Business Location in 1860 and 1870: Evidence from the Manufacturing Censuses

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The subject of industrial location has not been ignored by business and economic historians. Indeed, it pervades the literature in a variety of guises, ranging from the long-run relative development of the southern United States to urban-hinterland relationships and their effects on regional growth [2, 6, 7]. The symbiotic relationship between American economic growth and the manufacturing sector has guaranteed continued interest in the causal factors behind the appearance of the latter.

My thesis represents an effort to combine existing knowledge about these factors into a formal framework of industrial locational choice for the years 1860 and 1870. Specifically, I assume that firms were cost-minimizers with respect to location. The existence and extent of manufacturing activity at the county level must therefore have been a function of the relative costs of location in each county. Location theory suggests that firms reacted in particular to transportation, labor, and capital costs. An econometric model has been constructed to test the hypothesis that the existence and extent of manufacturing activity at the county level was a function of these costs, in addition to available external economies offered by urban activity.

A subset of specific issues related to factor market conditions and institutional factors lies beneath the surface of the broad questions about relative levels of industrialization. The simple observation that, "The art in locating a factory, . . . , is to locate the assembly point so that it minimizes the cost of the product at the market," implies that differences in the availability and quality of inputs such as capital, labor, and transportation services could be expected to result in an uneven industrial geography [5, p. 587]. It is also im-

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possible to ignore the contribution made to cost-minimization by any external economies that appeared in an urban environment.

Clearly, nineteenth-century entrepreneurs acted on these cost differentials at the most disaggregated geographic level possible--the particular factory site. However, this fact has been obscured in the existing literature, which tends to concentrate analysis on regional and, at best, state-level industrial aggregates when examining the characteristics of that sector. When the problem is approached from this angle, we are left with a tale of the dominance of the eastern states. In terms of average firm size and the size and diversity of the manufacturing sector, the East clearly led the rest of the nation [9, p. 246]. The output composition of the southern and western states was remarkably similar during these years. However, because it consisted mostly of products processed from the agricultural sector--flour, lumber, ginned cotton, liquor, and tanned leather--these states have been awarded a second-class status in American industrial history.

The story that is told by regional industrial aggregates is misleading. Census computation for 1860 reveals that in Massachusetts, Pennsylvania, New York, Maryland, Ohio, and Illinois, between one-third and one-half of total industrial output in the entire state was contributed by a *single* county. Within regions, per capita value of manufacturing output also showed significant variation. In terms of this yardstick, Richmond and Louisville possessed larger industrial sectors than Pittsburgh or Chicago in 1860 [2, p. 22].

These statistics add to the appeal of county-level analysis of firms' site-selection process. The heterogeneity of industrial responses even within state boundaries was guaranteed by the wide diversity of market conditions that prevailed in the United States during this time period. Differences in access to either water or rail transport also served to create a variety of conditions under which firms could market their output. How could the successful counties be characterized in terms of these factors?

THE MODEL

Qualitative dependent variable techniques were used to test variations on the following two models:

$$(1) \quad P = f(PERCAP, RR, WATER, URBAN1/URBAN2);$$

$$(2) \quad S = f(PERCAP, RR, WATER, URBAN1/URBAN2).$$

where

P = probability that a large firm existed in county;

S = number of such firms in county;

PERCAP = per capita wealth;

RR = total railroad mileage;

WATER = dummy variable reflecting presence of navigable water transport;

URBAN1 = dummy variable reflecting presence of a town of 3,500 or more inhabitants;

URBAN2 = dummy variable reflecting presence of a city of 20,000 or more inhabitants.

Model (1) was tested using the logit technique. Under this procedure, the dependent variable assumes a value of either zero or one, depending on whether a county hosts a large firm. The model thus attempts to explain the *existence* of a large firm in that county as a function of the hypothesized explanatory variables.

Model (2) was tested using the Tobit technique. The number of large firms per county, which cannot be less than zero, is also posited to depend on the same set of independent variables. The Tobit technique takes into account the fact that there exists a lower bound on the value that the dependent variable can assume. We used these two models to answer two very different questions, one regarding the existence of an initial impetus to industrialize and the second dealing with the ultimate magnitude that sector would attain.

The data set used to test this model was created from a variety of sources. Information on the number of large firms per county was obtained from the Bateman-Weiss large-firm sample of the manuscript censuses for 1860 and 1870. Per capita wealth and the urbanization dummies were obtained from published census sources. The number of miles of railroad per county was measured with a map reader and contemporary maps. These maps also supplied information on the existence of water transport in each county.

We should note that methodological and conceptual problems do arise with the application of such a model. First of all, the coincident nature of the data makes it impossible to infer causality. That is, although we anticipate that locational cost advantages should lure producers to that site, the industrial data we have at our disposal reflect sites that were chosen at some earlier time. Information and adjustment costs surely existed; the true nature of the locational relationship is one where advantages from previous time periods motivated the current configuration of firms. However, time series data

will never be available for these variables for 1860-1870, so we must rely on an admittedly imperfect substitute to supply the information that is sought.

