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ABSTRACT

This paper examined the effects on the performance of local SMEs of a modernization fund program for small business enterprises implemented by Osaka Prefecture in the early 1950s. Utilizing firm-level panel data based on business credit reports, we empirically evaluated the effects of the program. We found an improvement in production levels among the recipients. In addition, recipients in sectors related to munitions production or in industrial agglomerations specialized in these sectors achieved additional or larger improvements in their production levels.

Keywords: place-based policy, postwar revival, directed credit, modernization, Osaka

JEL code: H84, N95, O12, R51, R58

1. Introduction

Access to finance plays a crucial role in the development of local economies. Financial market development affects regional industrial outcomes such as the start-up rate, new firm entry (Guiso, Sapienza, & Zingales, 2004) and the firm survival rate (Arcuri & Levratto, 2020), as well as more general regional outcomes, such as urbanization (Bodenhorn & Cuberes, 2018), investment and savings rates (Carbó Valverde, López del Paso, & Rodríguez Fernández, 2007), and the accumulation of human capital (Kendall, 2012)[1]. In the process of improvement of access to finance, policy intervention by the government is often justified. The access to finance of SMEs and venture firms tends to be limited because of problems such as credit constraints, which can prevent the launch or expansion of such businesses (Carpenter & Petersen, 2002; Fritsch & Storey, 2014). Thus, the role of SME finance policies in mitigating these constraints has been emphasized (Calomiris & Himmelberg, 1993; Karlan & Morduch, 2010). Despite the importance of policy interventions to improve access to finance, little is empirically known about the historical aspects of SME finance policies of local governments and their effects on the development of local industry. Although the form of access to finance depends on the local economic environment, these place-based factors have been ignored in the empirical literature so far (Ughetto, Cowling, & Lee, 2019).

In this paper, we fill this gap by empirically examining the effects of a modernization fund program for small business enterprises implemented by Osaka Prefecture in the early 1950s. This paper contributes to the literature in two main ways. First, we contribute to the research on (SME) finance policy and local industrial development. This paper is one of few investigations empirically examining the SME finance policy of a local government; the previous literature has mostly focused on such policies implemented by central governments.

[1] Arestis, Chortareas, & Magkonis (2015), for instance, provide a more comprehensive review of the empirical work testing the association between access to finance and economic growth.

In addition, we investigate not only the effects of the policy on average but also the effect heterogeneity in relation to the historical environment of Osaka and the spatial unevenness of the vestiges of wartime economies in particular. We also contribute to the literature on (SME) finance policy and local industrial reconstruction. The frequent occurrence of natural disasters and economic crises in this decade has led regional economists to investigate the role of policy-based finance in the process of local industrial reconstruction after exogenous shocks. Despite the rapid growth of this literature, few have examined the role of policy-based finance in the recovery of local industry after more catastrophic shocks such as war. Furthermore, due to data limitations, the number of empirical investigations on the activities of SMEs during the postwar period in Japan remains insufficient. In this paper, we construct a firm-level panel data set that is tractable for microeconometric evaluation by exploiting SME microdata collected shortly after WW2 based on a business credit survey combined with detailed internal data about place-based finance policy. Our empirical analysis is valuable in the sense that we evaluate the role of local finance policy in postwar reconstruction by constructing and utilizing panel data.

2. Literature Review

2.1 SME Finance and Local Industrial Development

The development of econometric methods for program evaluation and the improvement of access to firm-level microdata and spatially detailed regional data from the 2000s enabled researchers to empirically examine the effects of finance policies for local SMEs on these enterprises' outcomes. For example, Bernini & Pellegrini (2011) tested the effects of discretionary grants in Southern Italy on recipients' production and employment levels and productivity. Lee (2019) evaluated the effects of guarantee loan programs run by the U.S. Small Business Administration on the employment and wage level of metropolitan areas, and Rupasingha, Crown, & Pender (2019) investigated the effects of the USDA's Business and Industry (B&I) Guaranteed Loan Program to support businesses located in rural areas on recipients' survival[2].

It is quite important to discuss the design and effects of local industrial policies, including SME finance policies, considering their interaction with the socioeconomic factors peculiar to each region. This is because one industrial policy does not fit all regions, and designing policies rooted in each region's characteristics is challenging (Tödtling & Trippl, 2005). However, the literature has hardly addressed this issue, although investigations on regional heterogeneity of the effects within a country and on local governments' own programs can offer perspective on the issue.

As an example of the empirical research on within-country heterogeneity, Briozzo & Cardone-Riportella (2016) examined the effects of Spanish SMEs' subsidized and guaranteed credit during the economic crisis. These authors showed that the effects on firms in Catalonia and Basque (which have a different socioeconomic environment from that in other Spanish

[2] For further noteworthy empirical research on discretionary grants, see, for example, Neumark & Simpson (2015).

regions) were quite different from those on firms in other Spanish regions. There have been several recent investigations testing the effects of local governments' own SME finance policies. Cannone & Ughetto (2014) evaluated the effects of the public financing program DOCUP 2000–2006 (Documento Unico di Programmazione) in the Piedmont region of Italy. They showed an increase in indebtedness and total fixed assets in subsidized firms, though they could not find any evidence of an impact on firm profitability. Similarly, Martín-García & Santor (2019) investigated the effects of public credit guarantees on SME business activity and investment. They found a positive effect in terms of mitigation of credit constraints and the enhancement of investment in supported firms.

This paper is oriented within the latter literature. We complement this literature by empirically revealing the historical aspects and effects of local governments' SME finance policy. As stated in the decentralization theorem (Oates, 1972), the superiority of local governments over the central government is based on the fact that they can collect more information about the local environment and thus can design and manage flexible policies that are more suitable for regional economic conditions (Fernandez-Ribas, 2009). Therefore, both policies implemented by the local government and those implemented by the central government are remarkably important, and it is necessary to learn more about them. Despite this importance, most of the policies examined in the previous literature—for example, in the research on rationalization policies—were implemented under the initiative of the central government or targeted toward large firms, (e.g., Kiyota & Okazaki, 2005; Nakamura & Ohashi, 2012). We fill this research gap by focusing on a policy implemented by a local government, Osaka Prefecture, during the postwar period.

2.2 SME Finance for Local Industrial Reconstruction

Policy-based finance plays a more important role after disruptions such as economic

crises, war damage, and natural disasters. As described above, the primary role of policy-based finance is to mitigate credit constraints arising from information asymmetry. This role becomes more crucial after economic disruptions because SMEs' difficulty in securing working capital obviously increases. Additionally, the so-called cowbell effect of policy-based finance, which induces lending to SMEs by the private financial sector, is particularly important following disruptions (Vittas & Cho 1999; Shimada 2016).

The recent occurrence of the great recession and devastating disasters has spurred discussion in the field of regional science about the resilience of regional economic systems (Martin & Sunley, 2015; Boschma, 2015). As part of this trend, the role of SME finance in the process of industrial revival has been empirically examined. Here, we briefly review the work focusing on natural disasters. As a representative study, Davlasheridze & Geylani (2017) analyzed the impacts of floods on businesses and the effects of disaster loans provided by the U.S. Small Business Administration. Utilizing county-level panel data, these authors showed that SMEs are extremely vulnerable to flood disasters because of the lack of business adaptation to extreme events and further found that loans are significant for the postdisaster recovery of smaller firms. In contrast, more recent literature has shown that the effects of financial support are not always straightforward. For example, Cole, Elliott, Okubo, & Strobl (2019) examined the case of the great Hanshin-Awaji earthquake and showed that postdisaster financial aid contributed to plant survival and sustainment of the employment level in the short term but that the effects were eventually offset by the increase in debt combined with the sluggishness of the Japanese economy. Similarly, Kashiwagi (2019) found that the effects of postdisaster loans were quite limited in manufacturing sectors because of recovery through interfirm cooperation before the loans were granted.

Despite the recent progress in this literature, little research has empirically examined the effects of SME finance policy during postwar reconstruction. War damage is quite different

from economic disruptions like natural disasters in that it generally is accompanied by catastrophic changes in domestic institutions and industrial structures. Thus, investigating the contribution of SME finance policy in overcoming economic disruptions during the postwar period is remarkably valuable for expanding the insights from policy studies on regional economic resilience.

As one of a few related empirical investigations, Bianchi & Giorcelli (2019) tested the effects of the Marshall Plan implemented in post-WW2 Europe utilizing Italian prefecture-level panel data. They showed that the prefectures receiving large postwar aid achieved growth in the employment level in the manufacturing and agriculture sectors and in the production level in the agriculture sector. This paper complements this literature by carrying out an empirical evaluation utilizing firm-level microdata, focusing on prefecture-level policies rather than nation-level policies, and examining the within-region heterogeneity of the effects due to the spatial unevenness of the dependence on wartime economies. In regards to descriptive studies related to this paper, Sawai (2017) examined the current state of a factory diagnosis program and R&D activities in a local public technology center carried out by Osaka Prefecture and Osaka City in the late 1940s, and Spadavecchia (2005) implemented a cross-regional comparison of subsidy programs for Italian industrial districts after the 1950s.

