

Carlos, Ann; Lewis, Frank

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The Profitability of Early Canadian Railroads: Evidence from the Grand Trunk and Great Western Railway Companies Spring 1991

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The Profitability of Early Canadian Railroads: Evidence from the Grand Trunk and Great Western Railway Companies Spring 1991

Ann Carlos

Frank Lewis

Department of Economics
Queen's University
94 University Avenue
Kingston, Ontario, Canada
K7L 3N6

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THE PROFITABILITY OF EARLY CANADIAN RAILROADS:
EVIDENCE FROM THE GRAND TRUNK AND
GREAT WESTERN RAILWAY COMPANIES

Ann Carlos and Frank Lewis

DISCUSSION PAPER #814

Ann M. Carlos
University of Colorado

Frank Lewis
Queen's University

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THE PROFITABILITY OF EARLY CANADIAN RAILROADS:
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ABSTRACT

This paper addresses whether government subsidies to two Canadian railroads built in the 1850s - the Grand Trunk and the Great Western - made economic sense. The historical literature suggests that these railroads, although privately unprofitable, were socially profitable. Through a careful study of company records, we find that the Great Western was socially profitable and that a relatively small additional subsidy would also have made it privately profitable. But the Grand Trunk was privately unprofitable and probably socially unprofitable as well. The form of the subsidy offered the railroads - loan guarantees - and the consequences, have a depressingly up-to-date ring. While the Great Western received small amounts of limited guarantees, the Grand Trunk received considerable aid. The Grand Trunk was then encouraged to issue large amounts of heavily discounted debt, which contributed to its eventual failure.

INTRODUCTION

It was not until the middle of the nineteenth century that Canada moved into the railroad era. Although railroads had been built in the United States some twenty years earlier, it was during the decade of the 1850s that Canadian construction began in earnest. With only 66 miles of track in 1850, Central Canada had, within ten years, nearly 2,000 miles of track, or three quarters of a mile per thousand inhabitants.¹ But far from bringing the shareholders the 11 to 15 per cent rates of return anticipated, these early railroads teetered on the brink of bankruptcy for most of their lives and were nationalized in 1917.

Yet when it comes to discussions of Canadian railroads, economists have shown far greater interest in the transcontinental or post-Confederation (1867) phase.² This is not to say the earlier railroad boom went unnoticed. Economic historians have extolled the ability of the Province of Canada to build an extensive and unified rail system, while telling the usual railroad story of corruption, greed, and government scandal. A.W. Currie begins his history of the longest line built, the Grand Trunk Railway, by stating that although this company has been "characterized as the world's worst commercial failure . . . it was, in fact a pioneer - in design and management, in finance and in the economic interrelations of Britain, the United States and Canada."³ O.D. Skelton makes the same assessment: "there had been waste and mismanagement, . . . , but the railways had brought indirect gain that more than offset the direct loss."⁴ A more directly economic perspective is given by William Marr and Donald Paterson who write: "examining only Canadian trade, the railways' contribution to social savings and indirect benefits are clearly positive and large," but "the railways of Central Canada were, on the other hand, not an unqualified success."⁵

The generally accepted view is that this first railroad boom, although financially unsuccessful, contributed greatly to the general development of the region. This is clearly an ex post assessment of the pre-Confederation construction phase. The ex ante expectation, on the other hand, was not only that the railroads would contribute to the general development of the region but also that private investors would enjoy large financial rewards. It was this combination of expected profitability and large social benefits that led the provincial government to promote railway building. The Grand Trunk Railway Company, for example, received over £3 million in government loan guarantees during its early construction phase.

Although the motivation for government involvement differs, there are striking parallels between the history of the Grand Trunk Railway Company of Canada and the Union Pacific Railroad.⁶ As Robert Fogel documents, every history of the Union Pacific praises the joining of the country from coast to coast while at the same time decrying the political manoeuvring, bribery, and corruption. This is also the history of the Grand Trunk Railway, a line that linked the Province of Canada from Sarnia to Montreal and from Montreal to Portland on the Atlantic seaboard, since coloring this achievement have been claims that the British construction company of Peto, Brassey, Jackson, and Betts "foisted a 'job' on the Grand Trunk and then quietly withdrew, leaving the company to work out its own salvation." In addition, Sir Francis Hincks, premier of the province, and some members of his cabinet were allegedly corrupt in their dealings with the railroad. These allegations led to the formation of special legislative committees of investigation, first in 1857 and then in 1861.⁷

Given the vast literature on railways, it is surprising that no one has examined the widely-held view that lines built during the first Canadian railroad boom were privately unprofitable but socially desirable. Here we address this issue by examining two of the lines, the Grand Trunk Railway Company of Canada and the Great Western Railway Company. Together they accounted for 70 percent of the track built during the 1850s and one, the Grand Trunk, received a large amount of government aid. We find that for each line both the ex post unaided and ex post aided private rates of return lie below the market rate. The ex post social rate of return lies below the market rate for the Grand Trunk and above that rate for the Great Western. Our findings on private profitability are consistent with the historical literature, but our estimate of the Grand Trunk's social profitability suggests that the £3 million subsidy it received might have been used more efficiently elsewhere in the economy.⁸ Indeed, if some of this aid had been given to the Great Western, it would have been in a far more stable financial position. We also argue that the form of the government aid, guaranteed bonds, may have contributed to the Grand Trunk Railway's financial difficulties.

THE CENTRAL CANADIAN ENVIRONMENT AND GOVERNMENT LEGISLATION

The timing and pattern of railroad construction in Canada differed from its southern neighbor. Not only did the first period of major construction occur later than in the United States, but government was more directly involved. The provincial government granted financial aid, legislated a uniform gauge, specified those companies comprising the main trunk line, and helped determine the location of that line. This occurred while state

governments in the United States were moving away from direct involvement with railroads.⁹

Whatever the lag in actual construction, Canadian railroad companies began to emerge almost as early as in the United States. The first railroad was chartered in Central Canada in 1832, and many more were chartered in subsequent years, but they were unable to proceed with actual construction. The capital market in Canada was small; Ontario, the province with the largest number of companies chartered, was only partially settled; and the government had no independent source of funds.¹⁰ With the union of Ontario and Quebec in 1841 and the rapid growth of Ontario's population, some of these problems were solved. However, the newly unified province immediately became involved in canal construction on the St. Lawrence River rather than in railroads. As a result, Ontario and Quebec had, by 1848, a well-developed water route from the Upper Lakes to Montreal with a canal capacity that far outstripped its shipping requirements.¹¹

The St. Lawrence canal system was intended to channel the products of the Great Lakes drainage basin to Montreal and then on to England. As early as 1825, the Erie Canal threatened the primacy of the St. Lawrence, but the Canadian route was protected, at least early on, by the Corn Laws, Navigation Acts, and high American tariffs. In 1846 with the end of colonial privilege and with the drawback legislation in the United States, which allowed products for re-export to move through that country in bond, the dominance of the St. Lawrence route was again put at risk. These events caused a crisis within the province and, in spite of the well-developed water route, led to a call for a more modern mode of

transportation that would allow the province to compete for the midwestern trade and reestablish Montreal as a leading entrepot.

Vocal demand for railroads elicited a government response, but the government's intention was to help the railways acquire funds on capital markets rather than to build lines themselves. The first general railroad act, the Guarantee Act of 1849, guaranteed the interest on loans of companies chartered by the legislature of the province.¹² The guarantee, which was available to any company building a line at least 75 miles long that was at least half completed, provided for the interest on a sum up to half the company's expenditure. But the rate was to be no greater than 6 percent; the government was to have first charge on the tolls and profits of the company; and no dividends could be paid unless a sinking fund equal to 3 percent of the loans outstanding was set aside annually. Despite these constraints, it was believed that such aid would make it easier for companies to float shares and bonds, and because the railroads would be profitable ventures, the guarantees would cost the government nothing. In fact most guarantees were eventually converted into cash subsidies.

In 1851 the government altered the terms of the Guarantee Act with an "Act to Make Provision for the Construction of a Main Trunk Line." Now the guarantee was "restricted and confined to those railroads which may form part of the said Main Trunk Line."¹³ In essence the government was trying to ensure that assisted lines would form part of a unified system that would move commodities and people along the St. Lawrence route. The act defined the main trunk line to include those lines that would run from Detroit/Windsor to Montreal and then on to Portland (see Map). The government also mandated a gauge, and

although restricting the number of lines that could apply for the guarantee, it relaxed the mileage provision. Now any company whose line was longer than 100 miles could divide it into sections of not less than 50 miles, each section being viewed as a distinct railroad for the purposes of the act. The act also extended the guarantee provisions to principal as well as to interest. A second act was passed in 1851. "An Act to Consolidate and Regulate the General Clauses relating to Railways," otherwise known as "The Railway Clauses Consolidation Act," covered all railroads unless the individual acts of incorporation specifically exempted them.¹⁴ This legislation specified various conditions companies had to meet with respect to capital stock, shareholders, bridges, fences, rights-of-way, and so on.

