

The Argentinean North Central Railway, a State funded line: Some results about its economic performance for the period from 1889 to 1920.

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ABSTRACT

At the beginning of the 20th century, the state funded railways in Argentina became one the most important enterprise in the country, partly because of its political role as well as its prominent part in the national economy. Our goal is to analyze the behavior of the North Central Railway. In order to do that, we will work with a series of variables that describe its economic performance, such as the annual series of rail kilometers, transported passengers, transported cargo (measured in tons) and a measure of the invested capital, which we are going to called *return*. We are going to use some techniques related to time series analysis. These techniques will lead us to check if the transport policy carried out by the Argentine State was done with a true sense of economic gain or not.

Key words: State funded enterprises, railways, economic performance, time series.

1. The railway as an agent of change and development.

From the second half of the 19th century, we can see that the railways help transform Argentina from a rural country to a more developed and integrated one. The railways arrived late to our country, they were finally ready to operate in late 1857, when the West Railway, built with national funds, was inaugurated. The introduction of this mean of transport changed forever the argentine physiognomy and with this began a development stage for our country. But it was necessary to bring the basic machinery and working labor from Europe for its correct installation.

According to its level of economic development, we can easily identify to large zones in our country. The littoral with a production required to external market, was the zone that attracted private funding. The places far away from the country's main harbor, specially the ones in the north, did not have the same production so the expected return was lesser. It was there where the government, with great effort, invested in railways and other means of transport, despite this serious setback.

The building of a railway is an enterprise that demands large amounts of money, because of its size and complexity. The state funded network grew in periods of economic stability. This expansion was made using Treasury resources and with internal as well as external loans. This loans were supposed to be paid with taxes incomes and using, in some way the expected railway benefits. The State was largely indebted as a result of the construction and the equipment of its railways.

One of this lines was the North Central Railway, projected in late 1868 according to Law N° 280. Its construction as well as its mechanical performance was filled with serious errors. Among them was the choosing of the trocha. They eventually decided to use a narrow one mainly because of economical reasons. Other issue was the lamentable state of the infrastructure because of the reduction in construction costs and the little knowledge of the terrain where the rail was supposed to pass. The government tried several times to lease it, but finally had to take over its exploitation. Nevertheless, it cannot be denied that the State provided the north part of the country, a place far away from the distribution points and the larger population centers, with a vast railway

that crossed the country. At the same time, this modern form of transport allowed communication as well as trade exchange with nearby regions and enabled the integration of the north to the economic development of the country.

But in 1914 everything changed. The construction of every line was suspended because of the lack of funding due to the First World War. This caused the decline of the product trade and it stopped all the branches of the rail activity. All this factors created an intense crisis that affected in a crucial way the performance of every line and this one in particular. Things slowly began to take its normal course by the beginning of the '20s.

2. Statistical analysis of the line figures for this period.

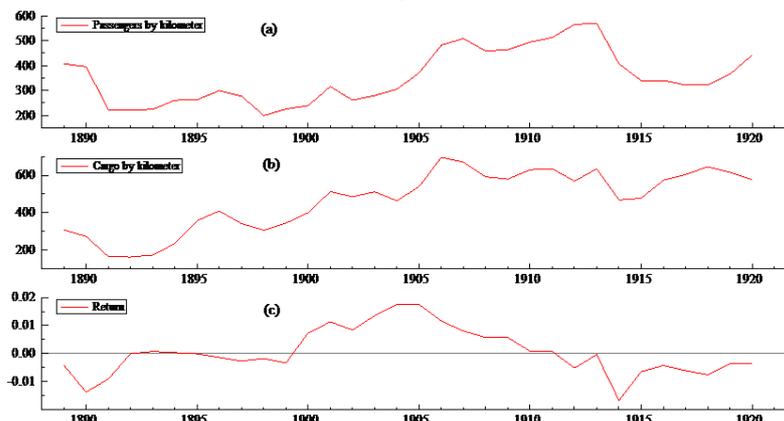
The basic idea behind a time series is quite simple. It simply is the register of any quantity that evolves through time. Certainly the data from the railway activity can be circumscribed into this definition.

