Company Perceptions of Comparative Advantage by Region

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(Received December 1989; in revised form September 1990)

DEBBAGE K. and REES J. (1991) Company perceptions of comparative advantage by region, Reg. Studies 25, 199-206. This paper considers differences in comparative advantage as perceived by companies in similar industries but different locations. Based on evidence from 160 companies located in: the manufacturing heartland of Ohio, New York, and Pennsylvania; California; and the less industrial states of the US, it is argued that proximity to both markets and suppliers plays a powerful role in explaining perceived comparative advantage. Firms located in both the manufacturing heartland and California were more likely to perceive a comparative advantage in proximity than were companies located in the less industrial states. Other factors that played an important role include product price and labour costs.

INTRODUCTION

Comparative advantage is one of the most important and well-established concepts in economic geography as well as in economics. Differences in production costs in national and regional space-economies are testimony to the relative advantage of one location over another. Comparative advantage is fundamental in our understanding of such processes as industrial agglomeration, location decision making, regional growth and international trade. If, as LLOYD, 1989, suggests, development is the expression of comparative advantage, it would seem appropriate that we explicitly re-examine the perception of comparative advantage by contemporary industry.

The purpose of this paper is to explore geographical differences in comparative advantage as perceived by companies in a similar group of industries across the country. The companies examined are involved in microelectronics and computer-aided manufacturing, thus allowing comparative advantage to be examined in a group of technologically sophisticated companies. Particular attention will be paid to differences in the perception of comparative advantage by focusing on companies from three areas of the United States: the heartland of the traditional manufacturing belt (New York, Ohio, and Penn-
The newly emerging industrial spaces of Pennsylvania; the less industrial states of the country.

The analysis undertaken in this study is based on a national survey of 216 firms involved in some of the more innovative sectors of US manufacturing. It is our contention that geographic proximity to both suppliers and markets remain fundamental to our understanding of how the high technology industries under study perceive their comparative advantage.

**CONCEPTUAL BACKGROUND**

The concept of comparative advantage has a long history in economics, dating back to Ricardo's, 1817, early notions that market forces will allocate a nation's resource base to those industries where it is relatively more productive. A later version of comparative advantage developed elegantly by Ohlin, 1933, is based on the notion that all nations have similar technology but differ in factor endowments that form the basic inputs for production—land, labour, natural resources and capital. The theory of comparative advantage based on factors of production had appeal to many governments over time, who have designed various macro level policies to improve comparative advantage in various factors—by reducing interest rates, devaluing currencies, holding down wages and manipulating other factors.

Porter, 1990, recently reminded us that comparative advantage based on traditional factors of production is not sufficient to explain patterns of trade nor economic competition between nations. There is also a growing awareness that assumptions underlying classical comparative advantage theory are unrealistic in many industries today. The standard theory assumes that there are no economies of scale, that technologies everywhere are identical, that products are undifferentiated and that the pool of national factors is fixed' (ibid., p. 12). It is in this spirit of a need to re-examine the concept of comparative advantage that this research is framed to include factors of particular interest to contemporary industry. These factors include technological change, human resources (more than just labour costs), access to capital and spatial linkage patterns as well as product price (see Table 1).

This paper is not concerned with comparative advantage in the context of international trade, however. The study considers perceptions of a wider range of factors in which companies see themselves as having a comparative advantage relative to their competitors. In doing this we recognize the important distinction between comparative advantage as perceived (ex ante) in an initial locational decision and that perceived (ex post) when a company tries to maximize profits in an existing location as technology and markets change. This study focuses on company perceptions of comparative advantage ex post, given an existing set of locations. We recognize that the interpretation of comparative advantage by companies is made complex by the turbulent environment caused by a dynamic economy and manifested in technological change, the changing labour and financial requirements of a company, pricing strategies and spatial linkage patterns. Oakey, 1984, p. 146, reminds us that 'for many, locational advantage is virtually synonymous with the concept of agglomeration economies and the local advantages of labour, linkage, technology, information and financial resources'. Because the recent literature has ignored the concept of comparative advantage as manifest here, we chose to focus on the broad set of factors summarized in Table 1.

