IJER © Serials Publications
11(1), Jan.-June 2014: 61-70
ISSN: 0972-9380

Location Determinants of Greenfield FDI in the United States: Evidence from 2003-2009

Hong Zhuang*

Abstract: *Using greenfield investment data from 2003 to 2009, this paper analyzes location determinants of new foreign plants in the United States. The results indicate that agglomeration economies, wages, the availability of potential workers and the access to highway transportation are important factors influencing location decisions of multinational corporations in the U.S.*

Keywords: *Greenfield investment, multinational corporations, location decisions*

JEL Classifications: *F20*

I. INTRODUCTION

The United States remains to be the largest recipient country of foreign direct investment (FDI) from 2004 to 2009, according to the World Investment Report (WIR).[1] FDI can be classified into two modes of entry: cross-border mergers & acquisitions (M&As) and greenfield investment. M&As imply the acquisition of existing assets within the host nation, while greenfield investment refers to the investment in new assets or establishing new firms. Even though M&As are the dominant mode of FDI, there have been substantial efforts to attract greenfield investment by state and local governments in the U.S. because setting up new facilities is associated with an increase in productive capacity and job creation while foreign acquisitions are often accompanied by layoffs of employees or the closing of some production or functional activities (UNCTAD, 2000). Friedman *et al.* (1992) view new foreign manufacturing plants in the U.S. the most important and coveted type of FDI because it creates jobs. Therefore, the study on factors affecting location decisions of greenfield investment has important policy implications for state and local policy makers who intend to foster economic development within their regions.

When the inflows of FDI in the U.S. surged in the 1980s, a number of studies have examined state characteristics that are attractive to multinational corporations

* Judd Leighton School of Business and Economics, Indiana University South Bend, South Beng, Indiana, U.S.A., *E-mail: zhuangh@iusb.edu.* I would like to thank the support of Faculty Research Grant from Indiana University South Beng and Faculty Research Fellowship from Judd Leighton School of Business and Economics, Indiana University South Bend for this project.

(MNCs). Based on manufacturing data for 1975-1976, the study by Little (1978) focuses on the ratio of foreign investment to domestic investment and shows that foreign firms are more sensitive to inter-state wage differentials and the availability of large ports. Using property, plant and equipment data on foreign manufacturing firms between 1974 and 1980, Glickman and Woodward (1988) examine the impact on foreign investment of agglomeration economies measured by the total value of gross fixed assets for manufacturing firms, labor climate which is a comprehensive measure of unionization, average strike activity, right-to-work and average weekly wages, and the access to public transportation. The findings are that agglomeration economies and the access to public transportation are positively related to foreign manufacturing investment in the U.S. while the labor climate has a negative impact. Coughlin *et al.* (1991) examine data on foreign manufacturing firms in the U.S. over the period 1981-1983 and report that positive determinants of foreign investment location decisions include the land area which is a proxy for the number of potential sites, state income per capita which is a proxy for market demand, manufacturing density which is a proxy for agglomeration economies, the unemployment rate, state development funding to entice foreign investment, the unionization rate and transportation infrastructure including highway miles, railroad miles and the number of public airports; whereas the wage rate and taxes have adverse effects on the location decision of MNCs. Friedman *et al.* (1992, 1996) are concerned with the newly established foreign manufacturing firms in the United States from 1977 to 1986 and distinguish important location determinants for high-technology and non-high-technology firms and for foreign firms originated from Japan, Europe or other countries. Friedman *et al.* (1992) use a conditional logit model and find that the market potential variable which measures market demand and agglomeration economies, labor market conditions, state promotional spending to attract foreign investment and state and local personal taxes are significant factors in the location decision. Friedman *et al.* (1996) report that the importance of manufacturing wages and the access to port facilities to foreign firms is mitigated and corporate taxes do not have significant impact in the regressions distinguishing industries and source countries.[2] State development spending to attract foreign firms has a positive effect on non-high-technology plants and plants sourcing from Europe. The skilled labor measured by the number of scientists and engineers is attractive to high-technology foreign firms.

