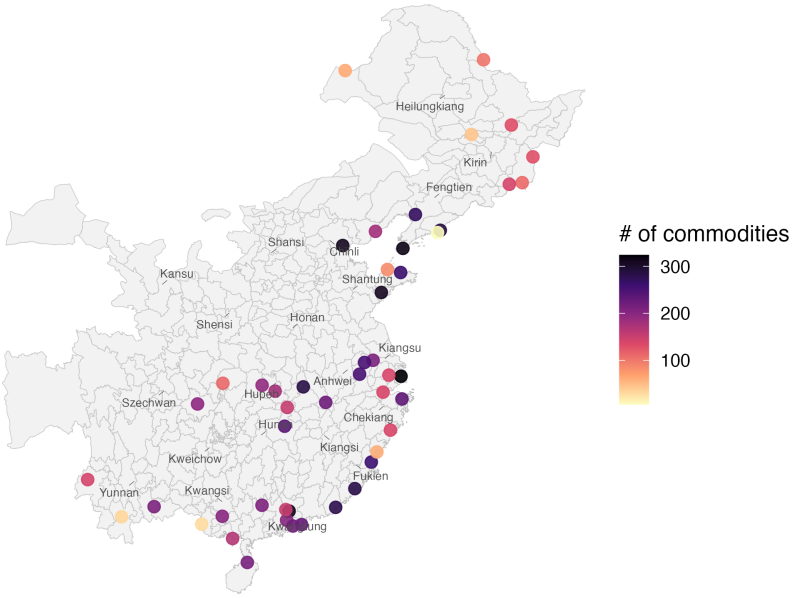


Figure 1: A Map of the Treaty Port System in 1920

Source: the CMC trade reports. See Section 3 for details. Red dots represent treaty ports. Labels represent provinces in China.

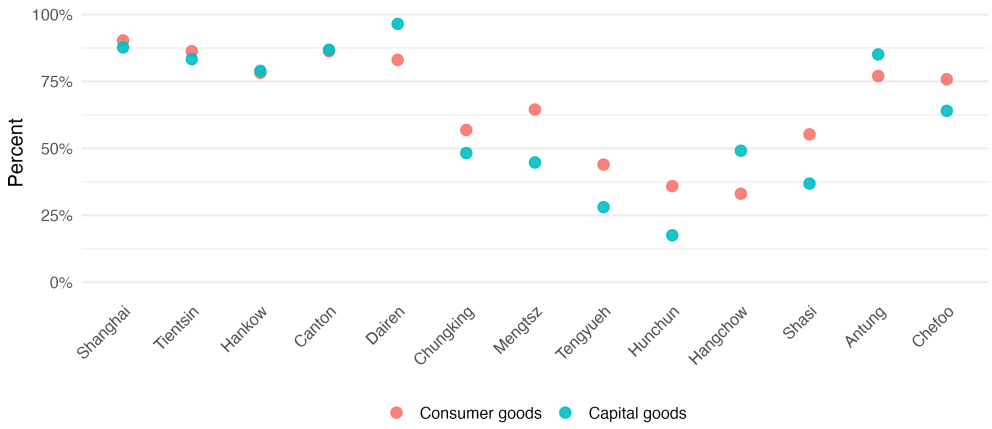


Figure 2: Commodity Coverage by Selected Ports, 1920

treaty ports such as Shanghai, coverage was high for both consumer goods and capital goods. In contrast, smaller ports not only had lower coverage for both types of goods, but also exhibited larger differences in coverage between consumer and capital goods. For example, Mengtze in Yunnan covered 64.5% of the consumer goods items available in that year, but only 44.7% of capital goods items.

A detailed summary of commodity coverage by port is presented in Table A1.

The second part of my trade dataset consists of province–port trade data for each year between 1907 and 1928, drawn from the **Inland Transit** section of the CMC trade reports.[6] The dataset records the value of foreign goods, namely imports, transported from treaty ports to provinces under the Transit Pass system in each year.[7] Transit passes issued by the CMC provided valuable protection for the internal movement of foreign goods and prevented Chinese officials from levying additional taxes on them. They were believed to have been widely used by merchants, especially during the Republican period, due to internal political instability. Even for treaty ports located within the destination provinces, such trade was usually covered by transit passes. However, goods consumed directly within the treaty ports themselves were generally not covered by transit passes.[8]

[6]The CMC trade reports underwent several changes. The Inland Transit section became available only after 1907.

[7]In the Trade Report of Dairen (Dalian), foreign goods shipped to Kirin (Jilin), Heilungkiang (Heilongjiang), and Fengtien (now Liaoning) were all recorded under "Manchuria." In this case, I split the trade flows equally across the three provinces.

[8]Goods covered under transit passes can be viewed as being protected by the CMC (backed by foreign powers), which was particularly important during the early Republican period given the high level of domestic political instability. The system of transit passes was initially created to give foreign merchants the option of either paying all internal taxes as they were levied by local officials or, alternatively, obtaining an exemption from further taxes by paying the Maritime Customs a fifty percent surcharge on regular customs duties. Chinese merchants were included

Figure 3: Total Trade Value by Year

These internal trade flows of foreign goods within China provide valuable observations that are rarely available for most countries, especially developing countries. In this context, these trade flows offer valuable insight into each provincial market's reliance on different treaty ports, which I use to construct each province's measure of foreign trade access.[9]

Figure 3 presents the total value of trade between provinces and ports by year. The total value increased from 1907 to 1919, and then fluctuated around 10 million (in 1907 USD) between 1919 and 1927.

Figure 4 presents the average trade value within each distance bin. Average trade value declined as distance increased, indicating significant internal trade costs. However, trade could still occur over long distances. In fact, the average trade value in the over-1,200 km bin was still several thousand dollars.

In summary, the overlap between the two trade datasets covers the period from 1907 to 1926, which defines our sample period and roughly corresponds to the early Republican Era. Detailed data summaries are presented in Table A2 and Table A3.

after 1876. Transit passes could be purchased for both foreign imports shipped to inland areas and inland goods shipped to treaty ports. There were controversies regarding the implementation of these policies, but it is generally believed that during the Early Republican period, due to internal political instability, most trade was conducted under transit passes to benefit from the protection of the CMC. See Matthews (1999) and Brown (1978) for details.

[9]Throughout this paper, I drop Sinkiang, Tibet, and Mongolia (which refers to both present-day Inner Mongolia in China and present-day Mongolia).

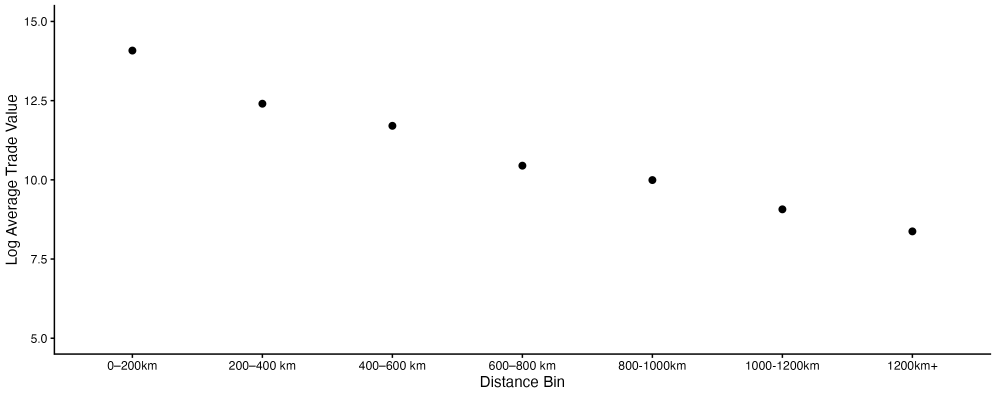


Figure 4: Average Trade Value by Distance Bin

3.2 Firm Data

The firm data is collected from Du (1991).[10] It covers modern firms established between 1858 and 1927 all over China.[11] For each firm, it provides the name, start date, location, founder, ownership, industry, and initial capital.[12] This dataset is regarded as a highly complete collection of industrial firms in China and has been used in recent papers (e.g., Ma, 2024). A limitation of this dataset is that it does not record how long each firm survived. However, since the objective of this paper is to study how foreign trade access affected the entry decisions of domestic producers, this limitation is not particularly problematic. Moreover, the trade data provide suggestive evidence that these domestic firms were indeed actively producing. For example, Figure 5 provides an overview of the matchstick industry. As more match factories entered the market, imports of matches declined but remained positive. Exports, by contrast, remained zero until the very end of the sample period.

Based on the industry recorded in the data, firms are first classified as either "industrial" or "service" firms. Industrial firms refer to firms in the secondary sector, including manufacturing, extraction, construction, and utilities. Service firms, on the other hand, refer to firms in the tertiary

[10]Du (1991) synthesized data from various sources, including but not limited to Chinese government reports (e.g., *The Statistics of the Ministry of Agriculture, Industry, and Commerce* (农商统计表)), foreign government reports (e.g., *Overview of Chinese Industry* (支那工業総覧)), newspapers (e.g., *Journal of the General Chamber of Commerce of Shanghai* (上海总商会月报)), and local gazetteers (e.g., *Jiangsu Provincial Yearbook* (江苏省年鉴)). Although the Qing government introduced incorporation in the 1904 Company Law, many firms did not incorporate. Regarding firm registration, see Kirby (1995). This dataset includes both registered and unregistered firms.

[11]In Du (1991), these firms are referred to as Chinese national-capitalist enterprises, which the historical literature often treats as new-style enterprises. They were distinguished from traditional workshops in China by their modern business organization, production methods, and the use of factory machinery and equipment. These firms are therefore commonly used as indicators of economic modernization and industrialization.

[12]I remove a small number of firms without clear start date.

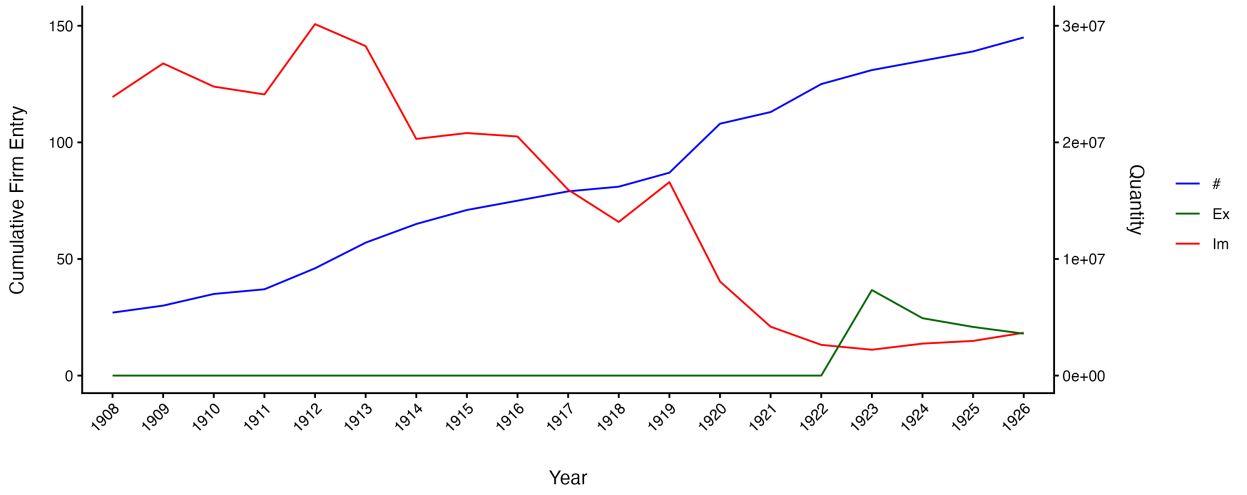


Figure 5: The Matchstick Industry

This figure provides an overview of the match industry. The blue line shows the cumulative number of match firms. The red line shows the total quantity of matches imported each year, while the green line shows the quantity exported. For ease of visualization, import and export quantities are divided by 200,000.

sector, including finance and transportation.

In total, 2,712 firms were established between 1908 and 1926. Figure 6 shows the total number of modern firm entries in each year. In most years, the total number of firm entries exceeded 100. Among these firms, most were industrial firms.

Among all industrial firms, I further classify each firm into manufacturing, construction, extraction, or utilities based on the industry recorded in the data. Figure 7 further splits firm entries in each year by sector. The majority of these new firm entries were in manufacturing.

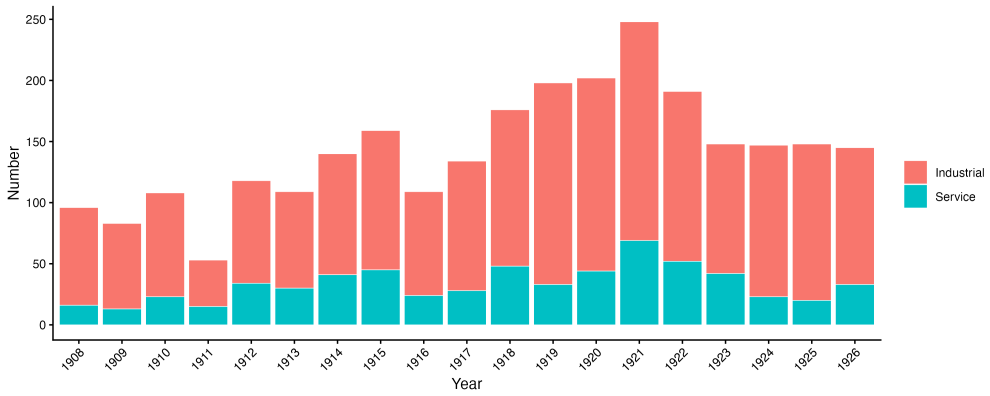


Figure 6: Firm Entry by Year, 1908 - 1926

Figure 7: Firm Entry by Sector and Year, 1908–1926

Among all manufacturing firms, light industry accounted for the vast majority. I therefore group most light-industry firms into four major categories. First, more than 30% of manufacturing firms were in textiles, including cotton spinning and weaving. Second, many firms were engaged in food, beverage, and tobacco processing, such as flour milling. Third, some firms produced light chemical goods, including matches and soap. Finally, another major category consisted of material-based household goods, such as leather products and porcelain. Although these four groups do not cover all manufacturing or industrial firms in this period, they account for the majority of manufacturing firms and capture the main patterns of industrial development during the time.[13] Moreover, these four are the categories that can be most directly matched to the trade data, which allows me to construct industry-specific measures of foreign trade access. Table A4 presents the detailed classification of firms.

