The collapse of the Railway Mania, the development of capital markets, and Robert Lucas Nash, a forgotten pioneer of accounting and financial analysis

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Abstract. It is well known that the great Railway Mania in Britain in the 1840s had a great impact on accounting. This paper contributes a description and analysis of the events that led to the two main upheavals in accounting that took place then, and of the key role played by Robert Lucas Nash in those events. He was a pioneer in accounting and financial analysis, providing studies on the financial performance of railways that were more penetrating and systematic than those available to the public from any one else. His contemporaries credited him with precipitating a market crash that led to one of two dramatic changes in accounting practices that occurred in the late 1840s. Yet his contributions have been totally forgotten.

The collapse of the Railway Mania provides interesting perspectives on the development of capital markets. The accounting revolution was just one of the byproducts of the collision of investors' rosy profit expectations with cold reality. Shareholders' struggles to understand, or, more precisely, to avoid understanding, the inevitability of ruin, have many similarities to the events of recent financial crashes. The Railway Mania events thus provide cautionary notes on what even penetrating accounting and financial analysis reports can accomplish. Railway share price behavior suggests that Nash's contributions had a much smaller effect than his contemporaries gave him credit for.

1 Introduction

The 1840s were a period of dramatic growth and change for British accountants. Many of today's big accounting firms trace some of their roots to that period. As just one example, the accounting firms around the world that use the name "Deloitte" derive it from William Welch Deloitte, who set up his own practice in London in 1845. There is rare unanimity among experts on this period in attributing the growth in the ranks and prosperity of accountants to the rising demand for accounting services from the railway industry. For example, in Deloitte's career, "[a] crucial event ... was [his] appointment in 1849 ... to assist the shareholder auditors of the Great Western Railway" [44].

Many books on the history of accounting do mention the important influence on this field that railways, and the Railway Mania in particular, had, cf. [17,29,45]. There are also numerous scholarly articles on railways and accounting, in particular [15,16,18,19,27,28,36] and [46,52,58,59,69,70]. The most recent addition to this topic is a series of careful studies by two accounting scholars, Arnold and McCartney [8,9,10,47,48,49,50]. They provided extensive quantitative studies and refuted many pervasive myths about the Railway Mania.

Developments of professions are often hard to describe. Sometimes there are some key inventions, such as that of double-entry bookkeeping, that one can try (usually with great difficulty, as there are almost always numerous precedents) to locate in time and space, and then chart their spread. More often we find just a growing sophistication of a field that is hard to quantify. However, the existing accounting history literature (see, for example, [27]) does point to two important events in the late 1840s, sometimes referred to as revolutions. One was the production of a "financial statement" by the London and North Western Railway (LNWR) in October 1848, which was soon followed by similar statements from most of the major railways. These statements provided to shareholders a significantly clearer look at the finances of their lines. However, these statements were produced by railway managers, and public accountants did not play any role that was visible to the public.

The second railway accounting revolution of the late 1840s was the elevation of accountants from nameless drudges in the back office, doing routine bookkeeping work, to the "Priesthood of Industry," in the title phrase of [45]. This elevation took place primarily in 1849, when shareholder committees of investigation were set up and relied heavily on outside accountants, in an acknowledgment that railways were not the simple enterprises that investors had expected.

Both of these accounting revolutions were accompanied by an upsurge in public interest in railway accounting. Both houses of Parliament had debates on this topic, the House of Lords held hearings and put out a report on it, and leading newspapers published numerous leaders (similar to modern editorials, but typically far more extensive, mixing in factual presentations and analysis) about it. Such public attention was unprecedented for a technical business issue in private enterprise.

This paper provides greater detail and analysis of the key events that were associated with those two accounting revolutions. They were both byproducts of the collapse of the Railway Mania.

A central figure in the presentation is Robert Lucas Nash. Totally unknown in the modern literature, he was widely regarded by his contemporaries as having precipitated a railway share crash in late 1848. This crash led to the first accounting revolution of the late 1840s. But Nash did a lot more, both to advance accounting and to establish modern financial analysis. His "dissections of railway accounts" established a new standard of sophistication, and were cited by the press for their penetrating quantitative insights.

A brief chronology of the Mania can be presented with the help of Fig. 1, which shows two British share price indices[1]. (For more information about the earlier history of the railway industry in Britain and the development of the Mania, see the manuscript [55], which will be cited several times for additional background information.) As this figure

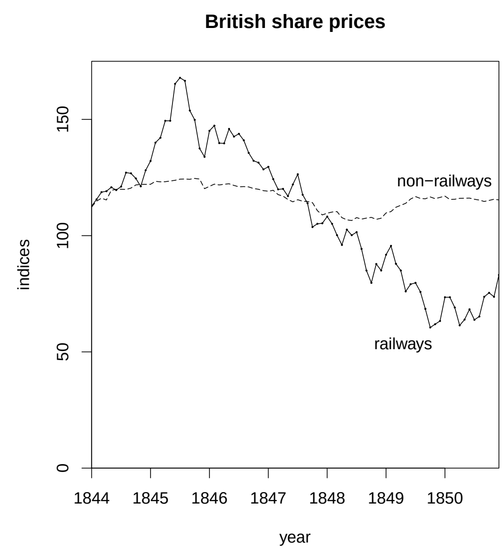

Fig. 1. Share prices in Britain, 1844 through end of 1850.

shows, the speculative excitement of the Mania was confined almost exclusively to railway shares, and got going in earnest in 1844, with peak prices reached in mid-1845. (For earlier history of railway shares prices, see the graphs in [55,56].) After that, railway shares went into a prolonged, 4-year slide, until a bottom was reached at the end of 1849. (More detail on the final decline is presented in Fig. 2 later.) However, actual investments in railway construction moved in the opposite direction, rising from £13 million in 1845, to £30 million in 1846, and a peak of £44 million in 1847, almost 8% of British GDP, and twice the military budget of that year. (See tables 1 and 2 in [55] for more comprehensive statistics on the British economy and railway industry in particular.) They did not decline back to the £13 million per year level until 1850.

This paper concentrates on the final phases of the Railway Mania, the years 1847–49, especially the year 1848. It investigates how the public and the markets came to the realization that railways were going to yield disappointing returns. In hindsight, it is easy to see (as is shown in Section 2) what led to this result, but it was hard for Mania investors to see it without access to the information available today. The primary resources used in the study were contemporary publications, newspapers, periodicals, pamphlets, and books. Some archival material was consulted, but citations are only to published material. No references are made to accounting documents inside railway companies, only the financial reports made available to shareholders and the public are relied on. It is the reactions of those groups that are studied. Who was being cited as an authority for either positive or negative evaluations? How sophisticated were their analyses, and how did they compare to modern ones? Were there any quantitative models that pointed out the problems that led to the low profitability of railways? Why and how were outside accountants brought in? The aim was to find out how the early Victorian investors operated in an environment of great uncertainty and considerable disinformation. How well did their opinions reflect the reality that we can see in hindsight, and how did those opinions compare to the price action of the share markets?

As is explained later, the first couple years of decline in railway share prices were easy for investors to rationalize away. However, by 1848, the continuation of the decline, the growing disparity that investors saw between prices of railway and other shares, and the alarms raised by Nash and others, led to a dramatic rise in investor anxiety. Railway accounting became a focal point of concern, and the railway share crash at the end of 1848, which was widely attributed to Nash, led to the first accounting revolution. In the words of a book published in early 1849 ([62], p. 16),

> [t]he reasonable demand made by the public has been for railway accounts such as they could understand; and aided by an eloquent press, they obtained from the directories, in October and November last, accounts at once explicit and clear, and then the clamour ceased.

A substantial recovery of share prices followed this first accounting revolution.

The rise of railway shares at the end of 1848 continued only a few months, and was followed by a second crash in 1849, more severe and more prolonged than the one in 1848. This crash was closely associated with the revelations of the accounting frauds of George Hudson, the Railway King. The most powerful operator in the industry in the mid-1840s, he was discovered in early 1849 to have engaged in doctoring accounts and enriching himself at the expense of his shareholders. This led to the second accounting revolution.

Section 2 discusses the extent and significance of fraud in the collapse of the Railway Mania. There is still some controversy, and there are few hard estimates. However, some quantitative measures are presented which confirm the opinion of most serious scholars of the period, namely that accounting fraud was not the fundamental problem of the Mania. The fatal defect of this period of investor exuberance was that costs of construction and operation were higher than expected, while demand for railway service was lower than expected. However, poor financial reporting, in some cases compounded by fraud, as well as by a stream of optimistic reassurances from a variety of sources, helped conceal the grim reality from investors until 1849.

Section 3 outlines the first few years of the railway share market decline after the exuberant peak in mid-1845. It shows an example of some of the misinformation that kept investors in the dark about the true prospects of the railway industry, and demonstrates the inadequacy of the financial analysis that was publicly available.

Section 4 discusses some of the figures who helped raise public alarm about railway accounting, in particular Arthur Smith. Smith is mentioned frequently in the literature about the Railway Mania, and is given varying degrees of credit for contributing to its collapse. However, Section 4 shows, apparently for the first time, that he did not understand railway economics, and that his main claims were incorrect. Just like many rabble rousers, he served a useful purpose in hastening the accounting revolution, but he cannot be credited with any significant insights.

The main subject of this paper is Robert Lucas Nash, whose career (along with developments in railway finances and railway accounting) is covered in sections 5 through 10. I have not found a single mention of him in the modern literature. (There are traces of a

Robert Lucas Nash one can find, but that is the son of the central figure of this paper, see Section 14.) Even during the collapse of the Mania, his name shows up only occasionally, as his most significant contribution came as the anonymous author of a section of the *London Weekly Railway Share List, LWRSL* for short from now on. However, he had a much more profound, and much greater, impact than Smith. At the height of the railway share crisis in the fall of 1848, the railway interest was mostly dismissing Smith as either loony or corrupt. Nash was also accused of corruption, but his penetrating observations and analyses could not be dismissed as easily as Smith's. These analyses were more sophisticated and extensive than any others available at the time, and were recognized as such through citations by the press that was looking for reliable evaluations of railway finance. Many contemporary observers claimed that it was principally Nash's work that extracted those "financial statements" from railways.

Sections 13 through 15 weigh the likely impact of Nash's work. Although his contemporaries assigned great significance to his work, railway share market behavior suggests his impact on the markets may have been more modest. His penetrating analyses of railway finances were likely just one of several significant factors in hastening the public's slow recognition of the impending ruin. Even the event he was either celebrated or damned for, the share crash of 1848 and the subsequent accounting revolution, would surely have happened without him half a year later, when the big accounting revolution took place that elevated the stature of accountants. By that time the recognition of the disastrous investment returns from Railway Mania projects was no longer avoidable. As with more recent manias, public acknowledgment of the investment disaster was slow, even if some smart (or lucky) investors figured it out earlier and were able to profit from it.

2 The Railway Mania: Fraud or disappointed expectations?

In much of the existing literature, especially the popular one, the Railway Mania is associated with fraud by managers, in particular with "paying dividends out of capital." The standard example that is cited is George Hudson, the "Railway King," the most prominent of the railway potentates of the era, who was found to have committed accounting fraud and to have misappropriated his shareholders' money for his own benefit. Recently an even more extreme form of this view has been published. Bryer [18] has come up with an imaginative tale, a gloss on a stray remark of Karl Marx, which portrays the Railway Mania as a "great railway swindle," "the product of a rational and rapacious social hierarchy," in which profits of railways were initially deliberately overstated to lure ignorant investors to purchase shares. Then, supposedly, those profits were deliberately understated in order to buy those shares at low prices.

McCartney and Arnold [50] have convincingly refuted the flimsy arguments of [18]. In another paper, these authors have also considered in detail over three dozen claims in modern literature about the supposed prevalence of fraudulent accounting during the Mania [9]. They have found all these claims left a lot to be desired. In their words, "*more than half* (15) the references were simply wrong, either because they did not relate to the matter at hand ... or because the quotation was clearly taken out of its intended context or demonstrably failed to provide a basis for the conclusion reached." However, while their paper does demolish the published arguments for extensive accounting abuses, it does not prove that such abuses did not exist. A quick reading of their paper might lead a reader to believe that only the well-known cases of Hudson's fraud on three of the four major lines he controlled had been solidly established. There were other cases as well, on lines outside Hudson's control, even if they were not cited in the claims analyzed and criticized by Arnold and McCartney. Thus, for example, the May 1849 report of the shareholder committee of investigation of the South Eastern Railway concluded that over the previous three years £150,000 had been "charged to capital instead of against revenue." This was about 30% of the dividends paid out during that period[2].

There appear to have been many cases of accounting abuse that were never officially designated as such. The boundaries between honest differences of opinion, stretching the rules, and outright fraud, never very clear, were extremely nebulous in the middle of the nineteenth century, as is already well documented in the accounting history literature. (See Appendix 2 for more extensive discussion of investor attitudes.) There were no accounting standards imposed by the government or by the stock exchanges, and there was not even a professional society of accountants. As one example of questionable accounting, in early 1849, Nash noted the North British Railway had 99 miles in service, and was paying out of its revenues interest and 4% dividends on £1.7 million of capital. But there were 53.5 miles under construction, and the eventual cost of the entire 152.5 miles of this line was projected to be £4 million[3]. Hence if the accounting was accurate, the construction cost per mile of the additional 53.5 miles was going to be about two and a half times that of the 99 miles in service (£43,000 vs. £17,000 per mile). This strongly suggested that somehow the accounting was misleading, and that costs of the main trunk had been allocated to the more recent projects that were under construction. Yet the shareholder Committee of Investigation that was set up soon afterwards gave management a clean bill of health. While they did complain about payments to shareholders out of capital on a branch line, that was a move proposed by shareholders at a general meeting and approved by them. As far as official accounts went, the Committee reported they were "enabled to state that after the most diligent inquiries on their part, and the systematic investigation of their accounts by Mr. Cope, of Manchester (an experienced railway accountant, and entirely unconnected with the North British district), they feel convinced of the perfect fidelity and correctness of the accounts, the accuracy with which capital and revenue accounts have been charged to the proper head, and of the unquestionable integrity with which the Directors have conducted your affairs."[4] Yet however one apportions the blame, it is clear that the financial reports of this line did not provide a reliable signal for shareholders. Within a couple of years, Nash's criticism was vindicated. There was no dividend on the common shares, and only partial on the preference shares.

In the aggregate, the uncertainties facing investors were huge. At the end of 1848, Nash estimated that the 42 main lines that he was tracking had invested a total of £172 million in equity and loan capital[5]. They had Parliamentary authorizations to raise a total of £268 million. The revenue-producing mileage had at that stage cost £138 million, but

> the portion of this capital which, according to the last adopted accounts, was made chargeable upon revenue, or which received dividend and interest from revenue, was [£99 million].

Nash concluded that even

> assuming, as a very insufficient estimate, that 26 millions only will be required to complete the works now in progress, ..., the capital becoming chargeable upon the general revenue of the whole will, in the course of the next two or three years, be 198 millions, or exactly double the present amount; a corresponding increase will, of course, be required in the revenue, or the average of profit must be subject to further declension.

Investors did not even know where in the range of £172 million and £268 million the total capital was going to be at the end. The main result of the railway share crash of 1848 and the first accounting revolution of late 1848 was to extract from managers an estimate of the expected total cost for individual lines. There was a bewildering variety of shares, leases, extensions, and the like, and there was little information about costs of the various branches and extensions, or revenues as those lines came into service. Nowadays, we have financial analysts to undertake such tasks, assembling publicly available information and badgering managers for details and explanations. In 1848, the person who did the most to provide such information was Robert Lucas Nash.

However, while railway financial reporting during the Railway Mania did not provide investors with reliable information, the main cause of the investment disaster was neither fraud, nor conceptually inadequate accounting. Rather, as appears to have been understood by most scholars who looked at this period, the fundamental problem was that original financial projections were overoptimistic. The low level of railway share prices at year-end 1850 visible in Fig. 1 continued through the 1850s. Another railway share index that covers the years 1850–60 is available on p. 187 of [39], and its average for the 10 years 1851 through 1860 is about 4% lower than its value in Dec. 1850, with some fluctuations (with peak about 19% higher, and trough about 23% lower). This reflected the poor profits earned during that period. The risk-free rate of return during that period can be taken to be that for British government "consols" and similar instruments, and those tended to be close to 3%. (There were occasional spikes close to 4% during crises, such as the one in October 1847, or during the French revolution of early 1848, as can be seen in Fig. 4.) Long-established and stable companies were expected to pay about 4% per year. British railways did not come close to meeting that standard after the collapse of the Mania. Dividends on common shares in railways averaged just 1.9% on the paid-up capital in 1849, and only 2.8% over the decade 1849–1858, according to one estimate[6].

The profit expectations of Railway Mania investors varied, with many hoping for 10% dividends. (For a fuller discussion of investor expectations, see [55]. As an example, one of the most prominent opponents of the Mania was James Morrison, a wealthy merchant, banker, and MP. His concern was that excessively high railway profit rates would strangle the economy, and by that he meant 10% annual dividends [53].) Up until 1846, new railway companies had to submit detailed business plans to Parliament with their applications.

Those for 1845, which can be taken as typical, were conveniently summarized in a table in the *Railway Chronicle*[7]. Discarding a few entries in the table, which did not have complete information for their projects, one finds expected construction cost of £15,600 per mile, annual revenues of £1,670 per mile, expenses at 40% of revenues, and 7% annual dividends. (For the 1846 session, which authorized far greater mileage, we do not have complete business plans, but cost estimates were higher, approximately £21,000 per mile, and for the 1847 session they were about £25,000 per mile.)

Table 1. British railway industry in the late 1840s.

year	miles in service	construction cost per mile	annual revenues per mile
1844	2,240	£35,700	£3,280
1845	2,536	35,000	3,470
1846	3,142	31,800	3,300
1847	3,945	31,700	2,870
1848	5,127	34,200	2,560
1849	5,996	35,200	2,100
1850	6,621	35,200	2,080
1851	6,890	35,100	2,220

The reasons for the poor investment returns of Mania railways can be demonstrated in a quantitative way with the data in Table 1[8]. Railway mileage in service (and total invested capital) tripled as a result of the Railway Mania. Had all the projects sanctioned by Parliament been carried out, British railway mileage would have grown by a factor of 5, not 3, and a far greater investment disaster would surely have resulted. Table 1 shows actual costs were far higher than projected. However, the cost overruns on the new railways were likely not as extreme as it might seem. This table shows total costs for the industry, and so includes considerable spending on established lines, for example for better stations. Revenues in the table appear to be comfortably above the 1845 expectations, but that is also misleading. The reason is that the per-mile revenues of the established lines appear to have grown, and those of the new lines to have come in below expectations. (Appendix 1 has data for one of the new lines, the Leeds and Thirst Railway, which illustrates what happened in all too many cases.) Finally, operating costs in the early 1850s were estimated at 45% of revenues[9], which exceeded the 40% expectation, and contributed to poor financial results.

The financial debacle of the Railway Mania was caused by construction of new lines. Those completed before the Mania were on average quite profitable. This can be seen in the approximately 8% dividend rates for the lines shown in Fig. 3 at the start of 1847, although that figure may have been somewhat exaggerated by improper accounting. (See also [55,56] for data on growth in profitability before the Mania, which contributed to the attractiveness of railways as investments during the Mania.) It is also consistent with some estimates made at the tail end of the Mania, in particular at the York and North Midland Railway. This line had been run by George Hudson, and after his forced departure in 1849 was found to be close to bankruptcy. An independent shareholder Committee of Investigation for this line prepared an extensive series of reports, coming to almost 200 pages [73]. This committee concluded that lines belonging to their company that had been authorized by Parliament before 1845 were earning (after paying interest on debt) 7.65%, those authorized in 1845 were earning 4.15%, and those authorized in 1846 just 0.07%.

The widespread belief in pervasive fraud in railway accounting was likely fed by several factors. One was the popular tendency noted in many financial crashes, including that of 2008, to attribute misfortune to corruption by a few individuals. Another was the widespread anomalies in pricing of railway shares, to be discussed later, which led to suspicions that dividends were being artificially inflated. Yet another was that British railway shareholders felt they had been deceived by their managers. Even when there was no corruption, investors had memories not just of the initial rosy promises of enormous profits, but also of the stream of misleading reassurances for many years afterwards. Thus in mid-1849 a shareholder of the North British Railway complained about the work of that line's Committee of Investigation:

> The Committee congratulate themselves on not having any painful disclosures to make, and at the same time make disclosures which will be most painful to every Shareholder. For instance, it appears the estimate for the land was £218,812, and the actual cost will be £693,356, or only the trifling sum of £474,544 more than supposed necessary when the various bills were obtained; and yet these Directors, in whom the Committee place so much confidence, had, up to November, 1848, appeared before the Shareholders, and congratulated them on the satisfactory terms upon which the land had been procured.

On another line, a shareholder complained that his company's directors kept claiming construction costs were under control for three years, and then "the cloven hoof display[ed] itself" when it was revealed that costs were over 50% higher than projected[10]. When sections of a line were opened for service, the standard claim that shareholders and the public heard was that "traffic had exceeded the most sanguine expectations of the directors," and it often took years before it became clear this traffic fell far short of initial projections.

Thus we can conclude that the lack of adequate financial reporting standards, combined with a mixture of wishful thinking, stretching the flexible limits of accepted practice, and outright fraud, did serve to mislead investors. Future research may quantify the contributions of each of these factors. However, the fundamental problem of the Railway Mania was that initial projections for costs and revenues were not realized. This is not something that better financial reporting could have demonstrated ahead of time. However, better accounting could have made the inevitability of ruin apparent much faster, and could have saved immense sums, as various extensions would not have been started, or would have been aborted, or would have been build less expensively.

