



The Southern Railway, Transportation Costs and the Economy of Southern Peru

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Recibido: 15 de marzo de 2019 / Aceptado: 17 de julio de 2019

Abstract. This article analyzes the effects of the *Ferrocarril del Sur* (Southern Railway) on the economy of southern Peru. The construction of the Southern Railway, one of the two largest railway systems of Peru, generated great optimism about the economic future of the region. The study shows (as promised by its promoters) that the railroad reduced transportation costs. Compared to muleteers and llama owners, the railroad charged low freight rates and passenger fares. The social savings of this railroad ranged between 2.3% and 6.2% of the stock of capital in 1890 and between 10% and 20% in 1904. The railroad did not have an immediate impact on the economy of the South of Peru. From the late 19th century, however, the volume of freight increased at high rates. Over time, the railroad fostered the integration of the South with the world economy and with the rest of the Peruvian economy.

Keywords: Railroad; Economic Growth; Peru; 19-20th Centuries

[esp] El Ferrocarril del Sur, Costos de transporte y la economía del sur del Perú

Resumen. Este artículo analiza los efectos del Ferrocarril del Sur en la economía del sur del Perú. La construcción del Ferrocarril del Sur, uno de los sistemas ferroviarios de mayor longitud del Perú, generó gran optimismo acerca del futuro económico de la región. Este estudio muestra (como fue prometido por sus promotores) que el ferrocarril redujo los costos de transporte. Comparado con los muleteros y llameros, el ferrocarril cobró bajas tarifas a pasajeros y de carga. El ahorro social del ferrocarril osciló entre 2.3% and 6.2% del stock de capital en 1890 y entre 10% y 22% en 1904. El ferrocarril no tuvo un efecto inmediato en la economía del sur del Perú. Desde finales del siglo XIX, sin embargo, el volumen de carga creció a tasas elevadas. A lo largo del tiempo, el ferrocarril promovió la integración del sur con la economía mundial y con el resto de la economía peruana.

Palabras clave: Ferrocarril; Crecimiento económico, Perú; siglos XIX-XX.

Sumario. 1. Introduction. 2. The economy of the South and the Southern Railway. 3. Did the railroad reduce transportation costs?. 4. The direct impact on consumer surplus. 5. Transportation and economic growth. 6. Conclusions. 7. References.

Cómo citar: Zegarra, L. F. (2020) The Southern Railway, Transportation Costs and the Economy of Southern Peru, en *Revista Complutense de Historia de América* 46, 155-175.

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1. Introducción

Economists and economic historians have paid much attention to the study of railroads and their economic impact. Rostow², for example, indicated that “the introduction of the railroad has been historically the most powerful single initiator of take-offs. It was decisive in the United States, Germany and Russia [...]”³. Other studies have also supported the hypothesis that railroads played an important role for economic growth in industrialized economies³. Fogel, however, argued that the railroads in the United States did not yield large social savings –savings in transportation costs–, because in the absence of railroads much of transportation would have been conducted by waterways, a low-cost mode of transportation⁴. Fishlow, Hawke, Vamplew and Crafts – Mulatu also argued that railroads in the United States and some European countries did not yield large savings in transportation costs⁵.

For Latin America, some studies have indicated that railroads had an important effect on transportation costs. In Brazil, the construction of railroads led to a significant reduction in transportation costs. Leff and Summerhill, for example, showed that waterways were not widely used for transportation, and the conditions of the terrain were poor⁶. As a result, before the railroad, transport costs from the agricultural regions to the largest markets were high. Similarly, the construction of railroads in Mexico reduced time and money transport costs⁷. Prior to the railroad, waterways were not available in the habitable regions, so freight was transported by wagon or on the backs of animals and men⁸. By reducing transportation costs, the Mexican railroads fostered trade⁹. In addition, for Colombia and Cuba, Mc. Greevey and Hoernel found that railroads charged lower freight rates and promoted economic growth¹⁰.

For Peru, some studies have analyzed the impact of railroads on the economy. Zegarra indicated that the social savings of railroads in Peru were low, in spite of the difficulties of the geography and the lack of waterways¹¹. The fact that social savings were low, however, does not necessarily imply that railroads did not have any impact on the economy. In fact, other studies indicate that the construction of railroads in the central highlands and on the coast had a positive impact on economic growth. According to Miller, for example, railroads played an important role for the mining sector in the central highlands of Peru, although yielded small effects in other sectors in the region¹². Meanwhile, Contreras, Deustua and Zegarra indicated that the construction railroads facilitated the expansion of mining production, especially copper,

² Rostow, 1962: 302.

³ Fremdling, 1977; Price, 1975; Metzger, 1974.

⁴ Fogel, 1962, 1964 y 1979.

⁵ Fishlow, 1966; Hawke, 1971; Vamplew, 1971; Crafts – Mulatu, 2006.

⁶ Leff, 1972; Summerhill, 2005.

⁷ Coatsworth, 1979.

⁸ Coatsworth indicates that Mexico did not have a river system suitable for use in transportation, and most of the population and economic activity was located far from the two coasts as to use the sea as a means of communication. Coatsworth, 1979.

⁹ Dobado – Manero, 2005.

¹⁰ Mc. Greevey, 1971; Hoernel, 1976.

¹¹ Zegarra, 2013.

¹² Miller; 1976b.

in the Central Andes, and of sugar and cotton on the coast¹³. On the other hand, one must be careful about the interpretation of average social savings. Low average social savings for Peru do not mean that all railroads yielded low social savings. It is plausible that some railroads yielded greater benefits than others, depending on the freight rates and passenger fares they charged.

In the 19th and early 20th centuries, the Southern region of Peru –formed by the departments of Arequipa, Cuzco and Puno– was a rich region with abundant natural resources. Mining and agricultural resources made the South a region with enormous economic potential. Economic growth could be hindered, however, by the lack of modern modes of transportation. Numerous contemporary sources suggest that transportation was difficult and costly. Railroads had the potential to make transportation faster and less costly. The region witnessed the construction of the Southern Railway –*Ferrocarril del Sur*– from the late 1860s. This railroad was one of the two largest railway systems of Peru and connected the departments of Arequipa, Cuzco and Puno with the Pacific coast¹⁴. The construction of the railroad generated much optimism in the region. Compared to the traditional system of mules and llamas, the fastest steam machine was faster and cheaper and so could bring prosperity to the region.

In this article, I examine the role of the Southern Railway in the southern economy of Peru in the late 19th and early 20th centuries. Our aim is to determine the effects of this railroad on transportation costs and on the economy of the South of Peru. This study shows that the Southern Railway generated much hope in terms of economic progress. As expected, the Southern Railway had an important effect on transportation costs. Compared to muleteers and *llameros* –llama owners–, this railroad charged low freight rates and passenger fares. The social savings of the railroad ranged between 2.3% and 6.2% of the stock of capital in 1890 and between 10% and 22% in 1904; freight savings were by far more important than passenger savings. The railroad did not have an immediate impact on the economy. Over time, however, railroad services grew at high rates. The Southern Railway facilitated the transportation of a variety of products. Wool –the main export commodity of the South– benefited from the cheap and fast railroad service. The Southern Railway, however, transported much more than wool. It transported a variety of mining, agricultural, livestock and manufacturing products.

