

Railroads, Reallocation, and the Rise of American Manufacturing*

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Over the latter half of the 19th century, manufacturing grew substantially in the United States. We estimate impacts on manufacturing from the expansion of the railroad network, which integrated large domestic markets with vast land and commodity resources. The railroads represented a technological improvement in the transportation sector, with modest direct benefits, but we estimate that the railroads generated substantial indirect benefits through encouraging expansion in the manufacturing sector and other sectors. The railroads thereby generated much larger economic gains than included in previous estimates (Fogel, 1964; Donaldson and Hornbeck, 2016), which highlights how broadly-used technologies or infrastructure can substantially impact economic growth.

Using data from the US Census of Manufacturers, we calculate the contribution of each county to US manufacturing productivity growth. Following Petrin and Levinsohn (2012), we decompose county manufacturing productivity growth into two components: growth in “technical efficiency,” which reflects increases in output for a given level of inputs; and growth in “reallocative efficiency,” which reflects increased input usage in counties where the value marginal product of output exceeds marginal cost (e.g., due to firm markups, capital constraints, or other “frictions”). Growth in reallocative efficiency is the main focus of our analysis, which includes both (1) changes in the allocation of initial manufacturing inputs across counties and (2) increases in the levels of manufacturing inputs.

We examine how the expansion of the railroad network impacted county manufacturing productivity, along with other measures of county manufacturing activity. Following Donaldson and Hornbeck (2016), we measure how changes in the national railroad network affected county “market access,” which captures how a county’s manufacturing establishments were affected by the railroads changing establishments’ access to consumers, workers, and material inputs. While railroad construction is potentially endogenous, and otherwise correlated with local growth in manufacturing, the estimated impacts from changes in county market access are robust to controlling flexibly for local railroad construction. The estimated impacts of county market access are thereby identified from more-distant changes in the railroad network, and how a spreading railroad network complements or substitutes for the previously established waterway network.

We estimate that county manufacturing productivity increases substantially with increases in county market access. . This increase in productivity is driven by gains in reallocative efficiency, as railroads enabled the substantial expansion of manufacturing activity in marginally productive areas (i.e., in areas with value marginal product greater than marginal cost). This expansion in economic activity generated substantial economic gains due to the presence of market inefficiencies, such as markups or credit constraints, but we do not estimate that the railroads reduced these market inefficiencies. We also estimate little

productivity impact through increases in technical efficiency, though observed changes in manufacturing revenues and expenditures may understate the impacts of market access on technical efficiency.

In the last section of the paper, we explore aggregate economic impacts from counterfactual changes in the transportation network. New transportation infrastructure may shift economic activity across areas, with large relative effects on some counties but small aggregate effects on the United States. Drawing further on the model's structure, in which changes in market access capture how counties are affected by changes in transportation costs, the estimated relative effects of market access can inform the aggregate impacts from counterfactual changes in market access. We use our estimates from the manufacturing sector to assign key parameters in the model, such as county-specific gaps between the value marginal product of inputs and their marginal cost. To the extent that these county-specific gaps arise from county-specific frictions, data from the manufacturing sector is informative about the county economy more generally.

We estimate that US aggregate productivity would have been -25.5% lower in 1890, in the absence of the railroads. These economic losses as a share of GDP are much larger than previous estimates of 3.2% (Donaldson and Hornbeck, 2016) or 2.1% (Fogel, 1964). We estimate much larger economic losses because we allow for inputs to be productive on the margin, as measured in the manufacturing sector, whereas (Fogel, 1964; Donaldson and Hornbeck, 2016) assume that resources are allocated efficiently such that the value marginal product of inputs are equal to their marginal cost. Our estimated economic losses reflect a less productive spatial allocation of inputs, in the absence of the railroads, but are mostly due to a substantial aggregate decline in US population, capital, and material inputs whose value marginal product exceeds their marginal cost. If we instead assume that the labor force was fixed, we estimate aggregate productivity losses of -5.0% . The railroads had a central role in enabling the substantial growth of the US economy.

References

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