3 Declining shares and market information and disinformation

Fig. 1 shows railway share prices declining relentlessly, with just a few rallies, from the peak in the summer of 1845 to the trough in the fall of 1849. The first two years of the decline were easy for railway enthusiasts to explain. The initial phase of this decline could be ascribed to the end of what most agreed had been investor exuberance that got to be a little irrational at the peak[11]. After that, there was a general economic depression, two sharp financial crises in 1847, and extremely poor harvests, including the disastrous Irish Famine. Later, in 1848, there were revolutions in Europe, to be discussed in more detail later, and a cholera epidemic. These all could, and were, blamed for the low railway share prices. Still, all this time investors' anxiety mounted. Many had bought shares with small deposits in the hopes of quickly reselling them at a profit. But those profits did not materialize, and now they were stuck with shares and had to come up with more money. In those days, it was usual for initial shareholders to pay only a small deposit when a company was formed, and then to pay the rest of the nominal value of their shares in installments, in response to "calls" from management as funds were needed for expansion. In the late 1840s, many railway investors had to scramble to obtain the necessary cash to pay their calls. While they struggled, shares kept going down. What was especially disconcerting to the shareholders was that not only were railway shares going down, but they were not behaving the way joint-stock company shares were supposed to.

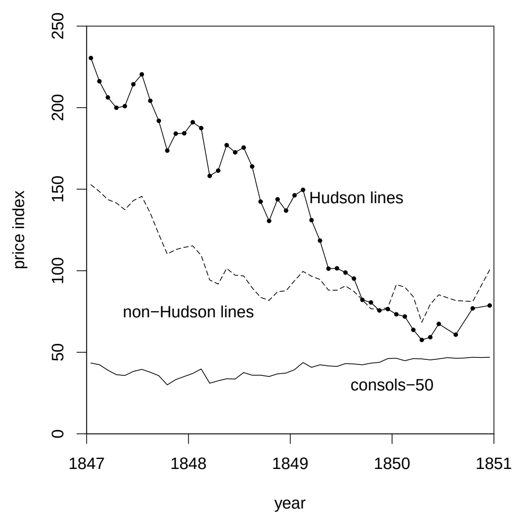

Fig. 2. Share price indices for lines controlled by George Hudson and others.

A more detailed picture of the financial markets during the final phases of the Railway Mania is shown in figures 2–4. Figure 2 shows the behavior of Consols, the UK government bonds with nominal yield of 3% which were a standard benchmark for long-term interest rates, and of two sets of railways. One consists of the four main lines controlled by George Hudson, and the other of six established lines that were independent of Hudson[12]. The two railway price indices were adjusted so each would equal 100 in mid–October 1852. At that stage the Mania extensions were largely fully built, and the effects of Hudson's manipulations on valuations had dissipated. Hence it appears reasonable to argue that the valuations at that time were appropriate, and that the adjusted indices in Fig. 2 show how well the markets could value long-term prospects of railways.

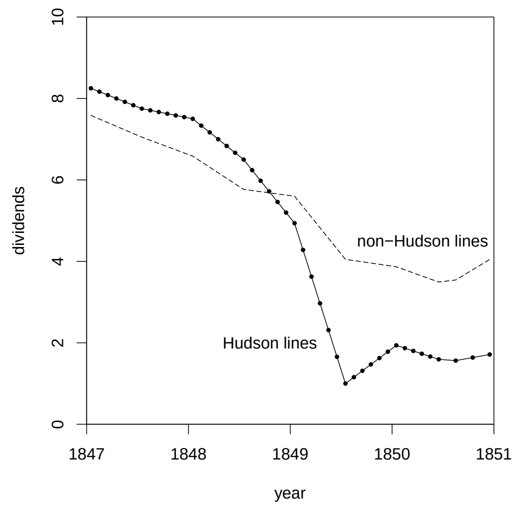

Fig. 3. Interpolated dividend rates for lines controlled by George Hudson and others.

Early Victorians valued shares primarily on the basis of dividend yield, see, for example [61], or the discussion in Appendix 2. Further, their expectations reflected their experience, with most of their actual gains coming from dividends [1]. Each of the 10 railways represented in the two indices in Fig. 2 was by 1847 a nicely established company paying good dividends, but it was also engaged in a headlong expansion that would multiply its capital. Fig. 3 shows the adjusted dividend yields for these two classes of railways. Dividends were set at the semi-annual meetings, which in most cases took place in February and August of each year. However, many investors usually had some idea of what the dividend would be ahead of time, based on watching the weekly revenue figures published in newspapers for individual lines. Hence Fig. 3 is based on monthly figures for dividends that were obtained by interpolating previous and forthcoming dividends[13]. These are dividends on the paid-up values of the shares. The interpolation was performed to smooth the graph, which otherwise would consist of a step function with only a few segments, corresponding to dividend rates being set twice a year.

Fig. 4 presents the market yields for the two sets of lines. In this graph, the interpolated dividend yields shown in Fig. 3 were divided by the ratio of the market value to the paid-up value of each index, to represent the actual yield (adjusted for expectations of changes in dividends) faced by a purchaser of common shares.

Shares of stable companies tended to yield about one percent more than Consols. However, as Figure 4 shows, by 1847 and 1848, shares of established railways were yielding around three percent more than Consols. This was puzzling and frightening, and the press was full of letters and leaders complaining of the anomaly and searching for explanations.

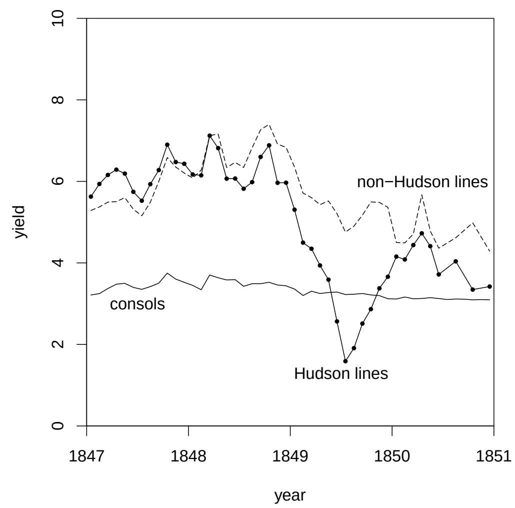

Fig. 4. Dividend yield on market prices for lines controlled by George Hudson and others, as well as the yield on British government 3% bonds.

As time went on, and shareholder anxiety mounted, blame for declining share prices tended to be assigned primarily to three factors:

- the nefarious activities of short-sellers, then called "bears"
- actual or suspected corruption by managers
- the difficulty shareholders had in paying their calls

The first factor, short-selling, needs no explanation. Whenever markets go down, it seems, many observers complain of market manipulation. It was especially amusing when during the crash in late 2008, some of the investment banks that had made huge profits from either selling short themselves, or from providing facilities for others to engage in such activities, advocated (and won) a (limited-time) prohibition of short sales of their shares.

The second factor is also easy to understand, but the seriousness with which it was considered might appear surprising. The reason for that appears to have been the anomaly mentioned above, namely railway shares were far lower than was thought justified, given the level of dividends. This led to the suspicion that the dividends were not covered by profits, but were augmented by infusions of capital, and that insiders were selling.

The third factor is not something familiar today. The issue of calls was the standard excuse in the 1840s. For example, at the height of the railway share crisis of 1848, Frederic Spackman published a letter in *The Times,* detailing his computation of the extent of further calls that were authorized under acts of Parliament. He claimed this huge sum was "a good and sufficient answer" to the question as to what caused the decline in railway share prices, and asserted that if calls and further railway construction were curtailed, "confidence in [railway property] value would soon be restored."[14] A few days later, the *Morning Chronicle* claimed that "the numerous calls ... [is the single cause that has] produced the great reaction [in railway prices]," and that "[t]he remedy ... for this pressing evil, is to do away with the necessity ... *for an increased outlay of capital.*"[15] This excuse was credible because of a wide perception that a similar phenomenon had led to a prolonged depression in railway share prices in the late 1830s and early 1840s, and because that is what most of the Railway Mania critics at its peak in 1845 were warning about. It supported the view, embraced by railway enthusiasts as well as by many critics of the Railway Mania (see [55]) that once the new lines were built, they were going to be profitable. However, by the middle of 1848, increasing numbers of people were realizing that calls were not the fundamental problem, since interest rates were dropping, and money was plentiful. For example, in August 1848, *Bankers' Magazine*, which had earlier warned about the danger of excessive calls, wrote that "[w]e have always admitted, ..., that, carried beyond a certain point, the railway calls would be simply impossible. ... we suspect that by this time most practical people are agreed that neither during last year nor the present, looking at the question free from *extraneous* complications, has this extreme limit been ever attained."

The real problem that the railway industry faced was three-fold, as was shown in the second section. Construction and operating costs were higher than expected, and traffic on new lines was lower than expected. Because of poor accounting and reporting, this was not apparent, and was seldom discussed explicitly. But during 1847, some substantial fraction of observers did begin to grasp at least some of the problems. At this point let me illustrate this evolution of thinking through a few quotes. In Dec. 1848, Nash wrote that

> it has been almost invariably argued that [the] reduced cost [of the new lines] would compensate for any diminution in the rate of mileage receipts, and that the return for the capital employed would thus prove as great as that of the old lines. It will be found, we believe, upon a comparison of the present productive-capital and mileage with that of three years back, that there has been no sensible diminution in the average rate of mileage cost.[16]

Table 1 shows this very clearly, but that table was compiled much later. Even as late as the end of 1848, and after all the work he had put into "dissections of railway accounts," Nash was only able to put in a tentative claim to construction costs not having been reduced. If nothing else, this demonstrates clearly the poor state of railway financial reporting at that time.

Revenue shortfalls became apparent even more slowly. Early in 1847, *Herapath,* a weekly railway paper, claimed that profits from branch lines were matching those on established trunk lines[17]. But by the middle of 1847, another leader in the same paper presented a different picture, when it wrote of the huge capital that was authorized, but not yet spent, being meant primarily for branch lines, and claimed that "[m[ost of them, we will be bound to say, are next to useless, and will only tend to dilute the profits of Companies which are now paying good dividends." James Aytoun, a Scotsman who was involved with railways as investor, promoter, and lawyer, wrote in a similar vein in October 1847, and so did the *Railway Gazette* in January 1848[18]. Such voices likely were taken into account by the markets in pricing railway shares. But they were few, and the public and the press, for the most part, refused to accept the declining profitability prospects.

Various contemporary sources show that at least some investors were paying careful attention to the weekly revenue figures announced by most railways. These figures were

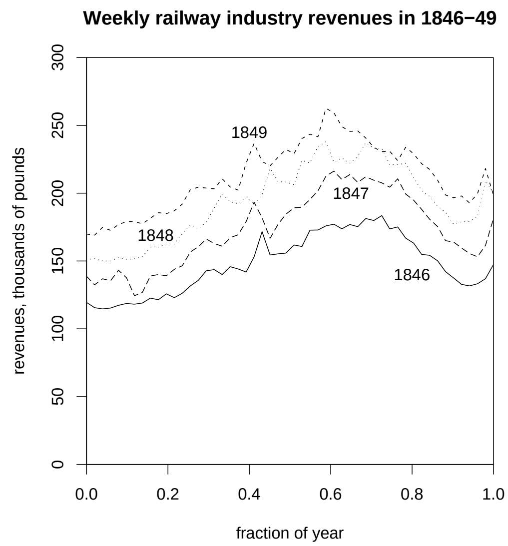

Fig. 5. Weekly revenues of British railways, 1846 through 1849.

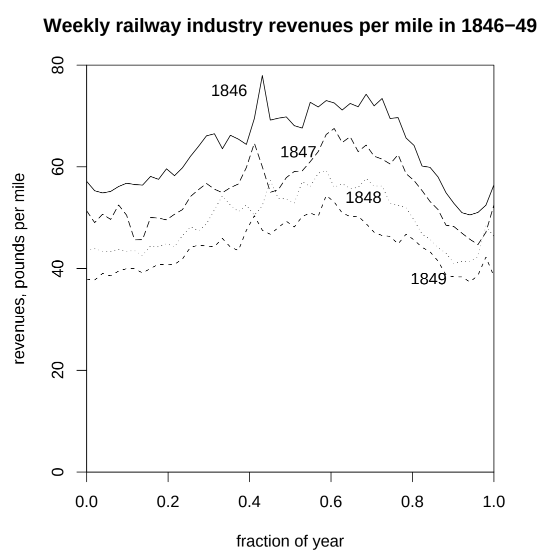

Fig. 6. Weekly revenues per mile of British railways, 1846 through 1849.

frequently published in newspapers (with provincial papers usually giving only brief summaries of data for nearby lines, railway papers providing more details and for most major lines throughout the country). These figures were often delayed, had mistakes, did not include some important sources of revenue (such as payments received through the Railway Clearing House for through traffic), and sometimes were suspected of being manipulated by railways[19]. Usually they did not include information on the lengths of miles in service, which had to be obtained from other sources. Still, such statistics did provide extensive quantitative information. J. T. Hackett, a long-time reporter for *Herapath* (see Appendix 8 to [55] for more information about him and his work, including his interest in astrology) seemed to be the most assiduous collector of such statistics, aside from Nash (and he started this work before Nash came on the scene). Each year, in the early January issues of *Herapath*, he published statistics of revenues and railway mileage for each week of the preceding year for the main railways in the United Kingdom. Through 1846 this information was presented in a tabular format. In 1847, only a graph such as that of Figure 5 (but covering 1842 through 1846) was presented. Starting in 1848, both graphs like that of Figure 5 and tables were given, so that one could easily prepare graphs such as Figure 6.

Figures 5 and 6 show total industry revenues growing rapidly from year to year, but revenues per mile dropping inexorably. That should have been a clear sign to investors that their hopes for bountiful profits were illusory. But this argument from the graph of Figure 6 alone is not iron-tight. If costs of construction were to decline as well, satisfactory profit rates might still be obtained. In addition, the per-mile revenue statistics of Figure 6 include brand-new lines, and some allowance had to be made for "development of traffic," the period during which demand was expected to build up to its ultimate level (which was assumed to be constant). Further, one had to make allowances for various disruptions in the economy. Also, even the graphs of figures 5 and 6 show substantial variation from week to week (as well as marked seasonality), which was greatly magnified when considering smaller collections of railways. Thus there were many ways for investors in a hopeful mood to interpret traffic statistics positively, and there is evidence they frequently did so. It appears that not many cited the annual compilations of data by Hackett in *Herapath*. Instead, they worked with their own collections of data, often for local lines, which offered more opportunities for selective data choice. Thus a letter in the Oct. 9, 1847 issue of *Herapath*, p. 1160, looked at revenue statistics for 29 lines, but just for one week in September 1847, compared the figures with the corresponding week a year earlier, and concluded that revenues grew just as much as mileage.

The lack of sophistication in financial analysis during the Railway Mania is shown by the reception that was given to an article by Wyndham Harding. As investor unease was increasing, there was a growing flood of reassurances to investors that they were facing only temporary setbacks, and that better times were ahead. (The similarities with the numerous reassurances by high authorities about the stability of the world financial system in 2006–2008 are obvious.) As is true today, support from recognized authorities, ideally ones with serious scholarly credentials, was eagerly sought, and (just as today) was easily found. Special prominence was attained by a report by Wyndham Harding. This report should have been seen from the beginning as a very questionable exercise in selective data manipulation, an attempt to "make things pleasant," in the phrase that came up in one of Hudson's frauds. But I have not seen any published articles, or letters-to-the-editor, then or later, pointing out the many serious and obvious flaws in Harding's analysis.

Wyndham Harding was a civil engineer, one who gained some prominence by publishing several polemical pamphlets during the "gauge wars" of the mid-1840s, as well as a well-received technical treatise on resistances of trains. Later, in 1852, he would be elected a Fellow of the Royal Society (FRS). He was also a widely respected railway administrator. At the August 1848 meeting of the British Association for the Advancement of Science, while employed as Secretary of the Buckinghamshire Railway, Harding presented a detailed study of the railway system. Among many other findings, he claimed ([38], p. 324) that the statistics he had compiled

> must be regarded as a very favourable general feature in the state of railways; there was much reason to fear, that as the first railways ran between the great towns or traversed the manufacturing districts, the railways which were next opened would show a great falling in the receipts. Hitherto, then, we find that this is not so—a fact which tends to give confidence as regards the great length of railway which has been sanctioned by Parliament but is not yet open.

In particular, Harding asserted ([38], p. 323) that revenues per mile had been £2,489 in 1842, and £2,596 in 1847. Articles touting this finding (and other observations of Harding's) were soon published in numerous papers[20].

How did Harding manage to come up with his conclusions, so convenient for those attempting to allay investors' concerns? By statistical chicanery. He relied on the most recent comprehensive government report with railway statistics[21]. However, as is often the case with very solid and reliable government reports, this one was not up-to-date, and included only data up to the middle of 1847, a year before his presentation. That allowed Harding to pass over the substantial decline that had already taken place in revenues per mile as a result of the opening of new lines and branches over the preceding year. Furthermore, by only comparing 1847 to 1842, he managed to avoid discussing what had happened over the previous couple of years. There had been a rapid rise in per-mile revenues after 1842, but, as is shown in Table 1, this was followed by a drop by about a sixth from 1845 to 1847[22]. This drop, the forerunner of even greater drops to come, was the result of new mileage going into service. By not discussing those intervening years 1843 to 1846, Harding managed to conceal this clear sign of impending catastrophe.

Harding's paper, and the publicity it garnered, demonstrates the extent of often carefully crafted disinformation that the public was exposed to. While the reliance on data that was a year-old can be excused on the grounds that there was nothing else quite as authoritative that was more recent, the suppression of the statistics for the years between 1842 and 1847 can only be ascribed to an intention to conceal unpleasant truth. This incident also demonstrates a phenomenon that occurred in other contexts during the Railway Mania (as shown in [55]), or during recent Internet and financial manias. Relevant information, even when widely available, is often not processed and disseminated properly. Given the publicity that Harding's paper received, it would have been natural to ask questions about both those intervening years, 1843 to 1846, and about what happened in the full year since the end date of the statistics that Harding had relied on. The government report (one of the “Blue Books” put out by Parliament) drawn on by Harding had information for the intervening years, and it would have been simple to do the computations, which would immediately have shown the problem. Also, the January 1, 1848 issue of *Herapath* had J. T. Hackett’s statistics through the end of 1847, which, with a bit of arithmetic, also told the grim tale of declining per-mile revenues. Finally, it would not have been difficult to collect weekly traffic data for a sample of railways for the first half of 1848, which would have shown even further damage.

Table 2. Hyde Clarke statistics of annual British railway revenues per mile.

year	annual revenues per mile
1842	£3,036
1843	3,081
1844	3,283
1845	3,500
1846	3,288
1847	2,862
1847–8	2,719

All these steps were actually taken by Hyde Clarke in an article [20] published the same month that Harding presented his work. Among the 15 tables on the first page of Clarke’s paper there was one which, after eliminating two columns about system mileage, is given in Table 2. The numbers differ from those of Harding (or those found in other places, such as those of Table 1), since the selection of basic data differed. Harding used years ending June 30, whereas Clarke worked with calendar years, except for the 1847–8 entry, which he did not explain in detail, and which may have been for the year ended June 30, 1848. Also, Clarke relied primarily on Hackett’s statistics, which covered only some lines, while Harding appears to have done some selections of his own that are not fully documented in his paper. Some statistics from that period cover all of the UK, some exclude Ireland, some also exclude Scotland. However, the basic implication of the Clarke numbers was that indeed, revenues per mile in 1846 were higher than in 1843 (by an even higher margin than in Harding’s paper), but from 1845 on the trend in revenues per mile was persistently down.

Clarke did not make a major point of his finding about declining revenues per mile. And neither did the few places I have not found that reprinted his article. On the other hand, *Civil Engineer and Architect’s Journal,* the journal that published Clarke’s paper, also published, two months later, the Harding paper, without any mention of the wildly disparate conclusions about revenue trends!

The reception of Harding’s work provides an interesting perspective on the functioning of the press and markets at the time of the Railway Mania. Harding’s paper led to some obvious questions that could easily be answered with the information available to the press. But this does not appear to have been done to any substantial extent, and when it was done, by Hyde Clarke, it was ignored. To what extent this can be attributed to the undeveloped state of financial analysis, and to what extent to biases (as with many financial analysts in recent booms, who, as the saying goes, "were paid a lot not to notice" inconvenient things), is hard to tell.

4 Arthur Smith and some other skeptics

Let us next consider some writers of this period who did the opposite of Harding, namely stirred up investor doubts. The most prominent among them was Arthur Smith. He showed up on the railway scene in 1847, played a prominent role in catalyzing the crisis of 1848, and then faded from view. We know very little about him. Various catalogs and compilations of literary figures list him just as a "writer on railways." Soon after the climax of that crisis, a letter in the *Railway Chronicle* claimed Smith was "simply a young barrister, with little business."[23]

Arthur Smith's first venture into railway finance, the pamphlet [64] about the Eastern Counties Railway, ECR, was negative on the prospects of this line, but not very persuasive. Smith's projection (apparently written in July or early August of 1847, before the semi-annual shareholder meeting in August) was that ECR earnings for the first half of 1847 would only be sufficient to pay dividends at an annual rate of 1.5% (as opposed to the 5% that was paid). When we compare his estimates to the accounts presented by the company for that period, we find that the main difference on the revenue side is that he did not include in his estimate a substantial sum of money due from other railways. On the expense side, he included the interest on calls that the company charged to capital. But that move, as was discussed before, was widely practiced and accepted, even if slightly controversial then (and against modern accounting principles). There was one very suspicious observation in Smith's pamphlet. He noted that the ECR had reported working expenses of £103,330 for the full year ending in the middle of 1845 to the shareholders. But to a Parliamentary committee in 1846, it reported those expenses as £143,859. However, to most shareholders, that likely seemed ancient and irrelevant history. Those events had taken place before the new management team headed by George Hudson was installed at the end of 1845. It just confirmed what was widely acknowledged, namely that ECR accounts were very sloppily kept, and the company had been poorly managed.

