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Location Determinants of New Foreign-Owned Manufacturing Plants

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Abstract

Manufacturing employment in the United States trended downward between 1979 and 1993. Geographically, the Northeast and Mideast regions incurred the brunt of this decline and, except in the Southwest region, urban counties tended to fare worse than rural counties. Meanwhile, foreign-owned manufacturing associated with new plants has been playing a larger role in the U.S. economy, especially in the Southeast region. The current research explains the pattern at the county level of new foreign plant location. Economic size, labor force quality, agglomeration and urbanization economies, and transportation infrastructure are found to affect positively the location of new foreign-owned plants, while unit labor costs and taxes are found to deter new plants. Comparing regions, our results reveal that the key advantages of the Southeast region stem from relatively high manufacturing density and low taxes. Comparing urban with rural counties, we found that nearly all the explanatory variables possess average values for urban counties that are more favorable to foreign direct investment. For example, the labor force is relatively more productive and skilled in urban than in rural counties.

Keywords: Foreign-Owned Manufacturing, Plant Location, Regional Patterns

JEL Classification: R11, F23

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LOCATION DETERMINANTS OF NEW FOREIGN-OWNED MANUFACTURING PLANTS

I. Introduction

The number and geographic distribution of manufacturing jobs have changed substantially over time in the United States. Since peaking in 1979 with 21.0 million jobs, manufacturing employment declined to 18.1 million in 1993 and was 18.7 million in 1997. Using the eight Bureau of Economic Analysis regions, Bernat (1996) has shown that the manufacturing job losses between 1982 and 1994 occurred almost entirely in the New England and Mideast regions. Bernat also found that urban counties generally fared worse than rural counties. Rural counties in all but two regions — New England and the Mideast — experienced increases in manufacturing employment between 1982 and 1994. Even the percentage reductions in manufacturing employment in the New England and Mideast regions were less severe in rural than in urban counties. Only the Southwest region experienced faster manufacturing employment growth in urban than in rural counties.

The changing geographic distribution of manufacturing employment has been accompanied by changes in the ownership of manufacturing facilities. Over time, an increasing share of manufacturing production in the United States is taking place under foreign rather than U.S. ownership. In fact, despite the national decline in manufacturing employment since 1979, manufacturing employment in foreign-owned firms more than doubled between 1979 and 1995 as it rose from 1.0 million to 2.1 million.[1] As a result, in

[1] See U.S. Department of Commerce, Bureau of Economic Analysis (1985), Table F-7 for manufacturing employment in foreign-owned firms in 1979 and Fahim-Nader and Zeile (1997), Table 14 for the 1995 data.

1995 approximately one of every nine manufacturing employees in the United States was employed by a foreign firm, as compared with one of every 20 in 1979.

Given the rising share of foreign enterprises in U.S. manufacturing activity, the location of new foreign-owned plants is a significant determinant of the geographic distribution of manufacturing employment.[2] Based on data from the International Trade Administration, between 1989 and 1994 foreign investors made plans to build 380 new manufacturing (excluding SIC 29 – petroleum and related industries) plants throughout the United States.[3] The locations of these plants are summarized in figure 1. The goal of the current research is to generate an economically sound, statistical model to explain the pattern of new foreign plant location.[4] This model is used to produce insights into the differences among Bureau of Economic Analysis regions as well as between rural and urban counties in the location of these plants.[5]

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[2] We restrict our focus to cases in which the foreign-owned firms have the most discretion with respect to their location decisions. The majority of manufacturing employment in foreign-owned firms is tied to mergers with or acquisitions of U.S. firms.

[3] Information on new foreign-owned plants is contained in an annual publication from the International Trade Administration. For 1989, the title is *Foreign Direct Investment in the United States – 1989 Transactions*. The definition of a new plant is a new operating facility, established either in conjunction with an existing foreign-owned productive enterprise or as a completely new venture.

[4] Our dependent variable is the absolute number of new plant transactions identified in the International Trade Administration publications from each year between 1989 and 1994. In their state-level study, Friedman et al. (1992) use similar data covering 1977 to 1988. Glickman and Woodward (1987) also use this data source for 1979 to 1983.

[5] Our analysis focuses on the location of new foreign-owned plants primarily because of the rapid increase in foreign ownership and the resulting public attention. An important issue is whether the location determinants, or parameter estimates, differ for foreign-owned firms versus domestic-owned ones. A starting point for potential differences is that these new foreign plants are part of multinational enterprises that possess unique ownership advantages. A more appropriate comparison group for foreign–owned firms is U.S. multinational companies. Unfortunately, we lack the data for these companies to undertake the analysis in the current study. See Zeile (1998) for a study comparing the domestic orientation of production and sales by U.S. manufacturing affiliates of foreign companies with similar U.S. firms operating in the United States.

Additional details on the regional location of plants are provided in the next section. This is followed by an overview of the econometric procedures we use in estimating our model. Next, potential determinants of new plant location are discussed. The econometric results are then presented with a special emphasis on their implications for the location of new plants among regions, as well as in rural versus urban counties. A summary of the key findings and suggestions for additional research complete the paper.

II. A Regional View of New Foreign-Owned Plants

Table 1 summarizes the data on new foreign-owned plants for the 48 contiguous U.S. states. In terms of the absolute number of planned plants, the five leading states are North Carolina - 35, California - 34, Texas - 27, Kentucky - 22, and Ohio - 22. Meanwhile, no new foreign-owned plants were planned for seven states — Idaho, Montana, North Dakota, South Dakota, Utah, Vermont, and Wyoming.

Since states with larger economies are likely to have more new plants than states with smaller economies, we calculated a size-adjusted measure of each state's share of new plants. The fifth column in table 1 shows each state's national share of new foreign-owned manufacturing plants divided by its share of the 1989 national sum of gross state products. The five leading states according to this measure are Kentucky, South Carolina, North Carolina, Tennessee, and Oregon. Their shares of new plants exceed their shares of national gross state product by more than 2.5 times.

Since the four leading states are located in the Southeast region, it is no surprise that the Southeast is the leading region when we combine states into Bureau of Economic Analysis areas. Table 2 shows the national shares of new plants of the eight regions, along with each region's share of the nation's total gross state products.[6] When comparing size-adjusted shares of new plants, the Southeast region is the clear leader, with its share of new plants approximately double its share of gross state product. The Great Lakes region is a distant second. Meanwhile, each of the six other regions has shares of new plants smaller than their shares of gross state product. One goal of the model developed in this paper is to identify reasons for these differential results across regions.

III. Negative Binomial Model

Various modeling approaches and levels of aggregation have been used for analyzing industrial location. For example, ordinary least squares, logit, Tobit, Poisson, and negative binomial estimation procedures have been used. These procedures have been applied to foreign direct investment aggregated to the state level and, more frequently in recent years, to the county level.[7]

We estimate a negative binomial model below; however, as background, it might be useful to review the Poisson model. A Poisson distribution is frequently used to characterize processes that generate non-negative integer outcomes, such as the number of accidents that occur at a particular intersection. The number of new plants locating in a specific region, especially since the count is zero in many counties, is a reasonable candidate for a Poisson

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[6] See Table 3 for a list of the states included in each region.

[7] Aggregation, however, takes place on many other dimensions as well, such as industry, source country, and mode of foreign direct investment. Much research attention has been focused on the geography of the automobile industry. For example, see Klier (1995) for evidence of the geographic structure of supplier plants and Smith and Florida (1994) for an econometric study of the location of Japanese automotive-related manufacturing establishments.

distribution. The density function of n_j, or the likelihood of observing a count of new plants n_j, is

$$f(n_j) = \frac{e^{-\lambda_j} \lambda_j^{nj}}{n_j!}, \; n_j = 0,1,2,... \tag{1}$$

The expectation of n_j, λ_j, is assumed to be log-linearly dependent on some explanatory variables. Thus,

$$\ln(\lambda_j) = \beta' x_j, \tag{2}$$

where β is a parameter vector to be estimated and x_j is a vector of observable county characteristics that influences firms' profits. The log likelihood function for this model is

$$\ln L = -\sum_j \lambda_j + \sum_j n_j \beta' x_j - \sum_j \ln(n_j!). \tag{3}$$

The Poisson model, however, imposes the restriction that the dependent variable's mean and variance equal λ_j. This proposition can be tested. Since our results indicate otherwise, we do not estimate a Poisson model. Instead, we use a negative binomial distribution, specifying $\ln(\lambda_j) = \beta' x_j + \in_i$, where $\in$ is gamma distributed with mean 1.0 and variance alpha. This allows the variance to exceed the mean.