The above studies focus on foreign manufacturing affiliates in the United States and such focus may be due to the concentration of foreign investment in the manufacturing sector in the 1980s. For example, 82.6 per cent of new plants set up by the MNCs between 1977 and 1986 were in the manufacturing sector (Friedman *et al.*, 1996). However, current statistics show that the share of manufacturing FDI was 33 per cent in 2011, less than periods when such investment accounted for a majority share of the total (Jackson, 2012). The remainder of FDI is distributed in the banking and finance, retail and wholesale trade, information, real estate and services, and other sectors. Therefore, a study that merely includes manufacturing data is not

adequate to analyze foreign location preferences in the current time period. The contribution of this paper is to utilize greenfield investment data covering all sectors from 2003 to 2009 to examine state characteristics influencing the location choice of MNCs establishing plants in the U.S. The findings suggest that agglomeration economies, the availability of potential workers and the access to highway transportation are important determinants of greenfield investment projects which corroborate findings in prior studies. Yet, the nonfarm wages, an indicator for labor cost, is shown to be positively related with new foreign investment, whereas this variable is typically found to be deterrent or insignificant in the prior studies.

The remainder of the paper proceeds as follows. Section II specifies the econometric model used to explore the location determinants of greenfield investment projects. Section III describes the data. Section IV presents the empirical results and section V concludes.

II. ECONOMETRIC MODEL

$$\log(GF_{it}) = \beta_0 + \beta_1\log(Market_{it}) + \beta_2\log(Manu\_Density_{it}) + \beta_3\log(Wage_{it}) + \beta_4 Union_{it} + \beta_5 Unemployment_{it} + \beta_6\log(Highway_{it}) + \beta_7\log(Railroad_{it}) + \beta_8\log(Airport_{it}) + \beta_9\log(Tax_{it}) + \gamma_t + \delta_i + \varepsilon_{it} \quad (1)$$

where GF_{it} represents the number of greenfield investment project occurred in state *i* in year *t*. The control variables are the location deterministic factors in the prior studies on inward FDI in the U.S.

First, market demand ($Market_{it}$) in a state is measured by gross state product (GSP) per capita in chained 2005 dollars. Market demand is anticipated to have a positive effect on the inflows of foreign firms if the motive of foreign plants is to serve the local markets.

Second, *Manu_Density* is state manufacturing employment per square mile of state land. This variable measures manufacturing density in a state, a proxy for agglomeration economies. New foreign plants tend to be attracted to the regions with a large amount of existing activities such that the close proximity to other similar types of firms and suppliers and demanders enhances productivity and reduces cost (Cohen and Paul, 2005).

Third, a set of variables are included to measure the characteristics of state labor market. $Wage_{it}$ is the average wages in nonfarm industries and measures the labor cost. A higher wage rate indicates a higher production cost for a firm and therefore may adversely affect the location decision of foreign firms. Empirical studies on firms' location decision by Bartik (1985), Luger and Shetty (1985), and Coughlin *et al.* (1991) support this hypothesis. $Union_{it}$ is the percentage of workers represented by unions which measures the labor-management environment. As suggested by Glickmand and Woodward (1988), foreign firms prefer regions with a weaker labor union because a weaker organized labor lowers labor costs, increases labor force

flexibility and promotes more effective managerial control. $Unemployment_{it}$ is the unemployment rate and reflects labor availability in a state. A higher unemployment rate indicates more workers available to work and is expected to be positively related to foreign firm's location decision.

Fourth, the availability of transportation facilities is widely recognized as important to foreign firms' location decision (Friedman *et al.*, 1996). The following three variables, $Highway_{it}$, $Railroad_{it}$, and $Airport_{it}$ measure highway mileage, railroad mileage and the number of public airports in a state and are expected to positively affect FDI inflows.

