Industrial Transformation and Market Integration Along the American Manufacturing Frontier: The Midwest from 1850 to 1880

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The industrial transformation of the American Midwest during the mid-nineteenth century played a considerable role at a critical period in the emergence of an integrated, national economy. The Midwest's significance lies not only in its obvious central location but also in the apparently paradoxical industrial development of a region that initially had such a noticeable comparative advantage in agriculture. As the Industrial Revolution transformed the American economy from its rural, agrarian roots, the Midwest was the region that characterized the diversity and complexity of a modern, national economy.

This dissertation examines the regional industrialization of the American Midwest during the mid-nineteenth century and within the context of an emerging national economy. It argues that the pace and pattern of midwestern industrial development from 1850 to 1880 was determined not merely by relative factor endowments but also by the extent and integration of its markets. It provides empirical support for the idea that the industrial development of the region was driven largely by internal forces; that is, the reorganization and reallocation of its resources increased productivity and thereby stimulated further development.

Industrialization is neither a simple nor a singular process, but it seems reasonable to argue that the second half of the nineteenth century witnessed the transition from artisan production and local markets to mass production and more integrated markets in the United States. In 1850, the Midwest was characterized by small-scale, artisan manufacturers who exploited abundant natural resources and sold their products in local markets. By 1880, however, it had not only broadened its industrial base and diversified its techniques of production but had begun to export its manufactured products inter-regionally. Thus, the Midwest had undergone a dramatic industrial transition at a pivotal juncture in the economic development of the nation.

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The empirical evidence upon which this study was based consists of sample data drawn from the original manuscripts of the Federal Census of Manufactures for the census years 1850, 1860, 1870, and 1880. The primary sources of data for the 1850-1870 census years were the manufacturing samples initially compiled by Fred Bateman and Thomas Weiss.[1] These samples have been supplemented with additional data from the 1850-1870 Censuses as well as data from the 1880 Census.[2] The 1880 data not only provided additional information concerning a crucial decade (the 1870s) for the Midwest but in many ways the Tenth Census was the first truly "modern" and comprehensive census of American manufactures [6, 11].[3] Their inclusion allowed a comparison between the small-scale, artisan manufacturing activity of the antebellum Midwest with the more mature industrial development of the postbellum Midwest. Collectively, the samples consist of 7,049 observations randomly drawn from the states of Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin.

Even though techniques of collection as well as the apparent reliability of some data in the Census schedules varied from 1850 to 1880 they were all relatively extensive and do provide a reasonable basis for evaluating the relative economic performance and transformation of manufacturing activity during the mid-nineteenth century. The manuscripts contain sufficient information to provide, on a microeconomic level, a detailed examination of the production process for each manufacturing establishment or plant. All of the schedules listed plant capitalization, value of raw materials used, number and gender of hired hands, motive of industrial power, and value of plant output. The 1880 schedules included additional and very useful information on industrial power, length of a typical work day, average daily wages paid to skilled mechanics and ordinary laborers, and the seasonal nature of production.

The sample data consist of a series of samples from the various states from each census. Since each state was sampled independently it was necessary to weigh the sample data in order to construct regional estimates for midwestern industries. The samples were reweighted by the ratio of sampled establishments within the industry relative to the number of reported establishments in the aggregated, published census. It was assumed that the published reports provided a fair representation of the population and thus each state should have a ratio of sample observations equal to its share of aggregate observations.

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[1]For a description of these samples see Atack [1], Bateman and Weiss [3, 4].

[2]Data were added for Illinois (1850, 1870), Indiana (1870), Michigan (1850-70), and Missouri (1870).

[3]The greatly expanded 1880 Census was partly a result of an earlier attempt to commemorate the nation's centennial in 1876. The appointment of economist Francis Amasa Walker in February 1870 also greatly increased the scope and accuracy of the manufacturing census.

Twelve leading industries (agricultural implements; blacksmithing; boots and shoes; men's clothing; flour milling; furniture and woodwork; machine shops and iron foundries; lumber milling; meat packing; printing and publishing; tin, copper and sheet iron; wagons and carriages) were chosen to represent midwestern industrial activity during the mid-nineteenth century. These industries not only represent the principal types of midwestern manufacturing but they also represent a variety of forms of production. Collectively they accounted for 60.4 percent of the sampled plants in 1850, 72.3 percent in 1860, 60.7 percent in 1870, and 69.5 percent in 1880.

As the region underwent industrial change the structure and organization of its manufacturing establishments also changed. The segregated and seasonal markets that had characterized the Midwest in 1850 were well suited for small scale, part-time methods of production. But by 1880, with the extension of its markets, the Midwest had begun to be characterized by larger firms that not only tended to adopt more capital intensive methods of production but also were more likely to hire professional managers to run the business year-round.