Smith's big splash came the next year, when he published *The Bubble of the Age; Or, the Fallacies of Railway Investment, Railway Accounts, and Railway Dividends,* [65]. It first appeared in April or May 1848, with two further editions later in the year, the third one just in time for the peak of the crisis in October[24]. With rising skepticism about railway investment, there was an eager audience for such work, and the catchy title must have been a factor in its spread. The railway press generally treated *The Bubble of the Age* as too ridiculous to take seriously. The *Railway Chronicle* referred sneeringly to the "rumours and calumnies put forth by persons of the Arthur Smith class," and called *The Bubble of the Age* "a publication, as we have already remarked, quite undeserving of the importance given to it, and only likely to mislead parties who have no interest in ascertaining the real facts of the case." A more serious rebuttal of Smith's assertions was presented in the *Railway Chronicle* later. The mainstream press mostly had a similar attitude, at least until the crisis of October 1848. Still, even earlier they sometimes cited Smith's work as proof of inadequacy of railway accounting. As the crisis intensified in October of that year, it seems that more observers started taking Smith seriously[25].

Arthur Smith and his works, especially *The Bubble of the Age*, are frequently cited in the literature. He started receiving credit for helping deflate the Railway Mania early. Thus already in June 1850, *Bankers' Magazine* claimed that Smith "was, we believe, the first who called attention to the unsatisfactory character of railway accounts."[26] Peacock's book on George Hudson assigns a significant role to Smith, and calls *The Bubble of the Age* "an extraordinary book" ([57], vol. 2, p. 303). Smith is also mentioned in the Ellis history of the British railways ([31], vol. 1, p. 162), in the Pollins paper [58], and other places.

However, while Smith has a prominent place in history books, it is largely undeserved. The disparaging remarks about *The Bubble of the Age* by the railway interest were well deserved. The core of Smith's argument was based on juxtaposition of dividend payments and capital expenditures. Since the latter tended to be consistently larger than the former, he concluded that dividends were coming from capital:

> A review has now been taken of the leading companies, and it sufficiently indicates their real position, it is but too evident, that as soon as calls cease to be paid and loans to be made, from that period also cease the payment of dividends.[27]

Not only that, Smith claimed this conclusion had been generally true throughout the previous 18 years of modern railway history for most of the prominent lines. As was shown in Section 2, that is simply incorrect. Even in the worst year, 1849, British railways paid dividends of about 1.9%, with many of the prominent ones that Smith considered in detail paying far more, closer to the 4% shown in Fig. 3 for non-Hudson lines. Thus while Smith was surely correct about existence of accounting abuses, he was wrong in his main claim that all dividends were fraudulent.

The conclusion is that Arthur Smith did have a role in precipitating the railway share crisis of 1848. He crystallized many shareholders' fears, and carried an incendiary message. But he cannot be credited with having been right.

There was another set of pamphlets that helped raise the sense of alarm about railways among investors and the public, with the series title *Railways as They Really Are* [3,4,5,6]. Some of the prominence that has accrued to Arthur Smith came from their authorship being attributed to him in most publications and library catalogs[28]. However, while these four pamphlets were clearly by the same author, this person was very likely not Smith. For one thing, they do not carry his name, unlike [64,65,66]. They are also written in a different style and emphasize different points. They don't dwell on legalities of various actions, the way Smith, a lawyer, did, for example, and there are other reasons for doubting they were written by Smith.

The four pamphlets [3,4,5,6] (out of a planned series of 13, but it appears no others were published) contain careful collections of information about the lines they cover, presenting listings of the various mergers and acquisitions, Parliamentary acts relating to these lines, and financial reports for several years. In the introductory sections, they also contain much inflammatory language. But they do not contain anything like a proof of malfeasance or accounting abuse. The core of the argument of [3,4,5,6] was that continuing capital expenditures were a sign of fraud. The closest the author came to a proof that railway directors were using improper accounting was perhaps in the table on pp. 32–33 of [3] (and other similar tables in that and the other pamphlets), where he listed various items of expenditure that were charged to capital, but in his opinion should have been charged to working expenses. However, while the classification of those items as capital expenses might offend modern standards, they were fully disclosed to shareholders and widely accepted at that time.

Arthur Smith's prominence is a puzzle. His key message, that all railway dividends were delusive, had been published a few months earlier in the pamphlets [3,4,5,6]. It was also not novel, as similar claims had been common in the 1830s. Two of the people who had been prominent in spreading such claims then, Richard Cort and Alexander Gordon, published pamphlets in 1849 claiming they had finally been vindicated. It could be that Smith happened to come along with a catchy title that articulated the deepest fears of investors right at the moment when they switched to an extreme panic mode, and so received credit for the transformation.

There were many pamphlets about railways that were published towards the end of 1848, as the crisis was approaching, as well as in early 1849, such as [7,22,72]. Few if any seemed to have much impact, and few had any penetrating insights or analyses. The one that is worth discussing in a little detail is John Whitehead's *Railway Management* [71]. Whitehead had been Secretary of the South Eastern Railway from 1842 to 1845, and then became a stockbroker and a prominent writer on railway finance. Two weeks after the end of the railway share crisis of 1848, Whitehead published the pamphlet [71], whose main thesis was that railways were losing money on freight transport. He argued that "a well-filled carriage of first or second class passengers, ... produces nearly eight times more than does a fully laden truck of goods." Hence "either the goods rates are too low, or the passenger fares are too high." This pamphlet led to a furious volley of responses and counter-responses, with Whitehead producing two additional pamphlets on this topic, attacking the arguments of his opponents. *The Times* initially endorsed the Whitehead claims in its business column, but then, after reading the opposing analyses, backtracked[29]. What is noteworthy is that Whitehead's argument should have been seen as clearly fallacious from the beginning. And yet even *The Times* did not perceive this right away, and it refused to get into the merits of the case. When Whitehead's second pamphlet on the topic came out, this paper wrote:

> The dispute is one of great interest, but consisting as it does of assumptions and denials, it is impossible, in the absence of verified public accounts, to enter with any advantage upon its merits.[30]

The Whitehead controversy is worth mentioning because it illustrates, together with the treatment of the Wyndham Harding article, the low level of knowledge of railway economics among early Victorians. It also shows the limitations of the press, even of prestigious organs like *The Times*, which professed themselves unable to resolve something as simple as the question of whether the Whitehead thesis was valid.

Before concluding this section, I feel it is imperative to mention one other source of concern about railway accounts, the business column of the weekly *Era*. As is mentioned briefly in [55], the unknown editor of this section was a most remarkable person. He was a strong supporter of railways during their dark days in the early 1840s, and had a positive view on their long-term future. As far as I have been able to find out, he was also the first person in the press to raise an alarm about the Railway Mania, consistently and persistently warning readers that new railway investments of the late 1840s were destined for ruin. He also seems to have been an early and forceful advocate of better financial reporting. Some of his comments in the early 1840s already show that he was skeptical of the published figures. Starting in early 1846, he repeatedly called on Parliament to require better financial reporting. Then, at the beginning of 1847, the *Era* published a leader devoted to this crusade, followed by numerous additional requests for government action[31]. Thus this observer can be credited with great insight. However, he does not appear to have had any impact on public opinion, as there appear to be practically no references to his claims. More seriously, all he was making was claims, opinions stated in strong terms, but not substantiated by any concrete evidence. While he was right about railway accounts and railway investments, he was wrong about other topics (such as the quality of Hudson's management). Hence he does not rank with Nash in influencing thinking about railway finance.

5 Robert Lucas Nash: The start of a career in railway finance

Very little is known about the life of Robert Lucas Nash. He was born in 1818 in Bristol and died in 1871 in Kensington. At some early point he joined his father in the family brewery business, which failed in the early 1840s. He then became a stockbroker, only to fail in 1846, right after the collapse of the first, purely speculative phase of the Railway Mania. At that time many brokers failed, either because of their own mistakes, or because their customers defaulted[32].

Nash first came to the attention of the railway world in early 1847. By that time he had relocated to London, and in January and February of 1847 published two pioneering works in financial analysis. These were detailed reports on two of the largest and most prominent railways in Britain, the Great Western Railway (GWR) and the Eastern Counties Railway (ECR). Remaining copies appear to be rare, and I am aware of only one copy being available in major research libraries, that on the GWR. The description of the ECR report is therefore based on what various periodicals wrote about it, as well as excerpts from two letters by Nash that were published by *The Times*[33].

What was pioneering about Nash's reports? Judging both just on the basis of the GWR report, he assembled from public sources detailed data about the financial position of each company. He listed all the different shares (of which there were four types for GWR at that time, a number that increased later, each with a different nominal value and the amount paid up), all the different branches of the line, with length (and whether opened or not) and officially estimated cost of each, revenues and expenses for the previous five years, and notes about significant obligations, pricing changes, accounting for revenue associated with various lines tied to the GWR in one way or another, and so on. By today's standards, this was very rudimentary, something that any apprentice financial analyst would be expected to do as the first step. Not only that, most of that information is required to be presented in company financial reports. But for 1847 this was novel.

We still lack a careful and detailed study of financial analysis in the 1840s. The best treatments available appear to be [60,68]. The paper [40] has some discussion of the increase in coverage of finance in newspapers, and there is also some information in [55], especially Appendix 3. Charlotte Brontë wrote to a friend that the sisters' decision to invest in railways was due to Emily, who "made herself mistress of the necessary degree of knowledge for conducting the matter, by dint of carefully reading every paragraph & every advertisement in the news-papers that related to rail-roads ..." There was much information available in the press, far more than in previous decades. Information was especially good in the early promotion phases, where promoters and opponents would often duel through ads. However, there was little systematic quantitative financial analysis.

Nash's tables are noteworthy for what they demonstrate about him. He was not an ardent foe of railways, and in fact had a positive prognosis for GWR. Perhaps most important, he showed that he understood the big issue for railways was the fate of the expansion they were undertaking, that one needed to check what was happening to the costs and revenues of the branches being built. Most investors appeared to be blithely assuming that the new projects would be at least as profitable as the old ones.

6 Nash and the *London Weekly Railway Share List*

After publishing his two financial analyses on the ECR and the GWR in early 1847, and sending several letters to *The Times*, Nash disappeared from public view[34]. However, in mid-1847 he started writing anonymously an influential section of a new publication. This was the *London Weekly Railway Share List*, henceforth to be referred to as *LWRSL,* which proclaimed it was "published under the authority of the Committee of the Stock Exchange." It was a single large sheet (about 16 by 19 inches), printed on both sides. The front was devoted to a listing of market prices of railway shares over the preceding week. The back side was the more interesting part for us, as that was the responsibility of Nash, and presented by far the best financial analysis of railways available to the public. That Nash wrote it did not become apparent until the end of 1848, during events to be described later. The only person identified with the *LWRSL* was Mihill Slaughter, in charge of the Railway Department of the Stock Exchange.

The second page of the *LWRSL* varied from week to week, and much of it, perhaps about a third or more on average, was filled with routine but important factual information, such as calls that were due in the near future, openings of lines, railway companies advertising for loans, dates of company meetings, sometimes short reports on such meetings, and so on. The centerpiece (typically about 40% of the page) was occupied by a large "traffic table," based on the same weekly revenue figures that non-specialist newspapers carried. However, the *LWRSL* traffic table was far more informative than even those in the railway papers. Nash put in 40 columns, listing share capital (common and preference) that had been raised, how much had been spent, how much was associated with lines in service versus those under construction, costs per mile in several categories, revenues in aggregate as well as per mile, etc. An example is available online at ⟨http://www.dtc.umn.edu/~odlyzko/rrsources/⟩, and similar tables can be found in Nash's own later paper, the *Money Market Examiner* of late 1848 through late 1850. Nothing striking by modern standards, but it was a substantial innovation for 1847, building on Nash's ECR and GWR tables, published earlier that year. Below the traffic table were Nash's notes and comments, which explained how he arrived at the figures.

Much of what I write about Nash and the *LWRSL* is based on fragmentary and secondary sources, especially during the crucial period of his activities at the *LWRSL*, from July through October of 1848, because of lack of access to a complete run of the *LWRSL*[35]. Fortunately, we can find some coverage of Nash's work in various other places. In particular, *Bankers' Magazine*, starting with the July 1848 issue, reprinted a number of Nash's pieces.

As time went on, Nash kept digging into the published accounts of railways, and trying to get additional information. There was a rise in pieces labeled "Dissection of accounts," consisting of analyses of published reports of particular companies. They were very similar to the reports put out by modern financial analysts, and far more penetrating than other contemporary pieces. Reading Nash's section, one finds increasing frustration with the unwillingness of railways to provide some basic information, as in a note about the York and North Midland line: "It is to be regretted that, in conformity with the practice of many other large Railway companies, information is not given as to ..."[36] One also occasionally finds copies of correspondence with various railways, requesting financial information. The tone becomes more acerbic, and there appears to be a growing conviction on Nash's part that railway managers were purposefully keeping information back.

By early 1848, Nash was increasingly writing in *LWRSL* about "honest" vs. "dishonest" dividends, and providing data to substantiate his suspicions. It should be said that many of Nash's complaints were also voiced by shareholders at railway meetings or in letters to newspapers, and were often echoed by editors of railway newspapers. There were also occasional insightful pieces of quantitative financial analysis published here and there, with those of Frank Marvel and J. S. Yeats in *Herapath* deserving mention. What was special about Nash's work was his systematic approach to railway finance, assembling comparative information for all the major lines in the UK, and persistently probing for more data and analyzing it in a consistent fashion from week to week.

At the end of 1847, Lord Monteagle proposed that Parliament enact a railway accounting law, which would allow a substantial group of shareholders to request an outside audit of their company's accounts[37]. This law was approved by the House of Lords, but failed in the House of Commons. The debates in those chambers, and the positive vote in the House of Lords, show that there was rising concern about railway finance and its lack of transparency. Further, press coverage of the Parliamentary debates likely increased public awareness of these issues.

In the *LWRSL,* Nash had very limited space for his analyses and evaluations[38]. However, in early 1848, the business section of *The Times* published extensive extracts from three long letters he sent to that paper[39]. In spite of our lack of access to copies of the *LWRSL*, we can still gain a good insight into Nash's thinking about railways at this time from these letters. Investors and the general public, used to valuing shares on the basis of dividends, were puzzled by the high yields on railway shares. Nash explained "that there is a general impression abroad that the dividends paid by railway companies do not result from actual profits." He then went into details of the improper accounting that was widely suspected to be in use. This included replacements of locomotives being charged to capital, and some costs of main lines being improperly allocated to the branches under construction, thereby allowing profits to be allocated to a smaller capital base, and thus show artificially high profit rates. Nash also presented a table of 13 of the main lines in the United Kingdom, showing that for most, the amount paid out in dividends on a line was suspiciously close to the amount by which the capital account of just that original line, excluding branches, had grown. He admitted to a slight suspicion (which was given full voice a few months later in Arthur Smith's *The Bubble of the Age*) "that railway profits are wholly delusive, and that the dividends are maintained chiefly by the receipts of additional capital," but he did not push it strongly.

As 1848 went on, Nash bore in on inconsistencies in accounts. He carefully collected extensive statistics for different railways and compared them. Seems very obvious, but nobody else was doing this, at least not in a systematic way. One would sometimes see brief mention of the issues in letters to the editor, or in reports of shareholder meetings, where questions would be raised as to why more was being spent on a particular item of expenditure on the given line than on others. But Nash's work appears to have been unique in the depth and thoroughness of its data collection and analysis[40]. Many lines were operating their own delivery services for the packages and goods they carried. Nash discovered and reported that the official gross revenue figures for some lines included the entire revenues from such services, whereas for others only the net profit was included. Track maintenance expenditures varied wildly between similar lines, suggesting either gross inefficiency on some lines, or, more likely, inconsistencies in what expenditures were assigned to that account. Locomotive expenses showed similar variations. And so on. These frequent cases of inconsistent treatment of expenses were not necessarily caused by a desire to confuse investors, but they certainly made comparisons of financial performance of different railways difficult.

7 The railway share crisis of the summer and fall of 1848

The British railway share market suffered some losses in the first few months of 1848, but those losses were on the order of 10% on average. Railway supporters had ready excuses for this decline. The "Spring of Nations," the wave of political upheavals that swept through most of continental Europe, started in earnest with the French Revolution in late February 1848. The possibility of war, disruption of trade, threats of expropriation of British investments in other countries, as well as fear of a revolution in Britain itself, weighed on the markets. All markets were affected, though. (See Fig. 4 for the yield on Consols, for example.)

As the summer of 1848 was drawing to a close, though, anxiety about railway shares had risen substantially. While much of Europe was still aflame, France and some other countries had stabilized, the internal threats from Chartists and Irish nationalists had fizzled, and British capitalists were breathing more easily. Most markets were well on their way to recovery, and interest rates, in particular had dropped substantially[41]. Railway shares, on the other hand, not only did not recover, but started declining further, eventually going into what seemed to railway investors to be a free-fall in October of that year, as is shown in figures 1 and 2. By the standards of modern share markets, the decline was almost trivial. Over the last decade, we have seen broad indices around the world fall by close to half in a few months during the crash of 2008. The U.S. NASDAQ index fell by 80% from the peak of the Internet bubble in the spring of 2000. By such comparisons, the events of 1848 were tame. The railway share index portrayed in Fig. 1 had dropped by about 10% from January to the middle of the year, and then another 20% into October. However, for the early Victorians, used to stability, and expecting railway shares to recover, the decline they were witnessing was unprecedented and deeply upsetting. A noteworthy passage in the business column of *The Times* observed that "[p]olitical news, while it sends Consols up and down, has no effect on railway shares. ... Where is this to end? It is evident the evil is peculiar to railways; it affects them alone, and hence, no revival in business, no abundance of money, nor even the assurance of universal peace, could bring a cure. This very question, however, "Where is it to end?" tells the whole history of the mischief. Each man asks it of his neighbour, and neither can give the slightest clue to its solution. No one has a single figure on which he can rely."[42]

The basic problem the industry faced was simple, and is described in the second section and in particular in Table 1. The public, though, was slow to recognize this, largely because of inadequate reporting. Even Nash took a while to become fully convinced. In July 1848, Nash speculated that the observed low revenues on new lines were not matched by similarly low costs[43]. Six weeks later, with most of the semiannual reports for the first half of 1848 available, and most dividends slashed, he was much more certain about the financial problems of the industry and used much more direct language:

> In a word, this, the primary cause of the reduction in dividends is the large increase in the capital now made chargeable to revenue, and the comparatively stationary condition of the traffic receipts. It is now found that the immense outlay of the last few years has not been attended with a corresponding increase in the revenue; that the new partners [branches and extensions], whatever they may prove hereafter, have done little hitherto by way of contribution to the general profits; ...[44]

Others also realized this, and some talked about it in public. For example, William Chaplin, the Chairman of the LSWR (see [55] for more about him, especially in Appendix 10 to that manuscript), declared at his company's August 1848 meeting that "it is our fault ... if we go in advance of that which is reasonable in the increase of the traffic."[45]

However, the investing public, as well as the press, refused to accept this simple and incontrovertible truth. As usual, they found some seemingly credible authorities willing to offer reassuring words, such as Wyndham Harding, whose report is described in Section 3.

Railway industry defenders rejected both the dire projections for the future and the accusations of misleading or fraudulent accounting. But they had to admit there was a serious perception problem, that the public was not inclined to accept their reassurances. To combat this perception, there were just a few weapons, and all were deployed. One was to distract the public's attention with activities that might be expected to lead to a financial improvement. A proposal for an amalgamation of three of the largest railways served that purpose. It did not make much business sense, but it did lead to much animated discussion.

Another method to deal with investors' concerns was to provide more detailed and trustworthy financial information that would refute the skeptics' insinuations. Initially calls for improved disclosure were disregarded, with railway managers claiming this would be too costly or disruptive. Some of these managers also alleged, especially about government audit proposals, that they would lead to a government takeover of the railway industry. Some credibility for such allegations came from the fact that a substantial fraction of Railway Mania opponents were in favor of government ownership or at least control of railways, and others were hoping more detailed financial disclosures would lead to a slowdown in construction. However, as time went on, the pressure from individual shareholders and from declining share prices mounted. Even the railway press started shifting its stance towards loud demands for more financial information, on the grounds that reality could not possibly be as bad as the fears. Eventually, railway managers capitulated, and as a last resort, produced those "financial statements" mentioned before and to be discussed again.

Finally, when under attack, one can always try to discredit the bearers of bad news. This last weapon was the easiest one to wield, and it was applied early.

8 Nash and "blaming the messenger"

Complaints about false rumors were nothing new. They were not without substance, either. Share price manipulation in general, through rumors and trades, legitimate or not, was regarded as widespread (and was not illegal in those *laissez faire* days). Thus it was natural for those upset with declining railway share prices to blame this phenomenon on short-sellers. That the railway industry regarded itself as a grass-roots capitalist movement, opposed to the large financial houses, the London Stock Exchange, and *The Times* (which was widely considered as closely allied with those institutions of "the City," the financial center of London) only made this attitude more popular.