The constant technological change experienced in industry has ensured that industrialists need to continuously monitor changes in comparative advantage relative to competitors. The capital intensive nature of many industrial activities, and associated restructuring, have transformed the industrial landscape. Lloyd, 1989, p. 438, suggests 'that the present technological/organizational regime has an unrivalled ability to seek out and exploit regional (or local) comparative advantage'. A substantial part of this 'new industrial order', we are told, has rapidly adopted post-Fordist production techniques that have emphasized flexible specialization. The emphasis on less rigid systems and small-batch production may partly explain why companies are rapidly responding to differences in comparative advantage. However, it is less clear how pervasive this 'new' order of flexible accumulation really is, and how the 'new' industrial system will alter real and/or perceived comparative advantage (Gertler, 1988).

In a recent study of high technology industry and the role of agglomerative advantage, Oakey and Cooper, 1989, contend that high technology industries may be actively seeking out the comparative advantage of agglomeration and that the period of footloose highly mobile industry 'may have been only an interlude in the evolution of industrial loca-
The fundamental shifts in the regional economies of the USA over the past twenty years also seem to imply that companies are responding to changing perceptions of comparative advantage. The emergence of the Sunbelt economy in the 1970s, and the revitalization of several Northeastern states during the 1980s, are signals to that effect. The emerging bicoastal economy and the rapid growth of southern California as a major economic system suggest that changes in comparative advantage, however, do not follow a purely north–south divide (US CONGRESS JOINT ECONOMIC COMMITTEE, 1986; SCOTT, 1988; WEINSTEIN, GROSS and REES, 1985). Furthermore, it is not only the private sector that seems to be responding to changes in comparative advantage. The plethora of new economic development programmes offered by state and local governments suggest that many communities across the country are also monitoring what they perceive as their comparative advantage when trying to become more attractive to industry (REES and BRADLEY, 1988).

When companies (and communities) assess their comparative advantage, they do so for a range of factors, some of which are more explicitly geographical than others. Companies have to continuously monitor their technological advantage with respect to competitors, and this includes their own technical expertise with regard to both product and process innovation. Given the increasing technological intensity of many industries today, the relative advantage of a company with respect to labour skills and labour costs as they effect productivity levels can be of critical importance. The concentration of financial capital in areas with significant agglomerative advantage implies that access to working capital and investment capital will vary spatially. Product price will also tend to reflect the spatial variation in the costs of the factors of production assuming comparable products. The spatial linkages that ‘drive’ large-scale economic systems should also provide agglomerative advantages with a built-in locational advantage particularly with respect to proximity to suppliers and markets, and distribution networks. Because of the current dearth of research on these factors as they effect a company’s comparative advantage (see Table 1), they become the central focus of this research.

RESEARCH DESIGN

A recent study of university–industry relationships with state-funded technology development programmes provided the opportunity to examine how companies perceived their comparative advantage in some detail (REES, 1989). Based on a series of interviews with directors of state-based economic and technology development programmes, several major industrial sectors were identified as frequent participants in these research programmes, involving microelectronics and computer-aided manufacturing. These industry categories encompassed the following: metal working machinery (SIC 354); office and computing machinery (SIC 357); electronic components and accessories (SIC 367); and aircraft and parts (SIC 372). They are also seen as among the most innovative sectors within American manufacturing today.

From these SIC groups, an adjusted population of 1,024 companies were identified and surveyed from the 1986 Dun and Bradstreet Corporation. The Dun and Bradstreet listings were used here because it still remains the best national directory of manufacturing establishments available to researchers, even though the accuracy of this Dun and Bradstreet data can still be questioned in studies of job creation. After an initial mail survey to vice presidents of production and/or engineering, and follow-up telephone checks, complete information was obtained on 216 of the 1,024 firms. A response rate of 21% is good compared to other surveys of this kind when completion depends on the co-operation of busy corporate executives. The 200-plus respondents also represent a relatively large data set that gives us the opportunity to look at geographical differences in comparative advantage for a specific set of factors. The firm-level data set is necessary in order to examine the comparative advantage question in a systematic manner and at a sufficiently disaggregated level. Furthermore, the respondents were involved in a number of similar and related industries which allows us to analyse the effect of comparative advantage for similar industries in different locations.

