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FDI Spillovers in History:

Interwar Japanese investment in the Chinese cotton industry

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Abstract

In this paper we use comprehensive historic firm level data for 1925 to 1938 to estimate productivity spillovers from Japanese textile companies' affiliates in China (Zaikabo) to local cotton producers in China. We geo-localized firms in order to capture the important role of distance in facilitating productivity spillovers. Our results provide clear evidence for positive productivity spillovers from Zaikabo to local Chinese firms. This goes hand-in-hand with a change in production technology towards greater use of capital (spindles). We also find that spillovers are very localised, being strongest within a radius of up to 10km around the Zaikabo. Furthermore, evidence for spillovers is particularly strong for firms in Shanghai. Our paper is the first to provide evidence for such spillovers from foreign firms in a historical context.

JEL Codes: F23, N65

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1 Introduction

Attracting foreign direct investment is frequently seen as an important means to foster overall economic development, or the growth of particular industries, in host countries. This is reflected in policies trying to boost inward investment (UNCTAD, 2018). Despite extensive research in the last decades on potential positive spillover effects from multinationals,[1] the jury is still out on whether such effects are there, and what the exact mechanisms are.

A convincing search for such effects is made difficult by the complexity of modern-day industry. Different industries use different technologies, and organise their production chains in different ways. Looking across various industries (which most empirical studies of spillovers do) therefore makes it difficult to tease out what the exact mechanisms are through which spillovers from FDI may happen. Also, it is challenging to disentangle possible positive knowledge transfers from negative competition effects crowding out local firms. In addition, the search for spillovers is further muddled by selection effects where it is important to clearly distinguish firms' locational choice from spillovers – do multinationals simply locate in industry-region clusters with favourable characteristics, or do they actually benefit local firms? Hence, to identify such effects more convincingly, it may make sense to look at a simpler world in history. This is what this paper sets out to do: We use comprehensive and unique historic firm level data for 1925 to 1938 to estimate productivity spillovers from Japanese textile companies' affiliates in China (Zaikabo) to local cotton producers in China.

We follow the well-established literature in modern contexts that tries to empirically identify "productivity spillovers" from foreign to domestic firms (Lu et al., 2017; Girma et al., 2015 look specifically at China). In the setting here we look at spillovers from the more advanced Japanese firms to local Chinese establishments. To this end we geo-localized and digitized information on all Japanese textile companies' affiliates in China (including Manchuria) as well as other local firms in China during the period 1925 until 1938. Importantly, apart from output and employment, the data contains detailed information on the quantity and type of capital stock employed, allowing us to accurately measure the nature of technology utilized by the Japanese foreign affiliates.

[1] Recent examples are Amiti et al. (2024), Jiang et al. (2024), Abebe et al. (2022), and Fons-Rosen et al. (2018). Görg and Strobl (2001) and Keller (2021) provide extensive surveys.

Being able to pinpoint the exact location of both the Japanese headquarters and plants and their Chinese counterparts importantly allows us to capture the role of distance in facilitating any productivity spillovers. This represents a novelty of our study, as the role of distance is generally neglected even in modern spillover studies on FDI. Rather, the focus of the spillover literature has been primarily on spillovers within an industry, or across vertically connected industries, with a few studies also considering spillovers within geographic units – usually defined as fairly large administrative region (e.g., Girma et al. 2015; Aitken and Harrison, 1999). Our fine-grained data with geolocalized information on both locations of Japanese FDI firms as well as local Chinese firms allows us to dig much deeper into the role of distance, using distance-weighted spillover variables as are commonly employed in the literature on knowledge spillovers (e.g. Jaffe and Trajtenberg, 1996; Figueriredo et al., 2015).

Some other papers investigated Japanese FDI in China in terms of location but without directly investigating spillovers, as, e.g., Belderbos and Carree (2002) and Kim et al. (2010)[2] However, none of these studies directly consider the role of distance between local and multinational firms in determining productivity spillovers, despite the crucial importance of distance in facilitating technological spillovers being well established in the literature (Bloom, et. al, 2013). Arguably, and in line with our results, geographic proximity of foreign and domestic firms is likely to have been even more important in terms of facilitating spillovers in historical settings with less developed transport and communication infrastructure.

Another attraction of our setting is that the time period of analysis (1925 to 1938) covers a turbulent time in the Japanese-Sino relationship. More precisely, while anti-Japanese movements (e.g., strikes in Japanese multinationals, non-use and non-sales campaigns against Japanese products) had already been happening since the 1910s, the "Mukden Incident (Manchuria Incident)" in 1931 resulted in Japanese troops occupying part of Chinese territory and the foundation of a nation, Manchuria, in 1932 under Japanese political and military control.[3] As a response, large riots occurred in Shanghai and Japanese military troops were

[2] Belderbos and Carree (2002) investigated the location of the Japanese affiliates in China in terms of firm heterogeneity and found that small size firms tend to locate closer to Japan but have less benefits from local Chinese market. Kim et al. (2010) investigated the exit of the Japanese subsidiaries in China from 1979 to 2001 and found that exit rates are affected by parent firms' operation experience in the industries and geographical distance from other Japanese subsidiaries.

[3] The Mukuden Incident is a Japanese military action, an explosion that destroyed South Manchuria Railways on September 18th 1931. The Japanese military accused Chinese dissidents of the act and used it as a pretext for the military invasion of North East China.

dispatched, eventually escalating into the Battle of Shanghai for three months in 1932 and full war skirmishes in other areas in China. Our data allow us to investigate whether the deterioration of the relationship after 1931 also had negative implications for productivity spillovers from Japanese multinationals to Chinese textile firms.

Apart from the focus on geographical distance, our data and context allows us to overcome a number of other limitations inherent in papers on FDI spillovers using modern data. Firstly, our sample covers nearly 15 years between WW I and the Second Sino-Japanese War, i.e., arguably a period where costs for FDI may be considered to have been quite high, as WWI had disrupted production activities in Europe and thereby also impeded global operations of firms. In particular, there were virtually no Japanese investments into the US or in Europe at that time.[4] Additionally, telegram wire cable, which was necessary to timely communicate with foreign affiliates, was connected from Japan only to Shanghai and Vladivostok. Moreover, Shanghai at the time was an international market (urbanized, with a concentration of information and advanced culture) and liberal, and was managed by developed countries (most notably France) rather than China. There were also several other incentives for Japanese multinationals to locate in the International Concession zone in Shanghai, such as tax concessions and low-priced land leases. For these reasons, the main FDI destination for Japan during our sample period was Shanghai, and subsequently other parts of China. Thus, in stark contrast to operations in today's global economy, where investors have to choose among a multitude of possible investment locations and therefore respond to a variety of location factors, thus making modelling these challenging, in our context Japanese firms had a strong incentive to mainly locate in China, and in particular Shanghai. In other words, we do not have to particularly worry about concurrent competing alternative locations playing a role and thus being endogenous.

