# What Attracts High Performance Factories?
# Management Culture and Regional Advantage

**Peter Doeringer**

Boston University

**Christine Evans-Klock**

International Labor Organization

**David Terkla**[1]

University of Massachusetts Boston

Classification Code: R3, R58: Management Practices and Firm Location

Abstract: National data and case studies are used to test the importance of management practices, particularly high performance practices, on the location decisions of new manufacturing plants. We find that plants with high performance management cultures rely on different criteria when making their location decisions, and also weigh standard location criteria differently, than those plants that are managed in more traditional ways. Omitting management culture from studies of business location may, therefore, result in biased estimates of the importance of various traditional location factors. By more accurately specifying location models for manufacturing plants with high performance management cultures, we are able to offer new insights for regional development policy.

[1] Department of Economics, University of Massachusetts Boston, 100 Morrissey Blvd., Boston, MA 02125-3393. Email: David.Terkla@umb.edu; Phone: 617-287-6952; Fax: 617-287-6976

Business location is traditionally analyzed within an economic framework where firms maximize profits subject to location-specific cost constraints such as wage rates, business taxes, and access to transportation networks (Herzog and Schlottmann, 1991; Bartik, 1991; Newman and Sullivan, 1988; Wasylenko, 1997). Apart from the occasional study that looks at differences between large and small firms, or among technologies (Schmenner, et al., 1987), plant-level "managerial" differences in location choices are rarely explored (Chapman and Walker, 1987; Schmenner, 1982).

This neglect of management is understandable in older studies of business location when managers followed similar strategies for minimizing production costs. However, there is a recent literature showing that management practices are becoming more differentiated as some firms opt to replace traditional management approaches with "high performance management" cultures that are built around investments in employee training and problem solving. These high performance cultures emphasize production flexibility and dynamic efficiency, which allow firms to respond quickly to changing market environments, participate in just-in-time supply relationships, and raise labor productivity over time (Appelbaum, et al., 2000; Mowery, 1999; Freeman and Kleiner, 2000; Black and Lynch, 1997, 1999; Capelli, 1999; Mohrman, Galbraith and Lawler, 1998).

Firms operating under traditional management cultures define regional advantage and make location decisions using factors that are typically included in the standard models of business location. However, we hypothesize that firms that have high performance management cultures might choose a different set of location criteria. For example, the importance of agglomeration economies may be enhanced for firms participating in just-in-time supply networks while an emphasis on workforce training and problem-solving might lead firms to locate where labor is easy to train and willing to collaborate with management, rather than where wages are lowest. Differentiating "regional advantage" by type of management culture has been noted previously in the context of electronics firms in Silicon Valley and Route 128 (Saxenian, 1994), but this study presents the first more general test of this proposition.

Our test compares the location choices of manufacturing plants that have traditional management cultures with those that have adopted newer "high performance management" cultures. We link detailed data on management practices and cultures from a small-scale survey of new manufacturing plants to a unique national database on the location of new manufacturing plants. Using conditional logit procedures, we find that plants with high performance management cultures rely on different criteria when making their location decisions, and also weigh standard location criteria differently, than those plants that are managed in more traditional ways. Omitting management culture from studies of business location may, therefore, result in biased estimates of the importance of various traditional location factors. By more accurately specifying location models for manufacturing plants with high performance management cultures, we are able to offer new insights for regional development policy.

**Management Cultures and the Location of New Manufacturing Plants**

In order to understand the relationship between management cultures and plant location, we conducted in-depth case studies of a sample of 48 new manufacturing plants that began operation between 1978 and 1989. The sample was drawn randomly from a universe of new U.S. branch plants owned by U.S. and Japanese multinationals in three 2-digit industries – rubber and plastic products (SIC 30), electrical equipment (SIC 35), and non-electrical machinery (SIC 36). The plants were located in five states (Georgia, Kentucky, New York, New Jersey, and Massachusetts) within three regions. (see Doeringer, Evans-Klock, and Terkla, 2002 for a more detailed description of these studies).

This mix of industries and states covers a wide range of location environments and products and technologies from relatively low skilled, labor-intensive, mass production (wire cable assembly) to intermediate-skilled, assembly line technologies (circuit boards and automobile dashboards), to high skilled, batch production technologies (cutting tools) and location environments. Japanese transplants were oversampled because they are known to have high performance management cultures, as evidenced by their high rates of adoption of high performance management practices (Kenney and Florida, 1993; Abo, 1994; Fucini, 1990; Florida and Jenkins, 1996).

Interviews were conducted on-site in the early 1990s. Plant visits typically lasted one half-day or more to allow ample time for detailed data to be collected. Interviews were conducted with senior plant managers, human resources and personnel managers, and production supervisors. We compiled detailed information on the plant location decision, management practices (such as compensation, training, and work organization), and the management cultures under which these practices operate.

**Management Practices and Management Cultures**

The plants in our sample made widespread use of management practices that are associated with high performance management cultures (Appelbaum, et al., 2000). Intensive training is the most common high performance practice, with 90% of the sample providing substantial job entry training and over two-thirds also providing technical training. Worker participation in problem solving is a close second, with over three-quarters of the plants holding regular meetings with workers to solve production and quality control problems and half using formal quality circles to promote continuous improvements in productivity. Almost 70% of the sample is involved in just-in-time supply relationships. Such utilization rates were quite high compared to older manufacturing plants (Osterman, 1994) and could signify that high performance management cultures are a nearly universal characteristic of new plants.

However, our interviews show that most branch plants of U.S. companies typically retain their traditional management cultures when adopting these practices whereas the new Japanese-owned plants almost universally have high performance management cultures. As a group, Japanese plants adopt many high performance management practices at statistically significantly higher rates than their counterpart domestic plants (Table 1), they use combinations of these practices more frequently, and they integrate these practices fully into their overall production and decision making processes.

Regardless of the particular product and production process, the Japanese plants devote more resources to identifying hard-to-observe workforce qualities such as flexibility, teamwork, loyalty, motivation, and problem-solving capacity than do domestic startups. Once hired, workers in Japanese transplants are immediately given a broad overview of the production process, followed by intensive training in technical skills, multiple job skills, and in how to contribute to continuous organizational improvement. U.S.-owned plants often provide substantial technical and on-the-job training, but job orientation in the domestic plants deals mostly with bureaucratic personnel matters, on-the-job training is limited to a single skill, and there is little effective involvement of employees in problem solving.

Even more dramatic evidence of these differences is that the Japanese plants treat improvements in productivity and quality as a collective responsibility of both workers and managers that operates within a labor-management culture of collaboration and commitment. Managers of domestic plants often report a similar interest in promoting teamwork and employee responsibility for quality and productivity, and they often use a variety of arrangements (ranging from quality circles to one-on-one discussions) for soliciting employee opinions. However, the interviews reveal that U.S. managers are less committed than managers of Japanese transplants to relying on employee problem solving, sharing authority and power with workers, and using commitment incentives (such as job guarantees) to motivate production workers. Instead, managers of new domestic plants tend to favor relatively traditional workplace cultures in which quality and cost are "control" functions that are rooted more in technology, engineering design, and the direct costs of factors of production than in the commitment and productivity of the workforce. They also view problem-identification and problem solving as management prerogatives, rather than as responsibilities to be shared with employees.

This distinction between traditional management cultures that focus on cost control and managerial authority and high performance management cultures that emphasize collaboration and commitment is a common theme from all of our plant interviews. These findings are also consistent with the international literature on the use of high performance management practices among Japanese firms (Kenney and Florida, 1993; Doeringer, Evans-Klock, and Terkla, 1998; Crowther and Graham, 1988; Munday, 1990; Elger and Smith, 1998; Sako, 1994; White and Trevor, 1983; Bourguignon, 1993).

This difference in management cultures translates into real differences in terms of economic development potential. Even after controlling for differences in management practices and other determinants of performance, the culture of Japanese transplants accounts for a 10 percentage point increase in annual employment growth, or roughly three times the effect of the average high performance management practice (Doeringer, Evans-Klock, and Terkla, 2002).

**Management Culture and Business Location**

Location decisions for both types of cultures involve many of the same considerations that are identified in the traditional plant location literature. However, there are also differences that are strongly correlated with culture.

For example, both management cultures prefer locations where unions are weak. However, the Japanese transplants associate unions with adversarial labor-management relationships and difficulties in developing a collaborative workforce while the U.S. owned plants avoid unions because of upward pressure on wages and the possibility of strikes. Similarly, both types of management cultures value a high quality labor force, however domestic startups measure labor quality in terms of formal education while Japanese startups define quality by workforce attitudes that favor problem solving and cooperation with management.

The case studies are geographically limited and too few to test these location differences empirically. Nevertheless, they show such a strong positive correlation between high performance management cultures and startups owned by Japanese multinationals across a variety of industries and regions that nationality of ownership can be used as an instrument for capturing differences in management culture, and thus provide a means for indirectly testing these relationships on a national sample of new plants.