Due to the emphasis on the spatial variation in comparative advantage by company location, it was important that each firm represented a random sam-
people that was not biased against any particular part of the country. A chi-square test revealed no significant difference between the distribution of the survey population when compared to that of respondents by census region. Although part of a larger study, the survey specifically asked company officials to indicate their firm's perceived comparative advantage or disadvantage relative to their competitors, for the twelve different factors listed in Table 1. While a four-part scaling procedure was used in the survey, results are reported as dichotomous variables. As suggested earlier, the factors can be classified into five broad categories pertaining to a company's perception of its own technological condition, human resources, financial capital, pricing strategy and locational attributes.

The focus of this paper is on how companies from the more industrialized or manufacturing-intensive states perceived comparative advantage differently relative to firms from the less industrial and more peripheral regions of the country. An employment threshold was used to classify states according to whether they were part of a core region or a less industrial peripheral state (LIS). The LIS states were defined as any state with less than 600,000 employees in manufacturing activity in 1981. The most industrial states (MIS), or core regions, were classified based on a minimum employment threshold of one million manufacturing persons per state. By using gross employment in manufacturing as the criterion for grouping states, this paper can differentiate manufacturing states with a 'critical mass' and potential agglomerative advantage from the less industrial sites. Subsequently, it is possible to test whether firms in the industrial regions perceive comparative advantage in fundamentally different ways from companies located in other parts of the country.

Based on the above criteria, the core regions in this study were subdivided into the traditional heartland of the manufacturing belt—New York, Ohio and Pennsylvania—and the emerging west coast core of California. According to Hicks, 1987, p. 491, the 'new geography of US manufacturing is illustrated by the fact that today only Pennsylvania, Ohio, and New York in the east and California in the west surpass Texas as an employer in manufacturing'. For a complete listing of the LIS states see Table 2.

Because of this regional classification of the states, sample size was further reduced from 216 firms to 160 firms, but this still represents a large sample size for analysis. Firms that were either located in states that employed between 600,000 and one million persons in manufacturing, and/or did not completely respond to the comparative advantage questions, were not considered in this analysis. Each of the three major regional groupings by state are well-represented with fifty-six firms from the LIS states, fifty-five firms originating in the traditional manufacturing belt, and forty-nine firms from California. The similarity in sample size ensures that each of the three areas are well represented in subsequent statistical analysis.

**LINEAR-LOGIT TECHNIQUE**

Because the data is discretely classified, a form of categorical data analysis is required to test for geographical differences in company perceptions of their comparative advantage. A linear-logit modeling approach was selected and is shown to be particularly appropriate to the analysis of the available data. Linear-logit models tend to be the method of choice when an a priori distinction is made between the response variable and the explanatory variables (Wrigley, 1985). In the simple case of a dichotomous response variable, the basic term of the linear-logit model is:

$$\log \frac{P_{1/2}}{P_{2/2}} = X' \beta$$
where:
\[
\log \frac{P_{1g}}{P_{2g}} = \text{the log odds probability of the first response category (} P_i \text{) occurring for a particular sub-population (} g \text{)}
\]
\[
X'g = \text{the row vector of explanatory variable values for sub-population (} g \text{)}
\]
\[
\beta = \text{a column vector of parameters.}
\]

Each sub-population (} g \text{) is defined on the basis of the cross-classification of the categorical explanatory variables, and the parameters were fitted using maximum likelihood estimation (ML). Although weighted least squares estimation (WLS) is sometimes preferred over ML, the WLS method assumes sufficiently large sub-populations to justify the approximation of the unknown probability values (} P_{1g}, P_{2g} \text{), by the actually observed proportions (} f_{1g}, f_{2g} \text{). However, as the number of explanatory variables increases, the size of each sub-population will tend to decline. To avoid problems of small sample size, and to allow a full-testing of state-level sub-samples, ML was chosen over WLS as the estimation technique.

Models were fitted using the SAS categorical data modelling procedure (SAS version 5.16, 1985) which is similar in capabilities to the GENCAT program by Landis et al., 1976. The SAS procedure calculates the ML estimates using the Newton-Ralphson method. The selection of variables was partly based on the screening process devised by Higgins and Koch, 1977. The first explanatory variable to be included was the one with the largest chi-square in relationship to the response variable. Other explanatory variables are then selected as members of the subset by applying similar selection rules. Only the main effect parameters are considered due to the limited covariance between the selected independent variables.

