FDI and the Local Labor Market: Japanese Automobile Plant Openings in the 1980s*

Haruka Hasegawa

University of Virginia

August 2017

Abstract

Using U.S. Census data, I investigate how much Japanese automobile firms' investments contributed to local wage increases over the 1980s. My difference-in-difference estimation shows that automobile workers experienced a 4.5 percent wage increase in areas where a Japanese assembly plant opened. The analysis also shows regional differences in the wage increase. Compared to workers who live in areas with new plant openings, workers in the South experienced a larger wage increase than workers in the Midwest. Furthermore, I find significant and positive labor demand spillovers both in manufacturing and non-manufacturing industries, but only in certain states.

*I am grateful to Kerem Coşar, James Harrigan, and John McLaren for their advices. I would like to thank Eric Chyn and Toshihiko Mukoyama for their comments and suggestions. I also thank my classmates, especially Brett Fischer, and researchers at the Institute of Developing Economies, Tomohiro Machikita and Kenmei Tsubota, for their help. All errors are mine.

1 Introduction

In the 1980s, the rapid growth of Japanese automobile exports to the U.S. had a serious impact on the U.S. automotive labor market. Japanese auto imports, combined with a recession, forced around 40% of the workers in automobile-related industries to be temporarily laid off in late 1981. In addition, although the exact number of job losses is difficult to estimate, membership in the United Auto Workers labor union declined by one third, from 1.5 million in 1979 to 1 million in 1987. Under political pressure from the United States, Japan imposed a voluntary export restraint (VER) and restricted the quantity of automobiles exported to the U.S. in 1981. In addition to the VER, the U.S. government also requested that Japanese automobile companies invest in the U.S. in order to offer new employment opportunities to their unemployed automobile workers. Because of this political pressure, Japanese automobile firms made their first investments in the U.S. in the 1980s. Starting with new assembly plants opened by Honda and Nissan, more than 250 plants for automobile parts were built in the U.S. by 1988 (Mair et al.,1998). According to Sturgeon and Florida (2004), investment in assembly plants added at least 35,000 jobs while other automobile-related plants, including those for bodies and parts, created about 337,600 additional jobs by 1998.

In this paper, I investigate the effects of Japanese automobile investments on U.S. local labor markets. I focus on assembly plants built in the 1980s. There are two objectives. First, I investigate how much Japanese automobile assembly plants contributed to increases in auto industry wages over the 1980s. Second, I test whether the Japanese automobile plant investments had demand spillovers to the other industries. Building a new and large assembly plant may increase the demand for workers. It is possible that workers in non-manufacturing industries, such as the retail sector, also see their average wages rise because of the locally increased labor demand as well as an increase in demand for their products. For example, it has been documented that the opening of the Honda plant in Marysville, Ohio, increased demand for housing, dining, recreation, and shopping, and the investment completely changed the business environment in the town (Inabetsu, 1998). The existing literature examines the impact of trade wars between the U.S. and Japan on the automobile

industry in the United States. However, the effects of Japanese foreign direct investment (FDI) on local labor markets has not been quantified. For example, Feenstra (1984) and Berry et al. (1999) study how much VER raised the prices of imported Japanese cars and how this policy affected U.S. consumer welfare, but they did not focus on the effect of the Japanese firms' investment caused by VER. In addition, Smith and Florida (1994) focus on the Japanese automobile investments, but they study only the location choice problems.[1]

Focusing on Japanese investment in the U.S. has a unique empirical advantage in the labor market analysis. Political pressure primarily drove Japanese automobile investments in the 1980s, and thus these investments are independent of firms' investment timing decisions. In general, firms analyze their business environments and decide to invest when they can anticipate their future profitability. However, econometricians cannot observe all of the factors driving the timing of firms' investment decisions. Therefore, Japanese auto firms' investments are ideal for local labor market analysis since the timing of investments can be regarded as exogenous. For example, a documentation in Toyota Motor Corporation suggests that, at the time of investment, Toyota's managers did not know whether or not their U.S. plant would turn a profit.[2] This example shows that the driving factor behind their investment was mainly political pressure, and thus I can analyze the impact on the local labor market without considering endogenous investment timing decisions.

For my empirical analysis, I use U.S. Census data for 1980 and 1990. The local labor markets are defined by *conspuma*, which is group of counties. The census indicates which conspuma each individual lives in. Since there were no Japanese automobile plants in the U.S. before 1980, I use a difference-in-difference estimation strategy. I control for workers' characteristics, such as age and educational attainment, in addition to the ratio of union membership in the state. The results show that automobile workers experienced a 4.5% wage increase in conspumas where Japanese assembly plants opened. I also find that the impact in the South is large and statistically significant, while the impact in the Midwest is small and statistically insignificant. This finding is consistent with the wider shift of

[1] While they do not focus on the automobile industry, Head et al. (1995, 1999) and Woodward (1992) also analyze the location choices behind Japanese investments.

[2] Source: Toyota Motor 75 Years' History (Japanese website) https://www.toyota.co.jp/jpn/company/history/75years/

automobile production locations from the Midwest to the South. Regarding the effect of Japanese automobile investments on other industries, I only find significant demand spillovers in manufacturing and non-manufacturing industries when sampling states where Toyota and Nissan built their new plants.

My research contributes to the literature concerning the impact of FDI on labor markets. There are two papers closely related to my research question. First, Feliciano and Lipsey (2006) investigate how an increase in foreign-owned establishments affects the U.S. labor market, and they find no significant employment effects in the manufacturing or non-manufacturing sectors. While the authors focus on changes in average wages across industries and states, I expand on their research by using individual-level wage data in conspumas. This enables my regression to control for workers' demographics and skill level and to see the effects more precisely within detailed geographical units. Second, Greenstone et al. (2010) measure the spillover effects of million-dollar plant openings in the 1980s and 1990s. They estimate that these openings increased wages by 2.7%. They focus on firms' investment in all manufacturing industries. In comparison, my paper focuses on a well-known case in the single industry.

