

Railway Investment in Uruguay before 1914: Profitability, Subsidies and Economic Impact

March, 2015

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Abstract

Railways were an important factor in the expansion of the Atlantic economy in the late-19th century. Due to the potential impact of this technology, governments often promoted railway construction through direct financing, land grants or various forms of subsidies. The Uruguayan state offered profit guarantees to foreign railway companies and was able to attract massive investment in the railway sector. However, the direct economic impact of this infrastructure was low. In order to explore the reasons for this, the paper examines the profit record of the railway companies and the social returns of the capital invested in the Uruguayan network from 1869 to 1913, as well as the impact of government subsidies over the period. The results show that although the partial public financing doubled the private returns, subsidized profitability did not compensate the domestic market rate of return and was lower than for railways in other low population-density regions. On average, for the period, social returns were higher than the opportunity cost of capital for the Uruguayan economy, although they were also low relative to railways in other regions. However, the distribution of social returns between the railway companies and consumers of transport services does not appear to have been unfavorable for this second group.

1. Introduction¹

Railways were a critical factor in the expansion of the Atlantic economy in the late-19th century. They contributed to export growth, aided market integration and stimulated changes in patterns of settlement and production in the regions in which they were built. In some areas, geographical constraints made railway investment a necessary condition for development. At the same time, there were many factors that conditioned the impact of railways on the economy, and not all countries that received large amounts of railway capital enjoyed benefits to the same degree. It is therefore interesting to explore the factors that affected railway construction and the subsequent economic impact of this investment. The railway historiography has tried to disentangle the determinants and effects of railway construction in a number of economies during the period of the expansion and primacy of this mode of transport. This paper studies the returns to railway investment in Uruguay, from when the first line opened in 1869 up to 1913, in order to shed light on the impact of this infrastructure on the country's development.

Railways had an enormous impact in many countries in which they were built, especially in Latin America, where they stimulated exports and integrated national markets. Indeed, they are considered to have been indispensable for economic development during the first globalization (see, for example, Summerhill (2003) for Brazil, and Coatsworth (1979) and Kuntz (1995) for Mexico). The high cost of railways was often prohibitive for peripheral economies with scarce capital and underdeveloped capital markets. For this reason, in developing countries, almost all railways were built with foreign capital (Eichengreen, 1994: 1). Great Britain was the most important source of capital for Latin America, and one third of this went to the railway sector (Stone, 1968: 324). Railways were therefore important for international financial markets, and, at the same time, these markets had influence over the development of the developing economies that received railway investment. Due to the potential impact of this technology, developing country governments often promoted railway construction through land grants or various forms of subsidies to private companies. Because railways were believed to be indispensable for development, it was thought that the public subsidies would provide large economic returns in the medium and long-term. Without subsidies, it was believed that investment would not occur, due to the high cost of capital and excessive perceived risk (Eichengreen, 1995: 1). However, with limited resources for promoting development, subsidies represented a sacrifice for the state and the economy. Public financing had to balance the need to attract sufficient investment in order to foster economic development, while not placing too much of a burden on state coffers. In addition, there was a danger

¹ The author thanks Enrique Bianchi and Werther Halarewicz for their help with sources, and Alfonso Herranz-Loncan, Luis Bértola, Reto Bertoni, Tommy Murphy, Agustina Rayes and Juan Carlos Odisio for their very helpful comments on earlier drafts.

that capital would be diverted away from other productive activities in search of easy government money.

The Uruguayan state, beginning in the 1860s, offered profit guarantees to private investors and was able to attract massive investment in the railway sector. This led to the construction of one of the densest networks in Latin America, second only to Argentina's in railway mileage per capita (Herranz-Loncán, 2011: 3). The development of this network accompanied and influenced the country's economic transformation in the late 19th and early 20th centuries, and helped link the country to the Atlantic economy.² However, the direct economic benefits from this infrastructure were very low compared to railways in other countries. The social savings of the Uruguayan railway in 1913 are estimated to be only 3.4% of GDP (Herranz-Loncán, 2011), whereas for Argentina, Brazil and México they are over 10% of the respective GDP of each country in similar years (Herranz-Loncán 2014).

Uruguayan historiography has, for the most part, taken a rather negative view of the railways and the British companies that built and operated them before 1913. Some authors, inspired by dependency theory, have argued that the railway benefited mostly foreign interests, and did not encourage development of the rural economy. For instance, Barrán and Nahum (1971: 540, 614; 1973: 446-49; 1978: 139) claim that the layout of railway network was designed to capture the interregional transit trade, and that the high prices charged were prohibitive to agriculture, and aimed at only high value product from the livestock sector. Martínez-Díaz (1987) has reiterated these points, claiming that the British companies adopted extractive strategies, and were not concerned with developing the rural economy. The railway companies are also accused of rent seeking behavior aimed at capturing state subsidies (Barrán and Nahum, 1971: 560-61; Finch, 2003: 213). In the opinion of this group of authors, all of this produced high returns for foreign investors, but retarded development of the rural economy. Other authors have challenged parts of this thesis. For example, Bertino and Millot (1996: 351) claim that the closed frontier and lack of state support for agricultural colonies were more important factors in the slow development of the rural economy, while Herranz-Loncán (2011: 21-22) shows that the high prices charged were probably a consequence of high operating costs rather than of an extractive strategy on the part of railway companies.

These issues are explored in this paper through an examination of the profits of the railway companies, the effect of state subsidies and the economic impact of the railway before 1914. Four questions are considered. First, what was the profitability of the Uruguayan railway? Second, what impact did subsidies have on profitability? Third, what

² Between 1870 and 1913, Uruguayan GDP increased by a factor of five, GDP per capita doubled and exports quadrupled (Bértola, 1998: 58).

were the social returns of the railway? And fourth, what was the distribution of social returns between the railway companies and the users of the service?

In responding to these questions, this paper provides estimates of the private and social returns to the Uruguayan railway network from 1869 to 1913. The results show that the network, as it was developed up to 1913, was not profitable. Although the partial public financing more than doubled the private returns to investors, subsidized profitability did not compensate the opportunity cost of capital and was lower than for railways in other settler regions. Social returns were also low relative to railways in other regions, although it cannot be said that there was overinvestment in the network. Furthermore, the distribution of social returns was not unfavorable to the consumers of railway services compared to what occurred in other regions.

The next section presents a brief description of the development of the Uruguayan railway network and the state's role in its financing. Section three responds to the first two questions by presenting railway company revenue and investment data, and estimating the subsidized and unsubsidized private rates of return. Section four takes up the question of the social returns from the investment, as well as the distribution of benefits between railway companies and the users of the service. Section five concludes.

2. History of the Uruguayan railway and the role of the state in its construction

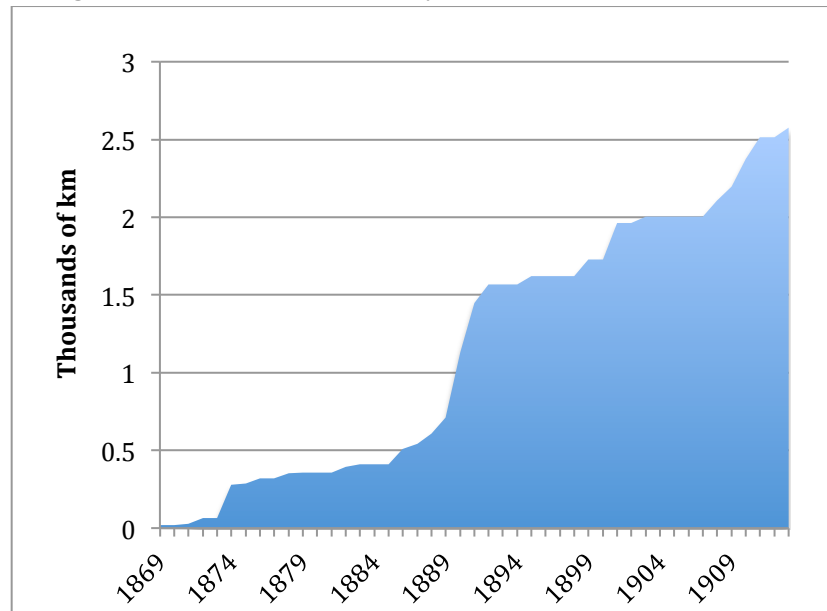
As mentioned in the introduction, by 1913, Uruguay had one of the densest railway networks in Latin America. There were over 20 kilometers of track per 10,000 people, and only a handful of the smallest Latin American economies had more track mileage in relation to surface area of the country (Herranz-Loncán, 2011: table 1). The capital invested represented on average about 7% of the country's annual gross fixed investment over the 45-year period under consideration.³

This technology arrived relatively late in Uruguay. The first stretches of track were not opened to traffic until 1869, more than a decade after neighboring Argentina and Brazil inaugurated theirs (Rodríguez Carrasco, 1998: 127, 175). The pace of construction was slow at first; fifteen years after the first line was opened there were less than 500km of track in operation. During the speculative boom at the end of the 1880s, investment poured into the country, most going to the railway sector (Winn, 2010: 112-113). This led to a tripling of track length in just five years. However, the Baring crisis of 1890 in neighboring Argentina spilled over to the Uruguayan economy and put an end to this

³ Calculated based on a gross fixed investment series from Roman and Willebald (2011) and my own figures.

expansion. After eight years of stagnation, construction picked up again and another 1,000km were built before 1913. Figure 1 shows the changes in railway track length over the period.