RESULTS

Manufacturing belt and California

Much has been made of the rapidly changing industrial landscape in areas outside the traditional manufacturing belt of the United States. Particular attention has been focused on the increasing significance of California as an emerging core region in the American space economy for certain types of industries. For example, Scott, 1985, contends that southern California has emerged as a rapidly-growing agglomeration of high-technology industry. What is left unanswered is whether similar firms located in California perceive comparative advantage in similar ways to firms situated in the more established manufacturing region of New York, Ohio and Pennsylvania. In order to test this thesis, categorical linear-logit analysis was applied to the 104 firms located in one of the above four 'core' states (Table 2).

The results suggested that none of the comparative advantage factors were significantly different based on a chi-squared test for a 10% level of significance. In particular, firms in both cores tended to be more likely to perceive a comparative advantage in proximity to both suppliers and market, especially relative to competitors in other areas of the country (Table 3). Such a finding is not surprising given the location-specific complexities of major agglomerations. The preponderance of forward and backward linkages, the increased emphasis on subcontracting, and the speed, frequency and efficiency in transactions throughout any major metropolitan system ensure that the major industrial states continue to have a built-in comparative advantage relative to other more isolated parts of the country.

Most firms from both cores also perceived a comparative advantage in product price, possibly due to the need to be price competitive given the high number of alternative suppliers, and the intensely competitive nature of the economic arena in these parts of the country (Table 3). However, a substantial number of respondents from the manufacturing belt states perceived a comparative disadvantage in product price possibly, in part, due to the higher production

<table>
<thead>
<tr>
<th>Table 3. Comparative advantage by company location</th>
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<tr>
<td>Manufacturing belt</td>
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<tr>
<td>A. Proximity to suppliers</td>
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<tr>
<td>Comparative advantage</td>
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<tr>
<td>Comparative disadvantage</td>
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<tr>
<td>Total</td>
</tr>
<tr>
<td>B. Proximity to markets</td>
</tr>
<tr>
<td>Comparative advantage</td>
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<tr>
<td>Comparative disadvantage</td>
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<tr>
<td>Total</td>
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<tr>
<td>C. Product price</td>
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<tr>
<td>Comparative advantage</td>
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<tr>
<td>Comparative disadvantage</td>
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<tr>
<td>Total</td>
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<tr>
<td>D. Labour costs</td>
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<tr>
<td>Comparative advantage</td>
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<tr>
<td>Comparative disadvantage</td>
</tr>
<tr>
<td>Total</td>
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</tbody>
</table>

Note: The totals for each region of the country do not correspond to the totals listed in Table 2 because a small number of firms had no opinion or did not respond to questions about some of the above factors.
costs and deteriorating infrastructure associated with parts of the northeastern states.

Firms in both regions also seemed more likely to perceive a comparative advantage in labour costs despite the traditionally higher labour costs in California, New York, Ohio, and Pennsylvania relative to the national average (Table 3). This suggests that similar companies in both areas evaluate labour costs per se as less important than the output and productivity characteristics of the labour force. The 'core' firms may perceive the lesser industrial states on the economic periphery of the nation as lacking in the skills needed for their production needs, despite the lower wage levels associated with such states.

The research findings for the other factors of comparative advantage were less clear with just as many firms perceiving both a comparative advantage as disadvantage, regardless of company location.

**Manufacturing belt and the less industrial states**

If firms from the major manufacturing states of the US perceive comparative advantage in broadly similar ways, then it may suggest that industrial agglomerations offer similar costs and benefits regardless of location. It may also imply that firms situated in some of the less industrial peripheral states may perceive comparative advantage in a fundamentally different way. Therefore, the following section of this paper directly compares the perception of comparative advantage for those firms located in the core regions to firms situated in the more peripheral parts of the nation's space-economy.

In this case, the response variable is the companies' location, and it has two categories: (1) the company location is Ohio, New York or Pennsylvania; and (2) the company is located in one of the less industrial states. The sub-populations, $g$, are defined on the basis of the cross-classification of the two explanatory variables that were significant at the 10% level: (1) the companies perceived comparative advantage with respect to Product price; and (2) the companies perceived comparative advantage with respect to Proximity to supplier (Table 4a).