Relying on Japanese ownership as a proxy for the presence of a high performance management culture allows us to test for differences in location decisions, using a national database we compiled on the location of new manufacturing plants. Our testing strategy is to posit both a "standard" location model that incorporates traditional location factors and a new "high performance" location model that reflects the findings from our case studies of Japanese-owned startups. We then determine which of these models best characterizes the location decisions of the new domestic and Japanese-owned plants in the national database.

**Competing Models of Business Location**

The most widely accepted approach for studying business location is the conditional logit model (McFadden, 1981; Maddala, 1983). In this model, startups make discrete, either-or choices of whether or not to locate in each state, based upon a set of state attributes that determines the profitability of location (Schmenner, Huber, and Cook, 1987; Bartik, 1985; Coughlin, et al, 1991; Friedman, et al, 1992). Each of the 48 continental United States represents a different combination of costs and attractions to the plant. The model assumes that the plant will select the location that maximizes its profits, given its production function and where its markets are located.

The profitability of a firm locating plant (i) in state (j) can be formally expressed as:

$$\pi_{ij} = \beta' X_j + \varepsilon_{ij} \qquad (1)$$

where $\pi_{ij}$ is the profits to be obtained by a plant being located in each state (j); X is a vector of relevant characteristics of state (j); β is a vector of coefficients indicating the relative weight of each of these characteristics; and ε is a term representing any unobserved (to the researcher) location factors and random errors. Choosing state (j) results in the maximum achievable profits relative to alternative locations.

The probability that state (j) is selected follows the rule:

$$\text{Prob}\ (\pi_{ij} > \pi_{ik})\ \text{for all}\ k \neq j\ . \qquad (2)$$

Assuming the error term ($\varepsilon_{ij}$) is "Weibull" distributed, a simple probability model of plant (i) being located in state (j) that meets this rule is:

$$\text{Prob (ij)} = \frac{e^{\beta' X_j}}{\Sigma_k e^{\beta' X_k}} \qquad (3)$$

where k=1...48 states.[2] Equation (3) can be estimated using maximum likelihood procedures incorporated into what is commonly referred to as McFadden's conditional logit model in which the factory location decision is "conditioned" on the cost attributes of all 48 alternative state locations (Maddala, 1983).

The state attributes (X's) in this model can also be modified to reflect how the attractiveness of state attributes may vary according to plant and industry characteristics (Schmenner, Huber and Cook, 1987). For example, the influence of unionization may depend on whether the plant is connected to the auto industry or the apparel industry, or the importance of the quality of education institutions may depend on the type of technology and skills used in the production function. These types of interactions moderate the weights in the ($\beta$) vector of coefficients in equation (3) and can be incorporated into the discrete choice model, as shown in Equation (4)

$$\pi_{ij} = \beta' X_j + \Sigma_n \beta_n' X_j Z_{in} \qquad (4)$$

where X is the vector of state attributes, $\beta'$ reflects the weight of each state attribute, $Z_n$ is a vector of plant characteristics 1...N, and the $\beta_n'$ account for the moderating impact of the plant characteristics (Z) on the influence of state attributes (X).

[2] In order to estimate the probability of a startup factory being located in state (j), a distribution for the disturbance term ($\varepsilon$ in equation 1) must be defined (Greene,1993). If it is assumed that that the $\varepsilon_{ij}$ terms are independent and that they follow the Weibull distribution, it can be shown (McFadden, 1974) that $F(\varepsilon) = \exp(e^{-\varepsilon})$.Thirteen states received no Japanese plants during the study period (1978-88): DE, ID, KS, LA, MD, MT, NH, NM, ND, RI, SD, VT and WY. However, the influence of the attributes of these states on state choice is accounted for in the denominator of equation (3).

**The "Standard" Model of Business Location**

We define a "standard" business location model based on a core set of factors -- taxes, wages, labor quality, proximity to markets, accessibility of transportation networks, unionization, and agglomeration economies -- commonly found in econometric studies of plant location. The effects of many of these core variables, such as proximity to large markets, access to good transportation networks, agglomeration economies, size of state, and avoidance of unions are almost universally robust across studies of business location (Herzog and Schlottmann, 1991; Bartik, 1985; Levinson, 1996; Wasylenko, 1997; Plaut and Pluta, 1983; Schmenner, et al, 1987).

We also include other frequently used variables such as wage rates, measures of labor quality, and taxes, where the empirical results are less consistent in order to avoid omitting factors that may be important.[3] For example, Bartik's (1991) survey of econometric location studies concludes that wage differentials matter to business location while other studies find that wage effects are much less important than might be expected (Schmenner, et. al, 1987; Levinson, 1996) and common measures related to education investments rarely have their expected effect upon location choices (Bartik, 1985; Levinson, 1996; Schmenner, et al (1987).[4] Similarly, there is widespread empirical disagreement on the effects of taxes (Herzog and Schlottmann, 1991, Kieschnick, 1981, Crandall, 1993; Bartik, 1991; Wasylenko, 1997).[5] However, we have omitted industrial location incentives from the standard model because such incentives appear to have only

[3] The effects of these variables are sensitive to differences in the specification of the location model, the definitions of variables, the database, and the time period covered (Bartik, 1991; Wasylenko, 1997).

[4] There are several explanations for the lack of evidence supporting the belief that labor quality (as measured by education) affects location selection: difficulty in measuring education quality, time lags between the education paid for with current taxes and the quality of education provided in the past to workers currently in the labor market, and non-financial inputs that affect education quality, such as socioeconomic conditions and effectiveness of using public education resources (Bartik, 1997; Fisher, 1997).

[5] While estimates of the magnitude of tax effects vary widely, there is some evidence that the influence of taxes on location declined between the 1970s and the 1980s as effective rates of taxation among states converged (Carroll and Wasylenko, 1994). There are also indications that the negative effects of taxes on location can be offset by expenditures on infrastructure and education, but this finding has also been debated (Bartik, 1985,1991; Fisher, 1997; Bartik, 1985; Ondrich and Wasylenko, 1993).

a marginal effect on business location decisions (Luger, 1987; Fisher and Peters, 1998) and were rarely mentioned during our field research.

We classify these location factors into four categories: the labor market, market size and access, agglomeration economies, and fiscal policy. We also include a vector of regional dummy variables and control for the size of each state. (See Table 2 for the definitions and data sources for the explanatory variables.)

*Labor market factors*

Wage costs, the probability of the workforce being unionized, and the education level of the workforce are the standard measures of labor costs in the location literature. The WAGE variable used in our analysis is the average hourly wage of production workers, which captures variations among states in the average cost of the largest category of labor employed by startups in our case study sample. The share of manufacturing production workers that are unionized workers, UNION, is used to measure the strength of unions in each state and the probability of a plant being organized by a union.[6] Because high school graduates over 25 were the most common type of labor recruited by the startups in our case study sample, our education measure (HSGRAD) is the share of the population over 25 with a high school education, but no post-secondary education.

*Market size and Access*

Following Woodward (1992) and others, we have use a "gravity adjusted" market size variable (MARKET), defined as the amount of personal income in a state plus the personal income of all other states weighted by distance from the selected state to indicate relative proximity to product markets.[7] States with similar total income are

---

[6] States with lower rates of unionization among manufacturing production workers would offer more locales free of unionized plants and a relatively higher proportion of workers whose work experience is less likely to be in unionized plants. Thus, average unionization rate is selected as a more precise measurement of potential difficulty of finding plant sites with non-unionized workers than the alternative measurement of whether states have Right-to-Work laws.

[7] The gravity-adjusted potential market size is the sum of the state's personal income and personal income of all other states, weighted by distance: $MARKET_j = \Sigma_k(PI_k/d^2_{jk})$, where $PI_k$ is total personal income in state k and $d_{jk}$ is the distance in highway miles from the population center in the selected state j to the population center of state k (Woodward, 1992.) The distance to states with two principal metropolitan areas,

weighted differently under this measure, depending on the income of, and distance to, all other states.[8] Managers in our case study sample frequently identified access to the interstate highway network as important for receiving shipments and delivering their products and we use the number of miles of interstate highway per square mile of state land area (HIGHWAY) to capture this transportation effect.

*Fiscal policy*

Our measure of taxes (CORPTAX) is the percentage share of income retained by the firm after taxes (Moore, Steece, and Swenson, 1987; Bartik, 1985). This measure provides a more accurate estimate of potential tax costs than nominal tax rates, which often involve state-by-state differences in exemptions and definitions of taxable income.

*Agglomeration Economies*

The presence of other manufacturing companies, particularly supplier firms or those that contribute to the pool of trained labor in the state may provide a positive location externality for startup firms. We use a typical measure of such agglomeration externalities (AGGLOM) -- manufacturing production hours per 1000 acres of non-federally owned land (Wasylenko, 1997; Bartik, 1985).

*Control variables*

In order to control for omitted variables that may have a systematic influence on a plant's choice of states, without over-identifying the location model; a vector of regional dummy variables is included. These regional control variables should capture the affects of unmeasured attributes of states, such as workforce attitudes or cultural and social mores that are correlated within regions.[9] These regional variables also provide a test of

---

such as California and Pennsylvania, is calculated as the average of the two distances. The distance value used for each state's own market is unity.