Figure 1: Kilometers of railway track in existence, 1869-1913



Sources: National Statistical Yearbooks and Central Uruguay Railway Company Annual Reports

Not long after WWI, the railway gradually began to lose importance in Uruguay. The political forces in power in the first decades of the 20th century were hostile to British capital (Nahum, 1994: 54-55), while technological change brought about a shift towards cars, trucks and highways (Bertino et al., 2005: 269), due to their clear transport advantages for short-to-medium distance trips and lighter loads. As a consequence, on the eve of WWII, the railway era in Uruguay was already drawing to a close.

The first railway company to operate in Uruguay was owned by domestic capitalists. This endeavor quickly ran into financial trouble and was bought up by British investors, who proceeded to build and operate most of the network until its nationalization in the first half of the 20th century.⁴ In 1913, 60% of the network was controlled by the Central Uruguay Railway Company (CUR), which operated the trunk line and various extensions. The rest of the network was divided between the Midland Railway Company, which operated almost 20%, and several smaller companies. Figure 2 shows the layout of the Uruguayan railway network as it stood in 1911.

⁴ Although the first portions of the network passed into state hands in 1915, most of it remained private during the interwar period. In 1948 the state acquired the railway lines of the five remaining privately owned companies as part of the settlement of British debts incurred during WWII (Millot and Bertino, 1996: 331).

Figure 2: Uruguayan Railway Network in 1911



Source: Central Uruguay Railway Company Annual Report for 1911

The state was heavily involved in the development of the railway network from the very beginning. It authorized the first proposed line, from Montevideo to Durazno, in 1865, and offered a profit guarantee of 7% over a fixed value of £10,000 per mile of track constructed (£6,214/km). It also offered to provide a large part of the initial capital; a promise that it did not keep. Concessions for other lines were provided under similar arrangements, although, as already mentioned, little building occurred over the next few years. Given the chaotic situation of the country and the weakness of the state, it proved difficult to attract sufficient funds for railway construction.

In response, the government institutionalized the guarantee in the Railway Law of 1884, with the hopes of alleviating investor unease and attracting more capital (Barrán and Nahum, 1971: 556). Similar to arrangements with earlier lines, the government agreed to supplement net revenue earnings below 7% of a fixed value per kilometer of track, now lowered from £6,214 to £5,000. In turn, the railway companies were obligated to return to the government part of any profits over 8% of the fixed capital per kilometer, until all guarantees paid in earlier years had been refunded. In addition, the government reserved the right to fix freight and passenger fares if profits rose above 12%; a right that they never ended up exercising. The 1884 Railway Law also established the general layout of

the future network and additional regulations under which the companies would operate. The second Railway Law of 1888 made some adjustments to the framework laid out four years earlier, most notably establishing the possibility for direct state intervention in the construction of railway lines. However, the projects initiated under this regime never came to fruition.

The crisis of 1890 resulted in the government's default on public debt the following year. The subsequent settlement included a renegotiation of the guarantee agreements. The guarantee rate was reduced to 3.5% and the level at which the companies had to begin returning the subsidy was lowered to 6%.

For a network with growing traffic and heavy use, the total amount of the guarantee payments made in the early years of low profitability would be returned in later years. The subsidy would then consist of the interest payments saved on the use of those funds between the time of payment and return. However, in Uruguay, since the companies under guarantee never reported profits above the level established in the law (at least according to their accounts), the state never recovered the money paid out. Instead of being simply an interest free loan, the subsidy ended up taking the form of a large transfer of funds from the state to the railway companies.

3. Profitability of the Railway Companies and the impact of government subsidies

A first step in evaluating the impact of the railway investment is estimating the average profitability of the railway network from 1869 to 1913. The nature of railway investment during the period meant large initial capital outlays, in order to connect disparate points in space, and building "ahead of demand", because it was hoped the infrastructure would encourage economic development, which would in turn generate traffic for the railway. Because income and spending could be uneven over time, profits varied from year to year. In order to avoid the problems associated with examining specific years, it is better to evaluate the performance of the investment over its useful life.

The appropriate measure for this is the internal rate of return (IRR) (McClelland, 1972: 472-74). This combines the annual operating revenues, operating costs, subsidy payments and capital expenditures in real terms, appropriately discounting them according to the year in which they occurred. In addition, in the case that the period analyzed is shorter than the useful life of the capital, a term is added to take into account the value of the network at the end of the period. The result is the rate of return actually received by the companies that operated the network. The formula for calculating the IRR is:

$$PV = \sum_{t=0}^T \frac{(R_t - C_t + G_t - I_t)}{(1+r_i)^t} + \frac{V}{(1+r_i)^T} \quad (1)$$

where R_t is the operating revenues in each year, C_t is the operating costs, G_t is the guarantees and related payments, I_t is the capital invested in construction of the network, t indicates the year in which the spending occurs, T is the last year of the period (1913) and V is the value of the network in the last year of the period, taking into account capital depreciation. The value for r_i when the present value (PV) is equal to zero is the internal rate of return.⁵

The operating revenues and costs series were estimated by Herranz-Loncan, and are based on the Statistical Yearbooks and Company Reports. Information for a few of the smaller companies is not available. In these cases, the series was adjusted by the percentage of track each company represented in the total network.⁶

The capital investment series includes the initial construction costs, as well as maintenance and replacement costs, and therefore represents the gross fixed capital formation in the railway sector. It has been estimated from the construction costs recorded in the capital account balance sheets found in the company reports for a sample of the railway companies that operated during this period. The companies for which information exists are the *Ferro-carril Central del Uruguay* (later *the Central Uruguay Railway Company*), *the Central Eastern Extension*, *the Central Northern Extension*, *the Central Western Extension*, *the Midland Uruguay Railway Company*, *the North Eastern of Uruguay Railway Company* (originally called the *Eastern Uruguay Railway Company*) and *the Uruguay Central and Hygueritas Railway Company*, which together owned 79% of the track in operation in 1913. All these, except the *Midland*, the *Northeastern* and the *Hygueritas* formed an integrated system (although they maintained separate accounts), in which *the Central Uruguay Railway Company* leased and operated the other companies' lines.

Identifying the appropriate construction costs in the company accounts is no simple task. In general, it is not possible to use differences in the year-to-year totals because these often include discounts offered on the sale of company bonds or shares, or other financial capital movements. Therefore, the sum of all items referring to construction costs found in the capital account balance sheets each year has been used. Only for the first years of the *Ferro-carril Central* and for a few years of *the Central Western Extension*, the differences in year-to-year totals have been used due to lack of more detailed

⁵ The equation is a polynomial for which there may be multiple solutions for r . The subscript i indicates the lowest, positive solution.

⁶ See Herranz-Loncan, 2011, figure 2, p. 6.

information. Another problem comes from the practice, common in 19th century accounting, of recording part of the construction costs in the operating account balance sheet and not the capital account balance sheet (Herranz-Loncán, 2004: 30). The lack of detail of the operating account balance sheets impedes the identification of all relevant construction costs, leading to a likely downward bias in the capital investment series (which would lead to an upward bias in the rate of return estimation). However, it is also known that the companies inflated the costs of construction in order to fraudulently reduce their declared profits (Barrán and Nahum, 1971: 581-86). This would introduce an upward bias into the capital investment estimation, which could, in part, offset the downward bias mentioned earlier.

Based on the sources available, a capital investment series from 1869 to 1913, in current pounds sterling, has been constructed for the sample of railway companies for which information exists. A GDP deflator estimated by Bértola (1998: 58-59) has been used to convert the series to constant 1913 prices.⁷ The average cost of construction was £9,543/km of track.⁸ This is in line with estimates for other economies in the region, such as Brazil and Argentina (Cambó Batlle, 1918-1922).⁹

Because the cost of the trunk line was so much higher than the rest of the network, the average value of only the secondary lines (£8,001/km) has been applied to the track length of the companies for which information is not available in order to estimate the total capital invested in the network. Information on the track length operated by these companies is found in the national statistical yearbooks. In nominal terms, a total of 16.5

⁷ The GDP deflator series begins in the year 1870; due to lack of information for earlier years, the value of the index in 1870 has been applied to the year 1869. This assumes that prices remained constant from the time construction began until the first kilometers of track were opened to traffic, although due to the small amount invested relative to later years, any bias introduced because of this assumption would be minimal.

Using this deflator may introduce some bias because some construction inputs were imported from Britain, where prices did not vary much during this period (Officer and Williamson, 2011).