Secondly, modern studies typically use micro data for the whole economy or the manufacturing sector, although modern industrial activity is characterised by substantial heterogeneity not only across industries but also within industries across firms (e.g., Javorcik, 2004; Girma et al., 2015; Lu et al., 2017). Moreover, technology in modern settings tends to be more multifaceted and thus mostly proxied in terms of the value of capital stock. This

[4] Tanno (2016) shows that during 1914 to 1936, direct investments to China (including Manchuria) accounted for 80-90% of all foreign investments by Japan, while the remainder went to the Philippines, Southern Pacific islands, and South East Asia (e.g. Malaya and Dutch Indies).

makes it difficult to gauge the potential spillover effects that might accrue to a particular firm in a particular industry due to a particular technology. In our paper we focus on one particular industry, namely the cotton industry, which at the time of analysis was fairly homogenous, with relatively straightforward technologies used for production. As such we are better able to capture the superior technology used by Japanese firms that may have benefitted local Chinese firms through productivity spillovers, rather than other aspects that might be correlated with the value of the capital stock.

The Chinese cotton industry is a highly interesting case to look at. China is today one of the major textile exporters world-wide. For example, in 2022, China accounted for more than 40 percent of the value added in global textile exports according to the WTO.[5] The seeds for this success were arguably sown in the inter-war period between World War I and World War II. As Liu (2020) argues, while textile production was among the first industrialised sectors in China, it was fairly unproductive, this only changing with the introduction of new technology in the form of industrialised spindles in the 1920s. A number of studies have explored possible explanations for this take-off in the textile industry in China, the most recent being Liu (2020). However, what has been neglected thus far is the role of foreign investment. In this regard Zeitz (2013) shows that during the inter-war period affiliates of Japanese textile producers located in China were by far the most productive in the country, enjoying productivity advantages of about 70 per cent over both local Chinese and affiliates of British firms. Moreover, the capital stock of Japanese firms increased from about 21 to 42 per cent during 1918 to 1936, while that of British firms declined from 35 to 6 per cent over the same period.

What the literature has not considered is whether local Chinese firms were able to learn from these foreign firms, in particular from the Japanese. To fill this gap in the literature, we investigate whether and how the presence of these highly productive Japanese firms in China may have contributed to the growth of the Chinese textiles industry through so-called "productivity spillovers".

Foreign direct investment has of course a long history, arguably starting with the East India Company in 1601 (Clegg, 2017).[6] However, given the unavailability of comprehensive and accessible historical data on FDI, especially at the firm or industry level, essentially all of the

[5] Source: https://www.wto.org/english/res_e/statis_e/miwi_e/gvc_sectoral_profiles_textiles_clothing24_e.pdf
[6] See Wilkins (2001) for an insightful overview.

existing studies examining its role for local economic development are limited to using a more narrative approach based on case studies or highly aggregate statistics.[7] For instance, Lopes and Simões (2020) provide many examples of foreign company involvement in Portugal from 1700 until the 2000s, also considering those companies' implications for local development. Lanciotti and Lluch (2020) use a somewhat similar approach to discuss investments by American and British firms in Argentina in the late 19th and early 20th century, focusing on recruitment and management aspects, including transfer of know-how to the domestic economy. Fernández-de-Pinedo et al. (2020) is a very detailed case study of the operations of a French multinational firm (Derosne & Cail) in the 19th century, exploring the consequences for knowledge transfer to the host countries. Mason (1987) provides a very detailed discussion of the involvement of foreign companies in Japan, as well as the implications for its economic development. Our study is to the best of our knowledge the first to consider very detailed and comprehensive firm level historic data, enabling us to quantify any spillovers from foreign direct investments.

Our results indicate that spillovers from Japanese firms had a statistically significant and economically meaningful impact on productivity of nearby Chinese cotton producers. Accounting for precise distance measurements is crucial in this regard, as spillover effects decline sharply with distance—becoming insignificant beyond approximately 20 to 30 kilometers. Exploiting further the geographic dimension of our data, we find that the average effect is primarily driven by firms in Shanghai. This makes sense as this was the centre for Cotton textile production at the time. Since then, of course, the industry has moved on to other regions in China, in particular after the cultural revolution (which turned existing producers in Shanghai into state-owned enterprises) and then the decision in the early 1990s to transition Shanghai from industry to services (https://bridgingthegaps.leeds.ac.uk/shanghai-textile-industry-chinas-mother-industry/).

Causal identification leverages variation in productivity within Chinese firms over time, alongside fluctuations in the activity levels of Japanese firms. In particular, Japanese operations experienced a sharp decline following the financial crisis of 1929, followed by a relatively rapid recovery. This time-varying exposure to Japanese firm activity is plausibly exogenous from the perspective of local Chinese producers, allowing us to isolate the causal

[7] The earliest paper in the more formal econometric "spillovers literature" that we are aware of is Caves (1974) using data for Australia for 1966. All other studies use data from the 1970s onwards (Görg and Strobl, 2001).

effect of foreign direct investment (FDI) from potentially endogenous location choices by Japanese firms.

As a possible mechanism of how firms boost productivity, we also observe an increase in capital stock, as reflected in the number of spindles employed by Chinese cotton firms. Although we cannot directly observe more about underlying mechanisms, our findings—particularly the highly localized nature of the effects—suggest that job-hopping within a shared labor market between Japanese and local Chinese firms may have played a role in facilitating knowledge transfer (Ashizawa, 2014, 2011). Regarding the Japanese firms themselves, we find that larger firms, both in terms of local plant size and total size as multi-plant enterprises, generate stronger spillovers. Additionally, older firms and those with a more international orientation—evidenced by headquarters located outside Japan—tend to have a greater spillover effect on local Chinese firms.

The remainder of the paper is organized as follows. We describe the relevant background of the cotton industry, including the role of Japanese firms, in China for our setting. The data used in our analysis is describe in Section III. Our methodological approach is outlined in Section IV. Results are discussed in Section V. In the final section we provide some concluding remarks.

2 Historical Background

2.1 The Development of the Japanese Cotton Industry Post-Autarky

Japan had been an autarky for around 250 years in the Edo period. It finally opened several ports to trade in 1858 as a result of the US–Japan Treaty of Army and Commerce. Consequently, silk and textiles quickly became major export products (see Yamazawa and Yamamoto, 1974; Okubo, 2007).[8] Trade continued to increase, with the process accelerating during the Meiji Restoration (1870s-1880s), where the core industries were silk reeling, and weaving, as well as cotton spinning and fabric manufacturing. In terms of cotton spinning, after Osaka Bouseki, Co. was founded in 1882, several large-scale companies followed and successfully produced high-quality cotton textile products by introducing advanced foreign technology and machines (Nakamura, 1971). By the early part of the 20th century, the textile

[8] The opening of trade also drastically changed the domestic market; see Bernhofen and Brown (2005) for details.

sector had become the primary manufacturing sector in Japan (Saxonhouse, 1974; Nishikawa and Abe, 1990; Takamura, 1971; Ishii, 1972). By 1920 42% of all manufacturing output was in textiles (the largest sector) (the Census of Manufacture, 1920). As was the case in other countries, an important feature of textiles firms was that they were very labour intensive (Hunter, Ch.4-5, 2003; Nakamura and Molteni, 1994).

2.2 Japanese Cotton FDI in China (1902-1937)

Emergence of Zaikabo

After the Russo-Japan War (1904 to 1905), Japan emerged as a one of the major players in international politics, substantially extending its geographical power base. One such expansion consisted of establishing some authority in North East China (later called "Manchuria"), including economically.[9] The The Northeast China area was taken over by a Japanese national policy company, the South Manchuria Railway. Also, some private companies started FDI in Shanghai, China. "Zaikabo", which is the common name of Japanese foreign direct investment of cotton mill companies in China, is a representative example. In 1902, Mitsui Trading Company bought some Chinese local cotton mills and then established a Japanese company, Shanghai Boseki, Co.. Subsequently, Naigaimen Co., headquartered in Osaka, and constructed a large production plant in Shanghai in 1911. This is considered the first large-scale private-company-based Japanese FDI (Takamura, 1971, 1982).

