# An Open Vein: Manganese Ore and the Central do Brasil Railway, 1894-1920

**Tyler Priest**
*University of Wisconsin-Madison*

"The division of labor among nations is that some specialize in winning and others in losing," wrote the Chilean journalist Eduardo Galeano in his classic 1970 polemic, *Open Veins of Latin America.* "Our part of the world, known today as Latin America," he continued, "was precocious: it has specialized in losing ever since those remote times when Renaissance Europeans ventured across the ocean...." [16, p. 11]. The state-owned Estrada de Ferro Central do Brasil, Brazil's largest and most important railroad during the Old Republic, was one such precocious Latin American enterprise that specialized in losing.

Conventional assessments of the Central do Brasil, both contemporary and historical [7,5], have charged that the railroad's faults were due to overemployment and the intrinsic inefficiencies of state railroad promotion and operation. On the other hand, some historians, such as Stephen Topik, have suggested persuasively that artificially low rates offered by the Central, and not overemployment and inefficiencies, explain the large deficits contracted by the line [46].[1] By subsidizing traffic, Topik claims, the Central achieved important developmental objectives of spatial and commercial integration in southeast Brazil. However, historians must be careful not to overemphasize the accomplishments of domestic integration by state-supported railroads like the Central, and exaggerate the independence of state initiatives in railroad policy-making. By analyzing more closely the reasons for the high cost structure of the Central, we can better appreciate the limitations and constraints on state policies governing the railroad.

The costly and subsidized service provided by the Central for the transport of manganese ore for export created serious financial and physical problems for the railroad. From 1894 through the end of World War I, the Central hauled nearly 6 million tons of ore from inland mines in the state of Minas Gerais south to Rio de Janeiro for shipment overseas, the majority of it between 1905 and 1920. In certain years, manganese constituted 35-50% of the total tonnage shipped southward. This was quite impressive, given that the Central was not designed, or properly equipped, to handle mineral ore. Rather, it was constructed to transport coffee. The decision to stimulate manganese exports was an attempt to increase traffic and revenues for the Central in anticipation of an imminent decline in the regional coffee economy.

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[1] Topik demonstrates that the Central actually used less manpower per unit of traffic than other profitable private lines.

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In subsequent years, the political, locational, and infrastructural inertia of railway enterprise in this region of Brazil sustained large shipments of manganese ore, but at increasing physical cost to the railroad and economic cost to the federal government.

**Coffee and Rails**

The exceptional geography and environment of southeast Brazil made the construction of the Central, and other railroads in this region in the late 19th century, expensive and technically challenging. Encouraged by federal interest guarantees, coffee growers in the Paraíba River Valley promoted the construction of the first segment of the Central (originally, the Estrada de Ferro Dom Pedro Segundo) from Rio de Janeiro to the foothills of the Serra do Mar, the coastal range separating the Paraíba Valley from the coastal plain and the city of Rio de Janeiro. However, the planters were unable to finance the railroad through the mountainous terrain. So the federal government took over the line in 1865, extending construction through a steeply-graded pass over the escarpment, tapping the coffee-growing regions beyond [14,20,46,2,7,3]. The incredible explosion in the production and export of coffee fueled the expansion of the Central, covered payment on the high debt incurred in its construction, and tied the railroad's fortunes to the crop. An American traveler in Brazil remarked in 1879 that the Central "was built to carry away the coffee; that is its main business, almost its only income" [43, p. 531].

In order to serve the coffee economy of the Paraíba Valley most efficiently, the Central do Brasil crossed the river several times over long bridges to provide easy access to train depots for planters on both sides. Transport constituted the planter's greatest marketing cost, and he could lower it considerably through close proximity to a depot. Some estimates placed the transport costs from plantation to train station at as much as 80% of rail freight rates to Rio [45, pp. 42-43]. Even for short distances, the expense of shipping coffee by mule or ox-driven carts took a significant chunk out of a given plantation's coffee earnings. The problem of humidity and storage also mandated that depots be situated close to plantations. The sooner dried coffee beans could be shipped, the less time for them to absorb moisture, especially during the rainy season. Therefore, the zig-zag configuration of the Central do Brasil resulted from economic imperatives of the coffee economy, and not merely from the patronage excesses of planters, as charged by the railroad's detractors.[2]