3. Institutional Background

3.1 Industrial Characteristics of Postwar Osaka

In advance of describing the historical background of Osaka during and after the war, we briefly review the characteristics of manufacturing sectors in Osaka. We show the names and locations of cities and wards that we frequently mention in this paper in Figure 3.1. Figure 3.2 roughly shows the spatial distribution of manufacturing plants in Osaka City and Sakai City in the central part of Osaka Prefecture, based on information from the Osaka Chamber of Commerce and Industry (OCCI) (1950). First, many plants in the metal and machinery industry agglomerated around the waterfront and riverside areas of *Yodogawa*. In particular, metal and machinery SMEs concentrated around the former state-operated arsenal on the eastern side of Osaka City (e.g., Higashinari Ward and Joto Ward). While the agglomeration described above still exists now, several industrial districts are no longer extant. For example, the agglomeration of the textile industry in the northern part of Osaka City and of the wood industry in the riverside area of *Kizugawa* (middle west area of Osaka City) almost vanished due to urbanization after the 1960s. Additionally, there were several large industrial districts of the textile industry that still exist today in the Senshu Region in the southern area of Osaka Prefecture, although these districts are not shown on the map. In sum, Osaka Prefecture was (and remains) one of the largest industrial districts in Japan, with a variety of manufacturing industries.

The industrial agglomeration beginning at the end of the 19th century played an important role in the production of weapons and munitions during WW2. We describe Osaka's wartime economies and their demise in Osaka City (1953), Osaka Prefecture (1968), Takebe (1982), and Abe (2006). During WW2, Osaka accounted for approximately 30% of the domestic production of weapons in Japan. In particular, the size of the metal and machinery industry related to the production of weapons and munitions grew remarkably thanks to preferential

assignment of labor, materials, capital equipment, funds, and food distribution. In addition, Osaka had 6 large state-operated arsenals, and approximately 70% of their production was outsourced to private firms. In this sense, the manufacturing firms in Osaka formed a company town of state-operated arsenals and large private weapon plants. In Figure 3.3, we show the geographical distribution of subcontract munitions plants, called "cooperating factories" (*Kyoryoku Kojo*), in 1943. We can confirm that the distribution is similar to that of the industrial districts of metal and machinery, while the magnitude of concentration is stronger in specific wards such as Higashinari, Minato, and Nishi-Yodogawa. In contrast, the daily necessities sectors like the textile and food industries, which were regarded as nonessential and nonurgent, declined during this period. Additionally, the chemical industry grew less than the metal and machinery industry due to the severe shortage of materials.

The prosperity of Osaka as an agglomeration of the munitions industry, however, began to collapse as the war situation deteriorated. The bombing of mainland Japan beginning in 1944 and 1945 caused massive damage to the Osaka economy. We show the area damaged by the bombings in Figure 3.4. The damage from the bombings was particularly large in Osaka City and Sakai City, which had many manufacturing plants. The burned area amounted to 52 sq km, the number of destroyed residences was 310,955, and the number of victims was 13,888 in Osaka City. The main target industrial districts of the bombings on Osaka were Konohana, with its large private weapon plants such as Sumitomo Metal Industries, and Higashinari and Joto, neighboring the Osaka Arsenal. Similarly, the bombings of Sakai City damaged the region around large private weapon plants. In Sakai City, the damaged area amounted to 5 sq km, and approximately 30,000 residences were destroyed.

3.2 Problems around SMEs during the Postwar Period

Following Nakamura, Akiya, Kiyonari, Yamazaki, and Bando (1981) and Takebe (1982),

we review the problems around Japanese SMEs, including those in Osaka, during the postwar period. The losses of production equipment and materials mainly due to the bombing led to a serious shortage of goods. Although there were several economic policies to address postwar problems and several large opportunities for revival around manufacturing sectors in the late 1940s and the beginning of the 1950s, these initiatives did not necessarily mitigate or solve the economic disruption and damage to Japanese SMEs. The first economic policy characterizing the postwar period was the austere fiscal policy under the Dodge Line. While this austerity contributed to the reduction in postwar hyperinflation, the following stabilization crisis caused an increase in unemployment and bankruptcies. In this regard, the Japanese economy declined because of austerity. The second policy was the priority production system (and intensive production system thereafter). The priority production system preferentially distributed funds and materials to key industries such as the iron and steel industry and coal industry, and the intensive production system distributed them to superior firms with higher production efficiency than other firms in the same sector, which was quite disadvantageous for most SMEs. In particular, because both SMEs and large firms coexisted in targeted sectors under the intensive production system, the system was harmful for SMEs.

The most significant event affecting Japanese manufacturing sectors was the special procurement brought by the Korean War and the export boom that progressed in parallel with procurement. Under procurement, massive demands for the production and repair of weapons and final goods for the military and their families emerged. The procurement remarkably increased the production level in munitions sectors such as the metal, machinery, and textile industries. Although procurement generally contributed to postwar reconstruction, it is said that the benefit of procurement for SMEs were limited. According to the Basic Survey of Small Business Finance conducted in 1950, only 32.1% and 23.9% of Japanese SMEs achieved an increase in production and sales in this period. Additionally, only 9% of SMEs received

procurement orders. Furthermore, the procurement was temporary because the demands for munitions decreased dramatically after the end of the Korean War.

The problem around SMEs that emerged in parallel with the problems above was the shortage of funds for their operations and capital investments. As described above, the materials and funds distributed to SMEs were quite limited because of the preferential production systems, which disadvantaged SMEs in terms of access to finance. More than 70% of SMEs reported that their financing was poor in the Basic Survey of Small Business Finance conducted in 1948. Consequently, this lack of access to finance made the introduction and replacement of production equipment by SMEs quite difficult, and they had no choice but to rely on production using overused, obsolete, and less efficient machine tools. Despite the excess demand in Japanese market, SMEs could not supply their goods in large amounts because their production level remained quite low.

3.3 Postwar SME Finance Policies

Relying on Nakamura et al. (1982), Ministry of International Trade and Industry (MITI) (1963), and Ueno, Murakoso, & Hirai (2006), we briefly explain the progress of Japanese SME finance policies at the beginning of the 1950s before describing the scheme of the modernization fund program in Osaka that we analyze in this paper. Due to the debilitation of SMEs and local financial institutions caused by the forced bank consolidations during WW2 and the vanishment of the wholesale finance system, the postwar financial difficulties of SMEs were more serious than those during the prewar period. Although the Reconstruction Finance Bank (*Fukko Kinyu Kinko*) was launched in 1947 as an institution providing loans for private firms, its contribution to the revival of SMEs was very small because its main targets were large firms, and it was eventually abolished due to the austere fiscal policy under the Dodge Line. Similarly, the SME finance program based on the collateral funds from U.S. aid to Japan

and launched in 1950 as a subsequent program of the Reconstruction Finance Bank did not function well because of the complexity of its operation for financial institutes and the strong restrictions on the ways that SMEs could use the funds.

To overcome this funding shortage, several policy-based financing institutions were established around 1950. After the establishment of the Small and Medium Enterprise Agency in 1948, the People's Finance Corporation and Japan Finance Corporation for Small Business were launched in 1949 and 1953, respectively. The aim of these institutions was, however, the relief and preservation of SMEs, and it was in the middle 1960s that policy-based finance aiming to enhance SMEs' competitiveness began to be established. Nevertheless, we cannot necessarily say that there was no policy-based finance for the modernization of SMEs. For example, a subsidy program for capital investment by business cooperatives was implemented in 1947. However, it was only in 1954 that a direct loan program for the modernization of SMEs started throughout Japan under the initiative of the Japanese government.

3.4 Modernization Fund by Osaka Prefecture

Despite the immature SME support policies under the initiative of the Japanese government at the beginning of the 1950s, Osaka Prefecture provided various support programs. According to Osaka Prefecture (1952), it provided programs including business and technical consulting, factory diagnosis, lending of high-performance machine tools, and directed credit for modernization. This directed credit program was provided by Osaka Prefecture independently from 1951 to 1953. Thus, the remarkable characteristic of this program is that it was implemented prior to the program under the initiative of the central government.

We describe the scheme of this program following the internal documentation of Osaka Prefecture used in the program's actual operation (Osaka Prefecture, 1951). The basic framework of the program was as follows: first, Osaka Prefecture deposited 1.6 billion yen into

7 designated private banks, and second, funds from the deposits were lent to SMEs for modernization at low interest (0.35 yen per day). Business cooperatives with their main office and SMEs (with capital of up to a million yen or 300 or fewer employees) in Osaka Prefecture were eligible for this modernization fund program. In addition, the designated banks could claim compensation if they suffered a loss from lending under the program. Thus, this modernization fund program sought to mitigate the difficulty in managing lending for private banks and in acquiring access to finance for SMEs.

