

# Railroads and the Brazilian Economy Before 1914

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Although the railroad was the most celebrated technological innovation of the nineteenth century, its impact varied considerably depending on the setting into which it was introduced. For Brazil, historians often claim that railroad development intensified dependence on foreign product and capital markets in the second half of the nineteenth century. According to this scenario, railroad enterprises, intended mainly to carry plantation crops to port, benefited foreign investors and export agriculture at the expense of the economy as a whole.

Based on an extensive array of new evidence and cliometric methods, this study's findings are sharply at odds with standing conclusions about the impact of nineteenth-century railroad development in Brazil. It examines modern Brazil's first wave of transport improvements, which began with the earliest construction of railroads in the 1850s and continued until motor vehicles began to supplant steam locomotion after 1900. The railroad held profound consequences for the economy, but not those heretofore stressed in the historiography. Relying heavily on risk-reducing subsidies, foreign capital, and government regulation, Brazil captured substantial gains from the iron horse. Indeed, the railroad proved indispensable to Brazil's emergence around 1900 as one of the fastest growing economies in the Western world.

This study addresses three main questions. First, what direct effects did the railroad have on the economy? Second, what difference did it make that railroads were often owned by foreigners and regulated by the government? And third, what broader set of outcomes might be attributed to the course of railroad development in Brazil? In posing answers to these questions I drew on a variety of sources, including the operating and financial reports of railroad companies archived in London and throughout Brazil, the contemporary commercial press, and railroad censuses and studies of Brazilian government ministries from the 1850s through 1913. These materials permitted the construction of original data sets on pre-rail transport costs, government

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subsidies, and the operations and financial performance of Brazil's major railroads. These data provided the empirical base for an examination of the scope and magnitude of the railroad's principal direct and indirect linkages to the economy.

In Brazil the railroad's principal consequences may be summed up in the following terms. The forward linkage to transport-using activities was large, and the impact of cheap transport on the internal economy quickly surpassed that of the export sector. However, backward linkages to activities whose output the railroad might otherwise have used intensively, especially industry, were weak. Nonetheless, the employment and income effects that were exported abroad were small. The opportunity costs of foreign finance for the development of domestic capital markets were low. The structural impact of railroads in Brazil differed markedly from the caricature of a dependent and underdeveloping Latin American economy. The broader institutional consequences, particularly regarding the way in which the railroad transformed the role of the state in the economy, were positive in the short run, but likely negative in the longer term.

Serious railroad development in Brazil began relatively late. An uncertain political situation and poorly developed capital markets handicapped attempts to build railroads before 1850. Pressure from the land- and slave-owning elite on government to improve transport increased through mid-century. The government mediated these demands by guaranteeing minimum dividend payments to investors in the desired projects. While native railroad entrepreneurs and project promoters often shared broad developmental concerns, the bulk of political support for the policy came from planters seeking to enhance their personal wealth. Dividend guarantees from the government harmonized the goals of the planter class with the desire of railroad investors to avoid excessive risk. Although the number of government-subsidized railroads increased markedly beginning in the 1870s, much of Brazil remained outside the reach of the railroad by 1913. Given the ready availability of coastwise shipping, most lines were built to link ports to the interior. Combined with the distributive character of dividend guarantees enacted by the Parliament, such a scattered pattern of subsidy and construction revealed that railroad development proceeded with little consideration given to establishing a large, national network.

However, the absence of an integrated railroad grid in no way attenuated the impact of the new mode of transport for Brazil. In fact, railroads in Brazil were remarkable for the very large direct benefits they generated. In terms of these gains, railroads proved to be tremendously important for economic growth. Consider the direct benefits obtained on freight and passenger services. In contrast to the United States, Brazil lacked cheap substitutes for railroads. River conditions in most of the country hindered long-distance shipment. Most freight and passengers moved over hilly terrain, in tropical conditions, on roads that were difficult to maintain. By supplanting mule trains, carts, and stagecoaches on even the best roads, the railroad dramatically reduced the cost of transporting both passengers and freight. The precipitous fall in overland transport charges extended the feasible margin of

agriculture, and integrated product and labor markets. Brazilian railroads both released resources to existing activities in the economy and stimulated the creation of new ones.

Estimates of the railroad's direct social savings reveal a large positive impact on the level of national income. The forward linkage to transport-using activities was exceptionally strong. To infer the magnitude of the gains afforded by railroads, I conducted a counterfactual exercise that measured the hypothetical costs of shutting down the railroad sector in 1913. The costs of relying on the next best alternative – carts and mules competing over improved roads – provide a static approximation of the benefits created by the railroad's cheap transport services. At the upper bound more than 30% of Brazil's gross domestic product in 1913 was due to the resources saved on shipping freight. Even under more restrictive assumptions, the freight social savings were still at least 10% of GDP. The benefits from passenger travel, though appreciable, were more modest. If first-class passengers had shifted to stagecoaches, and second-class passengers had walked, the costs to the economy would have been small. Together, passenger and freight benefits account for a large portion of the economy's gains between 1885, when the railroad sector began its first round of very rapid growth, and 1913.