Fifth, tax burdens undertaken by foreign firms (Tax_{it}) are taken into account in the model. Tax burdens are measured by state and local taxes per capita and the expected sign of the tax burdens is ambiguous. On the one hand, the higher tax burdens will deter the firm's location decision; on the other hand, the public goods and services provided by the taxes are attractions to foreign firms.

The model also controls for unobservable state and time fixed effects. ε is classical error term. The variables in equation (1) take the double-log form, except for the unionization rate, the unemployment rate, and the availability of skilled labor that are measured in percent values.

III. DATA

The data on the dependent variable, the number of greenfield investment projects by states are from fDi Markets, a database tracking cross-border greenfield investment since 2003 maintained by the Financial Times. This variable is measured in units. The website of the Bureau of Economic Analysis (BEA) provides data on GSP per capita in chained 2005 dollars, state manufacturing employment and nonfarm industry wages in thousands of dollars. The data on state land area are obtained from the website of World Atlas. The manufacturing density variable is generated by dividing state manufacturing employment by state land area and measured in the number of manufacturing jobs per squared mile. Average wages of nonfarm industries are generated by dividing total nonfarm industry wages by nonfarm industry employment. Furthermore, the average wages are converted to real values in 2005 dollars using the GDP deflator obtained from the BEA.

The data on the unionization rate and the unemployment rate are retrieved from the website of the Bureau of Labor Statistics (BLS). The data on the availability of skilled labor and state and local taxes come from the Census Bureau. Per capita state and local taxes are calculated by dividing state and local taxes by state population; and this variable is further divided by the GDP deflator to convert to real values in 2005 dollars. The data on transportation facilities measured by highway mileage, railroad mileage and the number of public airports are from the website of the U.S. Department of Transportation.

Descriptive statistics are provided in table 1. The dataset is an unbalanced panel covering 50 states and Washing D.C. in the U.S. from 2003 to 2009. Over the sample period, California received the most number of greenfield investment projects, an average of 105 projects; while Montana received an average of 1.2 greenfield investment projects, the least among all states. Dividing the number of greenfield investment projects over the sample period into quartiles shows that the first quartile is 2.857 projects, the second quartile is 6.286 projects and the third quartile is 20 projects. States are stratified into four groups based on the quartiles and presented in table 2.

Table 1
Descriptive Statistics

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
GF	338	15.784	22.564	1.000	184.000
Market	408	42891.630	16194.050	26814.000	152167.000
Manu_Density	406	9.180	11.816	0.019	59.935
Wage	406	472.412	82.440	332.272	760.522
Union	408	12.815	5.525	3.300	27.500
Unemployment	408	5.447	1.710	2.483	13.417
Highway	408	78578.680	53305.140	1500.000	310850.000
Railroad	408	3236.882	2473.394	0.000	15045.000
Airport	357	268.104	229.966	2.000	1703.000
Tax	408	36.934	11.016	23.530	134.540

Table 2
Greenfield Investment Projects in Quartiles

Quartiles of greenfield investment projects	*Number of States*	*States*
1 – 2.857	11	Montana, Rhode Island, South Dakota, Idaho, North Dakota, Wyoming, Hawaii, Maine, New Hampshire, Alaska, Vermont
2.857 – 6.286	14	Delaware, Nebraska, Arkansas, New Mexico, Utah, Iowa, Oklahoma, Kansas, West Virginia, Mississippi, Oregon, Minnesota, Missouri, Wisconsin
6.286 – 20	13	District of Columbia, Louisiana, Connecticut, Maryland, Nevada, Arizona, Colorado, Washington, Kentucky, Tennessee, Alabama, New Jersey, Virginia
20 – 184	13	Indiana, Pennsylvania, South Carolina, Ohio, Massachusetts, Michigan, Georgia, Illinois, North Carolina, Florida, North Carolina, Texas, New York and California

Note: States are divided into four groups based on the quartiles of average greenfield investment projects received by the states from 2003 to 2009. The first quartile is 2.857 projects, the second quartile is 6.286 projects, and the third quartile is 20 projects.