After WWI, Zaikabo investment drastically increased, and three important factors for increasing such FDI to China have been highlighted (Nakamura, 1971; Takamura, 1982; Mori, 2005; Ishii, 2012; Abe et al., 2017). The first one is tariff jumping as a result of the rise of tariff rates in China. While China did not have autonomy over tariff and trade policies and had been requesting a rise in tariff rates on Western and Japanese imports, this was, despite agreement from the UK, US, and France, only granted in August 1919 once Japan reversed its original refusal. The subsequent hike in tariff rates was followed by two further revisions. As a result, Japanese exports of cotton textiles to China decreased by 60-70%, constituting a 50% fall of total Japanese cotton exports (Nakamura, 1971: p282). To avoid the tariffs, many Japanese companies located cotton mills in China. The second factor for increasing FDI was the cost advantage of operating in China. Wage rates were much lower than in Japan. Furthermore,

[9] This was also the period when Japan annexed Korea (1910).

the Law of Factory which came into force in mainland Japan was not applicable in Japanese overseas affiliates[10], and thus translated into substantially lower relative wages for the abundantly available Chinese labour force. For example, wages in Zaikabo were from between half to two-thirds of what was paid in Japan domestic mills (ibid., p. 284). The third big driver of Japanese FDI in China was that Japanese cotton factories had large excess money for investment from the large accumulated profits during WWI due to temporarily but drastically increasing exports, compensating for the decline of European exports to Asia (ibid., pp.282-287).

An important aspect of FDI presence in China (Zaikabo) was the competition and dependence relationship with Chinese local firms in China. More precisely, during WWI, as a result of Europe and India decreasing production of cotton textiles, Chinese firms substantially increased their output and hence began seriously constituting a threat to the Japanese cotton mill FDI. As a reaction, Zaikabo shifted production to high-quality textile products for differentiation purposes (Kuwahara, 2011). Moreover, to further impede competition, some Zaikabo (e.g., Naigaimen, Co.) started collaborating with the Chinese local firms in importing cotton as well as through jointly undertaking projects to improve the quality of cotton (Abe, 2011). Additionally, until the Second Sino-Japanese war (1937), the Zaikabo also tended to keep a certain level of collaboration with the Chinese government and firms by employing many Chinese workers (Imai, 2010). At the same time, the Chinese local firms hoped to benefit from Japanese technology transfer through the employment of workers who had previously worked in Zaikabo's high-technology environment and management. Thus, as Imai (2010) points out, while Zaikabo and Chinese local firms did compete, they were also dependent on each other. This constitutes an important channel for technology spillovers from Japanese FDI, as we further discuss below.

Prosperity and Turbulence

By 1924, Zaikabo accounted for 32.4% of cotton yarn and 30.4% of cotton fabric, while Zaikabo output and imports from Japan represented 28% of Chinese cotton yarn and fabric consumption, i.e., a significant increase from the 8.4% post-World War I figure (Takamura,

[10] While the Law of Factories, prohibiting child labour and long working hours of young female workers, did come into force in 1916, it was not applicable to the textile sectors until a revision of the law was promulgated in 1923. Moreover, the earthquake in Tokyo in 1923 postponed the enforcement of the revised law, so that it only came into force in July 1929.

1982: p129-130). From the end of WWI to the early 1920s, all 10 major Japanese cotton spinning companies started operation in China as Zaikabo. By contrast, foreign ownership of the US and European countries in China became negligibly small (ibid., p. 118-120). These Zaikabo were geographically highly concentrated in that 26 out of 35 Zaikabo factories were located in Shanghai, and the remaining 7 were in Tsingtao. However, these two agglomerations were starkly different in that in Tsingtao, unlike in Shanghai, there was only one Chinese local firm, and the Japanese military government office in Tsingtao actively facilitated FDI from Japan by offering land, raw materials, and machinery at affordable prices.

The prosperity of Zaikabo in Shanghai was swayed by the political situation in China. The “21 Demands” proposed in 1915 by Japan steadily stirred up Chinese nationalism. The rise of anti-imperialism in China led to labor movements and boycotts, often orchestrated by the Communist Party. Furthermore, inflation in the boom after WWI caused workers to go on strikes for higher wages, of which 33 were in cotton mill factories during the 1918 to 1922 period. Out of these 33, 17 strikes happened in Zaikabo, while 2 were in companies under UK ownership and 14 in Chinese local (“Minzokubo”) factories (Takamura, 1982: p.139). In 1923, the movement for recovering Port Arther and Dalian led to a further anti-Japan sentiment. In 1925, riots erupted, such as the "May Thirtieth Movement," stemming from a frustration with the poor working conditions. On May 15th, a riot by Chinese workers erupted in a factory of Naigaimen, Co. (a Zaikabo firm), and one young Chinese Communist worker was shot dead. Then, riots spread to other Zaikabo firms. Finally, on 30th May, the Communist Party instigated a large-scale protest by thousands of workers and students in Shanghai City, resulting in 4 being shot dead, 20 injured, and many arrested by the Police of Shanghai Municipal Council, further inciting strikes all over China (ibid., pp.145-146). Importantly, according to Ishii (2012: pp180-183), the main cause of riots was not attributable to the Zaikabo but rather arose from an increased sense of Chinese nationalism due to Japan’s “21 Demands” in 1915 as well as criticism of Japan’s increased interest in the Manchuria area. Nakamura (1971: p330) similarly points out that the riots were just one political incident and not directly caused by Zaikabo’s wage and management system. More specifically, he argues that a Zaikabo was considered as a purely private company’s FDI buying raw materials, such as cotton, from the Chinese local

market, hiring Chinese workers, and selling textiles on the local market, and hence not thought of as vanguard of Japanese imperialism (ibid, p.331). [11]

Despite these events, Zaikabo's profitability remained relatively unaffected, arguably in part because they faced excess supply issues, and the unrest presented an opportunity to reduce this excess (Takamura, 1982: p. 148). Additionally, plants outside of Shanghai experienced little damage, allowing them to increase production. To address these challenges and coordinate efforts among Zaikabo firms while suppressing riots and strikes, the "Zaikabo Spinners' Association" was formed in June 1925. The association aimed to coordinate interests, exchange information, provide mutual assistance in case of riots, and exert political influence against the anti-Japanese movement (ibid, p.148).

Deterioration of the Sino-Japanese Relationship and withering Zaikabo

On September 18th, 1931, the Mukuden (Manchurian) Incident occurred, which is a Japanese military action, where an explosion destroyed the South Manchuria Railways. The Japanese military accused Chinese dissidents of the act and used it as a pretext for the military invasion of Northeast China. The Mukden Incident is a crucial moment of the deterioration of the Sino-Japanese relationship (e.g. Koike, 2003; Ishii, 2012), with the result that Japanese troops occupied the Northeast part of China. Subsequently, a new country, Manchuria, was founded in 1932 and put under Japanese political control. This triggered a boycott of Japanese goods and intensified the anti-Japanese movement across China (Bo et al., 2024). Shanghai was particularly affected by this movement, involving Chinese capitalists, workers, and the general public. To quell the movement, Japanese military troops were dispatched to Shanghai, and the international settlement area was placed under martial law. This eventually escalated into the Battle of Shanghai in January 1932, which lasted for three months. The Japanese military withdrew in May 1932 following a cease-fire agreement.[12] In response to the boycott and anti-Japanese sentiments, Zaikabo gradually relocated production from Shanghai to North China and Manchuria. Tianjin and Tsingtao thus became important locations for Zaikabo operations,

[11] Furthermore, after the May Thirtieth Movement in May 1925, Naigaimen sought to eliminate external disruptive factors by attempting to establish connections with Shanghai's social networks. Naigaimen approached secret societies to make use of these organizations, which intention was to have them serve as mediators in the event of labor disputes (Kuwahara, 2011: pp.20-22).