The paper is organized as follows. Section 2 shows the characteristics of Japanese automobile investment. Section 3 introduces the data source and summary statistics. Section 4 provides a regression model. Section 5 shows the results. Section 6 discusses the robustness. Section 7 concludes.

2 Japanese Automobile Investment in the 1980s

Table 1 shows Japanese automobile investment in the 1980s. There are seven assembly plants built during this period, and each plant created new employment. Some companies built plants in completely new places (i.e., *greenfield investment*), while others (Toyota and Mazda) reopened plants which were previously operated by U.S. companies (i.e., *brownfield investment*). Firms with greenfield investments had the advantage of being able to hire non-union workers, who could get accustomed to the Japanese management system relatively easily. However, these greenfield investors had to construct their business environment from

Table 1: Japanese Automobile Investments in the 1980s

Company	Honda	Nissan	Toyota	Mazda	Toyota	Mitsubishi	Subaru
Year	1982. Nov	1983. Jun	1984. Dec	1987. Sep	1988. May	1988. Sep	1989. Sep
Place	Marysville, Ohio	Smyrna, Tennessee	Fremont, California	Flat rock, Michigan	Georgetown, Kentucky	Normal, Illinois	Lafayette, Indiana
Greenfield investment	Yes	Yes	No (GM's plant)	No (Ford's plant)	Yes	Yes	Yes
Initial number of employees	5,200	6,000	4,550	3,100	7,150	3,900	3,000
Investment amount (in bil. USD)	1.7	1.43	1.6	0.55	3.4	1	4.6

The year means the time when they started production. Source: JAMA (Japan Automobile Manufacturers Association).

scratch. For example, there were no water supply or sewage systems in places where Honda and Toyota made greenfield investments. By contrast, investing in existing facilities enabled Japanese companies to start up their business smoothly. They benefited from procurement systems and other know-how developed by the previous companies. However, they were sometimes subjected to restrictions imposed by allied companies which previously owned their plants. For example, Toyota established a joint venture with General Motors (GM) in Fremont, California, and agreed to rehire workers laid off from the former GM plant (Cole and Deskins, 1998).

Although some Japanese firms used plants which U.S. firms previously operated and even hired the same people, their investments provided additional employment opportunities in the local labor markets. For example, Mazda operated a plant which Ford had previously run and closed four years earlier. Mazda not only provided employment to the people who were made unemployed by Ford's closure, but they improved the facility and built additional assembly lines. Toyota in Fremont, California, is another example. GM employed 6,800 hourly workers in 1978, and the number declined to around 3,000 when they closed the plant in 1982 (Adlar, 1993). Toyota's investment in this GM plant helped the unemployed who previously worked at the plant. In addition, Toyota made another investment in 1990 and

Table 2: Motor Vehicle Sector Employment and Relative Wages

Year	Share of U.S. Auto Workers (%)		Wages (U.S.=100)	
	South East	Great Lake	South East	Great Lake
1970	5.7	69.4	78.9	104.9
1975	6.8	68.7	72.9	106.8
1980	9.4	64.1	73.1	109.3
1985	12.5	60.9	73.5	111.9
1990	15.6	59.4	75.2	112.8
1992	16.7	59.1	79.1	110.8

Source: Sturgeon and Florida (2004, Table 3.6)

hired 650 more employees. According to these case studies, the Japanese investments in existing U.S. facilities may have also increased labor demand in the local labor markets.

Additionally, Japanese automobile companies invested both within the traditional Midwestern auto corridor as well as the adjacent states of Kentucky and Tennessee. According to Cole and Deskins (1998), Japanese auto firms that invested in the South sought access to growing markets, cheaper land and operating costs, and labor supplies with fewer union ties. The automobile industry in the South was undeveloped compared to that in the Midwest. Assuming that the new assembly plants led to additional investment by other auto-related parts companies, the impact on the local labor markets may be quite large especially in the East South Central division, including Kentucky and Tennessee. As we can see from Table 2, the regional share of U.S. automotive sector employment and relative wages have dramatically increased in the South East after 1980. In contrast, the share in the Great Lakes region decreased 5 percentage points between 1980 and 1992.

In addition to the effect on employment, there were large infrastructure investments made in tandem with the Japanese greenfield investments. The improved infrastructure benefited people living around the cities in which Japanese firms operated greenfield plants. The amount of investment shown in Table 1 can be the minimum value since most of the companies received incentives by state governments. For example, Subaru and Mitsubishi received around 85 US million dollars each, and Toyota received 150 million dollars. The state governments supported their efforts to improve the road quality, purchase land, and

train employees.

3 Data Source and Summary Statistics

I use the U.S. Census' 5% sample for 1980 and 1990, which is publicly available through IPUMS-USA. I select workers aged less than 65, who are in the labor force and report a positive income in the year before the census. I use samples only in the continental United States. In addition to wage and salary income, I obtain workers' personal characteristics, such as sex, age, race, and educational attainment. I create four categories in the educational level: high school dropout, high school graduate, some college, and college graduate. This categorization is similar to that in Hakobyan and McLaren (2015). I treat geographic areas in the census data, named conspumas (Consistent Public Use Microdata Areas), as the local labor markets. These are consistently defined between 1980 and 1990. The data has 539 different conspumas. Each conspuma consists of counties and conspumas do not cross state lines.

I also include a control for unionization in my regression. Since I do not have the union membership status for each individual in the census data, I use the ratio of wage and salary workers who are union members in each state.[3] Thus, the data about union membership is at the state level, not at the individual level. I obtain this information from the CPS's Union Membership and Coverage Database.[4]

Table 3 shows descriptive statistics of the control variables. The sample contains 123,990 workers who are in the automobile industry in 1980 or 1990. 80% of workers are male, and only 13% of workers are black. Around 70% of workers do not have a college education. Union membership varies across states, while 16% of total workers are union members on average. Table 4 shows the average union membership rate by region. Around 14% of workers have union memberships in South, while 20% and 22% of workers do in Northeast and Midwest respectively. This is because most states in the South already adopted right-

[3]Using the CPS data is another possibility, however they have individual union membership status only from 1990.

