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INDUSTRIAL PARK LOCATION: DO FIRM CHARACTERISTICS MATTER?

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Firms are not alike. Although not a controversial statement, it is an important one to remember when investigating the factors that influence the location of business firms. Despite the abundance of work on firm location and its determinants,[1] little or no attention has been given to differentiating the attractiveness of sites by the types of firms most interested in particular attributes of those sites. Industrial parks, one type of site, make available a bundle of attributes to locating firms.

Peddle [25] analyzes firm location within the Chicago metropolitan area and discerns a positive influence from industrial parks. Peddle [23] finds that successful industrial parks not only reflect attributes of ideal industrial sites,[2] but also tend to be located in particular types of communities.[3] As more information is gained about the role of industrial parks in the firm location decision, additional questions emerge. This paper focuses on one key issue regarding industrial parks, an issue that has significant policy implications for economic development projects. Namely, what kinds of firms do industrial parks tend to attract?

To answer this question, some ideas regarding relevant differences between firms should be developed, as well as some hypotheses about how these differences may affect a firm's propensity to locate in an industrial park. Having established some testable hypotheses, empirical investigation can proceed.

One barrier initially encountered in doing research on industrial parks is the definition of an industrial park. This issue evokes memory of former Justice Potter Stewart's definition of obscenity--as something he could not put into words, but knew when he saw it. In much the same way, it seems that there is no common definition of an industrial park

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[1]See Newman and Sullivan [16], Pacific Consultants [19], and Oakland [17] for surveys of some of the literature.

[2]For example, water and sewer lines, arterial highways, fire and police protection, rail and air access.

[3]Newer communities, larger communities, communities with a low population density, and communities with a high population growth rate are more likely to have industrial parks.

across the economic development literature. Moriarty [12] seems close to a universal definition when he describes an industrial park as "a large tract of land that can be subdivided as different industries decide to locate there" (Moriarty [12, p. 319]). Unfortunately, Moriarty writes from the point of view of community development, and his definition reflects the notion of an undeveloped industrial park. Building upon his definition, a working notion of the term may be:

> An industrial park is a large tract of land, subdivided and developed for the use of several firms simultaneously, distinguished by its sharable infrastructure and close proximity of firms.

Typically, successful industrial parks embody the characteristics of ideal industrial sites, and a single developer (private or public) provides the seed money for infrastructure, landscaping, and often for the basic physical plan. The developer recoups the investment through higher than average rental/purchase prices charged to locating firms or, in the (rare) case of public developments, through the positive externalities of firm location.[4]

Firm Characteristics and Industrial Parks: Some *Ex Ante* Thoughts

Little has been written about industrial parks as an economic institution. Even less has been written about the firms who tend to locate in industrial parks as opposed to other locations within the same community or metropolitan area. Moriarty suggests that industrial parks have distinct features that affect their relative attractiveness to different firms.

> The cost of land is generally quite high in such [parks], and room for expansion is limited . . . Most . . . are designed to accommodate light industry interested in occupying ten acres or less. For this reason, the [parks] are apt to be more appealing to small manufacturers than large ones, which can operate more effectively on raw industrial land (Moriarty [12, p. 319]).

[4]For example, employment benefits, expanded tax base, reduced tax price of local services, in-kind contributions from firms.

Moriarty's suggestions, combined with fundamental economic theory and basic marketing theory, can produce a set of working hypotheses regarding firm location in industrial parks:

- Small firms will be more likely to locate in industrial parks than their larger counterparts;
- Light industry will be more likely to locate in industrial parks than heavy industry;
- Industries that utilize weight-gaining production will be more likely to locate within industrial parks as opposed to outside industrial parks;
- The larger the geographic scope of a firm's market, the more likely they will be to locate within an industrial park;
- Firms in more energy-intensive industries will be less likely to locate within industrial parks.

The first hypothesis must be characterized more precisely than Moriarty's analysis would suggest. Small firms (by convention, firms with 20 employees or fewer) and large firms (those greater than 100 employees) both will be unlikely to locate within an industrial park. Very small firms will have difficulty making the high cost of an industrial location pay, and large firms will be able to operate more effectively on raw industrial land. Hence, medium-sized firms are expected to be located in industrial parks.

The second hypothesis is fine in theory, but a clear, objective delineation between light and heavy industry does not seem available.[5] The hypothesis will be retained, but its application will be cautious and exploratory.

With respect to the third hypothesis, weight-gaining industries are typically located further from their sources of raw materials than industries whose production involves a weight loss. The importance of the transportation amenities of industrial parks would seem to be more crucial for firms in the weight-gaining category, *ceteris paribus*.