[12] As a consequence, from January 28th to April 25th, 1932 Zaikabo operations came to a halt.

with Tsingtao already being under Japanese control due to territorial changes after World War I (Takamura, 1982: pp. 217-218)

The Second Sino-Japanese War began with the Marco Polo Bridge Incident on July 7th, 1937, and escalated into military conflicts, particularly in Shanghai, in August 1937. This conflict led to the suspension of Zaikabo operations from August 13th onwards. Japanese employees' families were sent back to Japan, and Japanese workers collaborated with Japanese military forces. Many Zaikabo mills in Shanghai were damaged or destroyed during military attacks. In particular, a significant portion of Zaikabo mills located in the international settlement area faced extensive damage. Shanghai suffered the greatest destruction, with all Zaikabo mills being completely obliterated in December 1937.

2.3 History of Shanghai and its prosperity as an International City

The reason why Shanghai served as a location for foreign business and trade activity, and ultimately the main location for Japanese textile firms, can be traced back to The Treaty of Nanking in 1842, which was the first of a number unequal treaties imposed on China by Great Britain as a results of the First Opium War (1839-1842).[13] As a result, Shanghai was opened to European countries and the US for trade and commerce, as well as creating the Shanghai International Settlement and the French International Settlement in Shanghai city. Additionally, in 1854 the Shanghai Municipal Council was established as an autonomous administrative body (including police and tax authorities) in the international settlements. Subsequently, many branch offices and factories were established by European and US trading, banking, financial, commercial, and manufacturing companies in the area, while at the same time, many modern buildings and transportation systems were constructed under European-style urban planning. After the Sino-Japanese war in 1894, the Treaty of Shimonoseki in 1895 added Japan as another foreign power in Shanghai and a member of the Shanghai Municipal Council. This resulted in a number of Japanese districts in Shanghai, attracting Japanese businesses, and the construction of residences, hospitals, schools, and commercial shops. By the 1920s, Shanghai had become a modern city and a center of finance and commerce in Asia.

[13] See e.g. Takahashi and Furumaya (1995) about the history of Shanghai City.

2.4 Background on productivity spillovers from Zaikabo

According to theories of the multinational enterprise (such as Markusen 1995), multinationals have a technology advantage vis-à-vis domestic firms, which can then "spill over" to local firms (e.g., Görg and Strobl, 2001). Hence, an important condition for productivity spillovers from Zakaibo to Chinese local firms ("Minzokubo") to occur is that the former had substantial productivity advantages over the latter. In this regard, as shown in Takamura (1982: p181), while Zaikabo's productivity was lower compared to Japan (48-52% of Japanese domestic production), it still outperformed local Chinese firms, which operated at only 55-70% of Zaikabo's productivity levels. As pointed out by Takamura (1982: pp.181–184), there are a number of reasons for this. Firstly, Zaikabo benefited from using modern and more advanced machinery, in particular new technologies like high draft machines, while Chinese local firms (Minzokubo) used outdated, often by decades, machines.[14] Second, Zaikabo had more efficient management systems. They implemented a direct control employment system, akin to the standard Japanese management system, which ensured better management and coordination of employees, often involving a piece rate wage system tied to class-based wages.[15] In contrast, Chinese local firms relied on the "Houshin Sei" employment system, which involved contractors hiring workers from rural areas, leading to inefficiencies, poor machine management, and an overall lack of effective supervision. Third, Japanese networks provided Zaikabo with access to lower-cost capital from Japanese banks and cotton at reasonable prices from Japanese trading companies, whereas Minzokubo firms often had limited access to capital and had to rely on higher-cost material inputs. Fourth, Minzokubo faced greater taxation than Zaikabo. For instance, in the Shanghai International Settlement, Zaikabo firms were levied only land tax and small contributions to the Japanese Residents Union, but otherwise no taxation. Thus, they enjoyed more favorable taxation conditions than the Minzokubo due to their extraterritoriality.

Given that Zaikabo had a productivity advantage compared to local firms, one may expect the potential for spillovers to be present. Indeed, there is evidence that Zaikabo aggressively transferred technologies and know-how from headquarters and main plants in Japan

[14] In Minzokubo, extremely old spinning machines, used for 26 to 47 years, accounted for 30%, while those used for 16 to 25 years made up 14%. While over 90% of Zaikabos used machines with electric motors, among the 45 Chinese factories, 29 used electric motors, 12 used steam engines, and 4 used both. (Takamura, 1982: p.182)

[15] One should note that while this was efficient, it did occasionally lead to racial tensions.

mainland to their affiliates in Shanghai. According to Kuwahara (2011, 2007), Nagianmen Co., one of the biggest Zaikabo, sent many Japanese workers to their Chinese affiliate factories to boost productivities. 54 Japanese workers were sent to Shanghai in 1917 and this increased to 365 workers in 1924 (Kuwahara, 2011: p.15). In terms of training, Chinese local workers were required to learn the Japanese language and know-how on cotton machines usage, spending one hour per working day or two days per week.

In terms of transfer of the technology to Chinese local firms (Minzokubo), Zhuang (2003) illustrated how Chinese local firm owners managed to boost productivity with the adaption of Japanese superior technology and management system. For example, imitating the Greater Japan Cotton Spinners' Association, they founded the association for Chinese Spinners, although it was not very successful. Moreover, they often visited Zaikabo Factories as well as Zaikabo's headquarters in Japan to learn their production systems, as well as recruiting some excellent Chinese technicians at Zaikabo.

Local worker's 'job hopping' was also a channel of spillovers. Ashizawa (2014, 2011), investigating job carrier, job training, and skills of Chinese employees using worker level data in Naigaimen, Co.[16], finds that before getting jobs in Naigaimen, many Chinese local workers had already some experience in neighboring local Chinese cotton factories in Shanghai. After acquiring some skills, they often obtained positions in Naigaimen in search of higher wage. Naigaimen used a system for on the job training and had a wage system based on bonuses and promotions to provide incentives to work hard (Ashizawa, 2011). However, job tenure was very short, where, as shown by Ashizawa (2014, Ch. 2), around 70% left within a few years.[17] They often subsequently obtained jobs in Chinese local firms, which appreciated the working experience in Zaikabos. Thus, Shanghai was characterized by a dense labor market for skilled cotton textiles workers involving frequent job-hopping between Zaikabo and Chinese local firms (Minzokubo).

[16] The micro-data in Naigaimen, Co. covers Chinese local workers' background, job carriers and experiences, salaries, and detail task and position inside Naigaimen factory.

[17] Male technicians tended to have longer tenure (many are more than 5 years). Main reasons are lay-off, double registration with other companies, and personal reasons. In terms of employment Naigaimen, Co. had the stance that "those who come are welcome and those who left are not regretted" (Ashizawa, 2011).