[4]Since the state level data are available only from 1983, I use 1983 data to describe samples in the 1980 census (the URL: www.unionstats.com).

Table 3: Summary Statistics

Variable	Mean	SD	Min	Max	Number
Individual level					
female	0.204	0.403	0	1	123,990
age	38.657	11.422	16	64	123,990
black	0.134	0.340	0	1	123,990
other race	0.026	0.160	0	1	123,990
high school dropouts	0.231	0.422	0	1	123,990
high school graduates	0.450	0.497	0	1	123,990
some college	0.254	0.436	0	1	123,990
college graduates	0.064	0.244	0	1	123,990
State level					
union membership ratio	0.175	0.073	0.046	0.349	98
auto worker ratio	0.020	0.050	0	0.344	98

The sample consists only of the workers who are in the automobile industry. 67,387 samples in 1980 and 56,603 samples in 1990. The number of union membership ratio is 49 in each year.

to-work laws by 1980. As I mentioned in Section 2, this is one of the reasons why some of the Japanese automobile companies invested in the South, such as Toyota investing in Kentucky and Nissan investing in Tennessee. Since there are lower rate of union membership in these states (18% in Kentucky and 15% Tennessee), the Japanese companies could avoid unexpected disputes with workers. In contrast, states in the traditional Midwestern auto corridor have higher percentages of unionized workers. For example, 30% of workers are union members in Michigan.

4 Econometric Model

I estimate the effect of Japanese automobile investment on the change in individual wages from 1980 to 1990. There were no Japanese automobile investments before 1980, and thus I conduct a difference-in-difference estimation at the conspuma level. I compare changes in individual wages among the treatment group to changes in wages of those in the control group. The treatment group consists of workers who live in conspumas where Japanese automobile

Table 4: Percentage of Workers with Union Membership in Total Employees

in 1983			in 1990		
rank:	state	union membership (%)	rank:	state	union membership (%)
1	Northeast	22	1	Northeast	19
2	Midwest	20	2	Midwest	17
3	West	19	3	West	16
4	South	14	4	South	11
Total		18	Total		15

Source: Union Membership and Coverage Database from the CPS (http://unionstats.com/)

plants opened. The control group consists of workers who do not live in conspumas where Japanese plants opened.

The regression equation is:

$$\log(wage_{i,j,t}) = \alpha\ plant_{ij} + \beta\ year90_t + \gamma\ (plant_{ij} \times year90_t) + \theta_1\ X_{i,j,t} + \theta_2\ union_{j,t} + \varepsilon_{i,j,t},$$

where $wage_{i,j,t}$ is wage and salary income of an individual i at time t in consupuma j. A treatment dummy, $plant_{ij}$, indicates whether an individual i lives in conspuma j which obtains new Japanese plant. A post treatment dummy, $year90_t$, is equal to 1 if the observation is in 1990 and 0 otherwise. The coefficient on $(plant_{ij} \times year90_t)$ is a difference-in-difference estimator which compares the change in the treatment group to the change in the control group. I include individual demographics, $X_{i,j,t}$, which are similar to those in Greenstone et al. (2010). The covariates include age, age-squared, education, sex, and race. There are three education dummies: high school graduate, some college, and college graduate. I add interactions of each education dummy and the post treatment dummy to control for trends in educational attainment. The regression also controls for the ratio of workers with union membership in the total employees, and this varies across states and time.

5 Results

5.1 Analysis within the Automobile Industry

First, I focus on the automobile industry samples. This industry categorization corresponds to "351-Motor vehicles and motor vehicle equipment" in the census industry code (IND90). I run two different regressions. One is a regression with individuals who live in all states, and the other is a regression with individuals who live in different regions.

5.1.1 Regression with All State Samples

Column 1 in Table 5 shows that wages in the automobile industry increased by 4.5% in conspumas where Japanese assembly plants opened. The coefficient of interest is statistically significant at the 5% level. This is similar to the results in Greenstone et al. (2010), who also evaluate the effects of new plant openings on local wage increases, although they do not focus on a specific sector.

Column 2 of Table 5 shows that I would overestimate the positive effect if I did not control for union membership. The union membership has an effect to increase wages by 1.8%. The coefficient is statistically significant at the 1% level. Without this state characteristic, the plant dummy is the only variable that varies across locations for similar workers. The plant dummy indicates whether an individual lives in a conspuma that gains a new Japanese automobile plant. By contrast, this indicator divides samples only into two groups, and this does not offer much variation. Therefore, additional variation at the state level is quite important in accounting for regional wage differences.

5.1.2 Regression by Region

Table 6 shows regression results by region. Northeast is omitted since there were no Japanese automobile investments in that region. Although the coefficient of interest is insignificant in the Midwest sample, the results indicate that workers in the South and West saw larger wage effects from Japanese automobile plants than those in the Midwest. As I mentioned in Section 2, the automobile industry in the South started to develop in the 1980s, not least due to the investments by Nissan and Toyota. The larger wage increase in the South

reflects the fact that prior to the Japanese firms' investments, the Southern auto industry was undeveloped and thus had relatively low wages. In contrast, the automobile industry was already developed by the 1980s in the Midwest, and thus Japanese automobile investments likely had relatively small employment and wage effects in this region. Finally, the large effect in the West reflects the fact that Ford and GM closed almost all of their assembly plants on the West coasts from 1970 to 1990 (Sturgeon and Florida, 2004). There is only one Japanese assembly plant in the West in my sample. Thus, it is likely that the impact on the conspumas with the Japanese plant stands out because of the low labor demand in the other conspumas.