[8] Many managers of Japanese plants also cite proximity to their main customer(s), usually other Japanese transplants, as a principal location determinant. This suggests that the MARKET variable in the standard and high performance management culture models, which measures proximity to general consumer markets, should be replaced by a variable that captures Japanese-specific markets. However, including such a variable reflecting the proximity of other Japanese transplants introduces too much endogeneity into the model.

[9] The assumption of the "independence of irrelevant alternatives" is made for computational convenience in the conditional logit model (McFadden, 1974). McFadden assumes that the error terms are distributed Weibull meaning that they are independent of the other alternatives. In location models, this assumption

whether important location factors have been omitted from either the standard or high performance management models. We also include LAND, defined as the total number of acres of non-federally owned land in each state, to control for the "dartboard theory" of industrial location, which is that the larger the size of the state, the higher is the probability of businesses finding suitable sites in the state (Bartik, 1985).

**The High Performance Management Culture Model**

We know of no studies that have explicitly tested for the effects of high performance management cultures on location. However, several studies have looked at the location of Japanese-owned plants and their results are consistent with our case study findings. This literature shows that there is considerable overlap between the core location criteria used by domestic businesses and those of Japanese transplants (Kujawa, 1986; Yoshida (1987). Yoshida (1987) reports that Japanese transplants consider workforce quality, proximity to suppliers and markets, and low unionization as the most important location factors. Other studies confirm that market size and access are positively associated with the location of Japanese transplants (Haigh, 1990; Chernotsky, 1983; Woodward, 1992), as are agglomeration economies (Friedman, et al., 1992; Woodward, 1992; Head, et al, 1995). The positive effect of labor quality (as measured by education) is documented by Smith and Florida (1994) and by Woodward (1992).

But there are differences as well. A recent survey comparing the location decisions of Japanese and domestic firms finds that Japanese firms place a greater weight on transportation services and proximity to suppliers and less weight on taxes and development incentives, than do domestic firms (Ulgado, 1996).[10] Flexible and tractable labor are also featured prominently in some studies of Japanese plant location (Haitani

---

implies that if a company's profits are higher in North Carolina than they would be in a state in another region, such as Iowa, there is no reason to expect that they would also be higher if the firm were instead located in South Carolina than they would be in Iowa. However, there may be unmeasured factors within regions that make South Carolina more likely to be profitable than Iowa. Therefore, Bartik (1985) proposed including regional dummy variables to control for this problem as a computationally easier solution to the independence problem in conditional logit than the nested logit model used by McFadden (1981).

[10] This finding about the importance of development incentives, however, is contradicted by Kujawa (1986) who reports that industrial recruitment effort by government agencies was the most important location factor considered by Japanese transplants.

and Marquis, 1990; Milkman (1991), and this aspect of "labor quality" may explain why Japanese transplants often seek to locate in medium-sized towns and less-unionized rural areas that they believe offer ample quantities of labor with a "good work ethic" (Abo, 1994; Reid, 1989; Mair, Florida and Kenney, 1988.

The statistical evidence on the effects of wages and industrial recruitment incentives is more ambiguous. Friedman, et al. (1992) find a substantial negative effect of wages on location while Smith and Florida (1994) report that Japanese firms prefer counties with higher wages, even after controlling for education.[11] Friedman, et al (1992) find a large positive effect of state spending on efforts to attract foreign investors, while Woodward (1992) finds no effect, and one study finds that industrial recruitment efforts are valued by Japanese executives because they signal that state and local government can be counted on to resolve problems that might arise during the startup or later operation of the plant, rather than because of their economic value (Milward and Newman, 1989).[12]

Another thread running through the literature on Japanese plant location is that special location considerations may affect Japanese transplants in particular industries. Japanese auto suppliers, for example, often locate near specific Japanese auto assembly plants (Smith and Florida, 1994; Abo, 1994; Reid, 1989; Mair, Florida and Kenney, 1988; MacDuffie and Helper, 1999) in order to facilitate the scheduling and delivery

---

[11] These ambiguous findings may be explained by regional differences in industrial composition of the three econometric studies of Japanese plant location, in particular whether they exclude auto-part manufacturers (Friedman, et al, 1992) or include only plants connected to the auto industry (Smith and Florida, 1994). For example, Haitani and Marquis (1990) report that Midwestern Japanese companies put far less weight on wages and unionization than on labor quality or productivity in their location decisions, while Milkman (1991) finds that electronics firms in southern California sought low-wage and anti-union locations. There is also the possibility that local wages don't matter much because Japanese transplants tend to pay higher wages than either domestic firms or affiliates of other foreign-owned firms (Graham and Krugman, 1989).

[12] Woodward's model uses Luger's (1987) index of state industrial recruitment programs as a measure of recruitment effort. It also includes a dummy variable indicating whether the state had a development office in Japan in the early 1980s, which is likely to be correlated with the use of other industrial development policies. Direct financial incentives may actually be disdained because of the perceived expectation of reciprocal obligations (Nakabayashi, 1987). Kujawa (1986) and Yoshida (1987) reach similar conclusions about the relative unimportance of direct financial incentives, but Kujawa attributes it to low variance among states and localities in the availability of location subsidies for Japanese transplants.

requirements of just-in-time (JIT) supply relationships (Head, et al, 1995).[13] The high technology industry is also cited as having distinctive location concerns relating to the availability of technical workers or the desire to locate near major high technology research centers in order to gain access to state-of-the-art research. (Kenney and Florida, 1993).

In order to develop better insights into the regional location advantages valued by high performance management cultures, we augment the standard location model with additional state attributes that our field research and the location literature suggest are potentially important to the location decision of Japanese transplants (see Table 2). We then further refine this model by adding a set of firm-specific interactions.

*Additional State Attributes*

Japanese transplants often define workforce quality in terms of work ethic, the strength of ties to local communities that might deter turnover, and the absence of adversarial attitudes toward the employment relationship that are often associated with unions. It was suggested during our interviews that these qualities are more likely to be found in small communities outside of urban areas so we add the variable RURAL (defined as the percent of the state population living in non-urban areas). We also add EXPEDUC, state and local expenditures per pupil on education to the standard model to capture a further aspect of labor quality often mentioned by Japanese startups.[14]

In addition to highway access, Japanese transplants often mentioned proximity to a large international airport as a location advantage that facilitates commuting by executives between the branch plant and the company headquarters in Japan. Therefore,

---

[13] Head et al (1995) conclude that a state that experiences a 10 % increase in either U.S. or Japanese or keiretsu agglomeration increases its probability of future selection by 5-7 %, and that this effect is robust when controlling for state effects, time trends and industry-level stocks and flows of U.S. investment. The results for keiretsu agglomeration, however, hold only for auto-related plants. Latecomers report that they try to avoid locating in areas already dominated by Japanese firms (Reid, 1989).

[14] State and local expenditures on education per pupil are divided by the average salary for an occupation requiring college education (similar to requirements for teachers). With this adjustment, variation in EXPEDUC better reflects real differences across states in spending on education rather than differences in average costs. Because differences across states in teacher salaries would reflect differences in value placed on quality education as well as differences in cost of living, average salary for an occupation requiring similar four-year university training is used instead. This variable may also be interpreted more broadly as a proxy for the benefits to business from public services that are financed by state taxes.

the variable AIRPORT, calculated as the number of enplaned passengers per year in the state's principal airport hub, is included in the high performance management culture model.[15]

Climate is often noted as a location factor by the Japanese plants, and is sometime used in traditional models as well. Climate variables are often used as indicators of heating costs, weather conditions that facilitate delivery schedules, and quality-of-life for managers (Bartik, 1985; Schmenner, et al, 1987). In addition, managers of some Japanese plants said that they looked for a climate similar to that of their plant locations in Japan in order to avoid potential problems of bringing equipment from Japan to areas with substantially different temperature and humidity. JTEMP, the twenty-year average January temperature, is used to capture these effects.[16]

Three other state attributes are included as controls because they affect Japanese transplants, but not their U.S. counterparts. These are unitary taxes (UNITARY) that are collected on world profits, industrial recruiting offices located in Japan (JOF), and proximity to corporate offices and quality-of-life amenities for Japanese managers found in the New York City area (NYC).

*Firm-specific Interactions*

One key establishment characteristic that appears to influence the location of Japanese transplants is the size of the plant. Managers of large plants often mentioned their size and visibility as a target for union organizing campaigns. We test for this effect by interacting SIZE (measured by employment) with unionization and wages.

Japanese auto parts transplants reported that they often followed their Japanese automobile assembly customers who had located in the Midwest, despite its relatively high union density, and auto parts suppliers often engage in just-in-time supply networks with specific customers. These firm-specific relationships are particularly likely to

[15] An average was taken in states with two or more major international airports. The variable is not normalized by state population because probability of direct flights and convenient transfers increases with the actual number of passengers.