Osaka Prefecture gave priority to the program objectives listed below. Accordingly, we can presume that the program mainly aimed to modernize local SMEs through the replacement of old equipment or production systems.

1. The improvement of production capability through the replacement of old and inefficient equipment.
2. The introduction of more efficient machine tools to substitute poorly made equipment or manual operation.
3. The increase of the production level through the extension of equipment.
4. The maintenance of facilities combined with the extension of equipment.

Based on the final report from Osaka Prefecture (Osaka, 1954), we show the specific achievements of the program. First, the total number of supported firms was 482 (326 of them with capital of a million yen or more and in manufacturing sectors or wholesale sectors related to manufacturing). The acceptance rate was 61.2%, so receipt of the funds was moderately competitive. Since approximately 99.6% of 1.6 billion yen was lent to SMEs, this program seemed to be well operated. The average lending amount was approximately 2.7 million yen (approximately 19 million yen in present value in 2017). The total number of replaced or introduced machine tools was 4,805, and that of improved facilities was 327.

Table 3.1 summarizes the average value of capital, number of employees, and loan amount for the applications by individual firms. The number of applications was large in the metal, machinery, and textile industries, strongly reflecting the industrial structure of Osaka. From the average value of capital and the number of employees, the main targets of this program seemed to be medium-sized firms rather than microenterprises. With few exceptions, the variation in the loan amount between sectors was not particularly large.

Osaka Prefecture summarized the achievements of the program by remarking that "each supported plant achieved rationalization and modernization through an increase in the production amount, improvement of technologies, reduction of costs, [and] improvement of product quality." Our objective is to objectively examine whether these effects subjectively observed at the time can be quantitatively supported and what kind of heterogeneity exists in the effects, exploiting microeconometric methods for the program evaluation.

4. Methodology

4.1 Hypotheses

In this paper, we mainly test the following two hypotheses.

- **H1-a**: The modernization fund improved supported SMEs' production level.
- **H1-b**: The modernization fund improved supported SMEs' production efficiency.

We assume the following mechanism in H1-a. Each SME has a production function represented by $Y = f(A, L, K)$, where Y is the production level, A is a parameter capturing technological progress, L is labor input, and K is capital input. As described in the previous section, for SMEs, financial restrictions on capital investment were quite large during the postwar period. Because the modernization fund program aimed to increase capital investment (increase K, in other words) through the mitigation of this restriction, the policy intervention might have improved the production level Y. For H1-b, we presume the mechanism to be that a higher production level was achieved, holding the amount of labor constant, through the replacement of old and inefficient equipment or the introduction of automation.

4.2 Econometric Methods

We evaluate the effects of the modernization fund on the supported SMEs' performances utilizing the difference-in-difference (DD) method. The use of DD mitigates the challenge of identifying the causal effects of the program due to time-varying unobservable variables with a similar trend between the treatment group (firms that receive funds) and control group (firms that did not receive funds). Furthermore, by combining DD with fixed effect estimation, we control for various confounding factors that prevent us from precisely estimating the effects. The DD regression specification in our analysis is as follows:

$$Y_{it} = \rho_t + \kappa_i + treat_i \times after_t \beta_1 + control_{it} + \varepsilon_{it}. \quad (1)$$

Y_{it} is firm i's outcome in period t. ρ_t is the time fixed effect that controls macroeconomic

trends common to all firms included in our dataset. κ_i is the individual (firm) fixed effect that controls time-invariant firm-specific unobservable factors such as corporate culture and history. $treat_i \times after_t$ is the variable of interest. $treat_i$ is a dummy variable taking 1 if firm i was a borrower, and $after_t$ takes 1 if period t is after the policy intervention. $control_{it}$ is a set of other control variables, including the sector-time fixed effect and city-time fixed effect. The inclusion of the sector-time fixed effect is particularly important to control sector-specific macro shocks. The specific representative shock in our analysis is special procurement because it positively affected specific sectors such as the metal and machinery industry. Although the effect of special procurement on SMEs was limited as described above, we cannot completely reject the likelihood of indirect effects through, for example, *keiretsu*. ε_{it} is a stochastic disturbance. Our hypotheses are supported if $\beta_1 > 0$.

Due to the specification of our panel data of Osaka SMEs, we implement the DD analysis using observations from 1951 and 1957. We use the logarithm of annual sales (million yen) as an outcome to measure the production level and the logarithm of annual sales per capita (million yen/employee) as an outcome to measure production efficiency.

4.3 Data

To identify the borrowers, we utilize the list of supported plants (Osaka, 1954) within an internal document summarizing the achievements of the program. This list includes detailed information about the loans as well as basic information about each borrower, such as company name, name of the president, capital, number of employees, and main products.

- Lending bank
- Loan amount
- Start and end date of lending
- List of equipment introduced or improved with funds

We match this list with a corporate information database called the Imperial Directory of Banks and Companies (IDBC – *Teikoku Ginko Kaisha Yoroku*) published by Teikoku Koushinjo Co., Ltd. (the present Teikoku Databank, Ltd.) in 1951 and 1957[3]. In the empirical analysis using DD, 4 categories of data, capturing observations both before and after the intervention and in both the treatment and control groups, are necessary. To the best of our knowledge, there is no SME micro-dataset for Japan except the IDBC. A total of 3,112 firms and 10,400 firms are observed in Osaka Prefecture in the 1951 IDBC and 1957 IDBC, respectively. In both the 1951 and 1957 IDBCs, the following attributes can be identified for firms with capital of a million yen or more.

- Company name
- Full address
- Foundation year and month
- Business objectives
- Capital
- List of executives
- Number of employees
- Annual or monthly sales
- Bankers
- List of plants, offices, and facilities (only some firms)

Although we can identify each firm's business objective in the IDBC, this information is difficult to directly convert into tractable variables for an empirical analysis. Thus, we match the industrial classification by using the following two supplemental databases.

[3] The records corresponding to firms in Osaka in 1957 IDBC will be available via the TDB Center for Advanced Empirical Research on Enterprise and Economy, Hitotsubashi University in Excel format for free, limited to academic use by March 2021.

- 1951 Osaka Commerce & Industry Directory (edited by the OCCI)
- 1949 and 1952 List of Factories in Japan (edited by the MITI)

The firms observed in our two-wave panel data satisfy the following conditions:

- Number of employees and sales observed in both 1951 and 1957.
- Industrial sector identified by the supplemental datasets.
- Located in the same sector and city as borrower firms (if a firm was a nonborrower).
- Number of employees less than or equal to 300.
- Capital less than or equal to 1 million yen.
- Never experienced a company split-up from 1951 to 1957.

5. Results

5.1 Baseline

In advance of the regression analysis, we show the average trend of outcomes observed both before (1951) and after (1957) the intervention and in both the treatment (borrower) and control (nonborrower) groups in Table 5.1. By taking the difference between the before-after change in an outcome in the treatment group and that in the control group, we can calculate naïve estimates of the effects of the program. While the average level of annual sales in the treatment group was lower than that in the control group, this gap was reduced after the policy intervention. In contrast, the gap in sales per capita did not decrease as much.

To confirm whether the results above are statistically valid and robust, we estimate the DD regression specified in Eq. (1). Table 5.2 shows the estimation results. Regarding annual sales, the estimated DD represented by the regression coefficient of treat×after is positive and statistically significant at the 1% level. Regarding sales per capita, however, the estimated DD is not statistically significant, although the sign is as expected. One of the reasons for the result on sales per capita is the increase in the employment level parallel to that in the production level. In the same table, we show the estimation result using the logarithm of the number of employees as an outcome, and we can observe the statistically significant positive DD at the 10% level. In short, H1-a is supported, while H1-b is not necessarily supported according to our estimation. In the following sections, we examine the baseline results in more detail by checking whether and how spatial and industrial heterogeneity are observed in the effects.

5.2 Vestiges of Wartime Economies

5.2.1 Prosperity and the Demise of the Osaka Arsenal

In this section, we evaluate the within-region spatial heterogeneity of the effects, focusing specifically on the historical milieu of local industry in Osaka and the spatial heterogeneity of

the vestiges of wartime economies. The subject of our analysis is the former Osaka Arsenal, the largest arsenal among 6 state-operated weapon plants in Osaka, and the Osaka Arsenal's company town. We briefly review the historical background on the Osaka Arsenal following Miyake (1993), a representative case study on the arsenals in Osaka.

The Osaka Arsenal was established in 1870 around Osaka Castle. The arsenal fulfilled a central role in the production of weapons used in the Japanese Army during the period from the Russo-Japanese War to WW2. While at first it engaged in weapons production relying on imported technologies, as time passed, it established a unique system and technologies for the mass production of guns, tanks, and munitions. In particular, its casting and metal processing technology was the leading technology in Japan and was even diverted into the production of civilian goods such as water pipes. At the end of WW2, the arsenal was the largest in the East, with approximately 64,000 engineers, 20,000 machine tools, and a site area of 6 million sq m.