In addition to the impact of new plant openings, my analysis also captures regional differences in union membership. The results show that the state unionization rate has a larger impact on individual wages in the Midwest than in the South and West. A 1% increase in the unionization rate raises the average wage by 2.3% in the Midwest, 1.4% in the South, and 1% in the West. As I explained previously, there are more union workers in the Midwest compared to the South and the West. The coefficient on the union membership ratio is higher in the Midwest potentially because a higher unionization rate gives all union workers more bargaining power over their working contracts.

One may be concerned that each state has a different wage level and demographic controls cannot explain these state differences. I run a regression with state fixed effects in order to control for state heterogeneity. The regression results are in Appendix A. Table 11 in Appendix A shows that the coefficients of interest are still positive, but insignificant. As for the regressions by region, I also find significant effects in the South and West (Table 12 in Appendix A).

Table 5: Regression Results, All States

Dependent variable:	(1)	(2)
log wage	with union	without union
plant	-0.012	-0.013
	(0.021)	(0.033)
year90	0.025	-0.092***
	(0.016)	(0.014)
plant × year90	0.045*	0.072***
	(0.026)	(0.020)
female	-0.436***	-0.446***
	(0.013)	(0.013)
black	-0.142***	-0.143***
	(0.019)	(0.021)
other race	-0.183***	-0.198***
	(0.020)	(0.019)
age	0.108***	0.111***
	(0.002)	(0.002)
age^2	-0.001***	-0.001***
	(0.000)	(0.000)
high school graduate	0.236***	0.252***
	(0.008)	(0.010)
some college	0.395***	0.420***
	(0.011)	(0.013)
college graduate	0.683***	0.724***
	(0.022)	(0.026)
union membership	0.018***	
	(0.001)	

N = 123,990. Hawaii and Alaska are excluded. The dependent variable is log wage. The regression includes interactions of each education dummy and the post treatment dummy. Standard errors in parentheses are clustered by conspuma. Significant at *10%, **5%, ***1%.

Table 6: Regression Results, by Region

Dependent variable:	(1)	(2)	(3)
log wage	Midwest	South	West
plant	-0.039	0.045*	0.171***
	(0.024)	(0.026)	(0.028)
year90	0.074***	0.010	-0.080
	(0.025)	(0.032)	(0.056)
plant × year90	0.034	0.123*	0.169***
	(0.027)	(0.064)	(0.033)
female	-0.449***	-0.411***	-0.424***
	(0.019)	(0.016)	(0.035)
black	-0.143***	-0.199***	-0.083*
	(0.035)	(0.030)	(0.043)
other race	-0.123***	-0.194***	-0.116***
	(0.031)	(0.044)	(0.022)
age	0.104***	0.113***	0.118***
	(0.002)	(0.004)	(0.008)
age^2	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)
high school graduate	0.227***	0.271***	0.236***
	(0.009)	(0.023)	(0.035)
some college	0.391***	0.407***	0.367***
	(0.014)	(0.024)	(0.040)
college graduate	0.681***	0.799***	0.572***
	(0.025)	(0.052)	(0.078)
union membership	0.023***	0.014***	0.010***
	(0.003)	(0.005)	(0.003)
N	83,895	20,195	7,500

Hawaii and Alaska are excluded. The regression includes interactions of each education dummy and the post treatment dummy. Standard errors in parentheses are clustered by conspuma. Significant at *10%, **5%, ***1%.

5.2 Analysis Across Industries

Second, I analyze the wage effects of Japanese automobile investments on other industries. The previous results show that the auto workers who lived in conspumas where new Japanese assembly plants opened experienced a wage increase. In this case, it is possible that workers in the other industries also saw their wages rise because local labor demand increase, and private demand for their goods and services increased as well. In order to estimate this effect, I run a regression with samples in manufacturing and non-manufacturing industries. Unlike the previous regression, I include industry dummies to control for industry-specific heterogeneity. I also exclude individuals who are in the auto industry from the sample.

5.2.1 Spillovers to the Other Manufacturing Industries

Column 1 in Table 7 shows that I do not find significant results among individuals in all manufacturing industries (excluding those in the automobile sector). Note that this regression uses individuals who live in the continental United States. Since only 7 out of 539 conspumas have Japanese automobile plants, the sample in the regression contains many individuals who are in the control group. In order to analyze the effect more locally, I also run the same regression only with individuals who live in the states with greenfield investments that create more than 5,000 jobs. Columns 1 to 3 in Table 9 are the results for individuals working in the manufacturing industry. I find that the manufacturing workers who live in conspumas where Nissan (in Tennessee) and Toyota (in Kentucky) invested experience significant wage increases of 5.1% and 2.6%, respectively.

The other columns in Table 7 are the regression results with workers in each industry. They show that the effects on workers who live in conspumas with new Japanese plant openings are different across industries. For example, the wages of the employees who are in the food manufacturing industry and the wood and furniture industry increase by 3.1% and 5%, respectively. In contrast, the wages of the employees who manufacture textile and apparel products, and rubber and plastics decrease by 8.7% and 6%, respectively. Although it is difficult to find the factors which cause the effects in each industry, these results indicate that the Japanese automobile investment increases the demand for food and some other

products such as furniture, and raises the wages of individuals who work in these industries and live in the areas with new plant openings.

5.2.2 Spillovers to the Non-Manufacturing Industries

Table 8 shows the results with workers in non-manufacturing industries. As in the regression with workers in manufacturing industries, I do not find s significant wage change for entire samples (Column 1 in Table 8). However, the wages of the non-manufacturing workers who live in conspumas where Nissan (in Tennessee) and Toyota (in Kentucky) invested rise by 3.5% and 3.6%, respectively. Column 5 and 6 in Table 9 show these results, and both coefficients of interest are significant at the 5% level. Table 9 also shows that most of the coefficients of interest in the regressions of each of the non-manufacturing industries are insignificant except for wholesale and retail trades. The coefficients of interest in the regressions with workers in wholesale and retail industry are negative. This indicates that wages of individuals who worked in the wholesale and retail industry and lived in conspumas with a new Japanese plant decreased compared to the workers who live in the other areas.