We model a time series because we want to predict its behavior. The distinctive feature of a time series model, opposed to an econometric one, is that we do not try to formulate a relation between the series behavior and any other explanatory variables. The series movement is explained in terms of its own past, or by its position in time, or by its own structure. Prediction, if the problem we are trying to solve requires it, are made through extrapolation.

The studied data was obtained from a statistical publication of this period called “*Estadísticas de los Ferrocarriles en Explotación*” surveyed by the Ministerio de Obras Públicas de la Nación Argentina.

For the analysis of the economic performance of this line we have the following series, all of them presented on **Figure 1**. This is passengers (divided by rail kilometers), total transported cargo (divided by rail kilometers) and the measure of the invested capital that we decided to called *return* in our scheme.

Figure 1: Annual series divided by line kilometers from 1889 to 1920. (a)Transported passengers by divided line kilometers. (b) Cargo divided by line kilometers and (c) return of the invested capital.



What we see in a number of series like the ones above is that there is no constant mean and in most cases there are periods of relative peacefulness followed by others with great changes. A great deal of the current research is focused in studying this sort of behavior. There is a characteristic present in series like the ones we are about to study named **volatility**. The volatility in a series is not observed directly and it is often defined as the variance of a random variable, conditional to its past.

For the series in **Figure 1** we adjusted a stochastic volatility model (or SV model) like the one below

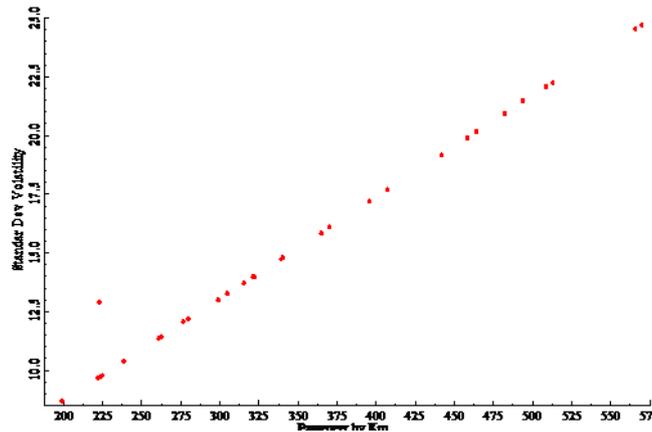
$$y_t = a + \sigma \exp\left(\frac{1}{2}\theta_t\right)\varepsilon_t \quad \varepsilon_t \sim N(0,1) \quad (1)$$

$$\theta_t = \rho\theta_{t-1} + \eta_t \quad \eta_t \sim N(0, \sigma_n^2), 0 < \rho < 1.$$

The signal, or θ_t in this case, is often seen as the unobserved logarithm of the volatility. We can see that both equations in (1) create a system that is similar to a state space kind of approach; this is why we tend to use both to analyze data of this form.

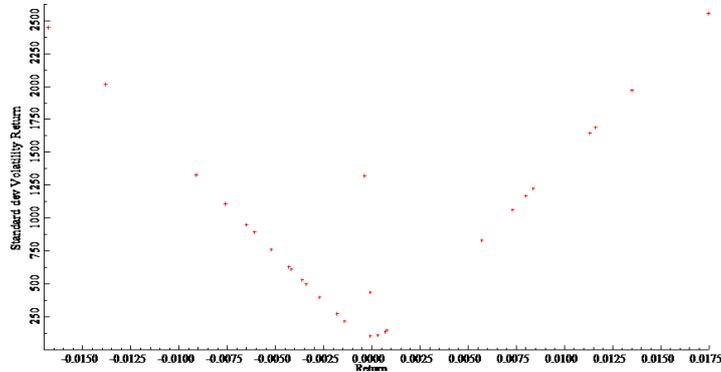
For the passenger series, expressed in (a) according to **Figure 1**, we observe that volatility is a dominant feature since the disturbances, or ε_t , turned out to have an extremely small variance. This situation is put in evidence in **Figure 2**. We also have to note that in this case we needed to put an intervention in 1891 that corresponded to a payment balance crisis due to an irresponsible economic policy during President Miguel A. Juarez Celman presidency

Figure 2: Estimated values of $\sigma \exp\left(\frac{1}{2}\theta_t\right)$ (vertical axis) together with the observed values of the passengers by kilometers series for the period from 1889 to 1920.