As world coffee prices continued to climb during the 1870s and 1880s, the Central railroad, and private lines such as the Leopoldina, followed and fed coffee expansion into the *zona da mata* (jungle region) of the state of Minas Gerais. But vibrant world demand masked impending troubles for the coffee economy in this region. One reason plantations had moved further and further inland was that intensive coffee cultivation by older plantations had begun to exhaust the fertility

[2] Freight costs from the interior to Rio de Janeiro could reach as much as five times more than ocean shipping costs from Rio to New York [45, p. 43; 48, pp. 247-50].

of their soils.[3] The inland movement of coffee, and railroads linked to coffee, however, could not proceed indefinitely as the climate grew increasingly arid in central Minas Gerais. By the late 1880s coffee exports had leveled off from the Paraíba, and new competition emerged in the fertile coffee-growing regions of São Paulo. In 1891 the world price collapsed. Still, coffee exports from the *mata* region of Minas Gerais rose steadily during the 1890s despite declining prices; and the Central advanced farther north into the state.[4] In the 1890s, for the first time, expenditures began to approach revenues on the Central.[5] But construction continued, pushed by federal administrators who envisioned the Central as a national railroad linking the coast with the population centers of Minas and the Northeast, and by Mineiro politicians from central Minas, who clamored for rail construction into their region.[6]

**The Manganese Boom**

Debt and the declining fortunes of coffee forced the Central to search for new commodities to pay for the operation and expansion of the line. The amount of inbound traffic on portions of the Central beyond the coffee-growing regions greatly exceeded outbound traffic toward Rio de Janeiro, leaving the railroad with unused capacity.[7] The federal government depended on revenues from the Central to cover external obligations and as collateral for taking on new foreign debt. By the early 1890s, there were simply too many freight cars on the Central returning empty to Rio de Janeiro [40].

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[3] The life span of a coffee tree in good, virgin soil was only twenty-five to forty years. The indiscriminate consumption of forest and wasteful agricultural practices of the Paraíba planters hastened soil depletion and declining fertility [44, pp. 213-49]. The abolition of slavery in 1889 also dealt a serious blow to the older plantations, whose labor force was almost totally based on slave labor.

[4] The world price of coffee dropped from 20.25 British pence per pound in 1890 to 13 pence in 1891, and bottomed out at 7 pence in 1897 [23, p. 89]. Total coffee exports from Minas Gerais, mostly via the Central or the Leopoldina (many lines of which connected to the Central) rose steadily from 3.8 million *arrobas* (measure of weight equal to 14.688 kilograms) in 1890 to 12.5 million *arrobas* in 1901 [26, pp. 33, 45].

[5] Whereas from 1882 to 1891, when expenditures on the Central averaged 61% of receipts, from 1891 to 1901 they reached 94% of receipts [14, p. 199].

[6] Mineiro politicians occupied crucial federal posts that controlled funding for public works and railroad construction projects during much of the First Republic. Most important was the tenure of Antonio Olinto dos Santos Pires in the Public Works Ministry during 1894-96. A Mineiro also served as chairman of the Public Works Committee of the Federal Chamber of Deputies for all but nine years from 1892 through 1922 (58, pp. 176-77).

[7] See Innis [24] for a discussion of unused capacity.

Large manganese deposits that had been discovered in central Minas Gerais offered new revenue possibilities for the railway. Beginning in the 1890s, world demand soared for manganese, a ferroalloy essential for steel making. The open hearth steel process, adopted in Europe in the 1880s and rapidly deployed in the United States during the 1890s, required manganese ore as an alloy and deoxidizer. Steel makers from Western Europe and the United States, where high grade sources of manganese were scarce, soon scurried around the globe in search of ore [11]. Carlos Wigg, a socially and politically well-connected iron producer from Minas Gerais, started mining a large deposit at a place called Miguel Burnier, located near a station on the Central about 300 miles inland from Rio de Janeiro. Turning it into a large-scale operation depended upon efficient and affordable railroad transportation to the coast. Wigg convinced the Central's administrators that manganese ore offered a solution to the costly problem of unused capacity by generating revenue for this increasingly deficit-ridden section of the Central. So in 1894, the railroad granted manganese a special tariff of 5 milreis (about $1) per ton of ore delivered to Rio [40, p. 193].