Note that I do not find a significant wage increase among manufacturing workers who live in a conspuma where Honda opened a plant (Column 1 in Table 9). The wage spillover effect on individuals who worked in non-manufacturing industry is significant, but the coefficient is negative (Column 4 in Table 9). Honda had started manufacturing motorcycles in 1979 in the same place where they built their automobile assembly plant in 1982. In this case, the local labor demand could have already increased before 1980, and thus the regressions do not capture the earlier wage increase.

Table 7: Regression Results, Manufacturing Industries

Dependent variable: log wage	(1) All manufacturing	(2) Food	(3) Textile Apparel	(4) Paper Printing	(5) Chemical Petroleum	(6) Rubber Plastics	(7) Leather
plant	0.025**	0.038	0.052	-0.031**	-0.044*	0.082***	0.109**
	(0.009)	(0.035)	(0.033)	(0.015)	(0.027)	(0.015)	(0.054)
year90	-0.007	-0.038***	0.009	0.007	-0.070***	-0.009	0.039
	(0.009)	(0.013)	(0.011)	(0.017)	(0.018)	(0.020)	(0.027)
plant × year90	-0.027	0.031**	-0.087**	-0.029	0.037	-0.060***	-0.031
	(0.022)	(0.015)	(0.040)	(0.028)	(0.024)	(0.015)	(0.063)
N	2,010,293	152,358	206,582	227,051	141,938	69,214	20,001

Dependent variable: log wage	(8) Woods Furniture	(9) Glass Concrete	(10) Metal	(11) Machinery Computing	(12) Electrical Machinery	(13) Professional Equipment
plant	-0.081***	0.062***	0.037**	0.018*	0.044***	-0.024
	(0.024)	(0.017)	(0.019)	(0.011)	(0.014)	(0.040)
year90	0.003	0.021	-0.040***	-0.026*	0.055	0.106***
	(0.014)	(0.016)	(0.013)	(0.015)	(0.018)	(0.019)
plant × year90	0.050**	-0.017	-0.032	0.032	-0.010	0.040
	(0.020)	(0.014)	(0.022)	(0.034)	(0.035)	(0.044)
N	130,126	61,864	239,898	256,224	206,733	64,004

Workers in the automobile industry are excluded from the samples. All regressions are controlled for gender, age, age-squared, education, race, unionization rate, and industry fixed effect. The regression also includes interactions of each education dummy and the post treatment dummy. Individuals who live in Hawaii and Alaska are excluded. The dependent variable is log wage. Standard errors in parentheses are clustered by conspuma. Significant at *10%, **5%, ***1%.

Table 8: Regression Results, Non-Manufacturing Industries

Dependent variable:	(1)	(2)	(3)	(4)	(5)
log wage	All	Transportation	Wholesale	Retail	Financing
	Non-Manufacturing	Communication	Trade	Trade	
plant	-0.036	0.005	-0.005	-0.023	-0.057
	(0.027)	(0.031)	(0.032)	(0.037)	(0.050)
year90	-.0071***	-0.104	-0.067***	-0.136***	0.012
	(0.011)	(0.010)	(0.013)	(0.012)	(0.018)
plant × year90	-0.036	-0.027	-0.048*	-0.054**	-0.045
	(0.028)	(0.027)	(0.025)	(0.025)	(0.034)
N	6,262,678	729,559	429,174	1,597,432	616,279

Dependent variable:	(6)	(7)	(8)	(9)
log wage	Business	Personal	Entertainment	Professional
	Repair	Service	Recreation	Service
plant	-0.058	-0.128*	-0.214***	-0.039***
	(0.056)	(0.067)	(0.046)	(0.010)
year90	-0.075***	0.091***	-0.061***	0.008
	(0.016)	(0.016)	(0.019)	(0.012)
plant × year90	-0.037	0.010	0.005	-0.016
	(0.040)	(0.019)	(0.035)	(0.031)
N	374,508	265,118	116,573	2,134,035

All regressions are controlled for gender, age, age-squared, education, race, unionization rate, and industry fixed effect. The regression also includes interactions of each education dummy and the post treatment dummy. Individuals who live in Hawaii and Alaska are excluded. The dependent variable is log wage. Standard errors in parentheses are clustered by conspuma. Significant at *10%, **5%, ***1%.

Table 9: Regression Only in the States With Greenfield Investments

Dependent variable:	Manufacturing			Non-manufacturing		
log(wage)	(1)	(2)	(3)	(4)	(5)	(6)
in state	Ohio (Honda)	Tennessee (Nissan)	Kentucky (Toyota)	Ohio (Honda)	Tennessee (Nissan)	Kentucky (Toyota)
plant	-0.039***	0.081***	-0.064***	0.048	-0.069***	-0.056**
	(0.010)	(0.019)	(0.019)	(0.015)	(0.036)	(0.026)
year90	-0.104***	-0.016	-0.100***	-0.129***	-0.101***	-0.185***
	(0.015)	(0.017)	(0.019)	(0.012)	(0.018)	(0.015)
plant × year90	0.015	0.051***	0.026*	-0.023**	0.035**	0.036***
	(0.010)	(0.006)	(0.014)	(0.009)	(0.007)	(0.012)
N	114,812	51,686	28,975	273,073	114,628	81,044

All regressions are controlled for gender, age, age-squared, education and race. The regression also includes interactions of each education dummy and the post treatment dummy. The dependent variable is log wage. Standard errors in parentheses are clustered by conspuma. Significant at *10%, **5%, ***1%.

6 Pre-Trend Analysis

The key assumption for the difference-in-difference estimation is that the wages of the treatment and control groups follow the same trend before the 1980s. Without this assumption, it is possible that the economies in the areas where new plants open had been thriving before the plants were built. If this is the case, the wages of the treatment group would already have started rising before the 1980s, and thus the difference-in-difference estimation may just capture the pre-trend which are likely to be caused by the other factors.