The provincial government quickly recognized that individual municipalities would not be able to provide funds on their own, especially for branch and feeder lines now disqualified by the Main Line Act. Thus in 1852, the legislature passed an "Act to Establish a Consolidated Municipal Loan Fund for Upper Canada." The preamble stated that such a fund "would greatly facilitate the borrowing upon advantageous terms of such sums as may be required . . . for effecting or aiding in effecting important works."¹⁵ This fund allowed individual municipalities to borrow from the fund rather than on the open capital market. In return for their debentures, municipalities received cash or provincial debentures which would be given to railroad companies in return for stock. These debentures stated that "the Provincial Government undertakes to pay the principal sum mentioned in them and the interest thereon, out of monies forming part of the Consolidated Municipal Loan Fund, and out of no other monies or funds whatsoever."¹⁶ Although the Municipal Loan Fund Act was intended to be self-financing, the provincial government became liable for all monies

lent to railroad companies by municipalities in the event that the railroads were not successful. In 1859 the government dissolved the fund and acquired a debt of almost £2 million.¹⁷

ECONOMIC ISSUES IN CANADIAN RAILROAD CONSTRUCTION

The literature on Canadian railroads, summarized briefly above, argues that the railroads were necessary for the continuing development of the country, especially in light of railroad development in the United States. The possibility that American lines would divert traffic from the existing Canadian infrastructure as well as the presumed benefits from having a rail system put pressure on the government to aid railroad construction. The contemporary view was that railroads would be financially profitable but the small size of the Canadian capital market made it impossible for them to raise sufficient funds locally. Funds could be obtained on the London market, but here Canadian companies were hurt by English investors' ignorance of the region. This was where government bond guarantees could increase accessibility.

There is a strong element of boosterism in the contemporary view that, once constructed, railroads would be privately profitable, but one might have expected that the early railroads built through the developed areas of southwestern Ontario would be successful. Historians, however, see these lines as financial failures even with the government subsidies. The issue of unaided and aided private profitability has been asked of the land-grant American lines by Lloyd Mercer and of the Canadian Pacific Railroad by both Mercer and Peter George.¹⁸ Mercer finds great variability in the unaided and aided

private rates of return across the lines studied. Here we follow Mercer's methodology, which allows us to measure the ex post private rates of return to the Grand Trunk and Great Western Railways and to compare these lines with the U.S. land grant railroads and the Canadian Pacific Railway.

Contemporaries not only argued that the early Canadian railroads would be successful, they also convinced the provincial government to aid these companies on the grounds that the lines would protect the existing trading network and encourage further development within the region. The commitment to railroad development was, in fact, a commitment to a policy of "defensive expansionism."¹⁹ The current view seems to be that the lines were socially profitable and on these grounds government aid was justified. Yet no assessment has been made of the social profitability of the early Canadian lines and in particular of the Grand Trunk line which received the lion's share of government help. The question of the social profitability of a line is also not new. Fogel addressed the issue in his study of the Union Pacific as did Lloyd Mercer in his study of the land-grant railroads. The methodology of studying social profitability has itself generated much controversy, a point we will return to later.²⁰

One justification for governmental involvement in the building of infrastructure is that such projects promote faster growth in a region, and without government help, these projects might be delayed. But as Fogel points, inherent in such "premature" enterprises is "a real dichotomy between sound private investment principles and public or national necessity."²¹ Railroads face the additional problem that a market for their services often does not develop until after the line is completed. This may require, what is sometimes

described as, building ahead of demand, which in turn can create a financial obstacle for railroad companies.²² They must secure the financing necessary to build the line before they earn any revenue. Government loan guarantees can alleviate the problem by improving access to capital markets, but such aid may have serious consequences for a company's financial viability: bond guarantees encourage firms to issue more debt, thereby increasing the likelihood of bankruptcy.²³ We suggest the Grand Trunk Railway may be a case in point. Encouraged by legislation, it acquired a large bonded debt which put the company in a precarious financial position. To make matters worse, it also was a line for which the private rate of return was far below the market rate.

PRIVATE RATES OF RETURN: THE GRAND TRUNK RAILWAY AND THE GREAT WESTERN RAILWAY COMPANIES

The Great Western Railway was initially incorporated in 1834 as the London [Ontario] and Gore Railroad Company. The act of incorporation gave the company until 1845 to build a line, but nothing was done. Due to lapse, the act was amended and the name of the company changed to the Great Western Railroad. It was now authorized to build from some point on the Niagara River to Windsor and was to service the southern part of Ontario, linking with American lines in New York and Michigan. Options on 55,000 shares were quickly taken in Britain and 5,000 in Canada, but the railroad boom in Britain collapsed before any money was paid. The company then took advantage of the Guarantee Act to sell stock and bonds. Construction commenced in 1851, and the line was open for traffic in late 1853.²⁴

The history of the Grand Trunk Railroad is more complex.²⁵ This railway grew out of a desire on the part of the British North American colonies for an all-weather link. By 1850, it was believed that the Imperial Parliament in Britain would subsidize an intercolonial line, and the British construction firm of Peto, Brassey, Jackson and Betts showed interest in building it. But with the decision of Lord Derby and the English government not to help with financing, the Premier of Canada, Sir Francis Hincks opened direct discussions with Peto and associates. The line was initially intended to run from Montreal to Toronto where it would join the Great Western, but through a series of particular circumstances, the Grand Trunk was extended from Montreal to Quebec City and from Toronto to Sarnia on Lake Huron. The Grand Trunk also leased the St. Lawrence and Atlantic which ran from Montreal to Portland. Once completed the Grand Trunk, at over 1,000 miles, was one of the longest railways in existence. Because of its length and because of the direct involvement of Hincks, the company was allowed to use the Guarantee Act up to only £727 (\$3,000) per mile rather than for fully half of the cost of construction.

The first question addressed here is the extent to which the Grand Trunk and Great Western Railways, which accounted for over 70 percent of track in the province, were privately profitable. We derive ex post private rates of return using the same approach as Lloyd Mercer in his analysis of six American land grant railroads and the Canadian Pacific Railway mentioned above.²⁶ The internal rate of return is the solution to:

$$\sum_{t=1}^T \frac{R_t - C_t - I_t}{(1+r)^t} + \frac{A}{(1+r)^T} = 0, \quad (1)$$

where R is the operating revenue, C is the operating cost, I is gross investment expenditures, A is the estimated value of the firm in the terminal year, and r is the internal rate of return. Like Mercer we adjust for the cost of leased lines and also base our estimates on actual construction cost rather than on the book value of each railway's securities. Actual construction costs and the book value of a railway's securities will diverge if the stocks and bonds of the company are discounted. In this latter regard the Grand Trunk did issue discounted securities. All too often in the railroad literature discounting has been taken as evidence of stock manipulation, but this is only one reason why securities might sell at a discount. As Fogel points out in his analysis of the Union Pacific, railroad companies might be forced to sell securities at a discount to obtain sufficient funding to allow them to commence construction or to finish construction already started. The existence of laws limiting the interest rate payable on the securities could also result in a security selling at a discount. We argue below, however, that the discounted bonds that Grand Trunk issued may have had more to do with the type of aid the railway received than with any usury laws or even the inherent riskiness of the project.