Buoyed by the favorable freight rate on manganese ore, Wigg's operation soon became a profitable one; he exported nearly 15,000 tons in 1896.[8] His success enticed other entrepreneurs into the area to exploit nearby deposits. As the world price of manganese climbed in the late 1890s (from about $7.77/ton in 1896 to $8.73/ton in 1899 delivered f.o.b. in Rio), however, reports of the enormous profits made by manganese exporters reached the government. The Central, hoping to capture a portion of this rent, doubled the freight rate on manganese in 1900. Although the rate was not high enough to halt mining (production rose from 62,278 tons in 1899 to 127,343 in 1900), the exporters complained bitterly about the tariff and about the service they received from the railway [40, p. 197; 5, p. 312]. Their complaints grew louder as the price of manganese ore plummeted by over $2/ton between 1899 and 1901. Like the Brazilians, manganese exporters in the other two major producing countries, the Russian Caucasus and British India, also had accelerated production in this period to take advantage of the swelling world market. Indian and Russian ore, generally higher grade than Brazilian, saturated the market and forced down prices and demand for Brazilian ore. Plus, the appreciation of the Brazilian milreis (from 15 cents in 1899 to 23 cents in 1901) had further eroded the Brazilian exporters' profit margins.[9]

Fortunately for Wigg and the other manganese producers, Minas Gerais emerged politically from its "inward-looking phase" at this time [see 58], as Mineiro politicians captured important posts in the federal government and bargained for concessions to assist their export and mining sectors. Minas Governor Silviano Brandão successfully conditioned his support for President Campos Sales's austerity program of 1898 on the provision of low and uniform

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[8] Wigg achieved an operating profit of about $2.60/ton [40, p. 193; 5, pp. 321-331].

[9] Russian production increased from 327,353 long tons in 1898 to 741,068 tons in 1900, while Indian production rose from 62,980 long tons to 157,736 tons -- most production in both places for export [40, pp. 189, 204; 21, pp. 36, 42].

railroad freight rates for minerals and commodities transported by the Central.[10] Accordingly, Dr. Alfredo Maia, Director of the Central, who was instructed to scale down the manganese freight rate in 1900, reassured the producers that Sales and Brandão, according to Wigg's mine manager, "were animated with better intentions towards the mining industry generally, and especially manganese mining" [40, p. 197]. Minas politicians interested in building an iron and steel industry within their state considered the development of manganese deposits one avenue toward that end. From 1900 to 1905, a Mineiro held the chairmanship of the Public Works Committee in the Federal Chamber of Deputies, which played a powerful role in the administration of the Central by way of its authority to set rates on federal railroads. No doubt the occupation of this post and others within the executive branch by politicians friendly to mineral exporters from Minas helped lower the manganese freight rate to 6 milreis/ton ($1.38/ton) in 1901, where it remained unchanged until 1915.[11]

The movement of larger volumes of manganese ore along the Central greatly contributed to the railway's mounting financial burdens. In terms of weight, or tonnage, from 1902 through 1905, manganese ore transported over the Central comprised nearly 38% of total exports from Minas Gerais, just slightly less than the amount of coffee shipped [27]. However, freight charges paid by manganese were significantly less than that paid by coffee or most other commodities, amounting to only about 3.6% of total receipts collected by the railroad between 1902 and 1911.[12] Critics of the industry estimated that the real cost of ore transport to Rio de Janeiro in 1910 was around 18 milreis/ton ($5.94/ton), three times the freight rate actually paid by the manganese exporters [4, pp. 84-86]. In effect, manganese received a large freight subsidy, underwritten by the railroad's growing expenditures, which surpassed total receipts during this period for the first time in the railroad's history. [14, p. 199].