To check the validity of this assumption, I run a placebo regression. The equation is almost the same as the one shown in Section 4, except that I use the census data for 1970 and 1980 instead of the data for 1980 and 1990. Thus, I investigate the average wage change from 1970 to 1980 instead of the change from 1980 to 1990. This exercise is similar to the ones conducted by Autor et al. (2013) and Hakobyan and McLaren (2015). The regression

equation is:

$$\log(wage_{i,j,t}) = \alpha\ plant_{ij} + \beta\ year80_t + \gamma\ (plant_j \times year80_t) + \theta\ X_{i,j,t} + \varepsilon_{i,j,t},$$

where $wage_{i,j,t}$ is wage and salary income of an individual i at time t in area j. Unlike the equation in Section 4, a post treatment dummy is now changed to $year80_t$. Note that here the unionization rate is not included in the regression because this information is only available from 1983. The demographic information, $X_{i,j,t}$ is the same as in Section 4. I expect the coefficient on $(plant_{ij} \times year80_t)$ to be insignificant, which means that there is no wage premium before 1980 in the areas where Japanese assembly plants open in the 1980s.

In order to proceed with the placebo test, I use the 1% sample of U.S. Census data for 1970 and 1980.[5] I limit the sample following the same criteria as I discuss in Section 3. As the geographical unit, I use the county group (or the metropolitan area, when applicable), instead of conspuma. Ideally, it is the best to use the conspumas as in the original difference-in-difference estimation. However, conspumas are not available in the 1970 data. In the placebo regression, the only geography-specific regressor is $plant_j$, which assigns one if the individual lives in the county groups where the Japanese investment occurred in the 1980s. The problem is that the definitions of the county groups are not consistent between the 1970 census and the 1980 census. To ensure consistency, I create sets of county groups with Japanese investments, while ensuring that they are similar across the two datasets. They are detailed in Appendix C. For individuals in these county groups, I assign 1 for the $plant_j$ variable. For the other individuals, I assign 0 for this variable.

Column 1 and Column 2 of Table 10 are the results of the placebo regression using only individuals in the automobile sector. Both of the coefficients on $(plant_j \times year80_t)$ are insignificant. This means that individuals in the areas where new plants opened in the 1980s did not experience a significant wage increase in the 1970s. Therefore, I do not detect any pre-trend among individuals who are in automobile sector.

There is another possibility that a pre-trend exists if I look at the difference of the

[5]Since the census data for 1970 is available only with the 1% sample, I use the 1% sample for 1980 as well.

average wage changes of individuals in all industries. For example, it is possible that the labor demand in an area has already started rising because of factors in other industries, and these factors also influenced the Japanese automobile companies' investment in this region. Column 3 of Table 10 shows that the coefficient of interest is still insignificant in the regression with samples including all industries. Once again, I do not detect any pre-trend before plants opened in the 1980s.

7 Conclusion

This paper examines the effects of Japanese automobile firms' investments on U.S. local labor markets. In the 1970s, a surge of Japanese automobile exports was claimed to have caused a significant amount of unemployment in the U.S. automotive industry. The U.S. government responded by requesting that Japan set a limit on car exports (voluntary export restraint, VER) and asking for Japanese auto firms to invest in the United States. While some of the existing literature studies the impact of VER, I focus on the effects of the second policy measure.

I use U.S. Census data and quantify how much Japanese automobile plants raised local wages over the 1980s. The analysis indicates that the wage of automobile workers who live in areas with a new Japanese plant increased by 4.5%. The result also shows regional differences in the effects of the labor demand increase. Auto workers in the South benefited from higher wage gains compared to those in the Midwest. Moreover, I examine whether the Japanese investment had labor demand spillovers. I do not find significant effects in the whole sample. However, I find significant and positive demand spillovers both in manufacturing and non-manufacturing industries when I look at the effect within some states, such as Tennessee and Kentucky, where a Japanese assembly plant opened.

There is room for improvement in my econometric model. For example, I can expand the model with additional indicators. Distance to a new Japanese plant and an indicator for conspuma neighboring with a new plant may bring additional variations for the impact of the new plant openings. The population density of each of the local labor markets is another possible independent variable which might explain individual wages.

Table 10: Placebo Regression

	without controls	with controls	
	(1)	(2)	(3)
	Auto industry	Auto industry	All industries
plant	0.155***	0.137***	0.119
	(0.022)	(0.022)	(0.076)
year80	-0.087**	-0.136***	-0.100***
	(0.035)	(0.037)	(0.030)
plant × year80	0.051	0.039	0.010
	(0.038)	(0.030)	(0.028)
female		-0.477***	-0.708***
		(0.021)	(0.016)
black		-0.217***	-0.195***
		(0.021)	(0.025)
other race		-0.282***	-0.151***
		(0.045)	(0.024)
age		0.095***	0.160***
		(0.005)	(0.002)
age^2		-0.001***	-0.002***
		(0.000)	(0.000)
high school graduate		0.194***	0.401***
		(0.014)	(0.009)
some college		0.313***	0.507***
		(0.022)	(0.007)
college graduate		0.685***	0.785***
		(0.028)	(0.014)
N	24,181	24,181	1,634,579

Standard errors in parentheses are clustered by state (state is the most aggregated geographical unit which is consistently defined between the data for 1970 and 1980). The regression includes interactions of each education dummy and the post treatment dummy. Significant at *10%, **5%, ***1%.

References

[1] Adler, Paul S. (1993) "Time-and-motion regained." *Harvard Business Review* 71 (1), 97-108.

[2] Autor, A. H., Dorn, D., and Hanson, G. H. (2013). "The China syndrome: Local labor market effects of import competition in the United States." *American Economic Review* 103 (6), 2121-2168.

[3] Berry, Steven, James Levinsohn, and Ariel Pakes. (1999) "Voluntary export restraints on automobiles: Evaluating a trade policy." *American Economic Review* 89 (3), 400-430.

[4] Cole, Robert E., and Deskins, Donald R. (1988) "Racial factors in site location and employment patterns of Japanese auto firms in America." *California Management Review* 31 (1), 9-22.