3 Data sources

In order to examine more comprehensively whether Chinese producers benefited from the presence of Zaikabo in their geographic vicinity, we have collected unique data at the firm level relating to the activities of Zaikabo and Chinese local cotton producers (Minzokubo). The data come from the *Handbook of Textile Industries* ("Boushoku Yoran") which is published annually by Boshoku Zasshi-sha, and *Statistics on Japanese Spinning Industry*, ("Bouseki Jijo Sankosho") published by Dai-Nihon Bouseki Rengokai (Japan Association of Cotton Spinning). We have assembled the data for the period 1925 to 1938. Both data cover all Japanese textile companies and their plants in Japan, their affiliates in China (including Manchuria) as well as other local firms in China.

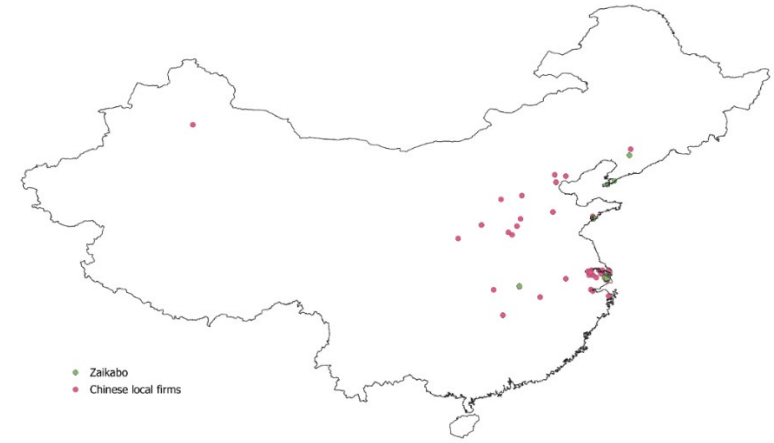
We are able to obtain information on firms' addresses (headquarters and plants), their total output in terms of cotton value, the number of spindles and looms, capital assets, number of employees as well as the year of foundation of the firm. This is available for Zaikabo and Chinese firms. Before 1935 the dataset covers information in Tan and afterwards in Yards, hence we adjust the data accordingly and measure everything in Yards. Likewise, capital assets for Chinese firms are in Chinese currency (silver) units (Tael and Yuan). We converted tael to yuan.

In order to geo-locate firms, using information on the firms' addresses we gather detailed information on longitude and latitude. We determine the coordinates of plant location in Shanghai from historical maps on the Shanghai Concession, "Plan of Shanghai" published by the War Office, Geographical Section (1937), "Saishin Shanghai Chizu (New Shanghai Map)" published by Osaka Asahi Newspaper (1932). These maps include all street names as well as locations of companies and plants, hotels, banks, apartments, shops, transportation infrastructure and public places (such as hospitals, schools, temples, and churches). We can also identify the location of the Japanese residential place, "Little Tokyo". Since most streets are the same as current ones, we use GIS to measure coordinates. We can thus identify the exact location of each plant in Shanghai.

To do the same for firms located outside of Shanghai, we use the information on firm location from the firm data, which is available at the town level. We then use the name of the town and determine the centre of the town by GIS. Figure 1, Panel A illustrates the locations of Zaikabo in green and the location of Chinese local firms (Minzokubo) in red. This shows a

concentration of firms in the Eastern part and, in particular, in Shanghai. Panel B zooms in on Shanghai.

Figure 1: Locations of Zaikabo and Chinese Local Firms



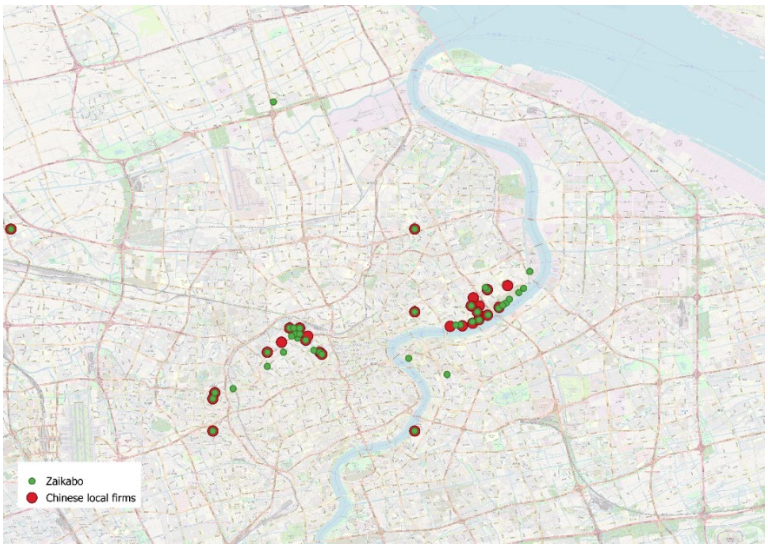


Table 1 shows descriptive statistics for Chinese local firms (Minzokubo) and Zaikabo in our data. There is a substantial variation in firm size as Chinese local firms employ between 270 and 5,923 workers. Similarly, the number of spindles employed per firm and the output volume vary substantially across firms. Descriptive statistics for Zaikabo firms are summarized in the second panel.

Table 1: Summary Statistics

a) Chinese firms

VARIABLES	Mean	Std. dev.	Min.	Max.	Observations
Output (in yards)	26,395.52	33,345.89	730	601,000	403
Spindles	46,640.88	38,131.98	5,120	407,480	403
Capital assets (yen)	2,432,080	2,549,121	71,500	1.20e+07	403
Number of workers	2,680.191	2,491.412	270	30,800	403

The sample is restricted to firm-year observations with positive output. The estimation sample includes only firms with positive output and positive number of spindles, resulting in 403 observations. This includes 50 Chinese local firms in an unbalanced panel.

b) Zaikabo

VARIABLES	Mean	Std. dev.	Min.	Max.	Observations
Spindles	29,764.16	26,001.23	1,020	338,000	375
Capital assets (yen)	2.55E+07	3.31E+07	2,400,000	1.60E+08	323
Founding year of plant	1904	15.31672	1887	1929	375
HQ in JPN	0.544	0.4987256	0	1	375

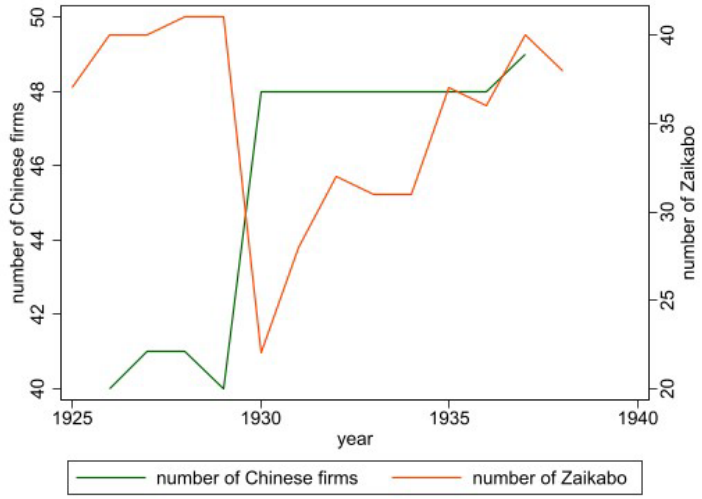
Note: The estimation sample is restricted to firm-year observations with a positive number of spindles. The time span is 1925-1938. The founding year is not Zaikabo's but the plant's.

