RIETI Discussion Paper Series 10-E-016

Industrial Relocation Policy and Heterogeneous Plants Sorted by Productivity: Evidence from Japan

OKUBO Toshihiro
Kobe University

TOMIURA Eiichi
RIETI

The Research Institute of Economy, Trade and Industry
http://www.rieti.go.jp/en/

RIETI Discussion Paper Series 10-E-016
April 2010

Industrial Relocation Policy and Heterogeneous Plants Sorted by Productivity: Evidence from Japan

Toshihiro OKUBO
Kobe University
and
Eiichi TOMIURA
Research Institute of Economy, Trade and Industry, and Yokohama National University

Abstract

In an economic geography model with firm heterogeneity, Baldwin and Okubo (2006) show that regional policies for promoting periphery development attract low-productivity firms and adversely affect the productivity gap within a country. This paper empirically examines their theoretical prediction by using plant-level data during active relocation policies in Japan. Our estimation results from plant-level regressions and propensity-score matching that are generally consistent with the theory. Compared to other regions, those targeted by policies, especially by industrial relocation subsidy programs, tend to have low-productivity plants.

Key words: geography, relocation subsidy, plant-level data
JEL classification: H32, R38

The authors wish to thank RIETI for its support and METI officials, especially Yuji Hosoya, who helped the authors collect historical documents. The authors are grateful for helpful comments by Masahisa Fujita, Masayuki Morikawa, Ryuhei Wakasugi and seminar participants at RIETI.

1. Introduction

Uneven development of regions within a country has been a serious social concern. To alleviate this problem, governments often adopt policies that promote the relocation of firms from industrial centers to undeveloped areas. By constructing a new economic geography model with firm heterogeneity, however, Baldwin and Okubo (2006) show that relocation subsidies for increasing the share of industry in periphery regions "attract the least productive firms since they have the lowest opportunity cost of leaving the agglomerated region" (p.2). If their theoretical prediction is true, regional policies should unintentionally widen the productivity gap between the core and the periphery.[1] This paper, the first empirical investigation of the sorting effect of regional policy, exploits plant-level data derived from manufacturing censuses during the period of active relocation policies in Japan.

Japanese industrial relocation policy can be regarded as a rare, suitable case for testing this theoretical prediction. First, all the regional policy programs considered in this paper are designed to relocate manufacturing plants from congested industrial core regions to undeveloped rural regions within a country, as formalized by Baldwin and Okubo (2006). In contrast, regional policies in other countries or other periods have been carried out for different objectives (e.g., the four Structural Funds and the Cohesion Fund to fight unemployment and stimulate economic growth in the poor regions in EU member countries and to support the transition of Eastern Europe into the EU). Second, Japan is *not* a federated country; instead, regional and local administrative units (prefecture, city, town, or village) possess only limited fiscal and judicial autonomy. This institutional fact implies that we can safely study the effects

---

1 In another example of theoretical work on the unintended effects of regional policy, Depont and Martin (2006) show that regional policies, especially subsidies to poor regions proportional to firms' profits financed by national taxes, *increase* cross-regional income inequality within a country. Their argument rests on the observation that the effect of subsidy spills over to rich regions, where many owners of capital (beneficiary of subsidized profits) reside.

of relocation policy on plants in the country by investigating the programs undertaken by the national government alone. In other countries, various layers of public authority (e.g., the states and the federal government in the U.S.A., and the nations and the European Commission of Europe) undertake their respective regional policies. Finally, Japan has accumulated experience in many regional subsidy programs, and the country has maintained rich regional data sets at the plant level. As discussed in the next section, the Japanese government actively tried to relocate plants from crowded industrial centers to peripheral regions particularly in the 1970s and 1980s. This makes Japan a good case by which to study regional policy impacts. In addition, the Japanese government has been consistently collecting comprehensive information on all manufacturing plants across all regions of the country. By making use of plant-level data derived from consecutive waves of manufacturing censuses, we can trace the effects of these economic policies in Japan.

While the list of global policy experiences over time is long, this issue remains vital in many countries. In Europe, the EU Structural Funds have had a substantial impact on the relocation of industries to peripheral countries in the last decade. However, as discussed by Midelfart-Knarvik and Overman (2002), regional policies result in attracting R&D intensive sectors to periphery regions with less skilled labor endowments. This tendency acts as a counter to comparative advantage and consequently fails to stimulate peripheral economic development. Previous empirical studies found that regional policies have not significantly raised productivity, although none has discussed the within-country productivity gap. For example, Boldrin and Canova (2001) and Dall’erba and Gallo (2007) detect no positive impacts of EU regional policies on productivity. In respective countries in Europe, Criscuolo et al. (2007) on U.K. Regional Selective Assistance and Martin et al. (2008) on the French regional cluster policy have found that supported firms/plants are not significantly different in terms of productivity.

None of these previous studies, however, have addressed the core-periphery productivity gap within a country.

More generally, the recent issue of the World Bank's influential *World Development Report* (2009), titled "Reshaping Economic Geography," argues that the side effects of regional development policy are becoming more serious in the age of globalization. When a country becomes more open to international trade "without changing the level of permissible subsidies to firms in remote regions, the subsidies will lead to an increasing distortion of the spatial allocation for industry" (Baldwin et al., 2003, p. 478). In this sense, while we examine only the case of Japan during the 1970s and 1980s, this investigation of a traditional relocation policy has far broader significance for our age.

The main results of our study are as follows. All regional policy programs are able to attract plants to targeted regions. However, plants located in these regions have below-average productivity. By using a matching technique and comparing pairs of plants in targeted and non-targeted regions, we find that all regional policies always attract significantly lower productivity plants. The results are quite robust. Even if we use only the sample of the machinery sectors or of mother cities in targeted regions, the principal outcomes remain unchanged.

The remainder of this paper is divided as follows. Section 2 offers a brief overview of the history of relocation policies in Japan. Section 3 describes the plant-level data acquired for our study. Section 4 explains our empirical methods. Section 5 reports the estimation results from regressions and propensity score matching. Section 6 presents the conclusions.

2. Overview of the relocation policy in Japan

This section, a historical summary of Japan's industrial relocation policy after World War II, is not presented as a comprehensive history but as a brief and sketchy background explanation for our estimations. It centers on the policy experience of Japan during the 1970s and 1980s, which provides us with a valuable opportunity to test the theoretical prediction of Baldwin and Okubo (2006).

Before discussing relocation policies, it would be informative to quickly scan the evolution of Japan's economic geography after World War II. As described by Fujita and Tabuchi (1997), the Japanese economic landscape has experienced two major transformations: first, the shift from the traditional Tokyo-Osaka bipolar system to the Pacific Industrial Belt during the historic high-growth period of the 1960s, and second, the move to a regional system dominated by monopolar Tokyo after the oil crisis in the mid-1970s. Labor reallocation was substantial from the agricultural sector in the periphery toward manufacturing industries on the Pacific Ocean coast during the first transformation period, whereas Tokyo attracted central management functions and service industries during the second period. Behind this geographic conversion, Japan also experienced changes in its industrial structure, which transitioned from one dominated by heavy industries dependent on imported materials to one led by knowledge-intensive, high-tech industries.

