Earnings Quality in Railway Companies during the 19th Century: The case of Spanish NORTE and MZA

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Abstract

Prior literature studying Railway accounting during the 19th Century criticizes, but fails to provide, direct evidence on the unreliability of accounting figures. In Spain, historical and economic research have admitted the thesis that Railway accounting was unreliable. In this paper, we attempt to provide novel evidence about the quality of Railway accounting by quantifying, through measures of earnings persistence, the quality of accounting information. In our analyses we study the persistence of reported earnings and of some of its components for the period 1861-1921. The reported evidence suggests, overall, that accounting information was of high quality, as earnings are highly persistent during this period. However, we show that there are differences across firms and that these differences are particularly obvious when analysing the adjustments for prior period earnings.

Key words: Railway accounting, Earnings persistence, Spanish Railways, MZA, NORTE.

1. INTRODUCTION

We investigate accounting quality in Railway Companies during the 19th and early 20th Centuries. Prior literature in the area generally provides evidence of low quality accounting, driven either by the underdevelopment of the overall information accounting system (Pollins, 1956; Lee G.A., 1975) or by managerial opportunism (e.g., Edwards, 1985; 1989). In this paper, we study the extent to which railway earnings exhibit evidence of persistence which we associate with a uniform and consistent application of accounting criteria, and therefore, with quality information (Dechow et al., 2010: 14). In particular, we try to disentangle whether the previously reported evidence of low accounting quality in Railway companies is driven by opportunism or by the underdevelopment of accounting both in theory (for example, because of the lack of conceptual frameworks) and in practice (for example, because of the lack of an established accounting profession).

We focus our analyses in the Spanish Railway industry, and in particular, we analyse the case of MZA and NORTE, the two largest Spanish railway firms of the 19th and 20th Centuries. This permits also comparing different accounting practices in both companies and thus, understanding to what extent the historical context overall (i.e., the aforementioned underdevelopment, which would have affected both firms equally), or firm-specific characteristics drive accounting quality. To separate these effects, we study a singular and novel element of Spanish Railway accounting: the use of prior period adjustments (*Ejercicios Cerrados*). These adjustments, made to current period earnings, reflected revenues and expenses from prior period(s), which were accounted for during the current period. We use these adjustments, which were material in size (around 4% of earnings on average) to identify

accounting policies which may help us differentiate between underdevelopment of the accounting system *versus* opportunism. To the extent that these adjustments simply reflected the lack of timely channels to communicate and measure economic events, they should not reflect any systematic bias. To the extent that we observe bias in the accounting for these adjustments, we may conclude that accounting was opportunistic.

In our analyses, we manually collect all available data from NORTE and MZA for the period 1861-1921. Using these data, we measure earnings persistence, using both reported figures and earnings before prior period adjustments. Our results provide the following key evidence. We find that, overall, earnings are highly persistent, indicating a consistent and uniform application of accounting criteria. We interpret this as indicative of accounting quality. Second, we find that MZA and NORTE used the prior period adjustments differently. Whilst MZA adjustments are consistently negative (income-decreasing), they are persistently positive (income increasing) in the case of NORTE. Indeed, when we remove the adjustments from NORTE, the persistence significantly decreases. This could be interpreted as evidence of opportunistic accounting practices in NORTE.

The reminder of the paper is structured as follows. Section 2 reviews the literature. Section 3 presents the model and hypotheses. Section 4 discusses the sample and section 5 presents the main results from our analyses. Finally, section 6 concludes.

2. LITERATURE REVIEW

The literature review supports the general thesis that Railways Companies reported unreliability accounting figures during the 19th and 20th Century. However, authors differ on the arguments

that would justify that thesis. These arguments vary from the lack of knowledge –or underdeveloped knowledge– of accounting techniques (minimum managerial awareness on accounting manipulation) to the deliberated manipulation (maximum manager's awareness).