[16] Alternative measures, such as energy costs and energy costs weighted by mean average temperature, were included in other specifications of the model but were not significant individually and did not improve the explanatory power of the model.

modify the influence of unions, highway access, and proximity to large markets in determining the location of auto-related plants. To evaluate the importance of these auto industry effects, a binary variable, AUTO (indicates plants whose principal product is in the automotive sector) is interacted with three state attributes – unionization, proximity to markets, and access to interstate highways.[17]

Similarly, the field research suggests that new plants in high technology industries are likely to disproportionately favor states that make relatively higher expenditures on high school and technical education and will see states with large pools of "high school only" grads as having smaller pools of workers with post-secondary technical education. To test for these industry effects, a binary variable (HTECH) is used to identify establishments in high technology industries and is interacted with both HSGRAD and EXPEDUC.[18] We also interact HTECH with WAGE to allow for the possibility that the cost of production workers may be less relevant to the location of high technology plants, with their emphasis on technical skills, than in other industries.

**Testing For Whether Management Culture Affects Plant Location**

We analyze these differences using three conditional logit models -- the standard location model, a parsimonious high performance management culture model with additional state attributes, and a more elaborate high performance management culture model with additional firm-specific interactions. We estimate these models using a national database we constructed from panel data compiled by the Small Business Administration, which contains information on industry, plant size, and location for a

[17] The automotive industry plants in the Japanese data set are identified by their product description in the JEI report, rather than by their SIC code. Only one fourth of the plants producing auto-related products are classified in SIC 3714 (automotive parts) or SIC 3711 (auto assembly). The rest are distributed among electronics, instruments, rubber and plastic products, and even textiles (car seat fabric manufacturers). This same set of 4-digit SIC codes is used to identify domestic auto-related producers in the USEEM database.

[18] Startups are identified as high technology according to the definition devised by Markusen, et al (1986). "High technology" industries are those in which the proportion of engineers, technicians, computer scientists and other physical and life scientists exceeds the manufacturing average. Twenty-three 3-digit industry sectors, the least aggregated industrial grouping for which occupational data are available, are thus classified as high tech.

random sample of about 1,000 new domestic plants.[19] These data are available only for the period 1977-1988, which corresponds closely to the years covered by our case studies. A counterpart universe of 498 new manufacturing plants owned by Japanese multinational enterprises is drawn from detailed directories of U.S. manufacturing affiliates of Japanese firms, *Japan's Expanding U.S. Manufacturing Presence* published annually by the Japan Economic Institute (JEI). Information on various state-level location attributes has been merged with these plant data.

The descriptive statistics from this database clearly show that the spatial distribution of new Japanese transplants is very different from that of new domestic manufacturing plants. Japanese transplants are concentrated on the east and west coasts while domestic startups tend to cluster in the Midwest and New England and these differences are even more pronounced at the state level. California accounts for the largest share of both domestic and Japanese plants, but the share of Japanese plants is 50% larger (18.3% of Japanese plants compared to 12.8 % of the domestic plants). Chi-square tests of differences in the distribution across the 48 states, and within regions, between the domestic and Japanese plants confirm the statistical significance of this difference in plant location patterns (Table 3).

**Regional Advantage as Defined by the Standard Location Model**

The results for the sample of domestic startups are largely consistent with those in the literature, and are generally in accord with the findings of the field research for our sample of domestic startups (Table 4). Domestic startups are most likely to locate in states that have low levels of unionization and good access to interstate highways. Proximity to product markets and to agglomerations of other manufacturing plants also have positive effects on location. The significance of the LAND variable supports the "dart board" theory of business location.

---

[19] It is not possible to identify establishments owned by non-Japanese foreign corporations, so to be more exact, the "domestic" database is the non-Japanese set of manufacturing plants. Plants owned by Japanese firms are identified by cross-referencing JEI and Dun and Bradstreet data sets. The Dun and Bradstreet identifier numbers are found for the establishments listed in the JEI directory by consulting the D&B published lists of companies. Records in the USEEM database with these identifier numbers are then verified as the Japanese transplants, by comparing location, industry, and startup year with the JEI Report, and then they are deleted from the domestic database.

Three variables – education, wages, and corporate taxation -- fail to achieve statistical significance when this model is applied to domestic startups, but these results are not uncommon in the location literature (Schmenner et al, 1987; Levinson, 1996). In addition, none of the regional control variables is significant, suggesting that we have not omitted any key location variables for domestic startups that are correlated with regional factors.

The standard model, however, provides a much less satisfactory explanation for the location decisions of Japanese transplants (Table 4). Only the opportunity for agglomeration economies and the "dart board" effect of state size seem to influence the location of Japanese transplants. The standard model fails to show significant location effects for access to interstate highways, non-union environments, and the availability of a large labor pool of high school graduates, all of which were noted frequently by managers of Japanese startups in our sample. This model also yields the anomalous finding that high wages seem to be an attraction for Japanese-owned startups.

One obvious explanation for the failure of the standard model to yield as sensible results for Japanese transplants as it did for domestic startups is that important location criteria for Japanese transplants have been omitted from the model. This possibility is further supported by the statistical significance of two of the regional control variables.

**Redefining Regional Advantage For High Performance Management Cultures**

Adding the additional set of state attributes to the standard location model substantially increases its ability to explain the location decisions of Japanese startups (see Table 5, Columns 1 & 2). The incremental increase in the explanatory power of this model, when compared to the standard model, is significant at the 1% level and the regional control variables become insignificant for Japanese transplants.[20] There is no

[20] For the "unrestricted" high performance management model (column 2 in Table 5) and the "restricted" standard model (column 2 in Table 4), $-2 (L_R - L_U)$ is distributed chi-square, with degrees of freedom equal to the number of restrictions in the reduced model, i.e. the 7 additional parameters estimated for the high performance management culture model:

$(8941.73 – 8853.5) = 88.23 > X^2_{.01, 7} = 18.48$ (1% significance level).

comparable increase in the explanatory power of this model when applied to domestic startups.[21]

These differences highlight how management culture affects plant location. The most interesting distinction involves the labor quality variables. The fraction of the population that is rural, our measure of positive work attitudes, is a relevant location factor only for Japanese transplants. A one-percentage point increase in the share of rural population in a state increases the probability of location selection by over 6 %. The supply of workers with a high school education (HSGRAD) now has a positive effect on the location of Japanese, as well as domestic, startups, and the size of this effect on Japanese plants is larger than for domestic plants by a factor of three.[22] The estimated negative effects of unionization are increased for both types of management cultures, but a one percentage point increase in a state's average unionization rate decreases the location selection probability of Japanese transplants by almost 5 percent compared to a less than 2 % for domestic plants.

This expanded model also shows that the presence of an international airport (AIRPORT) influences the location choices of both Japanese and domestic plants. However, the estimated magnitude of the effect is five times higher for the Japanese transplants.

The climate variable (JTEMP) is also only statistically significant for the Japanese transplants, as is the presence of an industrial recruitment office in Japan and the New York City variable. However, the puzzling fact still remains that states that pay relatively high wages to production workers have a positive effect on the location of Japanese transplants, and this effect is even stronger than in the standard location model.

**Interactions With Plant and Industry Variables**

---

[21] -2 ($L_R$ - $L_U$) for the domestic startups is distributed chi-square with 7 degrees of freedom:

$(21808.51 - 21798.8) = 9.71 < X^2_{.1,7} = 12.02$ (10% significance level).

[22] To test whether the results on labor quality were sensitive to the specific measure of education adopted, alternative measures, including median years of education, percentage of the population with a high school education or higher, value-added per production worker, and the number of engineers measured as the proportion of the total number of employed persons in the state, were substituted for HSGRAD. In all cases, the signs of the coefficients were either nonsensical or the coefficient was insignificant.

The second specification of the high performance management culture model involves interacting plant and industry variables with selected core location factors (see Table 6 for variable definitions). These additional modifiers contribute significantly to the explanatory power of the model for both Japanese and domestic plants, when compared to the standard model, but the improvement is greatest for the Japanese transplants (see Table 5, Columns 3 & 4).[23]

For example, the effect of plant size on location operates primarily through its interaction with unionization and only applies to the location decisions of large Japanese transplants. This is again consistent with our case study findings showing that both Japanese and domestic startups seek to avoid unionization, that Japanese transplants are more sensitive to unionization than domestic startups, and that large and visible Japanese transplants are more concerned with the possibility of unionization than are domestic startups.

A second important result is that there are significant industry differences in regional advantage. Japanese transplants that supply the automobile industry or assemble vehicles exhibit different location strategies from both domestic auto industry startups and Japanese transplants in other industries. For example, the overall effect of unionization on plant location for both domestic startups and Japanese transplants is strongly negative. However, unionization is positively correlated with the location of Japanese transplants in the automobile industry (see the UNION*AUTO interaction in Table 5). A one-percentage point increase in the unionization rate (for a state at the mean value across all states) is associated with a 3 % increase in selection probability by auto plants compared to a 4.5 % decrease in selection probability for the average startup.[24]

---

[23] For both Japanese and domestic plants, the models with the plant modifiers are superior to those restricted to state attribute characteristics at the 1 percent significance level.