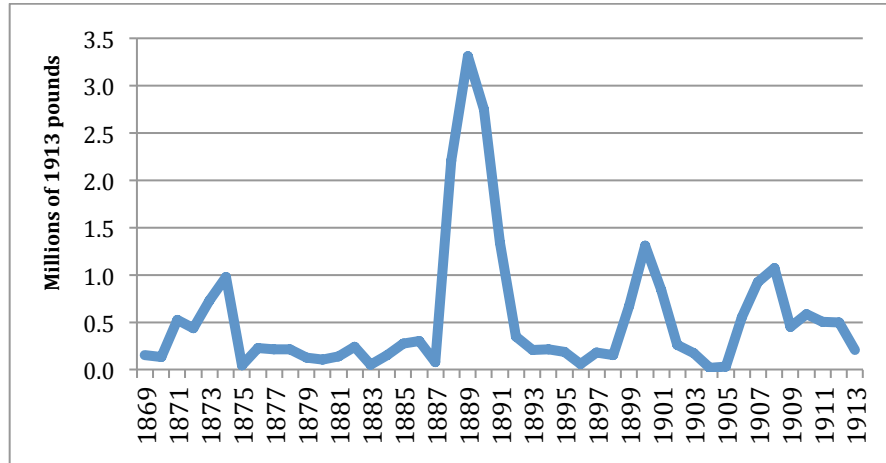
However, a study of construction costs for the Maldonado line by Ing. Arturo V. Rodríguez (1908) estimated that at least 60% corresponded to domestic inputs, while the rest were from imported material such as rails, rolling stock and the metal structures for engineering works. According to the author, this line had more bridges (which contained more imported inputs) than what was normal for the Uruguayan network. Therefore, the average percentage for domestic inputs was likely higher than 60%. Deflating only 60% of construction costs Bértola's series raises the rate of return by less than one half of one percentage point.

⁸ This is about 25% higher than the £5,000 per km (£6,214 before 1884) over which the guarantee was paid, since transforming a series of these fixed values per kilometer constructed into constant 1913 prices produces an average cost of £7,594 per km. However, there was significant variation in the cost per km of different parts of the network. The trunk line cost £12,373/km, while the rest of the lines cost between £7,330 and £9,675/km.

⁹ The values for Brazil (£5,648) and Argentina (£7,325/km) have been calculated using non-deflated series. Calculating the average costs per km from the non-deflated capital investment series for Uruguay gives a result of £6,438/km.

million pounds were invested over the period (24 million pounds at 1913 prices). Figure 3 shows a graph of the capital investment series.

Figure 3: Capital Invested in Railway Network, 1869-1913 (in British pounds of 1913)



Sources: Own calculation from Company reports and National Statistical Yearbooks. Notes: Figures are in 1913 prices

Calculating the IRR also requires knowing the value of the railway network at the end of the period, taking into account the efficiency losses due to capital depreciation. The declining balance method is commonly used in the literature (Herranz-Loncán, 2004: 22), and is applied in this case, with a geometric depreciation rate of 1.4% per year.¹⁰ The resulting value of the existing capital for 1913 is £18,008,411.

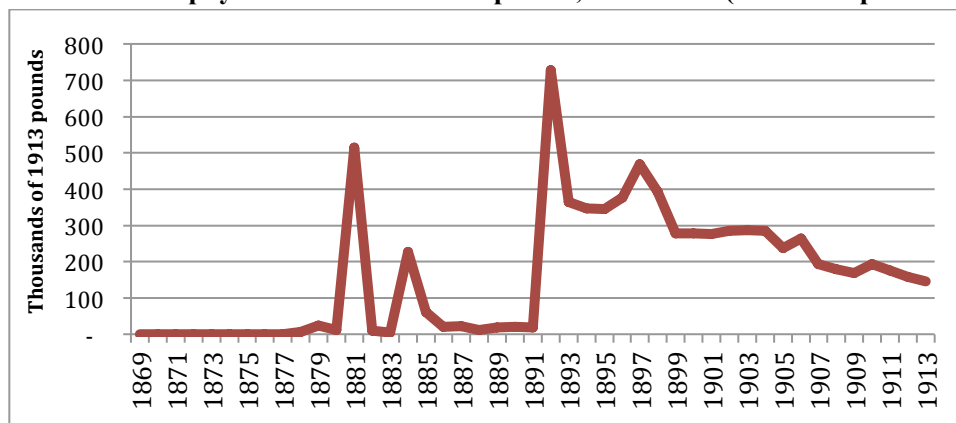
For most years before 1892, the government paid little or nothing of what it owed under the guarantee agreements. In some cases it handed over government bonds to the companies as settlement for unpaid guarantees. For example, in 1878, the *Central Uruguay Railway Company* accepted £212,766 in bonds in exchange for cancelation of outstanding guarantee payments of the same amount. The company proceeded to sell the bonds, a few thousand pounds at a time, over the course of the next 30 years, collecting interest in the meantime. In addition, the company renounced future guarantee payments, was freed from the obligation to return funds to the government when its profits exceeded 8% and accepted a subsidy of a fixed £5,319 per year for 10 years. At least two other companies arrived at similar settlements with the government. The *Northwestern Railway of Montevideo* accepted £382,979 in 1881 in exchange for cancelation of outstanding guarantee payments and renouncing its right to receive guarantee payments in the future, while the *Uruguay Central and Hygueritas Railway Company* received £148,936 in bonds in 1883 under similar conditions. Both companies appear to have sold the bonds

¹⁰ This paper uses the same depreciation rate employed by Herranz-Loncán (2008) in a similar exercise for the Spanish railway system, and is at the lower end of rates employed by other authors for 19th century railways.

the same year they received them. In 1892, all outstanding guarantee payments and related debts were absorbed in the Interior Unified Debt, and the government again gave bonds to the railway companies in exchange for unpaid guarantees. From the information available it appears that the companies involved in this deal promptly sold the bonds for approximately the value of the unpaid guarantees. An agreement was also reached to reserve 45% of all customs receipts for direct payment of railway guarantees. From this year on, it appears that the government paid the full amount of all its guarantee obligations (which, as mentioned earlier, had been reduced from 7% to 3.5% of the value of the fixed capital per kilometer of track).

Interest payments and income from the sale of government bonds registered in the available company reports, as well as the total guarantee payments reported in the statistical yearbooks starting in 1892, have been used to construct the series of payments from the state to the railway companies. This leaves out possible interest payments or income from the sale of bonds received by companies for which we do not have information. Because these settlements occurred in a somewhat arbitrary fashion, depending on the political and economic circumstances of the country, it is difficult to introduce reasonable assumptions that would allow us to augment the series to include all the railway companies. Due to this limitation, the series probably contains a downward bias for the years prior to 1892. However, this bias is most likely very small, since the companies not in the sample managed less than 15% of the network. In nominal terms, a total of 4.9 million pounds were transferred to the British companies over the period (7.4 million pounds at 1913 prices). Figure 4 shows a graph of this series.

Figure 4: Guarantee payments and related expenses, 1869-1913 (in British pounds of 1913)



Sources: Own calculation from Company reports and National Statistical Yearbooks. Notes: Figures are in 1913 prices.

Using the aforementioned operating revenue, operating cost, guarantee payments and capital spending series, the result for the average subsidized rate of return from 1869 to 1913 is 3.2% per year. In order to determine whether this was enough to compensate the

opportunity cost of capital, we must compare it with alternative investments of a similar risk level. It is common to use the effective interest rate on government bonds of the same country where the railway investment occurred, since both are guaranteed by the same institution and therefore bear similar risks (See, for example, Summerhill, 1998: 553).

The interest rate on Uruguayan public debt was relatively stable over this period: the government generally issued bonds with nominal interest rates of 5 or 6% (Nahum, 1994). The average rate for these issues, taking into account discounts offered on the sale of bonds and weighting by the amount of capital invested in the network each year, was around 7% per year¹¹, which is in line with rates in other peripheral countries during the period¹². This is the return an investor would obtain by investing in public debt over the course of the period, and approximates a lower bound for the market rate of return, or the opportunity cost of capital, for this economy.

The subsidized rate of return of 3.2% is far below the market rate of 7%. This indicates that the capital invested in the railway network over the course of the period did not generate enough income, through operating revenues and subsidies, to be profitable. It is important to point out that this result is robust to the possible biases in the estimation (see appendix C in Diaz, 2014). The largest source of bias likely comes from the possibility of inflated construction costs. However, if we suppose that construction costs were lower, say, in line with the fictive value established in the guarantee agreements, the rate of return rises to only 4.3%. In order for the rate of return to come close to the opportunity cost of capital, actual construction costs would have to have been around half of what were reported in the company reports.

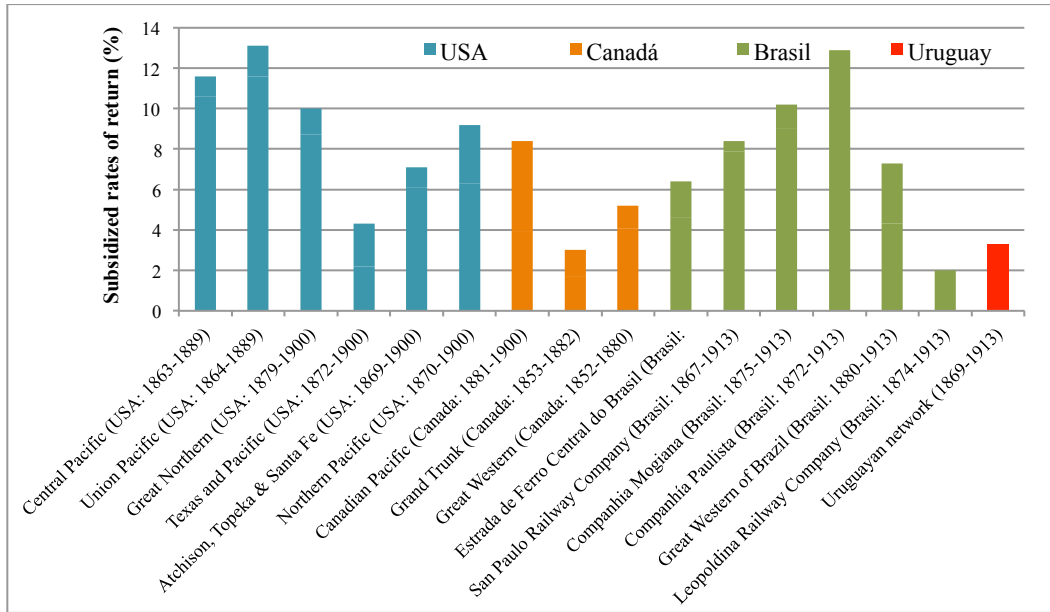
The estimated subsidized rate of return for Uruguay is also lower than comparable estimates for railways in other low-population density regions. Figure 5 shows the IRR of several railways in the US, Canada and Brazil built around the same time as the Uruguayan railway.¹³ Most of these railways were profitable with respect to the opportunity costs of capital that existed in the region where they were built during the respective period of estimation. The only ones that were not profitable were the Texas and Pacific and Santa Fe lines in the US, and the Great Western and Grand Trunk of Canada. Of these, only the last had a rate of return below that of the Uruguayan network.