Regarding the first group of arguments, some authors justify the unreliability of accounting figures by the conceptual and normative underdevelopment in earnings measurement (Pollins, 1956: 153; Lee G.A., 1975: 6). Or, more specifically, by the non-recognition of depreciation and the treatment of owners' investment interest as a cost (Pollard, 1965: 233; Perleman, 1997: 61; Toms & Shepherd, 2013: 14). Other authors argue for the incorrect allocation of expenses between Capital Account and Operating Account, which caused overvalued assets (Brief, 1966: 20).

Conversely, some authors point out that the Capital Account was used to increase the "necessary" disbursements to build the railway, specifically in relation to the item *expenses to obtain legal authorizations to build* (Pollins, 1952). Other authors affirm that Railway Companies manipulated the accounts to hide deficiencies and/or prevent comparison among them (Gourvish, 1972: 75). Finally, other authors point out, as a reason for the manipulation, the pressure by shareholders to collect dividends (Edwards, 1985: 34; 1989: 167). Or, more specifically, that the high-class investors (backed by the Central Government) manipulated the figures deliberately to swindle middle-class investors (Bryer, 1991; McCartney & Arnold, 2003).

Finally, a third group of arguments could be classified as being best explained by willful ignorance. In the 40s of the 19th Century, British Railways Companies knew that the rolling stock and permanent railway were not indestructible. Thus, they knew the concept of depreciation, and had already developed different accounting treatments to recognize it (Edwards, 1985, 1986; Bryer, 1991: 448-449). However, during the boom of 1844-1845, those

companies did not account for the depreciation of their investments. Thus, some authors defend there were omissions -or non-compliance of proceedings- instead of an underdeveloped concept or norm (McCartney & Arnold, 2003: 825-826). Accordingly, there was a decrease of depreciation expenses in order to distribute higher dividends during the years of the *railwaymania* (Edwards, 1985: 31; 1989: 168).

Prior literature on Spanish Railways Companies affirms that these companies did not report reliable figures. But, at the same time, they recognize that there is no evidence to support this conclusion (Artola, 1978, I: 152). Some of the usual arguments, to presume the manipulation of the figures, are the following:

- Accounting frauds are more probable while tax authorities' lawlessness and concessioner railway's political power are higher (Martín Aceña & Comín, 1994: 135).
- The establishment expenses were increased by promotors in order to obtain more public funds to build the rail infrastructure (Tortella, 1973; Cordero & Menéndez, 1978; Tedde, 1978; Comín et al., 1998; Herránz-Loncán, 2003: 51).[2]
- The *Act of 20 February 1850* mandated the Spanish State to pay interests to the Railway Companies. The amount of these interests had to be calculated in an inverse proportion to the net earnings made by these companies. In consequence, the *Act* could have been an incentive to manipulate figures (Comín et al., 1998, 53).

Conversely, few authors defend that Spanish Railway Companies were extremely careful with the accounting proceedings, because they had to return the assets to the State at the end of the

[2] Artola (1978, I: 152) affirms that, in some cases, Railway Companies were accused of manipulating the figures in the Establishment Account. The objective would be to justify the need for additional finance to build the permanent way and infrastructures. But, the author points out that evidences have still not been found in the sources.

concession term (Núñez et al., 2008: 101).

Prior research on the accounting of MZA focused on a number of specific issues: e.g. the treatment of the staff expenses (Martínez Vara, 2001, 2004, 2006); the internal accounting regulations (Fidalgo & Miranda, 2006); the recognition and measurement criteria for construction costs, caused by the Ibero-american Exhibition of 1929 (Martínez Vara & De Los Cobos, 2007); the coding system for expenses in workshops (Villacorta & Martínez Vara, 2009); changes of the Capital Account during the construction phase (Santos-Cabalgante et al., 2012a); the impact of the organizational structure on the Operating Account between 1856 and 1858 (Santos-Cabalgante et al., 2012b); or, the evolution of the Operating Account from 1856 to 1874 (Santos-Cabalgante et al., 2014).