The burgeoning amount of traffic on the Central increasingly taxed the railway's ability to operate efficiently and smoothly. After 1901, the Central no

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[10] Enormous federal government debt, much of it a result of interest guarantees paid to railroad companies, forced the Campos Sales government to implement an austerity program, contract a funding loan, consolidate the federal debt, and takeover or "recapture" many railroad lines. Congressional support for the austerity program was negotiated through the state governors [58, pp. 180-81; 1].

[11] A Mineiro also served as Minister of Finance every year from 1905 to 1920. João Pandiá Calógeras, a former manganese miner and strong booster of the industry, himself served as Minister of Finance during World War I.

[12] Coffee rates on the Central rose gradually from 31 milreis/ton in 1884 to 45 milreis/ton in 1915. That year, rice and beans paid 12 milreis/ton while manganese remained at 6 milreis/ton [49]. Percentage of manganese receipts in terms of total receipts are computed by dividing Duncan's [14] figures for total receipts by the product of 6 milreis times the total export tonnage for the period. Freight receipts exceeded passenger receipts and, by the early 1900s, traffic flow heading toward Rio was larger than that heading away from Rio [5, p. 316; 46, p. 112].

longer suffered from unused capacity, but began to experience overcapacity as it shipped increasing cargoes of manganese and other agricultural products from Minas Gerais and coffee from the northern regions of São Paulo to Rio de Janeiro.[13] The demands of transporting dense and heavy loads of manganese ore were probably the most exacting. The Central do Brasil simply was not originally built as an ore-carrying railroad. It was built to carry coffee, or at least light commodities, which did not generate excessive wear on the line. The low density of coffee, its perishability, and the land-extensive nature of its cultivation, had dictated the layout of the Central, which meandered from plantation to plantation, over ravines and steep grades, through the mountainous region. Coffee could travel without problem in wooden freight cars, over winding tracks, and up and down steep inclines. By contrast, the voyage for manganese from the interior to the coast was much more treacherous. The irregular grades and sharp curves through the coastal range caused recurring derailments and accidents by the ponderous ore trains. As more of them traveled over the line, frequent breakdowns and shortages of fuel and spare parts often halted traffic altogether. And the new, heavy Baldwin locomotives, purchased by the Central in the late 1890s to haul manganese-loaded trains, necessitated the widening of bridges and eventually the replacement of rails not sturdy enough to handle those locomotives [25, 37].

**The World Market for Manganese, 1900-1914**

Despite growing problems on the railroad during the 1900s, more and more cargoes of manganese ore managed to reach the coast. As world demand grew steadily, trains ladened with manganese rumbled down to Rio, carrying over 200,000 metric tons per year. The low freight rate provided by the Central was vital to the survival of the industry. It insulated Brazilian producers from volatile swings in purchasing orders from steel consumers and allowed Brazilian ore to compete with higher grade Russian and Indian ore. In 1905, the Russo-Japanese War and labor strikes in the Caucasus, along with a spike in U.S. steel production, lifted manganese prices. Rising world prices stimulated new mining in the area, most notably large-scale production from the Morro da Mina deposit, at Lafaiete near Carlos Wigg's Miguel Burnier operation. By 1910, the Minas manganese industry employed 1300 miners, accounted for 10% of export revenue for the state of Minas Gerais, and carried considerable political clout [4, p. 83; 42,41].

However, Brazilian ore production declined from 1910 to 1913. The poor condition of the Central began to impede the flow of ore. The financial woes of the

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[13] No longer were trains from the more northern sections of the Central returning empty to Rio de Janeiro. Tariffs on foreign imported agricultural products, low freight rates on cereals and feijão (beans), and a growing urban population in Rio de Janeiro had stimulated food shipments from interior Minas over the Central to the city.