¹¹ Own estimation based on the interest rates and discounts on bonds reported in Nahum (1994).

¹² Summerhill (1998: 553) calculates the average rate on Brazilian public debt was between 5 and 7%. Carlos and Lewis (1992: 412) state that the nominal rate on Canadian government bonds was in general 6% and stable throughout the period that is studied. Returns on US government public debt towards the end of the 19th century were around 3 to 5% (Siegel, 1992: 28).

¹³ The sample of railways presented here are the only ones for which strictly comparable estimations are available.

Figure 5: Private rate of return to railways in low population density regions



Sources: Mercer (1982: 107-118); Carlos & Lewis (1992: 413); Summerhill (2003: figure 7.1); and my own figures.

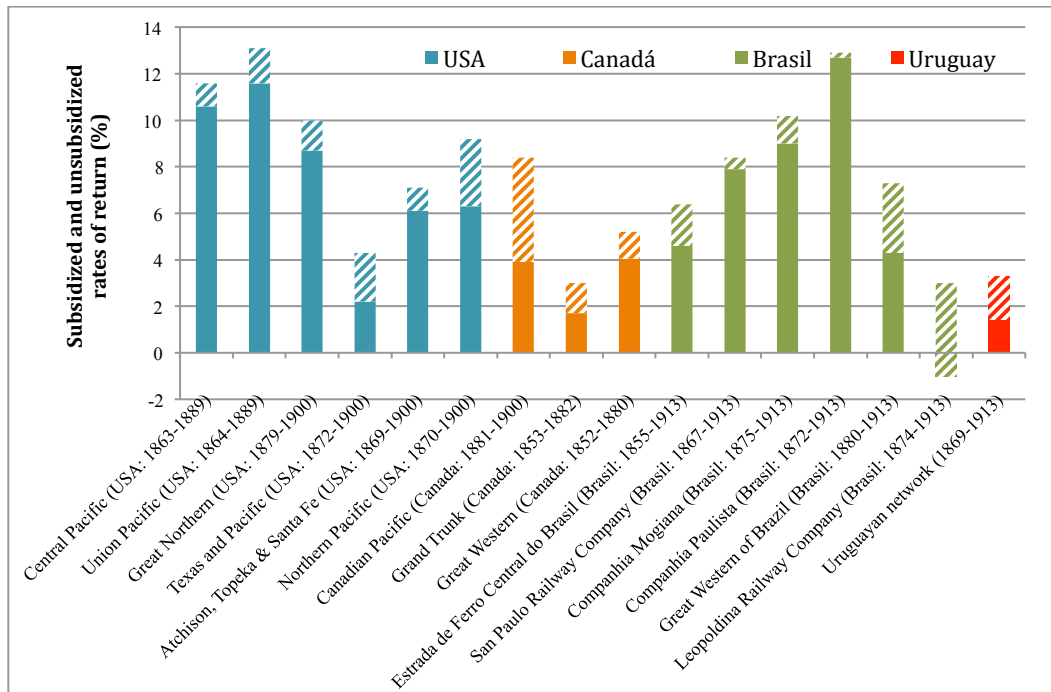
We can easily see the impact of the subsidies on profitability by removing the guarantee payments from the income stream in the numerator of equation 1. The formula for calculating the unsubsidized IRR is:

$$PV = \sum_{t=0}^T \frac{(R_t - C_t - I_t)}{(1+r_i)^t} + \frac{V}{(1+r_i)^T} \quad (2)$$

where all variables are the same as stated earlier.

The result of the estimation of the unsubsidized rate of return is 1.5%. This means that the guarantees and related payments more than double the return to railway investment in Uruguay over the period. Figure 6 shows the estimated IRR, with and without subsidies, for the same sample of railways discussed earlier.

Figure 6: Internal rates of return for railway lines in low population density regions, with and without subsidies



Sources: Mercer (1982: 107-118); Carlos & Lewis (1992: 413); Summerhill (2003: figure 7.1); and my own figures.

Note: solid bars represent the unsubsidized rate of return, while the striped bars indicate the level to which the return rises with the subsidy.

Six of the railways shown in figure 6 would have been profitable even without subsidies. These were the Central Pacific, the Union Pacific, the Great Northern, the Sao Paulo Railway Company, the Companhia Mogiana and the Companhia Paulista. On strictly economic grounds, there was no need to subsidize these railways in order to secure investment. Four lines, the Northern Pacific, the Canadian Pacific, the Estrada de Ferro and the Great Western of Brazil, would have been unprofitable without subsidies, but thanks to government support were able to produce returns that compensated the cost of capital invested. The remaining railways fell into the same category as the Uruguayan network, in that they were not profitable, even with state subsidies. These were the Texas and Pacific, the Santa Fe, the Grand Trunk, the Great Western and the Leopoldina Railway Co. On strictly economic grounds, the amount of subsidy to these railways was less than optimal. However, it is not necessarily reasonable to conclude that a larger subsidy would have increased efficiency. Profitability may have been low due to other reasons, for instance, a misjudgment on the part of investors about the economic potential of the project. Moreover, the optimality of subsidies also depends on the social returns being high enough; if they weren't, any amount of subsidy would have been a waste of state resources.

The contribution of subsidies to the overall returns for the railway lines represented in figure 6 ranges from 0.2% (Compañía Paulista) to 4.5% (Canadian Pacific) of the capital invested, but is generally between 1 and 3%. In Uruguay, the guarantees increased the rate of return by 1.7% of capital invested, putting the size of the subsidy in relation to investment in the same range as that for the other railways in the sample.

In Uruguay, the subsidies raised the income of the companies significantly, more than doubling profitability. This testifies to the importance of public financing in attracting investment; without it, railway construction would possibly have been greatly reduced. However, the guarantees were not enough to make railway investment more profitable than purchases of public debt or railway investment in other settler regions.¹⁴ In order to compensate the market rate of return, the subsidies paid each year would have had to be on average three times higher than what was actually paid.

Is it possible that the state's failure to pay the full subsidies before 1892 and the later reduction of the guarantee rate can explain the extremely low profit results? Calculating the rate of return under the assumption that profits had been fully guaranteed at 7% over the entire existing network raises the return on capital to 5.1%. This would have meant a subsidy of 3.5% over capital invested, and would have made the Uruguayan network one of the most subsidized in the sample. However, it would not have guaranteed profitability, due to the fact that the average costs of construction were greater than the fixed value stipulated in the guarantee agreements.

As discussed in section 2, Uruguay received a very large amount of railway investment relative to other countries in Latin America, indicating high hopes on the part of investors in regard to the economic potential of the country. Why were returns so low? One possibility is that the main goal of railway promoters wasn't always to achieve high returns through exploiting the network. If they had links to other industries that benefitted from railway investment, they could compensate low returns in the railway sector with higher revenues in their other industries, and even extract profits from the railway companies to benefit their other businesses. For example, George Drabble, who was director of the CUR and owned stock in the company, was also president of the London and River Plate Bank (Winn, 2010: 21). For Drabble, providing financial services to the railway companies may have been lucrative, and offset the low returns he received from his stock. Indeed, in 1875, the CUR took out a loan of 300,000 pounds from Drabble's

¹⁴ It is possible that, if the analysis were carried out for a longer period, the resulting rate of return would be somewhat higher, since after 1913 few kilometers of track were added to the network and the highest levels of traffic were probably reached during the interwar period. However, the same could probably be said about the other railway networks in figure 6. In addition, railway net revenues fell after 1913, and only reached their surpassed level in the late 1920s, and then only for a few years. After 1929 they fell drastically, and continued their decline until the network was nationalized in 1948.

bank (CUR Company Report, 1875). He also owned the River Plate Land Company (Winn, 2010: 21), which could have benefitted from land sales to the CUR or from inside knowledge about the company's investment plans. If promoters had links to construction companies, the type of cost inflation discussed earlier could be used to extract future profits from the railway companies. In this case, the biggest losers would have been the buyers of bonds and shares in the railway companies, who received lower returns due to the extraction of benefits by unscrupulous promoters and their accomplices. Although there is no direct evidence of this for Uruguay, this type of activity could at least partially explain the low returns.