2. The economy of the South and the Southern Railway

The Southern region of Peru is composed by the departments of Arequipa, Cuzco and Puno¹⁵. In 1850, the total population of the region was around 820,000 inhabitants¹⁶. Some provinces of Arequipa were on the coast of Peru and others in the

¹³ Contreras, 2004; Deustua, 2009; Zegarra, 2011.

¹⁴ Three lines formed part of this railway system: Mollendo-Arequipa, Arequipa-Puno and Juliaca-Cuzco.

¹⁵ Here I include the small provinces of Moquegua and Tacna, but not the province of Tarapaca. Tarapaca was not economically integrated with the rest of the South of Peru and had its own productive dynamics, very different from Arequipa, Cuzco and Puno.

¹⁶ In particular, the population was 186,000 inhabitants in Arequipa, 346,000 in Cuzco and 286,000 in Puno. Gootenberg, 1991.

highlands; whereas Cuzco and Puno were entirely in the highlands. Most population was Indigenous and lived in rural areas, working on agriculture and livestock¹⁷.

In colonial times, most exports of the region were minerals. After independence, the region experienced a greater specialization in the production and exportation of wool¹⁸. As Flores-Galindo indicates, “the South, having produced a diversity of exports with which it participated in international trade in the 18th century, during the next century began progressively to specialize in the production and export of wool”¹⁹. In the mid-19th century, wool was the main export of the region. In 1863, for example, the region exported 2.6 million dollars through the port of Islay. Around two million dollars were wool: 1.5 million corresponded to alpaca wool and half a million dollars to sheep wool. Silver exports were worth around 120,000 dollars and gold exports reached around 100,000 dollars²⁰.

In the late 19th and early 20th centuries, wool remained as an important export of the Southern region; but other products increased in importance. In 1900, for example, total wool exported by the port of Mollendo were 265,000 pounds. Wool accounted for 39% of the total value of exports. Exports of copper, silver and tin were worth more than 230,000 pounds, whereas exports of rubber and coca were worth 56,000 and 19,000 pounds, respectively²¹.

Until the 1860s, transportation on the South of Peru was mostly on the backs of mules and llamas, as in most of the rest of the country. Transporting bulk and people was costly in money and time. Several attempts were made from the 1850s to provide railroad infrastructure to the Southern region of Peru. In 1860 two Engineers, Federico Blume and Manuel Echeagaray made a project for the construction of a railroad between the city of Arequipa and the port of Islay. Initially the cost of the construction was estimated at ten million pesos soles –around ten million dollars. In 1864, a contract was signed between the Peruvian government and the entrepreneurs Patricio Gibson and Jose Pickering to construct the line, with a cost of 15 million soles –around 15 million dollars– and a State guarantee of a 7% return over the investment. However, the contract was soon cancelled.

In April of 1868 the government signed a contract with Henry Meiggs for the construction of the railroad Mollendo-Arequipa.²² In this case, the State would completely fund the construction, paying 12 million soles –around 12 million dollars– for the construction. The projected line would connect the sea port of Mollendo with the city of Arequipa, located at 2,301 meters over the sea level, traversing the Andes Mountains. The construction of the railroad faced important challenges. Rand, for example, argued that:

“The difficulties encountered were great; water for all uses was brought on mules from a vast distance, and the almost incredible sum of half a million soles was

¹⁷ In the late 1820s, Indigenous population accounted for 62% in Arequipa, 84% in Cuzco and 97% in Puno.

¹⁸ Miller, 1982; Jacobsen, 1993.

¹⁹ Flores-Galindo, 1993: 299. The original text is the following: “El sur, después de haber producido una diversidad de exportaciones con las que participaba en el comercio internacional en el siglo XVIII, durante el siglo siguiente comenzó progresivamente a especializarse en la producción y exportación de lanas”.

²⁰ In the same year, the region imported merchandise worth 2.1 million dollars. Most imports were textiles – around 1.6 million dollars. Bonilla, 1976: 140-141

²¹ Bonilla, 1976: 43.

²² Meiggs, 1876.

spent for this necessary of life during the brief period occupied in the construction of the road. In one section of the road, only 27 ½ miles long, 2,500,000 cubic meters of material had to be removed, The whole amount, including cuts, fills and embankments being about 7,000,000 cubic meters, part of the same being in extremely hard rock”²³.

In spite of the difficulties, the construction of the 172 kilometers of railroad was completed in three years, a few months before deadline. The railroad then started to operate in January of 1871²⁴.

In late 1869, another contract, this time to build the railroad Arequipa-Puno, was signed between the government and Henry Meiggs. According to the contract, the government would fund the construction of the new railroad for 32 million soles –around 32 million dollars. The railroad, with a length of 351 kilometers, was completed in 1876. The construction of the line Arequipa-Puno also faced enormous difficulties. According to Rand, this railroad,

like all its trans-Andean compeers, involves all sorts of topographical and engineering difficulties. It is a labyrinth of cuts, side cuttings, developments and bridges; requiring the use of steep gradients and curves of short radius, the former never exceeding however 4 per cent nor the latter being less than 352 feet. Before it is finished there will have been removed at least 7,800,000 cubic meters of earth clay and gravel, and 1,100,000 meters of rock and granite²⁵.

In December of 1871, Henry Meiggs obtained the authorization to build a line connecting Arequipa and Cuzco. By 1879, however, only the section Juliaca-Santa Rosa had been built. The death of Meiggs in 1877 and the War of the Pacific between Peru and Chile (1879-83) interrupted the construction of this line. After the war, some attempts were made to continue the construction of the line from Santa Rosa to Cuzco, but they were not successful²⁶. With the signing of the Grace Contract, the Peruvian Corporation –formed by the government bondholders– took over the administration of the Southern Railway and other government-owned railroads. The company would continue the construction of the line to Cuzco. In 1892 the line reached Marangani, and in 1893 it reached Sicuani. Then the railroad was extended to Checcacupe in 1906. In 1908 the line was extended to Cuzco²⁷.

The railroad was considered crucial for the development of the Southern region of Peru. In their project for the construction of the railroad Islay-Arequipa –which was finally replaced by the line Mollendo-Arequipa–, the Engineers Federico Blume and Mariano Echegaray indicated that railroads would charge lower transportation

²³ Rand, 1873: 47.

²⁴ Costa y Laurent, 1908; Galessio, 2007.

²⁵ Rand, 1873: 51.

²⁶ In 1886, the government then authorized continuing the construction of the line from Santa Rosa to Sicuani, but Congress did not pass the project.