During this period, the Japanese government was involved in a series of active initiatives designed to encourage the relocation of firms from heaving manufacturing centers to undeveloped periphery regions. While it gradually shrank during the high economic growth of the 1960s and early 1970s, the wide income gap between the core (the Pacific Industrial Belt, especially Tokyo and Osaka) and the periphery has remained one of the top priorities in the economic policy package. Social concerns, such as air pollution, commuting congestion, and soaring housing prices in core regions, promoted public supports for nationwide industrial repositioning. The government's long-term regional policy plan emphasized "balanced development" of regions. As Japan is not a federated nation, the central national government has a strong authority in many policy arenas, including regional development policy. Under the leadership of the central government, transport infrastructure systems, such as highways and railroads, have been developed to facilitate the relocation from high-density center regions. The industrial relocation policy programs considered in this paper are among these grand strategy packages.

Figure 1 shows the Gini coefficients of two-digit manufacturing sectors for 47 prefectures from the 1970s to the present.[2] Cross-regional variations are measured in terms of the number of plants, employees, and value added. All three Gini coefficients decline over time. In particular, the Gini coefficients in terms of plants and employees steadily decline until the mid-1990s. This indicates that manufacturing geographically became diversified across Japanese regions because of factors such as improvement of the infrastructure and highway network as well as regional development policies.

In this paper, we study several regional development policy initiatives. First, we examine the Industrial Relocation Subsidy, which subsidizes plants relocated from "the moving-out promotion areas"[3] to "the inducement areas"[4] (both areas explicitly defined by national government orders). Since almost all the regions in Japan are categorized under one or the other of these categories, this policy program should have a wide impact on Japanese industrial relocations. This subsidy program has a long history, dating back to 1972, and was stimulated

[2] The data are taken from Manufacturing Census (Report by Industries) for each year (METI).

[3] The areas from which plants are encouraged to leave (*iten-sokushin chi-iki* in Japanese) are mainly in and around Tokyo, Osaka, and Nagoya.

[4] The areas to which plants are encouraged to relocate (*yudo chi-iki* in Japanese) include almost all areas outside the three major industrial centers.

by serious congestions in industrial centers; these congestions were aggravated during the high-growth years of the 1960s.

Second, we examine the program Technopolis, started in 1983 and designed to form high-technology industrial complexes (e.g., machinery sectors). During the 1960s, Japan encouraged heavy industries, including petrochemicals, which depended on cheap imported oil. However, the national government, after the oil price hikes in the 1970s, tried to shift the country's industrial configuration from heavy to high-technology industries. The Technopolis plan was expected to play a pivotal role in transforming the countrywide industrial structure, while, at the same time, encouraging more balanced growth across regions through the establishment of new industry complexes in undeveloped areas.

In addition to these two governmental programs, we also include the following three initiatives, all of which were designed to support rural regions with declining manufacturing. While Technopolis emphasized high technology, manufacturing industries (firms developing high technology or manufacturing high-technology products, for example, machinery) remain the policy target. The additional three programs focus, instead, on non-manufacturing activities, such as software programming or scientific research that, although closely related to and intended to support manufacturing industries in the same region, reflect the historical shift in Japanese industrial structures.

Started in 1988, Intelligent Location (*zuno ritti* in Japanese)[5] is designed to attract software and information service industries, which critically support the progression of high technology-intensive manufacturing.[6] Although expanding its scope to information-related

---

5 As the original Japanese names of policy programs (shown in parentheses) have been translated by the authors, some of the English names are not officially authorized.

6 As this program started relatively late in our sample period, our analysis is limited to OLS estimations.

non-manufacturing activities, this program shares the fundamental policy objective with the preceding Technopolis in stimulating regional manufacturing.

Regional Hub City (*chiho kyoten toshi* in Japanese) began in 1992 and was created to attract regional headquarters. While the repositioning programs of earlier periods often tried to relocate manufacturing plants to alleviate congestion and pollution in urban areas, this plan focuses on regional headquarter offices. Its changed perspective is again in line with the general trend of the declining share of manufacturing in the Japanese economy. This program was initially started as part of a regional infrastructure development plan. However, by changing the office locations, the Regional Hub City program is likely to have an indirect effect on the locations of manufacturing plants owned by the same firm and those of others competing in the same markets.

Science City (*gakuen toshi* in Japanese) is designed to attract academic and research facilities. A prime example of this program is Tsukuba City, in which a national university was relocated from urban Tokyo as part of a comprehensive development plan for a new city. Integral to a national research policy, this program started in the early 1970s. However, since Japanese economic planning in the 1980s began to focus more on R&D, science, and technology than on production per se, the Science City program should be examined together with other industrial relocation programs.[7]

Finally, we consider Coal Mining Areas (*san tan chi-iki* in Japanese). Started in 1961, this policy program is intended to help industries in coal-mining regions. Although this initiative began much earlier than any of the others already mentioned, the political commitment to it has been strong and sustained. Japan had traditionally depended on domestic coal as the primary source of energy, until cheap oil imports started to expand in the late 1950s. Following this

[7] For example, Technopolis requires each targeted regions to have at least one university with an engineering department.

fundamental shift in demand, called the Energy Revolution, coal-mining areas, once populous and rich, entered a declining phase. The Japanese government supported these declining regions by providing funds to promote other industries in them. As this program clearly identifies the targeted regions, as the funds devoted to this program were far greater than those allocated to others and as manufacturing industries were often expected to develop in these regions, we decided to include the Coal Mining Areas program in our analysis.

As we examine the above policies, all mandated by national law, the targeted regions are explicitly defined by public ordinance documents. Whether or not the region is selected by each policy is identified at the most basic geographical unit (village, town, or city). Any region in Japan belongs to one village, town, or city exclusively. No more meticulous official geographical unit exists in the Japanese system. While most of the previous studies depend on broader prefecture or state-level data, our identification of target regions at the city/town/village level is far more complete and precise.[8]

3. Description of plant-level data

This section describes the data used in our study. We derive plant-level data from Japan's *Census of Manufacturers*. Basic plant characteristics, such as output (shipment), employment (number of regular workers), and expenditures on materials, are included in this census for virtually all plants across all manufacturing industries.

3.1. Coverage of plants

8 In some exceptional cases, targeted regions are defined by *chome* addresses (similar to street numbers) within the same city/town/village. As our plant data cannot identify a plant's *chome* address, we assume that all firms located in a city/town/village are subsidized if some parts of the city/town/village are targeted by a policy.

Although the annual survey covers plants above the given size threshold, small-sized plants are only included in the "census years" (year with 0, 3, 5, or 8 as its last digit). We concentrate on the census years to avoid truncations due to the sampling of plants. As plant-level data are maintained only for the plants with no less than five employees in the original micro-data files of the central government, even for the most recent census, our sample excludes plants with less than five employees. Since these extremely small-sized plants produce negligible volumes of output, their omission is unlikely to affect our conclusion on economic geography.

Among the available plant-level data, this paper focuses on plants owned by multi-plant firms. The census captures whether or not each plant is a part of a multi-plant firm, although no identifier is available for linking plants under the same ownership. Hence, the aggregation of our plant-level data to the firm level is impossible. We look at multi-plant firms because they are likely to relocate their plants more responsively to variations in economic geography conditions and in the government's subsidy. By focusing on these relatively "footloose" plants, this paper sheds light on the possible effects of the relocation policy on plant productivity. Our sample of plants owned by multi-plant firms includes 48,000 plants in 1978 and then steadily grows to 66,000 by 1990 (Table 1).

3.2. Sample period

Our sample period consists of the following six consecutive census years: 1978, 1980, 1983, 1985, 1988, and 1990. We selected these years for the following reasons.