The rate of return to the Grand Trunk is derived for the period 1853, the year in which it was formed, to 1882, the year in which it amalgamated with the Great Western. Figure 1 shows the path of revenue, expenses, and net revenue from 1853 to 1882. Our estimates are based on the company's semi-annual reports, which offer a complete series of revenues and costs, including capital costs.²⁷ The Grand Trunk was grossly over-capitalized. Bonds, and especially shares, sold at large discounts, and the company often issued securities in lieu of interest or dividend payments. As a result, the reported

capitalization exceeded the true cost of the line, the rolling stock, and other physical assets. To allow for this, we include in gross investment only reported expenditures, excluding interest, discounts, and other components that entered the company's capital account. Indeed, even reported investment outlays must be adjusted downward. As noted in Currie, Peto and Company, the chief contractor for the Grand Trunk, received some payments in company bonds and shares.²⁸ These were valued at par for the purpose of recording expenditure by the railroad even though their market values were much less. To compensate, Peto and Company inflated its reported costs. In deriving our estimates we, therefore, have used the market value of securities to adjust reported capital expenditures downward.²⁹

Table 1 presents the book value, reported capital cost, and adjusted capital cost for selected periods. The book value of the Grand Trunk approximated its construction cost in 1853 and 1854; and in 1855 its book value exceeded true expenditures by only 5 percent, but by 1857 book value was nearly 25 percent above expenditures. During the 1860s and 1870s, the book value of the Grand Trunk continued to grow rapidly despite a sharp decline in the rate of gross investment. As a result, by 1880 the railway's book value was more than double its true capital cost.³⁰

Much of the negative assessment of the Grand Trunk, both by contemporaries and historians, may be due in part to a comparison of the railway's net returns to its book value. Certainly on the basis of such a comparison, the railway did very poorly. We estimate an ex post (unaided) private return of -3.7 percent. As a reflection of the return to the project, this rate is far too low. In Table 2, we present ex post private rates of return using our best

estimates of the railway's actual cost. We estimate that, unaided, the railway would have provided private investors a return of 1.7 percent. This is much lower than the normal rate for the period, which was about 6 percent, and also lower than any of the equivalent rates estimated by Mercer for the railroads in his sample.³¹ Although the private return is low, it is not unusually so compared with the Canadian Pacific Railway, generally regarded as the success story of Canadian railway history. Mercer estimates that unaided the Canadian Pacific Railway would have yielded an ex post return of 2.4 percent, which is only 0.7 percent above the rate we estimate for the Grand Trunk.³²

The Grand Trunk Railway, like the Canadian Pacific, was subsidized, although the subsidy came in a different form. The Canadian Pacific received direct aid: cash grants, land grants, and aid to construction; whereas the Grand Trunk was provided guaranteed provincial debentures under the Guarantee Act. When issued, these debentures were given first priority on the firm's assets, but as the financial position of the firm worsened, the priority was reduced and eventually both interest and principal were forgiven. The railway received these debentures between 1853 and 1858, by which time they totaled £3,115,000 sterling. Incorporating this subsidy in our calculations gives an aided private rate of return of 3.0 percent.³³ This rate is far below the 8.4 percent ex post aided rate of return estimated by Mercer for the Canadian Pacific. The small gap in unaided rates and the large gap in aided rates of return suggests that differences in the ex post profitability of the projects to the private investors had more to do with the size and type of subsidy each railway received than to differences in their intrinsic profitability.

The Grand Trunk is sometimes criticized in the historical literature for having been, in Fogel's terms, a premature enterprise. Certainly the railway's net returns during the 1850s were very low. Early problems with construction may account for part of the poor performance, but more fundamental may have been the lack of demand for rail services in the early years. To test the proposition that the 1853 starting date was too early, we have recomputed rates of return starting in 1861 but otherwise apply the same aggregate investment expenditures.³⁴ Our estimates provide some support for the view that the enterprise was premature. Had construction of the Grand Trunk lines been delayed to 1861, the unaided rate of return would have increased by 0.5 percent, which would have made the railway comparable to the Canadian Pacific in intrinsic profitability. More importantly, with the delay in construction, the same government subsidy would have provided a rate of return to private investors only about one percent below the normal rate of 6 percent.³⁵

The Great Western was one of the first railway companies to operate in Canada, commencing operations in late 1853. It ran through some of the most populated areas of southwestern Ontario and provided an important link to the U.S. midwest. It also was viewed *ex ante* as profitable and successful. Company bonds and shares sold quickly and at a premium in the London market. Yet this line, like the Grand Trunk, has been viewed as a commercial failure. As Currie puts it: "From first to last it was badly managed."³⁶ While Currie's view of the management may be valid, the *ex post* rates of return implied by the revenue and cost data suggest that the Great Western was significantly more profitable than either the Grand Trunk or the Canadian Pacific (see Figure 2 and Table 2). We estimate the unaided private rate of return to be 4.1 percent. Although this is below

the normal rate, it exceeds the rates of return on the Canadian Pacific and Grand Trunk by 1.7 and 2.4 percentage points, respectively.³⁷

The provincial government offered loan guarantees to the Great Western as it did to the Grand Trunk, but these guarantees were, in total, much smaller, £700,000 rather than £3,115,000. In July 1860 the loan guarantees were only 13 percent of the company's book value (£5,204,000) and only 15 percent of the estimated capital cost (£4,568,000). The latter figure for the Grand Trunk was roughly 30 percent. In addition, since the loans to the Great Western were almost fully repaid almost no subsidy was granted ex post. Had the loan guarantees been converted into a subsidy, investors in the Great Western would have earned a rate of return of 5.2 percent, suggesting that a relatively small subsidy would have made the Great Western a privately profitable venture.

SOCIAL RATES OF RETURN: GRAND TRUNK RAILWAY AND GREAT WESTERN RAILWAY

More important than the issue of private profitability, at least from a policy perspective, is the question of whether the government decision to encourage the railways to proceed was appropriate. To help answer this question we have derived social rates of return based on estimates of the consumers' surplus of those who demanded railroad services. This approach is conceptually the same as social savings, since social savings also measures the net benefit of using railroads rather than a higher cost alternative; however, because we must choose a somewhat arbitrary demand elasticity, our estimates are necessarily less accurate. The demand elasticities we select are based on the assumption that the Grand Trunk and Great Western priced as profit-maximizing monopolists.³⁸ This

allows us to generate what we regard as plausible, downwardly-biased, estimates of the true social rate of return. In Figure 3, we represent consumers' surplus assuming a linear demand and a constant marginal cost.³⁹ Under these assumptions the per-period social return is given by

$$SR = pq + \frac{(a - p)q}{2} - cq \quad (2)$$

where p is price, q is output, c is marginal cost, and a is price where demand is zero.

Substituting the profit-maximizing condition:

$$p^* = \frac{a+c}{2}, \quad (3)$$

we derive the social return to be

$$SR^* = \frac{p^*q^*}{2} \left(3 - \frac{c}{p^*} \right) - cq^*, \quad (4)$$

where an asterisk indicates the profit-maximizing value. From equation 4, it follows that the private return is converted to the social return by multiplying total revenue by a factor that depends on the ratio of marginal cost to price. Note that if $c=p^*$, the firm, as a profit-maximizer, must face a perfectly elastic demand in which case the social and private return would be the same. The ratio, c/p^* , is central to the social return calculation. For both

railways we base it on the ratio of all costs, excluding capital costs, to total revenue. It should be noted that expenditures on maintenance and renewals are included in operating costs. To the extent that these are more appropriately treated as part of capital, we are overstating the ratio, c/p^* , and hence understating the social return.⁴⁰ Recognizing that our estimates are biased downward, we estimate that the Great Western Railway generated a social rate of return of 6.1 percent, which is just above the normal rate of 6 percent. Therefore, even though the Great Western was not a privately profitable project, our social return estimate suggests it was a socially desirable one.

Our estimate for the Grand Trunk Railway has a very different implication. We estimate that the social rate of return was 2.8 percent, well below the normal rate. Had the project had been delayed, though, the social rate of return would have been higher. If an 1861 starting date is assumed, the social rate of return is estimated to be 3.6 percent. This suggests that the problem with the Grand Trunk was partly one of timing. Perhaps the government was overly-optimistic about the early demand for rail services or overly-optimistic about the ability of the operators during the early years to run a socially desirable if not privately profitable line. Finally, given the biases associated with our procedure, we can conclude only that the Grand Trunk may have been a socially undesirable investment.

FINANCING THE GRAND TRUNK RAILWAY

As illustrated in Table 1 and also noted by Currie, the Grand Trunk was financed with discounted stocks and bonds. The use of discounted bonds, in modern parlance - junk bonds - may appear inconsistent with the insights of Modigliani-Miller. According to the

simplest version of their model, the value of a firm does not depend on the proportions of the firm's investment which are financed with debt and equity. That model, however, assumes no bankruptcy costs. Where bankruptcy costs are significant, the optimal strategy is to avoid these costs completely by issuing a face value of debt no greater than the liquidation value of the firm. Since such debt will be fully secured by the firm's assets, it follows that the optimal strategy is inconsistent with the issuing of discounted or junk bonds. This result extends to very risky projects, which should be financed almost entirely with equity.

In their analysis of a post-Confederation prairie railroad, the Canadian Northern Railway, Frank Lewis and Mary MacKinnon have shown that the optimal debt condition changes if the government offers to guarantee some of the firm's debt.⁴¹ The firm now maximizes its ex ante present value by issuing debt with a face value equal to the sum of its liquidation value and the full amount of the guarantees. This implies a positive bankruptcy probability because the firm's assets may not be sufficient to cover all debts. Whether or not the firm's bonds sell at a discount, however, also depends on how certain are investors of a government bailout in the event of bankruptcy. In the case of the Canadian Northern, for example, bonds were not discounted despite a high bankruptcy probability, because the railway's debt was fully secured by a combination of the firm's assets and the government guarantees.