²⁷ Other railroads were built in the department of Arequipa to transport products from nearby haciendas. One of them was the railroad Vitor-Sotillo. This railroad was built in 1899 and had a length of 17 kilometers. Traffic was suspended in 1930. The railroad of the valley of Tambo was open to the public in 1906 with a length of 24 kilometers. This line mainly served the hacienda Pampa Blanca. It operated until 1965. The railroad of the Hacienda Chucarapi, with 20 kilometers of length, started operations in 1922. It first served private interests but was in 1924 opened to the public. All of these railroads were connected to the line Mollendo-Arequipa.

costs than wagons. In 1862, the two Engineers indicated that transporting 20 quintals by wagon from Lima to Callao –around three leagues– cost between five and six pesos, so the cost of transporting one quintal between Arequipa and Islay –around 30 leagues of distance– would be around 2.4 pesos. This rate was 1.08 pesos greater than the projected freight rate of the railroad Islay-Arequipa. Moreover, according to Blume and Echegaray, the freight rate by wagon along the route Islay-Arequipa could be greater than 2.4 pesos considering that the route Islay-Arequipa had less favorable gradients than the route Callao-Lima. Other factors could have also led to greater differences in freight rates²⁸. The two Engineers were so optimistic that according to them “the liveliest imagination, proceeding upon the basis of a profound knowledge of the country and of its trade would fail to predict even faintly the progress of Southern Peru, ten years after the opening of the Islay and Arequipa railroad”²⁹.

The Engineers Blume and Echegaray were not the only people who defended the construction of a railroad connecting Arequipa and the Pacific coast. After the construction of the railroad Mollendo-Arequipa, Eugenio Larrabure y Unanue indicated that the agriculture in the valley of Tambo –31 kilometers from the port of Mollendo and 141 kilometers from the city of Arequipa– would be fostered by the railroad. According to Larrabure y Unanue, the large sandy desert that separated Tambo from the Pacific Ocean had been the main obstacle to the development of the valley. With the railroad, Larrabure y Unanue predicted that landlords would import machinery and hire more laborers, which would allow the valley of Tambo to increase its sugar production to similar levels as those in the main sugar valleys of Peru³⁰. Optimistic voices were heard when the line Mollendo-Arequipa was completed. For the inauguration in late December of 1870, the President travelled to Arequipa. After the blessing of the railroad by the Archbishop of Arequipa, the Marshal of the Diplomat Corps argued that the railroad would foster the economy. According to him, the Heavens now blessed locomotives “which, destined to communicate their movement to the trains between Mollendo and Arequipa, already evict the desert and eliminate the distance. They will stimulate exports, the industry and commerce, and will end up, as it will occur with others around the globe, impelling the towns from the truth of the religion, to the delights of order and peace, to the predominance and freedom”³¹.

Therefore, the construction of the Southern Railway generated much hope for the future. Pro-railroad men talked about a much faster service, a significant reduction in transportation costs and an important dynamism of the economic activity due to the railroad. Even though building the railroad represented a significant effort in conquering the geography at a considerable cost, the promise for a brighter future seemed to compensate the enormous effort.

²⁸ Camacho, 1871: 73. Additional costs on the provision of forage and water would have increased freight rates. Even the lower competition between wagons would have probably made the price of transportation by wagon between Islay and Arequipa greater than between Callao and Lima. Taking into account all this information, the railroad Islay-Arequipa –it was believed– would have allowed freight shippers to save significant transport costs.

²⁹ Rand, 1873: 50.

³⁰ Camacho, 1871: 204.

³¹ *Ibidem*: 186. The original text in Spanish is the following: “que destinadas a comunicar su movimiento a los trenes entre Mollendo y Arequipa, desahucian ya el desierto y eliminan la distancia. Ellas estimularán la exportación, la industria y el comercio, y acabarán, como ha de acontecer con los demás del globo, por impulsar a los pueblos desde la verdad de la religión, a las delicias del orden y de la paz, a la preponderancia y a la libertad.”

3. Did the railroad reduce transportation costs?

One of the arguments in favor of the construction of the Southern Railway was that it would reduce transportation costs for shippers and travelers. Did the construction of this railway system lead to lower freight rates and passenger fares? In this section, I rely on a variety of sources to compare transportation costs between the railroad and the traditional system of transportation. All figures are in constant dollars of 1900³².

Let us first analyze freight rates. According to the contract of 1890 between the Peruvian government and the Peruvian Corporation, there were three categories of freight in the railroad. First class referred to imported goods. Third class referred to coal, petroleum, and agricultural and livestock products. Over time, the railroad increased the number of categories for freight. By 1905, there were five categories of freight. The lowest classes referred to agricultural and mining export products. Freight rates in the Southern Railway varied according to category. In 1890, freight rates in first class ranged between 9 and 14 cents per ton kilometer (Table 1). For second class, rates ranged between 8 and 13 cents per ton kilometer. For third class, rates ranged between 6 and 11 cents per ton kilometer. Over time, rail freight rates declined. In the line Mollendo-Arequipa, for instance, rail rates declined from 8.3-11.4 cents per ton kilometer in 1890 to 2.2-8.7 cents in 1905.

Table 1. Passenger fares and freight rates of the Southern Railway (in dollar cents)³³.

	In current cents										In constant cents of 1900									
	1890			1905							1890			1905						
	1	2	3	1	2	3	4	5	1	2	3	1	2	3	4	5				
Passenger fares																				
Mollendo-Arequipa	<u>3.4</u>	<u>2.1</u>		<u>1.7</u>	<u>0.8</u>					<u>3.4</u>	<u>2.1</u>		<u>1.5</u>	<u>0.7</u>						
Mollendo-Ensenada	2.3	1.1								2.3	1.1									
Ensenada-Cachendo	4.6	3.1								4.6	3.0									
Cachendo-Vitor	2.3	1.1								2.3	1.1									
Vitor-Arequipa	4.6	3.1								4.6	3.0									
Arequipa-Puno	<u>3.7</u>	<u>2.3</u>		<u>1.9</u>	<u>1.0</u>					<u>3.7</u>	<u>2.3</u>		<u>1.7</u>	<u>0.8</u>						
Arequipa-Vincocaya	4.6	3.1								4.6	3.0									
Vincocaya-Crucero Alto	2.3	1.1								2.3	1.1									
Cucero Alto-Maravillas	4.6	3.1								4.6	3.0									
Maravillas-Puno	2.3	1.1								2.3	1.1									
Juliaca-Sicuaní	<u>4.6</u>	<u>3.1</u>		<u>1.7</u>	<u>0.8</u>					<u>4.6</u>	<u>3.0</u>		<u>1.5</u>	<u>0.7</u>						

³² I deflated the original figures in soles by a CPI index reported by Quiroz to convert the figure into constant soles of 1900. Quiroz, 1993. I then converted the figures to dollars of 1900 using the exchange rate between soles and dollars of 1900.

³³ Notes: The sources are Ministerio de Fomento (1897, 1905). Figures are in current dollar cents and constant dollar cents of 1900.