First, as mentioned in Section 2, the 1970s and 1980s were the heyday of Japan's active relocation policies. In later years, the focus of Japanese regional initiatives shifted from manufacturing to non-manufacturing activities. Although this shift naturally reflects changing shares in the national economy, the government's efforts on gathering data on non-manufacturing (service) sectors are generally insufficient when compared to the extensive censuses carried out on the manufacturing sector. Public support programs have also begun to concentrate more on functions, such as R&D, rather than on specific locations. Furthermore, greater emphasis was placed on strengthening the roles of Tokyo as a global financial center, especially during the Bubble boom period around 1990. After the bubble burst, public construction projects were actively financed in rural areas as part of macroeconomic stimulus during the 1990s but without the policy objective of industrial relocation. Consequently, to avoid these various contaminations in recent years when testing the productivity-sorting effect by Baldwin and Okubo (2006), we focus on the earlier period when policy programs for relocating manufacturing plants from crowded core areas to undeveloped periphery areas were actively undertaken.

Second, the 1970s and 1980s are suitable periods to measure the impact of regional policy on firm relocation across Japan. From the 1990s onward, unprecedented exchange rate appreciation led factories to relocate to lower wage Asian countries through foreign direct investment. More recently, production processes and firm organization have become much more complex. Many Japanese firms build production networks linked to domestic and overseas production by intermediate inputs purchase, foreign direct investment, and outsourcing. Since complete data sets covering global location information of individual plants are not available, we cannot appropriately examine regional policies in such a globalized era. To circumvent the statistical difficulties that arise from the complexity of firm organization and oversea production/relocation, we focus on the 1970s and 1980s. Finally, the *Census of Manufacturers* does not maintain plant-level data before the mid-1970s, even in the original government data files.

As no plant identifier tracing micro-data over time is available, our data set is unfortunately in the format of repeated cross-sections. As a result, we cannot discuss causality direction or dynamic effects on entry/exit or on productivity growth. In addition, without any longitudinal identifier in our repeated cross-section data, we cannot estimate the total factor productivity of each firm. Furthermore, previous research in related fields shows that the choice of productivity measure is unlikely to affect results.[9] Therefore, we measure productivity by value added per worker.

(Table 1)

During this period, the regions targeted by policies attracted plants. As Table 1 shows, the number of plants located in targeted regions increased substantially. Furthermore, this growth in the targeted regions is higher than the national average. As a result, the share of target regions in Japan rose during the sample period.

(Table 2)

The above table demonstrates that the share of targeted regions has increased during a series of relocation policy programs. This finding, reported in Table 2, is robust, even if we concentrate on the regions actually subsidized among the inducement areas listed by the law.[10] However,

---

9 For example, Bernard and Jones (1996) report that the difference between TFP and labor productivity is relatively small when countries are compared. Syverson (2004) also confirms that his result from TFP on the plant-level relation between productivity and spatial competition is robust even if labor productivity is used.

10 Staffs at Regional Economy Section in METI rearranged the historical data on individual subsidy provision after deleting firm identifiers and provided them to the authors exclusively for this research project.

the mere rise in the number of plants does not imply the success of these relocation policies. We will examine their impacts on productivity, especially at the plant level.

4. Empirical methods

This section explains the empirical methods used to estimate the impact of relocation policies on plant productivity. We take two different approaches. First, we estimate the regressions with the policy dummy variable. Second, we select comparable plants on the basis of the propensity score matching method.

4.1. Policy Premium

In the first approach, to estimate the policy premium on plant productivity, we estimate the following plant-level reduced-form regression:

$$\begin{aligned} PROD_j &= const + \alpha_1 SIZE_j + \alpha_2 MAT_j + \alpha_3 LABOR_j \\ &\quad + \sum \beta_k POLICY_k + \sum \gamma_l IND_l + \sum \delta_m PREF_m + \varepsilon_j \end{aligned} \qquad (1)$$

The plant is indexed by *j*. As no longitudinal plant identifier linking plants over time is available, all the regressions are in a cross-sectional format. The dependent variable is the productivity *PROD*, which is defined by the value added per worker.[11] Included on the right-hand side of the regression are plant characteristics, industry dummies (*IND)*, prefecture dummies (*PREF)*, and relocation policy dummies (*POLICY)*.[12] Plant-level variables included in (1) are the plant size, *SIZE* (the number of workers), the intensity of material used, *MAT* (expenditures on materials divided by output, both in yen), and the labor intensity *LABOR* (labor inputs [total wage paid]

[11] The denominator is the number of regular employees. The numerator is output (shipment) less the consumption tax, depreciation, and raw material costs.
[12] The policy dummy takes the value of 1 for the regions always targeted through the sample period. As a robustness check, however, the dummy for the regions targeted at each year (not necessarily targeted in other years) is also used in the cases of Technolopolis and Intelligent Location.

divided by output). All variables are in logarithmic form.[13] No other plant-level variables related to productivity, such as capital, are available in our census data that include small-sized plants.[14] Industries are defined at a two-digit level. The dummies for 47 prefectures are included to control for region-specific determinants of plant productivity, such as cross-regional differences in human capital. The error term is expressed by ε in (1). *POLICY* is a vector of dummy variables, which takes the value of 1 when the plant is located in the region (city, town, or village) targeted by each relocation policy program.[15] If the coefficient on a policy dummy is positive/negative, the plants located in the regions targeted by the policy are*, on average*, more/less productive than those located in other regions after controlling for plant characteristics, industry effects, and prefecture-specific factors. We must note, however, that we should not interpret equation (1) as indicating the direction of causality. As our sample is constrained as repeated cross-sections, we cannot discuss dynamics or causality appropriately.

4.2. Matching Technique (Treatment Effect)

While the regression discussed above is straightforward, plants located in the regions targeted by policy may differ, because of reasons not related to the policy, from those located in other regions in terms of productivity-related critical variables. In response to this selectivity problem, we choose the matching technique to select a pair of comparable plants from our sample.

The causal effect of the treatment is estimated as the mean difference in productivity between the treated and the untreated groups. The treated group is composed of the plants located in the targeted regions (city, town, or village level) identified by regional development policy programs. On the other hand, the non-treated group is a set of all plants outside the target

[13] For *MAT* and *LABOR*, the value of 1 is added before taking the logarithm.
[14] The manufacturing census contains data on tangible fixed assets only for large-sized plants.
[15] The policy dummy is defined time-invariant, irrespective of the start and finish of each policy.

regions. The average effect of the treatment on the treated group, ATT, is given by $E(y^1 - y^0 \mid D = 1)$, where D is the policy dummy variable (D = 1 if plants are treated, and 0 otherwise). y^1 and y^0 denote treated and non-treated plant-level productivity respectively. We assume that the non-treated outcomes are independent of treatment status and conditional on observable plant characteristics, $X \in (Size, Mat, Labor)$. The *Size*, *Mat*, and *Labor* capture all relevant differences between the two groups. Then, we adopt the propensity score matching as in Rosenbaum and Robin (1983). The probability of treatment, *p(X)*, defined as the propensity score (0 < *p* < 1), given the observables is specified as $p(X) \equiv p(D = 1 \mid X)$. The propensity score is estimated by probit regression using *X*. To match the sample, we use caliper matching at the level of 0.05 and involve one-to-one matching with replacement with common support.[16] For a pre-specified δ (= 0.05), treated plant *i* is matched to the non-treated plant *j* such that $\delta > \left|p_i - p_j\right| = \min_{k \in \{D=0\}} \{\left|p_i - p_j\right|\}$. When none of the non-treated units are within δ from treated plant *i*, the plant remains unmatched. The expected difference between matched pairs is given by $E(y \mid D = 1, p(X)) - E(y \middle| D = 0, p(X)) = E(y^1 - y^0 \middle| p(X))$.