I match each manufacturing category to category-specific consumer goods and capital goods in the trade data. For consumer goods, I use a large language model to assign each consumer-good commodity in the trade data to the most relevant manufacturing category. However, commodities are not forced into a category when no clear category-specific relationship exists. In particular, if a consumer-good commodity was not produced by any of the manufacturing categories in the firm data, it was not assigned to a category. The classification of capital goods is more difficult. For each capital-good commodity, I assign the commodity to the two most relevant manufacturing categories. This is because most capital goods were widely used across multiple categories. Assigning them to

[13]Paper and printing firms are not assigned to any manufacturing group because of their distinct nature. The printing industry produces goods for which content is important and is not standardized across countries.

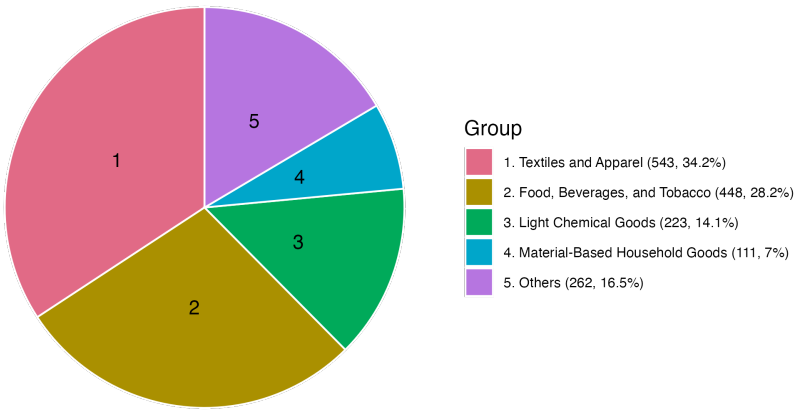


Figure 8: The Distribution of Manufacturing Firms by Group

all categories would eliminate meaningful cross-industry variation in the empirical analysis, while assigning them to only one category would be overly restrictive and potentially arbitrary. Table A5 provides a summary of the classification by industry group.

My firm data support Rawski (1989)'s view that China's economy was characterized by *private*, *civilian*, and *market-driven* initiatives. Among the 2,712 firms that entered between 1908 and 1926, 89.9% were private. Private businesses therefore dominated the economy. Most of these private enterprises were concentrated in consumer goods industries, such as food processing, textiles, and convenience goods. Importantly, these private firms were allowed to enter only after the 1904 Company Law, after the establishment of the Treaty Port system. However, once they were allowed to enter, they made their entry decisions based on market incentives shaped by foreign trade access under the Treaty Port system.

I match each firm's location to a prefecture in the CHGIS Version 6 database.[14]The prefecture and province boundaries follow the 1911 administrative divisions recorded in the database. Figure 6 shows the total number of firm entries in each prefecture during this period. As expected, the area around Shanghai had the largest number of firm entries. However, new firms were geographically dispersed: many regions in the interior also experienced firm entry. In fact, all provinces had at least some firm entries.

I further calculate the distance from each firm to the nearest treaty port using geographic

[14]The CHGIS Version 6 datasets are available through the Harvard Dataverse at `https://dataverse.harvard.edu/dataverse/chgis_v6`.

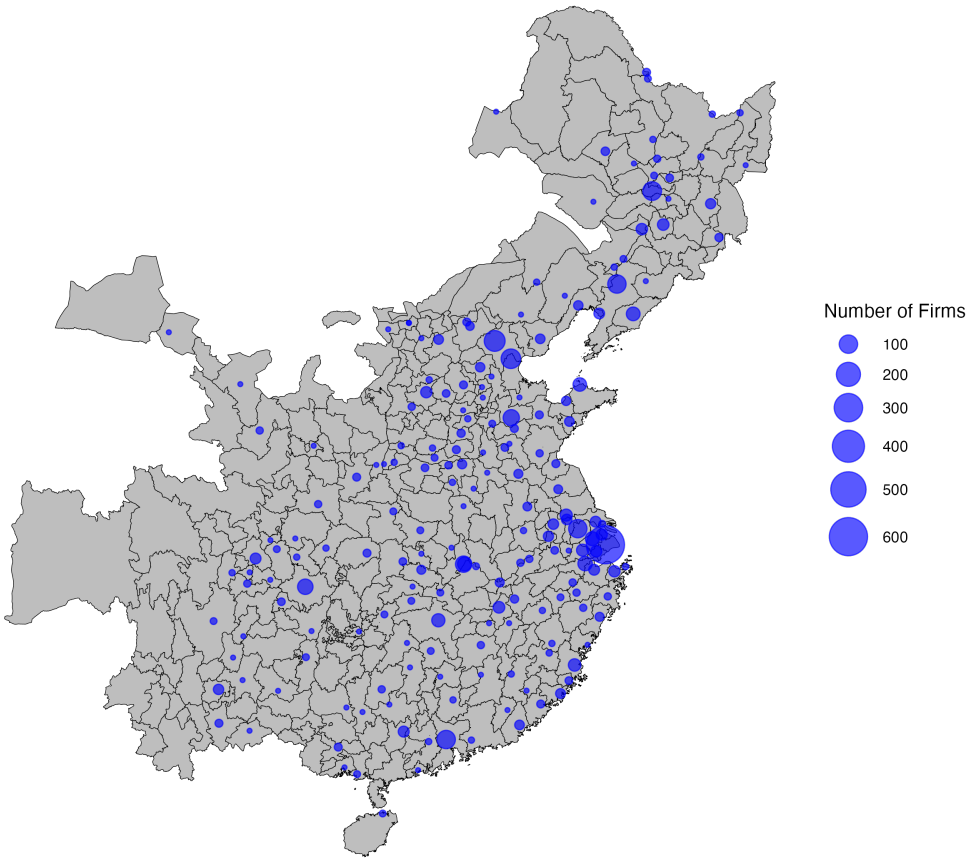


Figure 9: Firm Distribution by Prefecture, 1908 - 1926

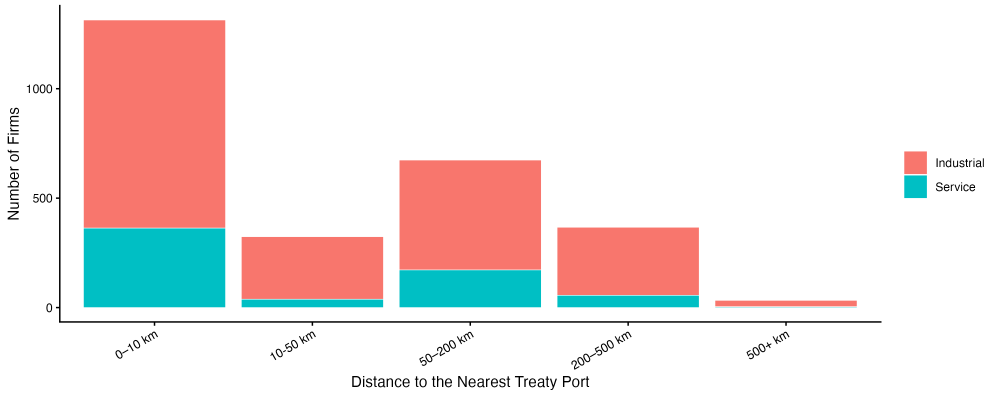


Figure 10: Firm Entry by Distance to the Nearest Port

coordinates. I group firms into five distance bins: 0–10 km, 10–50 km, 50–200 km, 200–500 km, and more than 500 km. Firms within 0–10 km are effectively located in treaty ports. Firms within 10–50 km are located in the immediate surroundings of treaty ports. Firms within 50–200 km are outside treaty ports but may still benefit from spillover effects from nearby treaty ports. Finally, firms within 200–500 km are located in more interior regions that may have experienced only limited spillovers from treaty ports, while firms more than 500 km away are far removed from treaty ports.

Figure 10 shows the distribution of firm entries by distance bin. As expected, regions within 0–10 km of the nearest treaty port had the largest number of firm entries. However, modern firm activity was not confined to treaty ports, as many firms also entered regions located 50 km or more from the nearest treaty port. It is also important to note that, compared to service firms, industrial firms were less concentrated in treaty ports.

As discussed earlier, the value of foreign goods consumed within treaty ports was not recorded under the inland transits data. The baseline empirical analysis therefore excludes firms in the first distance bin, those located within 10 km of a treaty port. This exclusion aligns the empirical sample with the coverage of the trade data. It allows the analysis to identify the relevant mechanisms more precisely. Moreover, unlike the late Qing period, the early Republican era is generally regarded as the first period in Chinese history to experience industrialization on a large scale. This industrialization was "large-scale" precisely because it extended beyond treaty ports into previously underdeveloped interior regions, which are the focus of the empirical analysis. In addition, foreign factories were permitted only in treaty ports and designated concessions, rather than in the interior. Industrialization outside treaty ports was therefore driven primarily by Chinese producers

responding to market forces shaped by access to foreign trade. Focusing on regions outside treaty ports thus offers broader insights into how access to international markets can shape domestically driven industrialization in developing economies.

Two issues, while not central, are nonetheless worth noting. The first concerns where producers learned production techniques (e.g., how to operate machinery). Qualitative evidence suggests that many producers either had previously worked in foreign factories in treaty ports or even had opportunities to study abroad. The second issue concerns how founders raised capital. Although the Chinese Merchants Stock and Commodity Exchange opened in 1920, the domestic stock market was still rarely used by private firms to raise funds (McElderry, 2001). According to Du (1991), firms' capital was primarily raised by founders through personal savings or from friends and relatives. For example, Mu Ouchu (1876–1943), born in Shanghai, was the founder of five textile factories, including a large one in Henan. He entered a textile factory in Shanghai as an apprentice in 1889, where he also attended night school to learn English. He later studied agriculture in the U.S. before returning to China to establish his own business in 1914.

4 Empirical Framework

4.1 Modeling the Decision to Enter the Market

To guide the empirical analysis, a simple firm entry model is presented in Appendix B. The intuition of the model is straightforward. A producer decides whether to enter a region as an industrial firm. If it enters, it relies on capital goods to produce consumer goods.[15] The price of consumer goods in the regional market therefore determines the firm's revenue, while the price of capital goods determines its costs.

As long as imports exist, the arrival price of foreign consumer goods determines the market price of consumer goods in a region, while the arrival price of foreign capital goods determines the market price of capital goods. The empirical task is therefore to measure a region's *foreign trade access*, which shapes the *expected arrival price of consumer goods* (PC) and the *arrival price of capital goods* (PK) faced by prospective entrants.[16] Better access to foreign consumer goods

[15] This reflects the fact that the vast majority of industrial firms during this period operated in the consumer goods sector.

[16] I use the "expected" arrival prices of foreign goods for three reasons. First, actual market prices were generally not available for most commodities in most provinces, so I construct proxies for these prices using measures of foreign

lowers the expected arrival price of consumer goods (PC), reducing the number of entrants due to lower expected revenues (the competition channel). Better access to foreign capital goods lowers the expected arrival price of capital goods (PK), increasing the number of entrants due to lower production costs (the cheaper technology channel).

In the baseline, I assume that in each region the supply of foreign consumer goods and the supply of foreign capital goods are perfectly elastic. This assumption is equivalent to producers in all regions being price takers. It is commonly used in the literature (e.g., Gregg, 2020) and is consistent with the historical context. First, markets during this period were dominated by small, private firms and were highly competitive (Rawski, 1989). Second, China accounted for only 2% of the global market (Keller and Shiue, 2020). Third, the Treaty Port system was largely fixed by treaties before private firms in this period were allowed to operate under market conditions. Under this assumption, PC and PK are exogenously determined.

There are two assumptions implicitly embedded in this setting. The first is that producers consider only immediate revenues and costs, rather than cumulative long-run discounted profits. This assumption is consistent with the historical context, as uncertainty during the early Republican period was high due to political instability (Rawski, 1989). It also reflects the high-uncertainty environments faced by producers in many developing countries. The second implicit assumption is that domestic producers aimed to sell primarily in surrounding markets rather than across provinces. This is consistent with the descriptions in Du (1991) and Rawski (1989), especially for firms outside treaty ports. Moreover, political instability during the early Republican period meant that transporting domestically produced goods over long distances was risky because these goods, unlike imports, did not have the protection afforded by the CMC.

Moreover, one may be concerned about the presence of foreign investment, which is not captured in the firm data. However, this is unlikely to be a major concern. First, following China's defeat in the First Sino-Japanese War in 1895, foreign investors were permitted to establish factories in China, but only within treaty ports and specially designated concessions. Therefore, by focusing on firms located outside treaty ports, the analysis substantially limits the influence of foreign investment.

trade access. Second, in reality, there was a time lag between when a producer decided whether to enter and when production was actually carried out. It is therefore reasonable to assume that producers formed expectations about market prices in a region based on how easily foreign goods reached that region. Finally, many commodities were never imported into a region until a firm chose to enter. For example, machinery used to cut matchsticks did not exist in a region's market until a matchstick factory was established. In such cases, it is even more appropriate to use expected prices, as actual prices would not have existed.

Second, in the competitive markets of the early Republican period, the entry of an additional firm was unlikely to alter the market prices shaped by access to foreign trade and therefore should not have affected other firms' entry decisions.

This framework can be further applied to both aggregate foreign trade access (i.e., the arrival prices of all consumer and capital goods), and industry-specific foreign trade access (i.e., the arrival prices of consumer and capital goods specific to each manufacturing group). However, it is useful to distinguish between these two levels of foreign trade access. Aggregate foreign trade access captures a region's overall exposure to foreign competition and technology transfer. It reflects the broader economic environment in which firms operate, but it is not necessarily tied to the specific margins relevant to firms in a particular manufacturing group. By contrast, industry-specific foreign trade access captures the arrival prices of goods that are more directly related to the costs and revenues faced by firms in that group.