The complaints about "bears" unduly depressing share prices had been present all along, and intensified as the railway financial crisis reached its climax in late 1848. Both the frequency and stridency of the claims grew rapidly. They may not have been unfounded. As will be discussed in Section 13, the persistent decline in the price index visible in figures 1 and 2, together with the growing understanding of its causes and the inevitability of further declines, may have allowed some short-sellers to make substantial profits.

For the railway interest, enemy #1 was *The Times*. It had been regarded as the main enemy of railways for a long time, see [55] for the background. As just one of myriad examples, in early 1848, one of the railway papers claimed that much of the depression in railway share prices was "effected by the most unblushing falsehoods, by the most atrocious fabrications, and by the most unbridled malice" of *The Times*[46]. Still, that was nothing new, the position of *The Times* had not changed, it had provided a steady drumbeat of criticisms over the years. Who else was getting blamed?

By 1848, the more than two dozen specialized railway papers that had existed at the peak of the Mania in late 1845 had dwindled to just a handful. Of the remaining ones, the *Railway Gazette* appears to have been the most vociferous in attacking the perceived inequities of the financial system. This paper claimed that "the so-called share-market is a delusion; ... the public really are deprived of the advantage of the market by the prevailing system, and that it is essential either to have new regulations or a new market."[47] A month later, as the crisis was growing, this railway paper attempted to attach names to the alleged evil machinations. It published a long leader, entitled "The four S's—Sampson, Spackman, Smith, and Slaughter,—or the rabid railway wreckers."[48] Sampson was Marmaduke Blake Sampson, the business column ("City article") editor of *The Times.* Spackman was Frederic Spackman, an economic statistician who several times upset the railway interest with his compilations of data and his dire interpretations of the same, as well as with his activities as a corporate raider. Smith was Arthur Smith. Slaughter was Mihill Slaughter, the public face of *LWRSL,* who was being blamed for the activities of Nash, whose involvement in that publication was not known to the public yet. These four were presented by the *Railway Gazette* as "the tools with which the *Times* attempts to work out its plundering purposes." The main enemy this railway paper saw was *The Times* as an institution; those four individuals, though, were presented as noteworthy accomplices in the dirty deeds. A month later, by which time Nash's name and role in the *LWRSL* had become known, the *Railway Gazette* talked of

> the suspicion which the *Times* paper—the Nashes, the Slaughters, the Samsons, the Spackmans, and Arthur Smiths, and all that brood of money-mongers' tools, have incessantly laboured to fill the public mind with, that railway Companies were fraudulent combinations of Directors, that railway property was an insolvent delusion, and that railway dividends were paid out of the shareholders' own subscriptions, and not out of the legitimate profits of traffic.[49]

The order in which these "rabid railway wreckers" were listed appears to be significant, *The Times* as number one, and Nash as number two. A perusal of the pages of the *Railway Gazette* (or other railway papers) during that period also shows that the greatest anger on the part of the writers of leaders as well as of letters to the editor, was directed at *The Times* and at Nash's work in the *LWRSL.* The *Railway Gazette* was particularly vituperative, referring to the *Jobbers' Weekly Railway Share List* in its leaders[50], and publishing letters such as one that claimed that

> [a]n atrocious act of malevolence has been perpetrated by the tool of the stock-jobbers, who publishes the stock-jobbers weekly *Share List*, with prices affixed to the shares, to suit the stock-jobbing and gambling transactions, though at the ruin of the *bona fide* holders.[51]

9 Railway "financial statements" and Nash's forced departure from the *London Weekly Railway Share List*

When ignoring the messenger bringing bad news becomes impossible, and discrediting the message does not work, one can always try to silence the offending voice. The railway interest could not do anything about Arthur Smith or about *The Times*. Nash, however, was working for the *LWRSL*, which was "published under the authority of the Committee of the Stock Exchange," and this connection could be exploited. Critics first cited it to explain away Nash's criticisms of railway companies as motivated by desire of stock brokers to plunder shareholders[52]. Then, when this tactic did not suffice, they used the Stock Exchange connection to silence him.

In the middle of October, 1848, *The Times* launched what was perceived by the railway interest as a large-scale and dangerous offensive. On Oct. 10, the business column of *The Times* published a lengthy passage about railway shares, claiming that it was "evident the evil [was] peculiar to railways," as cited earlier. The next day, it published Spackman's compilation of the huge volume of calls that were impending. The day after, October 12, it followed with a long leader about railway investments. Most noticeable in this leader was a clarion call for better financial reporting, to overcome "an almost inscrutable mystery upon the financial state of our great railway companies [which] excites alternately the wildest hopes and the most frantic fears." That same issue, in its business column, presented extracts from Nash's "dissections of railway accounts" for three of the leading railways. These showed that the three lines were committed to huge expansion programs[53].

All this pressure, on top of plummeting share prices, finally induced railway managers to respond formally and substantively. C. Stewart, one of the two secretaries of the LNWR, wrote a letter to *The Times*:

> The statement copied from the *Weekly Share Lists,* and republished in *The Times* ... being calculated to mislead and alarm the proprietors of this company, I am instructed by the directors to acquaint you that the statement in question, so far as it refers to the London and North-Western Railway, is grossly erroneous, and that there is now being prepared, and will shortly be issued to each shareholder, a full and correct account, exhibiting the present position of the company and all its engagements.[54]

It is noteworthy that it was Nash's analysis that was singled out as a reason for this action.

At the same time, the campaign to silence Nash went into high gear. Up until that time, most complaints about *LWRSL* were confined to the railway papers. But now the daily press weighed in. A day after the lengthy and weighty leader in *The Times* that was quoted above, which was accompanied by the extracts from Nash's pieces from the *LWRSL*, the *Daily News* jumped into the fight. Most of its business column on Oct. 13 (which was considerably longer than usual) was devoted to an attack on the *LWRSL*, although there were some barbs aimed at *The Times* and Spackman, too. It accused the Committee of the Stock Exchange of profiting from advance knowledge of the negative reports appearing in *LWRSL*.

Nash responded by writing a letter to the *Daily News*, which was published a couple of days later[55]. He revealed that he was the author of the "dissections of railway accounts" in question. This was the first time that the public had a chance to learn who was responsible, until then those analyses were attributed either to Mihill Slaughter, or just referred to as passages in *LWRSL*. Nash also denied all charges of corruption on the part of the Committee of the Stock Exchange, Slaughter, or himself. The following day, the *Daily News* accepted Nash's explanation as "sufficiently exculpatory" about the role of the Committee of the

Stock Exchange, but claimed that in any case it was highly improper for the London Stock Exchange to endorse any financial analyses that might affect prices of shares. The demand by the *Daily News* that the London Stock Exchange muzzle Nash was echoed by many other paper. George Hudson added his voice to this demand.

The Committee of the Stock Exchange yielded to the pressure. On Oct. 25, 1848, they adopted a resolution directing the *LWRSL* "to limit the contents ... to the usual tabular railway statistics, prices, and official correspondence."[56] This resolution was greeted with glee by much of the press. The *Daily News* exulted in what it regarded as its own leading role in a virtuous deed:

> ... the representations urged under this head against the ruinous assaults upon property committed by a paper published under the too weighty authority of the Stock Exchange committee, have had their effect. ... A feeling of indignation was aroused against the abuses growing out of such a species of publication ... We have thus contributed to, as well as originated, a very desirable reform in the administration of that great and honourable establishment, the Stock Exchange, for which individually acknowledgments have not been wanting from various quarters.[57]

The *Railway Gazette* claimed credit for the first "conclusive exposure of the abominable frauds, and fallacies inserted in the jobbers' share list and afterwards in the *Times*." The *Railway Times* exclaimed in evident relief, "No *Bearish* statements again." *Herapath* used more temperate language, but also roundly condemned Nash's activities, as a result of which, it claimed, "[m]any a worthy family has been totally ruined."[58]

At that stage Nash left the *LWRSL*, while the railway share market staged a remarkable recovery. The day that the *LWRSL* published the edict of the Stock Exchange, Saturday, Oct. 28, was also the day that the "financial statement" of the LNWR appeared in the press. The *Daily News* wrote about this, the first day of the railway share bull market:

> We had a brilliant market. Speculations for the rise have, perhaps, been carried too far for the moment, although gradually railway property is evidently in course of re-establishment.[59]

The caution about speculations being "carried too far" looked increasingly ludicrous over the next few weeks. The fireworks of Oct. 28 were just the start of a glorious three and a half month upward ride. The bellwether LNWR had started 1848 at about £150 per share (compared to a peak of about £250 per share in mid-1845), had briefly slipped below the psychologically frightening £100 per share nominal (and paid-up) value, and last traded at 106 on Friday, Oct. 27. On the key date of Oct. 28, it jumped to 116, and on the following Tuesday closed at 120. By the middle of February, 1849, it was back up to over £140 per share. The broader share index, depicted in Fig. 1, which started 1848 at 108, and hit a low of 80 in October 1848, was back up to 96 by that time.

The end of January, 1849, was the peak of that episode of investor exuberance. What followed was a sickening ride down, one that lasted over half a year. By October, 1849, at the lowest point of the 19th century for British railway shares, the railway share index of Fig. 1 was down to 60, and LNWR to about 110.

10 Nash, the *Money Market Examiner*, and the railway share crash of 1849

The hope of the *Railway Times* that there would be "No *Bearish* statements again" was not fulfilled. On Dec. 2, 1848, a month after leaving the *LWRSL*, Nash started his own weekly, the *Money Market Examiner and Railway Review*. The press and Nash himself referred to it mostly as the *Money Market Examiner*. There was little examination of the money market in it, but lots of railway reviews, mostly very skeptical ones. There was certainly a lot to be skeptical about.

The "financial statements" produced in late 1848 were received enthusiastically by the public. Most of the press greeted them as the definitive solution to the railway problem. However, they left quite a bit to be desired, as was noted by some letters and even some leaders in the press. Nash was especially critical. He claimed those statement

> have defeated the object of their publication, and strengthened the mistrust they were intended to remove. ... Important details are withheld, while speculative assumptions abound. We have a florid summary of future imaginative profit, instead of a candid unreserved account of present earnings. ... In a word, there is evident design to divert attention from the actual position of the undertakings reviewed, by exaggerated estimates of ultimate income, ...[60]

This was of course in addition to most of the basic problems with railway accounts that Nash had been hammering away at in the *LWRSL*, and which had not been fixed. The special "financial statements" being put out were still unaudited presentations of the directors, and only of the capital obligations of the companies. There were still no uniform standards in place for reporting working expenses, and no transparency. However, Nash was wrong in claiming that the financial statements had "strengthened the mistrust" in railway accounts. For most investors, those statements appeared to be more than satisfactory, at least for the moment. Nash was fighting a raging bull market. He admitted that "in writing anything adverse to railway property, we act against popular interests and the wishes of the majority."[61]

The *Money Market Examiner* did attract substantial vitriol from the railway interest[62]. However, it appears not to have had anywhere near as much influence as the *LWRSL*. It was not a financial success for its conductor. Circulation in 1849 averaged about 700 copies (as opposed to 4,500 for the *Economist,* 2,600 for the *Railway Times,* 1,850 for the *Mining Journal,* and 36,000 for *The Times*)[63]. After many complaints from Nash about the unremunerative nature of the business, it ceased regular weekly publication at the end of the first quarter of 1850, and then published just a few sporadic issues, to review the latest reports from railway companies. The last issue, the 78th, appeared on Sept. 28, 1850[64].

The railway share crash of 1849, to be discussed in Section 13, began in February of that year, the month of Hudson's downfall, and in the public imagination is inextricably interwoven with shareholder committees of investigation and the proofs that there had been massive accounting abuses. Hudson's disgrace started with the Feb. 20, 1849 meeting of the York, Newcastle, and Berwick Railway (YNBR). There he ran into a carefully planned ambush, described nicely in Chapter 7 of [11]. Shareholders raised questions about improper financial dealings by Hudson, in which he sold to the YNBR shares in a railway being acquired by the YNBR at higher than market prices. Nash's trenchant critiques of the accounts of Hudson's lines may have inspired the opponents of the Railway King to dig for personal dirt, but this is pure speculation. Hudson had created many enemies in his career, and that, combined with general unease about railway accounts, may have provided sufficient motivation to look into his operations. Once Hudson fell, investors and the public turned to the shareholder committees of investigation, which in turn called on outside accountants for help, leading to the accounting revolution of 1849. Nash provided critiques of some of the resulting reports, but there is no sign that he significantly influenced public perception. He did garner a number of respectful comments from *Bankers' Magazine* to accompany reprints of some of his analyses, but that seems to have been it[65]. When the House of Lords held the famous 1849 hearings about railway audits, Mihill Slaughter was among the witnesses, but Nash was not[66].

11 Nash's key role in the accounting revolution of 1848

All contemporary sources point to Nash as the reason the "financial statements" were issued, and more detailed and explicit internal accounting and external reporting practices were adopted. The letter from a secretary of the LNWR to *The Times* that was cited earlier was clearly phrased as a response to Nash's work, and the LNWR statement referred explicitly to the *LWRSL*. The London, Brighton, and South Coast Railway issued its "financial statement" even earlier than the LNWR, although it did not attract much attention[67]. It also explicitly cited *LWRSL* "dissections" as faulty. The other "financial statements" did not refer to *LWRSL* explicitly, but often complained about misleading rumors and press accounts, and it seems pretty clear they were motivated by the need to respond to Nash's work.

Nash was credited by many other sources, even some extremely hostile to his efforts, with wringing better accounting out of reluctant railway managers. The deficiencies in railway reporting were widely felt to be serious. Thus the *Daily News,* which led the effort to silence Nash, claimed that

> [t]he recent debates, springing out of the exaggerated calculations of the *Weekly Railway List*, published under the authority of the Stock Exchange Committee, have been productive of a beneficial effect in one respect at least. The London and North-Western board, mainly aggrieved by the misrepresentations published of the state of the affairs of that great line, have come forward to notify that correct and detailed statements are preparing for affording the proprietary exact information about the situation of their property.[68]

A few days later, the *Railway Times* clearly also thought Nash had won a substantial and worthwhile victory, but through underhand means and at substantial cost to railway investors:

> As a means of eliciting, or rather forcing, a full explanation from the Companies affected by his statements, Mr. Nash may, we believe, fairly congratulate himself

> on his successful maneuvre. Two Companies, the North-Western and the South-Western, have already accepted the challenge. In the meantime, he cannot but regret that a result, fatal to the interests of many shareholders, and highly prejudicial to railway property (for a time, at least), should have attended his ingenious and able production. "It might be the sport to him, but to the frogs," &c.[69]

Early the following year, a pamphlet by Charles Cotterill claimed ([25], pp. 4–5):

> The dissections of railway accounts which appeared at various times in the "London Weekly Share List," though they produced a hostile feeling in many parties connected with that interest, and led to the retirement of the late editor, and the establishment of a new publication, entitled "The Money-Market Examiner and Railway Review," were perhaps the principal instrument of bringing out those statements from different railways which have, in a great degree, calmed the perturbed feelings of the public. That such statements were necessary, few will deny.

Thus we can conclude that contemporary observers genuinely believed that Nash's "dissections" led to the railway share panic, and thereby forced railway directors to respond by providing their "financial statements."

12 Was Nash correct?

Nash had a large impact on railway accounting. But was he correct in his analyses? Arthur Smith also appears to have had a large impact, but his contribution came from making sensational claims that were buttressed by very questionable reasoning and were mostly incorrect.

Comparisons of Nash's figures for capital investments of various railways with their "financial statements" show some stark disparities. For example, for the LNWR, the account in *The Times* of Nash's analysis shows he was claiming the total capital of that line might reach £40 million. He did insert a caveat that his computation was based on all projects sanctioned by Parliament being carried out, and that "[i]t is almost certain that they never will be carried out in their integrity"[70]. On the other hand, the LNWR "financial statement" claimed that the total Parliamentary authorizations of the LNWR came to "only" £30 million. Furthermore, directors promised not to proceed with authorized projects that would have cost £4 million, which reduced the company liability to a total of £26 million[71]. That would require only £3 million above what had already been spent up to mid-1848.

The most directly comparable figures in Nash's analysis and the LNWR "financial statement" were £40 million in one, and £30 million in the other. They are largely compatible with each other, representing differing judgment on what was going to happen. Here is just one example of the different treatments of large investments. Nash included among LNWR potential capital responsibilities £3.8 million for the Shropshire Union Railway. This line was leased to LNWR in perpetuity, and £3.8 million is what this line was authorized to raise in capital. But would it? LNWR directors listed the Shropshire Union in their accounts at £100,000 already invested in that company, another £100,000 that would need to be paid (in subscriptions on some shares), and a guarantee on £600,000. The justification for that was that "the Shropshire Union Company as at present confined its outlay to the formation of a line from Shrewsbury to Stafford." If the Shropshire Union was confined to that one line, then LNWR liability might be confined to £800,000, just as the LNWR directors claimed. But if the entire line were built, then the full £3.8 million estimated by Nash might be called upon. Thus in this case, as well as in many others, the main difference was a matter of judgment, just how far would railway extension go, and how far would LNWR shareholder liability extend. There seem to have been just a few cases where Nash made clear mistakes, and in those cases he acknowledged them but blamed railways for not providing clear information[72].

Total railway investments ended up considerably below Nash's maximal figures. Pressure from shareholders, as well as recognition of just how unprofitable they would be, served to limit construction. (Only about half of the total mileage authorized by Parliament during the Mania was actually built by 1853.) Still, for investors looking at profit forecasts, those by Nash often turned out to be surprisingly accurate. When the London, Brighton, and South Coast Railway (LBSCR) issued its "financial statement," the *Railway Chronicle* crowed that "[i]t demolishes Mr. Nash; and shows the worthless quality of the data which the *Times* greedily adopts and makes the basis of its comments on railway affairs."[73] The LBSCR statement presented several reasons why Nash's estimate in the *LWRSL* that gross annual revenues of £609,340 would be required to pay a 4% dividend was "altogether erroneous." Well, in 1852, which is about the time railway managers were promising that branches would be complete, and the railway industry would stabilize (and after a couple of years of unexpectedly rapid growth and prosperity), the LBSCR had a dividend of 4.2% on annual revenues of £581,642[74]. Hence we can say that Nash's estimate was pretty accurate[75]. Similarly, the LNWR "financial statement" labored mightily to make the case that a 7% dividend in 1852 was going to be easy to achieve. It argued that it would take annual revenues of just £2.53 million to pay a 7% dividend in 1852, as opposed to £3.65 million that Nash estimated. As it turned out, in the second half of 1852, the LNWR revenues came to £2.62 million on an annual basis, but the dividend was just 5%. Given the expense ratio at that time, something close to Nash's £3.65 million would have been required to produce the promised 7% dividend.

How did Nash manage to make such accurate forecasts, given that he overestimated capital expenditures? As happens often with accurate predictions, he did it through cancellation of mistakes. While capital investments were lower, returns from the new lines appear to have turned out far lower than even Nash expected. (This is a somewhat speculative conclusion, since we do not have a complete copy of *LWRSL* available, and I have not been able to make a thorough study of Nash's "dissections.") Right after the LNWR "financial statement" was published, Nash wrote a letter to *The Times*[76]. This letter argued, based on a comparison of his "dissections" to the LNWR "financial statement," that he had not been guilty of the "grossly erroneous" claims he was accused of. Among other points, he remarked "that the company estimate the probable annual income to be derived from their contributions to other companies at 3 $\frac{1}{2}$ per cent., instead of four per cent. as estimated by" himself. A 4% profit for the new lines was very low, compared to initial investor expectations, but far above what was actually earned by most of the Mania projects. Most returns were closer to the zero returns of the Leeds and Thirsk Railway.

Nash thus appears to have overestimated the profits to be earned by the new lines. He does not appear to have ever come up with a convincing macroeconomic argument that railway investments of the Mania were on average bound to be disappointing, the argument that Dionysius Lardner appears to have figured out in 1846 [41,55]. Also, as is shown in Appendix 2, he never understood that traffic on railways would continue to grow at a relatively steady and rapid pace, and so he continued to cling to the idea that "closing the capital accounts" was feasible. He also overestimated the severity of competition between railways, most likely because, in common with most contemporary observers, he did not appreciate that most traffic was local (see [55] for an extended discussion of this issue). He continued in his extremely bearish mode through all issues of the *Money Market Examiner,* expecting that every stone that was turned over in railway finance would reveal more worms. He did not seem to realize that by late 1850 (and even late 1849) the markets were probably already discounting the problems of the industry, and were anticipating high growth rates.

On the other hand, Nash was right in all his criticisms of railway accounting and financial reporting of the day. He was also right to zero in on Hudson's lines, pointing out the deficiencies and implausibilities of their accounts. Most of all, he worked very hard to bring about reform, and in particular to obtain systematic and transparent financial data. There was simply no one at the time who was as insightful or working as hard to reform railway accounting. It took decades before the goals he outlined were achieved.

13 Capital markets during the Railway Mania

The capital markets of the first half of the 19th century have not been studied as much as they deserve. There is a wealth of quantitative data, and soon we are likely to see interesting studies, since Gareth Campbell of Queen's University Belfast has prepared a database of railway share prices from the time of the Mania. Hence we hopefully will see much more careful studies of railway share markets of that period, a formative era in the development of corporate capitalism. In this section, a small collection of prices will be used to examine Nash's influence on the market.

A major reason that investors disregarded market signals is that what was happening around them appeared to be a reprise of what happened in the late 1830s and early 1840s, during the railway mania of that period. That particular episode of financial exuberance turned out well for those shareholders who stayed faithful to their projects. Yet, as is sketched in [55,56], for many years they saw markets value their shares below their paid-up value. Thus while the investors of the Mania did pay attention to the market, they did not rely on it. And, indeed, they were right to distrust the market:

The railway share markets were consistently wrong during 1838–43,
and they were consistently wrong during 1846–48.