On the other hand, NORTE has not been studied in case study research as frequently as MZA has (except for the study of the historical treatment of depreciation and amortization expenses). Only a few articles focus on NORTE, and only during the first quarter of the 20th Century: e.g. the accounting treatment of depreciation (Bentabol et al., 2011), and the specific depreciation of rolling stock and the evolution of the Operating Account (Montoya & Guzmán, 2011). There are a very limited number of studies looking simultaneously and comparatively at the accounting of both companies: e.g. the accounting and statistical functions of the Chief of a railway station (Montoya et al., 2012), and the first internal audits (Villacorta & Müller, 2014).

2.1. Motivation

As previously discussed, there is a mix of theories and lack of evidence on the reliability of accounting practices in Railway Companies. During the 19th and the first third of the 20th Century, Spanish Railway Companies MZA and NORTE were the biggest Companies in Spain.

Exhibit 1 provides some evidence on the relative size of Railway Companies, as ranked within the top 50 Spanish firms.

Exhibit 1

RANKING OF SPANISH COMPANIES BY…	POSITION[3]	
	MZA	NORTE
Paid-in Capital in 1866-1867 term	1/50	3/50
Capitalización in 1913	3/25	2/25
Net Assets Value in 1917	2/50	1/50
Net Asstets Value in 1930	1/50	2/50

Source: Based on data from Carreras & Tafunell (2005: 786-789)

The relevance of these firms within the Spanish national economy justifies the development of accounting within that sector, and the interest of the detailed study of accounting practices. The main motivation of this paper is to measure the quality of the accounting information reported along the 19th century by Spanish Companies.

In addition, the thesis that argues that Railway Companies reported unreliable information has also been generally accepted in prior research about the Spanish Railway Companies. Thus, due to MZA and NORTE were Railway Companies, the secondary motivation is to measure quality of accounting information in order to validate or reject such assumption for Spanish railway accounting.

2.2. The Challenge of Measuring Quality Earnings in Historical Cases

Accounting quality[4] is a dynamic concept. Different stakeholders can value each quality

[3] n/N: where "n" represents the position of the Company in the ranking; and N is the total number of Companies that have been ranked.

[4] Nowadays, national and international (both ISAB and FASB) frameworks indicate the same desirable qualitative characteristics for the financial information. These are relevance (utility), reliability (free of material errors and bias;

characteristics in a different way (Dechow et al., 2010: 1). Whilst this may appear a sufficiently broad consideration, the qualitative characteristics to measure quality of the accounting information are even more difficult to pin down in an historical case. Like with many other concepts, the concept of quality has evolved. Therefore, first of all, we have to define what it was considered as quality of accounting information in the 19th Century.

For this purpose, we have reviewed the Spanish railway accounting framework. We have identified the adjectives (used in regulations) of how the accounting information should be. These adjectives closely align with desirable qualitative characteristics of accounting, and thus, potentially, with accounting quality. Summarizing these ample regulatory backdrop, accounting information should be complete and regular[5], legally binding[6], verified, publishable and communicated[7], clear[8], representative of the real business situation[9], and precise[10]. A close analysis of these characteristics revels that although not listed in a single conceptual framework, the overall concept of quality accounting information in 19th Century was a modern concept, similar to the current one.

Moreover, the Railway Companies' historical context had positive characteristics that helped to achieve quality in the accounting information; and negative characteristics that impeded such quality. Exhibit 2 provides a summary of these positive and negative

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and neutral), integrity (complete), comparability and clarity (comprehensible). Characteristics as verifiability and timeliness are frequent too.

[5] Commercial Code (1829: Art. 36), Regulation (1848, 17-Feb) and Law (1856, 11-Jul).

[6] Commercial Code (1829: Art. 36).

[7] Regulation (1848, 17-Feb).

[8] Regulation (1857, 12-Dic: Art. 1).

[9] Royal Order (1864, Sep).

[10] Royal Order (1864, Sep).

characteristics.

Exhibit 2: Historical Context and Key Determinants for Quality

POSITIVE DETERMINANTS	NEGATIVE DETERMINANTS
Numerous internal regulation of accounting proceedings and recognition and assessment criteria.	No external (or sectorial) accounting regulation.
In general, uniformity accounting reports per Railway Company.	Compliance of the three hypothesis on incentives to accounting manipulation (Watts & Zimmerman, 1986).
Using Notes to explain changes on recognition and assessment criteria.	Conceptual underdevelopment about depreciation, assessment and recognition of fix assets.
Internal Auditory by Accounts Commissions, and External Auditory by Government Representatives.	Frequent non-compliance of the assessment criteria.
.	Government Members as members of the Railway's Board of Directors.
	Legal context oriented to the periodical report of statements more than to relevance and reliability of the figures.