	In current cents									In constant cents of 1900								
	1890			1905						1890			1905					
	1	2	3	1	2	3	4	5	1	2	3	1	2	3	4	5		
Freight rates																		
Mollendo-Arequipa	11.4	9.9	8.3	8.7	7.0	5.6	3.9	2.2	11.4	9.8	8.3	7.6	6.1	4.9	3.4	1.9		
Mollendo-Ensenada	9.2	7.6	6.1						9.1	7.6	6.1							
Ensenada-Cachendo	13.7	12.2	10.7						13.7	12.2	10.7							
Cachendo-Vitor	9.2	7.6	6.1						9.1	7.6	6.1							
Vitor-Arequipa	13.7	12.2	10.7						13.7	12.2	10.7							
Arequipa-Puno	12.0	10.5	8.9	9.0	7.3	5.8	3.9	2.2	12.0	10.4	8.9	7.8	6.3	5.1	3.4	1.9		
Arequipa-Vincocaya	13.7	12.2	10.7						13.7	12.2	10.7							
Vincocaya-Crucero Alto	9.2	7.6	6.1						9.1	7.6	6.1							
Cucero Alto-Maravillas	13.7	12.2	10.7						13.7	12.2	10.7							
Maravillas-Puno	9.2	7.6	6.1						9.1	7.6	6.1							
Juliaca-Sicuani	13.7	12.2	10.7	8.7	7.0	5.6	3.9	2.2	13.7	12.2	10.7	7.6	6.1	4.9	3.4	1.9		

Mules and llamas were the substitutes for railroads in the 19th and early 20th centuries³⁴. In the 1860s, muleteers usually charged 12 cents per ton kilometer for the route Arequipa-Puno and 16 cents per ton kilometer for the route Arequipa-Cuzco³⁵. Similarly, according to the British Council of Islay, muleteers charged nine cents per ton kilometer in 1856 and 12 cents per ton kilometer in 1862 for the route Islay-Arequipa³⁶. In the early 20th century, mule freight rates were much higher. In 1909, for example, the cost of carrying bulk on mule along Ayacucho-Pisco was 18 cents per ton kilometer³⁷. Similarly, a study for the Peruvian government indicates that carrying bulk by mule cost around 16 cents per ton kilometer in the early 1920s³⁸. An alternative method by Zegarra to estimate the cost of mule transport provides similar results³⁹. On the other hand, llama owners charged less than muleteers for carrying bulk⁴⁰. According to Tizón y Bueno, llama rates were usually half of mule rates⁴¹. Then if one relies on information on mule rates from Briceño y Salinas, one can estimate llama rates by around eight cents per ton kilometer in the early 1920s⁴². Using information from Tizón y Bueno, one can estimate llama rates by around nine cents per ton kilometer in the route Arequipa-Pisco in the early 20th century⁴³.

³⁴ Zegarra, 2011 and 2013.

³⁵ Flores-Galindo, 1993: 318.

³⁶ Bonilla, 1976: 99 and 125.

³⁷ Tizón y Bueno, 1909.

³⁸ Briceño y Salinas, 1921.

³⁹ Zegarra uses a sample of 32 mule freight rates to estimate the effect of distance, railroad competition and economic activity on mule freight rates. With the OLS estimates, Zegarra then estimated the mule freight rates if railroads had not existed. Zegarra, 2013.

⁴⁰ Llamas were cheaper than mules. Tschudi, 1847: 308; Deustua, 2009: 176-177. In addition, llamas did not require much care and were cheaper to raise. Llamas were fed with practically any type of herbage from the mountains. Llamas were also better fit than mules for the physical conditions of the Andes. Hills, 1860: 101.

⁴¹ Tizón y Bueno, 1909.

⁴² Briceño y Salinas, 1921.

⁴³ Tizón y Bueno, 1909.

A comparison of freight rates for the late 19th century suggests that mule freight rates in the South of Peru were much higher than the rail rates for the lowest classes. In the case of the railroad Mollendo-Arequipa, for example, freight rates in 1890 were 8.3 cents per ton kilometer on third class. In contrast, muleteers charged between 9 and 12 cents per ton kilometer. Importantly, rail freight rates declined over time; whereas muleteers charged higher rates. In 1905, for example, mule rates were higher than first-class railroad rates. In particular, freight rates in the Southern Railway ranged between 1.9 and 7.8 cents per ton kilometer; whereas muleteers charged more than 15 cents per ton kilometer. Llamas were cheaper than mules. However, llama rates were higher than rail rates for the lowest classes of freight, such as agricultural and mining products.

Consider now passenger fares. In 1890, fares in the Southern Railway ranged between two and five cents per passenger kilometer for first class and between one and three cents per passenger kilometer for second class, depending on the route. These railroad passenger fares were lower than those charged by muleteers. In the early 1920s, for example, the fare on mule was around 4 cents per passenger kilometer⁴⁴. The Southern Railway granted relatively low transportation costs for passengers. Travelers not only saved time; they also paid less for travelling.

Therefore, the evidence indicates that the Southern Railway charged lower freight rates and passenger fares than the alternative modes of transportation. As predicted by the original defenders of the railroad project, shippers and travelers had in the Southern Railway not only a faster system of transportation, but also a cheaper one.

4. The direct impact on consumer surplus

Since the Southern Railway charged lower freight rates and passenger fares than the alternative systems of transportation, rail customers benefited from the construction of this railroad. How much they benefited, however, is not clear without a proper estimation of the social savings.

Investing in the Southern Railway may have led to an increase in consumer surplus due to the decline of freight rates and passenger fares. Social savings are defined as the increase in consumer surplus due to the railroad. Social savings can be divided into two components: freight savings and passenger savings. Freight savings are the savings in transportation costs for freight, whereas passenger savings are the savings in transportation costs for passengers. To estimate freight and passenger social savings, I rely on a standard methodology that has been employed previously by several studies⁴⁵. All figures are in constant dollars of 1900.

The freight savings of the Southern Railway measure the increase in consumer surplus for freight transportation due to this railroad. Shippers saved in freight transport costs due to the Southern Railway, because this railroad charged less than mules and llamas. Two elements have a determinant influence on the size of these freight savings: the difference in freight rates between railroads and the best alternative to railroads, and the demand for freight transportation. I calculate the freight savings

⁴⁴ Briceño y Salinas, 1921.

⁴⁵ Fogel, 1979; Coatsworth, 1979; Summerhill, 2005; Herranz-Loncan, 2011; Zegarra, 2013.

for 1890 and 1904. Data on freight services come from *Anales de las Obras Públicas*⁴⁶; and information on rail freight rates comes from Miller⁴⁷.

Considering that most roads were not appropriate for the traction of the wheel, I assume that in the absence of railroads all freight transportation would have been conducted on the backs of mules and llamas. Following Zegarra, two alternative scenarios have been considered: the first scenario assumes that only mules could be used instead of railroads, and the second scenario assumes that llamas—cheaper but slower than mules—were used as much as possible in the absence of railroads⁴⁸.