IV. Independent Variables

The probability that a foreign firm selects a specific county for an investment transaction depends on the levels of the county's characteristics that affect profits relative to the levels of these characteristics in other counties. These variables, defined and summarized in table 3 (along with the level of aggregation used to construct them), can be categorized as those affecting the revenue prospects and those affecting the costs of doing business. As a general statement, we use 1989 values for these variables to reflect conditions at the beginning of the investment period.

On the revenue side, one factor affecting the desirability of locating a plant in a specific location is the demand for the firm's good relative to the supply of the good. In the present context, similar to Wheat (1986) and Duffy (1994), we use a ratio of total personal income relative to manufacturing employment (MARKET). Regions where demand for manufactured goods is high relative to their supply should offer greater profit opportunities.[8] Unfortunately, it is difficult to know which market area to use in the construction of this variable. However, it is likely that most foreign-owned manufacturing firms are serving a much larger market than the county in which they produce.[9] We have chosen to use, for the construction of this variable, the "economic areas" constructed by the Bureau of Economic Analysis, which are shown in figure 2.[10] To date, this geographic unit has not been used in studies of foreign direct investment.

The size of the "local" market could serve as a rough proxy for agglomeration within a region, regardless of the geographic sales orientation of a firm. To capture the size of the local market, we use the total personal income of the Bureau of Economic Analysis'

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[8] Glickman and Woodward (1987) also use the ratio of total personal income relative to manufacturing employment, but both the numerator and denominator are gravity-adjusted. At the state-level, employment growth in foreign-owned firms was found to be associated positively with this demand/supply variable.

[9] Little is known about the geographic scope of the markets to be served by these new plants. Zeile (1998) found that the sales of foreign-owned manufacturing affiliates in the United States were primarily in the U.S. market. Virtually nothing is known about the distribution of sales of these companies within the United States.

[10] The construction of economic areas begins by identifying metropolitan areas or similar areas that are centers of economic activity. Next, primarily based on commuting patterns of its labor force, counties economically related to these centers are identified. These areas are called component economic areas. The construction is completed by aggregating the component economic areas to form larger economic areas. See Johnson (1995) for additional details on the construction of these 172 areas that cover the United States.

economic area in which the county is located (INCOME-EA).[11] Finally, to simply control for the possibility that larger counties are likely to be the sites for more new plants, we used two variables measured at the county level – total personal income (INCOME-C) and population (POP).

Labor Market Variables

On the cost side, we incorporated a number of variables related to the labor market. The first is unit labor cost (ULC), which is the average hourly wage rate of production workers (WAGE) divided by average productivity in manufacturing in the county (PROD).[12] Average productivity in manufacturing is measured by value added in manufacturing divided by the number of manufacturing employees.[13] Holding all other variables constant, higher unit labor costs should be related negatively to the number of new plants. Previous studies of the location of foreign direct investment throughout the United States have not examined specifically the effect of unit labor costs. In some cases separate variables for wages and productivity have been tried, while in others only a variable for wages was used. We also tried separate variables for wages and productivity, expecting higher wages to be related negatively to the number of new plants and higher productivity to be related positively.

Previous research results involving wages and productivity tend to conflict. For example, Luger and Shetty (1985), Coughlin et al. (1990 and 1991), and Friedman et al.

[11] An alternative used by Friedman et al. (1992) and Woodward (1992) is a gravity-adjusted measure of personal income that accounts for both the size of a region's market and its position relative to other markets. Both find this measure to be a positive, statistically significant location determinant.

[12] Since our unit of observation is the county, industry mix could lead to substantial wage differences across counties and affect the regression results. The use of unit labor cost tends to mitigate this problem as the industry mix effect is present in the numerator and the denominator.

(1992) found that higher wages deterred foreign direct investment using state level data; however, Ondrich and Wasylenko (1993) did not find a statistically significant relationship. Among these studies only Friedman et al. (1992) explicitly controlled for productivity, which affected plant location positively. Using county level data, Smith and Florida (1994) found a positive, statistically significant relationship between wage rates and the location of Japanese automotive-related manufacturing establishments across counties. On the other hand, Woodward (1992) found a negative, but not statistically significant, relationship between wage rates and the location of Japanese manufacturing start-ups. Of these two studies, only Woodward (1992) includes a specific productivity measure and finds it to be a positive, statistically significant determinant.

While studies of foreign direct investment in the United States have not tested for the effect of unit labor costs, this measure has been used in other location studies. For example, Kravis and Lipsey (1982) utilize such a variable in their study of overseas production for export by U.S. multinational corporations. They found unit labor costs to be related negatively to location in most cases, but the relationship was not statistically significant. More recently, Thomsen (1997) found a negative, statistically significant relationship between unit labor costs and the location of production for export by U.S. manufacturing firms in Europe.

Looking further at the labor market, we explore the importance of educational attainment in a county, which could be an indicator of the quality of its labor force.

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[13] Other measures of productivity, such as value added in manufacturing divided by production worker hours or by production workers were also tried, but our empirical results were not altered.

Glickman and Woodward (1987) found indicators of labor force quality to be statistically significant determinants of new foreign plant location. For the level of educational attainment we use the percentage of the population twenty-five or older with at least a high school diploma (EDU). We expect this measure of educational attainment to be related positively to the number of new plants in a county.

The extent of unionized labor is a characteristic of labor markets widely publicized by promoters of economic development in states with low unionization rates. The selling point is that firms will have the managerial freedom to pursue profit maximization unencumbered by union contract restrictions. Such an environment might be especially advantageous to foreign firms as they attempt to introduce new managerial practices. Bartik (1985) found evidence to support this position. On the other hand, Friedman et al. (1992) found higher levels of unionization to be a positive, statistically significant determinant of new foreign plant location. Nonetheless, as a working hypothesis we expect higher unionized shares of state manufacturing employment (MUNION) to deter foreign direct investment.

Another characteristic of labor markets whose impact we explore is the county unemployment rate (UNRATE). To the extent that the unemployment rate is an indicator of labor availability as well as a dampening influence on wages, higher unemployment rates will likely be related positively to foreign direct investment. On the other hand, Woodward (1992) finds empirical support for the argument that Japanese firms avoid high unemployment areas because such counties have less-competitive industrial conditions and a lower quality of life; however, Glickman and Woodward (1987) did not find unemployment rates to be statistically significant in explaining the plant location decisions of foreign firms that were not differentiated as to the source country.[14] Given the limited prior research and the conflicting arguments, we are uncertain about the expected relationship between unemployment rates and the location of foreign direct investment.

To examine the possible effects of agglomeration economies, we include the percentage of the labor force employed in manufacturing (MANDEN).[15] Higher values of this variable are expected to be related positively to the number of planned foreign-owned plants in a county. In addition, to examine whether the automobile industry might have specific agglomeration economies affecting the pattern of manufacturing new plant location, we use state employment in automobile assembly (AUTOEMP). Smith and Florida (1994) found that auto assembly plants attract supplier plants; however, it is unclear whether this specific effect will show up at the level of aggregation in our research. If it does, then this variable should be related positively to the number of planned foreign-owned plants in a county.