Based on the chi-squared goodness-of-fit test, a dichotomous linear-logit model can be fitted using the ML procedure which relates the odds that a company is from the manufacturing belt states to those categorical explanatory variables that were significant at the 10% level. The model takes the form:

$$\log \frac{f_{1g}}{f_{2g}} = \beta_1 + \beta_2 \times g_2 + \beta_3 \times g_3$$

where:

$$f_{1g} = \text{the odds that a company originates from a manufacturing belt state with characteristic} g$$

$$X_{g2} = \text{product price}_g = 1 \text{ whenever subgroup } g \text{ perceives a comparative advantage, 2 when a comparative disadvantage is perceived.}$$

$$X_{g3} = \text{proximity to supplier}_g = 1 \text{ whenever subgroup } g \text{ perceives a comparative advantage, 2 when a comparative disadvantage is perceived.}$$

Based on the model specification above, the following ML parameter estimates are reported with the estimated standard error for each parameter in parentheses:

$$\log \frac{f_{1g}}{f_{2g}} = -0.007 - 0.39 \times X_{g2} + 0.4 \times X_{g3}$$

The value of the constant term (0.007) can be taken to represent an estimate of the overall or grand mean of the log odds of a company coming from one of the 'core' states, where the overall mean is computed across all four sub-groups. The remaining parameter estimates for the model have signs and differential effects which conform with our expectations about product price, and proximity to supplier. The $X_{g2}$ parameter estimate represents the differential effect of product price on the way a company from the manufacturing belt perceives comparative advantage relative to its other competitors. The reported value for $X_{g2}$ (-0.39) has the expected negative sign, indicating that as the number of companies perceived to have a comparative advantage in terms of product price increases, so the odds of a company originating from the manufacturing belt decreases. A substantial number of respondents from the less industrial states perceived a comparative advantage in product price relative to the manufacturing belt states, in part due to the lower factor costs of production commonly associated with the industrial periphery of the USA.

Similar reasoning can be applied to the other explanatory variable, proximity to supplier. The reported value for $X_{g3}$ (0.4) indicated that companies originating from the manufacturing belt are more likely to perceive a distinct comparative advantage relative to their competitors with respect to proximity to suppliers. The geographic concentration of companies in the northeastern states and the complex web of spatial linkages between producers and suppliers provides companies in the manufacturing belt.
with a built-in locational advantage relative to the less industrial states.

Product price and proximity to supplier may be variables that are prone to multicollinearity. The price of a product is, in part, determined by the transportation costs incurred through the shipment of goods and services by various suppliers. Suppliers that are close to the point of production will incur lower transportation costs relative to more distant suppliers and that can translate into lower product prices, ceteris paribus. However, the interaction effect between product price and proximity to supplier did not prove to be significant when included in the model statement ($\chi^2 = 0.81$, probability = 0.37).

In general, the odds of a company being from the manufacturing belt increased if the company perceived itself as having a comparative disadvantage with respect to product price, but considered itself to have a distinct comparative advantage in terms of proximity to suppliers.

**California and the less industrial states**

Using the same methodology and criteria in comparing Californian companies to those from the LIS group produced only slightly different results. In this case, the only significant explanatory variable at the 10% level was proximity to supplier (Table 4b). Based on the earlier model specification, the following ML parameter estimates are reported with the estimated standard error for each parameter in parentheses:

$$\log\frac{\text{f}_1}{\text{f}_2} = -0.41 + 0.93 X_{g2}$$

The $X_{g2}$ parameter estimate represents the differential effect of proximity to supplier on the way a company from California perceives comparative advantage relative to its competitors. The reported value for $X_{g2}$ (0.93) indicates that as the number of companies perceived to have a comparative advantage in proximity to suppliers increases so the odds of a company originating from California increases. Upon closer inspection of Table 3, an overwhelming number of companies from California perceived a comparative advantage in proximity to supply (84% of all respondents) when compared to firms from the LIS (45% of all respondents). Such a finding seems to reassert Scott’s, 1988, notion that southern California is now a well-established economic system with a sophisticated array of linkages to suppliers and sub-contractors.

**CONCLUSION**

These results show that companies from more established industrial regions of the United States were more likely to perceive a comparative advantage in proximity to both markets and suppliers than were companies located in the less industrial states (Table 5). Such a finding is re-assuring to economic geographers and other social scientists who have consistently argued that proximity plays a powerful role in explaining firm location. Even with increasing decentralization of industry and the introduction of more flexible, small-batch production systems it appears that firms in similar sectors of the economy still perceive agglomerative advantage favourably today as they did in the days of Weber, 1929.