In the former case, markets were consistently too pessimistic, undervaluing the profit potential of the new infrastructure under construction. In the latter period, they were far more pessimistic than the shareholders, but were not pessimistic enough, as prices continued going down.

The main point of this discussion is that one cannot get a good understanding of the railway share market at the time of the Railway Mania without looking at the dynamics of this market, the beliefs and actions of different agents. The market is a price-discovery mechanism, with different opinions about a future that is more or less unknown being distilled into a single number. The big question about market efficiency is whether this number is a good estimate of the right price. Interestingly enough, this basic question was debated at the time of the Railway Mania, although not in these words.

As is shown in [55], the dominant attitude during the Railway Mania, among critics as well as supporters of fast railway expansion, was that the new lines were going to be profitable once placed in service. The critics were concerned primarily with limiting the rate of expansion, in order to minimize disruptions in the economy. To deter individuals, who might not be altruistic enough to care about the rest of the economy, skeptics cited the threat of calls depressing the value of railway shares. The message was that at least some investors, not having the means to pay the calls out of their other resources, would partially liquidate their railway holdings to provide the funds for railway expansion, and this would lead to lower prices. This explanation was easy for the public to accept, because the general perception was that the same phenomenon had led to the (temporary but substantial and prolonged) depression of prices in the late 1830s and early 1840s, in the aftermath of the smaller railway mania of the mid-1830s. Some defenders of the Railway Mania at its frenzied peak in 1845 argued this would not happen, see for example Appendix 7 of [55]. They claimed that if some shareholders had to liquidate railway shares to pay calls on new lines, other capitalists would step forward and purchase those shares at a fair price. As the Mania unfolded, though, railway prices kept going down, far below the level that railway supporters regarded as fair. (Recall the fulminations of the *Railway Gazette*, that "the so-called share-market is a delusion," cited in Section 8.) How to explain it? This time the railway interest embraced the explanation that Mania skeptics had posed as a threat earlier, that railway shareholders were being forced to sell at unreasonably low prices to meet their calls. This was the dominant belief. The opinion was that if railway construction could be curtailed, selling of shares to pay calls would cease, and share prices would recover. (The quotes in Section 3 illustrate this view.) Even some sophisticated observers felt compelled to accept this explanation. Thus, for example, the *Bankers' Magazine*, in commenting on railway shares going down while money was becoming more easily available and at lower rates, while all other markets were rising, said:

> We confess ourselves at a loss to reconcile this discrepancy between results which apparently depend upon the same causes. There is indeed one way of explanation, which is probably not far from the truth. If we suppose that the class of capitalists who are interested in railway property are very much a class to themselves, composed, with few exceptions from one year to another, of nearly the same men and women, it will then be easy to understand how the value of one description of shares should decline when there is a great transfer of funds–as in the case of extensive calls–to another description of shares.[77]

The main reason for the share decline was surely the spreading suspicion and even possibly knowledge that the new lines were going to be unprofitable. One finds a few observers making this point, as in the following quote, from October 1848:

> The true cause of the present severe depression will be found more deeply seated than in the matter of accounts, or the mere fact of realising stock. The dark prospects that now lower upon and overshadow most of our Railways [are caused by] leasing and purchasing branch lines, from which little or no revenue on any sound commercial ground could reasonably be expected. ... it is plain ... the whole profit arising from the traffic on the main trunk lines will be engulphed and utterly extinguished for many years to come. ... This is the fear felt by capitalists.[78]

Such opinions were rare, but it does not necessarily take many knowledgeable investors to bring prices to their fundamentals.

Railway share prices were thus the result of bargaining between a diminishing class of railway investors who still held hopes for bountiful profits, and others, who were either just skeptical about railways, or had good insight into the coming ruin. The latter may have included a substantial number of short sellers, the "bears" in the language of the time, who may have succeeded in earning large sums of money. The main point is that there was an obvious gross disparity between what railway enthusiasts thought about the value of railway shares, and what the market was effectively saying. How was this disparity narrowed, and what does it say about the influence of Robert Lucas Nash and his "dissections" of railway accounts?

In any study of railway share prices in this period, whether by econometric techniques, or others, there is a natural variable that should be used, namely whether a line was run by George Hudson or not. He was the most visible and most powerful railway manager in the industry, and the one who engaged in by far the greatest amount of accounting abuse. Further, the revelations of his mismanagement coincided with the start of the severe railway share market crash of 1849.

How could we determine whether some particular market move was influenced by Nash's analyses? Railway share prices were going down before Nash started writing for the *LWRSL*, and they continued going down afterwards. There was a visible acceleration in the rate of decline in the second half of 1847 as compared to the first half, but that is easy to ascribe to the financial crisis of that period. Other general market moves were also influenced by a variety of factors. If we had access to at least a large set of issues of the *LWRSL*, we could look for correlations between publications of some unusually negative or positive "dissections" of accounts of a particular railway and the movement of share prices of that line. But that avenue of investigation is not available to us right now.

The one area where one might hope that Nash's influence might be discernible is in the relative valuations of Hudson lines. Nash astutely identified the weaknesses in their general financial situation, in the extent of their lease and guarantee obligations. He also demonstrated the implausibilities in their official accounts. Hence if the investing public paid serious attention to Nash, shares of Hudson lines should have declined more than those of others. And that is indeed what we observe in Fig. 2. Unfortunately, we can't credit Nash for all of this effect, since the dividends of Hudson's lines also declined more precipitously than those of the rest of the industry, as is seen in Fig. 3. In fact, if we consider Fig. 4, which shows the effective yield investors obtained on market purchases, we are led to wonder whether Nash had any effect at all. If investors had serious doubts about Hudson's lines, they should have pushed down prices of their shares to a level where the market yield for them was considerably higher than for other railways. Fig. 4 shows that through most of 1847, Hudson lines did indeed yield more than the market. However, in 1848, when Nash was getting more active, and was attracting more attention, the yield on Hudson lines declined below that of others! It appears that the market was expecting Hudson lines to do better than average. Hence it is not clear that investors were paying much attention to Nash's persistent warnings about Hudson, and we are left with a puzzle of just how important his work was in influencing railway share prices.

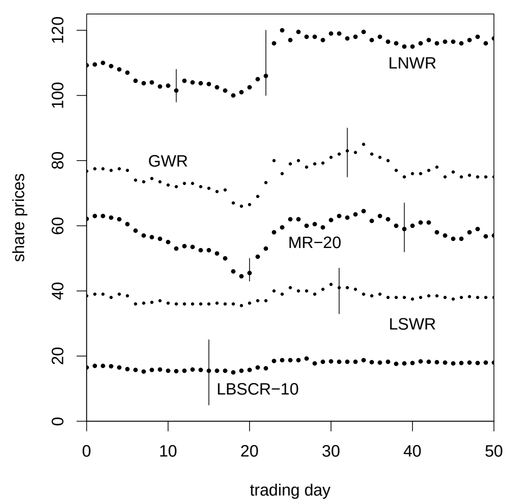

Fig. 7. Market reaction to "financial statements" from various railways in the fall of 1848.

Yet another puzzle about Nash's impact is presented by the reaction of the share market to the "financial statements" by the major railways. Fig. 7 shows share prices for six railways during the 51 days the London Stock Exchange was open between Monday, Oct. 2 (denoted as day zero), and Thursday, Nov. 30, 1848. These railways were the London and North Western (LNWR), the Great Western (GWR), the Midland (MR, except that to fit in the figure without clutter, prices were uniformly lowered by £20 per share, and are denoted by MR-20), the London and South Western (LSWR), and the London, Brighton, and South Coast (LBSCR, whose prices were lowered by £10 per share). For each line, the long vertical line is the date of its "financial statement." In addition, the LNWR and MR have two shorter vertical lines that correspond to special announcements. The one for LNWR corresponds to the letter from its Secretary to *The Times* promising the "financial statement." The one for MR corresponds to George Hudson's letter to shareholders of that line, which was published as an ad in the major London newspapers, and reprinted in many other papers. It also occurs on the day that Nash was muzzled by the Stock Exchange! More careful study of such data (with more attention to dates and methods of information transmission) might provide useful insights on the extent of insider trading (which was not illegal at that time), as well as general nature of the information networks that influenced investors[79]. Here I make just some preliminary remarks most relevant to evaluating Nash's contributions.

The most striking association in Fig. 7 is between the LNWR statement of Friday, October 27, and the 10% jump in the price of LNWR shares the next day, Saturday, October 28. The release of the LNWR statement was carefully planned. Some, and likely all, of the London dailies received copies early enough on Friday to enable them to publish that statement in their Saturday issues. Some even had, in those Saturday editions, long leaders hailing this much longed-for event. Other papers did not receive the statement on Friday. The *Economist,* which was was in this group, did note in its Oct. 28 issue that the statement was to be released that day, and ascribed some of the liveliness in the markets in the preceding day or two to anticipation of this event and to "an apparent confidence manifested by the directors of the several companies."

Earlier there was a smaller jump when the LNWR directors promised to provide their "financial statement" in the letter in *The Times* on Oct. 14. In between, there were various rumors about the forthcoming statement[80].

The "financial statements" of the other railways appear not to have had much effect. In particular, the earliest one to be released, that of the LBSCR, seemed to have absolutely no impact (and also did not attract much press attention). The GWR and Midland shares show substantial jumps before the LNWR statement, and far ahead of their own statements, which produced relatively little reaction. Those jumps might have come from semi-official notices from railway directors that did not get published. For example, the smaller bar on the MR price series corresponds to Hudson's letter that was published widely as an ad by the Midland Railway. That letter did not have any financial data, but did have a very strong statement about the profitability of all of Hudson's lines:

> Even the present amount of traffic justifies the anticipation that the rate of dividends will not undergo any material diminution; and this remark applies to all the lines over which I have the honour to preside.

On the other hand, according to a story in the *Scotsman* on Oct. 28, the Midland was already then circulating among shareholders a statement of its financial obligations. Thus it is possible that the official statement of Nov. 17 was just the final, verified one, but that the essence of it had been conveyed to shareholders and thereby to the market three weeks earlier. The jump in Midland prices might then be a reaction to that early release. Since all of Hudson's lines saw their prices jump rapidly the same day, though, it may have been the emphatic tone of Hudson's statement that inspired investors. If so, that leaves some other puzzles, such as why did GWR share price jump at about the same time, while that of LNWR had to wait for the release of its "financial statement."

What did the LNWR "financial statement" provide to the public? It claimed that the maximal obligations of the company were just £30 million, as opposed to the £40 million estimated by Nash. But, as was noted before, this was just a matter of "massaging the numbers." There did not seem to be any substantive difference. The LNWR statement also contained what seemed an explicit commitment to limit total capital expenditure to £26 million. As the *Economist* observed,

> the North Western Company has materially changed its position by *indefinitely postponing*–and which the public understand as *altogether abandoning*–all the lines for which it has obtained acts, and which are not yet commenced.[81]

That was a concrete figure, and it meant that not much extra money would be needed. For many observers (such as the *Economist*) who felt the pressure of calls was the main threat to the railway share market, this was the key element. Thus the *Economist* wrote (in the same piece as quoted above) that

> the question was ..., are the obligations of the company within such a limit, or can they be made so, that they will be easily accomplished without endangering the interests of the company and its proprietors? The public mind being satisfied upon that point, the danger of any panic which would produce indefinite depreciation is past.

But the reality was that the industry was already past the point of no return. The £4 million that LNWR's directors were promising not to invest without consultation with their shareholders were not going to make a major difference. The investments that had been made up to that point were leading to the opening of extensive new mileage, mileage on which revenues were going to be very disappointing, as was becoming clear week by week, from data such as that of Fig. 6. Thus the rebound in the share market in late 1848 and into early 1849 was occurring in the face of visibly negative objective evidence, and all the negative analyses by Nash in the *Money Market Examiner.* What is especially puzzling is that this rebound stretched over such a long time. If the LNWR "financial statement" provided important information for investors, why did not this information lead to a quick adjustment in LNWR share price, instead of taking several months?

More detailed studies of railway share behavior and information available to investors may provide a better explanation of what happened during the collapse of the Railway Mania. At this point it appears difficult to view the price data as reflecting purely rational evaluation of available information. It seems that mass psychology was leading investors towards herd behavior, oscillating between fear and greed, until reality could not be denied any further and a panic set in.

14 Revolution, evolution, and regression

Historians often find that revolutions, even as large as the French one of 1789 (and even more so those of 1830 and 1848) change much less than is often supposed, that many essential features of social, political, and economic systems are preserved. So it is natural to ask about the effects of the two accounting "revolutions" of 1848 and 1849.

McCartney and Arnold [49] carried out a quantitative study of the sophistication of railway accounts over the period 1840–55. They showed that there was measurable growth in the details reported to shareholders by managers over each five-year period. The only unusually large jump in the level of detail they noted was in capital accounts (but not operational accounts) between 1845 and 1850. It would be interesting to redo their studies for each 6-month period during those 5 years to see if there was a noticeable increase in late 1848 and early 1849, stimulated by the events described in this paper. It is very likely that if one could obtain a count of the number of railway employees who had training in accounting (which in those days was acquired exclusively through apprenticeship), one would find steady growth without any sudden jumps. Railways were becoming more larger and more complicated. and it seems probable that managers sought to obtain professional help. (There are some hints of this trend in the contemporary railway press.)

This work concentrates on investor attitudes to railway managers and to accounting and financial reporting in particular. There we can find a measurable jump in the appreciation of the importance of public accountants. During most of the 1840s, accountants were usually mentioned in railway contexts only in connection with routine work. An early indication of a transformation occurred already a year before the dramatic change of early 1849. At the London, Brighton, and South Coast Railway, a committee of investigation reported in April 1848 that they had "engaged an experienced accountant." However, this accountant was not named, and it appears he was only charged with checking the book-keeping procedures. In 1849, the proceedings and reports of the committees of investigation show the far greater weight being placed on outside expertise. Outside accountants' reports are attached as signed separate documents. As a further mark of the rising stature of accountants, a committee investigating the Eastern Counties Railway in 1849 boasted of having obtained the personal services of William Quilter[82]. Accountants even attained the pinnacle of professional stature in having shareholders discuss whether particular members of the profession were worth their fees[83].

To obtain a more quantitative measure of the status of public accountants, reports of regular railway meetings printed in the February 1847 and February 1850 issues of the *Railway Times* were scrutinized for any mention of accounting or auditing issues, other than the inevitable mention of official accounts. In 1847, in reports of over 50 meetings, fewer than a dozen even mention these issues, and usually in a perfunctory way. For example, at one meeting, annual salary of £1,000 was voted for the Secretary, while the two (part-time shareholder) auditors were appointed at £20 for each, while at another, "[t]he Chairman next moved the resolution for the appointment of auditors, and it was carried without observation." There were several requests for better accounts, and one shareholder claimed "it was quite evident to him that the dividend on Newport Extension shares was paid out of capital, and not out of interest [i.e., profits]." An interesting situation arose at the LSWR meeting. A shareholder asked "why it was that the report was not signed, as was usual with other companies, by auditors appointed by the proprietors, and in pursuance of the Act of Parliament." This was followed by some discussion, in which management stated that the Parliamentary acts for the LSWR did not require appointment of auditors, while some shareholders claimed this was false. A motion was made by a shareholder for the appointment of auditors, but it was voted down. At the GWR meeting, there was extensive discussion of their auditors' report. Just as for LSWR, the GWR did not have to have any, but two were appointed, on a one-time basis, at the previous semi-annual meeting, in response to the allegations that were made by GWR opponents in the "Gauge Wars" of that period. The qualifications of the two were stated by the Chairman in his speech to be that they were both merchants, and both among the largest shareholders. They devoted 6 days to their task, and although they recommended reclassifying some minor expenditures, they certified that the GWR "system of accounts [was] full, simple, and clear; ... all rumours of laxity or irregularity, if not of fraud, which have been unscrupulously circulated, must be swept away." In none of these Feburary 1847 reports is there any mention of professional accountants. While there are some doubts about accuracy and adequacy of accounts as presented, the implicit assumption is that in principle they are simple enough that if properly prepared, they can be comprehended by any shareholder.

In February 1850, the view is dramatically different. The very first shareholder meeting report printed in the *Railway Times* that month, that on the LBSCR, starts off with reading of the report of Quilter, Ball, and Co., which was received too late for inclusion with the reports circulated before the meeting, and a comment is made that a "report from such a quarter was one of high authority." The next report, on the North Staffordshire meeting, states that the Chairman "read a statement from the auditors and from Messrs. Quilter and Ball, setting forth that the accounts were kept with completeness and in a satisfactory manner." At the GWR meeting, the Chairman stated that "on the present occasion the auditors–gentlemen of great experience themselves in commercial matters–have been assisted by a public accountant, a gentleman most competent, I am informed, to discharge the duty." The LSWR, which rejected a shareholder motion for a system of (shareholder) audits three years ago, had its regular meeting consumed by considering a report of the Committee of Investigation, devoted to investigating alleged improprieties by the directors. But that same month, the *Railway Times* printed a report of a special LSWR committee on audit. This report recommended appointing two auditors, but suggested requiring only one of them to be a shareholder (unlike the usual Parliamentary rule that both had to be substantial shareholders of long standing), and suggested "[t]hat either auditor, if he finds it necessary, may employ a professional accountant or other assistant." Thus by 1850 there was a prominent new view, namely that accounting is complicated, and requires professionals who can master it. But this view was not universal by any means. Most of the reports printed that month don't mention outside accountants, and for many years afterwards there continued to be calls in the railway press for accounts that every shareholder could understand. It took two decades before a uniform system of railway accounts was imposed by the government, for example. Thus we can conclude that there was something like a revolution in the late 1840s in shareholder attitudes towards accounting, but it was not a complete one.

In financial analysis, there was a noticeable jump in sophistication represented in the late 1840s by Nash's work, followed by regression. Once the *Money Market Examiner* ceased publication, the level of investment analysis and advice available to the public dropped, and afterwards improved very slowly with time. (The paper [60] credits Nash indirectly, without naming him, for introducing "dissections of railway accounts," but is incorrect on several points, in particular in claiming that such "dissections" continued in the railway press.)

Examination of available newspapers, other periodicals, pamphlets, and books from the 1850s turns up no systematic application of quantitative methods to finance that compares in thoroughness or sophistication to what Nash had done at the *LWRSL* and *Money Market Examiner*.

Presumably Nash continued his analyses of railway accounts in the private circular that he promised, but no trace of it has been found so far. Nash died in 1871 in Kensington (London), but we do not know what he did in the intervening years. However, his son, also named Robert Lucas Nash, was a substantial contributor to the development of financial analysis, and quite a bit of his work is documented and turns up in library searches. The younger Nash was born in 1846, and in 1864 started a 20-year career at the *Economist,* where at the end he was a sub-editor. R. H. Inglis Palgrave, whose name survives most memorably as part of the name of a publishing house, and especially in the title of the *Palgrave Dictionary of Economics,* had been editor of the *Economist* until the middle of 1883. After leaving that position, he founded the *British Australasian* in 1884, and hired Nash, who had worked under him at the *Economist*, to be its editor. In 1892, Nash left the *British Australasian* in order to physically move to British Australasia. He became the financial editor of the *Daily Telegraph* in Sydney, Australia, a position he held until his death in 1920. Perhaps the most striking result of the younger Nash was the 1880 book [54] that provided the first convincing demonstration that British investors were not irrational in lending money to foreign countries. British observers of the financial markets from the 1820s onward to 1880 shared a rare unanimity in regarding investments in loans to foreign countries as utter folly, plagued as they were by defaults. Such observers certainly had no shortage of examples to support their views, starting with most of the loans to Greece, Spain, and Latin American countries in the 1820s, as well as to individual states of the U.S. in the 1830s. However, the popular view (popular even among investment experts) was wrong, the higher interest rates paid by those unreliable foreign governments actually more than made up for the defaults, at least on average. This was first shown conclusively by the younger Nash in [54], after some preliminary computations by Hyde Clarke [21]. (This was the same Hyde Clarke who had been prominent during the Railway Mania of the 1840s as a reporter, editor, and publisher, and was the person who published an analysis of per-mile railway revenues that refuted the Wyndham Harding reassurances in 1848, see Section 3.) This discovery is worth noting as an indicator of the low standards of financial analysis available even as late as 1880. One would have thought that something as important as average profitability of foreign investments would have been investigated systematically before, but that appears not to be the case.

In Australia, the younger Nash attained great eminence, and in addition to publishing numerous books on finance, was frequently consulted by government and business leaders. His obituary claimed that during the debates involved in writing and ratification of the Australian Federal Constitution, "[p]robably no single individual so conspicuously influenced public opinion on" numerous financial and economic issues.

During his career at the *Economist*, the younger Nash wrote some books, and was editor of several issues of the publication often called *Fenn on Funds* [33], starting with the 9th edition of 1867. (However, there is some uncertainty, it is possible that it may have been his father who was in charge at that point. There is a suspicion of a deliberate name confusion by those two individuals, since the younger Nash was known in childhood as Robert Henry Nash.) Given his style of writing and work, it is also tempting to speculate that the younger Nash was responsible for the *Investor's Monthly Manual* that was published by the *Economist*. The first issue of this publication appeared on Oct. 15, 1864, the same year he was hired. It was a major and influential advance in financial analysis, collecting comprehensive information about investments (dividends, liquidity, volatility, etc.) that was simply not available in any single place before, and is used extensively by modern scholars studying that period[84].