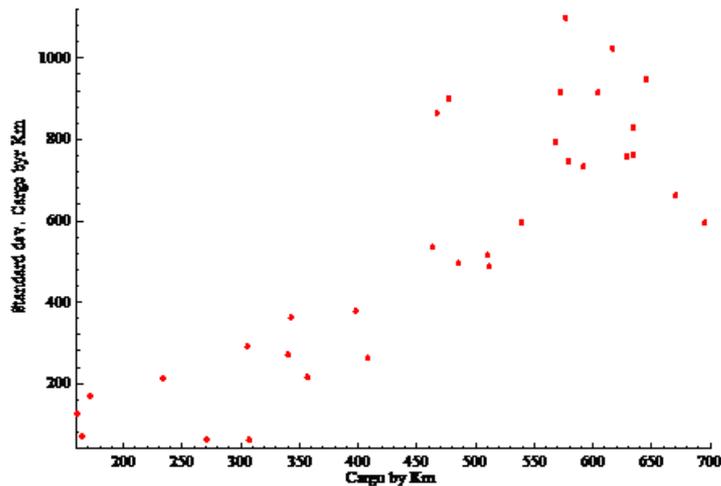
For the case of the return variable, expressed in (c) according to **Figure 1**, we needed to put two interventions. One in 1892, for the reason we just explained above, and another in 1913, corresponding to Balkan Crisis, previous to the First World War. We also see that volatility plays a great role when this line had earnings as well as when it had losses.

Figure 3: Estimated values of $\sigma \exp\left(\frac{1}{2}\theta_t\right)$ (vertical axis) together with the observed values of the return series for the period from 1889 to 1920.



For the cargo series we did not have to put any interventions. The estimated value for ρ was $\hat{\rho} = 0,95282$. Nevertheless we cannot come to the same conclusions as we did before. Even though there is an important relation between the volatility an the studied series it cannot be explained exclusively by the model stated in (1) since there are other forces involved in the behavior of the series. These forces can be historical questions such as the ongoing struggle to set a correct freight rate or by the fact that these lines were built with a sense of promotion because its main task was to bring closer the production of those places that were far from the country capital and economic center. This situation is evidenced **Figure 4** below

Figure 4: Estimated values of $\sigma \exp\left(\frac{1}{2}\theta_t\right)$ (vertical axis) together with the observed values of the cargo by kilometer series for the period from 1889 to 1920.



3. Conclusions.

The old proverb “A picture worth a thousand words” is pretty accurate for the analysis of any information set. Before we apply a statistical method to the data under study we need to observe it in order to become familiar with them. This can have a number of benefits, because this process will serve as an indicator for better and more detailed study ideas.

In Argentina, the emergence of the rail was very different from the European nations, where it brought a new economic and social order as well as the improvement of the transport unity. It can be better described as an element of political evolution. It was the sole factor that beat the large distances that isolated the population and made an illusion the idea of national unity.

Like most of the lines built in our country, as well as the rest of Latin America, the North Central Railway was more the result of a previous demand than the generator of a new one. The state funded lines absorbed more than 30% of the public work budget without taking into account the fact that its own resources could had been reinvested. We can say that despite the positive impact that the railways had in our country, they suffered from bad management and chronic lack of financial resources that eventually affected its functioning. The initial investment to set this enterprise was huge. Nevertheless, the earnings were not as expected and the expenses derived from its maintenance were very costly.

Volatility is the main feature in all the series we analyzed, that is, there is a conditional variability that changes in time. This shows that there was not a proper management policy. Everything was done with a strong sense of promotion and it was tied with the financial availability as well as the existing credit in every period of time, according to the international situation. This is why the benefits were very little and in many cases this line was forced to work at loss.

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