Although treaty ports are not the focus of this paper, areas closer to treaty ports may have benefited from spillovers from the more advanced financial and legal institutions located within treaty ports (Keller and Shiue, 2021). These spillovers may have allowed producers near treaty ports to identify useful information and opportunities and respond to them more efficiently. This suggests that the elasticity of responses to aggregate and industry-specific foreign trade access may vary with distance from treaty ports.

4.2 Price Indices At Ports

The major variation in foreign trade access across regions comes from differences across treaty ports. These differences stem from the fact that treaty ports were connected to different supplier countries, largely shaped by treaties signed during the Qing period.

In this subsection, I first introduce the construction of the price indices. I then use two representative international shocks, World War I and the 1917 Russian Revolution, to demonstrate two sources of exogenous variation. First, countries specialized in different commodities, so when some countries were more affected by a global shock than others, certain commodities were affected more than others. Second, when a country was more affected by a particular event, ports more closely connected to that country were affected more than other ports. Together, these two examples demonstrate the sources of exogenous variation both across treaty ports and between different

types of goods.

4.2.1 Price Indices at Treaty Ports

I compute the competitive price index for each treaty port j in each year t. Importantly, I construct one index for consumer goods ($I^C_{j,t}$) and one index for capital goods ($I^K_{j,t}$).

The competitive price index for consumer goods ($I^C_{j,t}$) is give by

$$I^C_{j,t} = \frac{\sum_{a \in Consumer} \log(V^T_{a,t}) P_{a,j,t}}{\sum_{a \in Consumer} \log(V^T_{a,t})}. \tag{1}$$

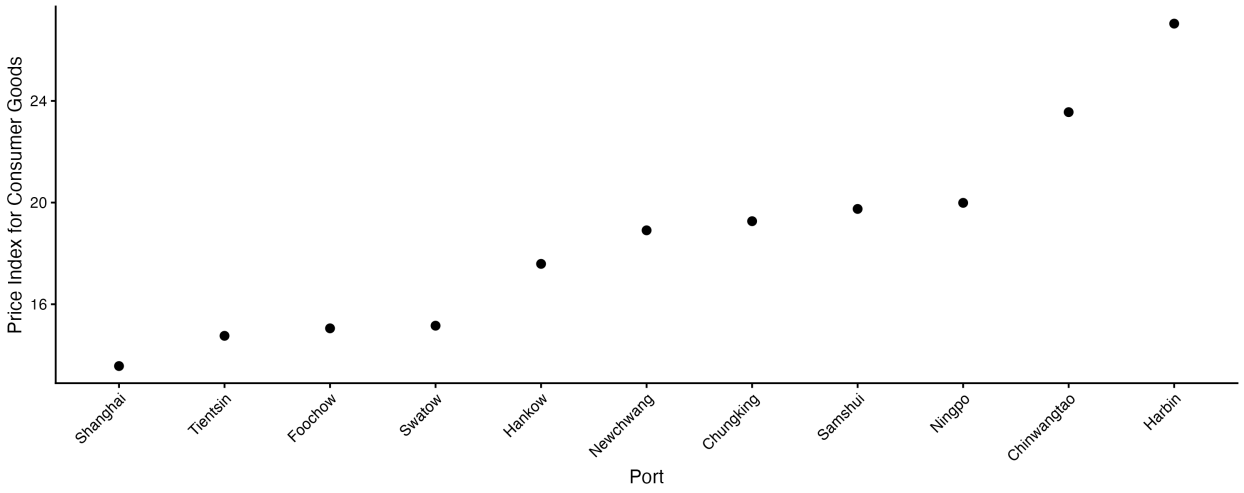
The subscript a refers to an individual commodity. $P_{a,j,t}$ is the price of commodity a at port j in year t, which can be directly observed in my trade data. $V^T_{a,t}$ is the total value of commodity a imported into China in year t, which can also be observed. In short, $I^C_{j,t}$ is the weighted average of the prices of all consumer goods at port j in year t.

For commodities that were not available at port j, I impute their prices using the maximum price of that commodity across all ports where it was available in that year. In this way, I penalize ports with a smaller set of available commodities. The weight for each commodity a, $\log(V^T_{a,t})$, reflects the importance of that commodity in China's total imports and is *independent* of trade at any specific port.

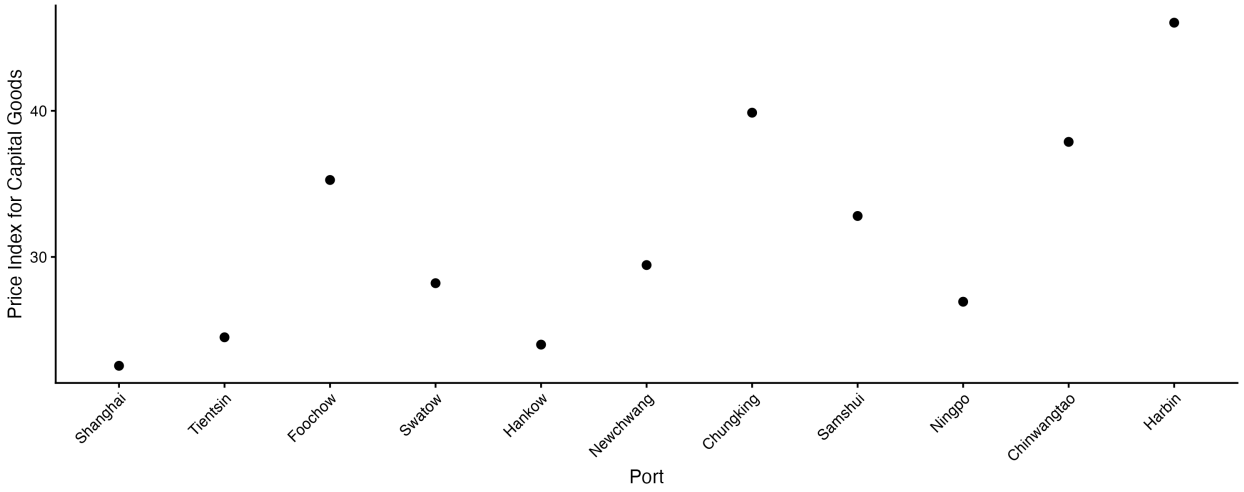
The construction of $I^C_{j,t}$ follows the classic competitive price index used in the trade literature (e.g., Junz and Rhomberg, 1973). This index measures how competitive a port is in supplying consumer goods in a given year. The lower $I^C_{j,t}$ is, the better a port is at supplying consumer goods.

The competitive price index for capital goods, $I^K_{j,t}$, is defined in the same manner as the weighted average of the prices of all capital goods.

Figure 11 presents the constructed I^C and I^K for selected ports in 1917. Larger ports such as Shanghai and Tientsin generally had both lower I^C and lower I^K. However, having a lower I^C did not necessarily imply having a lower I^K. For example, Foochow, a port along China's southeastern coast, had a relatively low I^C but a relatively high I^K. This pattern is consistent with Foochow's close trade connections to British imperial and Southeast Asian entrepôt networks, including Singapore, the Straits Settlements, and British Malaya. These regions had also begun to develop manufacturing during this period, which allowed them to supply consumer goods, but they remained less able to supply capital goods.



(a) Consumer Goods Indices I^C in 1917



(b) Capital Goods Indices I^K in 1917

Figure 11: Competitive Prices Index

4.2.2 Differences in Commodity Supply across Supplier Countries

To explain the sources of variation in price indices across ports, I first show that supplier countries specialized in different commodities. As a result, when a supplier country was hit by an international shock, commodities that depended more heavily on that supplier were affected more than others. Because other countries could not replace the disrupted supplier in the short run, these shocks generated commodity-specific changes in prices across treaty ports.

As an example, I examine the effect of World War I. During the war, Germany was blockaded by Britain, which sharply disrupted Germany's trade with China. I show that commodities primarily supplied by Germany before the war experienced larger price increases at treaty ports.

I define "Germany-dominant" commodities as commodities for which Germany was the largest exporter to China during 1904–1907, such as dyes, colors and paints, and artificial indigo. I then implement an event-study analysis to examine how the prices of these commodities changed relative to other commodities during World War I.

$$\log\left(Price_{j,a,t}\right) = \sum_{\tau \neq 1914} \beta_\tau \left[\text{Germany-dominant}_a \times \mathbf{1}\{t = \tau\}\right] + \gamma_j + \gamma_a + \gamma_t + \varepsilon_{j,a,t},$$

where the dependent variable is the log price of Commodity a at Port j in Year t. The treatment variables are the interactions between an indicator for whether Commodity a was Germany-dominant and a set of year indicators. The year 1914 is omitted as the reference year.

Figure 12 presents the results. Prices of Germany-dominant commodities at treaty ports increased significantly during World War I, when Germany's trade was disrupted by the British blockade. These prices only began to recover in 1921, when Germany gradually returned to the international trade network. This evidence shows that supplier-country shocks affected commodities differently depending on their sourcing structure. It suggests that these exogenous shocks affected different types of goods differently. In other words, access to consumer goods and access to capital goods did not move together.

4.2.3 Heterogeneous Responses to External Shocks across Treaty Ports

A second point is that when a shock hit a source country, some ports were affected more than other ports because of pre-established connections.

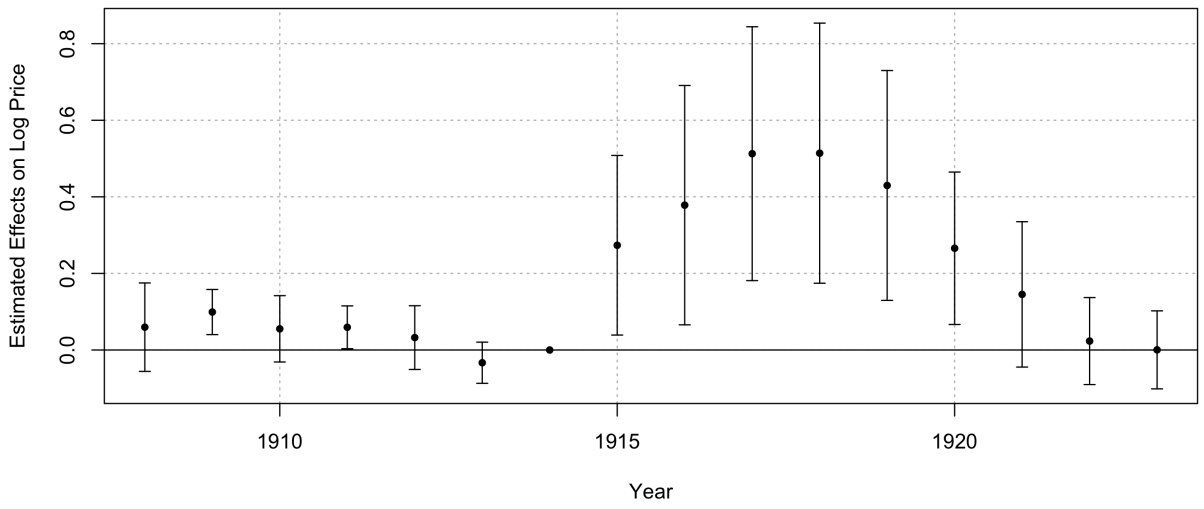


Figure 12: Estimated Effects of WWI on Germany-Dominant Commodities

To illustrate this point, I examine the 1917 Russian Revolution. Russia had become an important trading partner with China after the Treaty of Aigun in 1858. This treaty established the border between the Russian Far East and Northeast China and strengthened Russia's influence along the border. In particular, ports in Northeast China, including Aigun, Harbin, Hunchun, Manchouli, Suifenho had stronger connections with Russia. When the 1917 Revolution disrupted production within Russia, these ports were more heavily affected than other ports.

I estimate the following port-level specification:

$$y_{j,t} = \beta_1 \left(Russian_j \times Year_{t-1917}\right) + \beta_2 \left(Russian_j \times CivilWar_t\right) + \beta_3 \left(Russian_j \times CivilWarTrend_t\right) + \beta_4 \left(Russian_j \times Recovery_t\right) + \beta_5 \left(Russian_j \times RecoveryTrend_t\right) + \gamma_j + \gamma_t + \varepsilon_{j,t}.$$

where $y_{j,t}$ is alternatively $\log(I^C_{j,t})$, $\log(I^K_{j.t})$, or $\log(\frac{I^K_{j,t}}{I^C_{j,t}})$. $Russian_j$ is an indicator equal to one for ports with stronger pre-existing connections to Russia, including Aigun, Harbin, Hunchun, Manchouli, Suifenho. $Year_{t-1917}$ is a linear time trend centered at 1917. $CivilWar_t$ is an indicator for the Russian Civil War period, 1918-1921, and $CivilWarTrend_t$ is a linear trend within this period. $Recovery_t$ is an indicator for years 1922-1926, and $RecoveryTrend_t$ is a linear trend during the recovery period. I further control for port fixed effects, γ_j, and year fixed effects, γ_t.

The coefficients of interest capture whether Russian-connected ports experienced differential changes in price indices relative to other treaty ports after the Russian Revolution. Table 1 reports the results. The estimates show that Russian-connected ports experienced significant price increases during the Russian Civil War period relative to other ports. However, the trends differed between consumer goods and capital goods. Consumer goods prices began to decline relative to other ports, while capital goods prices continued to increase. At the beginning of the recovery period, capital goods prices remained significantly higher in Russian-connected ports, whereas consumer goods prices were not significantly different from those in other ports. Capital goods prices only began to recover gradually during the recovery period.

This pattern is consistent with the historical context. After the short-run disruption caused by the 1917 Russian Revolution and the Russian Civil War, Russian production of consumer goods recovered relatively quickly, while the production of capital goods recovered more slowly. The supply of capital goods only began to recover after 1921, when the New Economic Policy marked a shift toward economic stabilization.