15 Conclusions

The fundamental problem of the Railway Mania was not inadequate or fraudulent accounting. The great final railway share price crash of 1849 would have happened even if Nash and Smith had been silent, and Hudson's operations had been squeaky clean. New lines started during the Mania were coming into service, and the disappointing revenues they were earning could not be concealed for long. Once that crash commenced, demands for trustworthy information would likely have led to an accounting revolution in any case. Better accounting, of the kind demanded by Nash, might have accelerated the crash, by making investors aware of the impending ruin sooner. But it could not have prevented it.

The question that is harder to answer is whether the first accounting revolution, of late 1848, and the railway share crash that was its proximate cause, would have taken place had it not been for the activities of Nash and Smith.

Serious contemporary observers, including railway managers who produced those "financial statements" that calmed the scene at the end of 1848, blamed Nash for the crash, as was shown in Section 11. They often claimed he was the pawn of more powerful insidious forces. The *Railway Chronicle* argued that his influence was due to the implicit endorsement of the London Stock Exchange (whose brokers were often claimed to be scheming to plunder innocent investors), since his solitary effort with the financial tables of the ECR and the GWR in early 1847 failed to have any significant impact. A week later, the *Railway Times* claimed it was the support and publicity of *The Times* that made the difference: "it was not until the calorific process of the *Times* was applied to these Stock-Exchange eggs that the imps of mischief were brought into active existence."[85] These explanations for what was perceived to be Nash's key role in precipitating the crash are deficient in not taking into account the temporal factor. In early 1847, when Nash published the ECR and GWR tables, there was relatively little concern about the future profitability of railways. By mid-1848, concerns were mounting among investors and other observers, amid disturbing railway share price behavior. That's when the *Bankers' Magazine*, the *Morning Chronicle, The Times*, and other press organs started looking around for explanations for the developing disaster, and began giving prominence to Nash's analyses from *LWRSL*. Thus we have to consider Nash as just one player in the drawn-out and painful process by which investors discovered they faced ruin. His work was an important element, but not the only one, in the complicated set of feedback loops involving partial information and disinformation available to investors. Rumors, official announcements, stock market prices, and Nash's "dissections of railway accounts" all helped share perceptions of future prospects of railways, and it is impossible to assign a precise role to any of them.

However, we do have to allot to Nash a key role in the events of that period. It does appear that practically all those searching for quantitative and carefully reasoned, as well as reasonable, analyses of railway finances, ended up turning to Nash. He was far ahead of any one else in the completeness of his coverage and the sophistication of his studies. It is conceivable that had he not been active at that time, railway managers might have been able to allay shareholder concerns for a while longer without doing anything on the financial reporting front, until the inevitable disaster struck. The public perception was unstable, and the overwhelmingly positive reaction of the public and of the markets to the rather questionable financial statements of the end of 1848 from the major railways suggests that mass psychology was the dominant factor. Without the quantitative analyses produced by Nash, the doubts among the investing public might have lacked a solid anchor, and might not have led to any action in 1848.

Public opinion, whether that reflected in the railway press, or in regular newspapers, was slow to recognize the impending decline in profits and share prices of British railways. Markets were better at looking forward, but even they took a long time to realize just how low the returns from the new projects were going to be. Nash worked very hard to wake up the investing public to the dangers it faced. The reactions of the public, and especially of railway directors in producing those "financial statements" in late 1848, show that he did manage to raise awareness of problems with railway finance. However, it is less clear whether he had a significant effect on market prices. Still, he deserves credit for the intellectual achievement of penetrating further into railway accounting than anyone else, for strenuously advocating the proper reforms, for advancing the art of financial analysis, and for possibly bringing about the first accounting revolution about half a year sooner than it might have occurred without his efforts.

Appendix 1: The Leeds and Thirsk Railway

A nice example of the investment disasters of the Railway Mania is the Leeds and Thirsk Railway. This was a relatively small line, at least relative to other lines. It absorbed total capital investment of over £2 million, comparable, as a fraction of today's GDP, to about £5 billion for the UK and $50 billion for the U.S. Currently it is perhaps best known for its association with Samuel Smiles, the famous biographer and exponent of the Victorian self-help philosophy. He worked for the Leeds and Thirsk line from its inception until its merger with another line in 1854. Figuring out how well or poorly the new lines of the Railway Mania did financially is difficult for us today, and was difficult for contemporary investors, since there was a bewildering array of mergers, acquisitions, leases, and the like. The Leeds and Thirsk Railway presents a nice example because it remained independent for a long time, and did not carry out too many extensions, so we can figure out fairly well how its final results compared to initial projections. It was expected to cost about £20,000 per mile to construct, and to bring in annual revenues of about £3,000 per mile. In the end, costs were over £30,000 per mile, while revenues in 1852 came only to about £1,000 per mile[86].

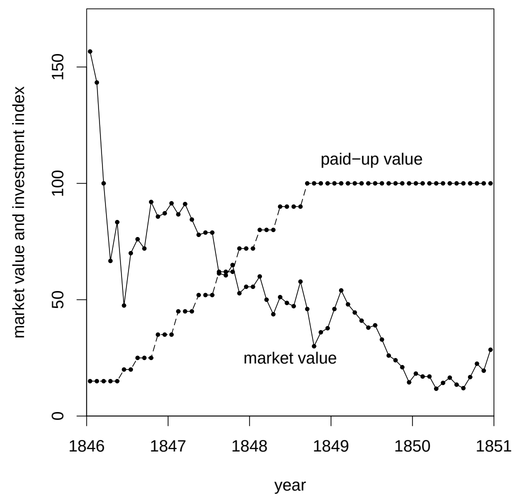

Fig. 8. Market valuation of investments in the Leeds and Thirsk Railway, 1846 to year-end 1851.

The original project was sanctioned by Parliament in the summer of 1845, with shares of nominal value £50 each. A substantial expansion was approved in 1846, with its own shares, and then there were just a few minor small deals. However, several new classes of shares were created, some preferred, to cope with cost overruns. The main project of the company, the line from Leeds to Thirsk, covering about two-thirds of total mileage, went into full service in July 1849, and the bulk of the remaining mileage was completed by early 1852. Fig. 8 reflects only the original common shares of this line. The paid-up index is 100 times the ratio of the amount actually paid on each £50 share to the nominal value of £50. By August 1848, a shareholder fulfilling all obligations would have paid the full amount, so this index stays at 100 from that point on.

The market value index for the Leeds and Thirsk Railway is 100 times the ratio of the market price of each share to the amount paid on it. In mid-January 1846, when the graph starts, the amount paid up is £7.5 per share (so the paid-up index is at 15), and the price is £11.75 per share, so the market value index is $100 \times 11.75/7.5$, or about 157. Around September 1845, at the height of the financial excitement of the Mania, Leeds and Thirsk shares, with just £2.5 paid up, were trading at over £20, so the market value index was at 800, which would be off the scale of Fig. 8 if one were to incorporate 1845 data in it. In October 1852, the Leeds and Thirsk index was at 35.5 (as opposed to the last value, 28.5, shown in Fig. 8 for mid-December 1850). This, however, represented much hopeful thinking on the part of investors. At that stage revenues barely covered the working expenses and interest on the debt of the company, and the common and preferred shareholders were fighting over control of the line.

The Leeds and Thirsk Railway provides an interesting perspective. From March 1846 on, when only £7.5 per share had been paid up, which was just 15% of the total amount, the market price was consistently lower than the amount paid up. By the time the last call of £5 per share was paid in August 1848, the market was discounting the investments by half. In between, the discount grew constantly, and even the ratio of market price to paid-up capital was basically declining from early 1847 on. In other words, over a period of two and a half years, as the investors were putting in more money into the venture, the market was telling them they were just compounding their mistake. (But the market was not pessimistic enough, as eventual reality turned out even worse than share prices appear to have anticipated.) Yet they persisted. Why did they do this? Part of it was inertia and institutional constraints. There is always a strong temptation to put in more money in the hope that things will turn out right, instead of abandoning a project and facing a clear loss. Furthermore, officially, shareholders were obliged to pay the calls, and if they did not, they could be sued, or forfeit their shares. Still, if enough shareholders felt strongly enough that the market signals were correct, they could act to abandon projects, by pressuring their directors, by voting for new directors, voting against new projects, etc. That did happen to some extent, but yet a huge amount of investment did take place.

Appendix 2: Background on investor attitudes

Section 2 mentioned how North British Railway investors voted to effectively pay dividends out of capital. (Formally, they voted to continue paying interest on shares in a project that was already in service, see the discussion below of paying interest on calls.) This is just one example that demonstrates the attitudes towards finance and accounting then differed from modern norms, and how difficult it is for us to decide whether particular acts were fraudulent, slightly questionable, or widely accepted. This part presents a high-level perspective on how investors at the time of the Railway Mania viewed railway finances. Most of the claims are not new, and are presented for completeness. Some, such as the dominant philosophy of a basically static but violently fluctuating economy, provide what appears a more insightful way to view phenomena such as the widespread demands for "closing the capital accounts," which have been documented extensively before. A few, such as the ones about widespread distrust of managers, suggest new interpretations for some old observations. (For example, it has been noted before that some British railways had depreciation funds early on, but abandoned them in the 1840s. Edwards ([27], p. 26) cited two previous sources as ascribing this either to the opinion that such funds "were superfluous provided rolling stock was properly maintained out of revenue," or to "the desire to maintain dividends when results deteriorated in the depression of 1846-8." This section suggests that concerns about giving managers control of such funds were even more important.) However, in the interests of brevity, comparisons with other sources are not made here, as the intention is just to set the stage for the description of the collapse of the Railway Mania and the role of Robert Lucas Nash in it.

The poor state of accounting in the 1840s was not peculiar to railways. Most joint-stock companies (corporations in modern American usage) were far more opaque. As an example, until the rise of railways, the Bank of England and the East India Company were the two largest companies, and their shares were the most widely held. A contemporary book by the respected financial journalist David Morier Evans [32] has an enlightening and amusing account of shareholder meetings of the Bank, which typically lasted 15–20 minutes, with shareholders standing, and with hardly any information being provided by management. Railways actually had a little more transparency forced on them. For example, their acts generally required that two auditors, elected from among the shareholders who were not involved in management, had to inspect the books of the company during the two weeks before the semi-annual meeting. But there was no requirement for written reports! Even when printed reports were prepared, they were usually handed to shareholders as they arrived for the semi-annual meetings. And there were no standards for accounting, for railways or other bodies.

The late 1840s were very painful for railway investors. They were hampered in dealing with the decline in the value of their shares by several deeply held beliefs:

- railways were simple businesses, to be run by part-time managers
- railways were to produce steady dividends, with no expected growth, starting within a year or so of completion
- after initial investment during construction, the "closing of the capital accounts" would take place, with any further investments minor and to be paid for out of revenues
- accounting principles could be treated very casually during the construction phase, and were obvious for running the line after the "closing of the capital accounts"
- managers had to be watched with great suspicion

By the end of the Mania, most of the public had been disabused of the first and fourth notions (which is what persuaded them to call in outside professional accountants), felt the last notion had been verified many times over, but stubbornly continued clinging to the second and third notions.

The five Victorian beliefs about investments listed above persisted for a long time, even in spite of extensive evidence to the contrary, because they fit the general world view of the time and because they reinforced each other. Many of the quotes in this section demonstrate simultaneously several of these beliefs, and the discussion that follows sometimes jumps from one to the other because they are so hard to disentangle.

Perhaps most important, the key beliefs listed above persisted because they were anchored in a basic view of the world as largely static. The modern sense of constant incremental change and growth was missing. Technological change was known, but it was perceived as coming in revolutionary jumps, such as the invention of the steam engine, or of the steam locomotive. The economy as a whole was growing, but this was not apparent to most people, since there were violent fluctuations. This dominant attitude coincided with some small fraction of the population holding modern views about continuous economic and technological progress. There is an extensive discussion with many citations in [55]. What it meant in practice is that railway and other corporate business plans assumed that once a line was opened, there would be a short period, of a year or at most two, of "development of traffic," when demand would grow, and then revenues would stabilize, to produce constant dividends. There might be a lucky jump to a higher level, say if a new coal mine started using the railway for transport, or an unlucky decline, if a competing line opened. But there was no expectation of steady growth, other than perhaps the slow growth associated with population increase. There was evidence to support such views.

For example, prominent companies tended to have stable dividends (with the usual circular feedback loop operating, in which expectations of stable dividends induced managers to produce such, which reinforced the expectations). A prototypical example was the Bank of England. It had 10% dividends (on the nominal value of its shares) from 1807 to 1822, then 8% until 1839, and from that point until the Railway Mania it paid 7% ([34], vol. 2, pp. 273–76). A quote from a leader (similar to a modern editorial) in *The Times* of 1867 (thus two decades after the Railway Mania, and in the wake of of the collapse of another giant railway mania) illustrates this attitude:

> The property of a Railway is represented by its shares; the value of this property is measured by the price of the shares in the market, and that price is determined by the dividend paid upon them, the dividend being taken to express the net profits of the concern.[87]

This attitude went along with an implicit but also widespread assumption that dividends would be constant, and that after an initial period of buildout, a company would "close its capital account." What this meant, in the words of that same leader from *The Times*, was "paying all expenses out of receipts." A few people realized such attitudes were unrealistic in the 1840s, and many more were convinced of this by the 1860s. However, the fact that *The Times*, the bastion of establishment respectability, would support them as late as 1867, shows just how entrenched and powerful they were. If one accepts these notions, then determining value is just a matter of looking at the dividend and applying a standard multiplier. There is no need for sophisticated accounting or financial analysis. of 1867 (thus two decades after the Railway Mania, and in the wake of of the collapse of another giant railway mania) illustrates this attitude:

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An excellent illustration of how hard it was for early Victorians to accept the notion of relatively steady and rapid economic growth is provided by some predictions of *The Times* and Robert Lucas Nash, made in the fall of 1849. At that time the railway share market was nearing its bottom, and investor attitudes were extraordinarily depressed. *The Times*, however, which had been regarded by the railway interest as the foremost enemy of their industry, had shifted to a positive view of the future for shareholders. In support of this optimistic outlook, it wrote that

> [railway] profits are certain, in the long run, to increase. The rate of that increase it would be idle to conjecture, but if any one will consider the rapid steps by which the travelling and traffic have increased in this country at any given intervals—if, for example, he will compare, as he easily may, the number of public conveyances in the years 1775, 1800, 1825, and 1850, he must conclude that in the year 1875 the internal travelling and traffic of this nation will be nearly doubled, if not more.[89]

Nash, who had earlier admitted that the growth in population would provide increased revenues, attacked *The Times* for providing "comfort to despairing shareholders [by means of] visionary estimates of increased traffic."[90] British population at that time (putting aside the Great Irish Famine of a few years earlier) was growing at about 1.5% per year. The rather diffident prediction (diffident undoubtedly because this was a controversial stand at the time) by *The Times* of a doubling in 26 years corresponds to a growth rate of slightly under 3% per year. But this was far short of the explosive growth rates that prevailed over the next few years. The number of passenger trips on British railways recorded in 1849 doubled by 1856, while revenues for the industry doubled by 1857, for growth rates of 9 to 10% per year. In 1849, such growth rates would have been regarded by almost all people as not just "visionary," but absurd. There were a few observers who had a good sense of just how rapidly the economy and the railway industry would grow (see, in particular, Chapter 29 in [55] on James Morrison), but they were very rare, and their opinions were not widely disseminated or shared.

The expectation of stable profits and revenues fit neatly with the view that once a line was completed, it should "close its capital account." In other words, the expectation was that there would be only small additional capital investments, and they would be paid for out of the revenue account. This of course violates basic accounting principles, as capital expenditures get hidden in working expenses, profitability measures get distorted, ... Not only that, with the need to grow investments by 9 to 10% per year (as in the long run capital investment largely paralleled traffic, something that early Victorians took a long time to learn), and dividends on common shares of 3%, there was no way that one could "close the capital accounts," whether that was good accounting practice or not. But such "closing" was the laudable goal in most eyes. The following account of a presentation at a regular semi-annual meeting of the London and South Western Railway (LSWR) in 1843 demonstrates this point, and some related ones, very clearly:

> [The Chairman, William Chaplin, speaking:] The coaches and carriages you will find in the same state of efficiency. And that the repairs and restoration of them are fully and fairly charged to the current expenditure–(Cheers.) I forgot to mention, when speaking of the locomotive department, that the substitution of parts, restoration, and general repairs are entirely charged to current expenses. I appeal to the Chairman who presides over the Committee of the Locomotive Department, if one farthing has been charged to capital account in this half year?
>
> Colonel Henderson (a Director)–Not one farthing has been so charged, and we have made good the deficiency in the stock by supplying new engines last year to the

> extent of five, while in the present year we shall have four more; so that your stock is better than it was in 1839 and 1840, when I first had the honour of presiding over the Locomotive Committee. It has been our particular anxiety to keep the stock in the best possible order, and not one penny has been applied from the capital account. We purchased new engines and made good the deficiencies in the stock entirely from the half-yearly expenditure–(Cheers).[91]

Shareholders wanted locomotives to be bought "entirely from the half-yearly expenditure." On the other hand, that the Chairman would make such a major production out of the issue demonstrates that the investing public was used to "the substitution of parts, restoration, and general repairs" being charged to capital. The practice was not approved of, but it was not particularly disreputable. In the early start-up years of a railway it was regarded as one of the many transitory expedients that could be excused.

The "closing of the capital accounts" was widely practiced in Britain. Arnold and McCartney have recently provided careful studies of the large extent to which estimates of canal profitability were distorted as a result [12,13]. But such distortions did not matter to most early Victorian investors. They were looking just at dividends. The prevalent mental image of markets was still primitive (cf. the discussion in [12]).

The notion of "closing the capital accounts" was refuted convincingly by Lardner in his *Railway Economy* of 1850 [42], and by others. But it persisted for decades. As an example, the 1867 leader in *The Times*, cited earlier, claimed that "[t]here is but one remedy for [the uncertainty about values of railway shares], and it lies, as we have repeatedly said, in paying all expenses out of receipts."

Paying for additional locomotives out of revenues is a clear violation of modern accounting standards. Another common violation of such standards was paying interest on calls. When a new company was started, and also usually when an established one was undertaking construction of a branch, new shares were issued. Purchasers of these shares followed the usual pattern of paying a small deposit, and then responding to "calls" for additional investments. It was common (but not universal) to pay interest on these calls up until the branch was placed in service. So it often happened that by the time shareholders had paid the full £20 per share, they had received £2 per share back in "interest." This was of course just an early return of capital, yet in the accounting of the time this "interest" was counted as part of the capital expenditure. Once the line went into service, the dividend rate was computed on the basis of capitalization of £20 per share[92].

The early Victorian attitudes towards rules and laws form an interesting topic one could not do full justice to even in a full book. It was the golden era of *laissez faire*, involving great reverence towards property rights. At the same time, it was an era that treated many laws very casually. Smuggling was common, with even MPs (Members of Parliament), engaging in it. Many activities that would lead to jail terms today were tolerated (even when regarded as disreputable). Consider George Hudson, the Railway King. In 1849, he was shown to have "cooked" accounts and misappropriated his shareholders' funds. Yet afterwards he got reelected to Parliament, and calls for his expulsion did not go anywhere. Other illegal transgressions were also taken lightly. In his *The Bubble of the Age* pamphlet, Arthur Smith, a lawyer, made a big fuss about illegal borrowing by railway companies

([65], 3rd ed., p. 7). Smith reminded his readers that in 1844, Parliamentary investigation established what had been an open secret in the industry, namely that many lines had borrowed money in excess of the limits set in their acts. Smith cited the incident in order to show that railway directors could not be trusted, as the illicit borrowing demonstrated they were apt to go behind the backs of their shareholders and violate laws. This might have increased concerns of some investors. But it is more likely that most shrugged it off. The attitude was that directors had done what had to be done, and only ignored a small technicality. After all, by retroactively legalizing those transactions, Parliament had in effect agreed this was not a serious issue.

To a large extent railway directors were known to have engaged in questionable transactions, and were expected to do so. The birth of the railway system was smoothed by the lubricating effect of corruption, or near-corruption. While that was a period of *laissez faire*, it was not pure *laissez faire*, as the free-marketers were still storming the last bastions of feudalism. Peter Lecount was an engineer on the pioneering London and Birmingham Railway (which became the core of the LNWR in a giant merger in 1846). In his history of the line, he described how it got approved by the House of Commons in 1832, but was tossed out by the House of Lords in that year, because of opposition from some noble landowners. The next year, it went through without opposition ([43], p. 22), and

> the means the directors were obliged to resort to, must be left to the imagination of the reader; suffice it to say, that no variation, sufficient to account for the different features of the case, took place in the numerical value of the assenting or dissenting landowners.

Not all the transactions that needed to be kept hidden involved outright bribery, or at least what was regarded as outright bribery then. Directors routinely had available to them a substantial number of shares to be used at their discretion to distribute as necessary among landowners, to lessen their opposition. Shareholders understood the need for such shares, and for discretionary control. But they did get upset when they learned the directors had appropriated such shares for themselves.

There was also a perception that in the earlier, and very successful, railway mania of the 1830s, investors had been lured towards what turned out to be a very bumpy ride, through overly rosy promises. Thus a review of a book about railways by Whishaw claimed in 1841 [2] that

> no doubt there is truth in what Mr. Whishaw relates when he says, “We have heard it frequently remarked that if real estimates had been sent forth to capitalists, not a tithe of the present extent of railway communication would have been effected.” We must therefore congratulate the country on the result, however much the mystification practised by projectors, contractors, and committees is to be blamed.

Because of the financial success of those lines, such creation of “beautiful illusions” was forgiven, but not completely forgotten. Hence whenever doubts arose about the current or future finances of a railway, shareholders were quick to suspect not just the competency, but also the honesty, of management (meaning the directors).