Each sample firm was classified as being an artisan shop, small mill, sweatshop, large mill, manufactory, or factory. The distinction between the various forms that an individual plant could have assumed were based on the plant's ability to specialize its labor force as well as its motive power. Artisan shops, sweatshops, and manufactories used animate power while small mills, large mills, and factories used inanimate power. Artisan shops and small mills employed no more than five equivalent workers. Sweatshops and large mills employed more than five but less than 26 equivalent workers. Manufactories and factories employed at least 26 equivalent workers.

Even though the emergence of large scale, factory production was an event of some consequence for the Midwest it is important to point out that smaller industrial plants not only survived but often prospered over the same period. The evidence indicates that throughout this period between 70 and 82 percent of midwestern plants were either artisan shops or small mills. The proportion of midwestern factories increased from 1.2 percent in 1850 to 7.3 percent in 1880. While it is true that the numerically few factories accounted for an increasing share of manufactured output, it still is misleading to suggest that all plants were moving toward the factory mode of production. Some small mills apparently became larger mills and ultimately factories, but it appears to have been relatively rare for an artisan shop, sweatshop, or manufactory to have adopted the factory mode of production.

As estimated by the so-called "survivor technique" optimal plant size did, on average, increase from 1850 to 1880 but for many industries there was relatively little change.[4] Agricultural implements, furniture, and meat packing

[4] An optimal sized plant is defined with respect to minimum average costs of production relative to market conditions [2, 7, 8].

were the industries that exhibited the most noticeable increase in size and appear to have had a minimum efficient scale of production in excess of 20,000 value-added 1860 dollars. These industries appear to have been the ones most actively engaged in inter-regional trade. There were, of course, exceptional firms within other industries, such as flour milling and wagons and carriages, that also engaged in inter-regional trade.

The profitability, measured as the ratio of net earnings to gross assets, of midwestern manufacturers appears to have been higher than alternative investments but that this gap declined from 1850 to 1880. While there was substantial variation the mean rate of return was often in excess of 20%. The variation among industries and over time suggests that the level of risk in midwestern manufacturing was declining from 1850 to 1880. This is consistent with the notion that by 1880 a more integrated national market had replaced the more segregated market of 1850.

The seemingly excessive rates of return may be vulnerable to an upward bias because of the relative size of sampled firms or problems associated with the aggregation of diverse industries [9]. Using weighted data and estimating rates of return by industry produced results that were, for the most part, consistent with the earlier results. Midwestern manufacturers earned rates of return that were often in excess of 20%, but that in many inter-regionally traded industries were beginning to fall in the range of 11 to 14%.

In 1850 smaller firms often earned higher rates of return than did larger firms. This can be explained by the notion that in the earlier era the larger firms were often more competitive, selling in more integrated markets, than were the smaller firms which often behaved as local monopolies operating in segregated markets. In 1880 large manufacturers, by then predominantly urban, earned higher average rates of return than did smaller, rural plants. However, remote rural manufacturers exhibited a higher degree of variation in profitability; that is, some manufacturers remained in segregated markets.

Since all sampled establishments were identified by location, it was possible to measure the impact that an urban or rural setting had upon the structure and performance of each plant. The distinction between urban and rural manufacturers was much less in 1850 than it was in 1880.[5] Within each industry in 1850 manufactures were organized and performed much the same regardless of location. By 1880, however, the advantages with respect to factor productivity and plant profitability that an urban plant held over a rural plant were consistently greater, particularly for inter-regionally traded products.

The region's largest urban centers (Chicago, St. Louis, and Cincinnati) also illustrate the significance that industrial organization and market integration had upon growth and how these variables changed from 1850 to 1880. The relative success of Chicago, from 1850 to 1880, over the older, river cities of St. Louis and

[5]In 1850 the Midwest was 90.7% rural, 9.3% urban. By 1880 it was 74.5% rural, 25.5% urban.

Cincinnati, may have been much more related to commercial and industrial organization than it was to the means of transportation. By 1880 Chicago manufacturers typically had larger plants, employed more equivalent workers, and used greater amounts of capital per plant than did her rivals. Indeed, by 1880 Chicago's factories relied on steam power twice as extensively as did St. Louis's or Cincinnati's, even though in 1850 there had been no significant difference.

I have argued that the integration of midwestern markets, broadly defined to include those factors that facilitate exchange, determined the pace and pattern of industrial development after 1860. I believe that this conclusion is supported by sample data. Midwestern industrialization paralleled and perhaps even defined the industrialization of the U.S. during the second half of the nineteenth century. The settlement of new territories certainly enhanced the productive capacity of the economy. Similarly, the relative reallocation of resources away from agriculture and toward manufacturing increased the productive capacity of the economy. Because of rising levels of productivity it became possible for the Midwest to broaden and develop its industrial sector while simultaneously further developing its agricultural sector. The benefits which resulted from urbanization, agglomeration economies, and market integration fueled the regional development of the Midwest, which had an impact on national development.

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