By iterated expectations, the average across the distribution of propensity scores gives $ATT = E(y^1 - y^0)$. To check whether a pair of sample has similar characteristics, *X*, we use a balance test. The test checks whether independent variables used in the above-mentioned probit regression to derive propensity score are significantly different, on average, between treated and non-treated groups. After matching the pair, when the gaps in almost all the average variables between two groups are insignificant in a t-statistic, we succeed in pair matching identical characteristics.

---

16 In our regression, common support is imposed on the treated units. Because of the common support, the treated units whose propensity score is higher than the largest propensity score in the non-treated group can remain unmatched.

5. Estimation results

5.1. Results from regression with dummies

The OLS regression results are reported in Table 3a. This regression exercise is intended to examine whether targeted regions tend to have an average productivity that is significantly higher than that of other regions. We estimate cross-sectional regressions for all years in our sample period irrespective of the starting period of each policy, with the policy dummy variable consistently taking the value of 1 for the targeted regions.[17]

(Table 3a)

The results shown in Table 3a demonstrate that the plants located in the regions targeted by most relocation policy programs tend to have significantly lower productivity or to be insignificantly different from plants located in regions not promoted by the policy. Negative coefficients are found especially in the cases of Regional Hub Cities and Science Cities. The regions targeted by these policy programs appear to attract low-productivity plants. Consequently, we find empirical evidence favorable for the sorting effect predicted by Baldwin and Okubo (2006) in these policy programs. We must note, however, that this negative effect on manufacturing productivity should not be regarded as a policy failure, since these two programs are intended to attract regional headquarter offices and academic/research facilities respectively, not productive manufacturing plants. In addition, we should not directly consider the OLS regression results as showing the causal effects of policy. We will later discuss the treatment effect on the basis of plant matching.

[17] The targeted region is strictly defined as the regions that have always been targeted since the start of each policy program.

In contrast, in the cases of Technopolis and Intelligent Locations, the positive productivity premium is found. However, we cannot assert simply on the basis of this regression result that these two policy schemes are exceptionally successful in attracting high-productivity firms. By comparing the productivity premium of the targeted regions before and after the start of the policy program, we can infer the policy effect. As reported in the table, the magnitude remains the same over time and the gap had been significant even *before* these policy programs started (Technopolis from 1983, Intelligent Locations from 1988). Thus, the results indicate that these two programs have selected regions in which higher productivity plants were *already* concentrated and/or average productivity was higher than the total for Japan.[18] In this sense, we should be cautious in concluding that these two programs succeed in attracting productive plants.

As a robustness check, for Technopolis and Intelligent Locations, we further introduce an alternative definition of a targeted region. In the above regressions, we have defined targeted regions as those targeted consistently through the sample period since the start of the policy program. We now alternatively define them as the regions targeted at each year (not necessarily targeted in other years). The former definition concentrates on the narrower groups of regions common across years, but the latter definition includes newly targeted regions in regressions on later years. The estimation results based on this alternative definition are shown in Table 3b. The regressions based on the latter definition are naturally limited to the years after the start of each policy program, though the regression based on the former can be estimated in any year during the sample period, as shown in the previous table. In both Technopolis and Intelligent Locations, the productivity of plants in the targeted regions are, on average, significantly lower at the

18 As a related finding, Midelfart-Knarvik and Overman (2002) report that the EU Structural Fund supports are effective in Ireland, where the share of high-skilled workers is higher than other targeted countries.

beginning of policies, though the premium turns to be positive in later years. Thus, this additional regression result rather strengthens our previous conclusion.

5.2. Matching results

Our main interest is to estimate the impact of regional policy programs directly. Table 4 reports ATT in the matching result. To discuss the periods before and after policy impact, we estimate ATT before starting policies in some programs in which treated groups are firms in regions to be targeted in the future but not yet subsidized. We note that balance tests pass in all independent variables used in the probit estimation in each policy program (See Appendix for a representative result).

As a result, almost all the cases have significantly negative values. Among them, in the Industrial Relocation program, the plants in moving-out regions are significantly more productive and the comparable plants in the inducement regions are significantly less productive at any point in time. Even if we distinguish the inducement regions listed by law and the regions actually subsidized, this clear result is confirmed. The signs remain unchanged over time. These indicate that the policy program cannot effectively work for high-productive firms to relocate from moving-out to inducement regions, although the number of firms increases in the latter.

Concerning the Technopolis and Intelligent Location programs, values are all significantly negative for entire periods. Even after starting programs, the negative values remain unchanged. Thus, as in the case of the Industrial Relocation program, the policy impact of these programs is nil. Therefore, after controlling for the plant characteristics, we can conclude that all regional policy programs fail to attract significantly high-productivity plants. Our finding of no productivity effect of regional policies is in line with previous results from other countries (e.g.

Curiscuolo et al. 2007 on U.K. and Martin et al. 2008 on France), though none has discussed the productivity gap within a country.

(Table 4)

Endogeneity might, however, affect the results given in Table 4. It is possible that the government intentionally subsidizes lower wage regions as a policy response to cross-regional income inequality. On the other hand, the plants in high-wage sectors are likely to locate their plants in these regions to save labor costs. The low-wage regions, which are likely to be subsidized, attract high-wage sectors, but not necessarily because of the subsidy. To control for this possible bias, the treatment probability by the probit estimation now takes into account not only plant characteristics, $X \in (Size, Mat, Labor)$ with a two-digit sector dummy, as in Table 4, but also the average wage in the region (city/town/village) where the plant is located and the average wage in the four-digit industry to which the plant belongs. The probit estimation results show that the average wage in the region is significantly negative and the average wage of the industry is significantly positive, as expected, in all programs in all years.[19]

(Table 5)

Using revised propensity scores, ATTs are newly estimated, as reported in Table 5. While treatment effects are smaller, most ATTs remain significantly negative. Thus, we confirm that the plants in subsidized regions tend to have lower productivity, even after considering this possible endogeneity.

5.3. Sensitivity analyses

---

19 Owing to space constraints, we only report the results for 1980, 1985, and 1990 and omit other years. The probit results have also been omitted. The results will be available upon request.

This section reports alternative estimation results to check the robustness of our principal findings.

First, we concentrate on the machinery sector, which was targeted in the Technopolis and Intelligent Location policy programs. The machinery sector, which includes automobile, general machinery, and electronics, was a growth industry given Japan's comparative advantage during this period. Peripheral regions tried to attract these industries. To avoid possible contaminations due to locations by other industries not directly targeted by relocation programs, we estimate the same specifications only for the plants in the machinery sector.

(Table 6)

The results displayed in Table 6 confirm our previous estimation results from the sample covering all sectors (Table 4). Thus, our findings are not affected by industrial compositions.

Second, we have more detailed information on the structure within each targeted region for some policy programs. In the cases of Technopolis and Intelligent Locations, every targeted region has its center city (or metropolis).[20] While our previous estimations are based on the broad definition of all targeted regions, this section will re-estimate the same specification with the policy dummy on the basis of the narrow definition, that is, the targeted region defined by the center city (metropolis) only.