The railway mania of the 1830s, mentioned above, played a key role in shaping the attitudes of investors and the public during the Mania of the 1840s. It was huge, it was wildly speculative, and it took a long time to complete the lines that it gave rise to. In the end, though, it was perceived as successful for investors, in spite of all the corruption and "mystification" that it was associated with. This mania faced extensive skepticism and opposition, including widespread allegations of accounting fraud. (For a brief but general overview of this episode of investor exuberance that turned out to be rational, see [55,56].) The most prominent advocate of the view that railways were complete financial failures, with share prices propped by dividends paid out of capital, was Richard Cort. He published several long pamphlets, such as [23], that claimed to prove, through voluminous processing of published statements, that railway directors were "cooking" their accounts. He was silent during the Mania of the 1840s. After Hudson's extensive frauds were revealed in 1849, he came out with a pamphlet claiming those events vindicated his earlier warnings [24]. Arthur Smith in his *The Bubble of the Age* pamphlet was basically repeating Cort's claims from the 1830s, claims that appeared to have been discredited by experience. There were many other people in the intervening years who were also warning, either for specific railways, or for the entire industry, that railway accounting might be leading investors astray[93].

Many of the warnings about accounting abuses could be discounted as the work of rival railways or other opponents, or else unreasonable[94]. But often very questionable financial maneuvers would be done with explicit shareholder approval. Thus at the August 1847 regular semi-annual meeting of the Eastern Counties Railway, George Hudson, the Chairman, recommended that "the interest on No. 2 shares should [not] be charged on the present half-year's dividend," but should come out of capital, because the line built with money from those shares "has not yet received the advantages that will be derived from an effective working of the through traffic over it."[95] As long as such questionable maneuvers were regarded as temporary, just smoothing the way to a steady stream of dividends and closed capital accounts, little protest was raised.

Steady dividends were highly valued and expected. The use of reserves to smooth those dividends was acceptable, but conflicted with the suspicions about the trustworthiness of managers. Thus during a GWR semi-annual meeting in 1844, the directors recommended a dividend for the preceding half-year

> leaving a balance of ..., which balance the Directors did not consider would be more than sufficient to enable them next half year to divide 3 per cent, and therefore they earnestly and unanimously recommended that it should be retained, as it was most important that the dividends should be as nearly as possible equalized. (Hear.)[96]

The reason the directors had to implore shareholders to retain a reserve is that investors were afraid their funds might be misused if left in the control of management. The existing literature on railway accounting does discuss the question of depreciation funds, and how some lines that had them in the early 1840s abandoned them later in the decade. What this literature usually does not explain is that much of the push to eliminate depreciation reserves came from this same distrust. Thus *Herapath* in 1848 wrote of a depreciation fund that it "had regarded it as one of those figments, unmercantile in fact, unjust in operation, towards the Shareholders, and a nest-egg from which a remedy for other evils might be hatched."[97]. This same mistrust of management was the main reason "closing the capital account" was so popular. Some railway managers, who saw the practical impossibility of such a measure, did talk of its desirability, as the only way to establish credibility with shareholders. Robert Lucas Nash was adamant in demanding the "closing of the capital account" largely for that reason. He was pushing for better and more transparent accounting, but did not believe that would suffice by itself, if the capital accounts were open.

The distrust of corporate managers was part of a general distrust of joint-stock companies. In the early 19th century, they were looked at with great general suspicion, and only a very limited role was envisaged for them. This attitude is seen very clearly in Adam Smith's *The Wealth of Nations*. He claimed that joint-stock companies were suitable only for businesses in "which all the operations are capable of being reduced to what is called a routine." Even for a canal, he seemed unsure whether its construction was not beyond the proper sphere of operations of such bodies. But once made, "the management of it becomes quite simple and easy, and it is reducible to strict rule and method," and can be entrusted to a joint-stock company. Such opinions dissipated only slowly. Thus, for example, at the time of the Railway Mania, John Ramsay McCulloch, a prominent economist who was an ardent free-trade advocate, reiterated that joint-stock companies were appropriate only to businesses that "admit of being carried on according to a regular systematic plan," even though he did acknowledge the valuable role of these bodies in carrying on "many ... establishments of great public utility"[98].

The main objections to joint-stock companies centered on their perceived inefficiency and propensity for swindling shareholders. The association of fraud with joint-stock companies was bolstered by the experience of the two big investment manias of the mid-1820s and mid-1830s, when most of the new ventures collapsed, typically involving allegations, and in many cases solid proofs, of management abuses. Hence there was an almost automatic tendency to be suspicious of railway managers. On the other hand, there were still the remains of the expectation that railways could be and should be simple businesses, ones in "which all the operations are capable of being reduced to what is called a routine," and which just about any shareholder could comprehend. Certainly the early railway companies were chartered with the expectation they would be close analogs of canals and turnpikes, building rail ways and letting any one use them on payment of the prescribed toll. In such a business, there would be no need for accounting expertise. But with time, railways became their own carriers, exclusive ones at that, running very complicated operations, most of them incapable "of being reduced to what is called a routine."

Direct operational management was still expected to be carried on by the boards of directors, who worked part-time. As an example, George Carr Glyn, the Chairman of the LNWR, also ran a large bank, and served in Parliament. Given current controversies over management compensation, it is amusing and perhaps instructive to note that some early Victorian critics were calling for increasing the pay of directors, in order to get them to be more diligent in their duties. Full-time employees were expected to handle only tasks "reducible to strict rule and method," with all serious decisions made by the directors. The beginnings of the rise of a powerful managerial class can be traced to this time, cf. [37], but those were just the beginnings of this rise.

The point of this section is that attitudes, expectations, and actions of investors and managers in the 1840s differed substantially from modern norms. Thus actions that today would be called fraud were often tolerated, if not accepted. On the other hand, investors were simply not prepared for the reality of the railway world, with much greater complexity than they envisaged, complexity they could not grasp without relying on professional managers and accountants. Hence the collision with the cold reality of complicated world and low profits was extremely painful.

Notes

[1]The railway price index is the one in [35]. The non-railway index is the average of the indices for insurance companies and waterworks firms, both also from [35].

[2]For information on this report, see *The Times,* May 16, 1849, p. 8, as well as the leader (editorial) and business column comments in the May 17 issue on pp. 4 and 7.

[3]*Money Market Examiner*, March 17, 1849, pp. 182–83.

[4]*Railway Times,* Aug. 4, 1849, pp. 779–780 and Aug. 11, pp. 801–802. It should be said that this report was not without its critics. It was said that "[o]ne almost fancies he can discover a disposition to overlook rather than to detect,–to gloss over rather than to criticise," see a leader and a letter cited below in *Herapath,* Aug. 4, 1849, pp. 776 and 779.

[5]*Money Market Examiner,* Dec. 9, 1848, pp. 13–14.

[6]*Report of Proceedings of Railway Dept., 1858,* Parliamentary Papers 1859 Session 2 [2560] XXVII.637 p. xi. That report estimated return on total capital invested (common and preferred shares, as well as loans) of 2.8% in 1849, with an average of 3.6% over 1849–1858. Slightly different profit rates were computed by Arnold and McCartney [10], who investigated a large sample of British railways using modern accounting methods.

[7]*Railway Chronicle*, Aug. 16, 1845, p. 1015. Reprinted in the *Morning Post* of the same day, p. 3, and in the *Scottish Railway Gazette* of Sept. 6, p. 380.

[8]Table 1 is derived from the table on p. 352 of [67], vol. 5. Somewhat different figures are available in Table 2 of [55]. Such differences are common in this area. But all the data sources show the same overall trends.

[9]*Report of Proceedings of Railway Dept., 1858,* Parliamentary Papers 1859 Session 2 [2560] XXVII.637 p. xi.

[10]The North British quote is from a letter in *Herapath,* Aug. 4, 1849, p. 779, the "cloven hoof" quote from a pamphlet about the Chester and Holyhead Railway Company in 1850.

[11]As an example, the *Railway Record* of Aug. 28, 1847, p. 893, in a leader entitled "Railway profits and experiences," wrote that "men's notions of railway profits are much more modest and narrow than they were," and that by then "the estimation of the public for railways is well-grounded."

[12]The four Hudson lines were the Eastern Counties Railway (ECR), the Midland Railway, the York, Newcastle, and Berwick Railway (the York and Newcastle for the first half of 1847), and the York and North Midland Railway. The six non-Hudson lines were the Edinburgh and Glasgow Railway, the Great Western Railway (GWR), the London, Brighton, and South Coast Railway (LBSCR), the London and North Western Railway (LNWR), the London and South Western Railway (LSWR), and the South Eastern Railway. Share prices were obtained for a day in mid-month for each month (and every two months in the second half of 1850) from either the *Railway Times* or the *Economist.* In each group, the share price was divided by the paid-up value of the main common share. An exception was made for the GWR, since there, until the end of 1848, the main shares were not fully paid-up. Instead the paid-up half-shares were used. A simple arithmetical average of these four or six ratios, respectively, was taken, with no adjustments for the varying amounts of capital involved. Finally, each of these two indices was divided by its value in mid-October 1852 to obtain the adjusted index value displayed in Fig. 2. The "Consols - 50" label means that the displayed price of Consols is lower by £50 than the actual one, a modification designed to lessen clutter in the graph. It is worth noting that the price of Consols hovered close to the nominal 100 in the halcyon days of early 1845, with a yield of almost exactly 3%.

[13]As an example, suppose A was the dividend (computed on an annual basis) for the second half of 1847. It would be officially proposed by directors and ratified by shareholder vote at the meeting in February 1848. Suppose further that B was the dividend for the first half of 1848, declared in August 1848. Then the interpolated dividend for January 1848 was taken to be A, that for February 1848 was taken as $(5 * A + B)/6$, and so on, with that for June 1848 set to $(A + 5 * B)/6$. This particular method of interpolation was chosen on an ad-hoc basis. More careful studies may produce better choices.

[14]*The Times,* Oct. 11, 1848, p. 8.

[15]*Morning Chronicle*, Oct. 14, 1848, p. 2.

[16]*Money Market Examiner,* Dec. 9, 1848, pp. 13–14.

[17]A leader in *Herapath,* Feb. 13, 1847, pp. 186–87.

[18]The *Herapath* leaders were published Feb. 13, 1847, pp. 186–87, and July 17, 1847, pp. 821–22. Aytoun's letter discussing declining profit prospects was published in the *Scotsman,*

Oct. 13, 1847, p. 3, and reprinted in [14], p. 14. The *Railway Gazette* leader was published Jan. 1, 1848, pp. 10–11.

[19]See footnote on p. 59 of [65].

[20]For example, *Daily News,* Sept. 5, 1848, p. 3, *Morning Chronicle,* Sept. 20 and 21, *Manchester Times,* Sept. 9, *Trewman's Exeter Flying Post,* Sept. 28, *Railway Record,* Sept. 23, pp. 936–37, *Civil Engineer and Architect's Journal,* vol. 11, Oct., pp. 308–10, the *Economist,* Nov. 18, pp. 1297–99, and *Mining Journal,* vol. 18, Sept. 16, p. 443. *Herapath,* Oct. 7, pp. 1067–69, reprinted the full Harding article, with some introductory comments. The *Railway Chronicle,* also had high praise for the work, and published extensive excerpts in issues of Aug. 26, pp. 587–588, Sept. 9, pp. 636–637, Sept. 30, pp. 692–693, and Oct. 7, pp. 709–710. And it kept getting cited, for example in a letter in *Daily News,* Oct. 30, p. 4. Some of these articles concentrated on Harding's advocacy of low fares, and the evidence he presented that low fares were beneficial. However, most dealt just with the issue of revenue per miles. Thus the *Morning Chronicle* of Sept. 20, 1848, in its business section, noted that by Harding's calculations, between 1842 and 1847, "[t]he receipts, therefore, were about doubled, upon a less proportionate amount of mileage, a circumstance which would tend to give confidence as regards the prospect for the great additional lengths of railway, for which acts have been passed."

The Harding paper was also reviewed, favorably, on the other side of the Atlantic, in the *American Railroad Journal,* Nov. 8, 1848, pp. 708–709.

[21]*Coms. of Railways. Report, 1847, Appendix,* Parliamentary Papers, 1847-48 [938] XXVI.289.

[22]The numbers in Table 1 come from a different source than those used by Harding.

[23]*Railway Chronicle*, Nov. 11, 1848, p. 780. The writer of this letter was visibly upset with Smith's activities, which supposedly served "to endanger the pecuniary welfare and happiness of whole classes of his fellow subjects, and to occasion great loss, misery and anxiety to many individuals and families."

[24]Based on ads on the front pages of the *Railway Times* in 1847, issues of April 15, April 22, May 6, June 3, June 17, July 8, October 7. Comparison of the three editions shows only minor differences among them. Some libraries have copies of the second edition that include *Appendix, No. 1. The London and North Western Railway Company.*

The October 7 ad mentions that a separate pamphlet, entitled *Observations on Mr. Glyn's Speech,* (Glyn being the Chairman of the LNWR) was about to come out. I have not been able to find this pamphlet in any library, nor whether it was ever published. Inside the front cover of the 3rd edition of *The Bubble of the Age,* there is mentioned, as available "at request," another appendix on the Glyn speech, which may refer to the same item.

There is one more known publication by Arthur Smith, [66]. However, while the introductory material in it does have dark warnings about railway fraud, there is no evidence presented.

[25]For example, the *Manchester Times*, Oct. 17, 1848, p. 2 and the *Economist*, Oct. 28, 1848, pp. 1229–30. The *Railway Chronicle* pieces cited above were in the issues of Aug. 19, 1848, pp. 577–578, and Oct. 21, 1848, p. 739.

[26]*Bankers' Magazine*, vol. 10, June 1850, in Appendix B.

[27][65], 3rd ed., p. 59.

[28]If this is a mistake, as I argue here, it is an old one. The *Bankers' Magazine,* vol. 8, July 1848, p. 459, had a brief review of [3,6,64,65], and wrote that this collection of four "appear to be written by the same hand." Also, the title page of [66] credits Smith with being the author of [3,4,5,6].

[29]*The Times*, Nov. 17, 1848, p. 6, and Nov. 30, 1848, p. 6.

[30]*The Times*, Dec. 1, 1848, p. 6.

[31]Business column coverage in the *Era*, March 22, 1846, p. 5 and August 23, 1846, p. 9, leader on January 17, 1847, p. 9.

[32]These conclusions are based on searches of print and online versions of publications from that period, especially *The Times* of Jan. 29, 1842, p. 7, and Feb. 5, 1842, p. 5, and the *Jurist,* vol. 10, part. II, 1847, p. 32, as well as private correspondence with Malcom Gain, a descendant of Nash.

[33]The Nash letters were excerpted in the business column of *The Times* on Feb. 9, 1847, p. 7 and Feb. 20, p. 7. Articles or leaders that mention these reports appeared in *Trewman's Exeter Flying Post* of Feb. 18, p. 4, *Railway Times* of Feb. 13, pp. 210–211, *Railway Gazette* of Feb. 20, p. 238, and *Railway Record* of Feb. 13, pp. 152–153. Some ads that allow precise dating of publication of these reports appear in the *Railway Times* of Jan. 23, p. 91, and of Feb. 6, p. 155. The ads refer to the GWR report as *The Financial History of the Great Western Railway.* Some places refer to *Nash's tables* or *Nash's Railway Statistics*. The Baker Library of the Harvard Business School has a copy of the GWR report in their Kress collection.

[34]In addition to the two letters of Feb. 9 and 20, 1847, mentioned in the previous section, one of which gives his name as the author, there was at least one other one. In the May 29, 1847 issue, the business ("City article") column on p. 6, *The Times* cited extensively from an anonymous letter about the risks some railways were incurring through indiscriminate leases and guarantees. Particular attention was drawn to the obligations that the Caledonian Railway was incurring. This was an astute observation, as the Caledonian was basically the only large British railway to be effectively bankrupt at the end of the Mania,

largely because of all those guarantees. The attribution of this letter to Nash is based on his claim in the *Money Market Examiner*, Oct. 6, 1849, pp. 531–32, a claim there is no reason to disbelieve. See also the letter of Frank Marvel in *Herapath,* June 5, 1847, p. 668, reprinted in the *Scottish Railway Gazette,* June 26, 1847, p. 204 about the Caledonian, with similar warnings.

[35]The only copy of *LWRSL* from this period that I was able to find was in the British Library. The last time I was able to access it was in June 2006. Some time afterwards, it was apparently misshelved in the Colindale facility, and has yet to be found. I have good notes only on the early issues of the *LWRSL*, and on the events in late October 1848 that led to Nash's parting with this paper.

[36]*LWRSL,* Aug. 21, 1847.

[37] Coverage of the Monteagle proposal in *The Times* is available on Dec. 21, 1847, p. 2; Dec. 30, 1847, p. 5; Feb. 12, 1848, p. 2; May 18, 1848, p. 3. For a general overview of proposals for British government overview of railway accounts, see [70].

[38]This changed in July 1848, just as the railway share crisis was developing. At that point the *LWRSL* shifted to a four-page format. Some of the extra space went to ads, which helped pay for the extra expense, but Nash now had space for far more detailed "dissections." This may have been a major contributor to his influence.

[39]The extracts appeared in *The Times,* Jan. 17, 1848, p. 2; Feb. 3, p. 6; and Feb. 17, p. 6. The passages printed in *The Times* did not disclose Nash's connection with the *LWRSL.*

[40]A caveat that needs to be made is that we have practically no record of a substantial body of work from that period, namely brokers' circulars. Some brokers would send out circulars to their customers, with evaluations of market conditions, and of individual securities. There do not seem to be any systematic collections of them in any research archives. From the available samples and the newspaper references I have seen, it does not appear that any engaged in financial analysis anywhere near as deep as *LWRSL*. On the other hand, there may have been some that did not attract public scrutiny. In particular, in the fall of 1851, Nash closed down his *Money Market Examiner*, which will be discussed later, and converted it to a broker's circular. I have not found any traces of it, but it presumably carried on his careful analyses.

[41]The Bank of England discount rate, which had risen to what was regarded as prohibitive level of 8% at the height of the monetary crisis in October 1847, was brought down to 4% at the end of January 1848, and to 3.5% in June 1848. For comparison, that rate was at 3% in the last four months of 1846, and would again be brought down to that level in early November 1848, just as the railway shares started their remarkable recovery following the publication of the "financial account" of the LNWR.

[42]*The Times*, Oct. 10, 1848, p. 6.

[43] *LWRSL*, July 15, 1848. A brief account of Nash's evaluation was published in the business column of the *Morning Chronicle*, July 19.

[44] *LWRSL*, Aug. 26, 1848. This article was reprinted, with a favorable recommendation from the editor of the business column of the *Morning Chronicle* in the Aug. 30 issue of that paper, and in *Bankers' Magazine,* vol. 8, Sept. 1848, pp. 570–71.

[45] *Railway Times,* Aug. 26, 1848, p. 920.

[46] *Railway Gazette,* Feb. 5, 1848, pp. 132–33.

[47] *Railway Gazette*, Sept. 16, 1848, p. 790.

[48] *Railway Gazette*, Oct. 14, 1848, pp. 854–55.

[49] *Railway Gazette*, Nov. 18, 1848, p. 934.

[50] *Railway Gazette*, Oct. 21, 1848, p. 873.

[51] *Railway Gazette*, Sept. 30, 1848, p. 816.

[52] They apparently also tried bribery. According to the statement in the Oct. 28, 1848 issue of *LWRSL*, "[t]empting bribes have been offered—proposals for purchase of an unlimited number of copies have been tendered—(let those companies which deserve it bear witness to the truth of this assertion) but they have all been rejected, ..." This statement was likely a joint one from Nash and Slaughter.

[53] *The Times*, Oct. 12, 1848, p. 6. The leader is on p. 4. The extracts from Nash's analyses were apparently taken from September issues of *LWRSL*.

[54] *The Times*, Oct. 14, 1848, p. 3. This letter was also sent to other papers, and published in some, for example in the *Daily News*, Oct. 14, 1848, p. 4.

[55] *Daily News*, Oct. 16, 1848, p. 4, in the business column.

[56] *LWRSL*, Oct. 28, 1848.

[57] *Daily News*, Oct. 30, 1848, p. 4, business column.

[58] These three quotes are from *Railway Times*, Oct. 28, 1848, p. 1152, *Railway Gazette*, Nov. 4, 1848, p. 903, and *Herapath*, Nov. 4, 1848, p. 1160.

[59] *Daily News*, Oct. 30, 1848, p. 4.

[60] *Money Market Examiner*, Dec. 2, 1848, pp. 2–3.

[61] *Money Market Examiner*, Dec. 23, 1848, pp. 37–8.

[62]See, for example, *Railway Gazette,* Dec. 9, 1848, p. 983, and *Railway Record,* Feb. 2, 1849, p. 128.

[63]*Return of Number of Stamps issued at One Penny to Newspapers in United Kingdom, 1837–50*, Parliamentary Papers 1852 (42) XXVIII.497.

[64]The final issue, as well as many earlier ones, announced that the *Money Market Examiner* was to be replaced by a private broker's circular. Unfortunately I have not been able to locate this circular. As was mentioned earlier, a major gap in our knowledge of the investment scene at that time is the lack of a collection of brokers' circulars.

[65]However, after a while the relations between *Bankers' Magazine* and Nash appear to have cooled. This may have been because *Bankers' Magazine* decided Nash was too bearish. On the other hand, rivalry may have been involved. The advertising material at the front of the January 1849 issue of this journal announced that "An examination of the railway accounts will commence immediately; and as the discontinuance of the Editorial Articles of the *Railway Share List* leaves room for a critical dissection of the accounts in a financial journal *altogether unconnected with any Railway Interest*, it is believed these articles will be found useful to the public."