I assume that renting a mule cost 16 cents per ton kilometer in 1900 prices, as indicated by Briceño y Salinas⁴⁹. For the second scenario, I assume that llamas were used for transportation in the highlands, but not on the coast. Llama freight rates were usually lower than mule rates. Following Tizón y Bueno⁵⁰, I assume that llama rates were half of mule rates. To calculate the cost of transportation in the second scenario, I take into account the relative importance of the coastal and highland sections of the Southern Railway and the fact that llamas could not transport freight on the coast.⁵¹

Define Q as the total freight service in ton kilometers, P as the freight rate per ton-kilometer, and $Q = Q(P)$ as the demand function for freight transportation. The

freight saving of the railroad (FS) can be calculated as $FS = \int_{P_R^F}^{P_N^F} Q(P) dP$, where P_R^F

is the freight rate of railroads, and P_N^F is the freight rate of the alternative to railroad in freight transportation. In the special case on which the demand for freight transportation is perfectly inelastic, the introduction of the railroad does not increase the volume of freight service. Then the saving of the railroad can be calculated as $FS = (P_N^F - P_R^F) Q$ ⁵²

Table 2 reports the estimation of freight saving for 1890 and 1904, assuming that the demand for freight transportation was perfectly inelastic, i.e. that mules and llamas would have transported the same freight as railroads. This assumption yields an upper bound for freight savings. Our estimations indicate that freight rail services were 10.7 million ton-kilometers in 1890 and 32.6 million ton-kilometers in 1904⁵³. The system of mules and llamas was more costly than railroads for carrying bulk. Freight savings ranged between 2.5% and 6.5% of the stock of capital in 1890 and between 9.8% and 21.7% of the stock of capital in 1904⁵⁴. As a percentage of the value of exports for the ports of Islay and Mollendo—the main ports of Arequipa—, freight savings ranged between 19% and 47% in 1890 and between 107% and 238% in 1904⁵⁵.

⁴⁶ Ministerio de Fomento, 1897 and 1908.

⁴⁷ Miller, 1979.

⁴⁸ Zegarra, 2013

⁴⁹ Briceño y Salinas, 1921.

⁵⁰ Tizón y Bueno, 1909.

⁵¹ I define the highland section of the Southern Railway as the section located above 1,000 meters of altitude.

⁵² I do not take into account the fact that mules and llamas were more flexible to leave the bulk at any location, whether trains left the cargo on a station. On that point, mules and llamas were preferable to trains.

⁵³ For 1904, there is data for the total volume of freight of the Southern Railway in tons, but there is no data for the level of freight service in ton-kilometers. I estimated the distance traveled by freight using interpolation for 1903 and 1905 multiplying such distance by the total tonnage to obtain a figure in ton-kilometers.

⁵⁴ This capital stock was 19.7 million dollars in 1890 and 19.9 million dollars in 1904.

⁵⁵ On prices of 1890, total exports were estimated on 2.7 million dollars for 1890 and 1.8 million in 1904.

Table 2. The Southern Railway: Freight social savings⁵⁶.

		1890	1904	
<i>First scenario</i>				
(A1)	Freight service	10,609	32,621	thousand ton-kilometers
(A2)	Rail freight rate	0.038	0.025	dollars per ton kilometer
(A3)	Freight rail revenues (line A1 X line A2)	404	826	thousand dollars
(A4)	Freight rate by mule	0.158	0.158	dollars per ton kilometer
(A5)	Freight revenues by mule (line A1 X line A4)	1,674	5,147	thousand dollars
(A6)	Savings on freight rates (line A5 - line A3)	1,270	4,321	thousand dollars
		6.5	21.7	% capital
		47.4	237.7	% exports
<i>Second scenario</i>				
(B1)	Freight service	10,609	32,621	thousand ton-kilometers
(B2)	Rail freight rate	0.038	0.025	dollars per ton kilometer
(B3)	Freight rail revenues (line B1 X line B2)	404	826	thousand dollars
(B4)	Freight rate by wagons and llamas	0.085	0.085	dollars per ton kilometer
(B5)	Freight revenues by mule and llama (line B1 X line B4)	902	2,772	thousand dollars
(B6)	Savings on freight rates (line B5 - line B3)	498	1946	thousand dollars
		2.5	9.8	% capital
		18.6	107.1	% exports

Let us now estimate the passenger savings. The passenger savings of the Southern Railway measure the increase in consumer surplus for passenger transportation due to this railroad. I calculate the passenger savings for 1890 and 1904 considering savings on travel fares and time savings⁵⁷. Passenger service –in passenger kilome-

⁵⁶ Notes: The table reports freight social savings for 1890 and 1904. The freight social savings have been calculating assuming that the demand for freight transport was perfectly inelastic. Figures are in constant dollars of 1900.

⁵⁷ There were probably other types of social savings for rail passengers. The comfort of travelling by train, rather than riding a mule or simply walking, yielded benefits to rail passengers. Those comfort-benefits for passengers were not included in the estimation of social savings.

ters— was obtained from *Anales de las Obras Públicas* for 1890 and 1904⁵⁸. I assume that the cost of travelling by mule was four cents per person per kilometer in 1900 prices⁵⁹. I also assume that the same number of rail passengers—in first and second class— would have continued travelling in the counterfactual economy. Savings on travel fares ($PCSF$) are calculated as follows: $PCSF = (P_N^P - P_R^P)Q$, where P_R^P is the price of passenger service by railroad, and P_N^P is the price of passenger services using the alternative mode of transportation.

Table 3 reports first- and second-class passenger savings. Total passenger service in first class was 1.5 million passenger kilometers in 1890 and 3.5 million in 1904. At a rail passenger fare of three cents per passenger, total revenues for first-class passenger transportation was 59,000 dollars in 1890 and 56,000 dollars in 1904. Transporting the same number of passengers by mule would have cost 58,000 dollars in 1890 and 134,000 dollars in 1904. There were no savings on travel fares in 1890; whereas savings on travel fares were 78,000 dollars in 1904. To calculate the value of the time saved by first-class rail passengers, one needs information on the speed of trains and mules. Passenger trains of the Southern Railway operated at an average speed of 25.55 kilometers per hour⁶⁰. Mules travelled at a rough speed of 6.3 kilometers per hour. I also assume that passengers participated in the labor force in the same proportion as the general population in the southern region, and first-class rail passengers valued their time at twice the hourly wage⁶¹. On average, first-class rail passengers saved 3.83 hours per trip, so the railroad allowed first-class rail passengers to save 180,000 hours in 1890 and 420,000 hours in 1904. The value of the time savings depends on the average wage: wages measure the opportunity cost of time. I assume the following values for wages: 3.9 cents per hour in agriculture, and 8.8 cents per hour in the rest of the economy⁶². Then the value of time saved by first-class rail passenger travelling was only 13,000 dollars in 1890 and 32,000 dollars in 1904. In total, first-class passenger savings were equal to 0.06% of the stock of capital in 1890 and 0.55% of the stock of capital in 1904. As a percentage of the value of exports, first-class social savings were 0.4% in 1890 and 6% in 1904.