Table 1: The Effects of the 1917 Revolution on Russia-Connected Ports

Dependent Variables:	$\log(I^K)$	$\log(I^C)$	$\log(\frac{I^K}{I^C})$
Model:	(1)	(2)	(3)
Variables			
Russian Ports × baseline trend	0.0024	0.0057	-0.0033
	(0.0054)	(0.0105)	(0.0072)
Russian Ports × Civil War level	0.0714***	0.1285**	-0.0571
	(0.0255)	(0.0553)	(0.0418)
Russian Ports × Civil War trend	0.0208**	-0.0533**	0.0741***
	(0.0098)	(0.0226)	(0.0177)
Russian Ports × Recovery level	0.1099*	-0.0964	0.2063***
	(0.0549)	(0.0982)	(0.0536)
Russian × Recovery trend	-0.0225**	−0.0000	-0.0225**
	(0.0094)	(0.0125)	(0.0099)
Fixed-effects			
Port	Yes	Yes	Yes
Year	Yes	Yes	Yes
Fit statistics			
Observations	886	886	886
R^2	0.93344	0.85192	0.84034
Within R^2	0.02204	0.02540	0.01801

Clustered (Port) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

These two examples both illustrate how external shocks created significant variation both across ports and across different types of commodities. However, it is important to note that both World

War I and the Russian Revolution are examples illustrating where the variation in price indices across ports came from. They should not be interpreted as the only sources of variation. In fact, because China was a price taker in the global market, any external supply shock could be viewed as an exogenous shock to China. The unique structure of the Treaty Port system further meant that these shocks were transmitted differently across ports. The price indices introduced above effectively incorporate all shocks of this type.

Finally, I test the degree of comovement between I^C and I^K. Specifically, I estimate the following specification:

$$\Delta \log I^K_{j,t} = \Delta \log I^C_{j,t} + \gamma_j + \gamma_t + \varepsilon_{j,t}, \tag{2}$$

where $\Delta I^K_{j,t} = I^K_{j,t} - I^K_{j,t-1}$. The key test is whether β is statistically significant, which would imply that I^C and I^K move together. Table 2 shows that there is not significant relationship between I^C and I^K.

Table 2: I^C and I^K Not Move Together

Dependent Variable:	$\Delta \log(I^K)$
Model:	(1)
Variables	
$\Delta \log(I^C)$	0.0879
	(0.0547)
Fixed-effects	
Year	Yes
Port	Yes
Fit statistics	
Observations	837
R^2	0.82454
Within R^2	0.00564

Clustered (Port) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

This result suggests that the capital goods and consumer goods price indices are not simply capturing the same aggregate port-level price shock. Instead, the two indices contain distinct sources of variation, making it possible to distinguish between the competition and technology transfer channels.

4.3 Estimates of Foreign Trade Access

I estimate foreign trade access primarily at the provincial level for three reasons. First, the province is the unit used in the inland transit data, which are observed at the port-province level. The data are therefore less suitable for empirical analysis at a more granular level. Second, provinces differed in their access to foreign consumer goods and foreign capital goods because they were connected to different treaty ports. As a result, there is substantial variation in foreign trade access across provinces. Third, during the early Republican period, China became fragmented into regions controlled by regional military governors, each of whom typically controlled one province. Grouping the data by province therefore aligns the analysis with the relevant historical context. I also present prefectural-level results as a robustness check in Appendix D.

For each province, foreign trade access consists of two components: the price index at each treaty port (either I^C or I^K), and the internal trade costs of moving foreign goods from each treaty port to the province, which are captured by the exogenous geographic distance $\log(Distance)$.

The baseline measure of a region's access to foreign consumer goods, PC, is given by

$$PC_{i,t} = \frac{\sum_{j=1}^{J} w_{i,j,t} \log(Distance_{i,j}) \cdot I^C_{j,t}}{\sum_{j=1}^{J} w_{i,j,t}}, \text{ where } w_{i,j,t} = \log(\rho^{Consumer}_{j,t-1} Flow_{i,j,t-1}). \tag{3}$$

The term $I^C_{j,t}$ denotes the competitive price index for consumer goods at port j in year t, and $\log(Distance_{i,j})$ is the geographic distance between province i and port j, calculated using geographic coordinates. This distance term captures the internal trade costs of moving imported goods from the port to the province. The product $\log(Distance_{i,j}) \cdot I^C_{j,t}$ therefore gives the expected arrival price of foreign consumer goods shipped from port j to province i.

The weights are given by $w_{i,j,t} = \log(\rho^{Consumer}_{j,t-1} Flow_{i,j,t-1})$, where $\rho^{Consumer}_{j,t-1}$ represents the share of consumer goods at port j in the previous year, and $Flow_{i,j,t-1}$ is the total value of imports transported from port j to province i in the previous year. Both variables are directly observed in the data. The log transformation mitigates the influence of extreme values.

Overall, a region's expected arrival price of foreign consumer goods is a weighted average of the expected arrival prices of consumer goods shipped from all treaty ports to that region. The weights capture the extent to which a region relied on each port for consumer goods.[17]

[17]The combination of current port-level prices with previous-year trade flows is justified by both historical considerations and practical constraints. While investors or prospective firms could potentially obtain up-to-date price

The expected arrival prices of capital goods, PK, are calculated in the same manner.[18]

$$PK_{i,t} = \frac{\sum_{j=1}^{J} w_{i,j,t} \log(Distance_{i,j}) \cdot I_{j,t}^{K}}{\sum_{j=1}^{J} w_{i,j,t}}, \text{ where } w_{i,j,t} = \log(\rho_{j,t-1}^{Capital} Flow_{i,j,t-1}). \tag{4}$$

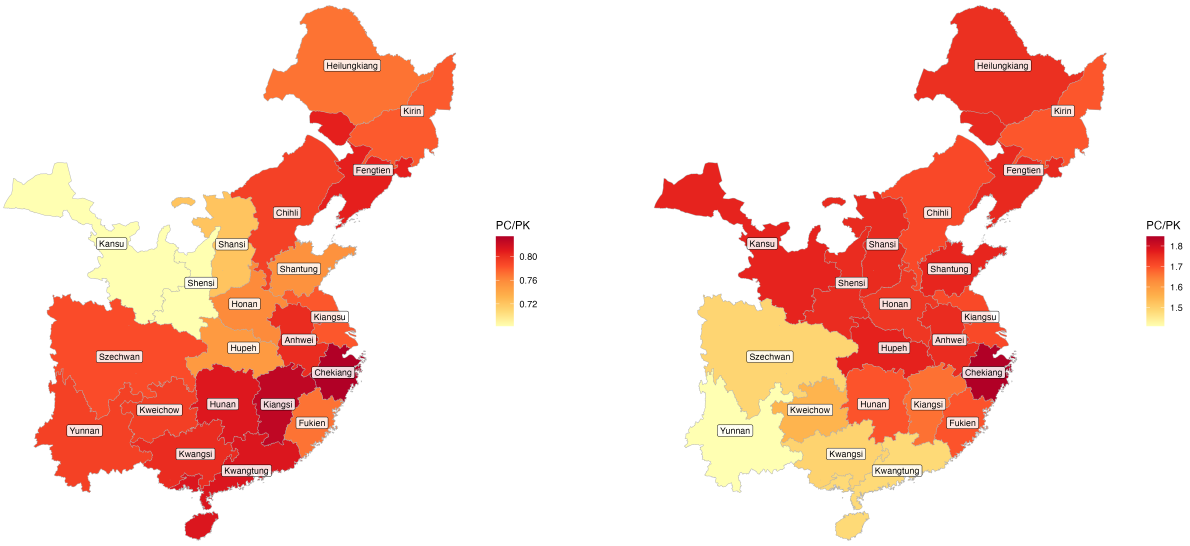
The expected arrival prices reflect the essence of the "market access" approach. Donaldson and Hornbeck (2016) constructs a measure of "market access," derived from general equilibrium trade theory, to quantify the trade potential of a region. A region's market access increases when its trade costs with other regions decrease, particularly when those regions have larger populations and are costly to access from elsewhere. The approach in this study captures each region's "access to global markets." A region's access increases when the trade cost between a province and a port was low, especially when the port is highly competitive (as measured by the competitive price indices I^C or I^K) and the province relies heavily on that port (as measured by the weights $w_{i,j,t}$). As a region's foreign trade access increases, the expected arrival price decreases.

The expected arrival prices also share the flavor of a shift-share design. The identification relies on many exogenous "shifts," driven by external global shocks, as captured by I^C and I^K. Lagged trade flows serve as the "shares," transmitting these global shocks to different regions. The absence of pre-trends in the examples of World War I and the Russian Revolution further suggests that the identifying shifts pass the relevant balance tests. One potential concern with this design is the possible endogeneity of the shares. However, with plausibly exogenous shifts, endogenous exposure shares need not invalidate a shift-share design, as pointed out by Borusyak et al. (2025). I further address this concern in Appendix F.

Figure 13 presents each region's access to foreign consumer goods relative to foreign capital goods (PC/PK). To separate the competition channel (through PC) from the cheaper technology channel (through PK), it is important to have variation not only in each measure individually but also in their relative values. Figure 13 confirms the presence of such variation. Another observation is that, over time, access to capital goods overall improved relative to access to consumer goods. This was likely due to successful industrialization in many countries, such as Japan, which increased the global supply of capital goods.

information from newspapers, their knowledge of port access and transportation costs typically relied on information from the previous year. Moreover, using lagged trade flows helps mitigate potential concerns about reverse causality.

[18] The main variation in foreign trade access came from differences across treaty ports. I therefore do not differentiate internal trade costs across different types of goods.



(a) PC/PK 1915 (b) PC/PK 1926

Figure 13: Relative Access PC/PK

Source: the CMC trade reports. See Section 3 for details. The PC and PK measures are explained in detail in the text.

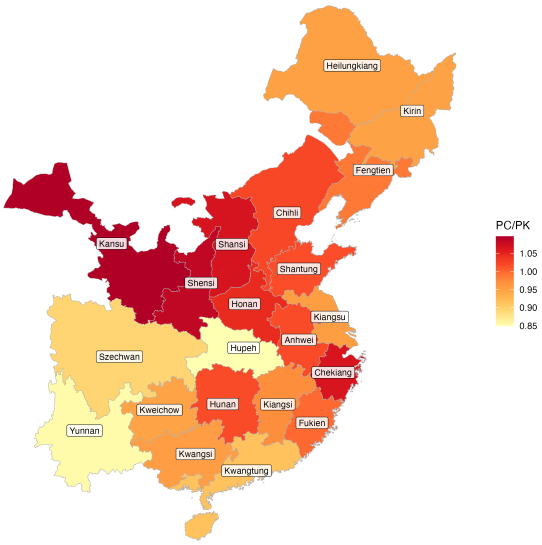
I further calculate category-specific measures of PC and PK. The formula is the same as in the baseline measure, except that, for each category, I use only the consumer goods or capital goods matched to that category rather than all consumer or capital goods. Figure 14 presents the ratio of PK to PC separately for four categories in 1924. The figure shows substantial variation across categories, reflecting differences in supplier-country specialization and pre-existing port-country connections, as discussed earlier.

In the following empirical analysis, I begin by analyzing the effects of aggregate foreign trade access on overall modern firm entry at the provincial level. I then examine the effects of industry-specific foreign trade access on industry-specific firm entry. I present the analysis at the most granular prefecture-group level in Appendix D.

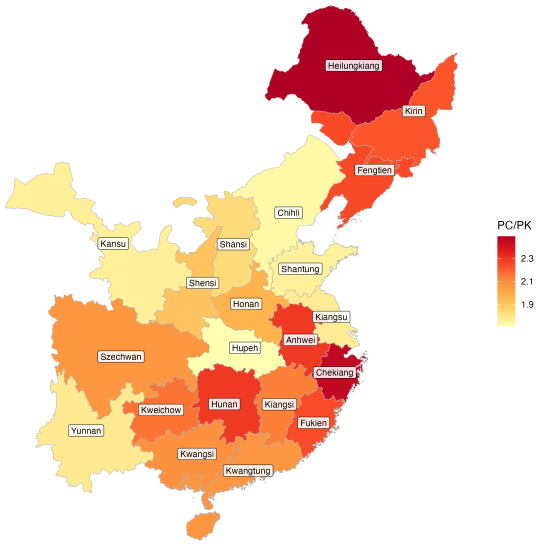
4.4 Aggregate Foreign Trade Access

The baseline estimating equation is given by

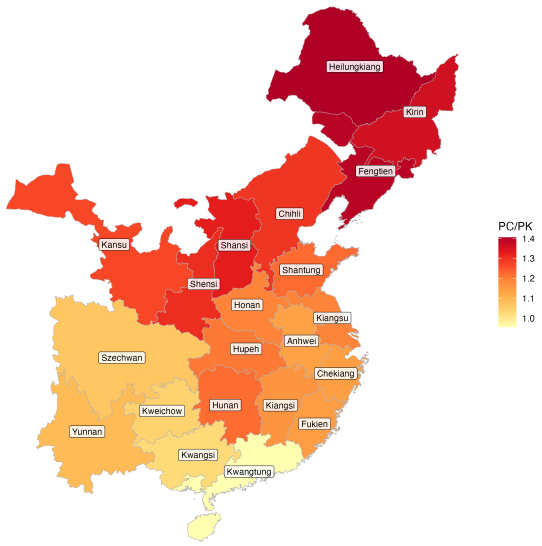
$$\log(\#Entry_{i,t}) = \beta^C \log(PC_{i,t}) + \beta^K \log(PK_{i,t}) + \gamma_i + \gamma_t + \epsilon_{i,t}. \tag{5}$$



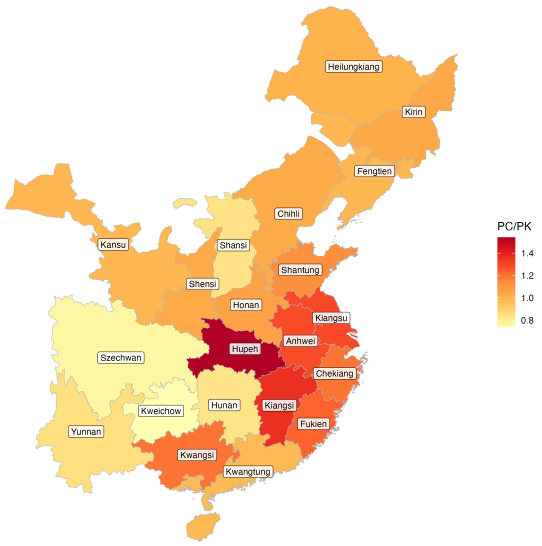
(a) Textiles and Apparel, PC/PK, 1924



(b) Light Chemical Goods, PC/PK, 1924



(c) Food, Beverages, and Tobacco, PC/PK, 1924



(d) Material-Based Daily-use Goods, PC/PK, 1924

Figure 14: Industry-Specific Relative Access (PC/PK) in 1924

Source: the CMC trade reports. See Section 3 for details. The industry-specific PC and PK measures are explained in detail in the text.