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[5]This delineation has been discussed with other economists, regional planners, business historians, city managers, and industry analysts. No clear, universal definition emerged from these efforts. Nevertheless, using the information acquired, it was possible to differentiate the SIC codes in the sample with some confidence, especially at the level of aggregation of the data. The author thanks Bob Murray, a major industry analyst for a large investment firm, for his time and expertise in verifying the classification of industries.

Similarly, as the fourth hypothesis reflects, access to good transportation nodes is especially important for firms operating in a national or international market because they must distribute their product over a large area.

The fifth hypothesis recognizes that industrial parks offer sites with established infrastructure, including utility access. A firm with special energy needs would have an incentive to meet these needs precisely and directly with their own primary site development.

The Data

The Chicago metropolitan area provides the geographic setting for the study. Chicago meets most of the conventional criteria for the classic homogeneous plan with numerous transportation nodes and varying local amenities, including a large number of industrial parks. Specifically, the population of interest is all firms located in communities that have industrial parks. In 1988, this amounted to approximately 8000 firms in the three county inner belt of the Chicago SMA (Cook, Lake, and DuPage counties), not including firms in the city of Chicago itself.

By limiting the study to communities with industrial parks, as listed specifically in the annual survey of industrial development by the Chicago Association of Commerce and Industry, this research is able to control for community effects on firm location and focus on the firm's choice between industrial park and nonpark locations.

For financial and computational reasons, 2000 of the 8000 firms were surveyed to determine the firms' principal lines of business, whether they were located within an industrial park,[6] and, if so, the names of the park. A response rate of over 40 percent was received, about two to three times the normal response to an unsolicited bulk survey.

The Model

In exploring the issues raised by the five *ex ante* hypotheses, the following probit model was developed:

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[6]The survey was necessitated by the inability to link the major sources of secondary data available: 1. industrial directories with extensive firm data (not including whether they were located in an industrial park); 2. industrial park surveys that identified name and town of location (as well as park characteristics) but not the specific site of the park; and 3. detailed street maps and telephone books that failed to identify industrial parks and/or their locations. As a point of information, each usable data point cost approximately $1.75 to acquire, making the financial limitations fairly clear and compelling.

PARK = f(SIC, INDEMP, MEDIUM, CAPLAB, ENERLAB, MKT)

where:

SIC	=	a series of dummy variables for 12 of the two digit industries represented in the data;[7]
INDEMP	=	average establishment employment in the observed industry;
MEDIUM	=	dummy variable for firms having between 20 and 100 employees;
CAPLAB	=	capital-labor ratio of the observed industry;
ENERLAB	=	energy cost-labor ratio of the observed industry;
MKT	=	ordinal discrete variable describing firm's market, increasing values indicating a broader market.

A priori, the signs of the partial regression coefficients easily are established. Higher average establishment employment, INDEMP, would be expected to reduce the probability of a firm locating in an industrial park. MEDIUM would be expected to have a significant positive influence on the probability of a firm locating in an industrial park. ENERLAB already has been hypothesized as carrying a negative sign, while MKT is expected to carry a positive sign. The capital-labor ratio, CAPLAB, would seem to be a relevant variable that differentiates industries/firms, but its *a priori* sign is difficult to establish. The SIC codes will be interpreted referring to the second and third hypotheses.

Results

The probit results are reported in Table 1. Generally, the results offer significant insights into the empirical hypotheses. Firms of medium size are most likely to locate in industrial parks, consistent with the *a priori* hypothesis. In addition, consistent with Moriarty's suggestion, firms in industries characterized by larger employment per establishment are less likely to locate in industrial parks *ceteris paribus*.[8] Firms whose production involves relatively intensive energy

[7]The omitted category includes 27 firms that are scattered randomly among several two digit SICs that represent diverse industries.

[8]Note that INDEMP and MEDIUM measure subtly different notions. MEDIUM is a dummy related to the firm's employment and is a binary variable. INDEMP is a continuous variable that controls for the industry's use of labor (or firm size in terms of employees), as measured by average establishment production employment in the industry in the United States. It also should be noted that a variable for the physical

use have a lower probability of locating within industrial parks. A higher capital-labor ratio is related to a higher probability of a firm locating in an industrial park. Additional work is necessary to verify the robustness and theoretical justification for this result. Though statistically insignificant in this regression, the expected positive sign on MKT was observed.

The effects of lines of business on industrial park location are somewhat mixed. Some of the difficulty in interpreting the results for the two digit SICs was reduced by appealing to data collected by the author on the four digit SICs of the firms in the sample. The interpretation of the regression coefficients makes explicit use of this knowledge.