[24] If the influence of the plant characteristic is to intensify the importance of the location attribute, then the estimated coefficient would have the same sign as the state attribute variable it modifies. If the plant characteristic tempers its influence, then it would carry the opposite sign. The estimated effect of unionization rates on selection probability by auto-industry transplants is the sum of the coefficients on UNION and on UNION*AUTO.

This shows that the attractions of proximity to auto assembly plants outweigh the negative effects of unionization on location.

The distinctive relationship between Japanese transplants in the auto industry and location near major markets supports the importance of proximity for just-in-time supply relationships between parts suppliers and assembly plants. The estimated effect of the MARKET*AUTO interaction is insignificant for domestic startups, while it is significant and negative for Japanese auto suppliers. This shows that Japanese transplants are less sensitive to locating near large markets than are their domestic counterparts because they have more customer-specific supply relationships.[25] Similarly, general interstate highway networks in a state do not influence the location of either type of auto parts suppliers because it is the highway links and travel times to their specific customers that are likely to be most important to Japanese auto suppliers.[26]

There is also a distinctive location pattern for high technology startups. Both Japanese transplants and domestic startups in high-tech industries are attracted to states with relatively higher levels of educational spending. However, the negative sign of the variable measuring the size of the pool of workers with only a high school education points to both types of high tech startups steering away from states that have large supplies of workers with only high school degrees. Taken together, these two findings support the conclusion that high tech startups are more interested in the quality and availability of a well-educated workforce than are startups in other industries.

Both high tech Japanese transplants and high tech domestic startups, however, also exhibit the same puzzling location behavior with respect to wages as do Japanese

---

[25] Less significance to auto-industry plants is shown by the negative sign on the MARKET*AUTO variable and its high significance level (p=.003), indicating that the difference between the estimated coefficients for MARKET across all the Japanese transplants versus for auto-related plants is statistically significant.

[26] Access to interstate highways and proximity to markets are alternative ways of measuring market access. To illustrate this point for the case of auto suppliers, we dropped MARKET*AUTO from the high performance management culture model with plant characteristics. The result was that HIGHWAY*AUTO interaction became significant for both Japanese transplants and domestic startups.

transplants generally. Both types of high technology startups tend to prefer states where production workers are relatively highly paid.[27]

**Alternative Tests of the High Performance Models**

The econometric results from the high performance management culture models mirror quite closely the expectations from our case studies of the differences among the factors that govern the location of domestic startups and Japanese transplants. This correspondence between the field research and the econometric data provides independent validation of the case study findings. However, we also conducted two additional cross checks on our high performance management culture models to evaluate further the robustness of these findings.

One test added the industry and plant variables (SIZE, AUTO, and HITECH) to the high performance management culture model with state characteristics, without any interactions terms. This test would show if the results from interacting plant-specific factors with state attributes are an artifact of more pervasive differences in the location behavior of either automotive or high technology plants. None of these variables, however, achieves statistical significance in either the Japanese transplant or domestic startup estimations and the underlying patterns of the parameter estimates for the state attributes are not affected.

A second test was to estimate a "counterfactual" version of the high performance management culture model, which tests for interactions between industry and plant and state characteristics, but has no basis in our field research. In this counterfactual model, the three industry and plant characteristics are interacted with the key state attributes –

[27] While addition of plant modifiers clearly improves the high performance management culture location model and illuminates further how different types of startups define regional location advantages, two of the regional control variables (ESC and PAC) reemerge as significant in the case of Japanese transplants. This is not wholly surprising, given the disproportionately high shares of Japanese transplants in California (in the PAC region) and Kentucky (in the ESC region) when compared to domestic startups. One likely possibility is that the historical preference of Japanese transplants for locating in California because of its large Japanese population, cultural amenities, and proximity to Japan (Milkman, 1991) continues to be a factor in the location of Japanese transplants. As for the preference of Japanese transplants for locating in Kentucky, our interviews reveal that labor quality characteristics such as loyalty to firms and strong work ethic is a particularly important factor in locating in Kentucky. These labor quality factors appear to be incompletely captured by the RURAL variable.

UNION, WAGE, HSGRAD, EXPEDUC, MARKET, and HIGHWAY. The results of this test are largely nonsense. Many of the variables that we know from the location literature and our field research should be significant are not, or have the wrong sign.

Given these results, we conclude that the high performance management culture model containing the relevant plant modifiers identified by our case studies is a reasonably robust and accurate depiction of the decision process made by startups in determining where to locate their plants, and of differences between domestic and Japanese-owned startups that can be traced to different visions of what constitutes high performance management strategies.

**Discussion of the Findings**

The standard model of industrial location accurately characterizes the broad outlines of the location decisions of domestic startup factories with traditional management cultures, but it is not a good predictor of the location decisions of Japanese transplants with high performance management cultures. Production costs and proximity to markets, included in the standard model, are important determinants of location for domestic startups that are our proxy for the type of new manufacturing plant that is likely to adopt high performance management practices without changing its management culture.

However, because Japanese transplants adopt high performance management cultures, they are less likely to be concerned with traditional factor costs and more inclined to rely on high performance practices to raise factor productivity. The standard model is, therefore, far less capable of explaining the location decisions of Japanese transplants than of domestic startups.

The findings from the field research enable us to enrich the traditional standard location model by adding variables that better explain the location decisions of both Japanese transplants and domestic startups. Enlarging the standard model in this way allows us to include additional variables that improve our ability to explain the business location decisions of both types of startup plants.[28]

The additional state attribute variables, in particular, help to clarify other common factors that belong in the standard model for both types of plants. The presence of a major international airport, for example, is important for the location of domestic startups, as well as Japanese transplants. However, the influence of international airports on the location of Japanese transplants remains far larger than for domestic startups.[29] Similarly, the high performance management culture models show that both types of high technology startups have a distinctive set of location preferences.

The high performance management culture models also confirm that Japanese transplants take many of the same core cost factors into account as domestic startups, once the effects of key omitted factors are controlled for. However, these findings do not change the basic conclusion that new domestic factories rely more heavily on traditional cost and market criteria when making location choices than their Japanese counterparts.

The high performance management culture models, for example, show that Japanese transplants are much more strongly affected by measures of labor quality, such as education, stability, cooperativeness, and commitment than are the domestic startups. For example, the availability of a rural workforce is an important location consideration for Japanese transplants and its estimated effect is statistically insignificant for domestic firms. Similarly, the size of the high school labor pool and the low probability of unionization influence the location of Japanese transplants more strongly than for domestic startups.[30]

---

[28] The criterion for "best" is based on the statistical significance of larger models compared to restricted models (with fewer explanatory variables.) For the domestic startups and the Japanese transplants, the high performance management models with interactive terms significantly improved upon the explanatory power of the standard model.

[29] A 10 % increase in the number of persons using the largest state airport is associated with an 8.8 % increase in selection probability by Japanese firms compared to a 1.5 % increase in selection probability by domestic firms.

[30] The literature also reports that race may be a factor in the location of Japanese transplants (Cole and Deskins, 1988; Woodward, 1992), along with concerns with the incidence of poverty and urban social problems. The racial composition of the workforce was not mentioned as a location concern in the field

The plant modifier terms identified in our field research are also much more important for understanding the location of Japanese transplants than of domestic startups. Only three of the eight plant modifier terms were significant for domestic startups, compared to six for the Japanese transplants. Similarly, the location of Japanese transplants is sensitive to factors that uniquely affect Japanese transplants, such as the presence of industrial recruitment offices in Japan.

The one persistent result from this analysis that appears anomalous from the perspective of the traditional location literature is the positive effect of wages on location for Japanese transplants and for both types of high technology startups. While there are a few other studies that find a similar positive effect of wages on location, this finding has never been satisfactorily explained.

The fact that wage differences among states do not matter to many domestic startups is not surprising. Other studies have found that wages have a minimal effect on plant location and our location models already control for factors such as education, region, unionization that are highly correlated with the wages of production workers in manufacturing.  None of these considerations, however, explains why high wages should have a positive effect on the location of either Japanese transplants or high technology startups in general.

One explanation for this seeming anomaly that is consistent with the overall tenor of our discussions with the managers of new manufacturing plants is that some set of intangible labor quality factors that influence location choice are positively correlated with the average wage level in different states. One possibility is that states that pay high

research, and many Japanese transplants had ethnically diverse workforces. However, poverty and urbanization did come up in the context of crime and workplace conflict.

We explored the influence of these variables in a further set of high performance management culture models by explicitly introducing a series of narrowly defined variables intended to separate the influences of race, urbanization, and poverty. Racial was measured as the share of African-Americans in the non-urban population with incomes above the poverty line, and the poverty measure was defined as the percent of population living below the poverty line outside of urban areas. Race has a marginally significant influence on the location of Japanese transplants, but poverty did not and neither factor mattered to domestic startups. However, these factors are also correlated with the HSGRAD and RURAL variables and our methodology may not be able to capture the underlying relationships among these factors and location decisions.

wages, after controlling for other dimensions of labor quality such as education and unionization, have workers with hard-to-observe abilities that are highly valued by employers.