For second-class rail passengers, the mode of transportation in the counterfactual economy may have been walking. Travelling by mule was too costly for these passengers⁶³. Social savings for second-class rail passengers involved positive time

⁵⁸ Notice that for the calculation of passenger social savings, it is important to have information on passenger-kilometers per class. I then assumed that in each railroad the distance traveled by first and second-class passengers was the same. Data on passenger service in passenger-kilometers have been obtained or estimated from Ministerio de Fomento, 1897 and 1908.

⁵⁹ I derive this figure from Briceño y Salinas. Briceño y Salinas, 1921.

⁶⁰ This calculation is based on information from Costa y Laurent, which reports the time spent by all railroads. Costa y Laurent, 1908.

⁶¹ I used interpolation to calculate the total population, the population younger than 15 years old—assumed not to be part of the labor force—and the rural population for 1890 and 1904, using data from the census of 1876 and the census of 1940. The portion of the rural population dedicated to agriculture of 1940 was used to approximate the population in agriculture in 1890 and 1904.

⁶² I rely on wage information from Ministerio de Fomento, 1929 for agriculture and Pino, 1910 and Torrejón, 2010 for non-agriculture.

⁶³ In 1904, for example, an average rail trip in the Southern Railway covered around 32.05 kilometers. Such a trip took 8.01 hours on foot and 5.08 hours by mule. The opportunity cost of walking 32.05 kilometers—the average journey— was then 95.9 cents. However, a person did not have to pay a fare for walking. On the other hand, the opportunity cost of travelling by mule was 60.8 cents, and the passenger fare for travelling by mule was 2.43 soles. Therefore, the total cost of travelling on foot was 95.9 cents, whereas the total cost of travelling by mule

savings and negative savings on travel fares. Savings on travel fares were negative, simply because the fare-cost of walking was zero. The volume of second-class rail passenger travelling was 3.9 million passenger-kilometers in 1890 and 7.7 million in 1904; whereas the average rail passenger fare was 2.5 cents per kilometer in 1890 and 0.8 cents in 1904. Then the negative consumer savings in travel fares were 96,000 dollars in 1890 and 60,000 dollars in 1904. Meanwhile, time savings for second-class passengers were equal to 30,000 dollars in 1890 and 62,000 dollars in 1904. Overall, second-class passenger savings were -0.3% of the stock of capital in 1890 and only 0.007% in 1904. As a percentage of the value of exports, second-class social savings were -2.5% in 1890 and 0.1% in 1904.

Table 3. The The Southern Railway: Social Savings on First- and Second-Class Rail Passengers⁶⁴.

		1890		1904		
		First	Second	First	Second	
		class	class	class	class	Units
<i>Savings on Travel Fares</i>						
(A1)	Passenger service	1,533	3,893	3,530	7,737	thousand passenger-km
(A2)	Rail rate	0.039	0.025	0.016	0.008	dollars per passenger-km
(A3)	Passenger rail revenues (line A1 X line A2)	59	96	56	60	thousand dollars
(A4)	Passenger revenues by mule (first-class) or walking (second-class)	58	0	134	0	thousand dollars
(A5)	Savings on travel fares (line A4 - line A3)	-1.1	-95.7	77.9	-60.3	thousand dollars
<i>Time Savings</i>						
(B1)	First-class passenger service	1,533	3,893	3,530	7,737	thousand passenger-km
(B2)	Average passenger journey	38.6	38.6	32.0	32.0	km
(B3)	Time saved per journey	4.606	8.133	3.827	6.758	hours
(B4)	Portion of passenger-kilometers by agricultural workers	0.419	0.419	0.372	0.372	
(B5)	Portion of passenger-kilometers by non-agricultural workers	0.223	0.223	0.265	0.265	
(B6)	Portion of passenger-kilometers by non-workers	0.358	0.358	0.363	0.363	
(B7)	Time savings for agricultural workers (line B1/ line B2) X (line B3 X line B4)	76.6	343.5	156.7	606.7	thousand hours
(B8)	Time savings for non-agricultural workers (line B1/ line B2) X (line B3 X line B5)	40.8	183.1	111.6	431.8	thousand hours
(B9)	Time savings for non-workers (line B1/ line B2) X (line B3 X line B6)	65.6	294.2	153.2	593.0	thousand hours
(B10)	Value of time saved in agriculture (K X 0.039 X line B7)	6.0	13.4	12.2	23.7	thousand dollars
(B11)	Value of time saved in non-agriculture (K X 0.088 X line B8)	7.2	16.1	19.6	38.0	thousand dollars
(B12)	Total first-class time savings (line B10 + line B11)	13.2	29.5	31.9	61.7	thousand dollars
<i>Savings on Fares and Time</i>						
	Total savings on travel fares and time (line A4 + line B12)	12.0	-66.2	109.8	1.4	thousand dollars
		0.061	-0.336	0.552	0.007	% stock of capital
		0.448	-2.467	6.040	0.076	% exports

was 3.04 soles. There was a large difference in passenger fares between walking and riding a mule. Due to the large differences in total cost between travelling by mule and walking, I assume that second-class rail passengers would have walked in the absence of railroads.

⁶⁴ Notes: The table reports passenger social savings for 1890 and 1904 for first and second class passengers. For the estimation of the value of time, K is 2 for first-class and 1 for second class. The calculations are in constant dollars of 1900.

Total social savings are equal to freight savings plus passenger savings. Total social savings of the Southern Railway in 1890 ranged between 2.3% and 6.2% of the stock of capital. In 1904, the social savings ranged between 10.3% and 22.3% of the stock of capital. As a percentage of the value of exports, social savings ranged between 16% and 45% in 1890 and ranged between 113% and 244% in 1904. Social savings largely came from freight savings. In 1890, passenger savings were negative; whereas in 1904 the lower bound of freight savings was equivalent to 18 times the passenger savings⁶⁵.

5. Transportation and economic growth

Several theoretical and empirical studies show that higher transport costs may reduce the gains from trade and retard economic growth. Increasing returns and horizontal specialization as well as vertical specialization may allow us to explain why transport costs reduce trade⁶⁶. Therefore, considering that the Southern Railway allowed Peruvians to save on freight rates and passenger fares, this railroad may have fostered trade and investment in the South, especially for those productive sectors on which the region had a comparative advantage.

To determine the impact of the railroad on the economy, it would be important to count with an estimate of GDP for the South of Peru. Unfortunately, regional GDP data is not available for Peru for the 19th and early 20th century. Some estimates for the total GDP of Peru do exist for this period, but they refer to the entire country. I then look at other indicators of the economy. I look at exports, railroad freight and qualitative evidence to infer whether the Southern Railway affected the economy of the South of Peru⁶⁷.

The hypothesis that pre-rail modes of transportation fostered investment seems supported by the evidence when looking at the difficulties of transporting machinery by mule or llama. In 1859, for example, three businessmen founded a textile company near Cuzco. The machinery was imported directly from France. They were highly modern machines, manufactured by the firm *Ateliers de Construction to Louviers A. Mercier*. Importantly, those machines were made under special order, bearing in mind that they would be transported from the coast to the sierra on the back of mules over 800 kilometers. "Transportation was indeed costly and difficult. A great number of mules and muleteers were employed. The roads had to be adapted. In other cases, special roads had to be built. In total 800 crates of machinery was transported"⁶⁸.