IV. EMPIRICAL RESULTS

Equation (1) is estimated using the random-effects estimator. The estimated results are presented in table 3 column (1). A Hausman-test is conducted to choose between the fixed-effects and random-effects estimators. The test statistic fails to reject the null hypothesis of no systematic difference between fixed-effects estimates and random-effects estimates, indicating that the random-effects estimates are preferred to the fixed-effects estimates. Furthermore, the Breusch and Pagan test statistics reject the null hypothesis that state fixed effects should not be included in the estimation at the 1 percent significant level. This result indicates that state fixed effects should be included in the estimation and the random-effects estimates are preferred to the pooled ordinary least squares (OLS) estimates.

Table 3
Basic Regression Results

	(1)	*(2)*	*(3)*	*(4)*
log(Market)	-0.415	-0.482	-0.462	-0.530
	(0.640)	(0.624)	(0.666)	(0.648)
log(Manu_Density)	0.207***	0.213***	0.193***	0.202***
	(0.0717)	(0.0708)	(0.0689)	(0.0679)
log(Wage)	4.420***	4.455***	4.237***	4.254***
	(1.079)	(1.047)	(1.115)	(1.075)
Union	-0.0169	-0.0202	-0.00305	-0.00637
	(0.0163)	(0.0159)	(0.0159)	(0.0155)
Unemployment	0.0937**	0.0979***	0.0830**	0.0865**
	(0.0375)	(0.0364)	(0.0370)	(0.0360)
log(Tax)	0.00986		0.00953	
	(0.377)		(0.378)	
log(Highway)	0.678**	0.699**	0.728***	0.731***
	(0.315)	(0.312)	(0.103)	(0.101)
log(Railroad)	-0.0392	-0.0233		
	(0.229)	(0.227)		
log(Airport)	0.148	0.117		
	(0.197)	(0.196)		
Taxshare		3.014		2.815
		(2.283)		(2.259)
State fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Constant	-28.30***	-28.27***	-26.94***	-26.62***
	(5.402)	(5.226)	(5.195)	(4.949)
Observations	331	331	338	338

Note: Standard errors are in parentheses. The symbols, ***, ** and * indicate statistical significance at the 1%, 5% and 10% level.

The random-effects estimates of equation (1) show that manufacturing density, average manufacturing wages, the unemployment rate, and highway mileage have positive coefficients. These coefficients are statistically significant at the 5 percent level or 1 percent level. However, other coefficients fail to be significantly different from zero.

Various specifications of equation (1) are estimated using the random-effects estimation approach and the results are reported in table 3 columns (2) – (4). Column (2) replaces per capita state and local taxes by the percentage share of state and local taxes in state personal income, $Taxshare_{it}$.[3] Considering that road transportation is the major transportation mode in economic use (Zhuang, 2011) and the coefficients of railroad and air transportation are not significant in column (1), foreign affiliates may attach more importance to the availability of highway infrastructure. Hence, column (3) of table 3 excludes the variables of railroad mileage and the number of public airports. Similarly, column (4) uses the variable $Taxshare_{it}$ as the alternative measure of tax burdens in a state and includes only the highway mileage to represent transportation facilities. The estimated results in columns (2) – (4) remain qualitatively similar to those in column (1). GSP per capita, the unionization rate, tax burdens, railroad mileage and public airports do not have significant impact on greenfield investment. Furthermore, the exclusion of transportation modes of railroad and aviation in columns (3) and (4) do not affect the other estimated coefficients significantly.