However, it is probable that the real possibilities of generating sufficient traffic were less than what investors had hoped for. There were two possible sources of traffic, and both likely fell short of initial expectations. One was the transport of goods in transit to and from neighboring regions, known in Spanish as the "*comercio de tránsito*". In the 19th century, Montevideo functioned as an *entrepôt* for distribution of goods, much of it contraband, to northeastern Argentina, Paraguay and Southern Brazil, and as a port for the export of the rural production from those regions (Mourat, 1971: II-VI). However, by the 1880s, this trade was in decline (Barrán and Nahum, 1971: 9), in part due to the rapid development railway network on the Argentine side of the Uruguay River, and to efforts by the Brazilian state to keep its southern provinces economically linked to the capital. This reduced the possibilities for the Uruguayan railway network to capture traffic from the larger region.

The other source of traffic was domestic production, which depended on economic development of the countryside. Between 1870 and 1913, Uruguay's population tripled, while GDP and the value of exports increased by a factor of four (Bértola et al., 1998; Bonino et al., 2012; Bonino et al., 2013). Despite this, rural development was slow (Barrán and Nahum, 1971: 10; 1973: 9). Uruguay did not experience an explosion of grain production, immigration and settlement, like that which occurred in Argentina starting in the 1880s (grain transport made up a large portion of Argentine railway receipts during the period). The frozen beef industry did have an impact on rural development in Uruguay, but the first plant wasn't opened until 1904, more than 20 years after the first Argentine plant was opened (Barrán and Nahum, 1977: 206).

There were many obstacles to agricultural development in Uruguay, including a closed frontier, lack of available state-owned land, and competition from Argentine wheat exporters. Government policies to promote agriculture, like financing for agricultural colonies or the establishment of technical institutes, and commercial protections for Uruguayan producers, fell short (Milot and Bertino, 1996: 197-98). Consequently, the structure of exports did not change during the period. In 1890 more than 90% of exports

were from the livestock sector, while agricultural products represented only 4%. In 1913, these proportions were basically unchanged (Statistical Yearbook, 1913/14)¹⁵. Agricultural production for internal consumption also could not provide a heavy flow of traffic for the railway. Montevideo, by far the largest market, was provisioned from areas close by, and often produce was shipped by cart so as not to pay the high prices charged by the railway. In 1913, only 13% of railway traffic was agricultural products, compared to 33% in Argentina (Herranz-Loncán, 2011: 25). Few agricultural colonies also meant that the countryside remained relatively unpopulated, limiting the amount of traffic from Montevideo to other parts of the country.

For Barrán and Nahum, these factors were not completely beyond the control of the railway companies. In the opinion of these authors, the railway companies were partly to blame for the slow development of the countryside, due to the high prices they charged, which only the high value products of the livestock sector could withstand (Barrán and Nahum, 1971: 614-19). However, Herranz-Loncán (2011: 20-23) points out the possibility of a reverse causality; railway prices were high due to the scarcity of traffic for the network. Low traffic made it impossible to achieve economies of scale, keeping average costs high, and forcing the companies to maintain prices high in order to cover costs.¹⁶

It is possible that faster development of the countryside or the capture of a greater portion of the interregional traffic could have led to a more efficient use of the railway infrastructure, and allowed the companies to lower the cost to users, by lowering fares or improving service. In turn, lower costs may have encouraged the development of more sources for traffic, reinforcing the process. This points to the possibility that the Uruguayan economy remained stuck in a sub optimal equilibrium, where high railway prices discouraged local development, and lack of traffic made it difficult to lower prices or improve service.

The nature of state intervention, and the manner in which it was carried out, may have had an impact on this process as well. The fact that the subsidy was paid per mile of track gave the companies an incentive to choose routes that were longer than necessary, building around geographic obstacles instead of spending more on expensive engineering

¹⁵ In contrast, the composition of Argentine exports changed radically during the period. In 1870/74, livestock related products made up 93% of exports, but by 1910/14 they only represented around 45% of the total, with 50% being made up of agricultural goods, primarily wheat and corn. In 1907, Argentina was the world's third largest exporter of grains, after the US and Russia (Rapoport, 2000: 74-76).

¹⁶ Herranz-Loncán (2011) finds a negative relationship between operating costs and ton-km shipped for the main Uruguayan and Argentinian railway companies that operated in 1912/13. The Uruguayan companies all tend towards the highest costs and lowest traffic of the sample. He finds a similar relationship between prices charged by the railways and ton-km shipped, with the Uruguayan companies again grouped towards the high price/low ton-km end of the sample.

works to reduce distances. This lowered costs while increasing total mileage (Irwin, 2007: 27-28). If this occurred on all or part of the network in Uruguay, as suggested by the Uruguayan historiography (Barrán and Nahum, 1971: 560-61; Bertino and Millot, 196: 343; Finch, 2005: 213, 241), it could have affected the ability of the companies to provide an efficient service and generate traffic. In addition, the construction cost inflation mentioned earlier could be exacerbated by the presence of guarantees, because investors had little incentive to be vigilant in ensuring efficiency on the part of promoters or the construction companies. However, with the available information, it is difficult to evaluate the degree to which these practices may have affected the development of the network or the quality of the service offered.

In addition, as mentioned, before 1892 the guarantees were rarely paid on time, and from that year forward the rate was lowered to only 3.5% of capital, half the rate of the original guarantee agreements. Because of this, the annual cash flow of the companies ended up being, on average, only 30% of what it would have been if the guarantees had been paid consistently at 7% over the period. Before 1892, cash flow was reduced by over 50% from what it would have been had the government paid all guarantees on time. It is reasonable to believe that this had an impact on decisions about how the companies allocated resources between covering current expenditures, investing in new infrastructure and making interest and dividend payments. Reducing current expenditure, by reducing the quality or the quantity of the service, could have affected the ability to generate future traffic. Postponing new investment could have slowed the completion of the network, giving an advantage to the networks of neighboring countries in capturing the interregional trade. Reducing interest or dividend payments could have made it more difficult to obtain capital in the future. Any of these situations would have been an impediment to ensuring the long-term profitability of the investment.¹⁷

In any case, the subsidies paid by the Uruguayan state, which were in line with what occurred in other countries, succeeded in attracting foreign investment that, by 1913, had resulted in the construction of one of the densest railway networks in Latin America. Its low profit record was likely, at least in part, the result of misjudging the potential of the sources of traffic. The type of subsidy and the government's poor payment record may have also played a role in the ability of the railway to generate traffic. However, by 1913,

¹⁷ For example, in 1889 and 1890 the North Western of Uruguay did not receive what it was owed by the Uruguayan government for the portion of its line under guarantee. According to the Company Report for 1890, it had to cancel dividend payments on its preferred shares that year, which would otherwise have been 3%. This is one of the companies that financially struggled most during the period (Northwestern of Uruguay Company Report, 1890). In regard to the loan received by the CUR in 1875, "In consequence of the Government's failure to provide the balance of funds required for the Interest and Sinking Fund of £300,000 of mortgage bonds, ... it became necessary to borrow the same amount from the London and River Plate Bank, and the loan is now being repaid out of revenue (CUR Company Report, 1875: 8) The loan was renewed in the following year for the same reason (CUR Company Report, 1876: 13).

the Uruguayan railway was transporting around 300 million ton-km and around 100 million passenger-km on a network that connected almost all the Departmental capitals, and the railway had become the most important form of transport in the country. The main reason for offering state subsidies was not to raise the private returns of the railway companies, but rather to encourage investment that would create benefits for the wider economy through lower transport prices. It makes sense then to ask to what degree these benefits materialized, and if there was a similar misjudgment about the potential for social returns as there was about the private returns. Was there overinvestment in the railway network from a societal point of view? Did government intervention produce an efficient use of resources?

4. Benefits of Railway Investment to the Economy

The estimations presented up to how the Uruguayan railway performed as a business venture, and how subsidies contributed to this result. Of equal interest is the question of in what measure railways produced benefits for the economy as a whole. One way of approaching this question is by means of an estimation of the social returns of the capital invested in the network. This measures the benefits provided by the railways, not only to the companies that operated them, but also to the consumers of the transport services offered. It also takes account of the costs borne by the economy owing to the subsidies paid by the state. In this calculation, the unsubsidized internal rate of return discussed in the preceding section represents the benefits to the providers of the transport services. The guarantee payments, because they are a transfer from society to the companies, are left out. An estimation of the social savings is commonly used as an approximation of the benefits to the consumers of transport services.

Because we cannot directly observe a counterfactual economy without the railways, it is impossible to precisely determine the income gains that arose due to the existence of this infrastructure. The social savings methodology models what the cost to the economy would be of shutting down the railway sector in a particular year, and in doing so approximates its economic impact (Summerhill, 2000: 8). It is an estimation of the resources saved on account of the lower transport costs generated by the railway service¹⁸, and is calculated by measuring the difference between the unit costs of railway transport and those of the next best alternative mode of transport, multiplied by the quantity of goods and passengers transported in a particular year, and can be calculated using the following formula:

¹⁸ This method assumes, among other things, that transport prices equal marginal cost, marginal costs are constant, and that the presence of the railways does not affect the prices charged by alternative modes of transport. For an in-depth discussion of the assumptions involved in social savings estimates, see McClelland (1972; 474-77) and Leunig (2010: 11-15).

$$SS = (P_{alt} - P_{rw}) * Q_{rw} \quad (3)$$

where P_{rw} is the price of railway transport, P_{alt} is the price of the next best alternative means of transport, Q_{rw} is the quantity transported by the railways in a particular year and SS is the social savings in that year. The result must then be adjusted by the price elasticity of demand for transport in order to account for the reduction in the amount that would be moved in an alternative economy with higher transport prices. Doing so transforms the social savings estimate into a measure of the increase in the consumer surplus derived from access to the network (McClelland, 1972: 474-77).