The baseline equation is a simple two-way fixed effects model, where $\#Entry_{i,t}$ denotes the number of industrial firm entries in province i in year t. $PC_{i,t}$ measures province i's aggregate access to foreign consumer goods (i.e., the arrival prices constructed from the full bundle of consumer goods), as defined in the previous subsection, and $PK_{i,t}$ measures the aggregate access to foreign capital goods. The coefficient β^C captures the elasticity of firm entry with respect to access to foreign consumer goods, while β^K captures the elasticity with respect to access to capital goods. The term γ_i represents province fixed effects, and γ_t represents year fixed effects. An advantage of using panel data rather than cross-sectional data is that it allows me to control for time-invariant characteristics that may influence the selection of treaty ports through province fixed effects.

Motivated by recent concerns in the econometrics literature regarding log-transformed outcomes with zeros, as emphasized by Chen and Roth (2024), I report both OLS and PPML results. Given the presence of zeros in the dependent variable, I primarily interpret the coefficients from the PPML specifications.

The competition channel predicts that $\beta^C > 0$: better access to foreign consumer goods leads to a lower PC, which in turn reduces industrial firm entry due to increased competition. The cheaper technology channel predicts that $\beta^K < 0$: better access to foreign capital goods leads to a lower PK, which in turn increases industrial firm entry by reducing the cost of technology.

Table 3 reports the estimates of Equation 5. Column (1) presents the OLS results for overall firm entry. Column (2) presents the PPML results for overall firm entry, while Column (3) reports the PPML results for industrial firm entry only. Column (2) shows that a 1% increase in the arrival price of consumer goods is associated with a 3% increase in firm entry, while a 1% increase in the arrival price of capital goods is associated with a 2.3% decrease in firm entry. To provide intuition for what a 1% increase in PC or PK represents, Equation (3) implies that such an increase is equivalent to a 1% increase in tariffs on all foreign consumer or capital goods. Column (3) confirms that industrial firms indeed responded to market incentives shaped by foreign trade access. The coefficients in Column (3) are similar to those in Column (2). This is reasonable because the majority of firms were industrial firms. Moreover, although service firms did not compete directly with foreign products, they often served industrial firms and therefore still responded to market incentives shaped by foreign trade access.

Two features of these results are noteworthy. First, they show that the competition channel

Table 3: The Effects of Aggregate Foreign Trade Access on Firm Entry

Dependent Variables:	log(Entry+1)	Entry	Industrial	log(Entry+1)	Entry	Industrial	Entry
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	OLS	PPML	PPML	OLS	PPML	PPML	PPML
Variables							
$\log(PC)$	1.942*	3.067***	3.108**				
	(0.9963)	(1.093)	(1.351)				
$\log(PK)$	-1.768**	-2.343**	-2.188**				
	(0.6709)	(0.9444)	(0.9591)				
$\log(PC) \times \mathbf{1}\{d^{port} < 50\}$				0.9095*	3.398**	3.528**	
				(0.5036)	(1.413)	(1.789)	
$\log(PC) \times \mathbf{1}\{50 \leq d^{port} < 200\}$				0.6110	2.980***	3.000***	
				(0.4300)	(0.9502)	(1.162)	
$\log(PC) \times \mathbf{1}\{200 \leq d^{port} < 500\}$				0.7165*	2.772***	2.683**	
				(0.4118)	(1.010)	(1.239)	
$\log(PC) \times \mathbf{1}\{d^{port} \geq 500\}$				0.9348**	3.862*	4.646**	
				(0.3738)	(1.983)	(2.320)	
$\log(PK) \times \mathbf{1}\{d^{port} < 50\}$				-0.5843*	-2.423**	-2.182**	
				(0.2947)	(0.9796)	(1.041)	
$\log(PK) \times \mathbf{1}\{50 \leq d^{port} < 200\}$				-0.6096*	-2.371***	-2.255**	
				(0.2929)	(0.9186)	(0.9251)	
$\log(PK) \times \mathbf{1}\{200 \leq d^{port} < 500\}$				-0.5908*	-2.278**	-2.138**	
				(0.3140)	(1.001)	(1.034)	
$\log(PK) \times \mathbf{1}\{d^{port} \geq 500\}$				-0.6649**	-2.782**	-2.780**	
				(0.2807)	(1.121)	(1.108)	
$Z_{\log(PC)}$							0.0556
							(0.1984)
$Z_{\log(PK)}$							-0.5065***
							(0.1684)
$Z_{\log(PC)} \times Z_{\log(PK)}$							-0.4369***
							(0.0931)
Fixed-effects							
Province	Yes	Yes	Yes				Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province × distance bin				Yes	Yes	Yes	
Fit statistics							
Observations	399	399	399	1,596	1,596	1,596	399
Squared Correlation	0.62430	0.75283	0.71223	0.64942	0.74722	0.67746	0.77589
Pseudo R^2	0.37762	0.47700	0.43912	0.55572	0.57224	0.53092	0.49075
BIC	889.33	1,753.5	1,652.0	2,148.7	3,216.4	3,038.6	1,719.8

Clustered (Province) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: This table reports the effects of aggregate access to foreign trade on domestic firm entry. The estimating equation is $\log(\#Entry_{i,t}) = \beta^C \log(PC_{i,t}) + \beta^K \log(PK_{i,t}) + \gamma_i + \gamma_t + \epsilon_{i,t}$. Column (1) reports the OLS estimates for all domestic firms. Column (2) reports the corresponding PPML estimates, and Column (3) reports the PPML estimates for industrial firms only. Columns (4)–(6) repeat the specifications in Columns (1)–(3), respectively, after dividing firm entry within each province into distance bins based on distance to the nearest treaty port. Column (7) uses the standardized arrival prices, and includes their interaction. Observations in fixed-effect groups that do not contribute to coefficient identification are retained when reporting the sample size, so that the reported number of observations reflects the full sample used for each specification; retaining these observations does not affect the coefficient estimates.

and the technology transfer channel operate simultaneously. The overall effects of foreign trade on industrialization can vary significantly across regions, depending on the relative strength of these two channels. Second, in general domestic producers appear to be more responsive to competition than to cheaper technology ($|\beta^C| > |\beta^K|$). This is also consistent with theoretical intuition: an increase in the unit price of output translates one-for-one into revenue, whereas an increase in the unit cost of capital goods does not translate one-for-one into total production costs when firms also use labor as an input.

Columns (4) to (6) in Table 3 further show the effects of foreign trade access by distance to the nearest treaty port. While the magnitudes of the coefficients varied slightly, the results indicate that producers actively responded to aggregate foreign trade access regardless of their distance from treaty ports. If anything, the OLS results suggest that producers closer to treaty ports were less responsive to aggregate foreign trade access, probably because spillovers from treaty ports allowed them to remain more stable in the face of fluctuations in the broader economic environment. These findings suggest that producers, even in developing regions such as early Republican China, still responded actively to market incentives, in this case shaped by foreign trade access.

The next question is how access to consumer goods interacts with access to capital goods. Column (7) shows that the interaction between normalized PC and PK has a significant negative effect.[19] Producers were more responsive to foreign competition when access to capital goods was better (i.e., PK was low). The interpretation is that, at the aggregate level, access to technology was the binding constraint. When capital goods were prohibitively expensive (PK was high), domestic producers had limited ability to enter the market in the first place. As a result, their entry decisions were less responsive to foreign competition. Only when access to capital goods improved sufficiently did competition from foreign consumer goods begin to play an important role in firm's entry decisions. This pattern is consistent with the experience of late-developing economies at the early stage of industrialization, where being able to access capital goods, such as equipment, machinery, and industrial materials, was often a prerequisite for modern firm entry. Moreover, when one force was more favorable (i.e., PC was high or PK was low), producers were more responsive to the other force. This pattern suggests that the two forces were complementary

[19] $Z_{\log(PC)}$ ($Z_{\log(PK)}$) refers to the within-year standardized value of $\log(PC)$ ($\log(PK)$), constructed by applying the z-score transformation separately within each year. Applying the z-score transformation makes the interpretation of the results more straightforward.

in shaping the aggregate economic environment: if either was sufficiently unfavorable, potential entrants were likely to be deterred, and improvements in the other had little effect.

4.5 Industry-Specific Foreign Trade Access

I next disaggregate foreign trade access by manufacturing group. The estimating equation for industry-specific foreign trade access is given by:

$$\log(\#Entry_{i,t,g}) = \beta^C \log(PC_{i,t,g}) + \beta^K \log(PK_{i,t,g}) + \gamma_{i,t} + \gamma_{g,t} + \epsilon_{i,t,g}. \tag{6}$$

This estimating equation is similar to Equation 5. The subscript g denotes a specific manufacturing group. However, because it allows foreign trade access to vary across sectors within a province-year, it can control for province-year fixed effects and compare sectors within the same province and year. The main source of variation in this equation comes not only from variation across treaty ports, but also from their relative advantages in supplying different industry-specific goods due to differences in their supplier countries. At the same time, the inclusion of province-year fixed effects controls for province-level political conditions, particularly differences across warlord regimes in a given year. Finally, comparing firms' responses to aggregate foreign trade access and industry-specific foreign trade access provides important insights into how foreign trade shaped industrial development in developing countries.

Columns (1) and (2) in Table 4 indicate that the channels of competition and technology transfer still worked effectively at the industry-specific level. Better access to industry-specific foreign consumer goods (lower PC), discouraged domestic firms in the same manufacturing group from entering the market, while better access to industry-specific foreign capital goods (lower PK), encouraged entry.[20]

However, Columns (3) and (4) show that producers in areas closer to treaty ports were more responsive to industry-specific foreign trade access. This pattern is different from the results for aggregate trade access, where producers all actively responded to market incentives. It provides important implications for understanding industrialization in developing countries. Producers under better institutional conditions may have been more able to capture and respond to industry-specific

[20]Due to the zeros in the dependent variable, the magnitudes of the estimates differ between OLS and PPML, but the qualitative patterns are the same.

incentives directly relevant to their own returns. In fact, a better institutional environment, even through spillovers from treaty ports, may have allowed producers to seize relevant economic opportunities more effectively. This was particularly pronounced for capital goods, whose expected arrival prices were less transparent and more difficult to assess than those of consumer goods.

Column (5) in Table 4 shows a different pattern from the aggregate foreign trade access results. The key difference is that the interaction between PC and PK becomes positive. Industry-specific access captures the relevant production margins faced directly by firms, rather than the broad economic environment captured by aggregate foreign trade access. At this more specific margin, competition directly faced by domestic producers became more critical. When competitive pressure was low (i.e., PC was high) producers were less sensitive to the cost of technology because expected revenues were sufficiently high to absorb even high production costs. Conversely, when one margin was unfavorable, the profitability of entry depended more tightly on whether the other margin remained manageable. As a result, producers were more responsive to changes along the other margin.

4.6 Robustness

One potential concern is that the baseline sample includes the transition from the Qing dynasty to the early Republican period. In particular, the Qing dynasty ended in 1911. Although the transition was relatively peaceful, some may concern that the estimated effects could be driven by the final years of the Qing dynasty. To address this concern, I rerun all regressions using only the post-1912 sample. The results, presented in Appendix C, are qualitatively unchanged.

Another potential concern is that the results may be driven primarily by influential provinces. In particular, provinces containing major treaty ports may drive the estimates. I therefore exclude Chihli, Kwangtung, and Kiangsu and re-estimate the baseline specifications for both aggregate foreign trade access and industry-specific foreign trade access. These provinces contained Tientsin, Canton, and Shanghai, respectively, the three largest treaty ports. Table 5 reports the PPML estimates. The coefficients remain robust across these specifications, suggesting that the estimated effects of foreign trade access are not driven by any single influential province.

Moreover, one might be concerned that wage levels are omitted from the baseline specifications. In principle, labor is an input alongside capital goods, and higher wages should therefore reduce

Table 4: The Effects of Industry-Specific Foreign Trade Access on Industry-Specific Firm Entry

Dependent Variables:	log(Entry+1)	Entry	log(Entry+1)	Entry	
Model:	(1)	(2)	(3)	(4)	(5)
	OLS	PPML	OLS	PPML	PPML
Variables					
$\log(PC)$	0.1702**	3.468***			
	(0.0751)	(0.8923)			
$\log(PK)$	-0.3493**	-1.678*			
	(0.1501)	(0.9327)			
$\log(PC) \times \mathbf{1}\{d^{port} < 50\}$			0.0522**	3.685***	
			(0.0226)	(0.9569)	
$\log(PC) \times \mathbf{1}\{50 \leq d^{port} < 200\}$			0.0567**	3.448***	
			(0.0222)	(0.9006)	
$\log(PC) \times \mathbf{1}\{200 \leq d^{port} < 500\}$			0.0533**	3.532***	
			(0.0228)	(0.9348)	
$\log(PC) \times \mathbf{1}\{d^{port} \geq 500\}$			0.0325	3.092***	
			(0.0221)	(1.004)	
$\log(PK) \times \mathbf{1}\{d^{port} < 50\}$			-0.1289***	-1.678*	
			(0.0446)	(0.9404)	
$\log(PK) \times \mathbf{1}\{50 \leq d^{port} < 200\}$			-0.1545***	-1.677*	
			(0.0460)	(0.9008)	
$\log(PK) \times \mathbf{1}\{200 \leq d^{port} < 500\}$			-0.0861*	-0.2887	
			(0.0441)	(0.9938)	
$\log(PK) \times \mathbf{1}\{d^{port} \geq 500\}$			-0.0828*	0.8352	
			(0.0432)	(1.185)	
$Z_{\log(PC)}$					0.4576**
					(0.2247)
$Z_{\log(PK)}$					-0.2990
					(0.2016)
$Z_{\log(PC)} \times Z_{\log(PK)}$					0.5286***
					(0.1543)
Fixed-effects					
Province × Year	Yes	Yes	Yes	Yes	Yes
Industry Group × Year	Yes	Yes	Yes	Yes	Yes
Province × distance bin			Yes	Yes	
Fit statistics					
Observations	1,596	1,596	6,384	6,384	1,596
Squared Correlation	0.45009	0.68935	0.27687	0.53392	0.67629
Pseudo R^2	0.52406	0.53026	-2.2029	0.54867	0.52833
BIC	4,377.4	4,948.9	1,941.3	6,988.4	4,962.2

Clustered (Province-Year & Industry Group-Year)) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: This table reports the effects of industry-specific access to foreign trade on industry-specific domestic firm entry. The estimating equation is $\log(\#Entry_{i,t,g}) = \beta^C \log(PC_{i,t,g}) + \beta^K \log(PK_{i,t,g}) + \gamma_{i,t} + \gamma_{g,t} + \epsilon_{i,t,g}$. Column (1) reports the OLS estimates and Column (2) reports the PPML estimates. Columns (3) and (4) repeat the specifications in Columns (1) and (2), respectively, after dividing firm entry within each province into distance bins based on distance to the nearest treaty port. Column (5) uses the standardized arrival prices, and includes their interaction. Observations in fixed-effect groups that do not contribute to coefficient identification are retained when reporting the sample size, so that the reported number of observations reflects the full sample used for each specification; retaining these observations does not affect the coefficient estimates.