2.3. Literature Review on Earnings Quality

There is no clear consensus in the literature on how to measure earnings quality. DeFond (2010) and Dechow et al. (2010) identify and review more than 300 recent papers on this issue. These prior work is usually grouped depending on the different approaches and techniques used to measure earnings quality. In particular, elements such as earnings persistence, accruals quality, timely recognition of losses and asymmetric opportunity have been extensively used. This prior literature tends to agree that earnings persistence is an adequate and extensively used earnings quality measure (Hribar et al. 2008; Dechow et al. 2010). Other models commonly used are those of value relevance, those that focus on a single item of the financial statements, and models that operationalize different aspects of accounting quality.

A number of these models, and particularly, value relevance models, measure quality by studying the relation between accounting figures and capital market prices and returns. These models assume that when accounting figures are strongly correlated with prices or returns, then, they provide relevant (and reliable) information. Thus, higher correlations with prices and returns are interpreted as indicating higher quality accounting.

However, these models have been criticized in the recent literature (Holthausen & Watts, 2001), because their implementation is not always viable. Obviously, these models are based on the relation between prices and accounting figures, so it requires the existence of developed capital markets, as a strong assumption of the model is that capital markets (and therefore, prices and returns) reflect all available information.

We evaluate the existence of earnings quality using earnings persistence in temporal series. This is similar to the work of Dichev et al. (2009), and it is not without criticism. However, a number of the current criticisms to this quantitative technique turn into advantages when applied to historical cases.

- The persistence analysis is frequently criticized, since it is focused exclusively on earnings quality. It does not evaluate quality taking into consideration the whole of the financial statements (Beest et al., 2009: 3-4). But, in the 19th Century, the historical context was characterized by a lack of accounting regulatory framework and accounting concepts and practices in an very underdeveloped stage. This makes it nearly impossible to control for all the variables that may have affected the quality of accounting information.
- Thus, to apply the technique of earnings persistence in historical cases can be more effective as a measure of quality, as it only requires bottom line earnings. Moreover, the

technique shows a partial and generic approach about quality, which is very appropriate in historical cases instead of drawing restricted conclusions.

- Some quantitative models are not workable to measure quality in historical cases. For example, due to they require non-existing information and the markets were not as development as they are currently. The technique of earnings persistence in temporal series provides a consistent model since the required information is available and kept in the Historical Archives. A similar approach was used by Sivakumar and Waymire (2003) when studying the earnings properties of US railway firms during the early 20th Century.
- Dechow et al. (2010: 7) criticize that persistence earnings is focused on the utility for the investors more than on utility for making-decision. But, precisely because Railway Companies Annual Reports were formulated only to inform shareholders, who were simultaneously members of the Board of Directors this approach is more useful. Railway Companies were only obliged to publish the Balance Sheet, but they usually infringed the law (Bernal, 2004: 77).

2.4. Earnings Persistence

In summary, earnings persistence can be measured through lineal autoregression of earnings (autocorrelation of the variable along time). If there is earnings persistence, it suggests that there is a uniform and subjacent application of accounting criteria. Therefore, this would be evidence of the existence of high quality information (Dechow et al., 2010: 14).

Earnings persistence depends on the fundamental earnings and on the implemented accounting system. In turn, the quality of an accounting system depends on two pillars: the

'fundamental' and the 'endogenous'. The 'fundamental' is the ability of an accounting normative framework to capture the value (without managerial intervention). And, the 'endogenous' provides measurements of values which are influenced by the managerial choices on accounting principles (Dechow et al., 2010), by looking at earnings persistence over a long window and across two different firms, we can keep the fundamental issues constant, and focus on endogenous elements of quality, such as managerial decision making. In the next section, we explain the models used to study accounting quality.