Fiscal Policy

With respect to the effects of fiscal policy on location, we use both tax and spending-related variables. The majority of evidence suggests that higher taxes deter foreign direct investment in the United States.[16] The first tax variable we examine is county per capita property taxes (PROPTAX). We expect higher values of this variable to be related negatively to the location of foreign direct investment; however, there are reasons why the

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[14] At the state level, Coughlin et al. (1991) found a positive relationship between unemployment rates and the location of foreign direct investment.

[15] Many studies, such as Luger and Shetty (1985) and Head et al. (1994 and 1995), find support for the importance of agglomeration economies.

[16] For example, see Coughlin et al. (1990), Friedman et al. (1992), Woodward (1992), and Hines (1996).

estimated relationship might not be negative. For example, the taxes may be financing the provision of goods and services, such as transportation infrastructure or education/training, valued by foreign investors; alternatively, tax incentives might be reducing the effective tax rates for foreign investors. In addition, Glickman and Woodward (1987) did not find property taxes to be a statistically significant determinant of new foreign plant location. Our second tax variable is a general measure of taxes calculated at the level of individual states rather than at the county level. We expect this measure, state and local taxes as a share of gross state product (TAXGSP), to be related negatively to the location of foreign direct investment.

Turning to the spending side of fiscal policy, we examine two types of spending. Previous studies, such as Glickman and Woodward (1987), have found that transportation infrastructure affects industrial location at the county level. Consequently, we have included a dummy variable to identify whether or not an interstate highway is located in the county (HIWAY), and expect this variable to be related positively to the number of new plants. In addition, we also explored whether interstate highways in the eastern portion of the United States (EHIWAY) had a separate effect in attracting new foreign-owned plants.

As part of their economic development strategies, all states attempt to attract foreign direct investment. Inducements in the form of tax breaks, financial assistance, and labor training are common. Trade missions, advertising, and promotional campaigns are also used to provide information to firms interested in investing in the United States. Statistical evidence on the effectiveness of these promotional efforts is scarce; however, most researchers have found a positive association between promotional budgets and foreign direct investment activity.[17] Lacking satisfactory data on promotional budgets, we explore the connection between state promotional offices abroad and new plant location. Two research efforts provide supporting evidence. First, Woodward (1992) found that the state location of Japanese foreign direct investment in the United States is related to the existence of a state's foreign offices in Japan. Second, Kozlowski et al. (1994) found that states with more foreign offices tended to attract more foreign direct investment. In our research we use two variables – the number of foreign offices (OFFICE) and the number of staff employed in the foreign offices (STAFF) – to see if a similar relationship can be identified for the location of new foreign-owned plants.

Other Explanatory Variables

A number of explanatory variables do not fit neatly into the preceding categories, so we have a catchall category to capture these "other" variables. One variable is county population density (POPDEN). This measure may capture urbanization economies; alternatively, it may be a proxy for land costs. If it is capturing urbanization economies, we expect this variable to be related positively to the number of new plants; however, higher land costs will likely deter firms from locating a new plant in a specific county, resulting in a negative relationship. On the basis of prior research, we expect the former relationship to dominate.[18]

We also explore whether foreign investors have specific preferences for urban locations. In their study of new foreign plant location, Glickman and Woodward (1987)

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[17] See Luger and Shetty (1985), Coughlin et al. (1991), Kozlowski and Weekly (1990), and Kozlowski et al. (1994).

[18] For example, see Woodward (1992).

found that percentage of a county's population residing in an urban area was a positive and statistically significant determinant of plant location. Some of our other independent variables, such as population density, already partially control for differences between urban and rural locations. As an additional control, we tried two other measures of urban/rural location. First, we defined a dummy variable (URBAN) that was given a value a one if the county was located in a metropolitan statistical area, and a value of zero otherwise. Second, we differentiated urban and rural locations based on Beale code classifications (BEALE), which is an urban/rural continuum ranging from zero to nine.[19]

To explore the possibility that investors have racial preferences, we examine the percentage of a county's population that is black (PBLACK). This variable is generally included in studies of Japanese foreign direct investment. Woodward (1992) found that Japanese manufacturing establishments tend to avoid areas with high percentages of African-Americans. On the other hand, Smith and Florida (1994) found that higher concentrations of minorities were associated positively with Japanese automotive-related foreign direct investment. Given the conflicting results for Japanese investment and the lack of other information, the expected relationship between the percentage of a county's population that is black and the number of new foreign plants is uncertain.

A factor commonly included in firm location studies, but not in foreign direct investment location studies, is climate. Wheat (1986) concluded that climate was the second strongest locational influence in explaining state manufacturing growth between 1963 and 1977. In a study of state manufacturing growth at the two-digit SIC level, however, Duffy (1994) found climate to have a much smaller effect than that found by Wheat. In addition to

[19] See Butler and Beale (1994) for additional information.

being a quality of life measure, climate could affect profitability through energy costs, plant construction costs, transportation delays, and worker absenteeism. Our measure of climate is the average temperature in a state's major city in January (CLIMATE). Generally speaking, warmer locations in the United States might be expected to receive more foreign direct investment.

Coastal locations may have characteristics that make these areas preferable to non-coastal locations for foreign plants. For example, European firms may prefer to locate plants in East Coast states to assist the shipping of parts and components between the United States and Europe as well as to ease management visits. In addition, life on the coast could offer some amenities. Similarly, Japanese firms may prefer to locate plants in West Coast states. Consequently, three variants of East Coast dummies (ECOAST1, ECOAST2, and ECOAST3) and one West Coast (WCOAST) dummy were used.

Finally, we have included seven dummy variables to differentiate among counties in each of the eight Bureau of Economic Analysis regions. The motivation for adding these dummies is to capture the influence of determinants we have not explicitly included that may differ systematically across regions.

An Omitted Variable

For various reasons we do not examine all the variables that may affect the pattern of new plant location. Rather than enumerate a lengthy list, which would include variables for amenities and transportation options other than interstate highways, we discuss one variable that affects foreign direct investment flows, exchange rate changes.

During the period covered by our investment data, the value of the dollar as measured by the Board of Governors' trade-weighted exchange rate index remained in the range of 80 to 100, which reflected much less variability than occurred in 1981-1985, 1985-1987, and 1995-1997. Thus, one could argue that exchange rate changes were unlikely to play a major role in our study.

One could also argue that since an exchange rate is a national variable – an exchange rate of 135 yen for one dollar is the same in New York and in North Dakota – the value of the exchange rate does not affect the decision of where to locate a plant in the United States. It might affect, however, the decision of whether or not to locate a plant in the United States. As noted by Dewenter (1995), several empirical analyses have found a depreciating dollar to be associated with higher inflows of foreign direct investment into the United States. To our knowledge, no analyses have examined how changes in the foreign exchange value of the dollar have affected the geographic distribution of foreign direct investment in the United States.[20] Any such analysis would be confronted with the challenge of constructing a variable to measure exchange rate changes at the local level. Efforts to construct this measure have only begun recently and apply only to groups of states rather than individual states or counties.[21]

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[20] To date, only the geographic effects of exchange rate changes on output have been studied. See Cox and Hill (1988) and Carlino et. al. (1994).

[21] See Clark et al. (forthcoming) and Hervey and Strauss (1996).

The bottom line is we do not examine if exchange rate changes affected the spatial distribution of new plants.[22] Estimating the effects of this variable would require overcoming a major measurement problem. We have reasons, however, to think exchange rate changes were unlikely to have been an important omitted factor in the current study. First, the national exchange rate was relatively stable during the period and, second, exchange rate changes have had little effect on manufacturing output growth.

V. Negative Binomial Regression Results

Due to data limitations we were unable to use all the counties in the forty-eight contiguous states shown in figure 1. Primarily because of an absence of manufacturing wage data, the number of counties examined was reduced from 3111 to 2316.[23] The excluded counties had few new plants, as the number of new plants in our sample was only reduced from 380 to 366. Figure 3 shows the pattern of new plant location that our regression model attempts to explain. Of these 2316 counties, zero foreign-owned plants were planned in 2,097 counties, one in 143 counties, two in 44 counties, three in 15 counties, four in 6 counties, five in 6 counties, six in 2 counties, seven in 2 counties, and ten in 1 county.