The estimated results in table 3 show that manufacturing density, the unemployment rate and highway mileage are positively related to foreign firms' investment decisions. These estimated results suggest that foreign firms are attracted to states with more dense manufacturing activities, greater availability of potential workers and more developed highway transportation infrastructure. These findings are consistent with Glickman and Woodward (1988), Coughlin *et al.* (1991), and Friedman *et al.* (1996). However, the finding that nonfarm wages have a positive impact on foreign firms' location decisions conflicts previous findings in the literature examining the determinants of foreign investment in the U.S. The previous studies, such as Glickman and Woodward (1988), Coughlin *et al.* (1991), and Friedman *et al.* (1996), focus on foreign manufacturing firms in the U.S. in the 1970s and 1980s. During those time periods, the manufacturing wage cost is an important factor determining the investment decision because manufacturing firms are more unskilled labor intensive and low wages help reduce production cost. The sample data in this study cover greenfield investment from 2003 to 2009 including sectors other than manufacturing, such as finance, information technology that are capital intensive. With the technological progress over time, technology is skewed toward more skilled labor. The higher wage cost may imply a labor market with greater productivity which is valued by the foreign firms.

The insignificance of market demand, measured by GSP per capita in the estimated results indicates that the newly established foreign affiliates may intend to serve the national market, thus the size of regional market is not a significant determinant of location choice. Furthermore, the finding that unionization is insignificant is consistent with Friedman *et al.* (1996), indicating that unionization is not an important factor influencing the location decision of multinational corporations.

Table 4
Regression Results for States with different Quartiles of Greenfield Investment Projects

	(1)	*(2)*	*(3)*	*(4)*
VARIABLES	*First quartile*	*Second quartile*	*Third quartile*	*Fourth quartile*
log(Market)	-0.545	0.195	0.436	1.695
	(0.937)	(0.840)	(0.815)	(1.671)
log(Manu_Density)	0.0817	0.0782	0.165**	-0.261
	(0.128)	(0.0726)	(0.0700)	(0.265)
log(Wage)	1.518	-0.331	0.500	0.266
	(1.818)	(1.474)	(1.683)	(1.955)
Union	-0.0247	0.0121	0.0179	0.0164
	(0.0296)	(0.0227)	(0.0201)	(0.0230)
Unemployment	0.0140	0.171**	-0.0650	-0.00177
	(0.0938)	(0.0856)	(0.0752)	(0.0542)
log(Tax)	0.523	0.419	-1.090	0.249
	(0.425)	(0.874)	(1.203)	(0.870)
log(Highway)	0.146	-0.121	0.541	2.083***
	(0.413)	(0.558)	(0.558)	(0.710)
log(Railroad)	-0.111	0.440	0.286	-0.500*
	(0.293)	(0.462)	(0.327)	(0.282)
log(Airport)	0.297	-0.213	-0.474*	-0.887**
	(0.197)	(0.325)	(0.265)	(0.411)
State fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Constant	-6.557	-2.126	-7.164	-31.15***
	(11.65)	(8.189)	(9.161)	(9.167)
Observations	55	94	98	91
Number of States	10	14	14	13

Note: Standard errors are in parentheses. The symbols, ***, ** and * indicate statistical significance at the 1%, 5% and 10% level.

Further investigation of location determinants is conducted for states receiving different amount of greenfield investment. Equation (1) is estimated for states with the number of greenfield investment projects up to the first, second, third and four quartile respectively and the estimated results are reported in table 4 from columns (1) to (4). Due to the decrease in the sample size in each regression, the majority of the coefficients are not statistically significant. It is still worth recognizing that the unemployment rate representing the availability of potential workers is a positive determinant of foreign firms' location choice for states receiving greenfield investment projects in the second quartile range. Local manufacturing density, an indication of agglomeration economies, is positively attracted to foreign investors for states with greenfield investment in the third quartile group. Moreover, the access to highway transportation is an important factor to attract foreign firms for states with greenfield investment projects in the fourth quartile group. However, the public airports have adverse effects on foreign firms' location decision for states with greenfield investment projects in the third and fourth quartile groups respectively.

V. CONCLUSION

There has been an ongoing interest in attracting greenfield investment, the construction of new plants, among U.S. local communities since the 1980s. One of the benefits of greenfield investment is creating jobs that is favored by the local communities. An analysis to identify and reflect states' relative advantages and disadvantages to attract this type of FDI provides useful information for policymakers to better plan state promotional efforts in order to lure future greenfield investment.

