

Local Control, Resources and the Nova Scotia Steel and Coal Company

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Article abstract

Financial market activity indicates that Maritime interests lost control of the Nova Scotia Steel and Coal Company in 1915 and 1916. Production and financial records of the firm suggest that poor profitability contributed to the change of ownership. The firm's weakness is traced to its resource base and the resulting high costs of production. The causation implicit in conventional accounts is reversed: control and ownership changes were a result of, rather than a cause of, production difficulties and weak profitability.

Local Control, Resources and the Nova Scotia Steel and Coal Company

KRIS E. INWOOD

Résumé

Financial market activity indicates that Maritime interests lost control of the Nova Scotia Steel and Coal Company in 1915 and 1916. Production and financial records of the firm suggest that poor profitability contributed to the change of ownership. The firm's weakness is traced to its resource base and the resulting high costs of production. The causation implicit in conventional accounts is reversed: control and ownership changes were a result of, rather than a cause of, production difficulties and weak profitability.



L'examen de l'activité boursière indique que les financiers des Maritimes ont perdu le contrôle de la compagnie Nova Scotia Steel and Coal pendant les années 1915 et 1916. Les états de comptes de la compagnie démontrent que les petits profits ont contribué à ce changement de contrôle. L'auteur suggère que la faiblesse économique de la compagnie était le résultat des ressources principales et de l'augmentation des coûts de la production du fer. L'explication traditionnelle est mise en doute: les changements de propriétaires étaient le résultat, et non la cause, des difficultés de production et des petits profits.

INTRODUCTION

One or other of two themes may be detected in most attempts to comprehend the economic history of Canada's Maritime or Atlantic region.¹ From the staple perspective a region's natural resource endowment is regarded as a major

I am grateful for financial assistance from the Social Sciences and Humanities Research Council in the preparation of this paper and for helpful comments and encouragement from Chris Armstrong, Ian Drummond, David Frank, Greg Kealey, Rosemary Langhout, Larry McCann, Eric Sager, Graham Taylor, and several anonymous referees of this journal.

1. The literature on Maritime industrialization is surveyed by A. Wilson, "Maritime Business History," *Business History Review* 47 (1973); T. W. Acheson, "Introduction," in S. A. Saunders, *The Economic History of the Maritime Provinces* (1939, rep. Fredericton, 1984), 5-14; and K. Inwood, "The Atlantic Canadian Industrial Lag: Competing Origins and Historical Origins," *Papers of the Atlantic Canadian Economics Association* 14 (1985), 20-31.

determinant of the character and pace of economic growth.² Recent research has supplanted the staple approach with a structural analysis emphasizing the regional impact of changes in the size, structure and control of business enterprise.³ This paper seeks to reconsider the experience of one firm, the Nova Scotia Steel and Coal Company (NSSC or Scotia), control of which slipped out of local hands during the decade between 1910 and 1920. By 1910 Scotia's competitive position was already weak and diminishing due to an erosion of its resource base; this fundamental weakness contributed to financial manoeuvring in 1910 and an eventual loss of local control in 1915 and 1916.

Conventional wisdom about Scotia emphasizes (and in some cases appears to ascribe) independent causal significance to ownership and control. The successful defence of local control in 1910 has been interpreted as a sign of strength, as "the high point of a late-developing effort on the part of the Halifax business community to create an industrial region structured on the Atlantic metropolis."⁴ In turn, the absorption of Scotia into a 1920 merger with other regional enterprises is regarded as a "decisive turning point" in the fortunes of the iron and steel industry and regional industrialization in general.⁵ These conventional views, however, leave us with a question. How could the firm lose its independence so soon after the show of strength in 1910? In other words, what went wrong?

Two alternative explanations may be considered. Either external circumstances changed quickly and disastrously, or Scotia was weaker in 1910 than historians have suggested. The former is a possible explanation since Scotia's economic

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2. M. Watkins, "A Staple Theory of Economic Growth," *Canadian Journal of Economics and Political Science* 29 (1963): 141–58; R. Baldwin, "Patterns of Development in Newly Settled Regions," *Manchester School of Economic and Social Studies* 24 (1956): 161–79.
 3. T. W. Acheson, "The National Policy and the Industrialization of the Maritimes," *Acadiensis* 1 (1972): 3–28; T. W. Acheson, "The Maritimes and Empire Canada," *Canada and the Burden of Unity*, ed. D. Bercuson (Toronto, 1977): 87–114; D. Frank, "The Cape Breton Coal Industry and the Rise and Fall of BESCO," *Acadiensis* 7 (1977): 3–34; R. J. Brym and R. J. Sacouman, eds., *Underdevelopment and Social Movements in Atlantic Canada* (Toronto, 1984). Although they are quite distinct, these two approaches are not mutually exclusive. A small but important body of work draws from both the staples and structuralist perspectives. See Saunders, *Economic History*, 28–30 and 84–85; L. McCann, "Staples and the New Industrialism," *Acadiensis* 8 (1979): 47–79 and L. McCann, "The Metal Towns of Pictou County," *Acadiensis* 10 (1981): 29–64.
 4. T. W. Acheson, "The National Policy. . . ."
 5. *Ibid.*; see also the same author's "The Maritimes and Empire Canada," Frank's "The Cape Breton Coal Industry," and McCann's "The Metal Towns." On the early Nova Scotia steel industry in Pictou County and Cape Breton, see K. Inwood, "Resource Discovery and Technological Change: The Early Years of Steel Production in Nova Scotia," *Bulletin of the Canadian Institute of Metallurgy* 76/855 (July 1983): 59–65 and D. Macgillivray, "Henry Melville Whitney Comes to Cape Breton," *Acadiensis* 9 (1979): 44–70.

environment certainly changed between 1910 and 1920, as it did for all Canadian steel companies. Nevertheless, other steel companies, such as the rival Stelco based in Hamilton, avoided disaster during the war decade. Moreover, many changes in the external environment were either neutral or favourable to Scotia. Certainly freight rate changes in 1917 were unfavourable, but the crucial loss of control over Scotia occurred before the effects of higher transportation costs were felt.⁶ Recession and war between 1913 and 1918 effectively ended the great Canadian railway construction boom, but this did not affect Scotia which never produced heavy steel rails. After 1913 the government-subsidized demand for rails was replaced by direct government purchases of shell steel, from which Scotia earned a controversially large profit.⁷

A more likely explanation is that the NSSC was weaker in 1910 than has been recognized hitherto. This perspective has the merit of accounting for another peculiarity of Scotia's balance sheet, the heavy dependence on external sources of capital during the firm's supposedly successful phase from 1900 to 1913. Successful steel companies at this time typically financed growth in large measure through the reinvestment of profits.⁸ The buoyant demand for metal in Canada during the period 1900-13 should have provided domestic steel companies with an especially large surplus which would be available for reinvestment. Hence, it is a little surprising that Scotia relied upon external sources of capital to the extent that it did. As Table 1 indicates, securities with a face value exceeding thirteen million dollars were sold between 1900 and 1913. Sales were more or less continuous with interruptions during recessions when suppliers and banks accommodated the firm with increases in bills payable and cash advances.⁹

The extent of the firm's dependence on external funds is highlighted by comparing data derived from the balance sheets of the NSSC and Stelco in Table 2. Between 1911 and 1914 the two steel companies paid similar amounts in dividends to shareholders and the firms had roughly the same amount available, seven million dollars, for investment, renewal, and liquidity expansion. The composition of this total, however, differed substantially. The NSSC had a much smaller profit (net of the necessary bond, mortgage, and bank interest payments) and, perhaps in consequence, it accumulated a larger external debt.

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6. E. Forbes, "Misguided Symmetry," *Canada and the Burden of Unity*, 60-86 and E. Forbes, *Maritime Rights: The Maritime Rights Movement, 1919-1927* (Montreal, 1977).
 7. D. Carnegie, *The History of Munitions Supply in Canada, 1914-1918* (London, 1925), 133; R. T. Naylor, "The Canadian State, the Accumulation of Capital, and the Great War," *Journal of Canadian Studies* 16 (1981): 26-55.
 8. J. S. Jeans, *American Industrial Conditions and Competition* (London, 1902), 301.
 9. Nova Scotia Steel and Coal Company, *Annual Report (AR)*, 1908, 8-10 and 23-27; *AR*, 1909, 26; *AR*, 1910, 21. Short-term accommodation was particularly important in 1913, when short-term liabilities were more than double their level of the 1903 and 1907-08 recessions.