The results of three negative binomial regressions are presented in table 4. In each case two statistical tests — a Wald test and a likelihood ratio test — indicate that the negative binomial model is superior to the Poisson model. Specifically, both the statistical

[22] We also do not examine how trade policy changes affect the spatial distribution of foreign direct investment. It is certainly possible that the U.S.-Canada Free Trade Agreement and the North American Free Trade Agreement, which had differential source country effects, might have affected the location of new plants.

[23] The absence of this data is due mainly to the disclosure policy of the U.S. Department of Commerce.

significance of alpha and the likelihood ratio allow the rejection of a null hypothesis that alpha equals zero, as is the case in a Poisson regression.[24]

Market/Size Variables

Turning to the results for specific variables, some of which are not reported in table 4, we start with the ratio of personal income to manufacturing employment (MARKET). In the first model reported, MARKET was not found to be related positively to the number of foreign-owned plants, but rather negatively. This relationship, however, was not statistically significant.[25] This result prompted an examination using other geographic areas to calculate the ratio of personal income to manufacturing employment. For example, using counties to calculate this variable, unreported regressions also produced a negative, but not statistically significant, relationship between this variable and the number of planned foreign-owned plants.[26]

An alternative to MARKET is total personal income at different levels of geographic aggregation. This measure of economic size was related positively to the number of planned foreign-owned plants at every level of aggregation we tried, and was frequently, but not always, statistically significant. Model 2 shows the relationship using income at the county level (INCOME-C).[27] This measure is a positive, statistically significant determinant of the number of planned foreign-owned plants. Results using total personal income of the

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[24] See Cameron and Trivedi (1986) for additional details.

[25] Throughout the rest of the paper our results will be discussed using a significance level of 0.05.

[26] A simple correlation using states as the unit of observation yielded a correlation of –0.34 between the ratio of personal income to manufacturing employment and the number of planned foreign-owned plants.

[27] The sample size for this regression was reduced from 2316 to 2272 because of inadequate income data for 44 counties.

economic area in which counties are located (INCOME-EA), which we do not report, show a positive, but not always, statistically significant relationship. Another alternative to MARKET, shown in model 3 in table 4, is county population (POP). POP is a positive, statistically significant determinant of the number of planned foreign-owned plants, indicating that larger counties are more likely to be the sites for more foreign-owned plants.

Labor Market Variables

With respect to the labor market variables, many of the results are strong. First, the results in table 4 show higher unit labor costs (ULC) in a county deter the location of new plants. We also entered the variables used to construct ULC separately. Both the average hourly wage rate of production workers (WAGE) and the average productivity in manufacturing (PROD) were positive, statistically significant determinants of the location of new plants. From the perspective of firms, the positive association between wages and the number of new plants is surprising. Not surprisingly, wages are correlated positively with average productivity (0.6). Average productivity can be viewed as an indicator of labor force quality. Another possible indicator of labor force quality, the level of education attainment (EDU), was also found to be a positive and statistically significant determinant of the number of new plants in a county.

Turning to the other variables related to the labor market, a state's unionization rate (MUNION) was not found to be a statistically significant determinant of new plant location. The estimated sign of this relationship was highly sensitive to which other independent variables were included. Similarly, various models did not reveal a statistically significant relationship between a county's unemployment rate (UNRATE) and the number of new plants. As shown in table 4, we did find, however, that manufacturing employment as a share of the labor force (MANDEN), a rough proxy for agglomeration economies, was a positive, statistically significant determinant of new plant location. In addition, our examination of whether the automobile industry might have specific agglomeration economies that would show up at our level of aggregation revealed that AUTOEMP, while positively signed, was statistically significant only in the variants using MARKET.

Fiscal Policy Variables

Contrary to expectations, per capita local property taxes (PROPTAX) was found to be related positively to foreign direct investment. This relationship, which is not reported in table 4, was not statistically significant in most models we tried. This finding suggests, very weakly, the possibility that these taxes may be financing the provision of goods and services valued highly by foreign investors. On the other hand, table 4 shows that state and local taxes as a share of gross state product (TAXGSP) was a negative, statistically significant location determinant.

Transportation infrastructure is potentially one publicly-provided good that is highly valued by foreign investors. Interstate highways are one specific example. As shown in table 4, the existence of an interstate highway serving the county (HIWAY) is a positive, statistically significant determinant of the location of new plants. In addition, a result not shown is that the existence of an interstate highway located in the eastern portion of the United States (EHIWAY) is a positive, statistically significant determinant of new plant location.

Our final fiscal policy variables relate to state attempts to attract new foreign-owned plants. Our results for the connection between state promotional offices abroad and new plant location, which are not reported in table 4, show a negative rather than a positive relationship. However, neither the number of foreign offices (OFFICE) nor the number of staff employed in these offices (STAFF), is a statistically significant determinant of new plant location.

Other Explanatory Variables

Various other variables were included to capture some of the other influences thought to influence the location decisions of foreign investors. For example, results not shown in table 4 for the population density of the county (POPDEN) are mixed. POPDEN was a positive and statistically significant of new plant location for models using INCOME-EA, but was not statistically significant for models using county-level measures of size, such as INCOME-C and POP.[28]

Another finding is that, even after controlling for variables differing between urban and rural locations, foreign investors appear to have specific preferences for urban locations. Such a conclusion is based on the results for two variables. First, the results in table 4 show that counties in metropolitan statistical areas (URBAN=1) tended to be the location for larger numbers of new plants than counties outside metropolitan statistical areas (URBAN=0). Second, in results not presented in table 4, the use of Beale code classifications revealed a similar preference for urban counties.

In addition to urban/rural preferences, we explored the possibility that foreign investors were deterred from locating in counties with higher proportions of the population being black (PBLACK). Our results suggest this is not the case. In fact, higher percentages

[28] Regressions in which the components of population density, population and land area, were entered separately revealed that population was statistically significant, while land area was not.

of a county's population being black were associated with larger numbers of new foreign-owned plants.

We also explored the possibility that climate affected the location decisions of foreign firms. Various models, whose results are not reported, using a state's average temperature in January (CLIMATE), failed to find a statistically significant association between CLIMATE and the location of new plants.

Finally, we used dummies to examine whether foreign investors had regional preferences. One focus was to explore the possibility of coastal preferences. The results, which are not reported, provide some support for this hypothesis. In models that exclude dummy variables for each Bureau of Economic Analysis region, the dummy variables for the East and West Coasts are positive and, in some cases, statistically significant. However, the inclusion of dummy variables for each Bureau of Economic Analysis region to control for omitted variables produced better results. Using the Southeast region as the base, we see in table 4 that the seven other regions generally exhibit negative signs. This suggests the existence of characteristics in these regions, relative to the Southeast, that make them relatively less desirable locations for foreign direct investment. In models 2 and 3 five of the seven regional dummy variables are statistically significant, while only two are statistically significant in model 1.

Regional Implications

During our discussion of the location of new foreign-owned manufacturing plants by region, we noted that the Southeast region received a more than proportionate share of these new plants. Combining the results from our estimated models with the regional mean values for the key determinants provides insight into the possible underlying reasons for this pattern of location.

Table 5 lists the mean values of the location determinants, calculated as the simple averages for all counties in a region, along with each region's rank. A favorable mean does not imply that a region as a whole is more attractive than others, but rather that its individual counties tend to have more favorable levels of a particular determinant relative to other regions. Thus, we expect regions with favorable means to have a larger share of new plants relative to other regions.

An examination of the Southeast region reveals that its major advantages in comparison to other regions are its relatively high manufacturing density (MANDEN) and its relatively low taxes as a share of gross state product (TAXGSP). In both cases, the Southeast ranks first. These advantages, along with the unidentified advantages suggested by the results for the regional dummy variables, more than offset the major disadvantage of the region, its relatively poorly educated work force (EDU).