(Table 7)

The results reported in Table 7 are basically the same as shown previously for all targeted regions (Table 4), though the values are small in magnitude. Although no such

[20] Each targeted region is designed to develop around a specified *bo-toshi* (in Japanese), which means a mother city (metropolis).

information distinguishing center cities within targeted regions is available for other relocation programs, the above findings from the two programs confirm the robustness of our previous principal findings.

Third, we examine the difference between the targeted regions and their adjacent (non-subsidized) regions using the data of all sectors. Since regions located adjacently are likely to share various unobservable geographical factors, the location decisions of plants may be affected by common factors. To isolate the policy effect from these unobservable, possibly geographic, factors common to nearby regions, we compare targeted regions with their neighbors. Different from the treatment effect estimated in the previous section (Table 4), this robustness check restricts the non-treated group only to the regions directly adjacent to those that are targeted.

(Table 8)

The results reported in Table 8 basically confirm the main findings of the previous section, although the statistical significance varies depending on the policy program. In general, even if we compare neighboring areas, the plants located in targeted regions tend to be significantly less productive than or insignificantly different from the plants located in other regions. The Industrial Relocation program shows significantly negative effects in the whole period, whereas the effects of Coal Mining Areas and Science Cities are not significant. In comparison, the plants in Technopolis or in Intelligent Locations are significantly or insignificantly positive. Here, we need to interpret carefully the results from the matching with only those of the adjacent regions. Interestingly, after starting policy programs, the treatment effect tends to be insignificant. This indicates two possibilities: (1) targeted regions attract more low-productivity firms, thus lowering the productivity gap with neighboring regions or (2) relocation to these regions might induce some related production in adjacent regions (e.g., parts and components).

This spillover effect or backward and forward linkages might reduce the productivity gap between targeted and its adjacent regions.

Summarizing the three estimations for robustness check, we cannot find any significantly positive impact of regional policy programs, and thus, these results confirm the robustness of our principal findings reported in the previous section.

6. Concluding remarks

The results reported in this paper are generally supportive of the theoretical prediction by Baldwin and Okubo (2006). All policy programs in Japan can successfully attract firms, both in number and share of plants, to targeted regions (Table 1). This may contribute to diversification across Japanese regions, as the Gini coefficient has declined over time (Figure 1). However, as shown in Table 3, plants located in targeted regions have lower average productivity, although productive plants were active in the areas subsidized in Technopolis and Intelligent Locations even before the start of these programs. The theory predicts that lower productivity firms are likely to relocate to the targeted regions. Once we use the matching technique and compare a pair of firms in targeted regions and non-targeted regions, all regional policies are found to attract lower productivity firms. We have to be careful about the relationship between the results of OLS and matching. The OLS regression discusses average productivity without the causality issue, while the propensity score-matching technique singles out pairs and directly compares their productivity without using unmatched samples in non-targeted regions.

Although we have found negative effects of relocation policy on plant productivity, this paper is not intended to deny the role of policy in shaping economic geography. The policy programs examined in this paper actually result in the location of more plants in targeted regions, though the productivity of relocated plants tends to be low. Since the high unemployment rate in undeveloped regions has been a serious policy issue in many mature countries, the activated relocations of plants itself should be positively evaluated.[21] We must also note that, in spite of our focus on variations within manufacturing, the agriculture sector was non-negligible in periphery during earlier period of development and the service sector becomes increasingly important in later years.

The variety of policy schemes is another issue left for future analyses. "The reality is that besides place-based incentives, governments have far more potent instruments for integration. They can build institutions that unify all places and put in place infrastructure that connects some places to others" (World Bank, 2009, p.xxiii). Even within our sample, various policy measurers support targeted regions, not necessarily by subsidy. A more detailed analysis that distinguishes individual support schemes will enrich our results in the future.

Acknowledgement

The authors acknowledge valuable comments from seminar participants at Keio University and RIETI, especially Masahisa Fujita, Masayuki Morikawa, and Ryuhei Wakasugi. This research is partly financed by Grant-in-Aid for Scientific Research and Japan's Research Institute of Economy, Trade, and Industry (RIETI). The access to official micro-data was arranged by RIETI. Officials at the Ministry of Economy, Trade and Industry (METI), especially Yuji Hosoya, helped us collect historical documents on relocation policies. Views expressed in this paper are not those of RIETI or METI.

References

---

[21] Martin et al. (2008) conclude that the French cluster policy is "the apparent failure" (p.22) in improving productivity, but they admit that the policy has a positive impact on employment. Criscuolo et al. (2007) also report a positive effect on employment in U.K. regional policy.

Baldwin, R., Forslid, R., Martin, P., Ottaviano, G., and Robert-Nicoud, F. (2003) *Economic Geography and Public Policy*, Princeton University Press.

Baldwin, R., and Krugman, P. (2004) "Agglomeration, integration and tax harmonisation," *European Economic Review* 48, 1-23.

Baldwin, R., and Okubo, T. (2006) "Heterogeneous firms, agglomeration and economic geography: spatial selection and sorting," *Journal of Economic Geography* 6, 323-346.

Bernard, A., and Jones, C. (1996) "Comparing apples to oranges: productivity convergence and measurement across industries and countries," *American Economic Review* 86, 1216-1238.

Boldrin, M and F. Canova (2001) "Inequality and spillovers in regions: Evidence from European regional policies," *Economic Policy* 32, 205-253.

Criscuolo, C., Martin, R., Overman, H., and Van Reenen, J. (2007) "The effect of industrial policy on corporate performance: Evidence from panel data," mimeo.

Dall'erba, S and J.L. Gallo (2007) "Regional Convergence and the Impact of European Structural Fund over 1989–1999: A Spatial Econometric Analysis," *mimeo,* University of Arizona.

Dupont, V., and Martin, P. (2006) "Subsidies to poor regions and inequalities: Some unpleasant arithmetic," *Journal of Economic Geography* 6, 223-240.

Egger, H., and Falkinger, J. (2006) "The role of public infrastructure and subsidies for firm location and international outsourcing," *European Economic Review* 50, 1993-2015.

Fujita, M., and Tabuchi, T. (1997) "Regional growth in postwar Japan," *Regional Science and Urban Economics* 27, 643-670.

Hines, J. (1996) "Altered states: taxes and the location of foreign direct investment in America," *American Economic Review* 86, 1076-1094.

Holmes, T. (1998) “The effect of state policies on the location of manufacturing: evidence from state borders,” *Journal of Political Economy* 106, 667-705.

Martin, P., Mayer, T., and Mayneris, F. (2008) "Public support to clusters: A firm level study of French Local Productive Systems,” CEPR Discussion Paper No. 7102.

Midelfart-Knarvik, K.H., and Overman, H. (2002) “Delocation and European integration,” *Economic Policy* 17, 322-359.

Syverson, C. (2004) “Market structure and productivity: A concrete example,” *Journal of Political Economy* 112, 1181-1222.

World Bank (2009) *World Development Report: Reshaping Economic Geography*, World Bank, Washington D.C.