Herranz-Loncán (2011) has estimated the social savings generated by the Uruguayan railway network based on information about freight and passenger transport prices and quantities, as well as information about water, carting and droving prices for freight transport, and water, road and travel time costs for passenger transport. The estimated social savings in 1912/13 were £2,197,872, or about 3.3% of GDP that year.¹⁹

In order to calculate the social returns for the period from 1869 to 1913, an estimate of the social savings for each year in the period is necessary. This has been done by extrapolating Herranz-Loncán's estimate for 1912/13 to cover whole period, using price and quantity series relevant to each component of the estimation, and when these are not available, making assumptions about the evolution of some variables over time. The appropriate information regarding ton-miles and passenger-miles transported are available for the years 1891 to 1913 from the CUR company reports. For earlier years, a railway transport quantity index from Bértola (1998: 56) has been used. Railway freight and passenger unit prices have been estimated from the CUR earnings per ton-mile and passenger-mile for 1891-1913, from earnings per ton and per passenger for 1875-1890, and by the year-to-year changes in track length for earlier years.

Changes in unit prices over time for the alternative modes of transport have been estimated in the following manner. The few figures that are available indicate that average-carting prices fell with distance²⁰. Using the available data, a log cost function of distance has been used to calculate the unit price, and this has been multiplied by the average distance of railway trips (total ton-km divided by total tons hauled).²¹ There is

¹⁹ Calculated using the social savings reported in Herranz-Loncán (2011) and the level of GDP in 1912/13 from Bonino et al. (2012).

²⁰ There was little technological change in carting and carriage transport during the period, and the road network was not much improved over time (Barrán y Nahum, 1971: 620-24; 1973: 461-63; 1978: 159-163).

²¹ Information for calculating the average distance of trips is available only starting in 1908. For earlier years, the figure for 1908 has been projected back adjusting by the year-to-year changes in total km of track.

less information about passenger transport prices, but the few figures that could be found indicate that prices did not vary much.²² Therefore, they have been held constant in real terms. I assume water transport prices for cargo fell by 50% in real terms over the period, in consonance with the fall in world transport prices due to the spread of steam technology (Jacks and Pendakur, 2008; Klovland, 2002). World passenger water transport prices appear to have remained stable, especially for first class travel, any productivity gains being applied to greater comfort rather than lower cost (Dupont et al., 2012). Because the Uruguayan railway was in general only an upper-class mode of travel (Herranz-Loncán, 2011), prices have been held constant in real terms.²³ Travel time costs for passengers have been adjusted by data on nominal wages for public sector workers from Bertino and Millot (1996: 402-03) and Bertino et al. (2005: 403).²⁴ For livestock transport, Herranz-Loncán takes into account not only the cost of droving, which fall with distance, but also the reduction in the sale price of animals due to weight loss from walking long distances. For earlier years, a log cost function of distance based on the few data points available has been used to calculate unit prices, and this has been applied to the average distance of trips.²⁵ The value of lost weight depended on the price of meat at the factory gate. Thus, this portion of the livestock unit costs have been adjusted by the changes in the price per ton of slaughtered cattle of the Liebig's Extract of Meat Company.²⁶

Herranz-Loncán also made assumptions about the way railway traffic would be distributed between the alternative modes of transport in 1913. It was assumed that all livestock would be moved by droving. The remaining cargo would be moved by water if it left from a station within 25km of the coast, and by carts otherwise. The cargo leaving from Montevideo was split according to the proportion of goods moved by each type of transport from the rest of the country. The same thing was done for passengers. These same assumptions have been maintained for early years, and the distribution applied for 1913 have been adjusted by the proportion of railway track within 25km of the coast in each year. Figure 7 shows the freight, passenger and total social savings from 1869 to 1913.

²² Transport prices are from Herranz-Loncán (2011).

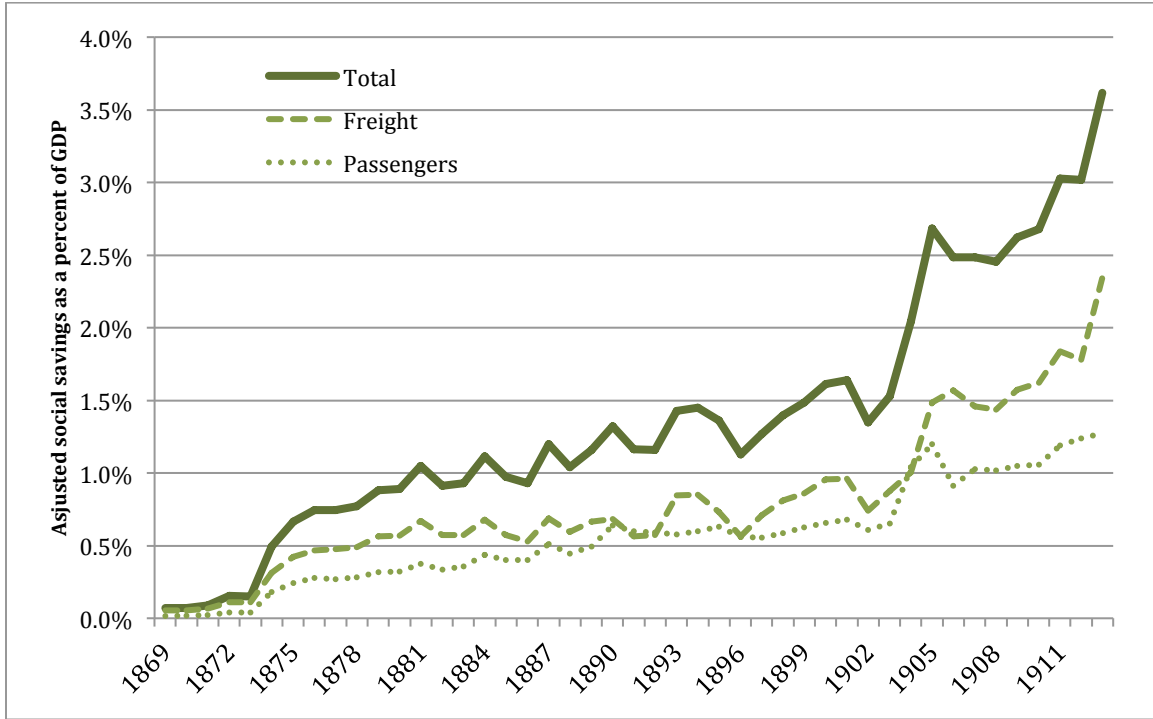
²³ The average distance of trips that would be replaced by water transport in the alternative economy cannot be assumed to rise over time, as in the case of carting transport, due to the way in which the railway network developed.

²⁴ See Diaz (2014: nota 62).

²⁵ The average distance travelled by livestock has been calculated in the same way as for carting transport.

²⁶ This series was obtained from the 1914 Statistical Yearbook. The animals transported by railways were most likely for slaughter at the frozen meat plants or for internal consumption. However, since the market was fairly integrated, it is reasonable to assume that the changes in prices for meat at the extract company reflected changes in economy wide meat prices.

Figure 7: Freight, passenger and total social savings as a percentage of GDP for the Uruguayan railway, 1869-1913



Sources: Own estimation based on Herranz-Loncán (2011b). GDP is from Bonino et al (2012).

Social savings grew steadily over the course of the period, as the network was extended to the far reaches of the country. The level of 3.4% of GDP for 1912/13 places Uruguay at the lower end of the spectrum of estimates of social savings for late 19th and early 20th century railway networks in other countries, and much lower than the large Latin American economies of Argentina, Brazil and Mexico (Herranz-Loncán, 2014: 15). Herranz-Loncán suggests several reasons for this (2011: 27). Uruguay's small size reduced the share of long distance trips over which the railways represented a clear advantage in terms of cost and time, and access to navigable rivers made water transport a competitive alternative in many areas. The country's productive specialization also reduced the need for this new technology; the share of livestock that was moved by droving remained high even into the 20th century. In this sense, according to Herranz-Loncán, geography limited the potential direct economic impact of the railways on the Uruguayan economy.