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Table 1:
Selected Aspects of the Financial Position
of the Nova Scotia Steel and Coal Company, 1901-14¹

Year	Spending on Capital Account	Bills Payable and Cash Advances	All Current Liabilities (incl. bills payable, etc.)	Face Value of Security Sales net of Retirements
1901	na	na	0.3	1.0 bonds and 2.0 common stock
1902	na	n	0.3	1.0 common stock
1903	na	0.8	1.2	
1904	na	0.2	0.4	1.5 bonds and 0.8 common stock
1905	0.7	0.5	0.8	
1906	0.2	0.3	0.6	
1907	0.4	0.6	1.0	
1908	0.3	0.9	1.3	
1909	0.4	0.6	1.0	1.0 debenture stock
1910	0.9	0.3	0.6	1.5 bonds
1911	1.1	0.8	1.5	1.0 bonds
1912	1.3	0.5	1.3	1.0 bonds and 0.8 preferreds
1913	1.2	0.2	0.9	2.0 debenture stock
1914	0.9	1.8	2.6	

1. All units are millions of dollars.

Source: annual reports of the company. Current liabilities in 1912 do not include the paper debt of NSSC to its wholly owned subsidiary, Eastern Car; securities sold in 1912 include those guaranteed by the company on behalf of Eastern Car. Expenditures on capital account in 1912 do not include the Eastern Car plant. Previously issued securities were retired in 1901, 1904, and 1909.

The firm's voracious demand for funds and its collapse so soon after the 1910 defence point to some persistent sources of difficulty against which the Nova Scotia steel company struggled. The difficulty identified in this paper is that the firm was not sufficiently profitable to continue operation as an independent firm. The firm was nevertheless attractive to outside investors because information about the firm's weakness was withheld from the capital market; additionally, a merger with other regional enterprises might reasonably be expected to lower costs and hence increase profits. The theoretical perspective from which these conclusions derives is that the long-run survival of a firm depends upon its ability to earn revenue in excess of costs. A comparison of production costs for Scotia and Stelco leads to the conclusion that the price and productivity of Scotia's material inputs created a fundamental and growing handicap for this firm.

Table 2:
Funds (\$000,000) Available to Stelco and the
NSSC, All Sources, 1911-1914 inclusive¹

	Stelco	NSSC
Disposable Profit	5.1	1.8
Dividends	1.6	1.6
Retained Earnings	3.5	0.2
Debt Expansion	3.2	6.8
Total Funds Available	6.7	7.0

1. Figures are in millions of dollars. Disposal profit consists of declared profit net of interest on bond, mortgage, and bank debt. Debt expansion reflects the change in current liabilities plus the face value of security sales net of retirements.

Source: annual reports of Stelco and NSSC:

THE LOSS OF LOCAL CONTROL OVER SCOTIA

In 1872 the Nova Scotia Forge Company began reworking scrap metal in Pictou County to meet the regional demand for capital goods largely in the shipping industry and, with the introduction of the Intercolonial Railway, railroading as well.¹⁰ The firm's backers in 1882 created the Nova Scotia Steel Company which erected an open-hearth steel furnace to convert pig and scrap iron to steel. The output of rolled and forged iron and steel expanded during the National Policy decade. Following the Tupper iron tariff of 1887 a blast furnace was built to smelt mainland Nova Scotia coal and iron ore. Although incorporated as an independent firm, the furnace, which went into blast in 1892, was controlled by many of the Pictou County investors and managers who had backed the Nova Scotia Steel Company and the Nova Scotia Forge Company.¹¹

10. McCann, "The Metal Towns," ably summarizes available information about the series of firms which evolved into the Nova Scotia Steel and Coal Company; also see J. M. Cameron, "The Scotia Steelmasters," *Collections of the Nova Scotia Historical Society* 40 (1980): 31-56. The general context is treated in W.J. Donald, *The Canadian Iron and Steel Industry* (Boston, 1915).

11. Henceforth the same name, Nova Scotia Steel and Coal Company, is used to refer to the firm in its successive corporate incarnations: the Nova Scotia Forge Company, the Nova Scotia Steel Company, the Nova Scotia Steel and Forge Company, the New Glasgow Iron, Coal and Railway Company, and finally the Nova Scotia Steel and Coal Company.

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The firm quickly discovered that mainland sources of ore were inadequate; Scotia's general manager later remarked that in Nova Scotia "there is only sufficient ore to get people in trouble."¹² The blast furnace undoubtedly would have been shut down if the enormous Wabana ore bed in Newfoundland had not been available.¹³ Part of the ore deposit was retained by Scotia for its own use and the remainder was resold to the newly formed Dominion Iron and Steel Company.¹⁴ The revenue from this transaction was used to finance the purchase in 1900 of a Cape Breton colliery, which was badly needed by Scotia. In the twentieth century, then, the firm emerged as a fully integrated producer of finished and semifinished rolled steel, which also sold coal to Canadian railways and exported iron ore.

The company sold \$2.5 million in new bonds and four million dollars of common stock between 1901 and 1904. This security sales campaign was interrupted by the high cost of capital during the 1903 recession which imposed the added burden of a decline in metal demand.¹⁵ Fortunately, suppliers and banks were prepared to accommodate the NSSC through a temporary increase in bills payable and cash advances (Table 1).

Scotia again approached the financial markets during 1907 and 1908, although the recession in those years made it difficult for the NSSC to borrow on agreeable terms in the London financial market.¹⁶ Again, the firm had to delay its sale of securities and rely temporarily on a substantial accommodation from suppliers and the banks. Following the recession the firm was able to place \$3.5 million in bonds and nearly four million dollars in preferred and debenture stock between 1909 and 1913.¹⁷

This sales campaign coincided with intense merger activity in the Canadian financial market.¹⁸ It is not surprising that two principal entrepreneurs in the merger activity, Rodolphe Forget and Max Aitken, would turn their attention to Scotia.¹⁹ The firm was an obvious candidate to be merged with the Dominion Iron and Steel Company (DISC), Canadian Car and Foundry, or the Steel Company of

12. Public Archives of Nova Scotia (PANS), Manuscript Group (MG) 3, v. 1877, #49, Cantley to the Tariff Commission, 6 Nov. 1920. Also see the remarks of Archibald McColl, another company insider, reported in the *Halifax Evening News*, 18 Dec. 1914.

13. K. Inwood, "The Economic Interpretation of Resource Discoveries: A Canadian Case Study," *Papers of the Atlantic Canada Economics Association* 12 (1983): 126-32.

14. L. McCann, "The Metal Towns," and K. Inwood, "Resource Discovery."

15. *AR*, 1903, 8; *AR*, 1904, 12.

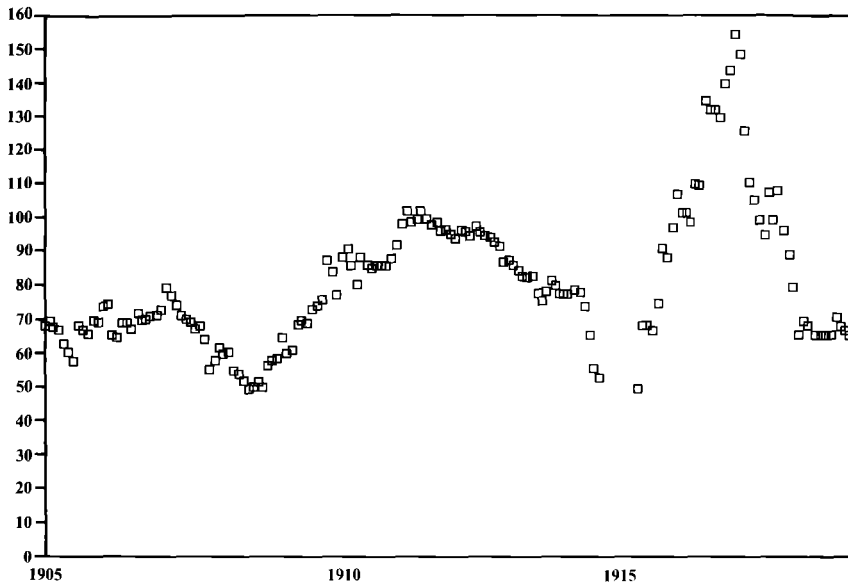
16. *AR*, 1908, 8-10.

17. *Ibid.*, 8-10 and 23-27; *AR*, 1909, 26; *AR*, 1910, 21.

18. T. W. Acheson, "The National Policy," and M. Bliss, "Another Anti-Trust Tradition," *Business History Review* 47 (1973): 158-76.

19. *Ibid.*; W. Kilbourn, *The Elements Combined* (Toronto, 1960), 65ff; R. T. Naylor, *The History of Canadian Business* (Toronto, 1976), 2:188; PANS, MG1, vols. 167-69, Cantley Letterbooks (hereafter *CL*), 28 Dec. 1909.

Figure 1
The Price (\$) of NSSC Shares
Monthly High Price, Montreal, 1905–1918



Source: Annual Financial Review, 1905–1918

Canada.²⁰ Moreover, Aitken's earlier underwriting for the firm and brokering for Scotia's general manager, Thomas Cantley, enabled him to predict Cantley's financial needs when the steel company prepared to go to the market again in 1908.²¹

The raid began quietly in October of 1908 when Aitken proposed to assist Scotia's sale of new securities by organizing a "syndicate" of financial institutions and entrepreneurs to raise the price of Scotia stock.²² The price of Scotia common stock, described in Figure 1, was beginning to sag noticeably as numerous newspaper articles reported the firm's accumulation of a substantial bank debt.²³

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20. Of course, NSSC could have been merged with more than one of these firms. The latter two firms, not coincidentally, were the outcomes of Aitken-arranged mergers about this time. Scotia General Manager Thomas Cantley himself came to believe that Aitken and Forget intended Canada Car and Foundry to be the corporate partner. On this point see *CL*, 13 April, 30 June and 16 July 1910.
21. *CL*, 2 April 1907, 20 and 22 Oct. 1908, and 11 March 1909.
22. *CL*, 20 Oct. 1908.
23. *Montreal Star*, 31 Dec. 1908, 9 Feb. 1909, and 16 March 1909; *Montreal Daily Herald*, 21 May 1909; *Halifax Herald*, 23 March 1909; *McCuaig Brothers Market Review*, 3 Nov. 1909.