Figure 1: Gini Coefficient

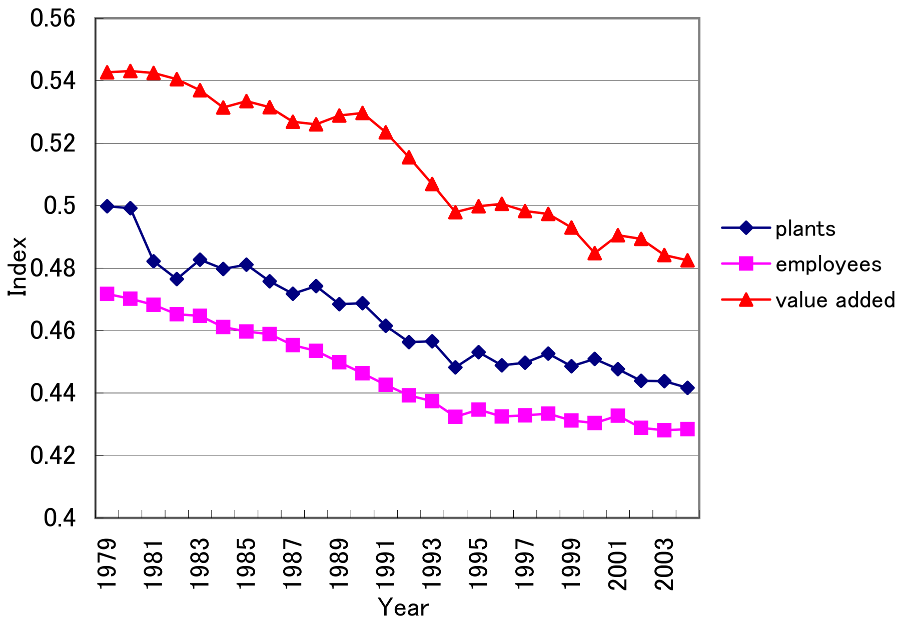

Table 1: Basic Statistic

Year	Variable	Observation	Mean	Std. Dev.	Min	Max
1978	PROD	48040	5.844501	1.05994	0	10.59039
	SIZE	48040	3.316469	1.280155	1.386294	9.781207
	LABOR	48040	0.2345804	0.1613151	0	3.793714
	MAT	48040	0.3865969	0.17278	0	5.542666
1980	PROD	48559	5.979857	1.116493	0	10.81911
	SIZE	48559	3.310036	1.272666	1.386294	9.795791
	LABOR	48559	0.2255405	0.1594183	0	2.939515
	MAT	48559	0.3944476	0.1736848	0	3.026459
1983	PROD	53655	6.051981	1.130118	0	11.66635
	SIZE	53655	3.276194	1.264586	1.386294	10.05096
	LABOR	53655	0.238533	0.1669842	0	3.813525
	MAT	53655	0.3843739	0.1739884	0	2.918972
1985	PROD	57942	6.138449	1.120561	0	11.59249
	SIZE	57942	3.31352	1.244825	1.386294	10.1092
	LABOR	57942	0.2389843	0.165001	0	4.167595
	MAT	57942	0.3820283	0.1736199	0	4.973279
1988	PROD	61726	6.237205	1.125369	0	11.79964
	SIZE	61726	3.302714	1.230873	1.386294	9.922604
	LABOR	61726	0.2429936	0.1755346	0	8.39841
	MAT	61726	0.3713824	0.1767701	0	11.35772
1990	PROD	66093	6.347178	1.155394	0	12.44145
	SIZE	66093	3.299687	1.21973	1.386294	9.943429
	LABOR	66093	0.2383255	0.1720533	0	7.920083
	MAT	66093	0.3680061	0.1729084	0	3.832807

Table 2: Number of Firms in Targeted Areas

Number of firms located in the targeted areas

		1978	1980	1983	1985	1988	1990
Industrial Relocation	moving-out promotion area	10723	10377	11059	11847	11662	12187
	inducement areas	16839	17302	18958	20935	22839	24746
	Subsidized inducement are:	3076	3175	3845	3623	11077	8477
Coal Mining Areas		1263	1258	1430	1339	1375	1455
Technopolis					3423	6210	4053
Intelligent Location						536	6159
Science City		234	222	233	277	285	295
Total		48040	48559	53655	57942	61726	66093

Share of firms located in the targeted area in total Japan

		1978	1980	1983	1985	1988	1990
Industrial Relocation	moving-out promotion area	0.22321	0.213699	0.206113	0.204463	0.188932	0.184392
	inducement areas	0.35052	0.356309	0.353331	0.36131	0.370006	0.374412
	Subsidized inducement are:	0.06403	0.065384	0.071662	0.062528	0.179454	0.128259
Coal Mining Areas		0.026291	0.025907	0.026652	0.023109	0.022276	0.022014
Technopolis					0.059076	0.100606	0.061323
Intelligent Location						0.008684	0.093187
Science City		0.004871	0.004572	0.004343	0.004781	0.004617	0.004463

Table 3a: OLS Results 1 Note: **: 5 % significance, *: 10% significance

	1978		1980		1983		1985		1988		1990	
Technopolis	0.0984		0.0897		0.0241		0.0543		0.0505		0.0507	
	7.62	**	*6.56*	**	*1.82*	*	*4.23*	**	*3.94*	**	*4.2*	**
Size	0.0814		0.1047		0.0979		0.0868		0.0953		0.1003	
	27.87	**	*33.74*	**	*32.58*	**	*29.06*	**	*31.43*	**	*34.67*	**
Labor	−4.6120		−5.0068		−4.7411		−4.4204		−3.6172		−4.2644	
	−172.64	**	*−173.51*	**	*−182.07*	**	*−176.08*	**	*−159.32*	**	*−189.48*	**
Mat	−3.1119		−3.3752		−3.3607		−2.9659		−2.2558		−2.9953	
	−125.9	**	*−128.24*	**	*−135.46*	**	*−125.26*	**	*−101.35*	**	*−134.5*	**
Number of Obs	48040		48559		53655		57942		61726		66093	
R−squared	0.4857		0.4862		0.4815		0.4572		0.4158		0.4685	
F	1647.25		1674.23		1827.23		1707.86		1589.91		2034.14	

	1978		1980		1983		1985		1988		1990	
Intelligent	0.1244		0.0989		0.0684		0.0952		0.0888		0.0875	
	9.74	**	*7.48*	**	*5.34*	**	*7.58*	**	*7.1*	**	*7.41*	**
Size	0.0810		0.1044		0.0977		0.0866		0.0951		0.1001	
	27.74	**	*33.64*	**	*32.5*	**	*28.98*	**	*31.37*	**	*34.59*	**
Labor	−4.6084		−5.0050		−4.7394		−4.4192		−3.6150		−4.2637	
	−172.57	**	*−173.45*	**	*−182.03*	**	*−176.09*	**	*−159.25*	**	*−189.49*	**
Mat	−3.1114		−3.3752		−3.3604		−2.9668		−2.2563		−2.9972	
	−125.94	**	*−128.26*	**	*−135.49*	**	*−125.34*	**	*−101.41*	**	*−134.61*	**
Number of Obs	48040		48559		53655		57942		61726		66093	
R−squared	0.4853		0.4864		0.4817		0.4576		0.4161		0.4688	
F	1649.98		1675.19		1829.1		1710.56		1592.2		2036.72	