However, an even stronger candidate for explaining the importance of locating in high wage states is that labor productivity in these states is high because of efficiency wage payments. States that pay relatively high wages to manufacturing workers may also be those that are relatively well-endowed with firms that pay efficiency wages and use other performance incentives to motivate high labor productivity (Lang, Leonard, and Lilien, 1987; Katz and Summers, 1989).

The startups that adopt high performance management cultures may locate in high wage states because the labor pools in these states are likely to contain a high proportion of workers who have previously been employed at workplaces where such efficiency wage incentives are being used to raise productivity. In effect, the workforce "quality" that is attractive to these startups is derived from prior work experience in such firms. Our field research also shows that the labor force qualities engendered by efficiency wage incentives are identical to those that high performance workplaces seek to recruit and develop. For these reasons, high wages can be seen as the functional equivalent of rural and non-union locations as signals of workers that possess the kinds of work attitudes that are most productive under high performance management cultures.

## Acknowledgements

We wish to thank Kevin Lang (Boston University) and comments from various members of the research staff of the W.E. Upjohn Institute For Employment Research for helpful comments on this paper.

**References**

Abo, Tetsuo, (ed.) Hybrid Factory, The Japanese Production System in the United States, (New York: Oxford University Press, 1994).

Ady, Robert M., "Discussion," New England Economic Review, (March/April, 1997), pp. 77-82.

Appelbaum, Eileen, Thomas Bailey, Peter Berg, and Arne L. Kalleberg , Manufacturing Advantage: Why High-Performance Work Systems Pay Off, (Ithaca, New York: ILR Press, 2000)

Bartik, Timothy J., "Business Location Decisions in the United States: Estimates of the Effects of Unionization, Taxes, and other Characteristics of States," Journal of Business & Economic Statistics, vol. 3, no. 1 (1985), pp. 14-22.

Bartik, T., Who Benefits from State and Local Economic Development Policies?, (Kalamazoo MI.: W. E. Upjohn Inst. For Employment Research, 1991).

Black, Sandra E. and Lisa M. Lynch, "How To Compete: The Impact of Workplace Practices and Information Technology on Productivity", National Bureau of Economic Research (Cambridge, MA) Working Paper No. 6120, August 1997.

Black, Sandra E. and Lisa M. Lynch, "What's Driving the New Economy: The Benefits of Workplace Innovation", authors' mimeo, November 1999.

Bourguignon, A. (1993) *Le modèle japonais de gestion*, Repères, la découverte, Paris.

Carroll, Robert and Michael Wasylenko, "Do State Business Climates Still Matter? Evidence of a Structural Change," National Tax Journal, vol. 47 (1994), pp. 19-38.

Capelli, Peter, The New Deal At Work, (Boston: Harvard Business School Press, 1999).

Chapman, Keith and David Walker, Industrial Location, Principles and Policies, (New York: Basil Blackwell, 1987).

Chernotsky, Harry I, "Selecting U.S. Sites: A Case Study of German and Japanese Firms," Management International Review, vol. 23, no. 2 (1983), pp. 45-55.

Cole, Robert E. and Donald R. Deskins, Jr., "Racial Factors in Site Location and Employment Patterns of Japanese Auto Firms in America", California Management Review, (Fall 1988), pp. 9-22.

Coughlin, Cletus C., Joseph V. Terza, and Vachira Arromdee, "State Characteristics and the Location of Foreign Direct Investment within the United States," Review of Economics and Statistics, vol. 73, no. 4, (November 1991), pp. 675-683.

Crandall, Robert W., Manufacturing on the Move (Washington, D.C.: Brookings Institution, 1993).

Crowther, S. and P. Graham, "Invitation to Sunderland: Corporate Power and the Local Economy," Industrial Relations Journal, Vol. 19, No. 1, (1988), pp. 51-59.

Doeringer, Peter, Christine Evans-Klock, and David Terkla, "Hybrids or Hodgepodges? Workplace Practices of Japanese and Domestic Startups in the United States," Industrial and Labor Relations Review, Vol. 51, No. 2 (1998), pp. 171-186.

Doeringer, Peter, Christine Evans-Klock, and David Terkla, Startup Factories: High Performance Management, Job Quality, and Regional Advantage, (New York, Kalamazoo: Oxford University Press and the W.E. Upjohn Institute for Employment Policy, 2002).

Elger, T. and C. Smith, " Exit, Voice, and Mandate: Management Strategies and Labour Practices of Japanese Firms in Britain," British Journal of Industrial Relations, Vol. 36, No. 2 (1998), pp. 185-207.

Fisher, Ronald C., "The Effects of State and Local Public Services on Economic Development," New England Economic Review, (April 1997), pp. 53-66.

Fisher, Peter S. and Alan H. Peters., Industrial Incentives: Competition among American States and Cities (Kalamazoo: Upjohn Institute, 1998).

Freeman, Richard and Davis Jenkins, "Transfer and Adoption of Organizational Innovations: Japanese Transplants in the United States",(mimeo), April 1996.

Freeman, Richard B. and Morris M. Kleiner, "Who Benefits Most From Employee Involvement: Firms or Workers?," American Economic Review, vol. 90, no. 3 (May 2000), pp. 219-223.

Friedman, Joseph, Daniel A Gerlowski, and Jonathan Silberman, "What Attracts Foreign Multinational Corporations? Evidence From Branch Plant Location in the United States," Journal of Regional Science, vol.34, no. 4 (1992), pp. 403-18.

Fucini, Joseph and Susan Fucini, Working For the Japanese: Inside Mazda's American Auto Plant (New York: Free Press, 1990).

Graham, Edward M. and Paul R. Krugman., Foreign Direct Investment in the United States, (Washington: Institute for International Economics, 1989).

Greene, William H., Econometric Analysis, (Englewood Cliffs, NJ: Prentice Hall, 1993).

Haigh, Robert, "Selecting a US Plant Location: The Management Decision Process in Foreign Companies," Columbia Journal of World Business, vol. 25, no. 3 (Fall 1990) , pp. 22-31.

Haitani, Kanji and Charles T. Marquis, “Japanese Investment in the Southeast United States: Factors, Obstacles, and Opportunities,” Economic Development Review, (Summer, 1990),pp. 42-48.

Head, Keith, John Ries and Deborah Swenson, “Agglomeration Benefits and Location Choice: Evidence from Japanese Manufacturing Investments in the United States,” Journal of International Economics, vol. 38 (1995), pp. 223-247.

Herzog, Henry W., Jr. and Alan M. Schlottmann, editors, Industry Location and Public Policy (Knoxville, TN: The University of Tennessee Press, 1991).

Katz, Lawrence F. and Lawrence H. Summers, "Industry Rents: Evidence and Implications," Brookings Papers on Economic Activity Microeconomics, (1989), pp. 209-247.

Kenney, Martin and Richard Florida, Beyond Mass Production: The Japanese System and its Transfer to the U.S, (New York: Oxford University Press, 1993).

Kieschnick, M., Taxes and Growth: Business Incentives and Development (Washington, DC: Council of State Planning Agencies, 1981).

Kujawa, Duane, Japanese Multinationals in the United States, (New York: Praeger Inc., 1986).

Lang, Kevin, Jonathan Leonard, and David M. Lilien, "Labor Markets Structure, Wages, and Unemployment," in Kevin Lang and Jonathan S. Leonard, Unemployment and the Structure of Labor Markets, (New York: Basil Blackwell, Inc., 1987).

Levinson, Arik, "Environmental Regulations and Manufacturers' Location Choices: Evidence from the Census of Manufacturers," Journal of Public Economics, Vol. 62, No. 1-2 (1996), pp. 5-26.

Luger, Michael I.,“The States and Industrial Development: Program Mix and Policy Effectiveness,” in Perspectives on Local Public Finance and Public Policy, John M. Quigley, editor (Greenwich, Connecticut: JAI Press Inc., 1987).

MacDuffie, John Paul and Susan Helper, "Creating Lean Suppliers: Diffusing Lean Production Through the Supply Chain", in Jeffrey K. Liker, W. Mark Fruin, and Paul S. Adler (Eds.), Remade in America, (New York: Oxford University Press, 1999)

Maddala, G.S., Limited-Dependent and Qualitative Variables in Econometrics, (Cambridge, U.K.: Cambridge University Press, 1983).

Mair, Andrew, Richard Florida, and Martin Kenney, "The New Geography of Automobile Production: Japanese Transplants in North America," Economic Geography, (October, 1988), pp. 352-373.

Markusen, Ann, Peter Hall and Amy Glasmeier, High Tech America (Boston: Allen & Unwin, 1986).

McFadden, Daniel,"Conditional Logit Analysis of Qualitative Choice Behavior," in Frontiers in Econometrics, Paul Zarembka, ed. (New York: Academic Press, 1974).

McFadden, Daniel, "Econometric Models of Probabalistic Choice" in Charles Manksi and D. MacFadden (eds) Structural Analysis of Discrete Data with Econometric Application,(Cambridge: MIT Press, 1981).