3. MODEL AND HYPOTHESES

We identify earnings quality through one of the attributes of quality (persistence). And persistence can be measured by the variable's auto-correlation along time. The correlation quantifies the strength and direction in the linearity and proportionality of the relation.

Exhibit 1: Statistical Model to the Persistence Analysis

$$(1)\ E_t = \beta_0 + \beta_1 E_{t-1} + \varepsilon$$

Where: $\boldsymbol{E_t}$: earnings in t; $\boldsymbol{\beta_0}$: constant; $\boldsymbol{E_{t-1}}$: earnings in t-1; $\boldsymbol{\beta_1}$: autocorrelation coefficient; $\boldsymbol{\varepsilon}$: statistical error.

Where, the *β1* coefficient measures the autocorrelation between earnings in *t* and in *t-1*. Therefore, higher *β1* coefficient implies higher earnings persistence, thus higher earnings quality.

Due to all the above, the hypothesis to test is formulated as follows:

H.1.: *If accounting quality is auto-correlated, there exists persistence in earnings. And in turn, the information is of quality, because persistence would suggest a uniform and subjacent application of recognition and measurement criteria.*

To provide additional evidence on our hypothesis, we analyze a novel element in Railway accounting research: the annual adjustments to the net income figure reflecting prior period

events. These adjustments are included on an annual basis and reflect earnings from prior periods that were not recorded in a timely manner and that are included as an adjustment in the current period. These adjustments could thus refer to the prior period, but also, to several periods prior. These adjustments can be identified as *Ajustes de Ejercicios Cerrados* and we denote them prior-period earnings adjustments (PP_ADJ).

These adjustments, which modify current-period earnings, could be introduced into the accounting simply to reflect events that are known after the fiscal year ends, for example, if information is not available at the time of preparing the financial statements. This would be a likely event particularly in the 19th Century, when communication and measurement of economic events was significantly delayed because of the lack of timely communication channel and strong internal controls as well as because of the underdevelopment of the overall accounting information system. Conversely, these adjustments could be used opportunistically, to delay the recognition of expenses or to time revenues and expenses, including them in the period when management considers it is in their best interest. The accounting for prior period transactions is a complicated area in accounting, which, even nowadays generates great controversy. By analysing these adjustments, which reflect a modern concept, we can provide novel evidence on the extent to which Railway accounting in the 19th Century was of high quality.

Exhibit 4 shows the item of *Ejercicios Cerrados* in a Railway Operating Account.

Exhibit 4: Expenses in the Operating Account

Total servicio de Vía y Obras	13.531.301	19
SERVICIO DE MATERIAL Y TRACCION.		
Personal	676.503	86
Gastos diversos	121.591	79
Conduccion de máquinas	3.213.767	58
Consumo de id	9.309.638	85
Conservacion del material móvil	7.124.117	16
Total servicio de Material y Traccion	20.445.619	24
GASTOS GENERALES.		
Gastos generales por todos los servicios	4.143.929	46
Ejercicios cerrados	949.276	30
Total gastos generales y ejercicios cerrados	5.093.205	76

Source: Annual Report (MZA, 1876)

Therefore, in our second set of analyses, we modify model (1), and run the model separately for the adjustments (PP_ADJ), and also, for earnings before the adjustments (EBADJ) instead of using reported earnings (E). We use these prior period adjustments (PP_ADJ) to provide direct evidence and therefore, attempt to disentangle the two competing views of the drivers of accounting quality in early Railway companies. To the extent that these adjustments lower the quality of reported earnings, we may conclude that accounting was opportunistic. To the extent that they do not lower the quality of reported earnings, we may conclude that these adjustments simply reflected the underdevelopment of the overall accounting information system and the lack of timely channels to measure economic events.

4. SAMPLE

The sample includes the earnings of the two main Spanish Companies (MZA and NORTE) for the period 1861-1921 (19th and 20th Century). The sample used in our tests comprises 121 firm-year observations.[11] As mentioned above, MZA and NORTE were the main Spanish Railway

[11] Year 1867 is not available for NORTE.