	1978		1980		1983		1985		1988		1990	
Moving−out	0.1212		0.1365		0.1457		0.0900		0.1120		0.0976	
	9.56	**	*10.26*	**	*11.58*	**	*7.3*	**	*8.89*	**	*8.14*	**
Size	0.0827		0.1061		0.0994		0.0882		0.0971		0.1018	
	28.31	**	*34.17*	**	*33.09*	**	*29.47*	**	*31.99*	**	*35.14*	**
Labor	−4.6146		−5.0127		−4.7440		−4.4242		−3.6197		−4.2680	
	−172.78	**	*−173.81*	**	*−182.39*	**	*−176.26*	**	*−159.51*	**	*−189.68*	**
Mat	−3.1129		−3.3767		−3.3616		−2.9660		−2.2564		−2.9959	
	−125.98	**	*−128.38*	**	*−135.67*	**	*−125.31*	**	*−101.44*	**	*−134.57*	**
Number of Obs	48040		48559		53655		57942		61726		66093	
R−squared	0.4861		0.4869		0.4828		0.4576		0.4164		0.4689	
F	1649.72		1678.85		1836.92		1710.27		1594.09		2037.51	

	1978		1980		1983		1985		1988		1990	
Inducement	−0.1487		−0.1401		−0.1170		−0.1314		−0.1410		−0.1170	
	−12.5	**	*−11.23*	**	*−9.64*	**	*−11.01*	**	*−11.88*	**	*−10.44*	**
Size	0.0802		0.1036		0.0973		0.0862		0.0948		0.0999	
	27.5	**	*33.41*	**	*32.38*	**	*28.85*	**	*31.28*	**	*34.54*	**
Labor	−4.6059		−5.0024		−4.7389		−4.4166		−3.6156		−4.2642	
	−172.57	**	*−173.48*	**	*−182.13*	**	*−176.07*	**	*−159.41*	**	*−189.6*	**
Mat	−3.1141		−3.3780		−3.3636		−2.9673		−2.2606		−2.9988	
	−126.12	**	*−128.45*	**	*−135.69*	**	*−125.43*	**	*−101.66*	**	*−134.73*	**
Number of Obs	48040		48559		53655		57942		61726		66093	
R−squared	0.4868		0.4864		0.4824		0.4582		0.4170		0.4692	
F	1654.55		1680.42		1833.87		1714.89		1598.17		2040.46	

	1978	1980	1983	1985	1988	1990
Coal	−0.0452	0.0085	0.1045	0.0650	0.0521	0.0666
	−1.31	*0.23*	*2.97* **	*1.77* *	*1.4*	*1.91* *
Size	0.0814	0.1048	0.0979	0.0869	0.0954	0.1005
	27.87 **	*33.75* **	*32.57* **	*29.09* **	*31.47* **	*34.72* **
Labor	−4.6110	−5.0082	−4.7412	−4.4213	−3.6176	−4.2649
	−172.5 **	*−173.48* **	*−182.08* **	*−176.08* **	*−159.32* **	*−189.48* **
Mat	−3.1096	−3.3737	−3.3599	−2.9654	−2.2561	−2.9953
	−125.74 **	*−128.13* **	*−135.45* **	*−125.22* **	*−101.35* **	*−134.48* **
Number of Obs	48040	48559	53655	57942	61726	66093
R−squared	0.4851	0.4858	0.4815	0.4571	0.4157	0.4684
F	1643.06	1671.02	1827.64	1706.86	1589.02	2033.17

	1978	1980	1983	1985	1988	1990
Science	0.0281	−0.0901	−0.0834	−0.1358	0.0081	−0.0148
	0.55	*−1.63*	*−1.53*	*−2.65* **	*0.15*	*−0.29*
Size	0.0814	0.1048	0.0980	0.0871	0.0954	0.1005
	27.86 **	*33.77* **	*32.61* **	*29.13* **	*31.47* **	*34.73* **
Labor	−4.6109	−5.0082	−4.7413	−4.4207	−3.6174	−4.2649
	−172.49 **	*−173.49* **	*−182.07* **	*−176.08* **	*−159.31* **	*−189.47* **
Mat	−3.1095	−3.3734	−3.3605	−2.9654	−2.2559	−2.9954
	−125.74 **	*−128.12* **	*−135.46* **	*−125.23* **	*−101.35* **	*−134.48* **
Number of Obs	48040	48559	53655	57942	61726	66093
R−squared	0.4851	0.4858	0.4808	0.4571	0.4157	0.4684
F	1642.96	1671.22	1827.16	1707.13	1588.89	2032.93

	1978	1980	1983	1985	1988	1990
Regional Hub	−0.0129	−0.0088	−0.0061	−0.0121	−0.0158	−0.0158
	−1.37	*−0.9*	*−0.65*	*−1.33*	*−1.74* **	*−1.84* **
Size	0.0815	0.1048	0.0980	0.0870	0.0955	0.1006
	27.88 **	*33.76* **	*32.59* **	*29.11* **	*31.49* **	*34.75* **
Labor	−4.6110	−5.0082	−4.7413	−4.4210	−3.6175	−4.2651
	−172.5 **	*−173.48* **	*−182.07* **	*−176.08* **	*−159.32* **	*−189.49* **
Mat	−3.1093	−3.3733	−3.3602	−2.9649	−2.2557	−2.9954
	−125.73 **	*−128.11* **	*−135.44* **	*−125.2* **	*−101.34* **	*−134.49* **
Number of Obs	48040	48559	53655	57942	61726	66093
R−squared	0.4851	0.4858	0.4815	0.4571	0.4157	0.4684
F	1643.08	1671.08	1827.02	1706.77	1589.09	2033.15

Table 3b: OLS Results 2 Note: **: 5 % significance, *: 10% significance

	1978	1980	1983	1985	1988	1990
Technopolis (subsidized only)			-0.3406	0.0412	0.0429	0.0261
			-3.37 **	*2.46* **	*3.27* **	*1.69* *
Size			0.0980	0.0869	0.0953	0.1004
			32.59 **	*29.09* **	*31.45* **	*34.7* **
Labor			-4.7415	-4.4207	-3.6173	-4.2649
			-182.1 **	*-176.08* **	*-159.32* **	*-189.48* **
Mat			-3.3599	-2.9653	-2.2559	-2.9954
			-135.45 **	*-125.22* **	*-101.36* **	*-134.49* **
Number of Obs			53655	57942	61726	66093
R-squared			0.4816	0.4571	0.4158	0.4684
F			1827.83	1707.06	1589.59	2033.12

	1978	1980	1983	1985	1988	1990
Inteligent (subsidized only)					-0.0694	0.0768
					-1.43	*4.9* **
Size					0.0955	0.1004
					31.49 **	*34.68* **
Labor					-3.6174	-4.2644
					-159.32 **	*-189.49* **
Mat					-2.2565	-2.9963
					-101.36 **	*-134.55* **
Number of Obs					61726	66093
R-squared					0.4157	0.4686
F					1589.02	2034.58

	1978	1980	1983	1985	1988	1990
Inducement	-0.0192	0.0571	0.0127	0.0330	-0.0598	-0.0033
(subsidized only)	*-1.24*	*3.54* **	*0.87*	*2.16* **	*-2.8* **	*-0.15*
Size	0.0814	0.1047	0.0979	0.0869	0.0955	0.1005
	27.87 **	*33.73* **	*32.58* **	*29.08* **	*31.49* **	*34.73* **
Labor	-4.6114	-5.0075	-4.7409	-4.4203	-3.6176	-4.2649
	-172.5 **	*-173.48* **	*-182.03* **	*-176.05* **	*-159.33* **	*-189.46* **
Mat	-3.1094	-3.3742	-3.3604	-2.9656	-2.2558	-2.9954
	-125.73 **	*-128.17* **	*-135.45* **	*-125.23* **	*-101.35* **	*-134.48* **
Number of Obs	48040	48559	53655	57942	61726	66093
R-squared	0.4843	0.4859	0.4815	0.4571	0.4157	0.4684
F	1643.05	1671.95	1827.04	1706.97	1589.4	2032.92