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After making his suggestion Aitken withdrew to the wings, permitting the public drama to be played out by Forget and several Canadian underwriters who had previously been considered friendly to Scotia.²⁴ The underwriting syndicate was to be financed by Canadian banks: the Merchant's and Royal banks each offered \$1.5 million to support the promotion although it was the Bank of Toronto with which arrangements ultimately were made.²⁵

From the outset, Cantley and Robert Harris, the NSSC president, were invited to participate in the syndicate. They agreed to cooperate while remaining suspicious of the syndicate's intentions; Cantley even provided Forget with a list of Toronto and Montreal brokers holding Scotia proxies.²⁶ Cantley and Harris agreed that their direct involvement would serve Scotia interests even if the syndicate attempted to use its share holdings against the wishes of management.²⁷ Aside from the immediate promotional support offered by the syndicate, their participation ensured that company insiders would be fully informed. "It may be that Forget will either humbug us or that we will find it impossible to control him; in any case, I think our safety lies in getting as close to him as we can; we should at least be in a somewhat better position inside than outside." Harris, in particular, was generally suspicious of Aitken. The former had backed the Royal Securities Corporation, used by Aitken for much of his early financial entrepreneurship. When the securities company was being sold early in 1908, Harris accused Aitken of wanting to purchase portions of the firm's portfolio at knockdown prices. The dispute was so bitter that W.B. Ross had to mediate a settlement.²⁸

Uncertainty about the intentions of Aitken and Forget persisted for more than a year. During the late fall of 1909 Cantley moved to forestall a merger bid by issuing a 20 per cent stock bonus.²⁹ By the end of February 1910, however, it had become clear to Cantley that Forget was leading a bid for control rather than a helpful manipulation of the market.³⁰ At this point the two protagonists began energetic and highly public campaigns to accumulate shares before the company's annual meeting in March. Cantley tried to place shares with friends in Great Britain, where the shares might escape Forget's reach without draining the resources of the Scotia principals; Forget did likewise, although Paris rather than London or

24. *CL*, 20 Oct. 1908, 28 Dec. 1909, and 24 Jan., 31 Mar., and 4 April 1910.

25. *CL*, 28 Dec. 1909, and 25 Feb. and 31 March 1910.

26. *CL*, 28 and 31 Dec. 1909, and 20 Jan. and 24 Feb. 1910.

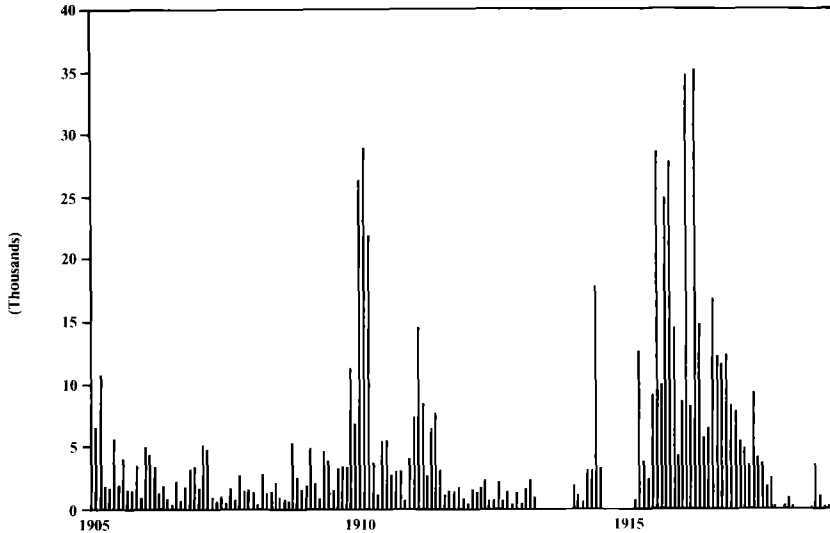
27. *CL*, 15, 18, and 27 Jan. 1910.

28. House of Lords Record Office, Beaverbrook Papers, series A, vol. 27, Aitken to W. B. Ross, 17 April 1908; vol. 28, Aitken to George Stairs, 16 March 1908. I am grateful to Chris Armstrong for providing this reference and the information reported in the text.

29. *Montreal Witness*, 29 Nov. 1909, and *Globe* (Toronto), 29 Nov. 1909.

30. *CL*, 24 and 25 Feb., and 1, 5, 7, and 12 March 1910.

Figure 2
Trading in NSSC Shares
Monthly Volume, Montreal, 1905–1918



Source: Annual Financial Review, 1905–1918

Glasgow was his preferred destination.³¹ Meanwhile, Aitken tried to depress the Canadian price of company securities by bringing bonds back from Britain.³² Nevertheless, the strong demand from both sides for Scotia shares had the effect of raising the price of Scotia common stock which, as Figures 1 and 2 indicate, traded very actively.

The outcome of the spectacular battle for proxies and shares was not decided until the April general meeting, at which time provincial loyalty carried the day, albeit narrowly. Ninety-five per cent of the firm's seventy thousand shares were voted and forty thousand of these were proxies. Forget and Aitken were defeated by a clear margin of only 228 votes.³³ Cantley later criticized the Bank of Toronto for its support of a "buccaneering movement" and enthused to his friends that "porridge is stronger than pea-soup."³⁴ He noted proudly that "the get-rich-quick-overnight reputed millionaires of Montreal have been routed horse, foot and

31. *CL*, 24 Feb., 1 March, and 27 May 1910.

32. *CL*, 4 April 1910 and 7 Feb. 1911.

33. *Halifax Morning Chronicle*, 30 March 1910.

34. *CL*, 4 and 13 April, and 20 July 1910.

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artillery. . . . The Scotch worthies defeated the French. . . . I do not think any similar attempt to pick Scotch thistles will be undertaken by any of the western people for a decade at least." The general manager justified the vehemence of his opposition partly on the grounds that a merger would have led to the removal of the company's works from New Glasgow, a shift which he had always opposed.

If it were not for the strong position I have taken in regard to the New Glasgow works during the past few years, there would not be a wheel turning in New Glasgow today — the mills would have been removed to Sydney Mines entirely. I have used arguments, and have shouldered responsibilities in connection with the expenditure on the plant here which nobody but a fool, a reckless man, or an exceedingly strong man would have undertaken.³⁵

The shareholder's meeting marked a victory for the New Glasgow loyalists but the war was not yet over. The takeover threat imposed considerable financial strain since Scotia was compelled to raise capital using fixed income securities that later reduced financial flexibility, rather than through the new issue of voting common stock. Indeed, the company and its friends purchased, rather than sold, shares in 1909 as a defence against the raid. After the raid collapsed, Scotia loyalists were forced to borrow one million dollars from the Royal Bank and a similar sum from the Bank of Nova Scotia in order to acquire the Forget share bloc and forestall another takeover bid.³⁶

The company could not meet its financial needs between 1909 and 1912 with a temporary decline in dividend payments because this might have disheartened hitherto loyal shareholders. Construction of a large railway car factory in order to reduce Scotia's vulnerability to another takeover bid again strained available resources.³⁷ Further funds were obtained in the following year through an expansion of current liabilities, which in turn were reduced with funds obtained from a two million dollar issue of debentures late in 1913.³⁸

During the war the firm's position deteriorated further. Dividends could not be paid in 1914 and 1915. Not surprisingly, the price of Nova Scotia Steel common stock fell in 1914 and early 1915 (Figure 1). Then, between April 1915 and the summer of 1916, the price jumped from 50 per cent below par to 50 per cent above par; a record volume of shares traded on the Montreal and Toronto exchanges (Figure 2). These price and quantity movements reflected a renewed demand for existing shares and for the 1.5 million new shares also being issued at this time. The most likely explanation for such a development is yet another move to acquire control of the firm and then reorganize in a way that might improve its profitability.

35. *CL*, 16 July 1910.

36. *CL*, 28 April, 5 and 30 June, and 6, 7, 16, and 25 July 1910. Acquisition of Forget's shares would have been more difficult had Aitken's money not been tied up in the Steel Company of Canada merger.