Table 5: Dropping Influential Provinces

Dependent Variable:	Aggregate			Industry-Specific		
	Entry					
	Chihli	Kiangsu	Kwangtung	Chihli	Kiangsu	Kwangtung
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
log(PC)	3.101**	2.486*	2.662***	3.495***	2.831***	3.138***
	(1.279)	(1.279)	(0.9851)	(0.9191)	(0.8541)	(0.9499)
log(PK)	-2.533**	-3.306***	-1.881**	-1.657*	-3.258***	-1.943*
	(1.012)	(0.9393)	(0.8029)	(0.9724)	(1.174)	(1.011)
Fixed-effects						
Province	Yes	Yes	Yes			
Year	Yes	Yes	Yes			
Province × Year				Yes	Yes	Yes
Industry Group × Year				Yes	Yes	Yes
Fit statistics						
Observations	380	380	380	1,520	1,520	1,520
Squared Correlation	0.71532	0.70029	0.77985	0.70029	0.68347	0.69380
Pseudo R^2	0.44903	0.42988	0.49996	0.54703	0.51288	0.53590
BIC	1,649.7	1,628.9	1,627.2	4,634.6	4,597.1	4,715.4

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: This table reports the leave-one-out PPML estimates. The first three columns report results using the aggregate foreign trade access, while the last three columns report results using the industry-specific foreign trade access. Column headings indicate the province excluded from each specification. Standard errors are clustered at the province level in the first three columns and clustered at the province-year and industry group-year levels in the last three columns.

firm entry. The estimates on PC and PK could be biased if wages are not controlled for. This concern is limited, however. In the industry-specific foreign trade access specifications, province-year fixed effects absorb time-varying differences in labor costs across provinces. In the aggregate specifications, province fixed effects account for time-invariant differences in wages across provinces, but time-varying changes in wages could still bias the estimates. Unfortunately, reliable province-level data on industrial wages are not available. I therefore collect annual province-level data on agricultural labor wages from Buck (1956) and use them as a proxy for labor costs. Appendix E provides further details on the wage data. Table 6 shows that higher wages have a significantly negative effect on firm entry. However, controlling for wages has little effect on the estimated coefficients for consumer-goods prices (PC) and capital-goods prices (PK).[21]

Table 6: The Effects of Aggregate Foreign Trade Access with Wage Controls

Dependent Variables:	log(Entry+1)	Entry	Industrial
Model:	(1)	(2)	(3)
	OLS	PPML	PPML
Variables			
log(PC)	2.828**	4.181***	4.471***
	(1.014)	(1.375)	(1.447)
log(PK)	-1.472*	-2.613**	-2.387**
	(0.7334)	(1.116)	(1.141)
log(Wage)	-1.116***	-1.398***	-1.704***
	(0.3723)	(0.3736)	(0.3588)
Fixed-effects			
Province	Yes	Yes	Yes
Year	Yes	Yes	Yes
Fit statistics			
Observations	342	342	342
Squared Correlation	0.64577	0.79395	0.77540
Pseudo R^2	0.40347	0.50303	0.46610
BIC	752.32	1,435.8	1,329.1

Clustered (Province) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

A final concern relates to the potential endogeneity of the baseline measures of foreign trade access. One might worry that the use of observed trade flows may introduce endogeneity. However, the measures are constructed using lagged trade flows, which helps mitigate concerns about reverse causality. Moreover, the availability of internal trade flow data, which is rare in other settings, allows foreign trade access to be measured more precisely. However, to further address endogeneity concerns, I construct instruments that replace observed trade shares with exogenous shares based on

[21] Wage data are unavailable for Manchuria (Heilungkiang, Fengtien, and Kirin), so these provinces are excluded from the analysis.

geographic distance. Further details are provided in the Appendix F. In summary, the instruments are strong, but the tests fail to reject the null hypothesis that the IV estimates are equal to the baseline estimates. Although this does not establish that the baseline measures of PC and PK are exogenous, the IV results, together with the evidence from shocks such as WWI and the Russian Revolution, largely alleviate concerns about endogeneity.

5 Conclusion

This paper develops a framework to analyze how foreign trade shapes industrialization in developing countries. In particular, it distinguishes between two opposing forces: competition and technology transfer. Increased access to foreign consumer goods introduces more competition and discourages the entry of domestic producers, whereas increased access to foreign capital goods lowers the cost of technology and encourages the entry of industrial producers. The findings in this paper show that these two forces operate simultaneously. The overall effects of foreign trade can therefore vary significantly across regions, depending on the relative strength of these two forces.

The findings have important implications. On the one hand, they provide evidence in support of infant industry protection. Domestic producers in general are more responsive to competition than to cheaper technology, so an increase in access to all foreign goods may not necessarily promote industrialization. On the other hand, access to foreign capital goods provides incentives for domestic producers to adopt new technologies. Foreign trade brings in machinery, equipment, and other inputs that could not be produced domestically. Rather than uniformly increasing or decreasing openness to all foreign goods, the key driver of industrialization lies in improving access to technology relative to competition.

Moreover, this paper distinguishes between aggregate foreign trade access and industry-specific foreign trade access. Aggregate foreign trade access shaped the broader economic environment, while industry-specific foreign trade access shaped the margins that producers directly faced. The paper shows the importance of institutional quality in shaping the effects of foreign trade access. Better institutional quality allowed producers to better capture the market signals most relevant to them. At the aggregate level, access to technology was critical, while at the industry-specific level, competition became more critical. Together, these findings have important implications for developing countries when designing trade policies and accounting for spatial differences under a

common trade regime.

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A Data Summary

Table A1: Average Number of Commodities by Port

Port	All Commodities	Consumer Goods	Capital Goods
Shanghai	301.7	204.4	97.3
Dairen	296.8	196.5	100.2
Tientsin	293.3	200.9	92.3
Canton	292.9	201.9	91.0
Hankow	278.3	190.0	88.3
Swatow	271.9	188.9	83.0
Antung	269.4	185.8	83.7
Amoy	262.3	181.0	81.3
Kiaochow	261.5	180.2	81.3
Newchwang	259.8	178.4	81.4
Foochow	256.9	177.8	79.1
Chefoo	246.0	173.7	72.3
Nanking	235.4	159.4	76.0
Changsha	232.7	162.7	70.0
Wuhu	228.8	156.1	72.7
Kiukiang	224.5	156.7	67.8
Ningpo	222.6	151.1	71.4
Chinkiang	222.3	151.9	70.5
Kowloon	220.8	145.1	75.7
Kiungchow	203.6	149.0	54.6
Chungking	200.9	147.0	53.9
Lappa	196.8	135.5	61.3
Wuchow	190.6	137.3	53.3
Mengtsz	188.9	140.8	48.1
Suifenho	187.5	130.1	57.5
Ichang	180.7	129.6	51.0
Pakhoi	179.0	133.9	45.0
Kongmoon	175.0	122.9	52.1
Chinwangtao	174.6	118.6	56.0
Wenchow	161.4	113.1	48.3
Hangchow	159.3	98.2	61.1
Manchouli	157.2	110.2	46.9
Samshui	155.9	110.6	45.3
Shasi	155.4	118.1	37.3
Soochow	146.4	99.6	46.8
Nanning	141.5	107.8	33.8
Lungchingtsun	136.1	101.6	34.4
Lungkow	135.1	96.2	38.8
Yochow	134.8	102.6	32.2
Aigun	129.9	101.7	28.2
Tengyueh	122.4	97.0	25.4
Wanhsien	120.7	89.8	30.8
Hunchun	103.9	83.2	20.6
Sansing	90.0	70.2	19.8
Harbin	60.2	41.3	18.9
Santuao	52.2	35.8	16.4
Lungchow	37.8	28.0	9.8
Szemao	35.4	29.7	5.7
Tatungkow	19.6	15.2	4.4

Table A2: Summary of Province–Port Trade Flows by Treaty Port

Port	Avg. total flows	Avg. no. provinces	Avg. flow per province	Avg. flow share (%)	Max no. provinces
Tientsin	21 707 942.85	10.33	2 098 834.02	33.21	12
Chungking	5 338 624.36	2.90	1 920 205.60	6.84	3
Hankow	5 251 530.61	12.95	398 743.81	7.55	16
Shanghai	5 030 221.50	9.90	474 934.93	6.85	13
Chinkiang	4 301 916.18	7.00	630 647.09	7.16	9
Wuhu	3 706 268.21	2.29	1 736 959.12	5.36	4
Kiukiang	3 107 379.04	4.10	766 147.46	4.24	6
Mengtsz	3 069 049.26	3.00	1 023 016.42	4.66	3
Newchwang	2 326 955.37	3.90	583 070.61	2.97	5
Dairen	1 966 317.39	3.00	655 439.13	2.43	3
Wuchow	1 589 928.23	4.24	356 851.07	2.97	5
Chinwangtao	1 424 930.40	3.67	468 535.07	2.27	8
Canton	1 140 780.73	5.48	218 105.51	1.72	6
Foochow	1 084 857.19	1.00	1 084 857.19	1.56	1
Amoy	891 702.82	1.00	891 702.82	1.29	1
Ningpo	875 999.76	3.38	269 357.53	1.44	4
Tengyueh	787 914.20	3.00	262 664.25	1.23	4
Yochow	607 665.00	2.14	259 144.84	0.75	4
Nanking	578 613.89	4.76	95 680.54	0.71	9
Harbin	416 089.08	2.16	195 268.89	0.81	3
Kiaochow	360 375.77	3.64	94 622.19	0.49	7
Hangchow	325 886.78	4.57	70 505.20	0.51	5
Changsha	316 903.49	2.76	142 038.78	0.42	5
Ichang	248 662.61	1.48	145 990.44	0.43	2
Nanning	237 131.76	2.90	82 489.98	0.42	5
Wenchow	204 718.52	2.00	102 359.26	0.28	2
Antung	190 417.75	2.86	61 313.23	0.25	5
Samshui	178 434.44	4.86	34 194.10	0.32	6
Kiungchow	160 446.09	1.05	155 354.79	0.24	2
Swatow	135 977.55	1.95	68 300.55	0.20	3
Suifenho	117 721.94	2.08	38 114.57	0.21	5
Santuao	107 397.20	1.00	107 397.20	0.17	1
Szemao	96 844.74	8.19	11 999.29	0.16	12
Soochow	95 697.83	2.35	41 125.60	0.14	5
Kongmoon	53 192.26	1.57	41 150.81	0.08	3
Lungchow	39 374.25	2.20	19 328.96	0.07	4
Pakhoi	37 873.55	2.67	15 234.91	0.06	4
Wanhsien	33 292.70	1.00	33 292.70	0.04	1
Tatungkow	24 400.86	1.00	24 400.86	0.05	1
Shasi	23 385.41	1.76	15 487.77	0.04	3
Chefoo	22 628.02	2.00	11 314.01	0.03	2
Lungchingtsun	9845.19	1.00	9845.19	0.01	1
Manchouli	3277.52	1.00	3277.52	0.01	1
Sansing	1805.52	1.00	1805.52	0.00	1
Lungkow	1457.59	1.00	1457.59	0.00	1
Hunchun	811.88	1.00	811.88	0.00	1

Table A3: Summary of Province–Port Trade Flows by Province

Province	Avg. total flows	Avg. no. ports	Avg. flow/port	Avg. share (%)	Max no. ports	Main port
Chihli	15 363 185.63	6.62	2 362 714.40	23.01	9	Tientsin
Szechwan	6 383 553.85	8.14	778 980.73	8.47	9	Chungking
Anhwei	5 606 646.17	8.90	635 340.00	8.01	11	Wuhu
Kiangsu	4 079 297.20	7.86	545 974.01	6.31	10	Chinkiang
Honan	3 720 895.88	5.90	634 652.33	5.66	7	Tientsin
Shansi	3 450 683.31	3.29	1 133 929.51	5.47	6	Tientsin
Kiangsi	3 208 520.35	10.10	330 667.51	4.41	13	Kiukiang
Fengtien	3 207 996.22	5.71	567 370.10	4.23	7	Newchwang
Kweichow	2 975 210.88	10.29	285 112.89	4.99	13	Wuchow
Yunnan	2 908 948.95	7.38	405 352.06	4.57	11	Mengtsz
Kansu	2 728 769.03	3.48	916 650.29	4.29	6	Tientsin
Chekiang	2 705 778.68	5.90	454 582.97	4.02	7	Shanghai
Fukien	2 478 096.07	8.24	294 945.56	3.51	10	Foochow
Hupeh	1 683 585.04	4.43	375 489.08	2.27	5	Hankow
Shantung	1 577 716.00	5.95	281 383.36	2.44	8	Tientsin
Kwangtung	1 310 757.11	8.95	151 056.58	1.96	10	Canton
Shensi	1 115 768.52	3.05	357 246.75	1.55	5	Hankow
Kirin	1 049 628.47	5.71	201 386.91	1.54	9	Dairen
Hunan	1 039 382.11	6.90	167 339.39	1.52	10	Hankow
Heilungkiang	913 146.61	4.57	188 373.93	1.31	6	Dairen
Kwangsi	253 958.21	7.62	31 331.47	0.46	10	Wuchow