Using data on greenfield investment from 2003 to 2009, this study finds that four variables are significant in determining the location choice of greenfield FDI in the U.S. They are manufacturing density, nonfarm industry wages, highway infrastructure, and the unemployment rate. The findings suggest that a presence of existing manufacturing activity is an important factor to attract new foreign plants due to the effect of agglomeration economies. The availability of highway transportation is another crucial factor to motivate the inflows of greenfield investment projects. A higher unemployment rate, though it is typically viewed as an indication of weaker economic performance, may be attractive to foreign investors, because the higher unemployment rate implies a greater supply of potential workers that is valued by foreign investors. High wage rates are shown to be detrimental in the location decision of foreign investment in the prior studies. This study finds that wage rates are positively related to inflows of greenfield investment. The correlation analysis shows that high wage rates are highly correlated with the share of skilled labor in the region.[4] Hence, high wages rates indicate high skills and productivity that are appealing to foreign investors.

An extension of this research is to explore location determinants of greenfield investment in different industries and originated from different countries. Friedman *et al.* (1992, 1996) show that location determinants vary for new manufacturing firms between 1977 and 1986 invested in non-high-tech and high-tech industries or insourced from Japan or Europe. It is reasonable to anticipate that the location determinants of new foreign plants differ by industry and source countries.

Note

1. The U.S. has long been known to receive the most FDI inflows in the world in the 1990s. China overtook the U.S. in 2002 – 2003 and received the most FDI inflows. The U.S. has resumed its leading position of receiving inward FDI since 2003.
2. Corporate taxes in Friedman et al (1996) include the corporate income tax, corporate property tax and unemployment insurance tax.
3. The percentage share of taxes in personal income is computed by dividing state and local taxes by state personal income obtained from the BEA.
4. The correlation coefficient between nonfarm wages and the share of state population aged 25 and over with a minimum 4-year college education is 0.7263 and statistically significant at the 1 percent level.

References

Bartik, T. J., (1985), 'Business Location Decisions in the United States: Estimates of the Effects of Unionization, Taxes, and Other Characteristics of States', *Journal of Business and Economic Statistics* 3, 14-22.

Cohen, J. P., & Paul, C. J. M., (2005), 'Agglomeration Economies and Industry Location Decisions: The Impacts of Spatial and Industrial Spillovers', *Regional Science and Urban Economics* 35, 215-237.

Coughlin, C. C., Terza, J. V., & Arromdee, V., (1991), 'State Characteristics and the Location of Foreign Direct Investment within the United States', *The Review of Economics and Statistics* 73, 675-683.

Friedman, J., Gerlowski, D. A., & Silberman, J., (1992), 'What Attracts Foreign Multinational Corporations? Evidence from Branch Plant Location in the United States', *Journal of Regional Science* 32, 403-418.

Friedman, J., Gerlowski, D. A., & Silberman, J., (1996), 'Foreign Direct Investment: The Factors Affecting the Location of Foreign Branch Plants in the United States', *Global Finance Journal* 7, 209-222.

Glickman, N. J., & Woodward, D. P., (1988), 'The Location of Foreign Direct Investment in the United States: Patterns and Determinants', *International Regional Science Reviews* 11, 137-154.

Jackson, J. K., (2012), Foreign Direct Investment in the United States: An Economic Analysis. Washington, DC: Congressional Research Service.

Little, J. S., (1978), 'Locational Decisions of Foreign Direct Investors in the United States', *New England Economic Review* 18, 43-63.

Luger, M. I., & Shetty, S., (1985), 'Determinants of Foreign Plant Start-Ups in the United States: Lessons for Policymakers in the Southeast', *Vanderbilt Journal of Transnational Law* 18, 223-245.

UNCTAD., (2000), World Investment Report 2000. New York: United Nations.

Zhuang, H., (2011), 'Foreign Direct Investment and Public Highway Expenditures: Evidence from the United States', *Review of Business Research* 11, 189-197.