[5] Feenstra, Robert C. (1984) "Voluntary export restraint in us autos, 1980-81: Quality, employment, and welfare effects." Baldwin, Robert E. and Krueger, Anne O. eds., *The structure and evolution of recent US trade policy*, Chicago:University of Chicago Press, 35-66.

[6] Feliciano, Zadia M., and Lipsey, Robert E. (2006) "Foreign ownership, wages, and wage changes in US industries, 1987-92." *Contemporary Economic Policy* 24 (1), 74-91.

[7] Greenstone, Michael, Hornbeck, Richard, and Moretti, Enrico (2010) "Identifying agglomeration spillovers: Evidence from winners and losers of large plant openings." *Journal of Political Economy* 118 (3), 536-598.

[8] Hakobyan, Shushanik, and McLaren, John. (2016) "Looking for local labor market effects of NAFTA." *Review of Economics and Statistics* 98 (4), 728-741.

[9] Head, Keith, Ries, John, and Swenson, Deborah. (1995) "Agglomeration benefits and location choice: Evidence from Japanese manufacturing investments in the United States." *Journal of international economics* 38 (3), 223-247.

[10] Head, C. Keith, Ries, John C., and Swenson, Deborah L. (1999) "Attracting foreign manufacturing: Investment promotion and agglomeration." *Regional Science and Urban Economics* 29 (2), 197-218.

[11] Inabetsu, Masaharu. (1998) *Honda's local management in the U.S.*, Tokyo: Bunshind (written in Japanese).

[12] Kamiyama, Kunio. (1988) "On the Local Production of Japanese Companies in the United States: A Report on a Field Study of Japanese Automobile and Electronics Plants in the United States." *Annals of the Society for Industrial Studies, Japan* 1988 (3), 55-71.

[13] Kusunoki, Kanetoshi. (2004) *Challenge and Leap - Start up the Toyota's North American Business*, Tokyo: Chubu Keizai Shinbun Sha (written in Japanese).

[14] Mair, Andrew, Florida, Richard, and Kenney, Martin. (1988) "The new geography of automobile production: Japanese transplants in North America." *Economic geography* 64 (4), 352-373.

[15] Oshikawa, Akira. (1992) *Global strategies of Toyota, Nissan, and Honda*, Tokyo: Sannou Daigaku Shuppan (written in Japanese).

[16] Smith, Donald F. Jr. and Florida, Richard. (1994) "Agglomeration and industrial location: An econometric analysis of Japanese-affiliated manufacturing establishments in automotive-related industries." *Journal of Urban Economics* 36 (1), 23-41.

[17] Sturgeon, Timothy and Florida, Richard. (2004) "Globalization, deverticalization, and employment in the motor vehicle industry." in Martin Kenney and Richard Florida eds., *Locating global advantage: Industry dynamics in the international economy*, California: Stanford University Press, 52-81.

[18] Woodward, Douglas P. (1992) "Locational determinants of Japanese manufacturing start-ups in the United States." *Southern Economic Journal* 58 (3), 690-708.

Appendix A Regression with State Fixed Effects

Table A.1: Regression with State Fixed Effects, All States

Dependent variable:	(1)	(2)
log wage	with union	without union
plant	-0.053*	-0.054*
	(0.032)	(0.032)
year90	-0.000	-0.043***
	(0.026)	(0.015)
plant×year90	0.033	0.035
	(0.027)	(0.026)
female	-0.433***	-0.433***
	(0.014)	(0.014)
black	-0.161***	-0.161***
	(0.022)	(0.022)
other race	-0.150***	-0.149***
	(0.017)	(0.017)
age	0.106***	0.106***
	(0.002)	(0.002)
age^2	-0.001***	-0.001***
	(0.000)	(0.000)
high school graduate	0.235***	0.235***
	(0.007)	(0.007)
some college	0.391***	0.391***
	(0.010)	(0.010)
college graduate	0.674***	0.674***
	(0.021)	(0.021)
union membership	0.010*	
	(0.006)	

N = 123,990. Hawaii and Alaska are excluded. The dependent variable is log wage. The regression includes state fixed effects and interactions of each education dummy and the post treatment dummy. Standard errors in parentheses are clustered by conspuma. Significant at *10%, **5%, ***1%.

Table A.2: Regression with State Fixed Effects, by Region

	(1)	(2)	(3)
	Midwest	South	West
plant	-0.092***	0.115***	0.154***
	(0.031)	(0.038)	(0.030)
year90	-0.062	-0.035	-0.253**
	(0.046)	(0.046)	(0.099)
plant×year90	0.037	0.110*	0.167***
	(0.023)	(0.064)	(0.031)
female	-0.445***	-0.388***	-0.428***
	(0.019)	(0.016)	(0.036)
black	-0.150***	-0.218***	-0.096**
	(0.034)	(0.026)	(0.041)
other race	-0.111***	-0.195***	-0.129***
	(0.027)	(0.041)	(0.022)
age	0.103***	0.110***	0.117***
	(0.002)	(0.004)	(0.008)
age^2	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)
high school graduate	0.225***	0.266***	0.245***
	(0.008)	(0.022)	(0.034)
some college	0.391***	0.405***	0.374***
	(0.013)	(0.022)	(0.040)
college graduate	0.681***	0.803***	0.581***
	(0.025)	(0.049)	(0.077)
N	83,895	20,195	7,500

Hawaii and Alaska are excluded. The dependent variable is log wage. The regression includes state fixed effects and interactions of each education dummy and the post treatment dummy. Standard errors in parentheses are clustered by conspuma. Significant at *10%, **5%, ***1%.