37. T. W. Acheson, "The National Policy."

38. Table 1 above; *AR*, 1914, 24 and *Investor's Guardian*, 18 Oct. 1913.

Indeed, changes were made almost immediately. In 1916 Scotia vice-president W.D. Ross visited Boston in successful pursuit of a loan from Hayden, Stone and Company.³⁹ The Boston investment house, which previously had acted as brokers for Cantley, had on its staff Bruce MacKelvey, an old friend of Ross and a former Bank of Nova Scotia employee.⁴⁰ MacKelvey became a Scotia director at the next shareholders' meeting with the understanding that a merger with DISC would be arranged. The Hayden, Stone loan was retired not long after with some of the proceeds from a large new issue of Scotia common stock, the sale of which was underwritten by Hayden, Stone.⁴¹ The remainder of the funds reportedly were used to develop Scotia's coal properties as quickly as possible.⁴² At the same time Thomas Cantley was replaced as general manager and president of Scotia. Details of the corporate restructuring were not finalized until the capital markets returned to something like normal activity after the war, but the crucial decision to surrender independence appears to have been made in 1915 and 1916.

THE PRICE AND PRODUCTIVITY OF SCOTIA'S RESOURCES

So far it appears that Scotia relied upon a rather large volume of external capital between 1900 and 1913 and that local interests relinquished their control in 1915 and 1916. Outside efforts to acquire control were attracted by the perceived potential for improvement through a reorganization. The firm's fundamental weakness helps to explain Scotia's vulnerability to these efforts. Yet what accounts for the marginal profitability of this firm? One line of investigation leads to the firm's resource supply.

It is particularly appropriate to examine carefully the cost and quality of material resources for an iron and steel company, because coal and iron ore typically accounted for about 75 per cent of all iron-making costs. Moreover, the quality of coal and ore significantly affected the remaining 25 per cent of cost through their influence upon labour and capital productivity. The profitability of iron and steel production was sensitive to small variations in the price and quality of materials inputs.⁴³

Conflicting views have been expressed about the resources available for steel production in Atlantic Canada. Kerr, Schwartzman, and Traves indicate that the resources were deficient; others claim that the raw materials available for steel

39. *Montreal Daily Star*, 9 May and 25 June 1917; Beaton Institute, MG 12, vol. 88, #3a, Diary of Billy Senator MacDonald, 23 July 1917.

40. *CL*, 18 July 1905 and 2 April 1907.

41. *Financial Times*, 23 June 1917.

42. *Financial Post*, 14 July 1917.

43. R. C. Allen, "The Peculiar Productivity History of American Blast Furnaces," *Journal of Economic History* 37 (1977): 605-33.

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manufacture were quite good.⁴⁴ The difference of opinion is crucial to larger interpretations of Scotia's evolution between 1900 and 1920. If resources were adequate, then a focus upon other influences is warranted. On the other hand, if the resource base was weak and failing, then alternative explanations for the industrial decline may be unnecessary. It is useful, therefore, to review available information about Scotia's cost structure focusing upon raw materials. It is therefore necessary to examine first the cost to Scotia of mining coal and iron ore and then to discuss input productivity at the various stages of Scotia's production.

The coal area purchased by Scotia had been opened in 1784. By 1900 it was in need of modernization, which Scotia was forced to provide at considerable cost during the early years of the century.⁴⁵ To a greater or lesser extent all Nova Scotia collieries were in need of modernization to enhance their labour productivity. Between 1890 and 1909 the output per unit of labour in bituminous coal mining increased by 77 per cent in the American mines with which Nova Scotia competed; over the same period labour productivity in Nova Scotia grew by only 16 per cent.⁴⁶ Company managers and government engineers agreed that Nova Scotia coal by 1913 was significantly more costly to extract than competing American coals.⁴⁷ Nova Scotia colliery profits suffered in consequence. As one source has noted, "the margin of profit has been too small to permit of the accumulation of proper reserves to provide against the troubles inseparable from mining coal, or to allow of adequate depreciation reserves for the amortization of capital liabilities and the depletion of coal areas."⁴⁸

Scotia's collieries appear to have been no exception in this regard. The average revenue per ton of coal from the mine acquired by Scotia increased by 24 per cent between 1880 and 1899 while in the same period the price of American bituminous coal declined by 31 per cent.⁴⁹ Under Scotia management the ratio of coal selling

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44. D. Kerr, "The Geography of the Canadian Iron and Steel Industry," *Economic Geography* 35 (1959): 151-63; T. Traves, *The State and Enterprise* (Toronto, 1979), 134-38; D. Schwartzman, "Mergers in the Nova Scotia Coal Fields," Ph. D. diss., University of California (Berkeley), 1953, 24, 129; D. Frank, "The Cape Breton Coal Industry," L. McCann, "The Metal Towns," 52-53; C. Heron, "Hamilton's Steelworkers and the Rise of Mass Production," *Historical Papers/Communications historiques* (1982): 103-31.
 45. T. C. Denis, "The Coal Fields of Canada," *An Investigation of the Coals of Canada*, eds. J.B. Porter and R.J. Durley (Ottawa, 1912), 1: 34.
 46. Nova Scotia, Department of Mines, *Annual Report*, various years; V. Eliasberg, "Some Aspects of the Development of the Coal Mining Industry, 1839-1918," National Bureau of Economic Research, *Output, Employment and Productivity in the United States after 1800, Studies in Income and Wealth* 30 (1966): 405-35.
 47. F. W. Gray, *The Coal-Fields and Coal Industry of Eastern Canada* (Ottawa, 1917), 9; E. J. McCracken, "The Steel Industry of Nova Scotia," MA diss., McGill University, 1932, 11; PANS, MG 3, vol. 1877, #49, Cantley to the Tariff Commission, 6 Nov. 1920.
 48. F. W. Gray, *The Coal Fields*, 12.
 49. PANS, MG 1, General Mining Association, *Annual Reports*, vol. 157 and *Historical Statistics of the United States*, series M6.

price to extraction cost declined from 1.32 in 1901/1903 to 1.06 in 1911/1913.⁵⁰ The ratio would have registered an even greater deterioration if the firm had computed depreciation correctly: it was later calculated that, allowing properly for depreciation and depletion costs, the Scotia mines had operated at a net loss as early as 1910 and never returned to profitability.⁵¹

By 1916 Scotia's submarine coal developments already extended more than a mile from shore.⁵² At this distance, the cost of transporting men and coal between the surface and mine-face was quite high; indeed, ventilation technology did not permit further expansion until after the war.⁵³ The cost of mining coal rose at an alarming rate during the early years of the war; very limited quantities were in sight for future extraction.⁵⁴ Between 1912 and 1918 labour productivity at Scotia's important Florence colliery declined by 50 per cent and the quality of the coal itself was deteriorating.⁵⁵ By the end of the war industry officials agreed that Scotia faced an almost complete exhaustion of its coal properties.⁵⁶ Charles Cantley, a NSSC engineer and son of the general manager, confirmed that coal depletion finally forced the firm's principals to surrender their independence and agree to a merger with DISC.⁵⁷

A parallel loss of resource advantage affected Scotia's iron mine. The Wabana ore field was the single largest source of iron ore in the North Atlantic region during the early twentieth century. Because the ore accessible by open pit mining was limited, however, the NSSC in 1904 began to explore submarine veins extending from the mine. Undersea production began in 1908; by 1911 all NSSC ore came from the submarine veins.⁵⁸

The submarine mine gave the company very large reserves of iron ore at tidewater. It was a valuable resource, as the company officers constantly reminded shareholders, but the submarine bed was enormously expensive to develop and

50. PANS, MG 3, vol. 1877, vol. 52.

51. PANS, MG 1, vol. 175, "manuscript book," chief clerk to Cantley, 6 Feb. 1924. It is not unknown for nineteenth-century firms to run a loss unwittingly because of capital accounting errors; see N. Lamoreux, *The Great Merger Movement in American Business, 1895-1904* (Cambridge, 1985), 53-54.

52. A. L. Hay, *Coal-mining Operations in the Sydney Coal Field*, American Institute of Mining and Metallurgical Engineers, Technical Publication #198 (1929), 43.

53. PANS, MG 3, vol. 1877, remarks of Thomas Cantley recorded in the proceedings of the Tariff Commission, Sydney, 3 Nov. 1920; Gray, *The Coal Fields*, 32.

54. Diary of Billy Senator MacDonald, 23 July 1917.

55. Transcript of remarks by the Florence mine manager, Fuel Controller's hearing, 27 Sept. 1918, 2 and 11; Gray, *The Coal-Fields*, 17.

56. Transcript of remarks by the deputy director of mines for Cape Breton, Fuel Controller's hearing, Sydney, 27 Sept. 1918, 28-30; *Canadian Mining Journal*, 31 Dec. 1919.

57. Diary of Billy Senator MacDonald, 23 July 1917.

58. *AR*, 1908, 7-10 and *AR*, 1911, 14.