While the railroad's forward linkage was powerful, strong backward linkages were conspicuously absent. In contrast to the large gains from lower transport costs, the quantity of Brazilian manufacturing output consumed by railroads was small. Demands for coal, rails, and rolling stock were met largely by overseas suppliers. There was little linkage from the railroad sector to producers of key inputs, especially industry. Instead, there was backward "leakage" of indirect benefits abroad. Brazil exported income and employment effects, chiefly to Great Britain. For many historians, it was the very success of railroads in reducing transport costs that led to the failure to create backward linkages. In this view, the ruling class's resolute ambition to obtain railroads as quickly as possible, combined with the absence of policies that forged linkages to coal mining and metal production, meant that railroad development constituted a foregone opportunity to industrialize. However, this view fails to square with evidence on the role of railroads in the industrialization of the more advanced economies, or with the obstacles to modern iron and steel production in Brazil. In the United States, for example, railroad construction and operation tapped extant manufacturing activities that depended only partly on the demands of the railroad sector. Brazil, by contrast, had weak backward linkages because railroad development came well before the rise of domestic industry. Moreover, direct outlays on foreign railroad inputs were minuscule relative to the benefits of cheap transport, coming to, at most, less than 0.5% of GDP in 1913. The opportunity costs of this reliance on foreign inputs were small. Lacking ore and coal deposits of sufficient quality to sustain a modern iron and steel industry in the nineteenth century, had Brazil pursued protectionist policies designed to forge backward linkages, railroad development would have ground to a halt in the late 1800s, thereby institutionalizing backwardness.

In terms of the unbalanced overall consequences of railroads, Brazil bears a strong resemblance to other relatively backward economies, such as Mexico and Spain. However, the distribution of direct gains from railroads differed markedly from that in Mexico, where cheap transport and discriminatory freight rates favored foreign-owned export activities. By contrast, Brazilian railroads, even when foreign-owned, served a growing and increasingly diverse economy characterized by Brazilian-owned industry, and native-Brazilian and immigrant farming. Government regulation ensured that consumers of transport services reaped the bulk of the railroad's benefits, so that transport savings accrued primarily to Brazilians. The government continuously pushed railroad rates down, and held them especially low for agricultural goods produced and consumed domestically. Foreign-owned railroad companies earned competitive profits, but rarely much more than that. Brazilian-owned railroads were better at opposing downward pressure on rates, and earned slightly higher profits. Both British-owned and Brazilian-owned railroads received some excess subsidies, but the losses to the economy from this extravagance were small. Especially low rates on domestic-use goods, mandated by government, fostered an expanding domestic market. Over time the relative share of exports in total railroad freight declined. So did the share of exports in the economy's overall output mix. The benefits that railroads bestowed on Brazil accrued increasingly to the domestic-use sector of the economy, and not to the export sector or foreigners. Government policy toward railroads helped to shift the economy's trajectory dramatically upward, and moved it away from the export "bias" of the early nineteenth century.

Beyond their overt impact Brazilian railroads also created less visible benefits and costs. The railroad's interaction with the institutional setting created unanticipated consequences whose implications for economic performance defy the static measures of linkages. These encompass some broader effects of the railroad for the long-run trajectory of Brazilian development. First is the connection between railroads and internal barriers to trade. By integrating product markets the railroad eliminated natural protection for many agricultural producers. Brazilian political organization facilitated the rise of internal tariffs in the late nineteenth century. These prevented the railroad's gains from being even higher than they were. Protectionist barriers offset some transport-cost reductions on some products in some regions, and concentrated them in others, thus likely worsening regional and class inequalities.

Rapid railroad development also altered the social and political map of Brazil. The pattern of railroad construction and subsidy accelerated political divisions over the institution of slavery, contributing to the strengthening of political support for slavery in the center-south by increasing the demand for slaves, and weakening it everywhere else. The regional redistribution of the slave population in the early decades of railroad development aided in undermining the status quo supporting slavery in Parliament. The railroad's opening of a fertile new frontier in São Paulo attracted immigrant labor from southern Europe, heralding both the onset of modern economic growth and compounding stark regional disparities in income and wealth.

Railroad development further promoted the formation of an important new class of professionals in both the public and private sectors. Although foreign investment and state ownership remained prominent, several of the country's largest and most successful railroads were owned by joint-stock companies organized within Brazil. The imperatives of modern production and coordination strengthened native entrepreneurship and business organization. At the same time, state ownership of railroads expanded. In government-owned railroads the dictates of effective administration created a cadre of professional staff, managers, and planners in the public sector. And the need to monitor the new industry, especially the foreign firms involved in it, created a shrewd and savvy group of regulators and railroad experts. Because less information is available on these effects, gauging their impact in quantifiable terms is not possible. Nonetheless, they may well be no less important in the long term than the observable consequences described earlier.

The study of the railroad's principal linkages in Brazil illustrates the myriad consequences of transport improvements for the transition to improved economic growth. The results of this study also call into question prevailing assumptions and generalizations about the roles of foreign investment, and the state, in Latin American economic development. In the Brazilian case, the claims about the consequences of railroad development found in dependency interpretations now appear exaggerated, at best. When considered within the confines of conventional economic analysis, the railroad's accomplishment in Brazil was substantial. The government subsidized and regulated railroads to reduce the burden of high transport costs for a rural elite that specialized in export agriculture. Foreigners invested in those railroads because they found the risks tolerable and believed they stood a chance of receiving good profits. Though built using foreign capital to link plantations to port, the railroads ultimately registered large gains for domestic markets and created new opportunities for immigration and industry. Early railroad enterprises also launched equity on the country's leading stock exchanges, aiding in the rise of modern capital markets in Brazil.

Though the railroad's role in the transition to modern economic growth can no longer be in doubt, in the longer term the impact of any technological innovation is always subject to question. In Brazil, railroad development increased the return from lobbying for government intervention by private entrepreneurs. The demonstrable effects of the government's heavy hand in the economy doubtless contributed to the growth of state intervention in economic affairs more generally, leading to market interventions that were of dubious value at best, and outright distorting and costly at worst. To the extent that railroads reduced transport costs, they may be credited with boosting the level of economic activity before 1914. However, to the extent that the broader process of railroad development contributed to a bloated government sector and inward-looking policies after World War I, the railroad's contribution may yet prove culpable in equal degree.