Note that, in our data, the founding year is the year of starting operation of the plant rather than the Zaikabo. The oldest Zaikabo's plant dates back to 1887. As mentioned above (section 2), the first Zaikabo was founded in 1911 (Naigaimen, Co.), and most of the Zaikabo plants were taken over from various local Chinese firms (Minzokubo) and foreign-owned firms (Takamura, 1982: pp.75-78, pp. 116-123).[18] Zaikabo often acquired cotton mills of exited firms or dormant/abandoned mills. The acquisition rather than green field FDI could save costs and time, which gave a large advantage to the Japanese firms in the Chinese market (Zhang, 2011: p.133). In addition, as pointed out in section 2, the entry of Japan to the Shanghai International Settlement was much later than that of European countries and the US. The major powers already dominated territories for business and manufacturing production. Furthermore, cotton mills were required to locate in riverside areas to transport raw materials and final products. As shown in Figure 1, cotton mills formed two clusters, Yangshupu district on the

[18] For example, Shanghai Bouseki (the first Zaikabo) and Toka Boseki took over the bankrupt Chinese local firms and Nikka Boushoku, Co. took over a British firm.

Huangpu river (East one in Figure 1) and Putuo district on the Suzhou Creek (West one). This implies that the Japanese FDI had almost no room for location choice, which reduces the selection bias in terms of geography inside Shanghai.

Figure 2: Trends in Active Zaikabo and Chinese Local Firms (Minzokubo) Over Time



Note: We define an active firm as one that has positive output in the respective year, according to our data.

Figure 2 illustrates the evolution of the number of active Zaikabo and local Chinese firms in our data. As is evident, Zaikabo were significantly affected by the economic crisis in 1930. The number of Zaikabo decreased from 41 in 1929 to 22 in 1930, but then recovered again to reach 38 by the year 1938. Over the same period, local Chinese firms experienced a steady increase in their numbers. This likely reflects several economic reforms (tariff, currency, and banking) by the Nationalist Government of China as mentioned above (section 2). In our data, the number of active local Chinese firms increased from 40 to 48 between 1926 and 1936.

4 Econometric Methodology

To investigate whether Japanese Zaikabo impacted the performance of Chinese cotton producers, we estimate sets of augmented production functions (as in, e.g., Aitken and Harrison, 1999; Javorcik, 2004; Lu et al., 2017). Output is measured as the total value of yarn produced. Firm-level inputs are the level of employment and the number of spindles used in the production process. We then analyse whether, conditional on these observable input factors, the presence of Zaikabo in the vicinity of the Chinese firm has any measurable impact on their output.

This idea for identifying FDI spillovers is implemented in the following production function equation:

$$y_{it} = \beta_1 s_{it} + \beta_2 l_{it} + \beta_3 pres\_zaikabo_{it-1} + d_i + d_t + \varepsilon_{it} \quad (1)$$

where *y* is log output (in terms of yarn produced) by local Chinese firm *i* in year *t*, *s* is the log number of spindles, *l* is log employment, and d_i and d_t are full sets of firm and year dummies, respectively.[19] *Pres_zaikabo* measures the lagged presence of Zaikabo in the vicinity of firm *i*, which will be defined in detail below. In this specification, the coefficient of interest β_3 measures, conditional on other variables in the model, the impact of changes in the presence of Japanese Cotton producers on the total factor productivity of Chinese firms. This is what we refer to as a "spillover effect".

In order to get an idea of the possible mechanisms through which firms change productivity, we also look at the impact of the presence of Zaikabo on capital employed by Chinese firms. Specifically, we use the number of spindles as an outcome. The spillover estimate in this case indicates whether Chinese firms have adapted their stock of spindles (as an indicator of capital stock), which may suggest changes in production technology.

The standard approach to measuring FDI spillovers is generally based on a variable that measures the presence of foreign firms as the share of employment (or output) in foreign multinationals relative to total employment in firm i's industry or in vertically related industries. To allow for a geographic dimension, this may be calculated for a geographic cluster, usually an administrative region or municipality (e.g., Girma et al., 2015, Aitken and Harrison, 1999). This is, of course, a fairly rough way of considering how the distance between local and foreign firms matters for spillovers through knowledge transfers. Given our detailed geographic data, we are able to follow a much more fine-grained approach.

We geo-reference all local Chinese firms and all Zaikabo $j \in J$ and compute the Euclidean distance for each pair $dist_{ij}$. We follow the literature on knowledge spillovers (e.g. Jaffe and Trajtenberg, 1996; Figueriredo et al., 2015) and construct a spillover term which given by

$$pres\_zaikabo_{it} = \sum_{j=1}^{J} \frac{1}{(dist_{ij})^{\alpha}} \quad (4)$$

[19] We note that the number of looms counted as spindle equivalent in our analysis follows the approach suggested by Kiyokawa (1974).

where α is set to unity in the benchmark specification and all Zaikabo are considered for each Chinese cotton producer. In other words, we allow for each Zaikabo to have a potential spillover effect, but this effect diminishes with distance.

Note that *pres_zaikabo* is firm *i* specific, as the distance between i and j varies across firms. This is an advantage over the spillover variables generally used in modern studies (as share of employment in foreign firms), which are industry-region, but not firm specific. For our spillover variable, time variation comes through new Zaikabos entering and existing Zaikabos becoming inactive. We only consider active Zaikabo for our purposes.

To look at more detail into the spatial characteristics of FDI spillovers, we also, in an extension to our baseline model, calculate spillover effects across different distance ranges. We then run alternative specifications with varying distance bands where we compute the spillover term for Zaikabo within the range *l* to *u* as $pres\_zaikabo_{it}^{l,u} = \sum_{j=1}^{J} \frac{1}{(dist_{ij})^{\alpha}} \ \ for\ l \leq dist < u$. Specifically, in what we report below we choose one distance band as between 0 and 10km, 0-20km and another as 0-30km. This reflects the finding in the literature that spillovers are generally geographically localised (e.g. Jaffe and Trajtenberg, 1996; Driffield and Girma, 2003; Figueriredo et al., 2015).

As these measures thus far are only based on number of Zaikabo, without giving regard to the size of the firm, we also use spillovers weighted by the size of the respective Zaikabo. This is measured in terms of the share of spindle of the respective Zaikabo in total production capacity in China (referred to as $pres\_zaikabo\_weighted_{it}$) as well as spillovers weighted by the size of the total number of spindles owned by the company to which the Zaikabo belongs to (i.e., summing over all China-based as well as non-China based plants of the company). Note that, in order to facilitate interpretation, we estimate standardized coefficients for the spillover terms so as to have comparable coefficients.

5 Estimation Results

Table 2 presents the results of estimating the models described above. The specification in column (1) estimates the Cobb-Douglas parameters for the two input coefficients. The parameters obtained have reasonable magnitudes, indicating a relatively high share of labor input, which is consistent with the characteristics of the cotton industry. Overall, this simple

and standard production function approach explains more than 70 percent of the variation in output.

Column (2) employs the distance-weighted measure of spillovers, *pres_zaikabo*, as defined in equation (4). The results indicate a statistically significant and positive coefficient for the distance-weighted spillover indicator. In other words, the findings suggest that cotton producers can increase their productivity when the number of Zaikabo firms in their vicinity rises. Given that the spillover variable is standardised, the point estimate gives the percentage change in productivity following a one-standard-deviation increase in the spillover variable. This is 15.1 percent in column (2), indicating that the estimated effect is not only statistically significant but also economically meaningful.