The same was not true of the Grand Trunk, and the difference, we argue, was in the nature of the government commitment. The Grand Trunk, Great Western, and Canadian Northern received loan guarantees, but in the case of the Grand Trunk, the status of the

loan guarantee was unclear. At the outset the loan guarantees had first priority on the firm's assets, but once the Grand Trunk got into serious financial difficulty, the status of the government loans was reduced. Now company bonds had first call on the assets of the company. Since ex post the status of the guarantee changed, we argue that ex ante the value of the government loan guarantee was uncertain. Indeed, as we discuss later, although the government made a definite commitment initially, the view of the investors was of a much more open-ended government policy.⁴²

We model this arrangement by assuming that government offers a loan guarantee that is uncertain; that is, will be honored with probability less than one. Bonds with first claim on the firm's assets are secure, but those backed by the uncertain loan guarantee have an ex ante value of:

$$V_G = [1 - (1-p)\pi]G, \quad (5)$$

where G is the face value of the loan guarantee, π is the probability of bankruptcy, and p is the probability the guarantee will be honored in the event of bankruptcy. In this formulation, the larger the (potential) loan guarantee, G , the higher the probability of bankruptcy (since the firm will take on more debt) and hence the greater the discount on the unsecured bonds.

The provincial loan guarantees to the Grand Trunk Railway, which totalled £3,111,500 by June 30, 1858, were given priority over the railway's assets. This reduced the effective guarantee. However, the status of the provincial debentures was reduced in the late 1850s, suggesting the government commitment to the Grand Trunk extended beyond

the initial value of the early loans. Provincial support for the Grand Trunk was less certain than in the case of the Canadian Northern Railway; nevertheless, the guarantees still allowed the Grand Trunk to raise substantial amounts on the bond market. It should be noted, however, that because the support from the government was uncertain, these bonds, sold at a discount.⁴³

Government subsidies mattered. In its review of 1852, the London Times reported:

During the concluding portion of the year, various loans and enterprises of all descriptions, home and foreign were introduced, the chief temptation employed being that of state guarantees . . . a system mainly traceable to the want of self-reliance, which, since the railway Mania has led people to prefer any undertaking backed with even as indifferent guarantee to the noblest enterprises dependent upon their own judgement.⁴⁴

Subsequent to the sale of the Grand Trunk shares, the Times laid out the level and the type of government involvement. At the same time, the public was given a somewhat wider interpretation of this aid package, one that implied a more open-ended commitment. Columnists talked about the line being "supported by the government" and that "in Canada the Board comprises some of the principal members of Parliament." Potential investors were told that in matters relating to the Grand Trunk that they "had to deal with Messrs. Glyn and Baring as the financial agents of the Canadian Government."⁴⁵ In addition, when the prospectus for the line was issued, appended to it was a report on the growth potential of the province from Lord Elgin, the Governor General, to Sir John Pakington,

the Colonial Secretary. Although the report says nothing about the Grand Trunk, by using it in this manner, the company "sought to convey the impression that Lord Elgin was endorsing the Railway."⁴⁶ Thus, while investors were informed of the actual nature of the aid, the packaging in which this information was placed suggested the possibility of a greater government role.

Certainly complaints of the shareholders in early 1861, when the company was once again in serious financial difficulty, suggest that some had a wider interpretation of the level of government support. Investors wrote:

that it was in bona fide reliance upon the representations put forward as from the Canadian Government in this [GTR] prospectus that, in 1853, the petitioners and other persons became subscribers to the Grand Trunk Railway, and in the full persuasion that a Colonial Government which had sought assistance in England in a form so public and conspicuous would at all time be ready to extend to the obligations thus incurred . . .⁴⁷

Herapath's Railway and Commercial Journal summed up the views of the ordinary bond holders in a similar manner. It traced

the whole of the misfortunes of the company to the conduct of the Canadian Government, since the Government knowing the quantity of traffic the line would have, must have been aware that it was not just to ask English people for their capital for such an enterprise unsupported and unprotected by a guarantee.⁴⁸

Although both quotations describe only, after the fact, what people believed, they do suggest that at least some of the investors saw the government commitment as being more open-ended than laid out in the Guarantee Act. This would, in turn, affect the quantity of bonds which the company could sell and because of the uncertain nature of the commitment, these bonds would have to sell at a discount. Indeed, the debt-equity ratio was far in excess of what is considered appropriate for a non-subsidized firm.⁴⁹ In 1854 the ratio was high but still a fairly reasonable 1.7, but by 1858 the ratio was 3.0 (see Table 3).⁵⁰ Moreover, because much of this debt had been sold at a discount, the face value of the firm's debt on June 30, 1858, was 82 percent of actual capital expenditures. This meant that an ex post return just slightly below the normal rate of return would have been enough, in the absence of government support, to drive the firm into bankruptcy. Of course the actual ex post return was far below the normal rate. Despite this the railway's bonds, while discounted, still sold at prices substantially higher than the company's shares.⁵¹ These prices, then, must have reflected, not investor confidence in the viability of the Grand Trunk, but rather the view, eventually borne out, that the government would bail investors out should the railway get into more serious trouble.

The financing of the Great Western is also consistent with our view of implicit and explicit government loan guarantees. In contrast to the Grand Trunk, the Great Western received little support ex ante and almost none ex post.⁵² This comparative lack of government involvement was reflected in the way the railway was financed. The debt-equity ratio remained well below one throughout its history, and unlike the Grand Trunk, the

Great Western sold no junk bonds. Even when its shares were selling at significant discounts, its bonds sold very close to par or, typically, at a premium.

The experience of the Grand Trunk may have implications for the financial problems currently facing U.S. firms and banks that became involved in the junk bond market. Some savings and loan associations were among the heaviest purchasers of junk bonds, and many are threatened with bankruptcy or have gone bankrupt. Most of their losses though, will be covered by the U.S. federal government which by law insures these banks' deposits.⁵³ This, of course, was known when the risky investments were undertaken. Thus deposit insurance, which is a form of government loan guarantee, may explain why some savings and loan associations became big players in the junk bond market and made other very risky investments, mainly in real estate.

CONCLUSION

The Great Western and the Grand Trunk Railways were two of the earliest lines built in the Province of Canada. Together they comprised over 70 percent of the rail line constructed during the decade of the 1850s. The historical literature on these two companies argues that, although they turned out to be privately unprofitable, they were socially necessary for the development of the area. For this latter reason the government was correct in subsidizing them. We attempt here to assess the historical view by measuring the degree to which these two lines were privately or socially profitable.

We begin by estimating the unaided and aided private rates of return to the Great Western and the Grand Trunk. Our unaided private rates of return show that the current

historical literature is correct in its assessment. Both lines had ex post private rates of return below the market rate. At the same time the Great Western performed better than the Canadian Pacific, which is considered to be a "successful" line in Canadian historiography and the Grand Trunk performed just marginally worse than the Canadian Pacific. The government subsidized the Grand Trunk and, to a much lesser degree, the Great Western, but our estimates of the aided private rates of return show that the subsidies were not large enough to make either railway privately profitable.

Our examination of the social rates of return for these two companies shows that although the Great Western was a socially profitable venture, the same cannot be said for the Grand Trunk; but we cannot say that this was a socially unprofitable venture either because of the downward-biased nature of our calculation. It is possible that with a more complete accounting of all benefits, the Grand Trunk could be shown to have been a socially desirable line as well.

The aid given to Canadian railroad companies came in the form of bond guarantees. In the case of the Grand Trunk, we argue that the form of the subsidy and the market perception of government actions resulted in a very high debt to equity ratio. It also resulted, down the road, in a situation where the government was forced to "bail out" the Grand Trunk to preserve the stability of the market for Canadian bonds.