Urban vs. Rural Implications

Our regression results can also be used to explore the differences in new plant location by foreign investors between urban and rural counties. Distinguishing between urban and rural locations on the basis of whether or not the county is located in a metropolitan statistical area, we generated information that compares the values of selected variables in urban and rural counties. This information is summarized in table 6.

For the period under consideration 288 new plants were to be located in urban counties and 78 in rural counties. Thus, the average per urban county was 0.44 and the average per rural county was 0.05. One should not, however, infer that rural counties received a disproportionately small share of the new plants by foreign investors. If one scales the number of new plants by the level of overall manufacturing activity in these counties, the results indicate that the rural share approximates their share of manufacturing generally. For example, rural counties accounted for 18 percent of manufacturing value added according to the 1987 Census of Manufacturers and received 21 percent of the new plants by foreign investors in our sample.

Returning our focus to the number of new plants in rural and urban locations, we see that the values of nearly every explanatory variable contributed to the higher levels of new foreign-owned plants in urban as opposed to rural locations.[29] Recall that our measures for population (POP), educational level (EDU), manufacturing density (MANDEN), and interstate highways (HIWAY) were all related positively to the number of new plants. Examining the mean values for these variables, one sees that for all variables except manufacturing density the urban value exceeds the rural value, thus placing urban counties at a relative advantage. Our measure for unit labor costs (ULC) is negatively related to the location of new plants. Since its mean value is higher in rural than in urban counties, rural counties tend to be at a disadvantage in attracting new foreign-owned plants based on this measure as well. This rural disadvantage exists despite nominal manufacturing wages in rural counties being nearly two dollars lower than in urban counties ($8.14 versus $10.10). Thus, relatively higher productivity in urban than in rural counties more than offsets this

[29] Since both state and local taxes as a share of gross state product (TAXGSP) and state employment in automobile assembly (AUTOEMP) are state-level variables, we exclude these variables from our county-level discussion.

difference in nominal wages. Overall then, rural counties only have an advantage over urban counties with respect to one county-level determinant, manufacturing density.

In addition to the mean values, the marginal effects of changes in the variables also differ between rural and urban counties. The marginal effects, which are based on the mean values in the two groups, differ because the estimated function is nonlinear. The estimated marginal effects are based on the model with POP, excluding the regional dummy variables. As one can see in table 6, the marginal effects in urban counties tend to be three to four times as large as in rural counties. Thus, in an urban county with mean urban values for all its determinants, marginal changes in these values will have much larger absolute effects than in a rural county with mean rural values.

The marginal effect of an interstate highway is not reported because the variable is a dummy variable. The results in table 4 suggest that having an interstate highway increases the number of new foreign-owned plants in a county by a factor slightly greater than 2 — *e* raised to the value of the highway coefficient — over the six-year period. For example, for a rural county in the Southeast with average rural values for all the other independent variables in model 3, the effect of an interstate highway increases the predicted number of new foreign-owned plants from 0.04 to 0.08 over the six-year period. A similar calculation for an urban county increases the predicted number of plants from 0.23 to 0.48.

VI. Conclusion

Foreign-owned manufacturing has been playing an increasingly larger role in the U.S. economy in recent years. At the same time, manufacturing employment in rural relative to urban counties has tended to either grow faster or decline less rapidly in most regions. The current study examines one aspect of the changing manufacturing environment — the location of new foreign-owned plants. Generally speaking, the location of new foreign-owned plants throughout the United States tends to respond to many of the variables thought to affect the profitability of locating in a particular area. For example, economic size, labor force quality, agglomeration economies, urbanization economies, and transportation infrastructure were all found to be positive, statistically significant determinants of location. Meanwhile, higher unit labor costs and taxes as a share of gross state product were found to deter foreign direct investment.

The states in the Southeast region have received more than proportionate shares of these new foreign-owned manufacturing plants. The chief advantages of this region stem from its high manufacturing densities and relatively low taxes as a share of gross state product.

Comparing urban with rural counties, one sees that the shares of new plants are roughly proportionate to their relative economic sizes. The results also point to a number of variables that account for the larger number of new plants planned for urban as opposed to rural counties. Not surprisingly, economic size is a significant factor in explaining statistically why more new plants were planned for urban rather than rural counties. In addition, nearly all the explanatory variables possessed average values for urban counties that were more favorable to foreign direct investment than the average values for rural counties. For example, the labor force was found to be relatively more productive and skilled in urban than in rural counties. Finally, the results indicate that the effects of marginal changes in the values of explanatory variables have much larger effects in urban than in rural counties.

An unanswered question is whether our results for 1989-1994 pertain to other time periods. Subsequent research will address whether the location determinants, or parameter estimates, change over time. Clearly, the level of aggregation in the present study does not allow for an examination of the possible differential behavior across industries and source countries, which may be useful to those interested in rural development. Future research will examine the location patterns existing in specific industries, especially those characterized as high technology. Such an examination will hopefully yield some insights on agglomeration economies. In addition, disaggregating by source country will hopefully generate some insights concerning the geographic preference of firms from individual countries.

References

Bernat, G. Andrew, Jr. 1996. "Manufacturing and Rural Economic Growth," manuscript for "The Rural Economy Heading into the 21st Century," presented at the Federal Reserve Bank of St. Louis, October 1996.

Butler, Margaret A. and Calvin L. Beale. 1994. *Rural-Urban Continuum Codes from Metro and Nonmetro Counties, 1993*, Agriculture and Rural Economy Division, Economic Research Service, U.S. Department of Agriculture, Staff Report No. 9425, September.

Cameron, A. Colin and Pravin K. Trivadi. 1986. "Econometric Models Based on Count Data: Comparisons and Applications of Some Estimators and Tests," *Journal of Applied Econometrics*, 1, 29-53.

Carlino, Gerald, Richard Voith and Brian Cody. 1994. "The Effects of Exchange Rate and Relative Productivity Changes on US Industrial Output at the State Level," *Urban Studies*, 31, 219-232.

Clark, Don P., W. Charles Sawyer and Richard L. Sprinkle. Forthcoming. "Regional Exchange Rates Indexes for the United States," *Journal of Regional Science*.

Cox, W. Michael and John K. Hill. 1988. 'Effects of the Lower Dollar on U.S. Manufacturing; Industry and State Comparisons," Federal Reserve Bank of St. Louis Reserve Bank of Dallas *Economic Review*, March, 1-9.

Coughlin, Cletus C., Joseph V. Terza and Vachira Arromdee. 1991. "State Characteristics and the Location of Foreign Direct Investment within the United States," *The Review of Economics and Statistics*, 73, 675-83.

______ 1990. "State Government Effects on the Location of Foreign Direct Investment," *Regional Science Perspectives*, 20, 194-207.

Dewenter, Kathryn L. 1995. "Do Exchange Rate Changes Drive Foreign Direct Investment?" *Journal of Business*, 68, 405-433.

Duffy, Neal E. 1994. "The Determinants of State Manufacturing Growth Rates: A Two-Digit-Level Analysis," *Journal of Regional Science*, 34, 137-162.

Fahim-Nader, Mahnaz and William J. Zeile. 1997. "Foreign-Direct Investment in the United States," *Survey of Current Business*, 77, 42-69.

Friedman, Joseph, Daniel A. Gerlowski and Jonathan Silberman. 1992. "What Attracts Foreign Multinational Corporations? Evidence from Branch Plant Location in the United States," *Journal of Regional Science*, 32, 403-18.

Glickman, Norman J., and Douglas P. Woodward. 1989. *The New Competitors*. New York: Basic Books.

______. 1987. *Regional Patterns of Manufacturing Foreign Direct Investment in the United States*. Report prepared for U.S. Department of Commerce, Economic Development Administration.

Head, Keith, John Ries and Deborah Swenson. 1995. "Agglomeration Benefits and Location Choice: Evidence from Japanese Manufacturing Investment in the United States," *Journal of International Economics*, 38, 223-47.