In columns (3) and (4) we use alternative spillover measures. Specifically, column (3) uses a size-weighted measure, *pres_zaikabo_weighted*, which accounts for firm sizes (proxied by the number of spindles). More specifically,

$$pres\_zaikabo\_weighted_{it}^{l,u} = \sum_{j=1}^{J} \frac{1}{(dist_{ij}) \times Spindles_j} \quad for\ l \leq dist < u \qquad (5)$$

It thus allows for the fact that we might expect a greater spillover potential from larger Zaikabos. Reassuringly, the results found using this size-weighted measure are very similar to the ones in column (2), in terms of sign, statistical significance, and magnitude of the estimated effect. Indeed, the coefficient estimate in column (3) compared to column (2) may suggest that the size of Zaikabo firms plays a role, as the estimates become somewhat more precise with the size-weighted measure of spillovers. It seems a reasonable assumption that larger firms generate more potential for spillovers. If spillovers happen through the movement of workers from Zaikabo to Chinese local firms (as alluded to above, section 2), then larger firms, with a larger number of workers, may generate more spillovers than smaller firms.

In column (4), we replace the size weights of individual Zaikabo firms with a measure based on the size of their parent firm, specifically the total number of spindles across all plants owned by the respective parent firm of the Zaikabo. Once again, we find strong evidence of spillovers, with the magnitude of the effects increasing slightly. In subsequent analyses, we adopt the size weights, accounting for the respective Zaikabo firm's size as our preferred measure for spillovers.

Table 2: FDI spillover effects

	(1)	(2)	(3)	(4)	(5)
	Log Output				Log spindles
pres_zaikabo		0.151**			
		(0.0686)			
pres_zaikabo_weighted			0.126***		0.0833**
			(0.0473)		(0.0397)
pres_zaikabo_weighted_HQ				0.330**	
				(0.159)	
log workers	0.484***	0.489***	0.486***	0.487***	0.360***
	(0.0991)	(0.0987)	(0.0971)	(0.079)	(0.0791)
log spindles	0.210**	0.202**	0.192*	0.192**	
	(0.0996)	(0.0996)	(0.0980)	(0.077)	
Observations	403	403	403	403	403
R-squared	0.764	0.765	0.767	0.767	0.883

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 . All columns include firm fixed effects and time fixed effects. Standardized coefficients are reported the for the spillover terms *pres_zaikabo* (inverse distance weighted sum of active Zaikabo), *pres_zaikabo_weight* (inverse distance weighted sum of active Zaikabo weighted by the size of the Zaikabo), and *pres_zaikabo_weight* (inverse distance weighted sum of active Zaikabo weighted by the size of the firm the Zaikabo belongs to)

.

Finally, in column (5), we look at one potential mechanism of how the productivity improvement that local firms experience may come about. Specifically, we look at whether local firms increase their capital stock. To do so, we shift the outcome variable to the number of spindles used by Chinese firms. The results suggest that the positive productivity effect of Zaikabo firms in proximity to Chinese firms may partly stem from an increase in the number of spindles used by Chinese producers. This indicates that Chinese firms may be upgrading their technology and shifting towards greater capital usage.

The literature suggests that it is reasonable to assume that spillovers are strongest if the foreign firm (Zaikabo in our context) is in the immediate geographic vicinity and that they peter out over longer distances (e.g. Jaffe and Trajtenberg, 1996; Driffield and Girma, 2003). This may be particularly relevant in the historic context we consider here, as information was arguably far less mobile and transferable than it is in today's age of modern communication technologies. In order to allow for the role of distance, we now calculate spillover measures for three distance bands: the first being within 0 to 10km from the local firm, the second 0 to 20km, and the third 0 to 30km. The results are reported in columns (1) to (3) in Table 3.

We report estimation results, using the size-weighted spillover variables as in Table 2, column (3), in all specifications of Table 3. The results in columns (1) to (3) clearly show that distance indeed matters: we only find statistically significant spillover effects from Zaikabo located within 0 to about 20km away from the local firms. The coefficient magnitudes monotonically decrease with increasing the distance bands. While effects are still of economic relevance at 30km distance band, they are not statistically significant anymore, and they further decline when increasing the distances to Zaikabo further away than 30km (these results are not reported to save space).

Table 3: Distance thresholds of spillover effects

	(1)	(2)	(3)
	Distance X=10km	Distance X=20km	Distance X=30km
pres_zaikabo_weighted distance 0 - X km	0.155**	0.135**	0.106
	(0.0663)	(0.0665)	(0.0674)
pres_zaikabo_weighted distance > X km	-0.0587	0.0215	-0.0406
	(0.0613)	(0.0581)	(0.0595)
log workers	0.492***	0.488***	0.480***
	(0.0798)	(0.0801)	(0.0801)
log spindles	0.190**	0.189**	0.199**
	(0.0780)	(0.0786)	(0.0786)
Observations	403	403	403
R-squared	0.767	0.767	0.767

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 . All columns include firm fixed effects and time fixed effects. Standardized coefficients are reported the for the spillover terms *pres_zaikabo_weighted* (inverse distance weighted sum of active Zaikabo weighted by the size of the Zaikabo).

We now turn to look at a number of other issues related to heterogeneity of the spillover effects, the results of which are reported in Table 4. As we saw in the map produced in Section 3 (Figure 1), Chinese local firms, as well as Zaikabo, are heavily concentrated in the city of Shanghai. We therefore check whether this city is driving our results, by allowing the spillover effect to be different for local firms located in Shanghai and those in the rest of the country. This is done by interacting the spillover variable with an indicator equal to one if the local firm is in Shanghai. These results are reported in Table 4, where we always estimated the baseline specification as presented in column 3 of Table 2 and added an interaction term for the corresponding heterogeneity. Table 5 reports only the main effect of the spillover for the reference and the comparison group. With regard to the location in China, the results in the

first line show that, indeed, mostly Chinese firms located in Shanghai benefit from spillovers. In contrast, we do not find significant spillover effects for firms located in Tsingtao (second line).

Table 4: Heterogeneity of spillover effects depending on Chinese firms

	(1)	(2)
VARIABLES	I=0 (No)	I=1 (Yes)
Presence in Shanghai	3.005	0.146***
	(4.742)	(0.052)
Presence in Tsingtao	0.178**	5.050
	(0.075)	(8.355)
Distance to JPN residential area<mean	0.078*	0.401***
	(0.045)	(0.045)
Foreign-owned firm	0.070	0.461***
	(0.044)	(0.077)
firm age >=median firm age	0.122***	0.134
	(0.045)	(0.092)
Multiplant firm	0.142***	0.088*
	(0.051)	(0.051)
Post 1931	0.070	-0.017
	(0.059)	(0.106)
Firm size > Median (measured by capital assets)	0.136***	0.204***
	(0.049)	(0.094)

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 . Standardized coefficients for the interaction terms are reported. All specifications use the size-weighted spillover term *pres_zaikabo_weighted* and include the same control variable as the main specification in column 3 of Table 2.