The arsenal influenced the Osaka manufacturing sectors. Due to the specialization of the arsenal in weapons production, it conducted mass layoffs every time a war ended. This massive release of engineers with high-quality technology acquired in the arsenal to the private sector had a large impact on industrial agglomeration in Osaka and the Joto region in particular (Abe, 2006). Many spinoff firms with an advantage in steel and aluminum processing and machinery were established by ex-employees of the arsenal (Matsushita, 2012). Additionally, as explained in Section 3.1, the outsourcing rate of the arsenal to the private sector was high. This formed the *keiretsu* and company town engaged in weapons production around the Joto region during the period from the 1930s to WW2 (Ueda, 2004). At the end of WW2, nearly 600 plants were under the control of the arsenal.

However, the defeat in WW2 marked the end of the Osaka Arsenal. The arsenal and the surrounding industrial agglomeration became the targets of bombings by the U.S., which damaged the region around the arsenal again and again from 1944 to 1945. The largest bombing

was executed on August 14, 1945, one day before the unconditional surrender. Approximately 650 one-ton bombs exactly hit their targets and destroyed most of the facilities. Due to the risks posed by unexploded bombs, it was difficult to redevelop the demolished area, which was kept idle until the 1960s. Although the area was eventually transformed into a business district after the 1970s, one of the industrial cores of the Joto region was lost forever.

After WW2, like other Japanese SMEs, SMEs around the former arsenal faced a trial. Ironically, however, the special procurement during the Korean War might have changed this situation for some firms. As described in Section 3.2, the benefit of special procurement for SMEs was generally limited. However, we should be cautious in the discussion of whether this is also the case in Osaka and is true even if we consider the indirect impact through the *keiretsu* relationship. Recent case studies have investigated anecdotal evidence of the impact of this special procurement. For example, Sawai (2018) revealed the historical fact that the orders of munitions such as cannonballs from special procurement were concentrated among large manufacturers with their main plants in Osaka, such as Komatsu, OKK, and Daikin. According to the Osaka Research Center for Industry and the Economy (ORCIE) (1953), the main reason for this concentration was that subcontract plants existed even after WW2 in former *keiretsu* for cannonball production. In this sense, we cannot necessarily ignore an effect of the former Osaka Arsenal as a vestige of wartime economies on industrial agglomeration in postwar Osaka.

5.2.2 Empirical Framework

Following the discussion in the previous section, we empirically investigate the effects of the modernization fund on the borrowers around the former Osaka Arsenal. Specifically, we examine below the following hypothesis in addition to those laid out in Section 4.1.

- **H2**: The effects of the fund on SMEs' performance were larger for the borrowers around the former Osaka Arsenal.

In formulating H2, we consider 3 possible mechanisms and their interaction. The first mechanism is special procurement. As described above, the industrial agglomeration around the arsenal specialized in the metal and machinery industry and was strongly related to the production of munitions. Considering the anecdotal evidence, the modernization fund might have contributed to the enhancement of the production of munitions. The second mechanism is the agglomeration externality. It has been theoretically and empirically pointed out that various types of externalities, including matching, learning, and sharing, are operative inside agglomerations (Duranton & Puga, 2004). This mechanism might have worked together with the first mechanism. Although not all metal and machinery SMEs were necessarily associated with the production of munitions, there might have been some technological and knowledge spillovers from geographically close subcontractor firms engaged in this type of production. The third mechanism is expansion of the room to recover conditioned by the policy intervention. The decline in agglomeration might have been more severe around the former arsenal than in other areas, although we cannot directly confirm this due to a lack of data for the prewar period. Unlike other large private munitions plants, the arsenal was lost forever because it was operated by the Japanese Army[4]. Due to this decommissioning, some of the technological and knowledge spillovers from the large plants (Greenstone, Hornbeck, & Moretti, 2010) might have been lost. However, the effects of the modernization fund might be larger if the borrowers had high potential from the outset based on the knowledge and technology that they had acquired as subcontractor plants of the arsenal. In contrast, if the shock of the decommissioning surpassed a certain threshold, the decline in agglomeration may have been persistent despite

[4] Many of the former private plants engaged in weapons production had to temporarily cease their operations after WW2, and their continuity was uncertain due to the postwar compensation plan (Compensation Agency, 1948). However, the plan was not fully implemented, and most of these plants managed to survive by transforming into peacetime industries.

the policy intervention.

To examine H2, we estimate the difference-in-difference-in-difference (DDD) regression model specified below.

$$Y_{it} = \rho_t' + \kappa_i' + treat_i \times after_t\tau_1 + kosho_i \times after_t\tau_2 + treat_i \times kosho_i \times after_t\theta_1 + control_{it} + \eta_{it}. \quad (2)$$

$kosho_i$ is a dummy variable taking 1 if firm i was in a ward neighboring the former arsenal (Joto and Higashinari, or simply the Joto region). Compared with the estimation in Eq. (1), this DDD in Eq. (2) tests whether the effects were heterogeneous between the borrowers inside and outside the agglomeration around the arsenal by introducing the triple interaction term $treat_i \times kosho_i \times after_t$. H2 is supported if $\theta_1 > 0$.

5.2.3 Results

As in Section 5.1, in advance of the regression analysis, we show in Table 5.3 the average trend of the outcomes observed in each group. The rows with Treat=1 show the results in the treated firms, and those with Kosho=1 show the results in the firms in the region neighboring the arsenal in 1951. Each outcome of firms inside the agglomeration is smaller than that of firms outside it. In regards to the trend for each outcome after the intervention focusing on the firms inside the agglomeration, annual sales reached almost the same level as that of the firms outside the agglomeration, and sales per capita grew. By taking the difference between the DD inside and outside the neighboring wards, we can calculate naïve estimates of the additional effects of the program on the borrowers inside the agglomeration.

To confirm whether the results above are statistically valid and robust, we estimate the DDD regression specified in Eq. (2). Table 5.4 shows the estimation results. Regarding annual sales, the estimated DDD represented by the regression coefficient of treat×after×kosho is positive and statistically significant at the 10% level. This result implies an additional effect of the fund on annual sales for the borrowers inside the agglomeration around the arsenal.

Regarding sales per capita, however, the estimated DDD is not statistically significant, although the sign is as expected. In sum, H2 is supported at the production level only.

5.3 Industrial Heterogeneity

The effects estimated in Section 5.1 are the overall average effects for the supported firms. However, additional analysis might be necessary to check whether the effects were different across industrial sectors. One of the objectives of this analysis is to assess the impact of special procurement. As described above, the *keiretsu* around the former arsenal was exploited in the production of munitions during the Korean War, and the impact through the *keiretsu* might have determined which industries were affected as well as the spatial extent of the effect examined in Section 5.2. The subcontractor firms of the Osaka Arsenal and large private munitions plants were located all over Osaka Prefecture, centered on the Joto region and the waterfront area (Kinki Region Cooperating Industry Council & Osaka Cooperating Industry Union, 1943; United States Strategic Bombing Survey, 1947). If this hypothesis is supported, stronger effects might be observed among the borrowers in the metal, machinery, and textile industries, following a mechanism similar to that elaborated in the previous section. To examine this, we decompose the effects of the program by estimating the regression model specified below.

$$Y_{its} = \rho_t'' + \kappa_i'' + \sum_s treat_i \times after_t \times sector_{is}\delta_s + control_{its} + \nu_{its}, \qquad (3)$$

$sector_{is}$ takes 1 if firm i was included in sector s.

The estimation results of the regression model are shown in Table 5.5. Regarding annual sales, we observe positive and significant DDs in the metal, machinery, and textile industries. On the other hand, we observe positive and significant DDs in the metal industry only. In sum, the effects of the program are heterogeneous across industrial sectors, and the results might reflect the impact of special procurement.

6. Discussion and Conclusion

The development of the financial market fulfills an important role in regional economic development, and policy interventions to improve SMEs' access to finance is often justified. Considering SMEs' extreme vulnerability to socioeconomic disruptions such as natural disasters and economic crises, the significance of policy-based finance increases even further. In this paper, we examine the effects of a modernization fund for SMEs implemented by Osaka Prefecture during the period of postwar economic disruption, the early 1950s. Despite the importance of local industrial policies in mitigating SMEs' financial constraints, the previous literature has hardly addressed the historical aspects and effects of local governments' SME finance policies while carefully considering the region-specific factors influencing the form of access to finance. In this sense, this paper contributes to the literature because we provide new insights into this open issue.