ENDNOTES

1. The Dominion of Canada grew out of the confederation, in 1867, of most of the existing British North American colonies. To help the reader, we use post-Confederation names for the provinces of Central Canada: Ontario and Quebec. From 1797 to 1841 these provinces were known as Upper and Lower Canada, and each had its own legislature. In 1841, the two colonies were merged to form the Province of Canada, which differentiated the two areas by calling them Canada West and Canada East. With Confederation, the Province of Canada was divided into the two existing provinces. The total railway mileage for Ontario and Quebec in 1861 was 1,856 miles, and the population of the region was 2.5 million, most of whom lived in rural areas. J. M. Trout and Edward Trout, The Railways of Canada for 1870-71 (Toronto, 1871), pp. 35-36; and Historical Statistics of Canada (2nd edn., Ottawa, 1983), pp. A2-14.
2. The following represents some of the research on the transcontinental phase. Harold A. Innis, A History of the Canadian Pacific Railway (Toronto, 1971); Peter J. George, "Rates of Return in Railway Investment and Implication for Government Subsidization of the Canadian Pacific Railway: Some Preliminary Results," Canadian Journal of Economics, 1 (Nov. 1968), pp. 740-62; Lloyd J. Mercer, "Rates of Return and Government Subsidization of the Canadian Pacific Railway: An Alternate View," Canadian Journal of Economics, 6 (Aug. 1973), pp. 428-37; and T. D. Regehr, The Canadian Northern Railway: Pioneer Road of the Northern Prairies, 1895-1917 (Toronto, 1976).
3. A. W. Currie, The Grand Trunk Railway of Canada (Toronto, 1957), p. 31.
4. O. D. Skelton, The Railroad Builders: A Chronicle of Overland Highways (Toronto, 1916), p. 94.
5. William L. Marr and Donald G. Paterson, Canada: An Economic History (Toronto, 1980), pp. 318-19.
6. Robert W. Fogel, The Union Pacific Railroad: A Case in Premature Enterprise (Baltimore, 1960).
7. Currie, Grand Trunk, pp. 35, 67-68.
8. As noted below, we must be equivocal about this finding because of the downward biases associated with out social return calculation.
9. For a detailed discussion of American railroad construction and the role of government, see Albert Fishlow, American Railroads and the Transformation of the Ante-Bellum Economy (Cambridge, Mass., 1965).

10. The main source of funds for the British North American colonies at this time was tariff revenue. Unfortunately for Ontario, it was upriver from Montreal. Thus all imports were landed at Montreal and assessed duty at that port even if the final destination was Ontario. Although a formula for the division of the import duties existed, the share going to Ontario was a continual source of conflict. Ontario argued that it was not receiving its due share. Ontario was also growing faster than Quebec, and it was on the Ontario section of the St. Lawrence that most of the canal construction was needed. To overcome these problems the two provinces united in 1840/41. As part of the union agreement, the British government guaranteed the interest payments on a £1.5 million loan to be used for improvements to infrastructure.

11. Thomas F. McIlwraith, "Freight Capacity and Utilization of the Erie and Great Lakes Canals before 1850," Journal of Economic History, 36 (Dec. 1976), pp. 852-75.

12. Province of Canada, Legislative Assembly, 12 Victoriae c. 29.

13. Ibid., 14 & 15 Vic. c. 73. The railroads specified as part of the main trunk line were the Great Western (main line only), the St. Lawrence and Atlantic (Montreal to the Maine border), and the Ontario Simcoe and Huron (from Goderich to Buffalo). The Grand Trunk was formed as part of the main trunk route through the province.

14. Ibid., 14 & 15 Vic. c. 51.

15. Ibid., 16 Vic. c. 22.

16. Ibid.

17. Although the Municipal Loan Fund Act was designed to aid in the building of branch and feeder lines, some of the municipalities used the fund to purchase stock in the main trunk line companies. For a full listing of the monies borrowed by the municipalities see the Monetary Times (Toronto, 1871).

18. Lloyd L. Mercer, Railroads and Land Grant Policy (New York, 1982); George, "Rates of Return."

19. Hugh G. J. Aitken, "Defensive Expansionism: The State and Economic Growth in Canada," in The State and Economic Growth, Hugh G.J. Aitken, ed. (New York, 1959).

20. Fogel, Union Pacific; Mercer, Land Grant; Stanley Engerman, "Some Economic Issues Relating to Railroad Subsidies and the Evaluation of Land Grants," Journal of Economic History, 32 (Sept. 1972), pp. 443-63.

21. Fogel, Union Pacific, pp. 23, 165-71.

22. On the question of building ahead of demand, see Fishlow, American Railroads and the Transformation of the Ante-Bellum Economy, pp. 165-71; C. Knick Harley, "Oligopoly Strategy and the Timing of American Railroad Construction," Journal of Economic History, 42 (Nov. 1982), pp. 797-824; and Engerman, "Some Economic Issues."

23. Fogel, Union Pacific, p. 55; Frank Lewis and Mary MacKinnon, "Government Loan Guarantees and the Failure of the Canadian Northern Railway," Journal of Economic History, 47 (Mar.1987), pp. 175-96.

24. The most accessible histories of the Great Western Railroad Company are in Currie, Grand Trunk, chaps. 8 and 9; and in Norman Thompson and Major J. H. Edgar, Canadian Railway Development from the Earliest Times (Toronto, 1933), chap. 2.

25. The standard history of this company is Currie, Grand Trunk.

26. Mercer, Land Grant, chap. 4.

27. Grand Trunk Railway Company of Canada, Half Yearly Reports of the Directors, 1853-1882.

28. Currie, Grand Trunk, pp. 41-46.

29. A complete breakdown of payments made to Peto and Co. over the period 1853-1856 is given in Canada, Parliamentary Legislative Assembly, Report of the Special Committee Appointed to Enquire and Report as to the Condition, Management and Prospects of the Grand Trunk Railway (Toronto, 1857), p. 180. Peto and Co. received payment in Grand Trunk "B" shares, "B" bonds, and the shares and debentures of the Atlantic and St. Lawrence Railway. All were selling at a discount. Our estimated construction cost is based on the market values rather than the face values of the railway securities at the time they were received by the contractor. We allow for the fact that Peto and Co. paid £12.5 for each "B" share it received. Currie, The Grand Trunk Railway, p. 41.

30. In 1880 the book value of the Grand Trunk was 2.15 times its estimated capital cost. Of Mercer's railroads only the Northern Pacific and Central Pacific had higher ratios, 2.36 and 3.17, respectively. Mercer, Land Grant, Table A-15, pp. 176-77.

31. This estimate is based on the assumption the Grand Trunk was a fully-maintained system. The railway made large outlays for maintenance and renewal of track and rolling stock, and these expenditures were charged to its operating account. In fact, the renewals in some cases led to the upgrading of old capital. We therefore base our rate-of-return estimates on a zero depreciation rate, but to the extent rolling stock and track were upgraded, our estimates would be biased downward. Another possible source of bias is our failure to deflate any of the railway's costs or revenues. This is dictated by the lack of a good general price index for Canada. If, however, the U.S. experience and

the available Canadian data can be taken as a guide, the period 1853-1880 appears to have been one of general price stability (note: Canada was not subject to as much of the U.S. Civil War inflation). If anything, by 1880 prices likely trended downward implying that as measures of the real rate of return our estimates are biased downward. Finally, it should be noted that the (nominal) rate of return on riskless securities remained fairly stable at about 6 percent. Government of Canada bonds, sold on the London market, carried a coupon rate of 6 percent.

32. This is based on the comparison using Mercer's "C" adjustment. Mercer assumes a depreciation rate of 1.97 percent which appears to have been appropriate given that it implies a terminal adjustment roughly equal to the market value of the firm's securities. Mercer, Land Grant, chap. 4. The unaided and aided rates of return (using terminal adjustment C) are:

<u>Railroad</u>	<u>Unaided</u>	<u>Aided</u>
Central Pacific	10.6	11.6
Union Pacific	11.6	13.1
Great Northern	8.7	10.0
Texas and Pacific	2.2	4.3
Atchison, Topeka & Santa Fe	6.1	7.1
Northern Pacific	6.3	9.2
Canadian Pacific	2.4	8.4

Thus the Grand Trunk performed more poorly than any of the lines in Mercer's study.

33. This rate is computed as above deducting from investment expenditures the (face) value of the government loan guarantees.

34. For this calculation, investment expenditures in the hypothetical initial year (1861) are the cumulated investment expenditures over the period 1853-1861. The capital value of leased lines is the discounted (at 6 percent) sum of all payments for leased lines from 1861 to 1881. Our estimates assume no lag between completion of a line and demand for rail services. Although this clearly is inappropriate in cases where a rail link is a prerequisite to settlement, the Grand Trunk, like the Great Western, was built through an already settled area. Indeed, the Great Western enjoyed high operating revenues as soon as the line was completed. The year 1861 also marks the start of the U.S. Civil War, which may have adversely affected earnings. Both companies reported large losses due to discounts on revenues received in U.S. dollars. However, to the extent that U.S. freight rates rose, this compensated for the change in exchange rates. Also the volume of through freight increased as trade was diverted from the Mississippi.

35. This calculation is based on the assumption that the present value of the government subsidy would have been the same. The actual subsidy payments are compounded at 6 percent to 1861.