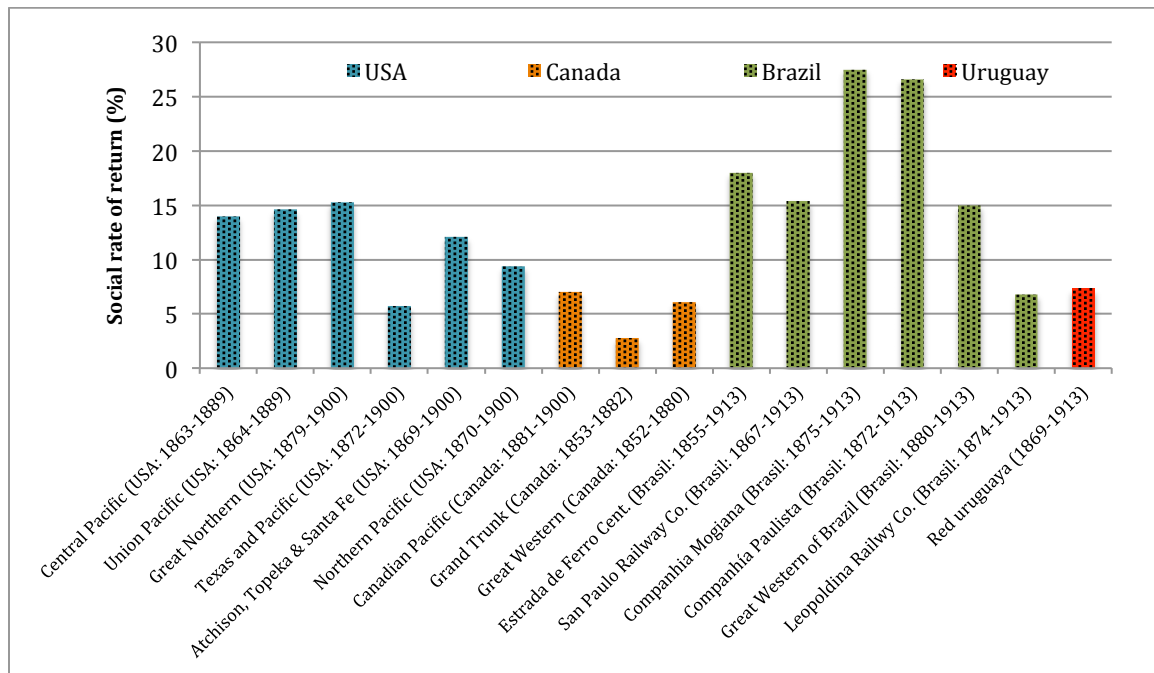
The annual social savings estimate can be used in an internal rate of return calculation to estimate the social returns, using the following formula:

$$PV = \sum_{t=0}^T \frac{SS_t + (R_t - C_t - I_t) + E_t}{(1+sr_i)^t} + \frac{V}{(1+sr_i)^T} \quad (4)$$

where SS_t represents the social savings in year t , sr_t is the social returns when the present value (PV) is equal to zero. The variable E represents the indirect externalities generated by the existence of the network. These include the economies of scale or agglomeration that are achieved thanks to the railways, as well as benefits due to political integration or the exercise of military control that this infrastructure allowed. In general, the existence of positive externalities is recognized, but no attempt is made to measure them; this therefore introduces a downward bias of an unknown amount into the estimation of the social returns. All other variables are the same as for the private rate of return calculation.

The average social returns for the 1869 to 1913 period were 7.5% over the capital invested. This is an average of the return on all railway capital in existence each year, factoring in depreciation and properly discounting payment flows. The downward biases due to the exclusion of positive externalities make the social returns estimate a lower bound. In order to evaluate whether there was overinvestment in the network from a societal point of view, we must contrast the social returns on railway investment with those for alternative investments available during the period. Because these are not known, it is customary to use the market rate of return as a lower bound for the social returns on alternative investments. The rate of 7% estimated in section 3 means that the social returns on railway investment were only slightly above the minimum rate for alternative investments.

Figure 8: Social rates of return for railway lines in low population density regions



Sources: Mercer (1982), pp. 107-118; Carlos & Lewis (1992), p. 413; Summerhill (2003: figure 7.2), and my own figures.

Given the difficulties in evaluating the social returns from perspective of the domestic economy, an international comparison is of interest for evaluating the result. Figure 8 shows estimates of the social returns for the same railway lines shown in figures 5 and 6. A rate of 7.5% for the period indicates that the Uruguayan railway falls into the group with low social returns, although five railway networks had returns that were even lower than in Uruguay (all three Canadian lines, the Texas and Pacific in the US, and the Leopoldina in Brazil). Only the Texas and Pacific and Canada's Grand Trunk railways generated social returns below the market rate of return for their respective economies.

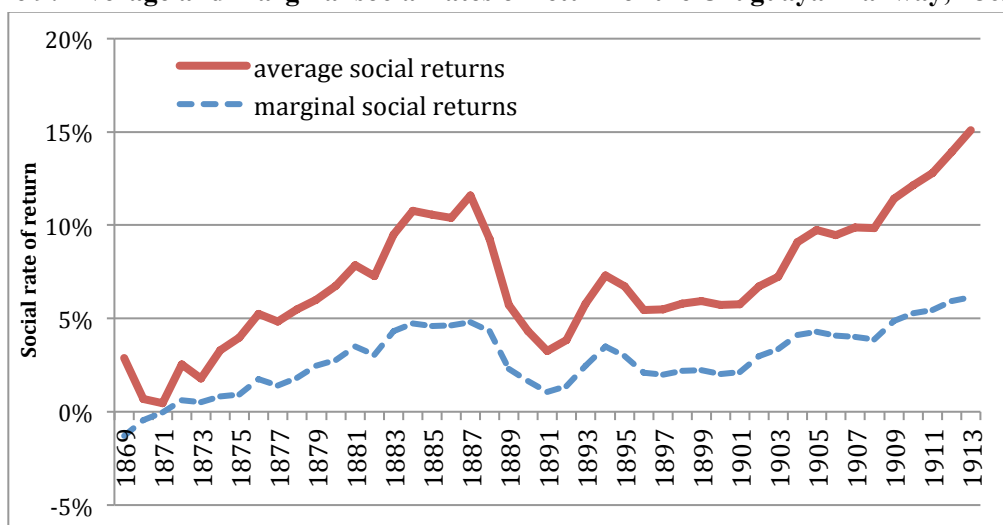
The estimation presented above represents the average social returns for the 45 years under study. However, with the same inputs, we can analyze the evolution of the annual social returns over time. The formula for calculating the annual social returns is:

$$rs = \frac{R-C-I+SS}{V} - \delta \quad (5)$$

where rs is the average social returns from all railway capital existing in a particular year, δ is the rate of depreciation and all other variables are the same as in equation 4. Analyzing the trend of average social returns over time can indicate in which periods construction was moving ahead of demand for transport services, and in which periods traffic was catching up to the capacity of the existing infrastructure.

However, in order to know whether the decision to invest in a particular year was justified by the returns generated by that new investment, it is necessary to know the marginal social rate of return. This can be estimated by multiplying the average social return by the elasticity of output with respect to capital in a particular year. It is not possible to directly estimate this elasticity from the information available. However, it is common to use the ratio between the net operating revenues and gross operating revenues as a proxy (Herranz-Loncán, 2008: 180). This ratio will reflect the true elasticity of private output with respect to capital under the assumptions of constant returns to scale in the railway sector, and both constant returns to scale and perfect competition in the economy as a whole. In order for it to reflect the true elasticity of social output, social benefits must be assumed to vary in direct proportion to private benefits. Given that these assumptions are unrealistic, the results of this estimation must be interpreted with caution. Figure 9 shows the average and marginal social rates of return for the Uruguayan railway during the period under study.

Figure 9: Average and marginal social rates of return of the Uruguayan railway, 1869-1913



Sources: see text.

The average social rate of return rose above the market rate of return briefly during the 1880s, but fell at the end of the decade due to the massive extension of the railways during these years and to the 1890 crisis, remaining around 5% until the first years of the 20th century. Only after 1903 can the benefits generated by the network be said to have consistently justified the accumulated investment up to that point. Towards the end of the period the average social return reached 15%, due in part to the introduction of the frozen beef industry, which increased demand for railway transport.

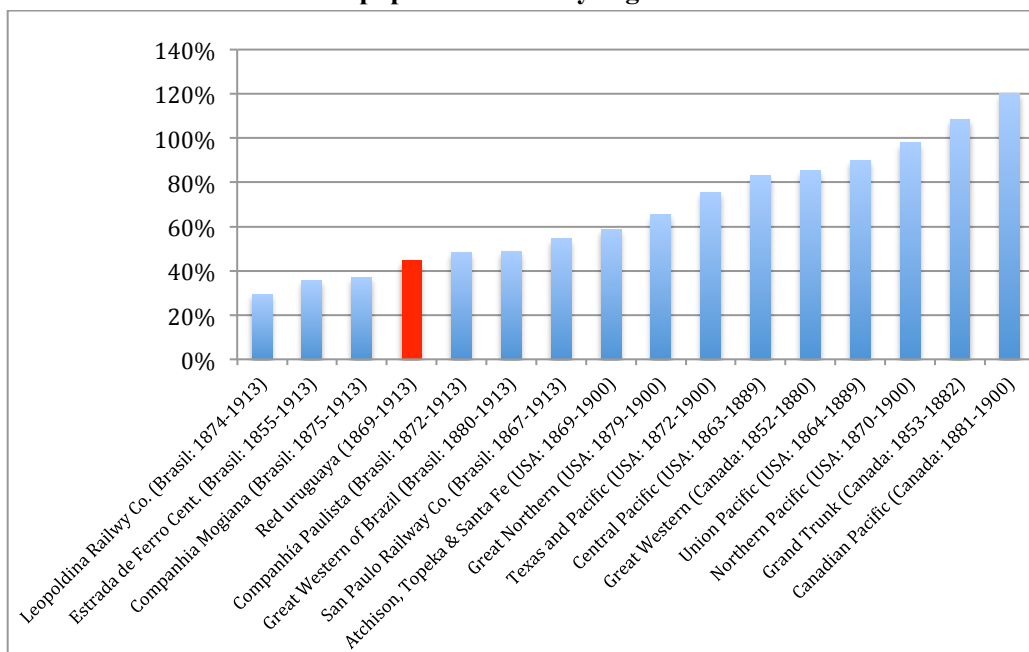
The marginal social rate of return followed a trend similar to the average rate, but remained below 5% until the last few years of the period. If the market rate of return is also considered a lower bound for the marginal social returns of alternative investments (McClelland, 1972: 488), then for most of the period the railway sector was not the best use of the new resources being invested in each year. However, given the weakness of this estimate, this conclusion should be seen only as a first approximation.