The high factor costs associated with industrial agglomerations in the more industrialized parts of the country do not seem to deter a group of high-technology companies from perceiving a comparative advantage in spatial proximity relative to companies from the less industrial parts of the country. In large part, this is explained by the exclusive nature of the sophisticated and skilled labour requirements available in core regions and the accessibility of specific material suppliers that allow the production of high value-added products. It is this sort of comparative

**Table 5. Perceived comparative advantage for product price and proximity to supplier by company location**

<table>
<thead>
<tr>
<th>Sub-populations</th>
<th>Response categories</th>
<th>$r = 1$</th>
<th>$r = 2$</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td><strong>a. Manufacturing belt firms versus LIS firms</strong></td>
<td><strong>Product price</strong></td>
<td><strong>Proximity to supplier</strong></td>
<td><strong>Manufacturing belt firm</strong></td>
<td><strong>LIS firm</strong></td>
</tr>
<tr>
<td>$g = 1$</td>
<td>Advantage</td>
<td>Advantage</td>
<td>15 (0.45)</td>
<td>17 (0.55)</td>
</tr>
<tr>
<td>$g = 2$</td>
<td>Advantage</td>
<td>Disadvantage</td>
<td>10 (0.35)</td>
<td>19 (0.65)</td>
</tr>
<tr>
<td>$g = 3$</td>
<td>Disadvantage</td>
<td>Advantage</td>
<td>14 (0.73)</td>
<td>5 (0.27)</td>
</tr>
<tr>
<td>$g = 4$</td>
<td>Disadvantage</td>
<td>Disadvantage</td>
<td>5 (0.46)</td>
<td>7 (0.54)</td>
</tr>
<tr>
<td><strong>b. California firms versus LIS firms</strong></td>
<td><strong>Proximity to supplier</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$g = 1$</td>
<td>Advantage</td>
<td></td>
<td>37 (0.63)</td>
<td>22 (0.37)</td>
</tr>
<tr>
<td>$g = 2$</td>
<td>Disadvantage</td>
<td></td>
<td>7 (0.21)</td>
<td>27 (0.79)</td>
</tr>
</tbody>
</table>
advantage, that according to Oakey and Cooper, 1989, p. 349, can 'ensure that the advantages of cheaper transport costs or unskilled labour wage rates of another non-agglomerated location are irrelevant'.

Other factors that seemed to play an important role in this study included product price and labour costs. However, these factors do not conform to a simple core-periphery explanation. While the Californian companies and firms from the LIS group seemed more likely to perceive a comparative advantage in product price (Table 3), firms from the manufacturing belt of New York, Ohio and Pennsylvania were less likely to do so. In part, this may be due to the high factor costs associated with manufacturing production in these states. However, this is changing as the manufacturing belt states in the 1980s have shown signs of an economic recovery associated with the large-scale restructuring of industry in parts of this region.

A high proportion of companies in the LIS states perceive themselves as having a comparative advantage in product price and this could be the result of a low price reflecting lower costs. In addition, firms from all regions of the country tended to perceive a comparative advantage in labour costs, although a greater proportion of companies located in the LIS seemed to perceive such an advantage (Table 3). The cheaper labour costs on the industrial periphery partly explain these differences. Firms situated in the core regions may also tend to discount employment advantages by taking for granted the highly skilled labour force available in any major agglomeration (Oakey and Cooper, 1989).

In summary, this study shows that firms located in the leading manufacturing states of the United States seemed to perceive comparative advantage in similar ways, while the most significant differences emerged when comparing these companies to those located in the less industrial states of the country. Key factors influencing a company's perception of comparative advantage seem to be inherently geographic and tend to reinforce the relative importance of agglomerative advantage. Proximity to either markets and/or suppliers still play an important role in explaining company perceptions of the relative advantage of one location over another.

Acknowledgements—The authors would like to acknowledge the insightful comments of an anonymous referee. John Rees also wishes to thank the Economic Development Administration, US Department of Commerce (Project No. 99-7-13675) for partially funding the empirical research on which this paper is based. The statements, findings and conclusions are those of the authors and do not reflect the views of the EDA.

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