36. Currie, Grand Trunk, p. 218.

37. As with the Grand Trunk, we assume expenditures on maintenance and renewals were sufficient to assure no depreciation of the Great Western's capital stock. The assumption of a zero depreciation rate implies a terminal capital stock in 1880 of £7,838,000, which is very close to the market value of the firm's securities in that year.

38. Since the railways had monopoly power and appeared able to set their own freight and passenger rates, assuming monopoly pricing seems reasonable. To the extent, however, that the railways priced below the monopoly level, our estimates of the social rate of return would be biased downward.

39. A linear demand is consistent with a location model where the intensity of activity is independent of distance to the market. To the extent that intensity declines with distance, our estimate of the social return would be biased downward. See Frank D. Lewis and David R. Robinson, "The Timing of Railway Construction on the Canadian Prairies," Canadian Journal of Economics, 17 (May 1984), pp. 344-45; Ann M. Carlos, "Land Use, Supply, and Welfare Distortions Induced by Inefficient Freight Rates," Canadian Journal of Economics, 21 (Nov. 1988), pp. 835-45. Assuming constant marginal cost may bias our social returns estimates upward since, with upward-sloping marginal cost, marginal cost exceeds average variable cost. This potential bias, however, is likely very small since neither the Grand Trunk nor the Great Western were operating near capacity, the implication being that marginal cost was not rising steeply if at all.

40. Mercer derives his social rate of return by adding to total revenue, estimates of intraregional benefits and passenger external benefits. Intraregional benefits are inconsistent with the linear demand we have assumed. Mercer's estimates of passenger external benefits, above, are generally between 30 and 40 percent of total revenue. This is more than double the external benefit we derive. Part of the difference may be due to the availability of good substitutes for the Canadian railways, but part is likely due as well to our attempt to understate benefits. Our estimated elasticities of demand at equilibrium are 3.2 for the Great Western and 4.3 for the Grand Trunk. See Mercer, Land Grant, appendices B and C.

41. Lewis and MacKinnon, "Government Loan Guarantees."

42. The government commitment to the Great Western was far less strong. This was made clear with the formation of the Grand Trunk. With the Main Line Act of 1851, the government incorporated the main line of the Great Western as part of the main trunk line. But once the Grand Trunk was extended from Toronto to Sarnia, the government sought to have that section as the trunk link instead of the Great Western. This would have disallowed the Great Western from any loan guarantees. Although the government was not successful, the incident showed its commitment to the two companies.

43. When the company introduced its 6 percent bond in July 1854, it sold at 93 to 95 on a 100 face value. Two years later, it was selling for 84 to 86. By 1858 the discount had risen yet again, and the bond sold for 72 to 77.

44. London, Times, January 1, 1852, Money Markets and City Intelligence column.

45. Ibid.

46. Currie, Grand Trunk, p. 21. Lord Elgin's report was not appended to the prospectus when it was issued in Canada.

47. Trout and Trout, The Railways of Canada for 1870-1.

48. Currie, Grand Trunk, p. 74.

49. In the twentieth century, debt-equity ratios for railroads that did not go bankrupt were close to one. See Lewis and MacKinnon, "Government Loan Guarantees."

50. This effect of government loan guarantees on the debt-equity ratios of railroads is also consistent with the U.S. experience. In the antebellum period, before government became heavily involved with railroad building, the debt-equity ratios of U.S. railroads averaged only 0.8. Fishlow, American Railroads and the Transformations of the Antebellum Economy, p. 187. This was in contrast to the postbellum experience of Mercer's land grant railroads, which all received loan guarantees. In the mid 1890s, their debt-equity ratios averaged 1.8. In fact, of the railroads in Mercer's study only the Canadian Pacific Railway received no loan guarantees, and its debt-equity ratio was just 0.6. Poor's Manual of Railroads, 1896 (New York, 1896) pp. 354, 553, 555, 893, 913, 922, 996.

51. In late June 1858, Grand Trunk shares were selling at a discount of 55 percent from par, while company bonds were selling at only a 20 percent discount. London, Times, Railway Intelligence column.

52. Under the Guarantee Act, the Great Western received £700,000 in bond guarantees over the period 1852 to 1854 and some interest payments were deferred. Eventually the company repaid more than 90 percent of the face value of the loan. See Currie, Grand Trunk, pp. 191-92.

53. As of December 1990, savings and loan institutions as a group owned only 5 percent of U.S. high-yield bonds. This was in part because the U.S. government, through the Resolution Trust Corporation, had already acquired a large portfolio of junk bonds from failed S and L's; and in part because only a small segment of the industry had purchased these securities. See The Economist, 30 March - 5 April 1991, p.73.

TABLE A1

Grand Trunk Railway Revenues and Expenses
(£000s sterling)

Year	Operating Revenue	Operating Expenses	Net Revenue	Investment Expenses
1853	0	0	0	1068.3
1853	24.9	13.6	11.3	1024.2
1854	72.5	58.8	13.8	734.0
1854	100.6	69.8	30.8	1659.0
1855	97.0	93.3	3.7	715.8
1855	126.1	106.6	19.5	709.3
1856	116.3	114.7	1.6	388.1
1856	170.8	143.9	27.0	21.8
1857	237.9	234.0	3.9	284.9
1857	262.0	219.1	42.9	535.0
1858	218.8	218.9	-0.1	778.4
1858	244.8	224.2	20.7	783.2
1859	223.9	203.1	20.9	435.5
1859	282.9	230.4	52.5	1114.1
1860	314.8	285.6	29.2	284.1
1860	367.8	330.8	37.1	131.4
1861	347.1	333.1	14.0	15.5
1861	468.5	323.8	144.7	137.2
1862	383.0	319.6	63.4	32.4
1862	425.7	332.6	93.1	167.1
1863	427.8	310.2	117.6	6.2
1863	457.8	312.1	145.7	59.8
1864	528.3	346.5	181.1	65.2
1864	539.8	450.5	89.3	116.7
1865	579.0	448.6	130.5	39.2
1865	655.9	538.3	117.6	37.9
1866	623.2	429.7	193.5	10.4
1866	657.5	486.0	171.5	52.9
1867	587.6	495.0	92.5	12.5
1867	665.0	539.3	125.7	25.8
1868	627.9	498.0	129.9	3.9
1868	712.8	576.3	136.6	0.4
1869	649.8	533.0	116.8	38.8
1869	758.3	558.3	200.0	67.5
1870	697.4	559.7	137.7	62.3
1870	785.5	668.9	116.6	93.0

TABLE A1
(continued)

Year	Operating Revenue	Operating Expenses	Net Revenue	Investment Expenses
1871	768.8	596.4	172.3	31.6
1871	917.2	751.0	166.2	22.6
1872	858.8	694.0	164.8	83.0
1872	942.5	793.3	149.2	227.7
1873	888.8	721.6	167.1	136.6
1873	1036.6	863.1	173.5	1022.1
1874	999.5	782.0	217.5	230.0
1874	1107.2	890.5	216.8	707.5
1875	893.1	701.5	191.7	164.8
1875	1023.9	818.4	205.4	99.4
1876	936.4	733.9	202.4	8.4
1876	893.9	716.6	177.2	170.6
1877	860.4	664.5	195.9	12.4
1877	1025.3	769.2	256.1	36.1
1878	881.0	667.3	213.8	12.7
1878	924.0	708.8	215.3	21.4
1879	832.9	634.4	198.4	10.7
1879	978.2	712.8	265.4	27.5
1880	992.0	675.3	316.6	-221.4
1880	1158.4	783.9	374.5	65.7
1881	1073.4	738.5	334.9	62.3
1881	1121.2	824.3	296.9	99.1

Source: Grand Trunk Railway Company of Canada. Report of the Directors to the Bond and Stockholders and Statement of the Revenue and Capital Accounts for the Half-Years ending June 30th and December 31st, 1853 to 1882.