Whether the resources invested in the railway sector were justified depends in part on whether the high social returns persisted after 1913. Railway traffic and revenues fell after this year, and it appears the 1913 levels were later surpassed only for a brief period in the 1920s (Statistical Yearbooks). From the information available, it is not possible to know whether the performance of the railway sector post 1913 was good enough to justify the resources invested in earlier decades, but the fact that the period of high traffic and revenues after this year was so short indicates that, if estimated for a longer period, social returns may have been lower than for the period from 1869 to 1913.

The social returns estimates presented above represent benefits for the whole economy, including the railway companies. However, subsidies were justified based on their benefits for users of the service. Therefore, it is important to know how the social returns were distributed between the railway companies and consumers of transport services. The Uruguayan historiography has suggested that the limited economic impact of the railways was due in part to most of the benefits being extracted by the British railway companies. If subsidized private returns were close to the level of social returns, it would mean that the companies had succeeded in absorbing almost the entire rise in income generated by the investment. This would give credence to the dependency theory inspired arguments that emphasize that foreign investment in Latin America, rather than create benefits for the domestic economy, served foreign interests.

Figure 10 shows the subsidized private returns as a percentage of social returns for the sample of railways discussed earlier. As can be seen, the result for Uruguay of 42% is towards the lower end of the sample, which goes from a low figure of 29% to a high of 120%. This last case is the Canadian Pacific, where the company captured more in subsidies than the savings generated for the economy through lower transport costs. In Uruguay, if the railway companies tried to extract the larger part of the rise in income created by the investment, through their monopolistic market position or through the capture of government subsidies, it seems that, in comparative terms, they did not succeed.

Figure 9: subsidized returns as a percentage of social returns for railway lines in low population density regions



Sources: Mercer (1982), pp. 107-118; Carlos & Lewis (1992), p. 413; Summerhill (2003: figure 7.2), and my own figures.

The results presented in this section show that, on average over the period, the funds invested in the railway network were an efficient use of resources for the Uruguayan economy, as there was no clear alternative use that would have generated greater benefits. Furthermore, a large share of benefits accrued to the users of the service, compared to what occurred in other countries. However, the social returns were low in an international context. Moreover, the annual social rate of return remained low for much of the period. This is to be expected for a railway built “ahead of demand”, but the persistence of this pattern into the 20th century indicates that for many years demand lagged far behind construction of new railways.

Were the government subsidies the best use of public resources? The massive amount of railway investment that was drawn to Uruguay and the relatively low social returns suggest that more overall investment would not have been beneficial to the economy, and therefore more subsidies would not have been justified. As discussed in section 3, perhaps more timely payment of subsidies would have allowed for faster construction or more efficient service, or a different type of subsidy could have discouraged possible rent seeking behavior on the part of railway promoters. However, could a different mix of policies have allowed the economy to take better advantage of the extensive railway infrastructure constructed? Could diverting state resources towards other economic sectors have improved the overall economic outcomes?

The enormous investment in the railway sector was made with the hopes of encouraging economic development that would create traffic and allow the infrastructure to be used efficiently. Part of the reason that this did not happen was out of the state’s hands: a closed frontier, land that was not apt for grain production and competition from cheap Argentine wheat exports. However, there are some areas in which the state could have played a greater role. There was not enough financial aid, tariff protections and technical support available for the agricultural sector during the period (Barrán and Nahum, 1971: 378-85; Bertino and Millot, 1996: 197-98). Moreover, modernization in the livestock sector was extremely slow. The fencing off of ranches may not have been completed until well into the 1890s (Bertino and Millot, 1996: 61-62), and by 1900 only 15 to 20% of the beef cattle stock had been improved through crossbreeding, while for sheep this figure reached only 10%. Credit was scarce, especially in the rural economy, due in part to the political class’s adherence to the Gold Standard. This limited the ability of the rural middle class from investing in improving their land or animal stocks. The fencing off of ranches and improvement of cattle through crossbreeding were prerequisites for the installation of the frozen meat industry. As mentioned earlier, the first frozen meat packing plant began operation in Uruguay in 1904, more than 20 after this industry had begun operating in Argentina (Barrán and Nahum, 1977: 206). Greater state support for

these activities could have accelerated development of the rural economy and generated more railway traffic.

However, the Uruguayan state struggled to meet its obligations throughout the period, in which military costs weighed heavily and debt service payments consumed almost 50% of the budget in some years (Bertino and Millot, 1996: 387-88). The railway subsidies absorbed close to 5% of the government budget between 1890 and 1910, while only 2% was reserved for subsidizing other sectors, including agriculture, industry and other utilities and transport companies (Bertino and Millot, 1996: 391). In other words, resources for promoting development outside the railway sector were limited.

In addition, it is unlikely that the government had much leverage for imposing the terms of the subsidy agreements or for reducing the overall amount of resources transferred to the British railway companies. Offering lower guarantee rates would likely have severely limited the possibilities for attracting foreign capital, given that Argentina and Brazil also offered guarantee rates of 7% under similar conditions (Rapoport, 2000: 33; Summerhill, 1998: 547, 549). Even though before 1892 the Uruguayan government rarely paid the guarantees on time, the companies recovered almost all of what they were owed in the deals struck in 1877, 1881, 1883 and 1893, and these instances were crucial for ensuring future access to capital markets for the Uruguayan state. Reducing the overall amount paid to the companies, in order to divert state resources to other activities, may not have been a realistic option.

5. Conclusions

In the second half of the 19th century, the Uruguayan state offered profit guarantees to foreign owned companies in order to attract investment in a technology that was thought to be indispensable for the region's development. This drew in foreign capital to the tune of 16.5 million pounds (in nominal terms) and led to the construction of one of the densest railway networks in Latin America. This investment accompanied and aided Uruguay's development during the late 19th and early 20th centuries. However, in comparison to other regions, this infrastructure underperformed in terms of private profitability as well as in providing social returns.

Subsidized private returns for the Uruguayan railway network were about half the market rate of return and lower than the private returns for networks in other countries. However, without the government guarantees, the private returns would have been much lower. This testifies to the importance of the role of public financing and indicates that without it railway investment would likely have been greatly reduced. Although the subsidies

actually paid by the Uruguayan state fell short of what was promised in the original agreements, in terms of the impact on overall profitability, the role of the state in financing railways in Uruguay seems to have been similar to what occurred in other countries. Furthermore, the unpaid guarantees were not enough to ensure profitability. This indicates that investors expected higher net operating revenues, either from faster development of the rural economy or from capturing a greater share of intraregional traffic.

The social returns of the railway were higher than the market rate of return, and therefore, on average for the period, it cannot be said that there was overinvestment in the network. However, direct economic benefits were lower than in other countries, and for much of the period it appears that new investment in railways was not the most productive use of resources. Railway investment in Uruguay during the first globalization appears to have been a case of building ahead of demand that lagged far behind investor expectations. Only towards the end of the period did this infrastructure begin offering high social returns. However, despite relatively low social returns over the period, subsidized private returns were much lower, and the overall distribution of benefits between the railway companies and the consumers of transport services was not unfavorable for the second group.

The reasons for the slow pace of change in the rural economy are not clear. The historiography suggests several culprits: the closed frontier, the general inadequacy of the land for grain production and the scarcity of credit in the countryside. Blame has also been laid at the feet of the railway companies themselves, accusing them of extracting gains through high prices that discouraged the development of agriculture (Barran and Nahum, 1971: 611-614). However, the evidence of low private returns presented in this paper puts this argument into question. The large amounts of investment received by Uruguay and continued construction up to 1913, despite low profits and low social returns generated, reveal a miscalculation on the part of investors. It appears that the railway companies were not able to capture economies of scale due to the persistently low traffic throughout the period, and therefore prices remained high, discouraging rural development. This suggests that the Uruguayan economy may have remained stuck in a low level equilibrium during most of the period. This could have occurred partly due to the railways failure to capture the interregional transit trade, which reduced the traffic that flowed over the network. It is also possible that the form and manner in which state intervention was carried out negatively affected railway traffic. It is not clear that more subsidies to the railway companies would have been beneficial, although more punctual guarantee payments could have allowed them to extend the network more rapidly or provide a more efficient service. In addition, state support for other rural activities or looser credit policies may have helped create more railway traffic, allowing the economy

to take better advantage of the railway infrastructure, and in turn creating economies of scale and allowing railway companies to lower fares. However, the state was financially constrained, and it is not clear that it could have diverted subsidies from railways towards other activities, or that this would have necessarily produced better results.

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