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operate.⁵⁹ The company's annual reports do not identify different kinds of capital account spending, but there is no reason to doubt the NSSC president when he told shareholders that submarine work dominated investment needs after 1904. Quite apart from new investment, operating costs were increasing. By the company's own reckoning, the cost of extracting one ton of NSSC ore increased by 250 per cent from 1901 to 1912; during the same period the price received for the ore increased by only 80 per cent in European markets and 88 per cent in the US market.⁶⁰

In addition to the rise in coal and ore prices Scotia was handicapped by poor productivity, which partly reflected difficulties with the quality of coal and ore. A full reconstruction of the firm's production costs is not possible but partial evidence describing several stages of production has survived. Fortunately, the data excepting capital costs are complete for iron smelting, which was the single most important stage.⁶¹

Before being charged to the blast furnace, coal was washed and transformed to coke. Washing removed or reduced the presence of various impurities including, most seriously, sulphur.⁶² Scotia's washing plant, for example, reduced the ash and sulphur content from 16 per cent and 2.2 per cent to 4.5 per cent and 1.5 per cent respectively just before the war.⁶³ Unfortunately, the remaining sulphur level was still high for metallurgical purposes. Very little of the Cape Breton coal was fit for metallurgical use partly because of the high level of sulphur, much of which resisted removal because it was held as sulphates and in organic compounds rather than as sulphides.⁶⁴ By the early twentieth century coal quality deteriorated further because the gradual depletion of the Sydney coal mines forced the companies to exploit dirtier seams.⁶⁵ By the 1920s Nova Scotia coke had a markedly higher sulphur content than that available in Hamilton, the site of a rival blast furnace.⁶⁶

59. *AR*, 1908, 23–27 and *AR*, 1909, 26.

60. PANS, MG 3, vol. 1877, vol. 52, General Manager's Ledger Book, #10.

61. The lack of capital data is less serious than might be supposed, since according to the Allen article cited in n. 44, capital typically accounted for 10 per cent of the total cost of iron and steel production.

62. J. B. Porter, "The Mechanical Preparation of Coal," *An Investigation of the Coals of Canada*, I: 163–204.

63. *Ibid.*, 183.

64. T. C. Denis, "The Coal Fields of Canada," 25; J. B. Porter, "Mechanical Preparation of Coal," 166. A transcript of hearings at Sydney reporting litigation between the Dominion Coal Company and the Dominion Steel Company during 1907 is a particularly informative source about the Cape Breton coal field. Three volumes of the transcript are held in the archives of the Beaton Institute, Sydney, Nova Scotia.

65. J. B. Porter, "The Mechanical Preparation of Coal," 165 and F. W. Gray, *The Coal Fields*, 17.

66. R. E. Gilmore, "Examination of Typical Cokes Sold in Canada," in Canada. Department of Mines, *Investigations of Fuels and Fuel Testing, 1925* (Ottawa, 1927), 13–14. Compare samples #2385 with #2287 and #3592 with #3497.

The inferior quality of local coal impaired efficiency in the coke ovens. Between 1904 and 1909 Scotia needed 15 per cent more coal to produce a ton of coke than did American sources.⁶⁷ Coke oven workers at the NSSC works produced an average of 794 tons per year compared with 1234 and 1263 tons at American ovens in 1904 and 1909. Labour productivity was so much lower in Nova Scotia that the substitution of labour for capital is unlikely to have been entirely responsible. Rather, the technical characteristics of Cape Breton coal responsible for a high coal/coke ratio probably also impaired labour productivity at the coke oven.⁶⁸

The coke oven contributed only a small share of the final cost of rolled steel; the blast furnace was responsible for a much larger part of the total cost. Tables 3 and 4 present production costs in the blast furnaces of the NSSC and the rival Hamilton Steel and Iron Company, which was situated in central Canada and relied on American coal and iron ore. The Hamilton and Nova Scotia firms were of comparable size at the turn of the century, and competed directly against one another. The Hamilton firm provides a useful contrast as well because, unlike Scotia, it was consistently successful.⁶⁹ The production data help to make sense of Hamilton's success and the NSSC's failure.

The Hamilton company enjoyed an average margin of price over variable costs during the period from 1896 to 1920 of about two dollars per ton; this probably sufficed to cover miscellaneous and capital costs.⁷⁰ The average NSSC margin during the period from 1892 to 1920, by contrast, was much smaller and undoubtedly failed to cover capital and miscellaneous costs. A more detailed consideration of smelting costs reveals a number of ways in which the furnaces differed.

One obvious difference was the location of the blast furnace. The NSSC spent little in assembling raw materials because the blast furnaces were situated at

67. The figures are 1.72 and 1.5 tons of coal per ton of coke; see Canada. Public Archives (PAC), Record Group (RG) 87, vol. 10; 1909 Census of Manufactures, vol. 10, "The Coke Industry," tables 1 and 14.

68. Cape Breton coals typically were low in carbon content and high in sulphur and ash.

69. K. Inwood, "The Iron Industry," *Progress Without Planning: The Economic History of Ontario, 1867-1939*, ed. I.M. Drummond (Toronto, 1987), ch. 11.

70. The Hamilton and NSSC furnaces were similar in many ways to small American coke blast furnaces. Data describing US blast furnaces in 1899 (found in the 1900 US Census of Manufacturers, "Iron and Steel Manufacturing," table 28) indicates miscellaneous costs of forty-five cents per ton and capital valuing nine dollars per ton. It is conventional to view the annual cost of capital as composed of depreciation and interest paid on funds needed for investment. Interest and depreciation rates combined are unlikely to have exceeded 15 per cent. As an upper bound estimate a combined interest and depreciation charge of 17 per cent may be imputed. This implies an annual capital cost of \$1.53, which in turn suggests that an average American furnace incurred about two dollars in capital and miscellaneous costs.

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Table 3: Average Annual Production Data: The Nova Scotia Steel and Coal Company

VARIABLE COST AND MARGIN PER TON OF IRON (\$)						
Year	Ore	Fuel	Flux	Labour	Variable Cost	Price less Variable Cost
1892	4.37	4.02	0.95	5.58	15.22	-0.22
1893	4.49	3.43	0.57	4.50	12.99	-0.99
1894	4.32	3.71	0.61	4.06	12.91	-2.41
1895	5.82	4.00	0.89	2.38	13.10	-1.00
1896	4.84	2.82	0.75	2.00	10.44	2.41
1897	3.93	3.18	0.84	2.50	10.46	-0.21
1898	4.07	2.95	0.83	2.00	9.85	1.76
1899	5.18	4.33	0.78	2.13	12.42	0.59
1900	4.30	6.40	0.70	2.60	14.00	1.00
1901	4.19	6.11	0.26	2.19	12.72	2.28
1902	3.30	5.70	0.57	2.19	11.77	3.73
1903	3.07	6.34	0.55	1.97	11.93	4.07
1904	3.20	5.14	0.48	1.10	9.92	0.08
1905	3.82	4.12	0.39	1.63	9.96	0.04
1906	3.10	3.87	0.36	1.38	8.70	1.30
1907	3.24	4.52	0.43	1.33	9.51	1.49
1908	3.34	4.54	0.42	1.29	9.59	0.41
1909	3.06	4.87	0.37	0.95	9.27	0.73
1910	2.87	4.50	0.38	0.97	8.71	3.29
1911	2.86	4.50	0.36	0.84	8.56	2.44
1912	3.07	5.02	0.36	0.95	9.39	0.61
1913	3.13	5.16	0.35	0.82	9.46	0.54
1914	3.79	5.04	0.43	0.93	10.20	-0.20
1915	6.58	4.42	0.62	0.92	12.55	2.45
1916	7.08	5.42	0.56	0.98	14.04	0.96
1917	7.86	9.63	0.61	1.36	19.45	2.55
1918	8.92	13.57	0.69	1.33	24.51	1.08
1919	6.93	14.65	0.84	1.90	24.31	1.09
1920	7.33	12.47	1.06	1.76	22.62	0.93
Average	4.55	5.67	0.59	1.89	12.71	1.06

Source: Public Archives of Canada, Record Group 87, Volume 18. Labour data are adjusted to remove construction labour in certain years; occasional missing entries are interpolated by taking the arithmetic mean and (in the case of wages before 1903) by extrapolating using other wage series. M. Urquhart and K. Buckley, eds., *Historical Statistics of Canada* [Toronto, 1965], D27 and D204-205). The number of days in blast is either reported by the company or inferred from the rate of capacity utilization.

Table 3: Average Annual Production Data: The Nova Scotia Steel and Coal Company (con't)

VARIABLE INPUT QUANTITIES PER TON OF IRON			
Ore/Iron	Fuel/Iron	Flux/Iron	Man-Days Iron
2.18	1.61	0.95	3.25
1.99	1.37	0.57	2.73
2.16	1.51	0.81	2.73
1.94	1.33	0.89	1.52
1.69	1.37	0.78	1.21
1.97	1.59	0.84	1.52
1.86	1.48	0.83	1.21
1.90	1.44	0.78	1.29
1.93	1.60	0.93	1.56
1.92	1.55	0.84	1.21
1.91	1.44	0.76	1.21
1.84	1.58	0.73	1.09
1.81	1.43	0.55	0.55
1.88	1.27	0.52	0.80
1.78	1.29	0.48	0.76
2.01	1.40	0.55	0.63
2.01	1.40	0.56	0.36
1.94	1.50	0.50	0.35
1.91	1.38	0.50	0.49
1.83	1.29	0.53	0.50
1.91	1.34	0.60	0.51
1.96	1.38	0.58	0.50
1.90	1.34	0.62	0.57
1.88	1.36	0.65	0.58
1.92	1.30	0.59	0.56
1.78	1.28	0.53	0.62
1.70	1.14	0.43	0.55
1.73	1.17	0.42	0.49
1.90	1.18	0.53	0.42
1.91	1.39	0.65	1.03

Source: Public Archives of Canada, Record Group 87, Volume 18. Labour data are adjusted to remove construction labour in certain years; occasional missing entries are interpolated by taking the arithmetic mean and (in the case of wages before 1903) by extrapolating using other wage series. M. Urquhart and K. Buckley, eds., *Historical Statistics of Canada* [Toronto, 1965], D27 and D204-205). The number of days in blast is either reported by the company or inferred from the rate of capacity utilization.