RESULTS

Space limitations necessitate a selective discussion of the results of the numerous regressions that were applied to variations of models (1) and (2). However, the information contained in Tables 1 and 2 is representative of our findings.

The models performed quite well for all specifications presented. It was, however, startling to discover that per capita wealth behaved so poorly in 1860 and yet was significant in the expected manner by 1870. Wealthier counties should have fostered more manufacturing activity, especially in light of nearly universal recognition of the importance of adequate capital supplies to the process of industrialization [8; 5, Chapters 8, 9]. Per capita wealth is not a perfect proxy for the state of the local capital market. However, access to county-level banking data for Ohio in 1870 did permit calculation of the simple correlation coefficient between per capita wealth and the magnitude of bank deposits. A simple correlation coefficient of 0.93 in Ohio does seem to indicate that *PERCAP* is an acceptable proxy for our purposes.

The improved behavior of this variable over the decade may indicate that, in 1860, agriculture was a much stronger competitor, or outlet, for capital funds generated by wealth [4, p. 367]. During the intervening years, the higher returns available in manufacturing [2, Chapter 5] began to lure capital from its traditional uses. Not only was the size of the industrial sector growing, but capital-intensive techniques were being integrated into the production process (especially in larger firms), with greater regularity [1; 3]. These results reveal that the link between capital supplies and the growth of large-scale production was strengthened, indeed almost created, during the Civil War decade.

Regional regressions were also run for both years, although the results are not presented here. *PERCAP* performed poorly in each region (East, West, South), in 1860. In 1870, it performed best in the East and was marginally acceptable in the West, where t-statistics ranged from 1.32 to 1.74. However, per capita wealth remained *negative* and insignificant in the South, creating further suspicion that, unlike the rest of the country, the link between capital markets and industrial activity was weak or nonexistent. The South's manufacturing sector had been quite similar to the West's in the antebellum period [2, p. 21]. These findings point to wartime disruption and destruction as possible causes for the interruption of that growth path.

Table 1
IMPORTANT FACTORS IN BUSINESS LOCATION IN 1860: The Entire United States

MODEL	VARIABLES: Percap	RR	Water	Urban1	Urban2	R^2
Logit	-	*	*	*		
Tobit	-	*	*	*		.15
Logit	-	*	*		*	
Tobit	-	*	*		*	.34

* Statistically significant coefficient
\- Coefficient not statistically significant
blank indicates that the variable was not entered in the equation

The SHAZAM econometrics package does not provide an R^2 for the logit procedure. The results of the likelihood ratio tests do indicate that each logit equation was significant at any level of confidence.

A variable is considered significant if its t-statistic is at least 2.00.

Table 2
IMPORTANT FACTORS IN BUSINESS LOCATION IN 1870: The Entire United States

MODEL	VARIABLES: Percap	RR	Water	Urban1	Urban2	R^2
Logit	*	*	-	*		
Tobit	*	*	-	*		.13
Logit	*	*			*	
Tobit	*	*			*	.30

See Notes to Table 1

The other intertemporal finding of note was the reduced significance of the availability of water transport. The extension of the rail network, combined with more extensive use of steam power, apparently diminished the necessity of location along a navigable waterway, as expected. Another interesting interregional comparison is possible for both 1860 and 1870. The South was again found to be "different"; the coefficients for both transportation variables were negative and insignificant. Western railroads were not highly correlated with industrial activity either, but waterways apparently were.

Only in the South was there no industrial link with transport of any kind in either year.

The outstanding result of the testing process was the striking importance of urban activity. Apparently external economies, in combination with superior access to labor and capital, caused the existence of an urban area to explain more of the variation in industrial activity at the county level than any other single variable. This finding, we should note, was not unexpected. Significant information and search costs caused cities and towns, with their highly concentrated population and economic activity, to be much more desirable industrial sites. This fact has long been recognized by many location theorists and urban historians [7].

The relative weakness of the other variables was unanticipated. Additional regressions were performed where *URBAN1* alternated with *URBAN2* as the sole explanatory variable. Although a significant loss in explanatory power occurred through use of *URBAN1* alone, almost none was experienced with *URBAN2*. Evidently, a relatively small concentration of persons required the support of additional transport and wealth to foster industrial growth; a *city*, on the other hand, offered such comparatively vast pools of labor, capital, transport connections, warehousing facilities, and more sizable markets that it was impossible to measure further separate impact of any other variable.

Attempts to measure these complex economic relationships are invariably constrained by data availability and the restrictive nature of econometric analysis. However, we have been able to confirm that nineteenth-century entrepreneurs reacted to locational factors in the manner predicted by microeconomic theory. This does not imply that we have answered all the questions about locational behavior--the Tobit results show that the greatest part of the variation in industrial orientation remains unexplained. Yet empirical demonstration of these relationships does highlight the characteristics that should be studied in any analysis of relative regional industrialization.

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