⁶⁵ These rates of social savings were similar to those in Brazil, where railroads also yielded large benefits to their customers: according to Summerhill, social savings of the railroads represented between 14% and 19% of the construction costs. Summerhill, 2005. I have calculated these figures by using the estimation of social savings and divided those savings by total construction costs.

⁶⁶ Gallup – Sachs – Mellinger, 1999; Overman – Redding – Venables, 2003; Eaton – Kortum, 2002; Rousslang – To, 1993.

⁶⁷ One must certainly be careful about the interpretation of the profit rates. Even if profit rates were not high, the railroad could have a large impact on the economy.

⁶⁸ Flores-Galindo, 1993: 319. The original text is the following: "El transporte fue, efectivamente, costoso y difícil. Se empleó gran cantidad de mulas y arrieros. Los caminos tuvieron que ser adaptados. En otros casos hasta tuvo que construirse caminos especiales. En total se transportó 800 cajones de maquinaria."

Even though pre-rail modes of transportation were highly inefficient, the evidence shows that the Southern Railway did not have an immediate impact on the economy of the South. In its first years of operations, the level of services and profits of the railroad were low. In 1873, for example, the British Council from Islay indicated that the railroad was not profitable due to the apparent low demand. “The lines in question are far from constituting lucrative enterprises. Between Arequipa and Mollendo, and viceverse, there is only one daily trip by train that only transports a few people, whereas the transportation of passengers between Arequipa and Puno by train occurs only once a week”⁶⁹. Some still relied on the traditional system of mules and llamas. The British Council indicated that muleteers still conducted commercial trips between Arequipa and Islay. Two years later, the British Council from Islay indicated that the hopes of using the line of Arequipa-Puno and the Titikaka Lake to transport the bulk that came from Bolivia were not materialized, due partly to the lack of steam boats in the lake. The traditional system of mules and llamas was still employed to transport merchandise between Bolivia and Arequipa through Lauca and Cobija. Meanwhile, the line Arequipa-Mollendo was still not profitable⁷⁰.

The evidence for exports also suggests that the Southern Railway did not have an immediate impact on the economy of the South⁷¹. There is no clear change in the rhythm of growth of exports after the opening of the railroad (Figure 1). In fact, wool exports expanded in the 1850s and 1860s –prior to the construction of the railroad– and declined in the 1870s –after the beginning of operations⁷². The railroad granted transportation at low cost. However, firms in the region may have taken time to make investments and expand their productive capacities in response to the decline in transportation costs⁷³. Moreover, the War of the Pacific in 1879-83 had severe effects on the region and probably limited the impact of the railroad on the economy⁷⁴.

The economy of the South did not take advantage of the low transportation costs provided by the railroad in the 1870s and 1880s. In 1890, the railroad transported 50,000 tons of bulk and 140,000 passengers. The output of the railroad was 10.6 million ton kilometers and 5.4 million passenger kilometers. I do not have information on freight and passengers prior to the war. However, the evidence suggests that the railroad output was too low to make the railroad very profitable. In 1890 gross revenues were around 1.4 million dollars and net revenues reached half a million dollars. The profit rate was less than 3% of the stock of capital. The demand was not large enough as to make the railroad company a very profitable business.

⁶⁹ Bonilla, 1976: 235.

⁷⁰ *Ibidem*: 244.

⁷¹ One might even argue that the expansion of the railroad occurred in response to the growth of exports and so to the greater need for transportation.

⁷² Miller also notices that wool exports increased prior to the construction of the Southern Railway. Miller, 1982.

⁷³ Other factors could have limited the growth of exports. For instance, credit constraints may have limited the capacity of economic agents of taking advantage of lower transportation costs. Imperfections of the system of property rights could also explain the non-significant impact of railroad length on wool exports. It is possible that even if transportation was facilitated by the construction of the Southern Railway, the production and exportation of wool were still limited by other factors. An analysis of other factors that impeded economic growth in the South is beyond the scope of this article. Further analysis needs to be done to provide a better understanding of the obstacles to economic growth in the South of Peru. Our results, however, suggests that transportation costs were not the only factor that influenced on the growth of exports in the South of Peru.

⁷⁴ The war affected the Peruvian economy, not only the South. In 1879-83, total GDP of Peru fell 38% and the index of export quantum fell by 45%.

Over time, however, the demand for railroad services increased. The volume of bulk transported by Southern Railway increased from almost 50,000 tons in 1890 to 72,000 tons in 1900, 170,000 tons in 1918 and 214,000 tons in 1930. Meanwhile, the number of passengers increased from 140,000 in 1890 to 310,000 in 1900, but then declined to 290,000 in 1906 and 240,000 in 1930. The increase in freight led to an increase in profits. According to Miller, the profit rates of the Southern Railway were below 3% of the stock of capital in the 1890s and in most of the 1900s⁷⁵. Profit rates then ranged between 1% and 4.5% in the 1910s, and ranged between 5% and 7% in the late 1920s.

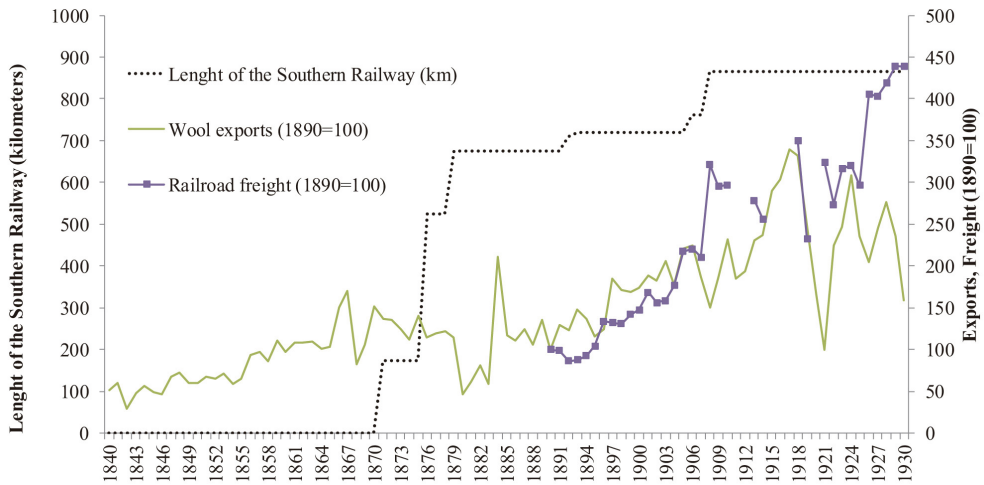


Figure 1. The Southern Railway and exports from the South of Peru⁷⁶.

As Bonilla indicates, the Southern Railway was useful for transporting wool and leather with a destination to England⁷⁷. Consistently with the expansion of railroad freight, exports of wool increased from the late 19th century: wool exports increased from 2,350 tons in 1895 to 4,700 tons in 1910 and 5,600 tons in 1928.