Table A4: Industry Classification and Firm Entries

Industry	Industrial	Sector	Manufacturing Group	Total	Non-Port
Flour Milling	Industrial	Manufacturing	Food, Beverages, and Tobacco	208	111
Oil-Pressing	Industrial	Manufacturing	Food, Beverages, and Tobacco	96	44
Rice Milling	Industrial	Manufacturing	Food, Beverages, and Tobacco	35	15
Cigarette Manufacturing	Industrial	Manufacturing	Food, Beverages, and Tobacco	24	3
Miscellaneous Food Industries	Industrial	Manufacturing	Food, Beverages, and Tobacco	15	7
Canned Food Manufacturing	Industrial	Manufacturing	Food, Beverages, and Tobacco	14	5
Egg Processing	Industrial	Manufacturing	Food, Beverages, and Tobacco	12	8
Brewing and Distilling	Industrial	Manufacturing	Food, Beverages, and Tobacco	11	8
Refined Salt	Industrial	Manufacturing	Food, Beverages, and Tobacco	11	9
Sugar Refining	Industrial	Manufacturing	Food, Beverages, and Tobacco	9	5
Beverage	Industrial	Manufacturing	Food, Beverages, and Tobacco	8	4
Tea Processing	Industrial	Manufacturing	Food, Beverages, and Tobacco	5	3
Match Manufacturing	Industrial	Manufacturing	Light Chemical Goods	122	86
Candle and Soap	Industrial	Manufacturing	Light Chemical Goods	48	12
Pharmaceutical	Industrial	Manufacturing	Light Chemical Goods	32	5
Cosmetics and Other Chemical Industries	Industrial	Manufacturing	Light Chemical Goods	21	2
Leather Manufacturing	Industrial	Manufacturing	Material-Based Daily-use Goods	56	20
Glass Manufacturing	Industrial	Manufacturing	Material-Based Daily-use Goods	27	6
Porcelain Manufacturing	Industrial	Manufacturing	Material-Based Daily-use Goods	14	11
Rubber	Industrial	Manufacturing	Material-Based Daily-use Goods	9	0
Enamelware Manufacturing	Industrial	Manufacturing	Material-Based Daily-use Goods	5	0
Silk Reeling	Industrial	Manufacturing	Textiles and Apparel	190	115
Dyeing and Weaving	Industrial	Manufacturing	Textiles and Apparel	111	45
Cotton Spinning	Industrial	Manufacturing	Textiles and Apparel	89	42
Silk Weaving	Industrial	Manufacturing	Textiles and Apparel	54	14
Apparel and Clothing Goods	Industrial	Manufacturing	Textiles and Apparel	41	10
Other Textile Industries	Industrial	Manufacturing	Textiles and Apparel	27	10
Woolen Textiles	Industrial	Manufacturing	Textiles and Apparel	25	10
Hemp Weaving	Industrial	Manufacturing	Textiles and Apparel	5	1
Cotton Ginning	Industrial	Manufacturing	Textiles and Apparel	1	1
Machinery Repair and Maintenance	Industrial	Manufacturing		62	18
Miscellaneous Industries	Industrial	Manufacturing		41	16
Publishing	Industrial	Manufacturing		39	10
Paper Manufacturing	Industrial	Manufacturing		33	15
Sawmilling and Lumber Processing	Industrial	Manufacturing		32	14
Brick and Tile Manufacturing	Industrial	Manufacturing		24	9

Acids, Alkalis, Soda Crystals, and Related Products	Industrial	Manufacturing	14	11
Paints, Dyes, Inks, and Related Products	Industrial	Manufacturing	12	5
Cement Manufacturing	Industrial	Manufacturing	3	2
Asbestos Products	Industrial	Manufacturing	2	1
Waterworks and Electrical Products	Industrial	Utilities	317	266
Fuel and Other Extractive Industries	Industrial	Extractive Industries	104	95
Metal Mining and Smelting	Industrial	Extractive Industries	59	49
Construction	Industrial	Construction	12	5
Banking	Non-industrial	Finance	322	186
Shipping	Non-industrial	Transport	249	63
Insurance, Trusts, etc.	Non-industrial	Finance	62	21

Table A5: Commodity Classification by Industry Group

Industry Group	Consumer #	Consumer %	Capital #	Capital %
Food, Beverages, and Tobacco	127	22.5%	144	56.0%
Light Chemical Goods	27	4.8%	93	36.2%
Material-Based Household Goods	46	8.2%	124	48.2%
Textiles and Apparel	246	43.6%	153	59.5%

Notes: This table presents the classification of commodities by industry group and type. Columns (1) and (3) report the number of unique commodities assigned to each industry group. Columns (2) and (4) report the share of consumer and capital goods assigned to each group. The entries in Column (2) sum to less than one because some consumer goods are not assigned to any industry group, whereas the entries in Column (4) sum to two because each capital good is assigned to two industry groups.

B Modeling the Decision to Enter the Market

To guide the empirical analysis, I present a simple static model that frames firms' entry decisions. The model considers a producer deciding whether to enter a specific consumer goods market as an industrial firm. The producer chooses only whether to enter the market, an assumption that simplifies the analysis of the role of foreign trade in entry decisions.

The model assumes that the firm (if it enters) is a price-taker in all the markets: the price of consumer goods it will produce (PC), the price of capital goods it might purchase (PK), and labor (w). The firm uses capital goods and labor to produce consumer goods, which it sells in the market at the market price. This is an assumption commonly used in the literature (e.g. Gregg, 2020). The assumption has two implications. First, this assumption suggests that the market is highly competitive and the firm has little market power. This assumption is justified by the historical setting. Markets during the sample period were dominated by small and private firms and were highly competitive (Rawski, 1989). This assumption suggests that the supply of consumer goods, the supply of capital goods, and the supply of labor are all perfectly elastic. As long as each firm has little market power, this is reasonable. At current market prices, foreign trade can easily supply additional units consumer goods and capital goods. At the given wage, more workers are willing to work for the firm, but if it cuts the wage, its labor force will go elsewhere. In the empirical analysis, I relax these conditions and consider the potential endogeneity problems associated with them.

The model assumes that every province imports every consumer good. If we had sufficiently disaggregated data, this assumption would surely fail for some goods. Yet, the trade data and numerous qualitative evidence show that imports were quite widespread. The existence of imported consumer goods implies that the market price of consumer goods (PC) is determined by the price of imported consumer goods in equilibrium. Figure A1 visualizes the consumer goods market. The intersection (O) of the local supply curve (S) and the local demand (D) is the market equilibrium in absence of imports. When imported consumer goods (IM) arrive, they drive the market to a new equilibrium (E) at a lower price (PC). I further assume that at a certain price, consumers always prefer locally produced goods. Therefore, if the firm chooses to enter the market, it shifts the local supply curve from S to S' and the market equilibrium from E to E'. However, no firm is able to drive out all the imports, so the market price remains at PC. Although the market price of consumer goods remains the same, the firm will substitute a portion of imports with local

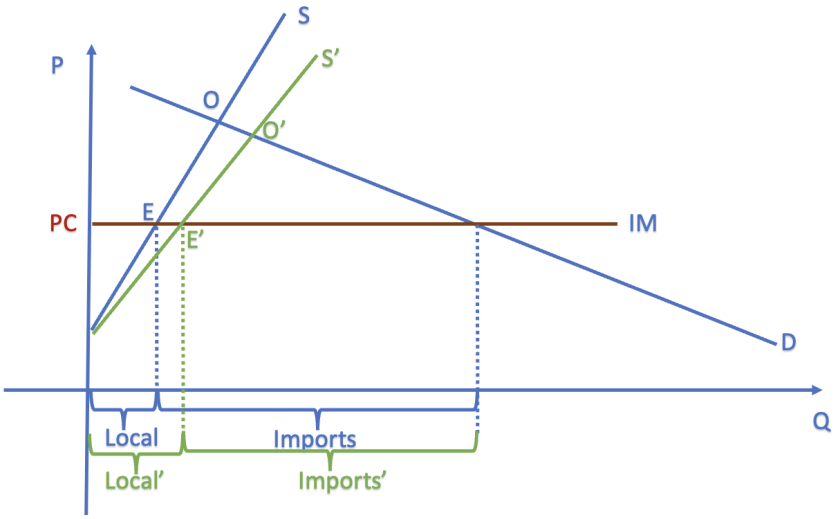

Figure A1: The Consumer Goods Market

This figure provides a visualization of the consumer goods market. When a new industrial firm enters, the local supply of consumer goods increases. However, it is unable to drive out all imports, so the market price is still determined by the import price.

production if it chooses to enter the market.

The model assumes that there is no local production of capital goods, so the price of capital goods is also determined by imports. This assumption is supported by the fact that as a late-developing country, China manufactured very few intermediate goods or machinery at that time and had to rely on imports for them.

The Setup

Given the assumptions above, the price of consumer goods and the price of capital goods in the market are modeled by

$$PC_i = H(GPC, \Gamma_i^C) \text{ and } PK_i = H(GPK, \Gamma_i^K).$$

Consumer goods prices and capital goods prices are functions of global prices and trade access. Although I consider only one market in the model, I use subscription i to distinguish the market-specific characteristics. GPC and GPK are the global prices of consumer goods and capital goods, which are not specific to the market. Γ_i^C and Γ_i^K measure the market-specific foreign trade access to consumer goods and capital goods. A higher Γ_i^C (Γ_i^K) means that the market has poorer access

to consumer goods (capital goods). The parameter Γ_i^C and Γ_i^K are determined by the prices of consumer goods and capital goods at ports that the market has access to and the internal trade costs. Although Γ_i^C and Γ_i^K tend to be correlated, they are not always the same. The parameters Γ_i^C and Γ_i^K are elaborated in the next section.

The firm has a standard Cobb-Douglas production function,

$$f(L) = AL^{\alpha}\bar{K}^{1-\alpha}.$$

A is the productivity of the firm, which is known to the firm. $\bar{K}$ is the fixed amount of capital goods stock[22], which I take to be fixed to pin down the size of the firm. This setting is justified by the historical fact that China lacked mature financial markets, which constrained the amount of capital that the firm could access.

The objective of the firm is to maximize profits, which is given by

$$\pi_i = f(L_i)PC_i - wL - \bar{K}PK_i.$$

Given the market prices, the optimal number of labor chosen by the firm (if it enters) is given by

$$L_i^* = (\frac{w_i}{\alpha A\bar{K}^{1-\alpha}PC_i})^{\frac{1}{\alpha-1}}.$$

The profits is given by

$$\pi_i^* = A^{\frac{1}{1-\alpha}}\bar{K}w^{\frac{\alpha}{\alpha-1}}[\alpha^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}](PC_i)^{\frac{1}{1-\alpha}} - \bar{K}PK_i.$$

Minimum Entry Condition

A necessary condition for the firm to enter the market is that that $\pi_i^* > 0$. That is,

$$\pi_i^* = A^{\frac{1}{1-\alpha}}\bar{K}w^{\frac{\alpha}{\alpha-1}}[\alpha^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}](PC_i)^{\frac{1}{1-\alpha}} - \bar{K}PK_i > 0$$

[22]In my model, I do not distinguish between materials (e.g., chemicals) and capital (e.g., machinery). They both are considered as capital goods.

Taking the log transformation,

$$\frac{1}{1-\alpha}\log(A) + \log(w^{\frac{\alpha}{\alpha-1}}[\alpha^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}]) > \log(PK_i) - \frac{1}{1-\alpha}\log(PC_i)$$

Notice that $\log(w^{\frac{\alpha}{\alpha-1}}[\alpha^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}])$ is a constant.

For fixed PC_i and PK_i, there exists $\underline{A}_i$ such that

$$\begin{aligned}\log(\underline{A}_i) &= (1-\alpha)\left(\log(PK_i) - \frac{1}{1-\alpha}\log(PC_i) - \log(\Sigma)\right) \\ &= (1-\alpha)\log(PK_i) - \log(PC_i) - (1-\alpha)\log(\Sigma),\end{aligned} \tag{1}$$

where Σ captures all the constant terms. I call this $\underline{A}_i$ *the minimum entry condition.* $\underline{A}_i$ is a function of PC_i and PK_i, so it is market-specific. Moreover, as equation (1) indicates, $\underline{A}_i$ increases as PK_i increases and increases as PC_i decreases. The intuition is simple: when the price of consumer goods is high, the firm has higher unit revenue and more opportunity to make profits, so the entry requirement on productivity is lower. When the price of capital goods is higher, the cost of production is higher and the firm has to be more productive to make a profit. Note that because in PC_i and PK_i are market-level variables, entry decisions are market-specific.