In 1890, the federal government purchased the São Paulo and Rio Railroad and incorporated it into the Central. Freight rate reductions on coffee over this branch resulted in a three-fold increase in coffee shipments from that area to Rio in 1899. But this did not last long, as Commercial Association of Santos successfully appealed to President Prudente de Morais, a Paulista, to have the Central's rates raised. [46, p. 98; 38, p. 245]

line, exacerbated by the expense of importing more coal to power its locomotives, prevented necessary maintenance and the furnishing of rolling stock to handle growing traffic demands. Declining demand for Brazilian ore also constrained exports. After supply and market instabilities caused by problems in the Russian Caucasus in 1905, European capital established commercial control over Russian and Indian ore production, leaving less room for the entry of Brazilian ore into world markets.[14] Foreign capital was largely absent from the Brazilian manganese industry, and local producers did not have strong international consumer affiliations. High grade Brazilian manganese did find markets in England and, increasingly, in the United States. But for steel producers in these countries, Brazilian ore typically just supplemented imports from India. Annual Brazilian production dropped from 249,954 tons in 1910 to 152,431 tons in 1912 [22,17,15,41].

**World War I**

World War I reversed the declining fortunes of Brazilian manganese production, as Americans rushed in to snatch up Brazilian ore. Carlos Wigg and his fellow producers shipped 275,579 tons in 1915, more than double the Brazilians' previous highest annual sale to the United States. After the German declaration of unrestricted submarine warfare, ore prices jumped and Brazilian production responded. In 1916, Brazil exported over 470,000 tons of ore to the United States, almost all of it over the Central do Brasil.[15]

Higher export levels were facilitated by improvements made to the Central that began in 1911. That year, the federal government appropriated $2.5 million (about 8 million milreis) to refurbish the line, largely as a concession to Carlos Wigg and other miners engaged in iron and manganese ore production, provided that they invested in steel making or ferromanganese facilities. Although Wigg did not follow through with his plans,[16] he did benefit from the new improvements to the railway. With the new appropriation, the Central laid heavier rails in certain sections, purchased more locomotives, and bought steel cars, which handled mineral

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[14] A British mining syndicate linked to British ferromanganese producers in England acquired the majority of Indian deposits in the Central Provinces. Carnegie Steel, as well, purchased a large mine in the same region. Meanwhile, German steel interests moved into the Caucasus and dominated the trade in Russian ore.

[15] In addition to the United States and Brazil Steamship Lines (U.S. Steel), which had been contracting with Brazilian producers for years, E. J. Lavino & Co. (an alloy producer based in Philadelphia), and W. R. Grace & Co. also entered into the business of brokering and shipping manganese. Small shipments of ore also were transported by these companies from Nazareth in the state of Bahia.

[16] See Callaghan [4, p. 242] for this story.

ore better than wooden ones.[17] Most importantly, the railroad completed a second parallel track over the pass in the coastal range from Belém to Barra do Piraí to relieve traffic bottlenecks that occurred there [25]. In 1915, the Central took advantage of high ore prices to raise the freight rate on manganese for the first time since 1901, from 6 milreis/ton ($1.50/ton) to 12 milreis/ton ($3.00/ton), but compensated the producers by granting them preferential treatment in obtaining rolling stock [30,31,51,53,19].

As it had in the earlier period, the increase in manganese ore shipments continued to place pressures on the Central. From 1914 to 1918, according to the Central's statistics, manganese accounted for 35% of all traffic tonnage on the railroad [34]. Manganese producers habitually overloaded their cars to avoid paying a portion of the freight rate. By mid-1917, the Central's director warned that the line was exceeding its transport capacity for mineral ore. The most serious problem was the shortage of coal to power the Central's locomotives. For years dependent on imports of British coal, the Central now had to import American coal at inflated wartime prices. The Central's Director, Dr. Mariano Aguiar Moreira, claimed that in 1916 coal constituted nearly 60% of the railroad's operating expenses per ton-kilometer of freight. Efforts by the federal government to substitute local energy resources for imported coal had failed. By late 1917, U.S. wartime shipping restrictions prevented the entry of enough American coal to release the amount of manganese demanded by U.S. steel producers. In early 1918, lacking fuel to power its locomotives, the Central embargoed manganese shipments on the line [18,47,25,19,6,13,54].