We summarize the research findings in this paper. Overall, the empirical results imply that the modernization fund program contributed to the improvement of the borrowers' production levels relative to the nonborrowers'. These results, based on modern program evaluation and counterfactual analysis methods, might support policymakers' subjective evaluation of the achievements of the program. On the other hand, we cannot necessarily observe the effect on supported SMEs' production efficiency, although we should be cautious about drawing conclusions from the evaluation based on an outcome such as sales per capita. This result, however, reflects the rise of the employment level among the borrowers. In this regard, the program worked well in terms of regional industrial activation rather than industrial rationalization.

In an additional analysis, we find that the effects of the modernization fund were heterogeneous across space and industries. In particular, local historical factors unique to Osaka—such as geographical or organizational proximity to the former Osaka Arsenal, as a

vestige of postwar economies; exogenous shocks such as the special procurement for the Korean War, and the existence of industrial agglomeration—might have been the causes of the heterogeneity. Our empirical results suggest that the effects of the program were larger in specific industrial sectors, such as the metal and machinery industry, and in the regions specialized in these sectors due to the historical background.

Before concluding, we mention future research directions and the limitations of this paper. First, we cannot observe the effects of the program on smaller firms with capital of 1 million yen or less because the firm-level database utilized in our analysis does not cover these firms. Additionally, the database coverage might be limited to firms with established reputations considering that the corporate information used in our analysis was collected shortly after WW2. Thus, we cannot reveal a truly complete picture of the program unless we can find more exhaustive SME microdata, such as a national census. Second, further analysis to reveal the detailed mechanism driving the effects of the program is required. Although we empirically show the heterogeneity of the effects due to various regional-specific factors in Osaka, such as wartime economies and special procurement, each estimated effect is still just a compound. Thus, we should decompose this complex result by, for example, additionally analyzing detailed data about wartime economies such as the *keiretsu* of munitions production during WW2.

Despite these future issues and limitations, this paper contributes to the literature in that we show the role of the local government's effort in postwar reconstruction. The discussion in this paper on the role and importance of place-based industrial policy implemented by a local government after a disruption might provide some insight into industrial revivals after local shocks not limited to war damage, such as natural disasters and economic crises.

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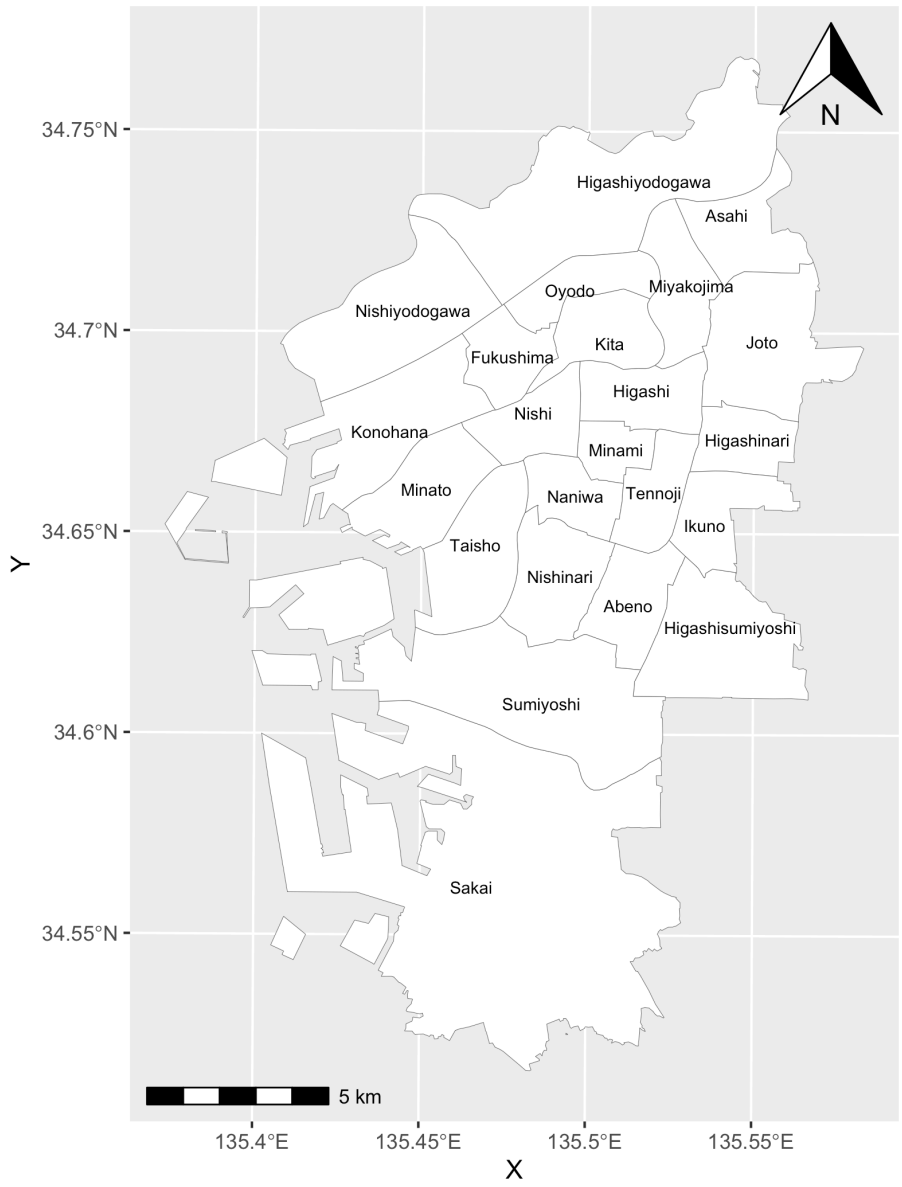

Figure 3.1: Name of primary cities and wards in Osaka Prefecture in 1950

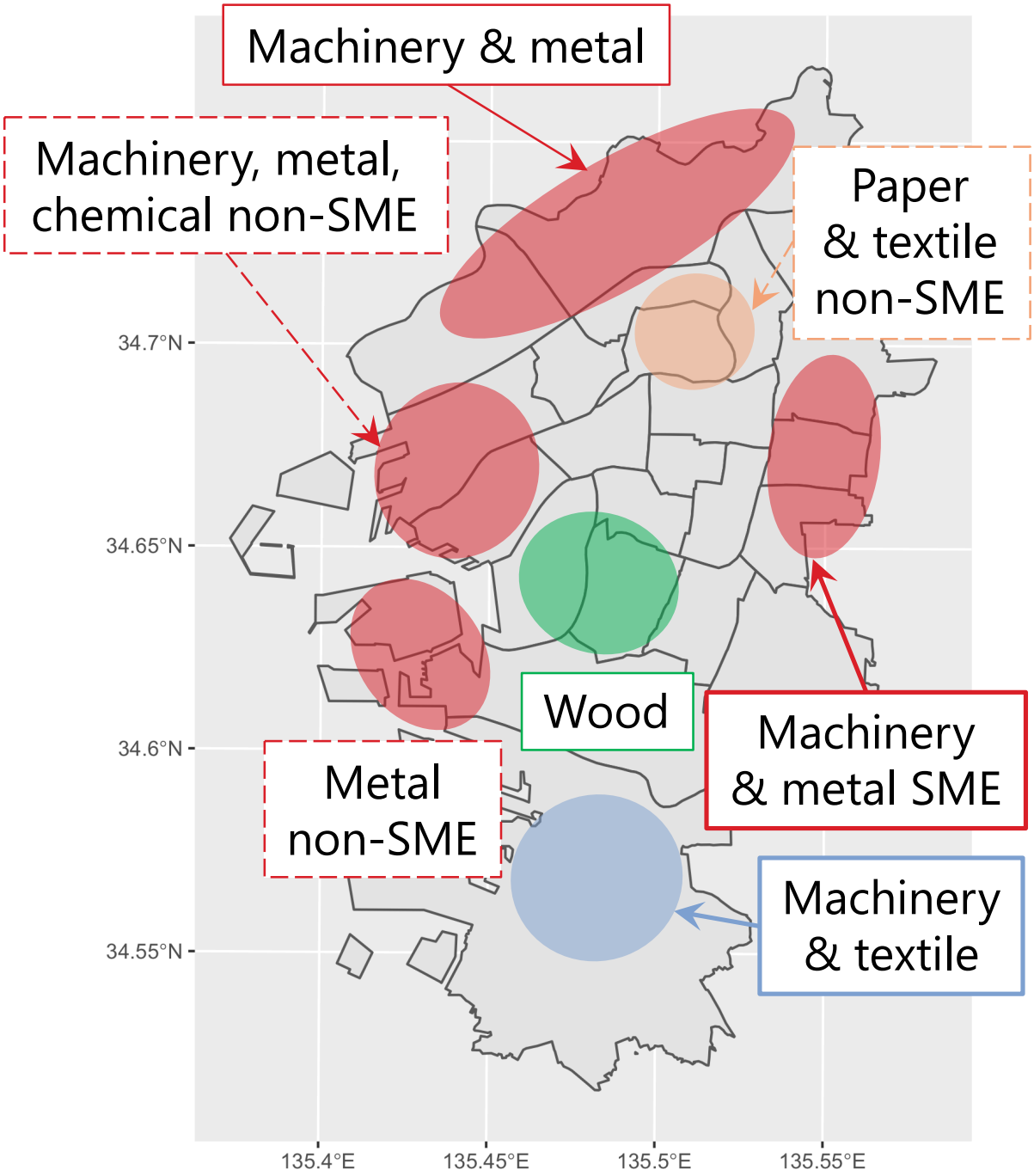

Figure 3.2: Industrial districts in Okasa in 1948
Source: Drawn by the authors based on OCCI, 1950.