The Firm's Productivity and Entry Probability

During the early Republican period, the productivity of a firm was determined not just by its knowledge of modern technology but also its managerial strategies (Zeitz, 2013). As Zeitz (2013) shows, the productivity varied greatly across firms. In the model, I assume that the prospective firm knows its productivity when making the entry decision. I further assume that the firm's productivity is a random draw from a distribution $z(A)$. I do not need to specify any functional form of $z(A)$ as long as its cumulative distribution function $Z(A)$ is regular. The probability that the firm enters the market is given by

$$Pr^{Entry}(\underline{A}_i) = 1 - Z(\underline{A}_i). \tag{2}$$

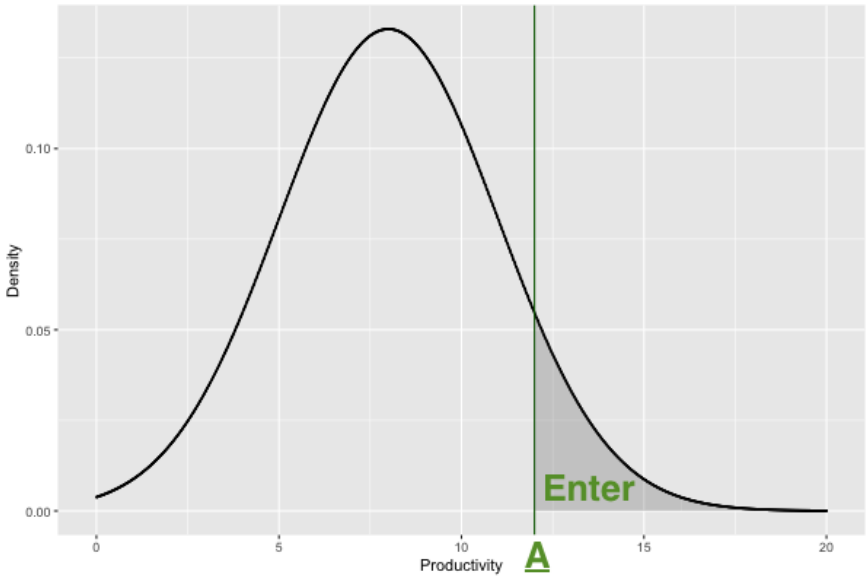

Figure A2: Entry Probability

This figure provides a visualization of the entry probability of a prospective investor. If the investor has productivity greater than $\underline{A}$ (to the right of the green vertical line), they will enter the market. The grey area indicates the entry probability. A higher consumer goods price or a lower capital goods price shifts $\underline{A}$ to the left, thereby increasing the investor's entry probability.

Given the property of cumulative distribution function, $Z(A)$ is a monotone increasing function. $Pr^{Entry}(\underline{A_i})$ therefore decreases as $\underline{A_i}$ increases. Figure A2 visualizes the firm's entry probability. For a certain minimum entry condition (indicated by the green vertical line), the firm will choose to enter if the productivity of the firm lies to the right of it. The shaded area is, therefore, the probability that the firm chooses to enter. If the minimum entry condition increases (the green vertical line moves to the right), the area will become smaller and the probability for the firm to enter will be lower. Equation (1) shows that $\underline{A_i}$ increases as PK_i increases and decreases as PC_i increases. Equation (1) and (2) together show that the entry probability of the firm $Pr^{Entry}(\underline{A_i})$ increases as PC_i increases and decreases as PK_i increases.

C Post-1912 Regressions

Table A6: The Effects of Aggregate Foreign Trade Access on Firm Entry after 1912

Dependent Variables:	log(Entry+1)	Entry	Industrial	log(Entry+1)	Entry	Industrial	Entry
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	OLS	PPML	PPML	OLS	PPML	PPML	PPML
Variables							
$\log(PC)$	2.130**	3.171**	3.100**				
	(0.9761)	(1.241)	(1.488)				
$\log(PK)$	-1.590**	-2.175**	-2.043**				
	(0.6056)	(0.9394)	(0.9335)				
$\log(PC) \times \mathbf{1}\{d^{port} < 50\}$				0.8589*	3.515**	3.575**	
				(0.4874)	(1.433)	(1.771)	
$\log(PC) \times \mathbf{1}\{50 \leq d^{port} < 200\}$				0.7244*	3.104***	2.986**	
				(0.4011)	(1.107)	(1.275)	
$\log(PC) \times \mathbf{1}\{200 \leq d^{port} < 500\}$				0.6616*	2.599**	2.450*	
				(0.3821)	(1.089)	(1.318)	
$\log(PC) \times \mathbf{1}\{d^{port} \geq 500\}$				0.7919**	4.278*	5.079*	
				(0.3725)	(2.366)	(2.805)	
$\log(PK) \times \mathbf{1}\{d^{port} < 50\}$				-0.5782**	-2.291**	-2.064**	
				(0.2696)	(0.9604)	(0.9831)	
$\log(PK) \times \mathbf{1}\{50 \leq d^{port} < 200\}$				-0.6577**	-2.233**	-2.112**	
				(0.2689)	(0.9169)	(0.9064)	
$\log(PK) \times \mathbf{1}\{200 \leq d^{port} < 500\}$				-0.5574*	-2.017**	-1.873*	
				(0.2857)	(0.9815)	(0.9890)	
$\log(PK) \times \mathbf{1}\{d^{port} \geq 500\}$				-0.6010**	-2.633**	-2.651**	
				(0.2626)	(1.102)	(1.062)	
$Z_{\log(PC)}$							0.0832
							(0.2274)
$Z_{\log(PK)}$							-0.4844***
							(0.1792)
$Z_{\log(PC)} \times Z_{\log(PK)}$							-0.4710***
							(0.1400)
Fixed-effects							
Province	Yes	Yes	Yes				Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province × distance bin				Yes	Yes	Yes	
Fit statistics							
Observations	315	315	315	1,260	1,260	1,260	315
Squared Correlation	0.67499	0.76589	0.73371	0.69295	0.76286	0.70019	0.78544
Pseudo R^2	0.42640	0.49187	0.45458	0.59601	0.58557	0.54280	0.50312
BIC	689.09	1,440.0	1,355.9	1,765.2	2,748.7	2,596.5	1,418.6

Clustered (Province) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table A7: The Effects of Industry-Specific Foreign Trade Access on Firm Entry after 1912

Dependent Variables:	log(Entry+1)	Entry	log(Entry+1)	Entry	
Model:	(1)	(2)	(3)	(4)	(5)
	OLS	PPML	OLS	PPML	PPML
Variables					
$\log(PC)$	0.1943**	3.536***			
	(0.0945)	(1.062)			
$\log(PK)$	-0.3813**	-1.817*			
	(0.1723)	(1.064)			
$\log(PC) \times \mathbf{1}\{d^{port} < 50\}$			0.0584*	3.758***	
			(0.0295)	(1.171)	
$\log(PC) \times \mathbf{1}\{50 \leq d^{port} < 200\}$			0.0653**	3.666***	
			(0.0284)	(1.089)	
$\log(PC) \times \mathbf{1}\{200 \leq d^{port} < 500\}$			0.0594**	3.654***	
			(0.0292)	(1.113)	
$\log(PC) \times \mathbf{1}\{d^{port} \geq 500\}$			0.0409	3.554***	
			(0.0283)	(1.095)	
$\log(PK) \times \mathbf{1}\{d^{port} < 50\}$			-0.1391***	-1.754	
			(0.0513)	(1.077)	
$\log(PK) \times \mathbf{1}\{50 \leq d^{port} < 200\}$			-0.1672***	-1.877*	
			(0.0531)	(1.039)	
$\log(PK) \times \mathbf{1}\{200 \leq d^{port} < 500\}$			-0.1010*	-0.3921	
			(0.0513)	(1.145)	
$\log(PK) \times \mathbf{1}\{d^{port} \geq 500\}$			-0.0944*	0.9311	
			(0.0501)	(1.322)	
$Z_{\log(PC)}$					0.4340*
					(0.2446)
$Z_{\log(PK)}$					-0.3275
					(0.2289)
$Z_{\log(PC)} \times Z_{\log(PK)}$					0.5977***
					(0.1714)
Fixed-effects					
Province × Year	Yes	Yes	Yes	Yes	Yes
Industry Group × Year	Yes	Yes	Yes	Yes	Yes
Province × distance bin			Yes	Yes	
Fit statistics					
Observations	1,260	1,260	5,040	5,040	1,260
Squared Correlation	0.45938	0.69670	0.28902	0.53938	0.68484
Pseudo R^2	0.50234	0.53066	-6.4716	0.54978	0.52990
BIC	3,451.9	3,900.3	1,979.3	5,693.0	3,909.4

Clustered (Province-Year & Industry Group-Year)) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

D Prefecture-Group Regressions

The construction of PC and PK remains similar at the prefectural level. The only difference is that bilateral trade flows between prefectures and treaty ports are not available. I therefore approximate prefecture-level bilateral trade flows by dividing province-level trade flows with each treaty port by the number of prefectures in each province. However, this data limitation reduces the variation among prefectures within the same province.

Table A8 presents the results for industry-specific foreign trade access and industry-specific firm entry at the prefectural level. The first two columns present the results for all prefectures, while the last two columns exclude prefectures that contain treaty ports. The results remain qualitatively similar to the provincial-level results presented in the main text.

Table A8: The Effects of Foreign Trade Access at the Prefectural Level

Dependent Variables:	Entry	log(Entry+1)
Model:	(1)	(2)
	PPML	OLS
Variables		
log(PC)	3.187***	0.0158**
	(0.8254)	(0.0060)
log(PK)	-1.781*	-0.0249*
	(0.9347)	(0.0141)
Fixed-effects		
Prefecture	Yes	Yes
Province × Year	Yes	Yes
Industry Group × Year	Yes	Yes
Fit statistics		
Observations	25,612	25,612
Squared Correlation	0.45533	0.17040
Pseudo R^2	0.53542	-0.12226
BIC	11,087.9	-35,676.0

Clustered (Province-Year& Industry Group-Year) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

E Farm Labor Wages

The data on farm labor wages is collected from **Index Numbers of Wages of Farm Year Labor** in *Land utilization in China* (Buck, 1956). It is survey data, ranging from 1901-1933. For each province, it surveyed a few counties. For some counties, some years are missing. The reference year is 1926. For all the counties, their index for 1926 is 100. These indices therefore were not comparable among provinces. However, they can reflect the trend in each province. This works for the regression since the time-invariant differences among provinces are controlled by province fixed effects and now adding wage data controls for changes in a province across years. It does not include Manchuria (Fengtien, Kirin, and Heilungkiang), so the number of observations decreases by 57 (the sample period is 19 years). I impute missing county-level observations using the temporally nearest available observation for the same county and then calculate the province-level measure as the average across all counties within each province.

F Addressing Endogenous Shares

In the baseline measure of foreign trade access, the arrival prices of foreign goods from each port are weighted by lagged trade flows. This raises the concern of potentially endogenous "shares," since trade reliance itself may be endogenous. Although the use of lagged shares helps address concerns about reverse causality, the shares may still reflect endogenous trade patterns. I therefore construct instrumental variables using purely exogenous shares shaped by geography.

The instrumental variable is defined as

$$IVPC_{i,t} = \frac{\sum_{j=1}^{J} w_{i,j,t}^{IV} \log(Distance_{i,j}) \cdot I_{j,t}^{C}}{\sum_{j=1}^{J} w_{i,j,t}^{IV}}, \text{ where } w_{i,j,t}^{IV} = \mathbf{1}(\text{closest 20 ports}) \cdot e^{-\log(Distance_{i,j})}. \tag{3}$$

That is, rather than using actual trade flows, the "shares" are inversely related to the distance between each port and each province. Moreover, for each province, I consider only the closest 20 ports, since no province traded with more than 20 ports in the data. The instrument therefore uses only variation from exogenous shocks, captured by the arrival prices from each port, combined with geography-based exposure shares.

Using this instrument, I perform IV regressions for both aggregate trade access and industry-specific trade access. For the OLS specification, I use standard 2SLS; for the PPML specification, I use a control-function approach.

The results are presented in Table A9. The first-stage F-statistics are above the conventional threshold of 10, suggesting that the instruments are relevant, although the first-stage F-statistics for aggregate trade access are more modest.

The IV coefficients are consistent with the baseline estimates in all cases. However, the Wu–Hausman tests are insignificant at conventional 10% level, meaning that the null that the OLS estimates and the IV estimates are not statistically different cannot be rejected. Similarly, in the PPML specifications, the control-function residuals are not statistically significant, suggesting that the residualized components of foreign trade access are not strongly correlated with firm entry after controlling for the baseline regressors and fixed effects. Although these tests cannot be interpreted as proof that the baseline measures of foreign trade access are exogenous, they provide reassuring evidence that endogeneity concerns are limited.

Finally, although the IV coefficients are qualitatively similar to the baseline estimates, they are

less precisely estimated. This is unsurprising because IV estimation relies only on the variation in the potentially endogenous regressors that is predicted by the instruments, which can result in larger standard errors than OLS.

Table A9: IV Regressions

	Aggregate				Industry-Specific			
Dependent Variables:	log(Entry+1)	Entry	log(PC)	log(PK)	log(Entry+1)	Entry	log(PC)	log(PK)
Model:	2SLS	CF	first-stage		2SLS	CF	first-stage	
Variables								
log(PC)	1.728	1.607			0.3409*	6.400		
	(1.812)	[-4.199, 6.488]			(0.1956)	[1.692, 15.65]		
log(PK)	-2.980*	-0.986			-0.9090**	-5.312		
	(1.523)	[-6.763, 1.947]			(0.4238)	[-19.12, 4.314]		
log($IVPC$)			0.5151***	0.3815**			0.6709***	0.0354
			(0.1008)	(0.1342)			(0.0758)	(0.0236)
log($IVPK$)			-0.1504	0.5789***			-0.1396	0.7239***
			(0.0929)	(0.1864)			(0.1063)	(0.1017)
Fixed-effects								
Province	Yes	Yes	Yes	Yes				
Year	Yes	Yes	Yes	Yes				
Province × Year					Yes	Yes	Yes	Yes
Industry Group × Year					Yes	Yes	Yes	Yes
IV diagnostics								
1st-stage F-stat			21.4	39.6			268.0	147.1
Wu-Hausman	0.863				1.90			
CF residual			1.981	-1.975			-4.202	4.311
			[-4.167 7.535]	[-5.677 3.676]			[-13.872 0.840]	[-5.637, 16.73]
Fit statistics								
Observations	399	399	399	399	1,596	1,596	1,596	1,596
R^2	0.61616	0.61616	0.94486	0.97169	0.45031	0.45031	0.99003	0.98539
Within R^2	0.01994	0.01994	0.10173	0.17347	0.00846	0.00846	0.25176	0.15588

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: This table addresses concerns about the potential endogeneity of the "shares" used to construct the baseline measures of foreign trade access. I implement 2SLS for the OLS specifications and a control-function approach for the PPML specifications. In constructing the instruments, the observed shares are replaced with exogenous shares based on geographic distance. The instruments are relevant, while the null hypothesis that the IV estimates are equal to the baseline estimates cannot be rejected. For the aggregate specifications, standard errors are clustered at the province level. For the industry-specific specifications, standard errors are clustered at the province-year and industry-group-year levels. For the control-function specifications, 95% confidence intervals based on 2,000 bootstrap replications are reported.