Companies during those decades. Other, smaller, railway firms also operated in Spain during those years, but their reduced dimensions and scope of operations make them difficult to compare with MZA and NORTE. For example, in terms of stock capital, MZA and NORTE represented 36% of Spanish Railways' Stock Capital in 1865, and 52, 5% in 1920. In terms of obligations volume, both represented 47, 7% in 1867, and 89% in 1900. And, in terms of permanent way, MZA and NORTE –individually– outnumbered the whole kilometers of the other three Spanish Railway Companies (Andaluces, Madrid-Cáceres-Portugal "MCP", Madrid-Zamora-Orense-Vigo "MZOV") (Comín et al., 1998 (I): 83, 152, 147).

To calculate model (1), we obtain MZA and NORTE's earnings (E) and prior period adjustments (PP_ADJ) at time *t*. Earnings are calculated by the difference between income and expenses (including both operating and financial expenses). In other words, earnings represent the distributable net result.[12] The *net earning* is a numeric data expressed in thousands of *Reales de Vellón* (Rs.vn.) until 1882[13], and in *pesetas* since then. We use the official conversion rate to transform Reales de Vellón into Pesetas. In our models, we incorporate a dummy variable (VELLON) that takes the value of 1 if the numbers are originally expressed in Reales de Vellón, 0 otherwise.

Each observation is manually collected directly from the Operating Accounts. In turn, these Operating Accounts are included in the MZA and NORTE's Annual Reports, which are kept currently in the Railway Library of the *Fundación de los Ferrocarriles Españoles*.

[12] Spanish Railway Companies reported a concept of earnings, which was calculated in a uniform manner along time (Santos-Cabalgante et al., 2014).

[13] Monetary Reform in 1882. The equivalence between the Real de Vellón and the peseta was fixed at 1 peseta equals 4 Reales de Vellón.

Graph 1 shows the behavior of our earnings proxy, since middle of the nineteenth century[14] to the Spanish Railway nationalization in 1941. Because of missing data for NORTE, we use, in our models and subsequently, the common sample from 1861 to 1921. It can be readily observed in Graph 1 that there are significant fluctuations on the values, but both Railway Companies show a similar trend in earnings.

Graph 1: MZA & NORTE's Earnings

Source: Based on data from Annual Reports (MZA 1858-1941; NORTE 1961-1921)

5. RESULTS AND DISCUSSION

5.1. Descriptive evidence

The aim of this paper is to measure the earnings quality of Spanish Railway Companies. Methodologically, we measure accounting quality using the attribute of earnings persistence. When earnings persistence exists, we interpret it as suggesting the existence of earnings quality.

[14] MZA was founded in 1856, and NORTE in 1858.

The sample includes the reported earnings by NORTE and MZA from the year of their foundation until the nationalization, but we can only obtain full data to run our analyses from 1861 to 1921. Thus, in the discussion that follows, we focus on that subsample. When running model (1), and to the extent that numbers were not reliable, we would expect to observe a reduced persistence in earnings. Such finding would be consistent with the prior literature suggesting low quality accounting information and vice versa in the case of finding evidence of earnings persistence.

[Insert Table 1 about here]

Table 1 presents descriptive evidence of sample variables. Both MZA and NORTE were profitable firms during this period, only 12 observations correspond to loss periods. In particular, MZA reported losses only in 1868 and 1869, whilst NORTE reported positive earnings in 50 years over the 60 year period considered (83%), most of the losses are accumulated in the period 1893-1897, where NORTE consistently reported losses for the five year period. Table 1 also reveals that the adjustments are material. On average, they represent 3% of E, with a minimum adjustment of -276.4% and a maximum of 80.4%. Albeit on average the adjustments are negative in both firms (-3.5% in MZA and -1.6% in NORTE), it is remarkable to note that whilst NORTE had both positive and negative adjustments, MZA only had negative adjustments to net income. This may be early evidence of heterogeneous use of the adjustments. In particular, and for the case of MZA, if we assume that managers would prefer to report positive earnings, the reported adjustments never serve to increase earnings, as adjusted earnings are always higher than reported earnings. All adjustments are income decreasing in nature. In the case of NORTE, 70% of the adjustments are income increasing in nature, this means that the reported number is higher because of the inclusion of the adjustment. Income increasing accounting is potentially

opportunistic in nature.