TABLE A2
Great Western Railway Revenues and Expenses
(£000s sterling)

Year	Operating Revenue	Operating Expenses	Net Revenue	Investment Expenses
1852	0	0	0	433.9
1852	0	0	0	397.2
1853	0	0	0	444.8
1853	0	0	0	492.3
1854	123.4	55.3	68.1	494.0
1854	195.5	102.5	93.1	403.7
1855	205.2	106.0	99.1	302.6
1855	272.7	155.4	117.2	223.9
1856	292.4	172.4	120.0	588.4
1856	323.7	164.5	159.3	303.3
1857	266.4	157.8	108.6	125.0
1857	256.1	199.2	57.0	164.3
1858	213.7	128.6	85.1	37.8
1858	211.0	131.2	79.8	83.3
1859	181.5	128.5	52.9	35.5
1859	207.5	132.2	75.3	11.7
1860	194.5	133.7	60.8	25.8
1860	252.8	153.3	99.5	11.1
1861	209.3	156.2	53.1	4.1
1861	266.0	153.8	112.2	16.7
1862	239.3	173.3	65.9	7.9
1862	268.4	167.4	101.0	12.4
1863	233.0	176.6	56.4	5.1
1863	247.6	175.1	72.5	21.1
1864	229.0	171.5	57.6	16.2
1864	238.2	168.6	69.7	18.2
1865	229.6	158.8	70.8	27.2
1865	313.7	170.0	143.7	32.5
1866	303.4	176.7	126.7	55.7
1866	283.3	173.0	110.3	137.7
1867	312.9	189.6	123.3	18.8
1867	334.2	201.6	132.6	21.3
1868	301.9	215.6	86.3	20.8
1868	352.9	215.2	137.8	5.5
1869	331.3	237.2	94.1	4.5
1869	387.0	247.0	140.0	98.8
1870	383.6	257.3	126.3	20.5

TABLE A2
(continued)

YEAR	Operating Revenue	Operating Expenses	Net Revenue	Investment Expenses
1870	427.0	266.6	160.4	71.6
1871	438.2	284.9	153.3	121.6
1871	499.5	332.7	166.9	225.6
1872	516.0	339.4	176.7	163.2
1872	562.7	386.7	175.9	626.4
1873	580.3	424.4	155.9	453.1
1873	598.7	443.0	155.7	695.9
1874	521.6	440.8	80.8	109.6
1874	485.4	395.3	90.1	105.0
1875	411.2	420.3	-9.1	44.3
1875	436.1	360.1	76.0	21.1
1876	394.8	346.2	48.5	10.6
1876	401.6	352.9	48.8	-13.3
1877	370.5	284.9	85.6	5.7
1877	467.2	331.5	135.8	16.2
1878	377.5	292.7	84.8	12.7
1878	387.3	271.5	115.8	7.3
1879	365.8	288.8	77.0	4.1
1879	461.1	296.1	165.0	6.4
1880	437.4	317.0	120.5	19.4
1880	513.0	330.3	182.8	11.1

Sources: Great Western Railway of Canada; Report of the Directors of the Great Western Railway of Canada, for the Half-Years July 31st and January 31st, 1852 to 1880.

TABLE 1

**Capital Cost of the Grand Trunk Railway for Selected Dates
(£000 sterling)**

Accumulated to	Book Value	Reported Expenditures	Adjusted Expenditures
July 15, 1853	1,068	1,068	1,068
June 30, 1854	2,981	2,827	2,827
June 30, 1855	5,505	5,201	5,201
June 30, 1856	7,316	6,966	6,299
June 30, 1857	8,207	7,627	6,605
June 30, 1860	12,388	11,560	10,536
June 30, 1865	17,210	12,330	11,306
June 30, 1870	18,999	12,643	11,619
June 30, 1875	30,633	15,362	14,338
June 30, 1880	30,988	15,540	14,516

Sources: Grand Trunk Railway Company of Canada; Report of the Directors to the Bond and Stockholders and Statement of the Revenue and Capital Accounts for the Half-Years ending 30th June and 31st December 1853 to 1882; The London Times, Railway Intelligence Column, 1853 to 1882. Also A. W. Currie, The Grand Trunk Railway of Canada (Toronto, 1957).

TABLE 2

**Private and Social Rates of Return
Grand Trunk and Great Western Railways
(percent)**

	Grand Trunk		Great Western
	Actual Starting Date	January 1, 1861	Actual Starting Date
Private Rate of Return			
Unaided	1.71	2.25	4.06
Aided	3.00	4.79	5.20
Social Rate of Return			
	2.77	3.57	6.10

Sources: Grand Trunk Railway Company of Canada; Report of the Directors to the Bond and Stockholders, and Statement of the Revenue and Capital Accounts for the Half-Years ending June 30th and December 31st, 1853 to 1882. Great Western Railway of Canada; Report of the Directors of the Great Western Railway of Canada for the Half-years ending July 31st and January 31st, 1852-1880. A detailed account of the derivation of these numbers is given in the text and footnotes 29 through 35.

Notes: The present value of leased lines for the Grand Trunk is £1,538 thousand based on the actual starting date, and £1,142 thousand assuming a starting date of January 1, 1961. The social rates of return are based on the estimated value of c/p^* , which is .77 for the Grand Trunk and .69 for the Great Western. In deriving the estimate of c/p^* for the Grand Trunk, the decade of the 1850s was excluded.

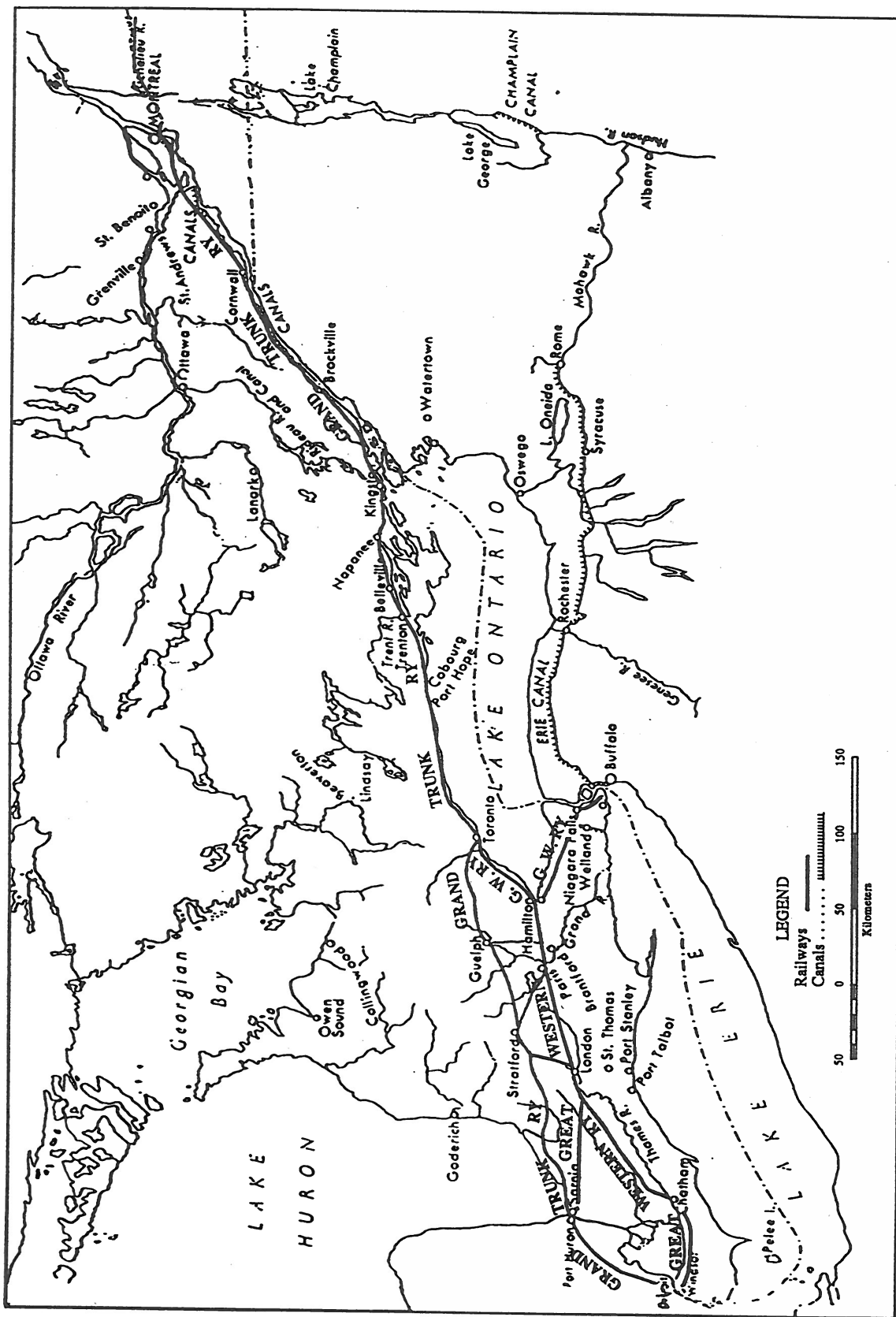
TABLE 3
Capital Structure of the Grand Trunk Railway Company, 1854-1858

(£000 sterling)

YEAR	Bonds (Face Value)			Shares		
Year	Provincial Debentures	Other Debentures	Total	Face Value	Market Value	Debt/ Equity
1854	467.5	1260.5	1728.0	1253.1	1026.1	1.68
1855	1776.3	1929.1	3705.5	1860.0	1326.7	2.79
1856	2793.8	1768.7	4562.5	2753.9	1931.4	2.36
1857	3044.8	1943.7	4988.5	3097.6	2101.3	2.37
1858	3111.5	3330.5	6442.0	3206.1	2172.6	2.97

Sources: Grand Trunk Railway Company of Canada; Report of the Directors to the Bond and Stockholders, and Statement of the Revenue and Capital Accounts for the Half-Years ending June 30th and December 31st, 1853 to 1882.