______ 1994. "The Attraction of Foreign Manufacturing Investments: Investment Promotion and Agglomeration Economies," *NBER* Working Paper No. 4878.

Hervey, Jack L., and William A. Strauss. 1998. "A Regional Export-Weighted Dollar: An Examination of the Regional Impact of Exchange Rate Change," *International Regional Science Review*, 21, 79-98.

Hines, James R., Jr. 1996. "Altered States: Taxes and the Location of Foreign Direct Investment in American," *American Economic Review*, 86, 1076-1094.

Johnson, Kenneth P. 1995. "Redefinition of the BEA Economic Areas," *Survey of Current Business*, 75, 75-81.

Klier, Thomas H. 1995. "The Geography of Lean Manufacturing: Recent Evidence from the U.S. Auto Industry," Federal Reserve Bank of Chicago *Economic Perspectives*, 19, 2-16.

Kozlowski, Paul J., Andrew Solocha and Lori Dixon. 1994. "Attracting Foreign Direct Investment to States: Outcomes, Budgets, and Foreign Offices," *Regional Science Perspectives*, 24, 3-14.

Kozlowski, Paul J., and James K. Weekly. 1990. "Explaining Interstate Variations in Foreign Direct Investment in the United States," *Regional Science Perspectives*, 20, 3-25.

Kravis, Irving and Robert Lipsey. 1982. "The Location of Overseas Production and Production for Export by U.S. Multinational Firms," *Journal of International Economics*, 12, 201-223.

Luger, Michael I., and Sudhir Shetty. 1985. "Determinants of Foreign Plant Start-ups in the United States: Lessons for Policymakers in the Southeast," *Vanderbilt Journal of Transnational Law*, 18, 223-45.

Ondrich, Jan and Michael Wasylenko. 1993. "*Foreign Direct Investment in the United States,*" Kalamazoo, MI: Upjohn Institute.

Smith, Donald F. Jr., and Richard Florida. 1994. "Agglomeration and Industrial Location: An Econometric Analysis of Japanese-affiliated Manufacturing Establishments in Automotive-related Industries," *Journal of Urban Economics*, 36, 23-41.

Thomsen, Stephen. 1995. "The Location of Production for Export by U.S. Manufacturing Firms in Europe: The Role of Agglomeration Benefits," in *Geography and Direct Investment: The Activities of Multinational Enterprises in* Europe, Ph.D. thesis, Graduate Institute of International Studies, Geneva.

U.S. Department of Commerce, Bureau of Economic Analysis. 1985. *Foreign Direct Investment in the United States: Operations of U.S. Affiliates, 1977-1980,* Washington DC: U.S. Government Printing Office.

U.S. Department of Commerce, International Trade Administration. 1991. *Foreign Direct Investment in the United States — 1989 Transactions*, Washington DC: U.S. Government Printing Office. (Also publications for 1990, 1991, 1992, 1993 and 1994.)

Wheat, Leonard F. 1986. "The Determinants of 1963-77 Regional Manufacturing Growth: Why the South and West Grow," *Journal of Regional Science*, 26, 635-659.

Woodward, Douglas P. 1992. "Locational Determinants of Japanese Manufacturing Start-ups in the United States," *Southern Economic Journal*, 58, 690-708.

Table 1 New Foreign-Owned Manufacturing Plants by State					
State	**Number of Plants**	**Share of Plants**	**Share of Gross State Product**	**Share of Plants/Gross State Product**	**Rank**
Alabama	8	2.11%	1.30%	1.62	11
Arkansas	2	0.53	0.71	0.75	21
Arizona	2	0.53	1.27	0.41	34
California	34	8.95	13.65	0.66	24
Colorado	5	1.32	1.32	0.99	19
Connecticut	1	0.26	1.78	0.15	40
Delaware	3	0.79	0.35	2.24	6
Florida	7	1.84	4.48	0.41	35
Georgia	19	5.00	2.55	1.96	9
Iowa	8	2.11	1.00	2.11	8
Idaho	0	0.00	0.33	0.00	42/48
Illinois	9	2.37	5.03	0.47	32
Indiana	17	4.47	2.08	2.15	7
Kansas	5	1.32	0.93	1.41	13
Kentucky	22	5.79	1.24	4.66	1
Louisiana	4	1.05	1.62	0.65	25
Massachusetts	3	0.79	2.97	0.27	38
Maryland	4	1.05	2.01	0.52	29
Maine	1	0.26	0.43	0.61	26
Michigan	19	5.00	3.63	1.38	16
Minnesota	1	0.26	1.85	0.14	41
Missouri	6	1.58	1.94	0.82	20
Mississippi	2	0.53	0.73	0.72	22
Montana	0	0.00	0.26	0.00	42/48
North Carolina	35	9.21	2.57	3.59	3
North Dakota	0	0.00	0.21	0.00	42/48
Nebraska	1	0.26	0.60	0.44	33
New Hampshire	1	0.26	0.45	0.58	27
New Jersey	7	1.84	3.88	0.47	31
New Mexico	3	0.79	0.49	1.61	12
Nevada	3	0.79	0.56	1.41	14
New York	11	2.89	8.71	0.33	37
Ohio	22	5.79	4.16	1.39	15
Oklahoma	1	0.26	1.04	0.25	39
Oregon	10	2.63	1.02	2.58	5
Pennsylvania	7	1.84	4.53	0.41	36
Rhode Island	1	0.26	0.39	0.68	23
South Carolina	18	4.74	1.15	4.12	2
South Dakota	0	0.00	0.23	0.00	42/48
Tennessee	20	5.26	1.78	2.96	4
Texas	27	7.11	6.85	1.04	18
Utah	0	0.00	0.56	0.00	42/48
Virginia	17	4.47	2.58	1.74	10
Vermont	0	0.00	0.21	0.00	42/48
Washington	9	2.37	1.98	1.20	17
Wisconsin	4	1.05	1.83	0.58	28
West Virginia	1	0.26	0.53	0.50	30
Wyoming	0	0.00	0.23	0.00	42/48

Table 2
New Foreign-Owned Manufacturing Plants by Region

Region	Number of Plants	Share of Plants	Share of Gross State Product	Share of Plants/Gross State Product
New England	7	1.84%	6.23%	0.30
Mideast	32	8.42	19.49	0.43
Great Lakes	71	18.68	16.73	1.12
Plains	21	5.53	6.76	0.82
Southwest	33	8.68	9.65	0.90
Rocky Mountain	5	1.32	2.70	0.49
Far West	56	14.74	17.21	0.86
Southeast	155	40.79	21.24	1.92
Total	380	100.00	100.00	1.00

Table 3
Data Summary

	Mean	Expected Sign	Source
NPFDI Foreign direct investment in new plants (n=366)	0.16		International Trade Administration
MARKET Total personal income (Thousand $) per manufacturing employee for the economic area in which the county is located (ECONA)	212.28	+	U.S. Bureau of Economic Analysis and Census of Manufacturers
INCOME-EA Total personal income (Bill $) for the economic area in which the county is located (ECONA)	49.23	+	U.S. Bureau of Economic Analysis
INCOME-C Total personal income (Bill $) (CNTY)	1.84	+	U.S. Bureau of Economic Analysis
POP Population in thousands (CNTY)	100.43	+	U.S. Bureau of the Census
ULC Production worker's average hourly wage ($/hrs) divided by average productivity in manufacturing multiplied by 10 (CNTY)	1.90	-	U.S. Bureau of the Census and Census of Manufacturers
WAGE Average hourly wage of production workers in manufacturing (CNTY)	8.70	-	Census of Manufacturers
PROD Value added in thousands in manufacturing divided by the number of manufacturing employees (CNTY)	51.76	+	Census of Manufacturers – 1987
EDU Percent of population 25 and over with at least a H.S. diploma (CNTY)	69.66	+	U.S. Bureau of the Census
MUNION Percent of manufacturing employment that is unionized (STATE)	19.79	-	Statistical Abstract of the United States
UNRATE Unemployment rate (CNTY)	6.79	?	U.S. Bureau of the Census
MANDEN Manufacturing employees as a percent of labor force (CNTY)	19.59	+	U.S. Bureau of the Census
AUTOEMP Employment in automobile assembly in thousands (STATE)	10.87	+	U.S. Bureau of Labor Statistics
PROPTAX Per capita property taxes (CNTY)	362.99	-	U.S. Bureau of the Census
TAXGSP State and local taxes as a percent of state GSP (STATE)	9.31	-	Data Resources, Inc. (state and local taxes) and U.S. Bureau of Economic Analysis (Gross state product)
HIWAY Counties with interstate highway = 1; other counties = 0 (CNTY)	0.48	+	ArcView
EHIWAY Counties east of IL, MS, and the Tennessee River in KY and TN with the interstate highway = 1; other counties = 0 (CNTY)	0.26	+	ArcView
OFFICE Number of foreign offices (STATE)	2.73	+	National Association of State Development Agencies, State Export Program Database
STAFF Number of staff employed in foreign offices (STATE)	18.27	+	National Association of State Development Agencies, State Export Program Database
POPDEN Population per square km of land (100s per sq km) (CNTY)	10.54	+	U.S. Bureau of the Census