SIC 20 is the code for food and kindred products, but the sign of the coefficient is understood better when one considers that a high percentage of the firms in the sample are beverage bottling plants, syrup and extract manufacturers/bottlers, and vegetable oil manufacturers. This information suggests an SIC dominated by weight-gaining production, and hence the expected positive coefficient on this dummy variable. Similar rationale is used to explain the positive sign on SIC 28 (chemicals and allied products). Additionally, SIC 28 contains a number of firms producing intermediate industrial products of use to firms in close proximity which, in turn, suggests the possibility of the exploitation of economies of agglomeration, another argument for locating in an industrial park. The positive sign of SIC 26, paper and allied products, is explained in similar fashion. Nearly all of the firms in this industry are involved in the production of industrial supplies such as paperboard, paperboard boxes, the folding of paperboard containers, and nonstationery envelopes. The opportunity for proximity economies is a fairly compelling rationale for the positive sign when all of the other factors in the model are controlled. SIC 30, rubber and miscellaneous plastics products, carries a positive sign. This is consistent with *a priori* theory due to the weight-gaining nature of this industry and its heavy reliance on water and sewer services. A similar need for water and sewer services underlies the positive coefficient on SIC 32 (stone, clay, and glass products).

Because industrial parks will be more appealing to light industry, it is not surprising that SIC 34, fabricated metal products, and SIC 35, machinery (except electrical), have negative signs, as both industries are examples of heavy industry.[9] On the other hand, SIC 27 has a

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size of the plant was tried as a means of controlling for the firm's size. There was no qualitative change in the results, and they were inferior statistically.

[9]The interpretation of the sign of SIC 34 was questioned by several participants in a session at the 1989 Eastern Economic Association meetings. The author subsequently did additional research on this SIC

negative sign, but is considered light industry because it is mainly composed of small printing shops. The reduced probability of finding these firms in industrial parks would appear to be a function of their relatively limited market and their lack of reliance on the key services of industrial parks (transportation nodes, water and sewer, centralized administrative functions).

Unfortunately, the other four SIC codes are more difficult to interpret. SIC 33, primary metal industries, seems to be a classic heavy industry, but enters with a positive sign. SIC 36, electric and electronic equipment, would appear to be a generally heavy industry, consistent with its negative sign, but research on the firms and industry reflects a diversity within the SIC that makes strong conclusions difficult. SIC 38, instruments and related products, and SIC 39, miscellaneous manufacturing industries, also contain a diverse set of firms, to the extent that a clear theoretical interpretation is nearly impossible.

Conclusion

Knowledge regarding firms and their locations inside and outside industrial parks has evolved slowly. This paper suggests that a few robust results already can be drawn, and that the learning process will continue to produce meaningful information about the types of firms who locate in industrial parks.

For now, it seems safe to say that relatively small firms in light industries that are not labor intensive and do not have special energy needs are the most likely candidates to locate in industrial parks. This paper offers convincing evidence that industrial parks have distinct attributes that appeal to particular types of firms. Further research needs to focus on a clearer delineation between heavy and light industry, as well as the costly task of increasing the number of firms analyzed in order to increase the power of the results. Nevertheless, this paper provides a first empirical look at the influence of firm characteristics on location in industrial parks.

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and discussed classification with an experienced city planner, an industry analyst with the federal government, and a private sector industry analyst. The research and conversations support the classification of SIC 34 as heavy industry, but again point to the lack of a universal definition of the delineation between heavy and light industry.

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Table 1
Firm Characteristics and the Probability of Industrial Park Location

Variable	Coefficient	Standard Error	Elasticity
SIC 20	2.741*	1.512	.0688
SIC 26	9.152**	4.449	.2585
SIC 27	-6.145**	2.725	-.9933
SIC 28	15.426**	7.266	.8957
SIC 30	1.246**	0.647	.0743
SIC 32	15.676**	7.755	.4182
SIC 33	28.695**	13.770	.5854
SIC 34	-0.936*	0.565	-.0998
SIC 35	-3.145**	1.466	-.6319
SIC 36	-1.444	0.942	-.1269
SIC 38	-2.928**	1.360	-.1608
SIC 39	-2.563**	1.142	-.1166
INDEMP	-0.0514**	0.0237	-2.5703
MEDIUM	0.2942**	0.1171	.0817
CAPLAB	47.474**	23.394	8.0600
ENERLAB	-82.193**	38.957	-8.1648
MKT	0.0575	0.0556	.0827
CONSTANT	2.3115*	1.3015	2.1511

*denotes significance at .10 level
** denotes significance at .05 level

N = 593

Likelihood Ratio Test (17 d.f.) .....= 42.2041

Maddala R-Squared .....= .0687

Cragg-Uhler R-Squared.....= .0917

Hensher-Johnson Normalized Success Index.....= .066