Milkman, Ruth, Japan's California Factories: Labor Relations and Economic Globalization, (Los Angeles: University of California Institute of Industrial Relations, 1991).

Milward, H. Brinton and Heidi Hosbach Newman, "State Incentive Packages and the Industrial Location Decision," Economic Development Quarterly, vol. 3, no. 3 (August, 1989), pp. 203-222.

Mohrman, Susan A., Jay R. Galbraith, Edward E. Lawler, III, and Associates Tomorrow's Organization (San Francisco: Jossey-Bass Publishing, 1998).

Moore, Michael, Bert Steece and Charles Swenson, "An Analysis of the Impact of State Income Rates and Bases on Foreign Investment," Accounting Review, vol. 62 (1987), pp. 671-85.

Mowery, David, (Ed.) U.S. *Industry 2000*, (Washington, DC: National Academy Press, 1999).

Munday, M., Japanese Manufacturing Investment in Wales, (Cardiff: University of Wales Press, 1990).

Nakabayashi, Takeshi, "A Study on Locational Choices of Japanese Manufacturing Companies in the U.S.: Guidelines for State & Local Governments in Attracting Japanese Firms' Investments," Policy Analysis Exercise, John F. Kennedy School of Government, Harvard University, (April, 1987), mimeograph.

Newman, Robert J. and Dennis H. Sullivan, "Econometric Analysis of Business Tax Impacts on Industrial Location: What Do We Know, and How Do We Know It?" Journal of Urban Economics, vol. 23 (1988), pp. 215-234.

Ondrich, Jan and Michael Wasylenko, Foreign Direct Investment in the United States, (Kalamazoo, Michigan: W.E. Upjohn Institute for Employment Research, 1993).

Osterman, Paul, "How Common Is Workplace Transformation and Who Adopts It?," Industrial and Labor Relations Review, Vol. 47, No. 2, January 1994, 173-188.

Plaut, Thomas R. and Joseph E. Pluta, "Business Climate, Taxes and Expenditures, and State Industrial Growth in the United States," Southern Economic Journal, vol. 50, no. 1 ( July, 1983),pp. 99-119.

Reid, Neil, "Spatial Patterns of Japanese Investment in the US Automobile Industry," Industrial Relations Journal, (August, 1989), pp. 49-59.

Sako,, M., "Training, Productivity, and Quality Control in Japanese Multinational Companies," in M. Aoki and R. Dore (eds.), The Japanese Firm: Sources of Competitive Strength, (Oxford: Oxford University Press, 1994).

Saxenian, AnnaLee, Regional Advantage: Culture and Competition in Silicon Valley and Route 128, (Cambridge, Mass: Harvard University Press, 1994).

Schmenner, Roger W., Making Location Decisions, (Englewood Cliffs, NJ: Prentice-Hall, 1982).

Schmenner, Roger W., Joel C. Huber, and Randall L. Cook, "Geographic Differences and the Location of New Manufacturing Facilities," Journal of Urban Economics, vol. 21, no. 1 (1987), pp. 83-104.

Smith, Donald F., Jr. and Richard Florida, "Agglomeration and Industrial Location: An Econometric Analysis of Japanese-Affiliated Manufacturing Establishments in Automotive-Related Industries," Journal of Urban Economics, vol. 35 (1994), pp. 1-19.

Ulgado, Francis M., "Location Characteristics of Manufacturing Investments in the U.S.: A Comparison of American and Foreign-based Firms," Management International Review, vol. 36, no. 1 (1996), pp. 7-26.

Wasylenko, Michael, "Taxation and Economic Development: The State of the Economic Literature," The New England Economic Review, (March/April, 1997), pp. 37-52.

White, M. and M. Trevor, Under Japanese Management, (London: Heinemann, 1983).

Woodward, Douglas P., "Locational Determinants of Japanese Manufacturing Start-ups in the United States," Southern Economic Journal, vol. 58, no. 3 (January, 1992), pp. 690-708.

Yoshida, Mamoru, Japanese Direct Manufacturing Investment in the United States (New York: Praeger Inc., 1987).

.

**Table 1**

**Adoption Rates of High Performance Management Practices: Japanese and Domestic Startups**

| Practice | Japanese(%) | Domestic (%) |
|---|---|---|
| Hiring of "team players" | 46.4* | 15.0 |
| Substantial job-entry training | 93.0** | 60.0 |
| Cross-training | 42.9* | 15.0 |
| Daily workgroup meetings | 39.3* | 10.0 |
| Quality circles | 64.3* | 35.0 |
| Weekly/monthly shift meetings | 100.0** | 45.0 |
| Quality control by production workers | 50.0* | 20.0 |
| No-Layoff Policy | 42.9** | 5.0 |
| N = | 28 | 20 |

Significance Test: We employed a Significance of Difference Test using Pearson Chi Square with Yates continuity correction. When expected frequency is too small, Fisher's Exact Test is used:

* = 0.05
** = 0.01

Source: Authors' Survey

**Table 2**
**Variable Definitions and Data Sources**

| Location Determinant | Independent Variable Name | Definition | Data Year | Source |
|---|---|---|---|---|
| Labor | UNION | % manufacturing production workers unionized | avg 1984/86 | Grant Thornton (data from Bureau of Labor Statistics) |
| | WAGE | ln(avg hourly wage of production workers) | 1985 | Grant Thornton (data from Bureau of Labor Statistics) |
| | HSGRAD | % population over age 25 w/ 4 yrs high school but no further education | avg 1980/90 | Dept. of Education, Digest of Education Statistics, 1992 |
| | RURAL | % population non-urban | 1979 | US Census, 1980 |
| Market Size & Transportation | MARKET | ln(gravity-adjusted state personal income) | 1985 | Income: Statistical Abstract Distance: Rand McNally Road Atlas |
| | AIRPORT | ln(# enplaned passengers state's principal hub) | avg 1983,87 | State and Metropolitan Area Data Book |
| | HIGHWAY | ln(interstate miles/sq mi) | avg 1983,87 | State and Metropolitan Area Data Book |
| Fiscal Policy | CORPTAX | ln(1-avg effective tax rate on corporate income) | avg 1983,88 | State and Metropolitan Area Databook, ACIR, "Measuring State Fiscal Capacity" |
| | UNITARY | dummy for unitary tax base | 1978-84 | Robert Tannenwald, 1984 |
| | JOF | dummy for state economic development office in Japan before 1985 | 1985 | National Association of State Development Agencies |

## Table 2 (cont.)

| | | | | |
|---|---|---|---|---|
| | EXPEDUC | ln(state+local expenditures on education, per pupil/median salary 4-year university occupation) | avg 1983,87 | US Statistical Abstract |
| Misc-ellaneous | AGGLOM | Manufacturing production hours/ 1000 acres non-federally owned land | avg 1983,87 | U.S. Census of Manufacturers |
| | NYC | dummy for NYC area | | 1 for NY, NJ, & CN |
| | JTEMP | ln(avg January temperature) | 20 yr avg | US Statistical Abstract, 1986 |
| Controls | LAND | ln(non-federally owned acres) | | US Statistical Abstract, 1986 |
| | PAC | Pacific | | CA, OR, WA |
| | ENC | East North Central | | OH, MI, IN, IL, WI |
| | WNC | West North Central | | MN, IA, MO, ND, SD, NE, KS |
| | ESC | East South Central | | KY, TN, AL, MS |
| | WSC | West South Central | | AR, LA, OK, TX |
| | SAT | South Atlantic | | VA, NC, SC, GA, FL |
| | MAT | Middle Atlantic | | NY, NJ, PA, DE, WV, MD |
| | NEW | New England | | MA, CT, RI, VT, NH, ME |
| | MTN | Mountain (omitted dummy) | | MT, ID, WY, CO, NM, AZ, UT, NV |

**Table 3**
**Distribution of Domestic and Japanese Startups, 1978-88**
**by Region and State**

| Region | % Japanese Startups | % Domestic Startups | State | % Japanese Startups | % Domestic Startups |
|---|---|---|---|---|---|
| E. N. Central | 27.0% ** | 20.5% | IL | 6.6% | 6.1% |
| | | | IN | 4.2% | 3.3% |
| | | | MI | 6.8% | 3.6% |
| | | | OH | 9.2% | 5.3% |
| | | | WI | 0.2% | 2.2% |
| Pacific | 24.1%** | 14.5% | CA | 18.3% | 11.8% |
| | | | OR | 2.2% | 1.1% |
| | | | WA | 3.6% | 1.6% |
| South Atlantic | 14.8% | 18.1% | FL | 0.6% | 4.5% |
| | | | GA | 8.4% | 4.2% |
| | | | NC | 3.4% | 4.0% |
| | | | SC | 0.8% | 1.8% |
| | | | VA | 1.4% | 2.1% |
| | | | DE | 0.0% | 0.1% |
| | | | MD | 0.0% | 1.1% |
| | | | WV | 0.2% | 0.3% |
| E. S. Central | 13.8% ** | 6.6% | AL | 1.8% | 1.1% |
| | | | KY | 6.6% | 1.7% |
| | | | MS | 0.4% | 1.1% |
| | | | TN | 5.0% | 2.7% |
| Middle Atlantic | 7.6% ** | 13.6% | NJ | 3.4% | 3.1% |
| | | | NY | 1.8% | 5.1% |
| | | | PA | 2.4% | 5.4% |
| W. S. Central | 6.2% ** | 11.6% | AR | 0.6% | 0.9% |
| | | | LA | 0.0% | 0.8% |
| | | | OK | 1.0% | 1.6% |
| | | | TX | 4.6% | 8.3% |
| W. N. Central | 2.6% ** | 6.8% | IA | 0.6% | 1.3% |
| | | | KS | 0.0% | 0.8% |
| | | | MN | 0.2% | 1.9% |
| | | | MO | 1.4% | 1.9% |
| | | | NE | 0.4% | 0.6% |
| | | | ND | 0.0% | 0.2% |
| | | | SD | 0.0% | 0.1% |