In May 1918, U.S. Steel Corporation President James A. Farrell announced to the U.S. War Industries Board that the entire U.S. steel industry would shut down by December unless manganese supplies could be procured from Brazil. U.S. officials quickly assured the Brazilians that enough shipping would be diverted to Brazil to supply the needed coal in exchange for manganese cargoes on the return.[18] By mid-summer, the Central lifted the embargo after more U.S. ships filled with coal arrived in Rio [35,55,56]. And after the manganese producers had joined forces to petition the government for reduced freight rates, the Brazilian Congress passed a law in December lowering the rate on manganese [57,9]. Exports to the United States recovered from the 1918 embargo and reached a total of almost 350,000 tons by the end of the year. From 1917 through 1921, the Central shipped nearly 2 million tons of manganese ore, 52% of the total tonnage moved from Minas Gerais in the direction of Rio [27,34]. But again, the costs incurred by accommodating such intense traffic levels, in terms of fuel and maintenance on the line, continued to help drive deficits on the Central to record levels [14, p. 199; 46, p. 111].

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[17] The Middleton Car Company of New York established a factory outside of Rio de Janeiro to manufacture rolling stock and import steel cars for the Central [25].

[18] Such was the urgency that U.S. Treasury officials even proposed taking over Brazil's external debt and allowing short-term repayments to be made with manganese sent to the U.S. Steel Corporation. Naturally, both the Brazilians and U.S. Steel rejected this proposal [36,39].

Convinced that the Brazilian government was friendly to the manganese sector and committed to refashioning and rebuilding parts of the Central, the U.S. Steel Corporation purchased the Morro da Mina manganese mine in 1920 for $4 million, giving the corporation a captive source in the Western Hemisphere [9]. But as resource nationalism in Minas Gerais and in the nation increased, the Companhia Meridional (the new U.S. Steel subsidiary) and the other manganese producers struggled throughout the 1920s to export their ore over the increasingly beleaguered railroad. After the war, the federal government searched unsuccessfully for ways to cut costs on the Central, such as electrifying line segments, which was too costly, or processing Brazilian coal, which proved unsatisfactory. In the 1920s, the Central adopted an unstable system of setting freight rates on manganese based on "market conditions" for manganese and coal,[19] and it allocated fewer cars for manganese shipments. While the Central passed through more cycles of repair and disrepair, Wigg, Meridional, and other producers nevertheless did manage to export nearly 150,000 tons per year in the 1920s to U.S. blast furnaces [10].

## Conclusion

From the 1890s on into the 1920s, the Central's main problem was the high costs of accommodating high traffic density and flow through inhospitable terrain with expensive, imported fuel. The actual costs of shipping manganese were higher than ore producers could withstand, given the competition in the world market. Financial and political pressures forced the Central to oblige in subsidizing transport for the industry, which greatly contributed to large deficits on the line. True, all freight and passengers received subsidized rates and fares. But manganese ore appears to have been especially costly to the railroad during the first two decades of the century and continued to burden the line in the 1920s. Brazilian hopes for the Central to be the great "national" railroad slowly evaporated, as roads and highways were built into the southeast to remedy the shortcomings of Brazil's railway system.

Stephen Topik claims that the Brazilian federal government "reshape(d) the railroad system to domestic needs in a way colonies and neocolonies could not" [46, p. 128] It appears that the Central do Brasil railroad was shaped more significantly by the environment into which it was built, by the commodities that depended on it, and by the shifts in the world market for those commodities. State policies implemented to overcome natural and economic obstacles to railroad development made the railroad even more vulnerable to the natural landscape and dependent on the world market for the freight that it hauled. The Brazilian federal government originally built the railway to overcome the locational disadvantages of transport for coffee producers in southeast Brazil. Once politically and financially committed to the line, the government was forced to promote other forms of economic activity like manganese mining, even though shipping the ore was costly and physically inappropriate for the line. The Central's infrastructural inertia allowed politically-powerful mining interests from Minas Gerais to maintain privileged service for the

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[19] Topik [46, p. 111] points out that almost half of the working loss of the Central in 1924 was a result of increases in the price of imported coal.

manganese, at increasing costs to the government. Although the Central was intended for regional and national integration, it subsidized the export of commodities to the world economy, behaving much like colonial and neocolonial railroads in other regions of the periphery. From 1900 to 1920, the Central railway can be seen as one of Eduardo Galeano's open veins, pumping the national finances, bleeding manganese ore from the interior, and demanding persistent medical attention and repair.

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