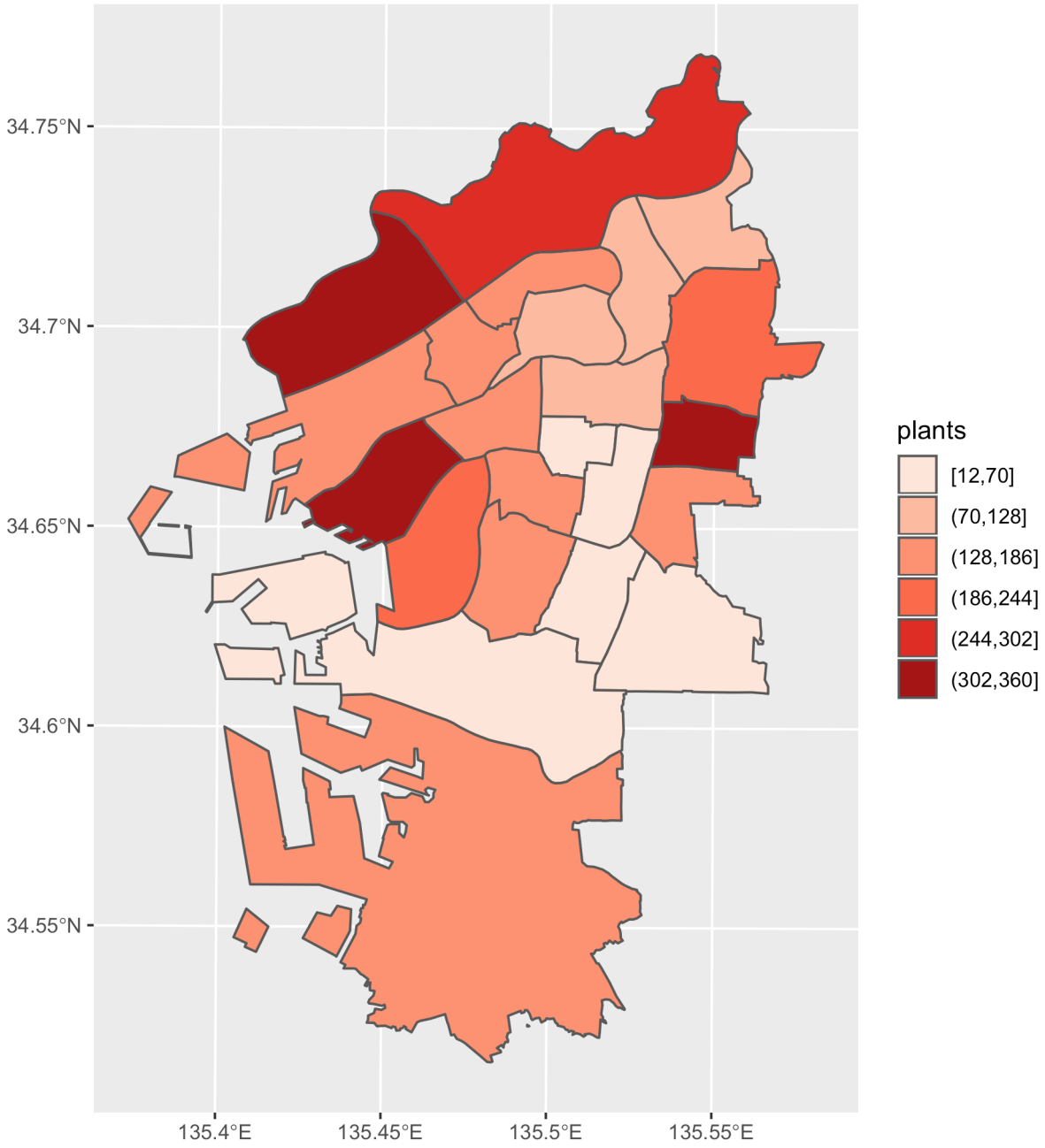

Figure 3.3: Geographical distribution of cooperating plants in Osaka and Sakai City
Source: Drawn by the authors based on Kinki Region Cooperating Industry Council & Osaka Cooperating Industry Union (1943).

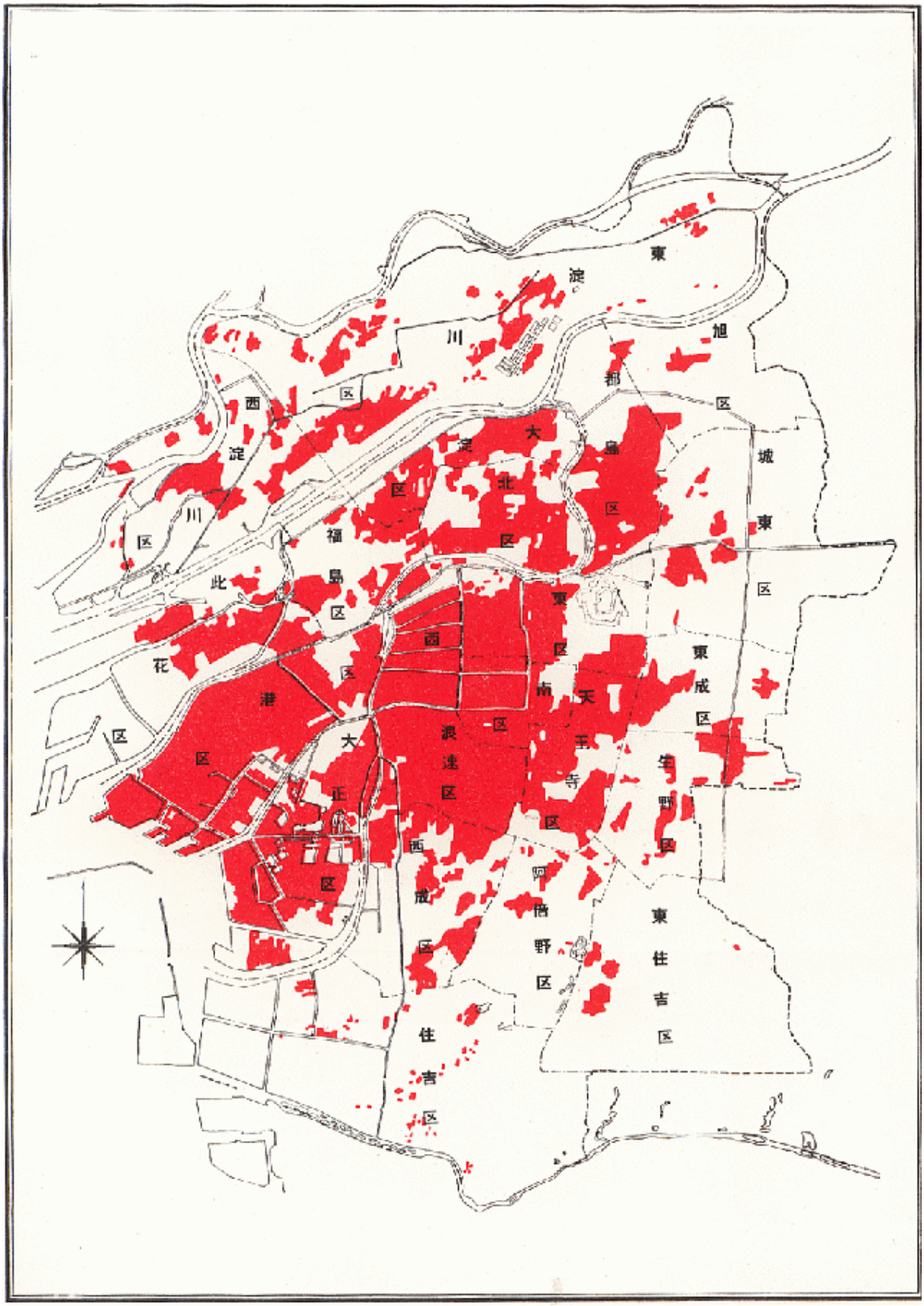

Figure 3.4: Damaged area (in red) from bombings in Osaka City
Available at https://www.oml.city.osaka.lg.jp/index.php?page_id=1147 (last accessed on September 18, 2020).