## Table 3 (cont.)

| | | | | | |
|---|---|---|---|---|---|
| Mountain | 2.4% | 3.7% | AZ | 0.4% | 1.2% |
| | | | CO | 0.4% | 0.9% |
| | | | ID | 0.0% | 0.4% |
| | | | MT | 0.0% | 0.4% |
| | | | NV | 1.4% | 0.3% |
| | | | NM | 0.0% | 0.1% |
| | | | UT | 0.2% | 0.3% |
| | | | WY | 0.0% | 0.1% |
| New England | 1.2%** | 4.7% | CT | 0.6% | 1.1% |
| | | | ME | 0.2% | 0.2% |
| | | | MA | 0.4% | 2.6% |
| | | | NH | 0.0% | 0.3% |
| | | | RI | 0.0% | 0.4% |
| | | | VT | 0.0% | 0.1% |

** = 0.01 significance level

Across all regions, Chi-square test: $H_o$ that nationality and location are independent is rejected at 0.01 significance level.

Sources: Authors' data from JEI and USEEM.

**Table 4**
**Conditional Logit Coefficients From the Standard Location Model: Domestic and Japanese Startups, 1978-88**[31]

| State attribute | Domestic startups | Japanese transplants |
|---|---|---|
| UNION | -1.28 * | -1.75 |
| WAGE | -0.03 | 5.34 ** |
| HSGRAD | 0.02 | -0.01 |
| CORPTAX | -0.16 | 3.14 |
| MARKET | 0.48 ** | -0.35 |
| AGGLOM | 0.45 ** | 1.47 ** |
| HIGHWAY | 0.44 * | 0.28 |
| LAND | 0.79 ** | 1.58 ** |
| PAC region | 0.23 | 0.25 |
| WSC region | 0.00 | -0.86 * |
| ESC region | 0.02 | 0.90 |
| SAT region | 0.02 | 0.30 |
| WNC region | -0.09 | -0.86 |
| ENC region | 0.06 | -0.63 |
| MAT region | -0.13 | -0.72 |
| NEW region | -0.39 | -1.61 * |
| # plants | 1055 | 481 |
| # variables | 16 | 16 |
| -2(Log L) | 21808.51 | 8941.73 |

Note: For this and subsequent logit result tables:
Significant at .05 level *
Significant at .01 level **

[31] Interpretation of the magnitude of the coefficient depends on the definition of the variable. Where the independent variables are expressed in natural log form, the coefficients are close approximations to elasticities. The logit specification for location selection, following Bartik (1985), implies:

$$(\partial \ln p) / (\partial \ln x) = \beta(1-p)$$

where $\beta$ is the estimated coefficient, p is the probability of locating in that state, x is the variable, and $\partial$ ln p is the percentage of change in the probability of locating in a state. Assuming equal probability across states would be 1/48, or .0208; thus (1-p) is very close to 1. The coefficients estimate the percentage change in new selection probability for a percentage change in the independent variable. For the variables expressed in percentages, such as unionization and high school education, the estimated coefficient can be roughly interpreted as the percentage change in selection probability for a 1 percentage point change in the independent variable. In any given state, the expected effect of a change in the independent variable depends on the deviation from the average value of that variable across the 48 states and the estimated elasticity ($\beta$), holding constant all other variables at their mean value.

## Table 5
## Conditional Logit Coefficients For the High Performance Management Culture Location Models: Domestic and Japanese Startups, 1978-88

| State Attribute | High Performance Management Culture Model: Domestic startups (1) | | High Performance Management Culture Model: Japanese transplants (2) | | High Performance Management Culture Model plus Firm-Specific Interactions: Domestic startups (3) | | High Performance Management Culture Model plus Firm-Specific Interactions: Japanese transplants (4) | |
|---|---|---|---|---|---|---|---|---|
| UNION | -1.75 | * | -4.64 | ** | -2.41 | ** | -4.53 | * |
| x AUTO | | | | | 1.33 | | 7.87 | ** |
| x SIZE | | | | | 0.14 | | -0.65 | * |
| WAGE | -0.11 | | 6.50 | ** | -0.42 | | 6.06 | ** |
| x HTECH | | | | | 1.42 | ** | 1.60 | ** |
| x SIZE | | | | | -0.02 | | 0.08 | |
| HSGRAD | 0.04 | * | 0.13 | ** | 0.06 | ** | 0.16 | ** |
| x HTECH | | | | | -0.07 | ** | -0.08 | ** |
| RURAL | 1.09 | | 6.29 | ** | 1.10 | | 6.55 | ** |
| CORPTAX | -0.49 | | -0.62 | | -0.52 | | -0.09 | |
| EXPEDUC | 0.01 | | 0.09 | | -0.16 | | -0.14 | |
| x HTECH | | | | | 0.63 | ** | 0.72 | * |
| JOF | 0.05 | | 0.51 | * | 0.06 | | 0.52 | * |
| UNITARY | -0.11 | | -0.33 | | -0.12 | | -0.25 | |
| MARKET | 0.65 | ** | 0.23 | | 0.65 | ** | 0.35 | |
| x AUTO | | | | | 0.04 | | -0.36 | ** |
| AGGLOM | 0.35 | * | 1.13 | ** | 0.34 | * | 1.06 | ** |
| HIGHWAY | 0.52 | * | 0.33 | | 0.52 | * | 0.36 | |
| x AUTO | | | | | 0.14 | | 0.18 | |
| AIRPORT | 0.15 | ** | 0.88 | ** | 0.15 | ** | 0.91 | ** |
| NYC | 0.05 | | 1.23 | ** | 0.04 | | 1.18 | * |
| JTEMP | -0.22 | | 0.92 | * | -0.22 | | 0.94 | * |
| LAND | 0.61 | ** | 0.94 | * | 0.61 | ** | 0.86 | * |
| PAC region | 0.41 | | 0.91 | | 0.41 | | 1.15 | * |
| WSC region | 0.05 | | -0.56 | | 0.06 | | -0.42 | |
| ESC region | 0.05 | | 1.20 | | 0.06 | | 1.45 | * |
| SAT region | -0.11 | | -0.50 | | -0.11 | | -0.38 | |
| WNC region | -0.34 | | -1.15 | | -0.33 | | -0.92 | |
| ENC region | -0.10 | | -0.55 | | -0.09 | | -0.36 | |
| MAT region | -0.32 | | -1.37 | | -0.32 | | -1.09 | |
| NEW region | -0.58 | | -1.61 | | -0.58 | | -1.43 | |
| | | | | | | | | |
| # plants | 1055 | | 481 | | 1055 | | 481 | |
| # variables | 23 | | 23 | | 31 | | 31 | |
| (-2L) | 21798.8 | | 8853.5 | | 21777.4 | | 8763.3 | |

* = Significant at .05 level
** = Significant at .01 level

## Table 6

## Interactions Between State Attributes and Plant Characteristics

| STATE ATTRIBUTES | PLANT MODIFIERS |
|---|---|
| UNION | *AUTO Japanese auto parts plants follow assembly plants to Midwest, despite higher unionization rates; pursue union-avoidance strategy in selecting community. |
| | *SIZE The larger the plant, the more likely a target of an organization attempt; expect large plants to place higher premium on avoiding unions. |
| WAGE | *SIZE The larger the plant, the more significant its wage bill in total costs (as proxy for labor intensity); expect larger plants to place greater importance on state wage averages. |
| | *HTECH Plants employing state-of-the-art technology may require higher-skilled workers; selecting areas with high graduation rates may place them in higher-wage areas. |
| HSGRAD | *HTECH The more sophisticated the technology, the higher the premium plants place on basic skills and education. |
| EXPEDUC | * HTECH The more sophisticated the technology, the greater the preference for higher quality education institutions, proxied by spending on education. |
| MARKET | *AUTO Auto-related plants locate in close proximity to auto assemblers to permit JIT; regional market size less vital. |
| HIGHWAY | *AUTO JIT schedules increase importance of interstate access. |

Notes: AUTO dummy for auto-related production; HTECH dummy for high-technology industry; SIZE ln(number of employees).