[66]*Select Committee of House of Lords on Audit of Railway Accounts. First and Second Reports, Minutes of Evidence, Appendix,* Parliamentary Papers, 1849 (371) X.1, 313.

[67]This account was dated Oct. 19, 1848, and appeared in the *Morning Chronicle* of Oct. 21. *The Times* only got around to presenting a summary on Oct. 23. The *Economist* presented a detailed account of it in its Oct. 28 issue.

[68]*Daily News,* Oct. 17, 1848, p. 4.

[69]*Railway Times*, Oct. 21, 1848, p. 1125.

[70]*The Times*, Oct. 12, 1848, p. 6.

[71]The *Economist* of Nov. 4, 1848, pp. 1241–42 noted that the LNWR "has materially changed its position by *indefinitely postponing*—and which the public understand as *altogether abandoning*" various lines on which work had not commenced yet.

[72]See, for example, his letter in *The Times,* Oct. 30, 1848, p. 4, or various discussions in the first few issues of *Money Market Examiner.*

[73]*Railway Chronicle*, Oct. 28, 1848, p. 761.

[74]*Railway Times,* Jan. 22, 1853, pp. 70–71.

[75]Had revenues reached the level of £609,340, then, assuming just 40% working expense ratio, the dividend rate might have reached 4.5%.

[76] *The Times*, Oct. 30, 1848, p. 4.

[77] *Bankers' Magazine*, vol. 8, July 1848, pp. 460–61.

[78] *Era*, Oct. 29, 1848, p. 9.

[79] The price data was obtained from the *Railway Times.* The line corresponding to Hudson's letter was placed on Oct. 25. His letter was dated Oct. 24, and appeared as an ad on the front pages of *The Times,* the *Daily News,* the *Morning Chronicle,* and presumably many other papers on Oct. 26. It is not unreasonable to suppose that it was distributed rather widely by the postal service (which had multiple daily deliveries in London) on Oct. 25, but that is debatable. Oct. 25 is also the day that the Committee of the Stock Exchange adopted the resolution confining the *LWRSL* to factual statements. Unfortunately I do not know how fast that information spread. There was a news story announcing the decision in the *Standard*, an afternoon London daily, on Oct. 27.

The letter from LNWR promising to provide a "financial statement" was dated Oct. 13, and appeared in *The Times* on Oct. 14. The line was placed on Oct. 14.

[80] For example, the *Daily News,* Oct. 16, 1848, p. 4, had a note based on a story in the *Observer,* almost surely the issue of Oct. 15, which provided considerable details on ways in which this statement was going to differ from Nash's "dissections."

[81] *Economist*, Nov. 4, 1848, pp. 1241–42.

[82] *The Times,* April 27, 1849, p. 8. Quilter was a partner in Quilter, Ball & Co., the firm that was the most prominent in railway accounting at that time. It was one of the many predecessors, through a long series of mergers, of Deloitte Touche Tohmatsu, see pp. 294–295 of [45]. This firm provided training to many other accountants who went on to gain fame or fortune.

[83] *The Times,* March 15, 1850, p. 8, South-Eastern Railway report. The accounting firm in this incident was again Quilter, Ball & Co. Of course, the elevation of accountants to the "Priesthood of Industry" was not without controversy. Recent scholarly literature has many citations to contemporary complaints of ignorance of railway realities, shoddy work, and the like.

[84] The sources for this section are the books [26,30,33,54], as well as the article "Twentieth Anniversary of the *British Australasian*" in the *British Australasian*, Oct. 6, 1904, pp. 1296–97, the obituary of the younger Nash in the *Daily Telegraph*, Feb. 27, 1920, and private correspondence with Malcom Gain, a direct descendant of the two Nashes.

[85] *Railway Chronicle*, Oct. 21, 1848, p. 742, and *Railway Times*, Oct. 28, 1848, pp. 1149–50.

[86] Based on [62] and the *Scottish Railway Gazette,* Sept. 6, 1845, p. 380, the initial proposal that was approved by Parliament in 1845 was for a line of about 45 miles at

a cost of £890,000. The expected annual revenues were to be £137,618, and provide a dividend of 10%. In 1846, a 22-mile extension was approved with a budget of £400,000. The projected cost was thus also about £20,000 per mile, and it appears reasonable to expect that revenue projections were similar to the main line from a year earlier. According to the *Railway Times,* Feb. 26, 1853, p. 224, the revenues for the line in the second half of 1852 came to £38,513, for an annual rate of £77,000. At that stage this railway had about 70 miles in service.

[87] *The Times*, Nov. 18, 1867, p. 8.

[88] *The Times*, Nov. 18, 1867, p. 8.

[89] A leader in *The Times*, Sept. 22, 1849, p. 4.

[90] *Money Market Examiner*, Sept. 8, 1849, pp. 481–82 admits growth in population, while Sept. 29, pp. 517–19 attacks *The Times.*

[91] *Herapath*, March 4, 1843, pp. 220–24.

[92] In this discussion I am avoiding the issue of the time value of money, compound interest, and the like.

Paying interest on calls was advocated strongly by the railway newspaper *Herapath* (as it is colloquially known, it started out as the *Railway Magazine* and became *Herapath's Railway and Commercial Journal.*) See the long discussion there in the May 1839 issue, pp. 209–15, in the leader "A few observations on the raising of capital, and hints to engineers" by John Herapath. While that issue does mention that the practice had been introduced earlier on some lines, *Herapath* would later take credit for its spread.

Herapath argued for paying interest on calls on the grounds it would lead to wider ownership of shares, and provide greater stability in prices. In practice, it seems that managers found its main advantage was in inducing more prompt payment of calls, see the testimony of Samuel Laing before a House of Lords committee, *Select Committee of House of Lords on Audit of Railway Accounts Third Report, ...,* Parliamentary Papers 1849 (421) X.469, p. 450.

[93] As just one example, consider the off-hand remark that "[t]he Bristol and Exeter is an instance on which even a year later half the dividend had been paid out of the capital," p. 76 of [63]. As another example, consider the long leader about the Great Western Railway, GWR, in *Herapath*, Aug. 14, 1847, pp. 937–39. Point #20 there has a strong insinuation that some items charged to capital account should have been classed with working expenses.

[94] The leader about GWR mentioned in the previous endnote, for example, in point #21 claimed that on some projects of that railway, construction materials were carried by GWR, and that regular freight charges were assessed on them, and charged to capital of those projects. This was regarded by the writer as improper!

[95] *Railway Times*, Aug. 14, 1847, p. 1039, col. 1.

[96] *Railway Times*, Feb. 17, 1844, p. 195. Three and a half years later, this same line used reserves, ones that had not not been cited explicitly before, to make up a dividend that profits did not justify. The *Railway Chronicle*, Aug. 21, 1847, p. 807 commented approvingly that it was "long aware that the Great Western Company were in possession of such a fund, derived from profits on the sale of shares, and we are glad to see it distributed among the shareholders at a time when it is most welcome."

[97] *Herapath*, Sept. 2, 1848, pp. 929–30, in a leader entitled "Depreciation fund. Captain Huish's report."

[98] [51], entry on "Companies" on p. 366 of the 1844 London edition.

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References

1. G. G. Acheson, C. R. Hickson, J. D. Turner, and Q. Ye, "Rule Britannia! British stock market returns, 1825–1870," *J. Economic History,* vol. 69, no. 4, Dec. 2009, pp. 1107–1137.
2. Anonymous, "Whishaw on railways," *Monthly Review,* Feb. 1841, pp. 215–220.
3. Anonymous, *Railways as They Really Are: Or, Facts for the Serious Consideration of Railway Proprietors. No. I. London Brighton and South Coast Railway,* Sherwood, Gilbert, and Piper, 1847.
4. Anonymous, *Railways as They Really Are: Or, Facts for the Serious Consideration of Railway Proprietors. No. II. The Dover, or South-Eastern Company. The Source of the Panic Traced by Facts; Its Evils, and Remedy,* Sherwood, Gilbert, and Piper, 1847.
5. Anonymous, *Railways as They Really Are: Or, Facts for the Serious Consideration of Railway Proprietors. No. VII. Lancashire and Yorkshire Railway,* 2nd ed., Sherwood, Gilbert, and Piper, 1847.
6. Anonymous, *Railways as They Really Are: Or, Facts for the Serious Consideration of Railway Proprietors. No. V. The Great Western and all Broad Gauge Lines,* Sherwood, Gilbert, and Piper, 1848.
7. Anonymous, *Railway Rescue: A Letter Addressed to the Directorates of Great Britain,* by "A Traveller of Many Lands," Effingham Wilson, 1848.
8. A. J. Arnold and S. McCartney, "The beginnings of accounting for capital consumption: disclosure practices in the British railway industry, 1830-55," *Accounting and Business Research,* vol. 32, no. 4, 2002, pp. 195–208.

9. A. J. Arnold and S. McCartney, ""It may be earlier than you think": Evidence, myths and informed debate in accounting history," *Critical Perspectives on Accounting,* vol. 14, 2003, pp. 227–253.
10. A. J. Arnold and S. McCartney, "Were they ever 'productive to the capitalist'? Rates of return on Britain's railways, 1830–55," *J. European Economic History,* vol. 33, no. 2, Fall 2004, pp. 383–410.
11. A. J. Arnold and S. McCartney, *George Hudson: The Rise and Fall of the Railway King,* Hambledon & London, 2004.
12. A. J. Arnold and S. McCartney, "The transition to financial capitalism and its implications for financial reporting: Evidence from the English canal companies," *Accounting, Auditing & Accountability Journal,* vol. 21, no. 8, 2008, pp. 1185–1209.
13. A. J. Arnold and S. McCartney, "'Veritable gold mines before the arrival of railway competition': But did dividends signal operating returns in the English canal industry?," *Economic History Rev.*, vol. 64, no. 1, Jan. 2011, pp. 214–236.
14. J. Aytoun, *The Railways and the Currency as Connected with the Present Monetary Crisis,* Adam and Charles Black, 1847.
15. R. P. Brief, "Nineteenth century accounting error," *J. Accounting Research,* vol. 3, no. 1, Spring 1965, pp. 12–31.
16. R. P. Brief, "The origin and evolution of nineteenth-century asset accounting," *Business History Review,* vol. 40, no. 1, Spring 1966, pp. 1–23.
17. R. Brown, ed., *A History of Accounting and Accountants,* T. C. & E. C. Jack, 1905.
18. R. A. Bryer, "Accounting for the 'railway mania' of 1845–a great railway swindle?," *Accounting, Organizations and Society,* vol. 16, no. 5/6, 1991, pp. 439–486.
19. R. A. Chandler, J. R. Edwards, and M. Anderson, "Changing perceptions of the role of the company auditor, 1840–1940," *Accounting and Business Research,* vol. 23, no. 92, Autumn 1993, pp. 443–459.
20. H. Clarke, "Contributions to railway statistics, in 1846, 1847, and 1848. No. I.–Passengers and fares," *Civil Engineer and Architect's Journal,* vol. 11, Aug. 1848, pp. 241–245. Reprinted as a pamphlet under the same title, John Weale, 1849.
21. H. Clarke, *Sovereign and Quasi-sovereign States: Their Debts to Foreign Countries,* Effingham Wilson, 1878. Reprinted from *Journal of the Statistical Society,* vol. 41, June 1878, pp. 299–341.
22. R. F. Cleveland, *Are Railways a Good Investment? The Question Considered, by an Examination of the Last Half-yearly Statements of the Six Leading Companies. The London and North Western Railway,* Effingham Wilson, 1848.
23. R. Cort, *Rail-road Impositions Detected: Or, Facts and Arguments to Prove that the Manchester and Liverpool Railway Has Not Paid One per cent. Nett Profit; And that the Birmingham, Bristol, Southampton, Windsor, and Other Railways, are, and must for ever be, only Bubble Speculations,* 2nd ed., W. Lake, 1834.
24. R. Cort, *Railway Reform: In a Letter to William Chaplin, Esq., M.P. Chairman of the London and South-Western Railway Company, Showing that the Liverpool and Manchester Railway Company Has* Not *Paid a Single Dividend Except Out of* Borrowed *Money; And that all other Railways are, and must be, in the Same Predicament. …,* Effingham Wilson, 1849.

25. C. F. Cotterill, *The Past, Present, and Future Prospects of the London and North Western, and Great Western Railway Companies; with* Pro-forma *Tabular Estimates of the Probable Nett Profit ...,* Effingham Wilson, 1849.
26. *The Economist, 1843–1943: A Centenary Volume,* Oxford Univ. Press, 1943.
27. J. R. Edwards, "The origins and evolution of the double account system: An example of accounting innovation," *Abacus,* vol. 21, no. 1, March 1985, pp. 19–43.
28. J. R. Edwards, "Depreciation and fixed asset valuation in British railway company accounts to 1911," *Accounting and Business Research,* summer 1986, pp. 251–263.
29. J. R. Edwards, *A History of Financial Accounting,* Routledge, 1989.
30. R. D. Edwards, *The Pursuit of Reason:* The Economist *1843–1993*, Hamish Hamilton, 1993.
31. H. Ellis, *British Railway History: An Outline from the Accession of William IV to the Nationalisation of Railways,* 2 vols., George Allen and Unwin, 1954.
32. D. M. Evans, *The City; or, The Physiology of London Business; with Sketches on 'Change, and at the Coffee Houses,* Baily Brothers, 1845.
33. C. Fenn, *Fenn's Compendium of the English and Foreign Funds, Debts and Revenues of all Nations; Together with Statistics Relating to State Finance and Liabilities, Imports, Exports, Population, Area, Railway Guarantees, ...,* 12th ed., "re-written by Robert Lucas Nash," Effingham Wilson, 1874.
34. J. Francis, *History of the Bank of England, Its Times and Traditions,* 2nd ed., 2 vols., Willoughby & Co., 1847.
35. A. D. Gayer, W. W. Rostow, and A. J. Schwartz, *The Growth and Fluctuations of the British Economy, 1790–1850: An Historical, Statistical, and Theoretical Study of Britain's Economic Development,* 2 vols., Oxford Univ. Press, 1953.
36. J. J. Glynn, "The development of British railway accounting: 1800–1911," pp. 327–342 in R. H. Parker and B. S. Yamey, eds., *Accounting History: Some British Contributions,* Oxford Univ. Press, 1994.
37. T. R. Gourvish, *Mark Huish and the London & North Western Railway: A Study of Management,* Leicester Univ. Press, 1972.
38. W. Harding, "Facts bearing on the progress of the railway system," *J. Statistical Society of London,* vol. 11, no. 4, Nov. 1848, pp. 322–343.
39. J. R. T. Hughes, *Fluctuations in Trade, Industry and Finance: A Study of British Economic Development, 1850–1860,* Oxford Univ. Press, 1960.
40. J. R. Killick and W. A. Thomas, "The provincial stock exchanges, 1830–1870," *Economic History Review,* N.S., vol. 23, no. 1, April 1970, pp. 96–111.
41. D. Lardner, "Railways at home and abroad," *Edinburgh Review,* vol. 84, no. 170, Oct. 1846, pp. 479–531. Available online at ⟨http://www.dtc.umn.edu/~odlyzko/rrsources/⟩.
42. D. Lardner, *Railway Economy; A Treatise on the New Art of Transport, its Management, Prospects, and Relations, Commercial, Financial, and Social, ...,* Harper & Brothers, 1850.
43. P. Lecount, *The History of the Railway Connecting London and Birmingham: Containing its Progress from the Commencement. To Which is Added, a Popular Description of the Locomotive Engine: And a Sketch of the Geological Features of the Line,* Simpkin, Marshall, and Co., 1839.

44. H. C. G. Matthew and B. Harrison, eds., *Oxford Dictionary of National Biography,* Oxford Univ. Press, 2004.
45. D. Matthews, M. Anderson, and J. R. Edwards, *The Priesthood of Industry: The Rise of the Professional Accountant in British Management,* Oxford Univ. Press, 1998.
46. G. O. May, "The influence of accounting on the development of an economy. III. Railroad retirements and depreciation," *J. Accountancy,* vol. 61, no. 3, March 1936, pp. 171–184.
47. S. McCartney and A. J. Arnold, "'A vast aggregate of avaricious and flagitious jobbing'? George Hudson and the evolution of early notions of directorial responsibility." *Accounting, Business & Financial History,* vol. 11, no. 2, July 2001, pp. 117–143.
48. S. McCartney and A. J. Arnold, "'Capital clamours for profitable investment, confidence has become eager and may shortly become blind': George Hudson and the 'railway mania' extensions of the York and North Midland Railway," *J. Industrial History,* vol. 4, no. 2, 2001, pp. 94–116.
49. S. McCartney and A. J. Arnold, "Financial reporting in the context of crisis: Reconsidering the impact of the 'mania' on early railway accounting," *European Accounting Review,* vol. 11, no. 2, 2002, pp. 401–417.
50. S. McCartney and A. J. Arnold, "The railway mania of 1845–1847: Market irrationality or collusive swindle based on accounting distortions?," *Accounting, Auditing & Accountability Journal,* vol. 16, no. 5, 2003, pp. 821–852.
51. J. R. McCulloch, *A Dictionary, Practical, Theoretical, and Historical, of Commerce and Commercial Navigation: Illustrated with Maps,* Longman, Rees, Orme, Brown, Green, & Longman, 1832.
52. R. D. Morris, "Distributable profit in nineteenth-century British regulated industries," *Accounting, Business and Financial History,* vol. 3, no. 2, Sept. 1993, pp. 165–195.
53. J. Morrison, *Observations Illustrative of the Defects of the English System of Railway Legislation, and of its Injurious Operation on the Public Interests; With Suggestions for its Improvement,* Longman, Brown, Green, and Longmans, 1846.
54. R. L. Nash, *A Short Inquiry Into the Profitable Nature of Our Investments. With a Record of More Than Five Hundred of Our Most Important Public Securities During the Ten Years 1870 to 1880,* Effingham Wilson, 1880.
55. A. M. Odlyzko, "Collective hallucinations and inefficient markets: The British Railway Mania of the 1840s," manuscript available at ⟨http://www.dtc.umn.edu/∼odlyzko/doc/recent.html⟩.
56. A. M. Odlyzko, "This time is different: An example of a giant, wildly speculative, and successful investment mania," *B. E. Journal of Economic Analysis & Policy,* vol. 10, issue 1, 2010, Article 60, ⟨http://www.bepress.com/bejeap/vol10/iss1/art60⟩. Preprint available at ⟨http://www.dtc.umn.edu/∼odlyzko/doc/mania01.pdf⟩.
57. A. J. Peacock, *George Hudson, 1800–1871: The Railway King,* 2 volumes, A. J. Peacock, 1988 and 1989.
58. H. Pollins, "Aspects of railway accounting before 1858," pp. 332–355 in A. G. Littleton and B. S. Yamey, eds., *Studies in the History of Accounting,* Richard D. Irwin, 1956.
59. H. Pollins, "Railway auditing–A report of 1867," *Accounting Research,* vol. 8, no. 1, Jan. 1957, pp. 14–22.

60. A. Preda, "The rise of the popular investor: Financial knowledge and investing in England and France, 1840–1880," *Sociological Quarterly,* vol. 42, no. 2, Spring 2001, pp. 205–232.
61. J. Rutterford, "From dividend yield to discounted cash flow: A history of UK and US equity valuation techniques," *Accounting, Business & Financial History,* vol. 14, no. 2, July 2004, pp. 115–149.
62. H. Scrivenor, *The Railways of the United Kingdom Statistically Considered, in Relation to their Extent, Capital, Amalgamations, Debentures, Financial Position, ...,* Smith, Elder, 1849.
63. S. Shaen, Jr., *A Review of Railways and Railway Legislation at Home and Abroad,* William Pickering, 1847.
64. A. Smith, *The Eastern Counties Railway Viewed as an Investment: With Statistical Information Taken from Parliamentary Papers, Showing the Powers Possessed by this Company of Raising Money. With Remarks on the Present and Prospective Outlay on the Eastern Counties District. Illustrated by References to Authorities with a View of Facilitating Inquiry,* Smith, Elder and Co., 1847.
65. A. Smith, *The Bubble of the Age; Or, the Fallacies of Railway Investment, Railway Accounts, and Railway Dividends,* 3 editions, Sherwood, Gilbert, and Piper, 1848.
66. A. Smith, *The Railway Returns Made to the Special Orders of the House of Lords, 1849-1850,* Effingham Wilson, 1850.
67. T. Tooke and W. Newmarch, *A History of Prices, and of the State of Circulation, During the Nine Years 1848–1856,* 2 vols., vols. 5–6 of Tooke's *The History of Prices from 1792 to the Present Time,* Longman, Brown, Green, Longmans, and Roberts, 1857.
68.
69. C. C. Wang, "Legislative regulation of railway finance in England," *University of Illinois Studies in the Social Sciences,* vol. 7, no. 1-2, March and June 1918, pp. 1–196.
70. H. Watts, "British railway audits: The long track from 1845 to 1868," *Accounting History,* vol. 4, no. 1, 1979, pp. 14–35.
71. J. Whitehead, *Railway Management: Letter to George Carr Glyn, Esq., M.P., Chairman of the London and North Western Railway Company,* 2nd ed., Smith, Elder, and Co., 1848.
72. T. J. Woodhouse, *Railway Property As It Is, and Railway Property As It Should Be; Or, An examination into the Causes of its Depression, and the Means Necessary to Retrieve it. ...,* "By a member of the Institution of Civil Engineers," Effingham Wilson, 1848.
73. York and North Midland Railway, *Reports of the Committee of Investigation,* Henry Sotheran, 1849.