URBAN Counties in metropolitan statistical areas = 1; other counties=0 (CNTY)	0.28	+	ArcView
BEALE Urban/rural continuum from zero to nine (CNTY)	5.04	-	U.S. Department of Agriculture
PBLACK Percent of county population that is black (CNTY)	9.96	?	U.S. Bureau of the Census
CLIMATE Average January temperature in state's major city (STATE)	33.60	+	National Weather Service
ECOAST1 Counties in states bordering Atlantic Ocean = 1; other counties = 0 (STATE)	0.29	+	ArcView
ECOAST2 Counties in states below New England bordering Atlantic Ocean = 1; other counties = 0 (STATE)	0.27	+	ArcView
ECOAST3 Counties in states below Maryland bordering Atlantic Ocean = 1; other counties = 0 (STATE)	0.19	+	ArcView
NE - NEW ENGLAND CT, ME, MA, NH, RI, VT = 1; other states = 0		?	U.S. Bureau of Economic Analysis
ME – MIDEAST DE, MD, NJ, NY, PA = 1; other states = 0		?	U.S. Bureau of Economic Analysis
GL - GREAT LAKES IL, IN, MI, OH, WI = 1; other states = 0		?	U.S. Bureau of Economic Analysis
PL - PLAINS IA, KS, MN, MO, NE, ND, SD = 1; other states = 0		?	U.S. Bureau of Economic Analysis
SW - SOUTHWEST AZ, NM, OK, TX = 1; other states = 0		?	U.S. Bureau of Economic Analysis
RM - ROCKY MOUNTAIN CO, ID, MT, UT, WY = 1; other states = 0		?	U.S. Bureau of Economic Analysis
FW - FAR WEST CA, NV, OR, WA = 1; other states = 0		?	U.S. Bureau of Economic Analysis
SE - SOUTHEAST - base AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA, WV		?	U.S. Bureau of Economic Analysis

Table 4 Negative Binomial Regression Results (1989-1994)			
Variable	1. Coefficient (t-statistic)	2. Coefficient (t-statistic)	3. Coefficient (t-statistic)
Constant	-4.10* (-3.12)	-5.26* (-4.58)	-5.47* (-4.77)
MARKET	-0.27E-02 (-1.79)		
INCOME – C		0.06* (7.93)	
POP			0.15E-02* (8.23)
ULC	-0.33* (-2.31)	-0.35* (-2.46)	-0.38* (-2.71)
EDU	0.05* (3.97)	0.06* (4.74)	0.06* (5.05)
MANDEN	0.03 (1.78)	0.04* (3.66)	0.05* (4.24)
AUTOEMP	0.69E-02* (2.76)	0.55E-02 (1.58)	0.52E-02 (1.42)
TAXGSP	-0.21* (2.36)	-0.22* (-2.47)	-0.24* (-2.60)
HIWAY	0.93* (4.37)	0.79* (3.88)	0.72* (3.58)
URBAN	1.53* (7.12)	1.13* (5.50)	1.06* (5.29)
NE	-0.97 (-1.49)	-1.61* (-2.45)	-1.50* (-2.28)
ME	0.04 (0.09)	-0.56 (-1.50)	-0.50 (-1.36)
GL	-0.70* (-2.69)	-0.94* (-3.48)	-0.95* (-3.55)
PL	-0.73* (-2.28)	-0.91* (-2.95)	-0.89* (-2.91)
SW	-0.20 (-0.67)	-0.85* (-2.55)	-0.91* (-2.68)
RM	-1.26 (-1.88)	-1.59* (-2.51)	-1.59* (-2.53)
FW	0.48 (1.30)	-0.29 (-0.93)	-0.32 (-1.00)
Alpha	2.68* (6.16)	1.87* (5.64)	1.81* (5.73)
-Log Likelihood	821.2	773.1	783.9
-Restricted Log Likelihood	907.5	850.3	867.3
Likelihood Ratio	172.6	154.3	166.6
Significance Level	0.000	0.000	0.000
Sample Size	2316	2272	2316

* Statistically significant at the .05 level (two-sided)

Table 5
Mean Values (Ranks) by Region of Location Determinants*

	Determinants								
Region	**INCOME-C**	**POP**	**ULC**	**EDU**	**MANDEN**	**AUTOEMP**	**TAXGSP**	**HIWAY**	**URBAN**
New England	4.67 (3)	211.89 (3)	1.88 (4)	78.95 (2)	18.28 (3)	0.34 (7)	10.15 (7)	0.74 (1)	0.44 (2)
Mideast	5.23 (2)	247.94 (2)	1.87 (3)	75.13 (4)	18.00 (4)	2.41 (6)	11.12 (8)	0.67 (2)	0.60 (1)
Great Lakes	1.83 (4)	102.44 (4)	1.86 (2)	74.46 (5)	23.00 (2)	44.31 (1)	9.77 (6)	0.50 (6)	0.30 (4)
Plains	0.74 (8)	42.90 (8)	1.90 (6)	74.61 (6)	16.52 (5)	6.55 (2)	9.50 (4)	0.35 (8)	0.15 (8)
Southwest	1.58 (5)	100.39 (5)	1.96 (7)	67.44 (7)	12.57 (7)	5.47 (3/4)	8.74 (2)	0.53 (4)	0.26 (5)
Rocky Mountain	0.97 (7)	60.35 (7)	2.13 (8)	80.68 (1)	10.75 (8)	0.10 (8)	9.49 (3)	0.58 (3)	0.18 (7)
Far West	5.98 (1)	310.88 (1)	1.83 (1)	78.02 (3)	13.58 (6)	5.47 (3/4)	9.66 (5)	0.51 (5)	0.41 (3)
Southeast	0.98 (6)	61.81 (6)	1.88 (5)	62.01 (8)	23.23 (1)	3.55 (5)	8.68 (1)	0.44 (7)	0.26 (6)

* The means for each variable are calculated as the simple average of the county values. Consequently, the regional mean value for a variable such as population density need not equal the overall population density for the entire region. A ranking of one indicates a value that is most favorable in terms of the number of new plants located in the region. Thus, for positive determinants the highest value is ranked one, while for negative determinants the lowest value is ranked one.

Table 6
Rural and Urban Means and Marginal Effects of County-level Variables

	Mean		Marginal Effect	
Variable	**Rural**	**Urban**	**Rural**	**Urban**
NPFDI	0.05	0.44		
POP	29.00	280.80	0.0001	0.0004
ULC	1.95	1.76	-0.0259	-0.1027
EDU	67.25	75.76	0.0028	0.0111
MANDEN	20.34	17.69	0.0024	0.0095
TAXGSP	9.24	9.48	-0.0168	-0.0665
AUTOEMP	11.02	10.48	0.0001	0.0004
HIWAY	0.35	0.80	*	*

* The marginal effect is not reported because a marginal change is not possible, since a county either has an interstate highway or it does not.