Table 3.1: Average lending status by industrial sector

Sector	Capital [M ¥]	No. of employees [persons]	Loan amount [M ¥]	Adoptions
Textile	3.524	60.2	3.034	85
Metal	2.419	59.267	2.895	116
Metal product	2.402	92.148	3.507	27
Machinery	2.049	75.059	2.572	101
Miscellaneous	4.813	93.484	3.484	31
Wood	2.492	65.118	6.488	17
Chemical	6.468	66	3.236	22
Chemical product	2.785	52	2.058	20
Medical	9.213	78.25	1.75	4
Other	2.653	37.968	2.755	31

Notes: Source is Osaka Prefecture (1954). From aggregate figures for individual firms participating in the program. We exclude firms with unknown capital or number of employees and cooperatives.

Table 5.1: DD table

	ln(sales)		ln(sales per capita)	
	Before	After	Before	After
Control	4.955	5.877	1.127	1.721
Treatment	4.341	5.576	0.123	0.778
DD		0.313		0.061

Table 5.2: Estimation results of DD (baseline)

	ln(sales)			ln(sales per capita)			ln(emp)		
	beta	tval		beta	tval		beta	tval	
treat×after	0.42	2.794	***	0.204	1.29		0.216	1.876	*
Treated firms	45			45			45		
n	1196			1196			1196		

Notes: Statistical significance at *** 1%, ** 5%, and * 10%. Estimation results of a two-way fixed effects model. Standard errors are clustered at the firm level. All models include time-sector and time-city fixed effects.

Table 5.3: DDD table

ln(sales)					ln(sales per capita)				
Treatment	Kosho	Before	After	DD	Treatment	Kosho	Before	After	DD
0	0	5.005	5.952		0	0	1.198	1.827	
1	0	4.462	5.584	0.176	1	0	0.135	0.718	−0.046
0	1	4.526	5.233		0	1	0.507	0.802	
1	1	3.967	5.551	0.878	1	1	0.085	0.965	0.585
DDD				0.702					0.631

Notes: Rows with Treat=1 show the results in the treated firms, and those with Kosho=1 show the results in the firms in wards neighboring the arsenal in 1951.

Table 5.4: Estimation results of DDD (former arsenal)

	ln(sales)		ln(sales per capita)	
	beta	tval	beta	tval
after×kosho	−0.203	−1.05	−0.152	−0.906
treat×after	0.232	1.748 *	0.066	0.622
treat×after×kosho	0.68	1.743 *	0.498	1.035
Treated firms	45		45	
n	1196		1196	

Notes: Statistical significance at *** 1%, ** 5%, and * 10%. Estimation results of a two-way fixed effects model. Standard errors are clustered at the firm level. All models include time-sector and time-city fixed effects.

Table 5.5: Estimation results of DD (industrial heterogeneity)

	ln(sales)			ln(sales per capita)		
	beta	tval		beta	tval	
treat×after×chemical	−0.048	−0.163		−0.072	−0.414	
treat×after×wood	0.235	0.578		−0.073	−0.183	
treat×after×machinery	0.474	1.791	*	0.049	0.152	
treat×after×textile	0.465	1.707	*	0.09	0.287	
treat×after×metal	0.952	2.196	**	1.011	2.499	**
treat×after×other	0.326	1.724	*	0.214	0.936	
Treated firms	45			45		
n	1196			1196		

Notes: Statistical significance at *** 1%, ** 5%, and * 10%. Estimation results of a two-way fixed effects model. Standard errors are clustered at the firm level. All models include time-sector and time-city fixed effects.

Appendix A: Descriptive Statistics

Table A.1: Descriptive statistics of key variables in two-wave panel data

	n	mean	sd	median	min	max
ln(emp)	1196	4.031	0.989	4.078	1.099	7.772
ln(sales)	1196	5.382	1.348	5.247	1.609	9.928
ln(sales per capita)	1196	1.351	1.302	1.204	−2.608	5.123
treat	1196	0.075	0.264	0.000	0.000	1.000

Table A.2: Correlation matrix of key variables in two-wave panel data

	ln(emp)	ln(sales)	ln(sales per capita)	treat
ln(emp)	1			
ln(sales)	0.412	1		
ln(sales per capita)	−0.332	0.722	1	
Treat	0.138	−0.09	−0.197	1

Appendix B: Empirical Analysis Using No. of Employees as Outcome

Table B.1: DD table

	ln(emp)	
	Before	After
Control	3.828	4.156
Treatment	4.218	4.798
DD		0.252

Table B.2: DDD table

ln(emp)				
Treatment	Kosho	Before	After	DD
0	0	3.806	4.125	
1	0	4.327	4.867	0.221
0	1	4.019	4.43	
1	1	3.882	4.586	0.292
DDD				0.071

Notes: Rows with Treat=1 show the results in the treated firms, and those with Kosho=1 show the results in the firms in wards neighboring the arsenal in 1951.

Table B.3: Estimation result of DDD (former arsenal)

	ln(emp)	
	beta	tval
after×kosho	−0.051	−0.409
treat×after	0.166	1.613
treat×after×kosho	0.181	0.565
Treated firms	45	
n	1196	

Notes: Statistical significance at *** 1%, ** 5%, and * 10%. Estimation results of a two-way fixed effects model. Standard errors are clustered at the firm level. All models include time-sector and time-city fixed effects.

Table B.4: Estimation result (industrial heterogeneity)

	ln(emp)		
	beta	tval	
treat×after×chemical	0.024	0.12	
treat×after×wood	0.308	1.09	
treat×after×machinery	0.424	1.952	*
treat×after×textile	0.375	1.588	
treat×after×metal	−0.059	−0.178	
treat×after×other	0.112	0.7	
Treated firms	45		
n	1196		

Notes: Statistical significance at *** 1%, ** 5%, and * 10%. Estimation results of a two-way fixed effects model. Standard errors are clustered at the firm level. All models include time-sector and time-city fixed effects.

Appendix C: Propensity Score Matching

The premise of the empirical analysis with DD and DDD is that the control group of nonborrowers can precisely represent the counterfactual case had the borrowers not received funding. However, the precise generation of the counterfactual suitable for DD and DDD becomes difficult if the likelihood of receiving a loan is different between the treatment and control groups. For example, factors related to each firm's capability, such as the stability of business conditions, can be covariates affecting this likelihood. Additionally, the importance and urgency of a fund may be different across industrial sectors. If whether a firm received funding was selectively determined by these covariates, the firm characteristics between the treatment and control groups could be naturally different. A difference between the treatment and control groups like that described above, as a confounding factor, would bias the DD and DDD estimates.

To tackle this problem, we utilize propensity score matching (PSM). With PSM, we can match treated firms to a subset of untreated firms with similar attributes (a similar propensity score, in other words). One of the advantages of PSM over ordinary least squares (OLS) multiple regression is that we can exclude observations that do not satisfy the common support condition. In other words, PSM allows us to implement a comparison discarding inadequate observations such as those absolutely treated or untreated.

We illustrate the procedures for PSM. First, we predict the propensity score based on the following specification with logistic regression.

$$Prob(treat_i = 1|\mathbf{z}_i) = \mathbf{z'}_i\boldsymbol{\zeta} + u_i, \tag{A1}$$

The dependent variable $Treat$ is a dummy variable taking one if firm i was a borrower and zero otherwise. The independent variables $\mathbf{z}_i$, common to all outcomes in DD and DDD, are the logarithm of capital (million yen), industrial classification dummies to control the difference in the likelihood between sectors, and city dummies to control that between cities.

We add the logarithm of annual sales in the PS prediction corresponding to ln(emp) and add the logarithm of the number of employees in that corresponding to ln(sales) and ln(sales per capita) as a covariate. Considering the nonlinear association between PS and the covariates and interaction effects between the covariates, we also add the squared value of the quantitative covariates and interaction terms between the quantitative and dummy variables. To obtain the PS prediction model with a more generalizable performance (to avoid overfitting of the prediction model, in other words), we carry out stepwise variable selection based on the Akaike information criterion (AIC). Table C.1 shows the PS prediction result for ln(emp), and C.2 shows that for ln(sales) and ln(sales per capita).

After the prediction, we implement the matching between the treatment and control groups. In this paper, we use 5-nearest-neighbor matching. We may generally judge that covariate balance has been achieved if the absolute value of standardized bias corresponding to each variable is below certain thresholds such as 0.1 or 0.25 (Stuart, Lee, & Leacy, 2013). We show the covariate balance for ln(emp) in Table C.3 and that for ln(sales) and ln(sales per capita) in Table C.4. Since the absolute value of standardized bias is smaller than 0.1 for most covariates, there is no convincing evidence for significant differences between the treatment and control groups within the limits of the observable covariates.