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Table 3: Average Annual Production Data: The Nova Scotia Steel and Coal Company (con't)

VARIABLE INPUT PRICES			
\$/Ton Ore	\$/Ton Fuel	\$/Ton Flux	\$/Man-Day
2.01	2.50	1.00	1.61
2.25	2.50	1.00	1.65
2.00	2.47	1.00	1.49
3.00	3.00	1.00	1.57
2.56	2.06	1.00	1.65
1.99	2.00	1.00	1.65
2.19	2.00	1.00	1.65
2.72	3.00	1.00	1.65
2.23	4.00	0.75	1.65
2.18	3.95	0.27	1.81
1.73	3.96	0.75	1.81
1.67	4.00	0.75	1.81
1.77	3.59	0.88	1.98
2.03	3.25	0.75	2.05
1.74	3.00	0.75	1.80
1.61	3.23	0.77	2.09
1.66	3.25	0.75	3.58
1.58	3.25	0.75	2.74
1.50	3.25	0.75	1.96
1.56	3.50	0.68	1.68
1.61	3.75	0.60	1.84
1.60	3.75	0.60	1.63
1.99	3.75	0.70	1.65
3.50	3.25	0.95	1.59
3.68	4.17	0.95	1.75
4.43	7.50	1.15	2.19
5.26	11.88	1.60	2.41
4.02	12.57	2.00	3.91
3.86	10.59	2.00	4.19
2.41	4.24	0.94	2.04

Source: Public Archives of Canada, Record Group 87, Volume 18. Labour data are adjusted to remove construction labour in certain years; occasional missing entries are interpolated by taking the arithmetic mean and (in the case of wages before 1903) by extrapolating using other wage series. M. Urquhart and K. Buckley, eds., *Historical Statistics of Canada* [Toronto, 1965], D27 and D204-205). The number of days in blast is either reported by the company or inferred from the rate of capacity utilization.

tidewater at the site of a coal mine and within easy shipping distance of the iron mine, which was also at tidewater. By contrast Hamilton's ore and coal were more expensive because they had to be shipped a considerable distance from the American mines. The average cost per ton of iron in Hamilton between 1896 and 1920 was \$3.40 greater than it would have been had ore and coke been available in Hamilton at Nova Scotia prices.

Hamilton's disadvantage in assembling raw materials was offset somewhat by its location close to the major Canadian centres of ferric metal consumption. The value of Hamilton iron averaged \$2.80 more than the Nova Scotia value between 1896 and 1920 largely because the former furnace absorbed smaller transportation costs on output. Overall, the transportation bills of the two furnaces were roughly comparable in size. The burden of Scotia's greater distance from the market was offset by its close proximity to raw materials. Viewed from this perspective, which is rooted in locational economics, Scotia's fundamental burden was that raw material prices were not low enough or the quality was not high enough to justify a location so far from the market. This burden became heavier over time in the face of unfavourable coal and ore price trends.

At the blast furnace the NSSC calculated that its ore almost doubled in value during the twenty years between 1897/1900 and 1917/1920, while at Hamilton the increase was only 50 per cent. To a lesser extent the same was true of coke; the NSSC price of coke quadrupled while the Hamilton price tripled. These price trends substantially reduced the attractiveness of Nova Scotia as a location for iron smelting. As we have seen, the rising price of ore and coke reflected real difficulties in mining.

Scotia's blast furnace was also handicapped by low input productivity. Before 1920 the NSSC on average used 20 per cent more coke and flux and 70 per cent more labour per ton of iron than did the Hamilton firm. To be sure, productivity increased more quickly in Nova Scotia, but this gain was offset by a faster increase in raw material prices.

Productivity in the Scotia blast furnace partly reflects the quality of local iron ore and coke. NSSC ore during the early 1900s averaged 50 per cent metallic iron content in contrast to an average of 55 per cent at US mines.⁷¹ Low-grade ore has a lower productivity and also requires additional fuel to smelt. Additional fuel, in turn, necessitates more flux. The increased volume of raw materials reduces furnace capacity and increases the labour in handling. These indirect effects implied a lower level of productivity for all inputs including capital and labour. Eckel estimates that a five percentage point reduction in an ore's iron content at this time would raise production costs overall by \$1.25 or by about 10 per cent.⁷²

71. J. Jeans, *Canada's Resources and Possibilities* (London, 1904), 154.

72. E. Eckel, *Iron Ores* (New York, 1914), 363. The cost effect decreased the value of ore in a competitive market; see *Iron Age*, 13 Dec. 1883.

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Table 4: Average Annual Production Data: The Hamilton Steel and Iron Company

VARIABLE COST AND MARGIN PER TON OF IRON (\$)						
Year	Ore	Fuel	Flux	Labour	Variable Cost	Price less Variable Cost
1896	9.13	7.50	0.60	1.11	18.34	-5.84
1897	4.11	3.62	0.32	1.20	9.26	1.90
1898	4.79	3.29	0.23	1.20	9.51	1.49
1899	6.77	3.75	0.33	1.48	12.34	-0.74
1900	5.64	4.95	0.34	1.48	12.60	2.40
1901	6.60	4.46	0.44	1.22	12.72	0.78
1902	6.05	4.31	0.35	1.35	12.06	0.94
1903	5.84	7.10	0.47	2.22	15.63	0.37
1904	8.90	3.98	0.37	2.13	15.38	-2.38
1905	5.72	4.78	0.38	1.63	12.52	1.48
1906	7.05	5.24	0.41	1.76	14.46	2.54
1907	6.22	5.74	0.42	1.58	13.96	4.04
1908	6.86	4.66	0.42	1.71	13.65	1.98
1909	6.55	4.41	0.49	1.48	12.93	2.69
1910	7.13	4.78	0.56	1.55	14.02	2.05
1911	6.87	4.55	0.48	1.79	13.68	1.50
1912	8.66	4.57	0.53	0.89	14.65	-0.85
1913	6.02	4.44	0.53	0.93	11.92	4.84
1914	6.03	4.43	0.57	0.84	11.86	2.06
1915	6.56	4.69	0.57	0.62	12.44	0.49
1916	5.85	5.09	0.57	0.97	12.48	3.08
1917	7.10	7.77	0.79	1.41	17.06	4.02
1918	8.61	10.99	1.10	1.45	22.15	9.17
1919	10.17	11.94	0.90	1.59	24.60	4.05
1920	12.20	11.12	1.01	1.34	25.67	6.08
Average	7.03	5.69	0.53	1.40	14.64	1.93

Source: As in Table 3.

Table 4: Average Annual Production Data: The Hamilton Steel and Iron Company (con't)

VARIABLE INPUT QUANTITIES PER TON OF IRON			
Ore/Iron	Fuel/Iron	Flux/Iron	Man-Days Iron
3.65	2.33	0.67	0.58
1.64	1.06	0.36	0.63
1.60	1.04	0.29	0.63
1.69	1.25	0.48	0.78
1.83	1.16	0.48	0.78
1.76	1.11	0.49	0.71
1.59	1.08	0.47	0.78
1.90	1.29	0.60	0.88
1.82	1.06	0.47	1.10
1.53	1.04	0.49	0.98
1.71	1.10	0.52	0.98
1.31	1.19	0.58	0.88
1.90	1.22	0.71	0.59
1.88	1.11	0.60	0.70
1.90	1.14	0.71	0.57
1.78	1.11	0.60	0.76
2.37	1.09	0.62	0.30
1.73	1.04	0.58	0.37
1.82	1.02	0.57	0.36
1.96	1.00	0.55	0.33
1.71	1.00	0.53	0.25
1.79	1.11	0.59	0.27
1.92	1.22	0.69	0.32
2.08	1.10	0.58	0.23
2.27	0.93	0.44	0.27
1.91	1.15	0.55	0.60

Source: As in Table 3.

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Table 4: Average Annual Production Data: The Hamilton Steel and Iron Company (con't)

VARIABLE INPUT PRICES			
\$/Ton Ore	\$/Ton Fuel	\$/Ton Flux	\$/Man-Day
2.50	3.21	0.90	1.90
2.51	3.40	0.89	1.90
3.00	3.15	0.80	1.90
4.00	3.00	0.70	1.90
3.19	4.25	0.70	1.90
3.75	4.00	0.90	1.73
3.80	4.00	0.75	1.73
3.07	5.50	0.78	2.54
4.88	3.75	0.79	1.94
3.75	4.60	0.79	1.66
4.13	4.75	0.80	1.80
3.44	4.80	0.73	1.79
3.60	3.83	0.59	2.90
3.49	3.98	0.81	2.11
3.75	4.20	0.79	2.71
3.85	4.12	0.80	2.34
3.66	4.19	0.86	2.98
3.48	4.26	0.92	2.52
3.30	4.33	0.99	2.34
3.35	4.70	1.03	1.87
3.41	5.06	1.07	3.90
3.96	7.03	1.33	5.19
4.49	9.00	1.59	4.60
4.88	10.86	1.55	6.79
5.38	12.00	2.31	5.06
3.71	5.04	0.97	2.72

Source: As in Table 3.