MAP 1
LOCATION OF GRAND TRUNK AND GREAT WESTERN
RAILWAY COMPANIES



Source: D.G.G. Kerr, Historical Atlas of Canada
Toronto, 1975 (p. 51)

FIGURE 1

GRAND TRUNK RAILWAY

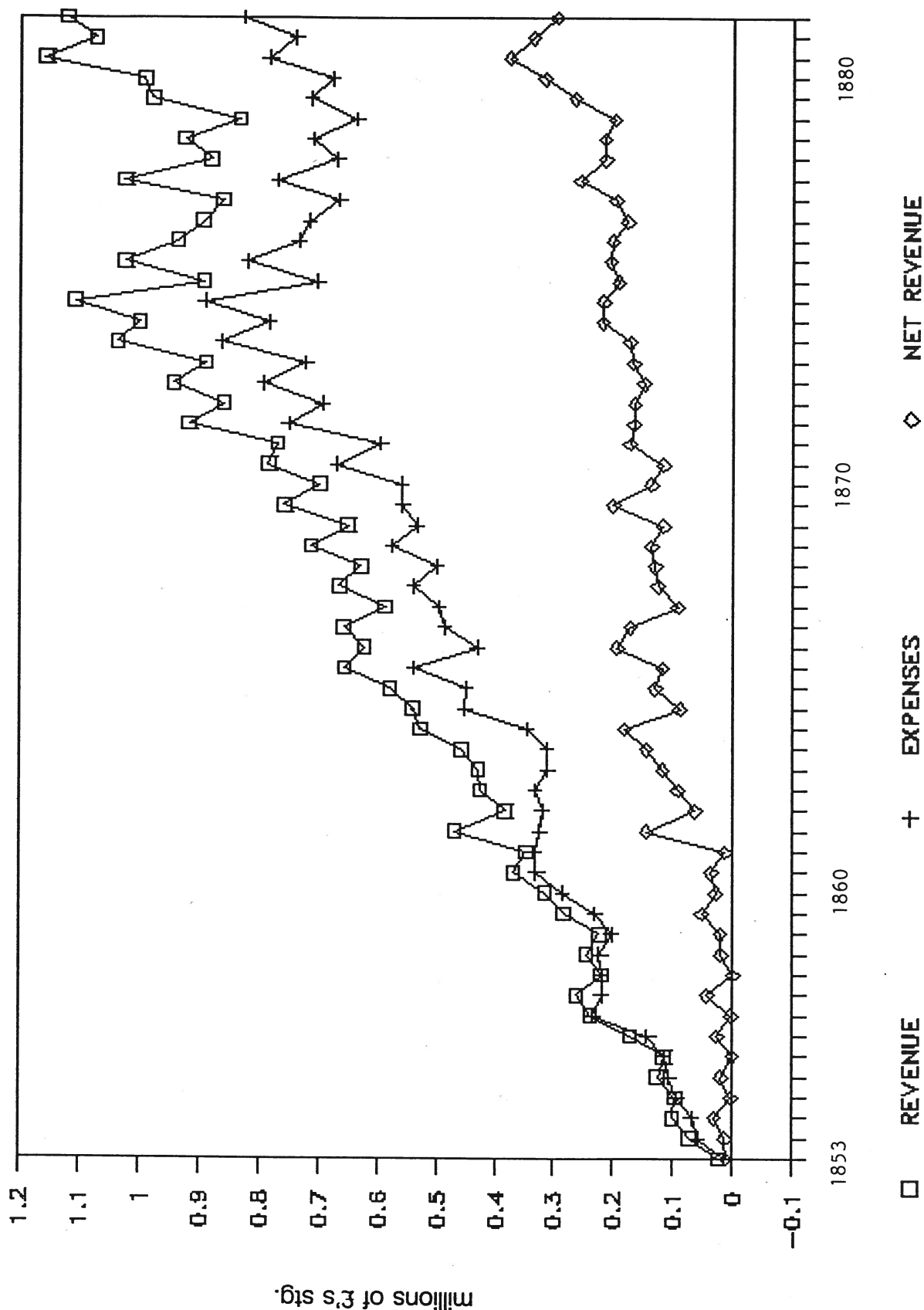


FIGURE 2
GREAT WESTERN RAILWAY

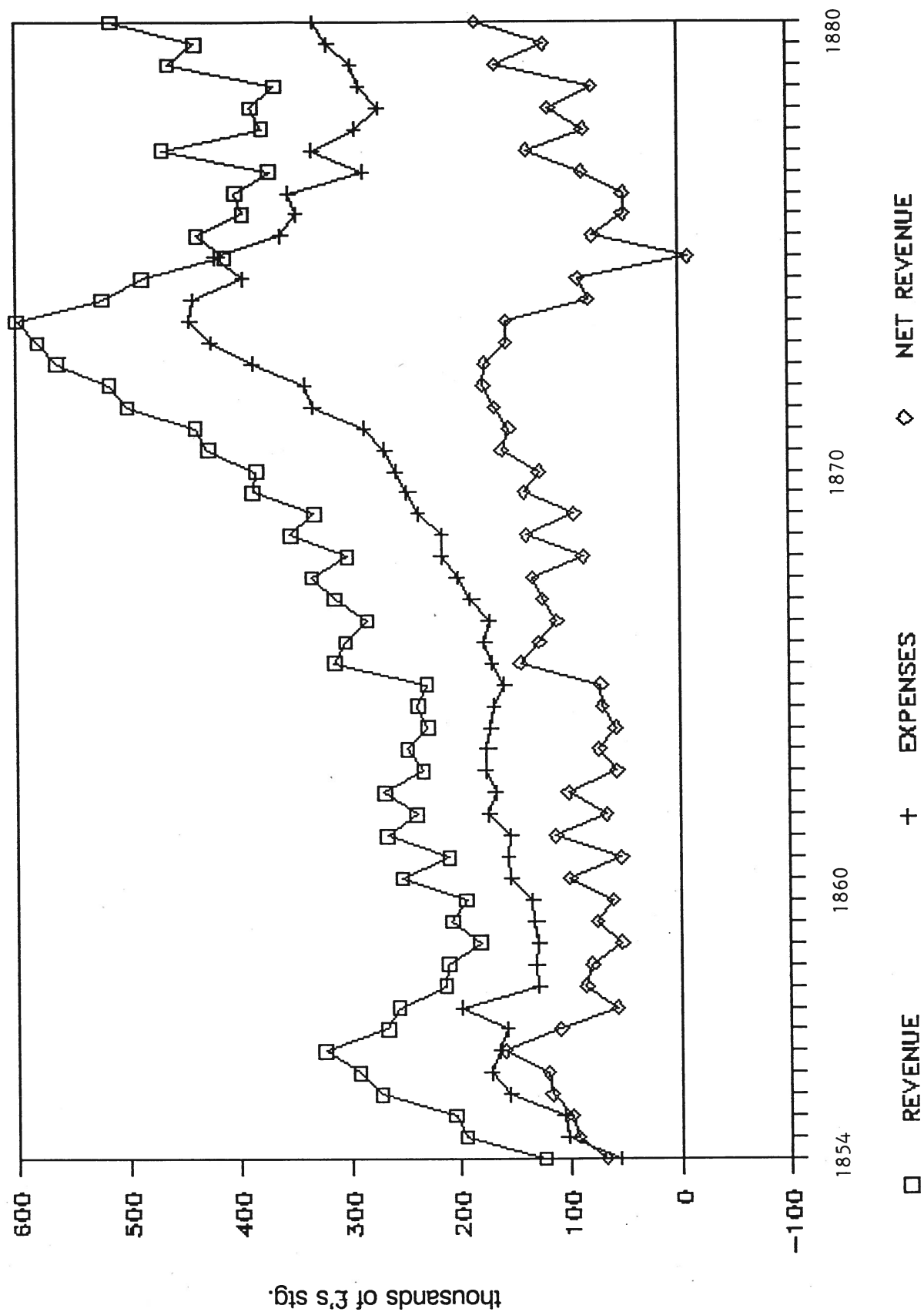


FIGURE 3
ESTIMATING THE SOCIAL RETURN TO RAILWAYS