However, the impact of the Southern Railway went beyond the transportation of wool. The railroad transported a variety of products. A report of the Ministerio de Fomento⁷⁸ shows that wool only accounted for 4% of the total freight of the Southern Railway in the early 1930s (Table 4). Compare the volume of exports—which mostly came from the South—and the freight of the Southern Railway. For 1890-1930 the

⁷⁵ Miller, 1976a.

⁷⁶ Notes: The original sources are Costa y Laurent (1908) and Galessio (2007) for the length of the Southern Railway; Zegarra (2013) and Ministerio de Fomento (1940) for railroad freight; and Hunt (1973), Zegarra (2018) and Ministerio de Fomento (1931) for wool exports in metric tons. Exports of wool are for the entire country. However, most Peruvian wool exports came from the Southern region. In 1889, for instance, Peru exported 596 tons of sheep wool, of which 565 tons corresponded to exports by the port of Mollendo (Bonilla, 1975a: 239). In 1905 exports of sheep and alpaca wool through Mollendo were 4,236 tons. Total wool exports of Peru were 4,511 tons (Bonilla, 1975b: 127). In 1925, the southern region produced the 86% of the volume of exported wool of Peru (Hohagen, 1927: 101).

⁷⁷ Bonilla, 2005: 321.

⁷⁸ Ministerio de Fomento, 1932.

volume of Peruvian wool exports never represented more than 5% of the total freight of the Southern Railway⁷⁹. Non-wool freight –estimated as the difference between railroad freight and Peruvian wool exports– increased from 47,000 tons in 1890 to 68,000 tons in 1900, 140,000 tons in 1910 and 210,000 tons in 1929⁸⁰.

Table 4. Freight transported by the Southern Railway, 1931⁸¹.

	Freight (tons)	%
Agriculture		
Wheat and maize	7,711	7.0
Sugar	5,959	5.4
Fruits and legumes	2,152	1.9
Rice	2,047	1.8
Coca	1,702	1.5
Cotton	756	0.7
Coffee	422	0.4
Livestock and derivatives		
Wool	4,572	4.1
Leather	541	0.5
Animals	3,981	3.6
Guano	4,236	3.8
Mining		
Minerals	5,765	5.2
Oil and derivatives	2,955	2.7
Coal and firewood	6,255	5.6
Cement and lime	4,971	4.5
Salt	1,540	1.4
Manufacture		
Flour	4,934	4.4
Textiles	834	0.8
Liquors	2,264	2.0
Sacks and containers	1,536	1.4
Machinery	351	0.3
Freight from and to Bolivia	22,154	20.0
Others	30,980	27.9
Total	110,907	100.0

⁷⁹ I compare total wool exports of Peru with total freight of the Southern Railway.

⁸⁰ Other Peruvian railroads largely concentrated on the transportation of a few products. The Central Railway, for example, specialized on the transportation of minerals. In 1931, minerals accounted for nearly 50% of total freight. In contrast, the Southern Railway served a variety of agricultural, livestock, mining and manufacturing products.

⁸¹ Source: Ministerio de Fomento (1932).

The railroad transported a variety of products. In 1931, for example, the Southern Railway transported 7,700 tons of wheat and maize, 6,000 tons of sugar, 5,700 tons of minerals and 4,500 tons of wool. The railroad contributed with the diversification of the export basket. In the 1860s, most exports by the port of Islay were wool. Over time, the region increased the exportation of other products by the port of Mollendo. In particular, silver, copper, tin, rubber, coca, among other products, were largely exported. Exports of copper, for example, increased from 537 tons in 1890 to 3,000 tons in 1900 and 3,500 tons in 1910. Exports of tin were null in 1880, but reached 352 tons in 1900 and 1,125 tons in 1910. Exports of coca leaves increased from only 11 tons in 1890 to 87 tons in 1910.

The railroad facilitated the integration of the regional economy with the rest of the world. As a result, the population in the region had access to products from other countries and from the rest of Peru. The railroad, for instance, carried imports of wheat, flour and machinery. Wheat and flour was imported from Chile for domestic consumption. The railroad also transported machinery, facilitating the industrialization of the region. The railroad also transported guano from the islands of Chincha in Ica for the agriculture of the region. The railroad also facilitated the integration of Bolivia with the South of Peru and with the rest of the world. The railroad served as a means of transportation for Bolivian exports and imports: around 20% of freight went to Bolivia or went to this country⁸².

6. Conclusions

The construction of the Southern Railway generated great hope about the economic future of the South of Peru. Businessmen and politicians considered that the railroad would bring speed to their communications and lower transportation costs. As railroads were bringing prosperity to other countries around the world, the Southern Railway would bring prosperity to the South of Peru. This optimistic view of the railroad was certainly not limited to the Southern Railway. In general, the period 1860-75 was a period of great optimism about the economic prospects of Peru due to the construction of railroads on the coast and in the highlands.

The promise of a brighter future seems to have been met with the faster service provided by railroads. Naturally, the steam machine provided a faster transportation than the traditional system of mules and llamas. In addition, the railroad reduced freight rates and passenger fares, especially for transporting bulk and passengers over long routes. With the Southern Railway, Peruvians in Arequipa, Cuzco and Puno could pay less for a faster, more comfortable and more secure trip. In 1905, for example, the Southern Railway charged a freight rate of around two cents per ton kilometer in fifth class over the routes Mollendo-Arequipa, Arequipa-Puno and Juliaca-Cuzco. In contrast, muleteers charged more than eight cents in the 1860s and more than 15 cents per ton kilometer in the early 1920s.

The reduction of transportation costs due to the railroad led to an increase in consumer surplus. Clients of the Southern Railway enjoyed an increase in their consumer surplus as a result of the construction of this railroad. For 1890, the social sa-

⁸² In 1891, the British Council in Mollendo argued that the future of the South and of the railroad largely depended on Bolivian trade. Bonilla, 1976: 23.

vings of the railroad ranged between 2.3% and 6.2% of the stock of capital; for 1904, the social savings ranged between 10% and 22% of the stock of capital. Freight savings were much greater than passenger savings. Railroad owners also benefited from the expansion of the demand: profit rates increased over time, reaching around 7% of the capital stock in the late 1920s. However, the owners of the railroad were not the main beneficiaries. Customers –rather than railroad owners– were the main beneficiaries of the Southern Railway.

The Southern Railway did not have an immediate impact on the economy of the South. Wool exports, for example, did not increase at higher rates soon after the construction of the railroad. The War of the Pacific (1879-83) may have limited the influence of the railroad on the economy. Over time, however, the railroad served a variety of sectors. The railroad allowed the transportation of wool. However, wool was not the main beneficiary of the railroad. Wool accounted for less than 5% of the freight. The railroad transported a variety of mining, agricultural, livestock and manufacturing products. By providing fast transportation at a low cost, the railroad facilitated the integration of the Southern region and Bolivia with the world economy. The railroad also facilitated the integration of the Southern region with the rest of the Peruvian economy.

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