The Newfoundland ore was further bedevilled with a high silicon content, from 8 per cent to 13 per cent. This compared unfavourably with an 6 per cent average during the early 1900s for American ore such as was used by the Hamilton blast furnace.⁷³ Removal of silicon in the blast and steel furnaces required heavy fluxing, and this increased fuel consumption and handling costs and reduced furnace capacity.⁷⁴

The additional coke, in turn, brought with it more sulphur to the melt.⁷⁵ Indeed, the mere presence of a silicious slag induced absorption of sulphur by the metal.⁷⁶ Because Nova Scotia coke tended to be quite sulphuric, the introduction of additional sulphur was not easily tolerated. The less sulphuric of the Nova Scotia coke tended to have a much higher ash content and to be weaker structurally.⁷⁷ The latter was itself a serious problem, since much of the coke lacked the strength to support the material burden descending in a large modern blast furnace.

Finally, both ore and coke showed significant variations in their chemical and mechanical compositions. This undoubtedly contributed to higher costs because continuous production at large levels of through-put required strictly uniform conditions. Scotia's fast rate of productivity growth between 1897 and 1920 indicates that the firm was learning how to use its awkward resource combination, although unfortunately this gain was largely offset by a rise in raw material prices.⁷⁸

The influence of resource quality was, if anything, more serious at the next stage of production, the conversion of iron to steel, because the Newfoundland ore contained excessive phosphorus as well as silicon. Silicious ore was converted in a

73. M. Campbell, "The History of Basic Steel Manufacture at Sydney," *Transactions of the Mining Society of Nova Scotia* 55 (1952): 217-25; J. Jeans, *Canada's Resources and Possibilities*, 129-30, 154 and 169; C. Macdonald, *The Coal and Iron Industries of Nova Scotia* (New Glasgow, 1909), 91; PANS, MG 3, vol. 1877, vol. 52; S. Saunders and R. MacKay, "The Economy of Newfoundland," *The Economy of Newfoundland*, ed. R. MacKay (Toronto, 1946), 47, 108; *Canadian Courier*, 31 Dec. 1910; *Wall Street Journal*, 14 Sept. 1910.

74. M. Campbell, "The History of Basic Steel Manufacture at Sydney;" D. Burn, *The Economic History of Steelmaking* (Cambridge, 1940), 174-77; H. Skelton, *The Economics of Iron and Steel* (2nd ed., London, 1924), 68; J. Jeans, *Steel* (London, 1880), 576 and 600-06; B. Stoughton, *The Metallurgy of Iron and Steel* (3rd ed., New York, 1923), 29-42; *Canadian Engineer* (1895): 134; *Journal of the Iron and Steel Institute* 59 (1901): 507; *Canadian Mining Review* (1898): 221; *Journal of the U.S. Association of Charcoal Iron Workers* (1884): 340; J. Jeans, *Steel*, 576 and 606-06; R. C. Allen, "The Peculiar Productivity."

75. I. Lowthian Bell, *The Manufacture of Iron and Steel* (London, 1884), 103.

76. *Canadian Mining Review* (1898): 221.

77. E. Forsey, *Economic and Social Aspects of the Nova Scotia Coal Industry* (Toronto, 1926); F. W. Gray, *The Coal Fields*, 36.

78. In part the productivity gap narrowed because the quality of American ores gradually declined; see E. Eckel, *Iron Ores*, 358-9.

steel furnace with an acid lining that eliminated silicon at little cost, but could not remove phosphorus; phosphoric ore could be converted with a basic lining that reacted with the phosphorus, which was a very harmful impurity. In some ores, however, there would be sufficient phosphorus to require its removal but insufficient to fire effectively the conversion to steel.⁷⁹ The Newfoundland ore appears to have contained a level of phosphorus in this range.⁸⁰ Even more serious was the joint presence of silicon and phosphorus, since neither basic nor acid metallurgy could eliminate easily both silicon and phosphorus.⁸¹

Additional equipment was needed to work this type of ore. One Nova Scotia steel-maker adopted the simple although costly expedient of duplexing, or running the metal through both acid and basic furnaces.⁸² The extra slag occasioned by heavy fluxing could be removed more easily with a special tilting furnace.⁸³ A “pig mixer” was used to refine and homogenize the metal between the blast furnace and steel-works; a fluid compression press inhibited the formation of imperfections as

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79. D. Burn, *The Economic History of Steelmaking*, 174, n. 1; N. Pounds and W. Parker, *Coal and Steel in Western Europe* (Bloomington, 1957), 120–2; H. Skelton, *The Economics of Iron and Steel*, 136; *Iron Age*, 1 Jan. 1885 and 25 July 1889; *Journal of the Iron and Steel Institute* 59 (1901): 158–63.
80. J. Jeans, *Canada's Resources and Possibilities*, 154.
81. D. Burn, *The Economic History of Steelmaking*, 174–7; J. Jeans, *Steel*, 576 and 600–06; A. Milward and S. Saul, *The Development of the Economies of Continental Europe* (2nd ed., London, 1979), 26; Peter Termin, 139–44; *Journal of the Iron and Steel Institute* 59 (1901): 507 and 61 (1902): 54–78; *Journal of the U.S. Association of Charcoal Iron Workers* (1884): 340; *Iron Age*, 1 Jan. and 5 March 1885, and 25 July 1889; *Iron and Coal Trades Review* (1898): 264–5 and 559–60. Bell, in *The Manufacture of Iron and Steel*, p. 163, observes that “in the basic treatment an excessive amount of silicon is accompanied with considerable inconvenience.”
82. H. Skelton, *The Economics of Iron and Steel*, 36; B. Stoughton, *The Metallurgy of Iron and Steel*, 91; *Iron Age*, 8 July 1875 and 2 May 1902, *Stahl und Eisen* 21 (1901): 1303–13; *Mining Journal*, 7 Feb. 1880, 151; *Journal of Iron and Steel Institute* (1896): 396; *ibid.* (1901): 474 and *ibid.* (1902): 587 and 590; *Canadian Engineer* (1900–1901): 147 and *ibid.* (1907): 168. It may be more than mere coincidence that F. H. Crockard, who replaced Cantley as Scotia president in 1917, came with credentials in the construction and operation of a duplexing plant.
83. I.L. Bell, *The Manufacture of Iron and Steel*, 113; M. Campbell, “The History of Basic Steel Manufacture at Sydney,” D. Eldon, “American Influence in the Canadian Iron and Steel Industry,” PhD diss., Harvard University, 1952, 308; D. McCloskey, *Economic Maturity and Entrepreneurial Decline* (Cambridge, 1973), 71–2; E. J. McCracken, “The Steel Industry of Nova Scotia,” 90; H. Skelton, *The Economics of Iron and Steel*, 239–42; *Journal of the Iron and Steel Institute* 62 (1902): 582 and *ibid.*, 63 (1903): 57–94; J. S. Jeans, *American Industrial Conditions*, 175; PANS, MG 3, vol. 1877, #45; Canada. Department of Mines, *Report* (Ottawa, 1908), 548. Hall observes that “tilting furnaces are more expensive to install and maintain and should not be used except where there is good reason for incurring the extra overhead and operating expenses”; J. Hall, *The Steel Foundry* (2nd ed., New York, 1923), 145.

the steel ingot cooled.⁸⁴ The Nova Scotia steel companies learned to use these innovations, although in so doing they required special machinery and incurred other costs, which are reflected in the data describing steel conversion.⁸⁵

Between 1910 and 1920 Scotia needed 520 pounds of flux for every ton of steel while the Hamilton firm averaged only 240 pounds.⁸⁶ The direct cost of purchasing and handling the flux was less burdensome than the indirect effect on capital and labour of reduced through-put.⁸⁷ Reliable capital data are, of course, unavailable. It is known, however, that labour at the NSSC steel furnaces produced 1.40 tons per day in 1909-10 and 1.43 in 1918-20 in which years the Hamilton workers averaged respectively 1.46 and 2.99.⁸⁸ Overall, it is difficult to escape the judgement that the Nova Scotia locational advantage "with respect to raw materials was offset by certain metallurgical deficiencies in the Wabana ore and Cape Breton coal, the overcoming of which increased production costs."⁸⁹

Ingots were taken from the steel furnace to the rolling mills. During the three-year period from 1907 to 1909 the Hamilton mills rolled 0.49 tons of steel per man-day compared with 0.24 tons for Scotia.⁹⁰ As with the coke ovens it is highly unlikely that a productivity gap of such magnitude resulted simply from the substitution of labour for capital; total factor productivity undoubtedly was lower in Nova Scotia. It is especially significant to observe a productivity lag before the important mill modernization in Hamilton which began in 1911.⁹¹

In part the NSSC mills were less efficient because of their location in Pictou County at some distance from the steel furnaces in Cape Breton. This curious arrangement increased costs because inventory management was more complicated, transportation and loading/unloading needs were greater, and contiguity economies were unavailable.⁹² The NSSC mills were disadvantaged also because their output per year was only 60 per cent that of the Hamilton mills, but it is rather

84. N. Pounds and W. Parker, *Coal and Steel in Western Europe*, 122; H. Skelton, *The Economics of Iron and Steel*, 248 and 559; K. Inwood, "Economic Interpretation of Resource Discoveries," n. 64; *Canadian Engineer* (1903): 140; *Stahl und Eisen* 29 (1909): 1465-77; *Journal of the Iron and Steel Institute* 136 (1937): 77P-97P; *Iron Age*, 18 June 1891; J. S. Jeans, *American Industrial Conditions*, 514.