Finally, Table 1 incorporates information about the number of years when the Real de Vellón is the denomination currency. In both cases, the Real de Vellón was used from 1861 until 1881. After 1882 the accounts are reported using peseta.

5.2. Regression results

To assess accounting quality in Railway Companies, we run model (1) for the full sample, and then, separately for MZA and NORTE. Table 2 presents results of running model (1) using E as our dependent variable. Because our E variable is positively skewed, we log transform E before running our models.

[Insert Table 2 about here]

Table 2 Panel A presents results for the full sample, first using a simple OLS model, and then, robust regression estimation. The results are consistent across estimations, thus, in our interpretation, we focus on the Robust OLS case, mentioning any differences with the OLS case when necessary. The evidence reported in Table 2 Panels A, B and C suggest earnings are highly persistent (coeff=0.605, p-val<0.01 for the full sample). When looking separately at NORTE and MZA we also find evidence of high persistence. In particular, Panel C suggests very high persistence in NORTE. Such a high persistence is unlikely to reflect reality, and would likely suggest managerial intervention to attain it. Overall, the fit of the model, as measured by the adjusted R-square is of 0.25, which is reasonable. There is also a difference between both firms, as in the case of MZA the model has an adjusted R-square of 0.29, whilst it is only of 0.20 for NORTE. This suggests that accounting is of heterogeneous quality across Railway firms, given that both NORTE and MZA were likely similarly affected by economic and Spanish-wide

effects, and had similar operating, financing and investment frameworks, differences in accounting quality can be likely attributed to the internal accounting information system in place in each firm, as well as to firm-specific characteristics.

In any case, to properly interpret the findings, we must take into account the historical context, and also, be very cautious when reaching conclusions, as we are applying a modern concept of reliability.

To further investigate into the accounting quality in Railway companies, we rerun model (1), but using earnings before adjustments (EBAJD). These earnings are calculated by removing the prior period adjustment from reported earnings. Table 3 presents the results from this analysis. Again, we report pure OLS regressions as well as robust regressions. Again, because our EBAJD variable is positively skewed, we log transform it before running our models. Table 3 Panel A presents the findings for the full sample. Table 3 Panel B presents results for MZA and finally, Table 3 Panel C presents the results for NORTE. As before, we find evidence of earnings persistence in all three model specifications.

[Insert Table 3 about here]

Perhaps more interestingly it is to note that the coefficients of earnings persistence in MZA do not change with respect to those reported in Table 2, whilst this is not the case for NORTE. In the case of NORTE, we find a significant change in the coefficient, which is reduced from 0.987 to 0.562 when we eliminate the adjustment. This evidence strongly suggests that the adjustments, in the case of MZA did not affect accounting quality, whilst they did in NORTE. Although we must be necessary cautious in interpreting this evidence, this result would suggest that the (on average) income increasing adjustments introduced by NORTE lowered accounting

quality.

6. CONCLUSIONS

Prior literature studying Railway accounting during the 19th Century criticizes, but fails to provide direct evidence on the unreliability of accounting figures. In Spain, the historical and economic researches have admitted the thesis that Railway accounting was unreliable. In this paper, we attempt to provide novel evidence on the quality of Railway accounting by quantifying, through measures of earnings persistence, the quality of accounting information. In our analyses we study the persistence of reported earnings and of some of its components for the period 1861-1921. The reported evidence suggests, overall, that accounting information was of high quality, as earnings are highly persistent during this period. However, we show that there are differences across firms and that these differences are particularly obvious when analysing the adjustments for prior period earnings. Although our results are still tentative and additional evidence on firm-specific characteristics may be necessary to reach a clear conclusion, we consider that our evidence speaks, overall, of accounting quality in the Railway sector, and also, of heterogeneous accounting practices reflecting potentially opportunistic behaviour.