Appendix B County Groups in Placebo Regressions

I use the 1% sample of the Census data for 1970 and 1980 for the placebo regression which I conduct in Section 6.2. Specifically, I use "1970 1% form 1 metro sample" and " 1980 1% metro sample". Both are not a sample only of metro areas. The smallest geographical units are metropolitan areas and county groups, and both units are combinations of counties with total populations of 100,000 regardless of the geographical relationship. The problem is that the components of metropolitan areas and county groups in the 1970 and 1980 data are not consistent. Therefore, I need to assign metropolitan areas and county groups which include similar counties across both datasets.

The following is the list of metropolitan areas and county groups which I assign as the new Japanese plant locations. It is difficult to create combinations of metropolitan areas and county groups that consist of exactly the same counties between 1970 and 1980. For example, Honda invested in Union County, Ohio. If I create the groups which include Union County and have exactly the same counties in 1970 and 1980, I pick up 71 counties out of 88 counties in the state. This means that the group of counties which I assign as the new Japanese plant location contains 80% of all counties in Ohio. Therefore, I organize the combination of counties as similarly as possible by considering adjacent counties.

Only in Alameda County, California where Toyota invested, I can identify the individuals who lives in this county. The county has a large enough population for the census to disclose the county code both in 1970 and 1980. The identification of the county is countyfips=1.

Honda's Plant in Union County, Ohio

1970 census			1980 census		
type	code	county	type	code	county
cntygp97	6003	Fayette	cntygp98	31	Hankock
		Jackson			Hardin*
		Madison*			*Logan**
		Marion*			**Union**
		Pike			
		Ross			
		Union			
		Vinton			
cntygp97	5902	Clark			
		Darke			
		*Logan**			
		Shelby			

cntygp97 and cntygp97 means 1970 county group and 1980 county group, respectively. A county with bold text is the county where a new Japanese plant is located. * indicates the adjacent counties. If the same county is shown in both the 1970 and 1980 county groups, this county is written in italics.

Nissan's Plant in Rutherford County, Tennessee

1970 census			1980 census		
type	code	county	type	code	county
cntygp97	4504	*Bedford**	cntygp98	10	**Rutherford**
		*Coffee**			Wilson*
		Giles	cntygp98	12	*Bedford**
		Hickman			*Coffee**
		Lawrence			Flanklin
		Lewis			*Moore*
		Marshall*			
		Maury			
		Moore			
		Perry			
		Rutherford			

cntygp97 and cntygp97 means 1970 county group and 1980 county group, respectively. A county with bold text is the county where new Japanese plant located. * indicates the adjacent counties. If same counties are shown both in 1970 and 1980 county groups, these counties are written in italics.

Mitsubishi's Plant in McLean County, Illinois

1970 census			1980 census		
type	code	county	type	code	county
metarea	104	**McLean**	cntygp98	26	**McLean**
cntygp97	7208	De Kalb	cntygp98	27	*Ford**
		Grundy			*Grundy*
		Kendall			Iroquois
		La Salle			*Kendall*
		*Livingston**			*Livingston**
		Putnam	cntygp98	23	*Coles*
cntygp97	5401	*Champaign**			*Cumberland*
		Coles			*De Witt**
		Cumberland			Moultrie
		Douglas			*Piatt**
		Edgar			*Shelby*
		*Ford**	cntygp98	25	*Champaign**
		*Piatt**	cntygp98	11	*Cass*
		Vermilion			*Logan**
cntygp97	5301	*Cass*			*Mason*
		Christian			*Morgan*
		*De Witt**			*Scott*
		*Logan**			
		Macon			
		Mason			
		Menard			
		Morgan			
		Moultrie			
		Sangamon			
		Scott			
		Shelby			

cntygp97 and cntygp97 means 1970 county group and 1980 county group, respectively. metarea represents metropolitan area. A county with bold text is the county where new Japanese plant located. * indicates the adjacent counties. If same counties are shown both in 1970 and 1980 county groups, these counties are written in italics.

Toyota's Plant in Scott County, Kentucky

1970 census			1980 census		
type	code	county	type	code	county
cntygp97	4901	Anderson	cntygp98	5	*Fayette**
		Bath	cntygp98	6	*Bourbon**
		*Bourbon**			*Clark*
		Clark			*Jessamine*
		Estill			**Scott**
		*Fayette**			*Woodford**
		Franklin*			
		Harrison*			
		Jessamine			
		Madison			
		Mercer			
		Montgomery			
		Nicholas			
		Powell			
		Scott			
		*Woodford**			

cntygp97 and cntygp97 means "1970 county group" and "1980 county group", respectively. A county with bold text is the county where new Japanese plant located. * indicates the adjacent counties. If same counties are shown both in 1970 and 1980 county groups, these counties are written in italics.

Mazda's Plant in Wayne County, Michigan

1970 census			1980 census		
type	code	county	type	code	county
metarea	216	*MaComb**	metarea	216	Lapeer
		*Oakland**			Livingston
		Wayne			*MaComb**
					*Oakland**
					St. Clair
					Wayne

cntygp97 and cntygp97 means 1970 county group and 1980 county group, respectively. metarea represents metropolitan area. A county with bold text is the county where new Japanese plant located. * indicates the adjacent counties. If same counties are shown both in 1970 and 1980 county groups, these counties are written in italics.

Subaru's Plant in Tippecanoe County, Indiana

1970 census			1980 census		
type	code	county	type	code	county
cntygp97	5501	*Benton**	cntygp98	13	*Benton**
		*Carroll**			*Jasper*
		*Clinton**			*Newton*
		*Fountain**			*Pulaski*
		*Montgomery**			*Starke*
		Tippecanoe			*White**
		*Warren**	cntygp98	14	**Tippecanoe**
		*White**	cntygp98	15	*Carroll**
cntygp97	7207	*Jasper*			*Clinton**
		La Porte			*Fountain**
		Newton			*Montgomery**
		Pulaski			Parke
		Starke			Putnam
					*Warren**

cntygp97 and cntygp97 means "1970 county group" and "1980 county group", respectively. A county with bold text is the county where new Japanese plant located. * indicates the adjacent counties. If same counties are shown both in 1970 and 1980 county groups, these counties are written in italics.