Table 4: ATT Results Note: **: 5 % significance, *: 10% significance

		1978		1980		1983		1985		1988		1990	
Industrial Relocation	inducement areas	−0.30001		−0.2983		−0.2694		−0.2768		−0.2431		−0.2427	
		−20.86	**	*−19.78*	**	*−18.75*	**	*−19.84*	**	*−18.09*	**	*−18.68*	**
	Subsidized areas	−0.1946		−0.0649		−0.1616		−0.0972		−0.1946		−0.1558	
		−6.86	**	*−2.22*	**	*−5.91*	**	*−3.32*	**	*−11.79*	**	*−8.05*	**
Coal Mining Area		0.0128		0.0215		−0.007		−0.1318		−0.0094		−0.1425	
		0.26		*0.46*		*−0.16*		*−2.75*		*−0.19*		*−2.88*	**
Technopolis		−0.0878		−0.081		−0.1708		−0.1197		−0.0864		−0.1058	
		−3.86	**	*−3.34*	**	*−7.28*	**	*−5.42*	**	*−4.14*	**	*−5.1*	**
Intelligent Location		−0.061		−0.0914		−0.0927		−0.0951		−0.0904		−0.0803	
		−3.2	**	*−4.65*	**	*−4.77*	**	*−5.33*	**	*−5.29*	**	*−4.68*	**
Science		0.141		0.124		0.0486		0.0436		0.2257		0.0309	
		1.46		*0.99*		*0.51*		*0.47*		*2.46*	**	*0.35*	
Region		−0.163		−0.1625		−0.1521		−0.1431		−0.125		−0.1314	
		−10.15	**	*−9.46*	**	*−9.53*	**	*−9.34*	**	*−8.45*	**	*−9*	**
moving−out		0.3097		0.2982		0.3039		0.254		0.2386		0.2404	
		18.93	**	*17.51*	**	*18.04*	**	*15.46*	**	*14.64*	**	*14.65*	**

Note: "Inducement area" is defined as all regions specified in laws, while "Subsidized area" is defined as the regions which actually receive subsidy.

Table 5: ATT Results and Endogeneity

Note: **: 5 % significance, *: 10% significance

		1980	1985	1990
Industrial Relocation	inducement areas	−0.10541	−0.10702	−0.09908
		−4.18 **	*−4.49* **	*−4.5* **
	Subsidized areas	0.02262	−0.0382	−0.08904
		0.67	*−1.09*	*−3.66* **
Coal Mining Area		−0.03529	−0.15972	−0.20684
		−0.73	*−2.99* **	*−3.94* **
Technopolis		−0.00904	−0.05328	−0.04749
		−0.34	*−2.06* **	*−1.88* *
Intelligent Location		−0.05583	−0.06657	−0.0411
		−2.4 **	*−3.01* **	*−1.91* **
Science		−0.07146	−0.15111	−0.20742
		−0.59	*−1.42*	*−2.05* **

Table 6: ATT Results in Machinery Sector

	1978	1980	1983	1985	1988	1990
Technopolis	−0.1989	−0.155	−0.2342	−0.0398	0.0057	−0.1965
	−4.35 **	*−3.82* **	*−5.78* **	*−2.33* **	*0.11*	*−5.77* **
Intelligent Location	−0.1365	−0.1821	−0.0973	−0.1183	−0.0829	−0.0994
	−3.99 **	*−5.5* **	*−2.84* **	*−3.64* **	*−2.77* **	*−3.25* **

Table 7: ATT Results: Mother Cities Only

	1978	1980	1983	1985	1988	1990
Technopolis	−0.0621	−0.041	−0.1206	−0.0502	−0.0551	−0.0656
	−2.15 **	*−1.32*	*−3.84* **	*−1.68* *	*−2* **	*−2.28* **
Intelligent Location	−0.0649	−0.0803	−0.1312	−0.0613	−0.0568	−0.0594
	−2.86 **	*−3.33* **	*−5.53* **	*−2.85* **	*−2.75* **	*−2.83* **

Table 8: ATT Results: Adjacent Regions

Note: **: 5 % significance, *: 10% significance

		1978	1980	1983	1985	1988	1990
Industrial Relocation	inducement areas	−0.2233	−0.1837	−0.1876	−0.205	−0.1865	−0.1937
		−10.68 **	*−8.42* **	*−8.97* **	*−10.36* **	*−10* **	*−10.55* **
	Subsidized areas	−0.0886	−0.1054	−0.0982	−0.0411	−0.051	−0.0687
		−3.74 **	*−4.4* **	*−4.17* **	*−1.78* *	*−1.7* *	*−3.06* **
Technopolis		0.1095	0.0783	0.0818	0.0397	0.1312	0.0079
		3.38 **	*2.26* **	*2.3* **	*1.31*	*3.51* **	*0.29*
Intelligent Location		0.0915	0.0582	0.0291	0.0267	0.0343	0.0373
		3.27 **	*2* **	*0.99*	*1.59*	*1.37*	*1.48*
Coal Mining Area		−0.0113	−0.0058	0.1198	0.0492	0.052	−0.0842
		−0.15	*−0.08*	*1.5*	*0.64*	*0.66*	*−1.08*
Science		0.1042	−0.0915	−0.2738	−0.2134	−0.1747	−0.0889
		0.81	*−0.7*	*−2.87* **	*−2.28* **	*−2.07* **	*−0.97*

Appendix: Matching Results in a Representative Regression

Inducement subsidized area in 1990

Probit Regression

	Coefficients	z-value	
Size	0.0443	8.01	**
Labor	0.1373	3.41	**
Mat	−0.0649	−1.56	
sec12	0.7190	1.43	
sec13	0.5936	1.17	
sec14	0.5539	1.1	
sec15	0.6041	1.2	
sec16	0.8241	1.63	
sec17	0.3082	0.61	
sec18	0.1126	0.22	
sec19	0.0727	0.14	
sec20	0.2479	0.49	
sec21	0.7506	1.48	
sec22	0.1332	0.26	
sec23	−0.0282	−0.06	
sec24	0.3748	0.74	
sec25	0.6513	1.29	
sec26	0.2873	0.57	
sec27	0.1556	0.31	
sec28	0.2371	0.47	
sec29	0.1311	0.26	
sec30	0.3511	0.7	
sec31	−0.0433	−0.09	
sec32	0.2451	0.49	
sec34	0.2382	0.47	
Const	−1.6737	−3.32	**

R−squared	0.0301
Obs	66093
Untreated Sampl	57616
Treated Sample	8477

Balance test

		Mean			
		Treated	Control	t−test	
Size	Unmatched	3.3528	3.2919	4.29	**
	Matched	3.3528	3.3524	0.02	
Labor	Unmatched	0.24455	0.23741	3.57	**
	Matched	0.24455	0.24494	−0.15	
Mat	Unmatched	0.36531	0.3684	−1.54	
	Matched	0.36531	0.36417	0.41	

Note: In the matched sample, each variables should have no significant differences between treated and control groups.