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Table 1. Descriptive evidence

Panel A: Full Sample

Variable	Obs	Mean	Std. Dev.	Min	Max
E	121	6351763	6960995	-20400000	28500000
PP_ADJ	115	-38970	265556	-1038244	761942
EBADJ	121	6388801	6975703	-20600000	28500000
%ADJ	115	-0.026	0.319	-2.764	0.804
POSITIVE	120	0.350	0.479	0	1
VELLON	121	0.339	0.475	0	1

Panel B: MZA

Variable	Obs	Mean	Std. Dev.	Min	Max
E	61	7826677	6932003	-857007.4	28500000
PP_ADJ	61	-66840	104728	-476561	0
EADJ	61	7893517	6895539	-738013.2	28500000
%ADJ	61	-0.035	0.182	-1.270	0.394
POSITIVE	60	0.000	0.000	0	0
VELLON	61	0.344	0.479	0	1

Panel C: NORTE

Variable	Obs	Mean	Std. Dev.	Min	Max
E	60	4852268	6719422	-20400000	22100000
PP_ADJ	54	-7487	370626	-1038244	761942
EADJ	60	4859006	6774596	-20600000	23100000
%ADJ	54	-0.016	0.425	-2.764	0.804
POSITIVE	60	0.700	0.462	0	1
VELLON	60	0.333	0.475	0	1

Descriptive evidence of MZA and NORTE for the period 1861-1921. E is net income for the period. PP_ADJ is prior period net income adjustement. EADJ is earnings after adjustment, calculated by substracting the PP_ADJ from E in period t. %ADJ is the ratio of PP_ADJ over E. POSITIVE is a dummy variable that takes the value of 1 if the PP_AJD is positive, 0 otherwise. VELLON is a dummy variable that takes the value of 1 if the data belongs to a period when numbers are originally reported in Reales de Vellón instead of pesetas, 0 otherwise.

Table 2. Regression results (Dependent variable = E_t)

Panel A: Full sample

	OLS			Robust OLS		
	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t
E_{t-1}	0.527	0.083	0.000	0.605	0.007	0.000
Intercept	5.726	1.268	0.000	6.315	0.100	0.000
N			118			118
F			40.07			8416.67
Adj R-sq.			0.2503			

Panel B: MZA

	OLS			Robust OLS		
	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t
E_{t-1}	0.546	0.110	0.000	0.684	0.066	0.000
Intercept	6.584	1.696	0.000	5.076	1.018	0.000
N			60			58
F			24.55			108.15
Adj R-sq.			0.2852			

Panel C: NORTE

	OLS			Robust OLS		
	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t
E_{t-1}	0.482	0.124	0.000	0.987	0.007	0.000
Intercept	5.019	1.865	0.000	0.325	0.112	0.005
N			58			58
F			15.2			17792.6
Adj R-sq.			0.1995			

Regression results of running model (1) for the full sample, and then, separately for MZA and NORTE for the period 1861-1921. E is the natural logarithm of net income for the period *t*.

Table 3. Regression results (Dependent variable = $EBADJ_t$)

Panel A: Full sample

	OLS			Robust OLS		
	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t
EBADJt-1	0.522	0.084	0.000	0.630	0.006	0.000
Intercept	5.803	1.273	0.000	5.903	0.097	0.000
N			118			118
F			38.98			9731.68
Adj R-sq.			0.2451			

Panel B: MZA

	OLS			Robust OLS		
	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t
EBADJt-1	0.541	0.111	0.000	0.683	0.069	0.000
Intercept	6.682	1.705	0.000	5.092	1.072	0.000
N			60			58
F			23.87			97.51
Adj R-sq.			0.2794			

Panel C: NORTE

	OLS			Robust OLS		
	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t
EBADJt-1	0.476	0.124	0.000	0.562	0.008	0.000
Intercept	5.091	1.869	0.009	6.981	0.115	0.000
N			58			58
F			14.67			5366.78
Adj R-sq.			0.1935			

Regression results of running model (1) for the full sample, and then, separately for MZA and NORTE for the period 1861-1921. EBADJ is the natural logarithm of net income before prior period adjustments for the period *t*.