Figure 1

The Spatial Distribution of FDIUS

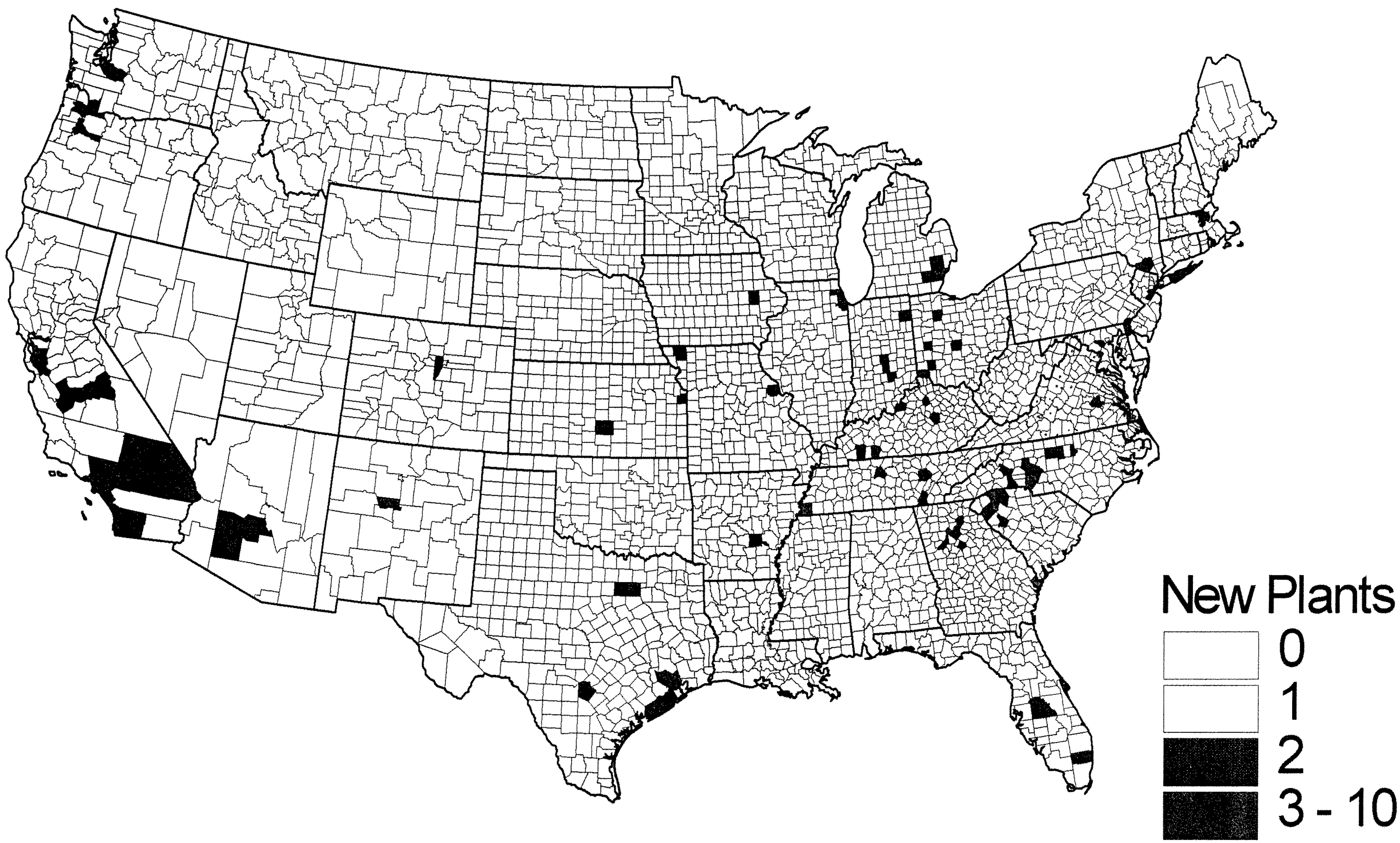

Figure 2

BEA Economic Areas

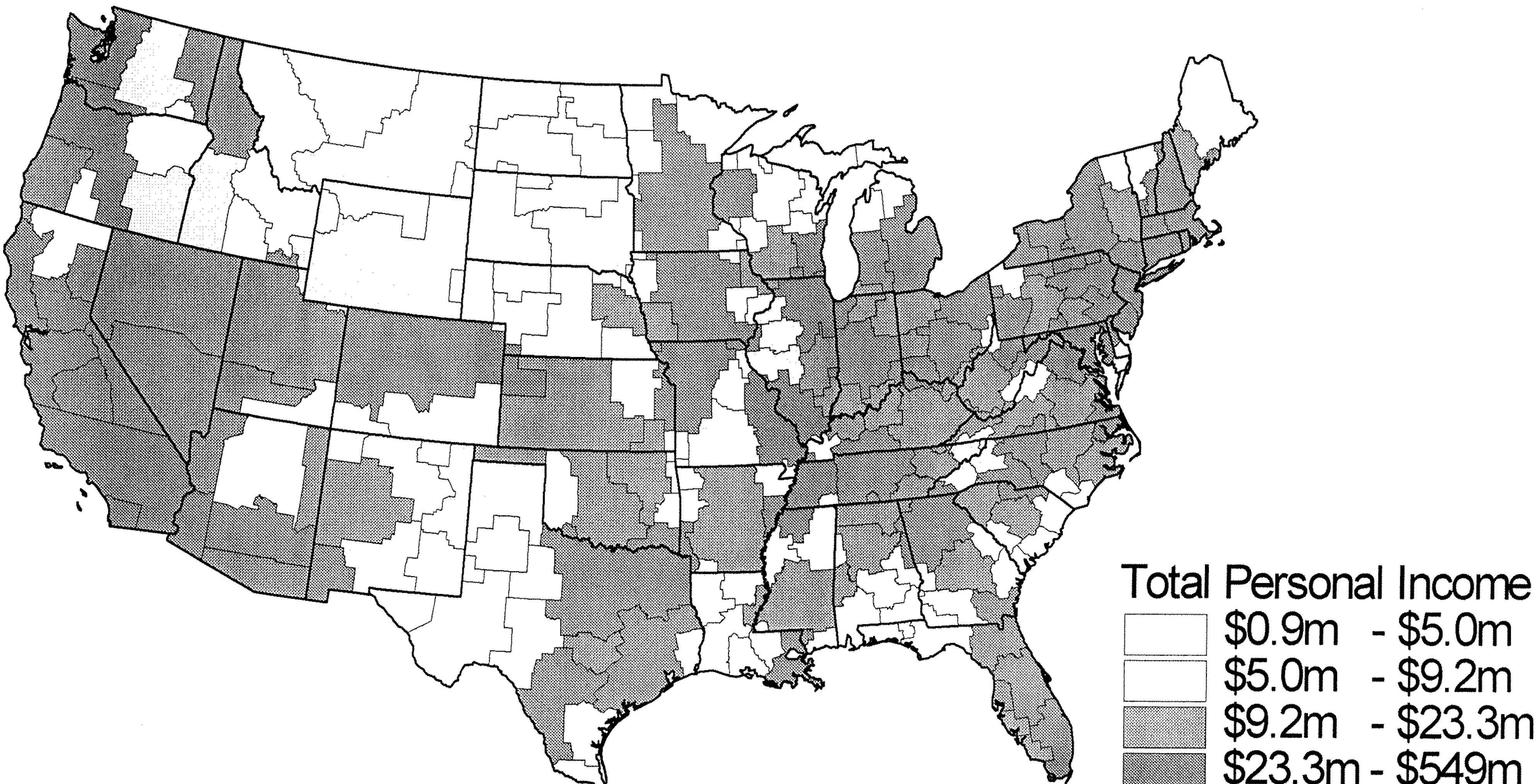

Figure 3

FDIUS - Model Sample