We dig a little deeper into the locational aspects by looking at the proximity of the firm location to the Japanese residential area (Little Tokyo) in Shanghai city. One might argue that Little Tokyo provided additional opportunities for knowledge transfer through informal face-to-face communication in meeting places in this residential area. To account for this, we measure the firm's distance from the central place of Little Tokyo. We then split the sample based on the mean of this measure. The results confirm our hypothesis: while the positive impact remains significant for both groups, the effect is clearly more pronounced for the firms in the proximity of Little Tokyo.

Further heterogeneities that we looked at are related to other characteristics of the local Chinese firms: size, whether they are a plant of a larger multi-plant company, whether they have some level of foreign ownership (other than Japanese), and the founding year of the

firm. Firm size, measured by the capital assets of Chinese firms, appears to be relevant insofar as the point estimates are larger for above-average-sized firms. However, the estimates are also statistically significant for smaller firms, and the confidence intervals of the spillover effects overlap across both size groups.

Somewhat surprisingly, we find that the spillover effects are more pronounced for single-plant firms. One explanation could be due to the pre-existing knowledge capacity that is arguably less pronounced in single-plant than in multi-plant firms. This could be explained by the better potential to take up information and knowledge from Zaikabo. With regard to the age of the local Chinese firms, we observe little heterogeneity in the magnitude of the effects, but the statistical significance is higher for the younger firms. A significant effect pertains to the ownership type of local firms: firms with some foreign-ownership participation tend to see more pronounced spillover effects. Note that the size-weighted spillover effects are still significant at the 15 percent level for non-foreign firms, and the spillovers without size weights remain significant at the 5 percent level with a magnitude of 0.152 for non-foreign firms. Hence, the spillovers were not limited to firms with some foreign ownership but they were clearly more pronounced.

As noted in Section 2, relations between Japan and China deteriorated rapidly in the 1930s, particularly after the 1931 *Mukden Incident (Manchurian Incident)*. In such a hostile political environment, one might expect interactions between firms—and their workers—to be limited, thereby restricting potential spillovers. To examine whether this is reflected in our data, we interact our spillover variable with a dummy variable that equals one for years after 1931 and zero otherwise. This allows us to assess whether the nature of spillovers changed following the *Mukden/Manchurian Incident*. The results, reported in the last row of the firms panel in Table 5, indicate that the coefficient turns negative when the sample is restricted to post-1931 observations. However, introducing an interaction term to examine group-specific effects reduces within-firm variation, which is crucial for identification in fixed-effects specifications. As a result, the effect remains positive in earlier years but ceases to be statistically significant. These findings suggest that Chinese firms adapted their production technology and no longer benefited in terms of output once spillovers from *Zaikabo* diminished. This is consistent with the above-mentioned evidence that Zaikabo shifted their production to Manchuria and North China to prevent a boycott of Japanese goods and intensified the anti-Japanese movement after the Mukden incident.

We also examine the implications for spillovers of heterogeneities among Japanese *Zaikabo*. Zaikabo firms had substantial heterogeneity in ownership, management system, products, firm organization, process/background/history/timing of investment in China (Takamura, 1982). Therefore, not all types of *Zaikabo* might have the same potential for spillovers, and this is what we investigate here. We first consider whether the Zaikabo reports its headquarters to be in China or in Japan. Some firms (e.g. Naigaimen) headquartered in Japan and established branch offices and plants in China, while some established affiliated companies headquartered in China with parent firms in Japan and some (e.g. Shanghai Bouseki) were headquartered in China and established branch offices in Japan. The idea is that the potential for spillovers may be higher if the HQ is not located in Japan, as this may indicate that firms are more deeply invested in China and are more internationally oriented and thus generate stronger spillovers. We also consider whether the HQ is located in Manchuria, with the same reasoning applying.

To look at this, we calculate two spillover variables as in equation (4), one based on Zaikabo with HQ in Japan and the other without. We then include both variables in the productivity estimation and report both coefficients in Table 5. We proceed similarly in the case of HQs in Manchuria. Our findings suggest that spillover effects are most pronounced for *Zaikabo* headquartered outside both Japan and Manchuria, in line with our expectations.

Furthermore, we also investigate whether the spillover potential differs depending on the size and the age of the *Zaikabo*. We would expect a higher potential for large and old firms to generate spillovers. Larger firms have a higher absolute number of employees, which can potentially move to local firms and transfer knowledge, thus facilitating job-hopping as discussed in Section 2. Also, large and older firms may have a more established knowledge about the industry and the competitive environment, knowledge that can be usefullytransferred to local firms. To check this aspect of heterogeneity, we first distinguish firms by employment size into whether they are larger than the lowest percentile of the size distribution or not. We also use an alternative measure defined using the median. Firms are also classified by age using the median age.

Results, shown in the bottom rows of Table 5, indicate that, regarding firm size, firms on either side of the median exhibit similar spillover effects, whereas very small firms—those in the first quartile of the size distribution—do not display significant spillovers. Similarly, older *Zaikabo*

generate stronger spillover effects. These findings suggest that a minimum threshold of firm size and age is necessary for a *Zaikabo* to possess the human capital or knowledge required to contribute meaningfully to positive spillovers for local Chinese firms.

Table 5: Heterogeneity of spillover effects depending on Zaikabo

	(1)	(2)
VARIABLES	I=0 (No)	I=1 (Yes)
Headquarter in Japan	0.154***	0.023
	(0.060)	(0.063)
Headquarter in Manchuria	0.159**	0.091
	(0.066)	(0.073)
Firm size > 1. Quartile	0.026	0.146**
	(0.039)	(0.070)
Firm size > Median	0.271***	0.243***
	(0.090)	(0.072)
Age > Median	-0.013	0.159***
	(0.059)	(0.075)

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 . Standardized coefficients for the interaction terms are reported. All specifications include the same control variable as the main specification in column 3 of Table 2.

6 Conclusions

In this paper, we use comprehensive historic firmlevel data to estimate productivity spillovers from Japanese textile companies' affiliates in China (*Zaikabo*) to local cotton producers in China. We have access to very detailed information on all *Zaikabo* as well as local textile firms during the period 1925 until 1938, a period of tumultuous relationships between Japan and China. We geo-localized and digitized this information in order to allow us to pinpoint the exact location of the firms. This enables us to also capture the role of distance in facilitating productivity spillovers.

Our results provide clear evidence for positive spillovers from the Japanese foreign affiliates (Zaikabo) to local Chinese firms. They are able to improve their overall productivity and this goes hand-in-hand with a change in production technology towards greater use of capital / spindles. Our paper is thus the first to provide evidence for such spillovers in a historical context. We also find that spillovers are very localised, being strongest within a radius of up to 10km around the Zaikabo and then petering out with further distance. These extremely

localised spillover results may also explain why much of the "spillovers literature" generally fails to find strong evidence for spillovers in the same industry: these studies are not able to zoom in on the geographic dimension in the same detail as we are able to.

At another cut at the geographic dimension of our data, we find that evidence for spillovers is particularly strong for firms in Shanghai. This reflects the importance of Shanghai as the centre for Cotton textile production at the time.

Overall, our paper shows that FDI spillovers matter also in a historic context. From today's perspective, our paper, by focusing on a very distinct sector with a fairly homogeneous product, provides a novel identification of spillovers, as we can abstract from industry heterogeneity and to a large extent also endogenous plant location, that plague many modern studies using data for the whole manufacturing sector (e.g., Girma et al. 2015 or Lu et al. 2017 for China). We are therefore able to clearly pinpoint the source of spillovers and the geographical dimension to it. Our historical approach hence shows that horizontal spillovers can be important.

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