Table C.5 shows the PSM-DD estimation results corresponding to the baseline results in Section 5.1. The DD estimate using ln(emp) as an outcome is smaller than that without PSM and is statistically nonsignificant even at the 10% level under the alternative hypothesis of $\beta_1 \neq 0$. However, we cannot completely say that the effect on ln(emp) is nonsignificant because the DD estimate is statistically significant at the 10% level under the alternative hypothesis of $\beta_1 > 0$. The DD estimate for ln(sales) is robustly significant, and the value of the estimate is not so different from that in the regression result without PSM. Additionally, the result is not different for ln(sales per capita). In Table C.6, we show the PSM-DDD estimation

results of corresponding to the DDD estimation focusing on the Osaka Arsenal in Section 5.2. Although there is no remarkable difference from the results without PSM, the magnitude of the DDD estimate for ln(sales) becomes marginally larger. We show the PSM-DD estimation results corresponding to the DD examining the cross-sectoral effect heterogeneity in Section 5.3 in Table C.7. Although there are several differences from the results without PSM, we can robustly observe the positive effects on the metal and machinery industry.

Table C.1: PS prediction result for ln(emp)

	beta	z value
(Intercept)	−6.078	−1.193
ln(sales)	2.55	1.654
ln(sales)^2	−0.392	−2.126
ln(capital)	0.054	0.186
chemical	−6.128	−2.134
Wood	−10.203	−1.988
Textile	−4.898	−1.498
Metal	−17.036	−1.96
Higashi	−1.95	−2.839
Minato	2.507	2.31
other_cities	−0.877	−2.419
ln(sales)×chemical	1.367	2.144
ln(sales)×wood	2.715	2.28
ln(sales)×textile	1.148	1.622
ln(capital)×metal	1.158	1.966
Pseudo R2	0.171	
n	597	

Table C.2: PS prediction result for ln(sales) and ln(sales per capita)

	beta	z value
(Intercept)	13.765	1.718
ln(emp)	0.924	2.786
ln(capital)	−1.36	−2.373
Chemical	−17.107	−1.722
Wood	1.933	2.251
machinery	−10.02	−0.992
Textile	−4.35	−1.143
Metal	−16.468	−1.588
Higashi	−1.981	−2.917
Minato	2.275	2.127
other_cities	−0.939	−2.581
ln(emp)×machinery	−1.269	−2.412
ln(emp)×textile	1.083	1.307
ln(capital)×chemical	1.197	1.756
ln(capital)×machinery	1.094	1.488
ln(capital)×metal	1.131	1.591
Pseudo R2	0.177	
n	597	

Table C.3: Covariate balance for ln(emp)

	Before matching			After matching		
	Means Treated	Means Control	Std. Bias	Means Treated	Means Control	Std. Bias
ln(sales)	4.341	4.956	−0.753	4.303	4.251	0.064
ln(sales)^2	19.495	26.175	−0.966	19.16	18.697	0.067
ln(capital)	14.592	14.676	−0.11	14.591	14.538	0.069
Chemical	0.178	0.223	−0.117	0.186	0.163	0.06
Wood	0.111	0.022	0.281	0.07	0.042	0.088
Textile	0.133	0.25	−0.339	0.14	0.172	−0.095
Metal	0.178	0.199	−0.056	0.186	0.167	0.048
Higashi	0.067	0.301	−0.928	0.07	0.084	−0.055
Minato	0.044	0.004	0.196	0.047	0.009	0.179
other_cities	0.356	0.455	−0.205	0.372	0.433	−0.125
ln(sales)×chemical	0.824	1.085	−0.143	0.862	0.772	0.05
ln(sales)×wood	0.504	0.084	0.288	0.288	0.17	0.081
ln(sales)×textile	0.639	1.364	−0.44	0.668	0.835	−0.101
ln(capital)×metal	2.656	2.917	−0.045	2.78	2.46	0.055

Table C.4: Covariate balance for ln(sales) and ln(sales per capita)

	Before matching			After matching		
	Means Treated	Means Control	Std. Bias	Means Treated	Means Control	Std. Bias
ln(emp)	4.218	3.827	0.514	4.175	4.253	−0.103
ln(capital)	14.592	14.676	−0.11	14.564	14.654	−0.117
Chemical	0.178	0.223	−0.117	0.2	0.205	−0.013
Wood	0.111	0.022	0.281	0.05	0.05	0
Machinery	0.333	0.199	0.281	0.35	0.32	0.063
Textile	0.133	0.25	−0.339	0.15	0.12	0.087
Metal	0.178	0.199	−0.056	0.175	0.215	−0.103
Higashi	0.067	0.301	−0.928	0.075	0.065	0.04
Minato	0.044	0.004	0.196	0	0.01	−0.048
other_cities	0.356	0.455	−0.205	0.4	0.41	−0.021
ln(emp)×machinery	1.326	0.821	0.258	1.379	1.327	0.027
ln(emp)×textile	0.617	0.915	−0.187	0.694	0.557	0.085
ln(capital)×chemical	2.653	3.271	−0.107	2.985	3.054	−0.012
ln(capital)×machinery	4.806	2.92	0.274	5.021	4.666	0.052
ln(capital)×metal	2.656	2.917	−0.045	2.598	3.18	−0.101

Table C.5: PSM-DD estimation results (baseline)

	ln(emp)		ln(sales)			ln(sales per capita)	
	beta	tval	beta	tval		beta	tval
treat×after	0.156	1.306	0.439	2.423	**	0.195	1.005
Treated firms	43		40			40	
n	516		480			480	

Notes: Statistical significance at *** 1%, ** 5%, and * 10%. Estimation results of a two-way fixed effects model. Standard errors are clustered at the firm level. All models include time-sector and time-city fixed effects. The results are based on 5-nearest-neighbor matching.

Table C.6: DDD estimation results (former arsenal)

	ln(emp)		ln(sales)			ln(sales per capita)	
	beta	tval	beta	tval		beta	tval
after×kosho	−0.064	−0.389	−0.284	−0.908		−0.359	−1.218
treat×after	0.072	0.675	0.165	0.979		−0.02	−0.139
treat×after×kosho	0.287	0.874	0.873	1.947	*	0.684	1.28
Treated firms	43		40			40	
n	516		480			480	

Notes: Statistical significance at *** 1%, ** 5%, and * 10%. Estimation results of a two-way fixed effects model. Standard errors are clustered at the firm level. All models include time-sector and time-city fixed effects. The results are based on 5-nearest-neighbor matching.

Table C.7: DD estimation results (industrial heterogeneity)

	ln(emp)			ln(sales)			ln(sales per capita)		
	beta	tval		beta	tval		beta	tval	
treat×after×chemical	0.065	0.261		−0.322	−1.003		−0.225	−1.14	
treat×after×wood	0.249	0.615		0.031	0.069		−0.525	−1.131	
treat×after×machinery	0.431	2.111	**	0.678	2.342	**	0.219	0.613	
treat×after×textile	0.158	0.479		0.239	0.793		−0.875	−3.263	***
treat×after×metal	−0.159	−0.471		1.11	2.11	**	1.125	2.458	**
treat×after×other	−0.194	−0.811		0.074	0.298		−0.101	−0.318	
Treated firms		43			40			40	
n		516			480			480	

Notes: Statistical significance at *** 1%, ** 5%, and * 10%. Estimation results of a two-way fixed effects model. Standard errors are clustered at the firm level. All models include time-sector and time-city fixed effects. The results are based on 5-nearest-neighbor matching.

Appendix D: Matching between the IDBC and Borrower List

Table D.1 shows the result of matching the IDBC and the borrower list from Osaka Prefecture (1954). We attempt to match 326 borrowers with capital of 1 million yen or more.

The borrowers included in the panel data used in our analysis were limited to 45 firms whose attributes used in generating the outcomes were observed in both 1951 and 1957 (we exclude one borrower whose number of employees was more than 300). In terms of survival bias, it might be better to check the difference in the attributes between the successfully matched borrower group and the unmatched group. For example, we compare the attributes of matched borrowers and unmatched borrowers (whose attributes were observed in 1951 but not in 1957). Table D.2 shows the difference in key variables between the matched (46) and unmatched (31) firms in 1951. For any variable, we cannot necessarily find a statistically significant difference on average. However, due to data limitations, we cannot check the difference in the attributes of matched borrowers and other kinds of unmatched borrowers (whose attributes could be observed neither in 1951 nor 1957 or whose attributes were observed in 1957 only).

Table D.1: Matching result based on 1951 IDBC

Matched	102		
No. of employees, sales & sector are identified	Yes		No
	77		25
No. of employees & sales were also observed in 1957	Yes	No	
	46	31	
Unmatched	224		

Table D.2: Difference in key attributes between the matched (46) and unmatched (31) firms

	Unobserved	Observed	SD	z val
ln (sales)	4.324	4.382	0.2	0.287
ln (emp)	4.425	4.263	0.182	−0.891
ln (sales per capita)	−0.101	0.119	0.177	1.243