85. M. Campbell, "The History of Basic Steel Manufacture at Sydney;" K. Inwood, "Economic Interpretation of Resource Discoveries;" L. McCann, "The Metal Towns."

86. PAC, RG 87, vol. 18.

87. M. Campbell, "The History of Basic Steel Manufacture at Sydney;" E. Eckel, *Iron Ores*, 363.

88. PAC, RG 87, vol. 18.

89. L. Beehler, *The Maritime Provinces in Their Relation to the National Economy of Canada* (Ottawa, 1948), 92.

90. *Ibid.*

91. C. Heron, "Hamilton's Steelworkers."

92. The transportation cost burden alone was estimated to be thirty cents per ton during the war; see PANS, MG 1, vol. 175, "BESCO file," to Crockard, 19 March 1918.

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difficult to know if this should be regarded as a cause or as a result of the low NSSC productivity.

High production costs at the rolling mills, and also at the coke oven, blast furnace, and steel converter, explain Scotia's inability to generate a surplus for reinvestment even in the period of extraordinarily strong demand for capital goods in the decade preceding World War I.⁹³ The repeated need for external finance, in turn, made the firm vulnerable to outside bids for control. The large issue between 1901 and 1904 of voting common stock was a tempting target for outside interests hoping to assume control, especially if it was known that the firm was likely to renew its quest for funds later in the decade.

SCOTIA'S STRATEGY FOR SURVIVAL

In order to prolong Scotia's life as an independent firm in these difficult circumstances Cantley, the Scotia general manager, employed a sophisticated financial strategy. Cantley carefully cultivated Scotia's image in the financial press and avoided public discussion of the firm's technical difficulties and rise in mining costs.

This task was made easier by Cantley's technique of underwriting and placing of securities as much as possible within the region or with "friends" of the company and the region. To this end Cantley cultivated loyalty to the corporation and identified it with confidence in the incumbent management and the defence of regional interests in general.⁹⁴ When no further supply of capital was available locally, the general manager preferred to seek European sources in order to disperse ownership and remove it from the easy reach of Canadian financiers.⁹⁵ Large domestic underwriters, who might have provided powerful support to a takeover bid, were avoided whenever company securities had to be marketed in Canada.⁹⁶

An extensive network of minor financial entrepreneurs and institutions marketed NSSC securities in Canada. Eastern Trust in Halifax issued a mortgage to secure NSSC bonds.⁹⁷ Eastern Trust securities, in turn, were held by wealthy Haligonians such as John Douall, successively vice-president and president of the

93. K. Buckley, *Capital Formation in Canada* (1955, rep. Toronto, 1974).

94. This remark is based on a reading of Cantley's personal letterbooks, cited earlier, between 1903 and 1911.

95. *CL*, 23 Dec. 1908, 28 May 1909, 21 and 27 May 1910, 16 July 1910; Dalhousie University Archives (DAL), Hawker Siddely Papers (HS), vol. 1g, 13 Dec. 1900; PANS, MG I, vol. 167, trip notes and MG 2, vol. 296, 17 June and 13 July 1909.

96. The largest and most aggressive institutions which might have acted as Canadian underwriters for Scotia were the Bank of Commerce, Bank of Montreal, and their associated intermediaries. However, these firms had already committed considerable support to DISC, a potential merger partner for NSSC.

97. DAL, HS, vol. 1g, 8 March 1901 and vol. li, 1 July and 11 Oct. 1900.

Bank of Nova Scotia from 1874 to 1899, and John Payzant, successively vice-president and, from 1897 to 1899, president of Eastern Trust itself.⁹⁸

Part of the Cantley strategy, too, was to underwrite Scotia share placement using funds borrowed from Royal Securities, the Union Bank, and the Metropolitan Bank.⁹⁹ The principal manager of the latter was W.D. Ross, a NSSC director. Also involved in the underwriting syndicate were A.E. Ames of Dominion Securities; Robert Reford, securities broker, Bank of Toronto director and also a NSSC director; the Securities Holding Company in Toronto; and the anticipated array of Halifax and Pictou County figures including NSSC directors. Pricing and rate of sale through this large network of underwriting agents was directed carefully by Cantley, who in turn received personal loans from the Union, Metropolitan, and Royal banks secured by NSSC securities.¹⁰⁰

Bonds were distributed in a similar fashion. When two-thirds or more of the 1908–09 bond issue could not be placed in Britain, the Bank of Nova Scotia absorbed a bloc of one-half million dollars, the Union Bank of Halifax took \$750,000 and a third bank accepted \$250,000.¹⁰¹ Union Bank participation is hardly surprising, since one purpose of the issue was to reduce its one million dollar short-term accommodation to the steel company.¹⁰² NSSC securities also found their way into the personal portfolios of directors of the Bank of Nova Scotia.¹⁰³

The Bank of Nova Scotia and Union Bank connections were influential but they did not preclude a reliance on other small banks for underwriting.¹⁰⁴ The pattern of relying first on regional sources of finance and later on several small central Canadian banks suggests a desire to diversify and to avoid the large financial institutions with industrial interests in Canada, such as Bank of Montreal and the Bank of Commerce, both of which provided extensive support to DISC.¹⁰⁵

98. J. Frost, "The Nationalization of the Bank of Nova Scotia," *Acadiensis* 12 (1982).

99. On the Union Bank, see *CL*, 2 Nov. 1904 and 3 Feb. 1905; on Aitken and Royal Securities, see *CL*, 18 Jan., 21 May, 16 July and 10 Nov. 1904, 20 and 22 Oct. 1908, and 11 March 1909; on the Metropolitan Bank, see *CL*, 1 Oct. and 7 Nov. 1904 and the 1909 company report to shareholders; on Ames, see *CL*, 17 Aug. and 31 Oct. 1904; on Reford, see *Monetary Times (MT)*, 1900–01, 163 and *CL*, 28 July 1904; on the Securities Holding Company, see *CL*, 10 Oct. 1904; on the directors, see *CL*, 12, 13, and 18 April, 17 August, and 10 Oct. 1904 and 7 August 1905.

100. *CL*, 3 May 1904; 3 Jan. 1906; 6 and 28 Jan. 1907; 19, 25, and 28 May and 15 Dec. 1909; 14 Jan. 1910; 24 Jan. and 4 May 1911.

101. *CL*, 31 March 1910, 9 April 1909 and 4 April 1910; Bank of Nova Scotia, *Annual Report*, 1909.

102. *Financial Times*, 21 Feb. 1914; *Montreal Star*, 3 Nov. and 31 Dec. 1909; *CL*, 25 May 1909; PANS, MG 1, vol. 398, 5ff and vol. 167, 1909 trip notes.

103. J. Frost, "The Nationalization of the Bank of Nova Scotia," 17.

104. The Imperial, Toronto and Metropolitan banks, in addition to the Bank of Nova Scotia, were all represented on the NSSC board of directors in the early twentieth century.

105. K. Inwood, *The Canadian Charcoal Iron Industry, 1870–1914* (New York, 1986), ch. 7.

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Strategic financial alliances, manipulation of the securities markets, and the exploitation of local loyalties enabled the NSSC to survive as long as it did with large capital needs and low profit margins. Unfortunately, this strategy left the firm perennially short of funds needed for reinvestment. The effect of this was apparent on the eve of the BESCO merger, when company shareholders were told that Scotia, if it were to remain independent, required millions of dollars for new equipment and mine development.¹⁰⁶

Moreover, even this strategy could not eliminate the attractions offered by a merger. A consolidation would have reduced the operating costs of mining the Cape Breton coal field and Wabana ore bed, in each of which DISC and Scotia worked adjacent portions.¹⁰⁷ A sharing of facilities undoubtedly would have permitted some reduction of manufacturing and transportation overhead costs on a per-unit basis. Additionally, the earnings of the two companies together would have been greater than they were separately, because the NSSC rolling mills undoubtedly would have been removed to Cape Breton where the blast furnaces of both companies were located. As long as profitability could be improved through such remedies, the firm was a tempting target for reorganization by outsiders. Unfortunately, its poor profit record forced Scotia to depend on external finance to an extent that made it impossible for the incumbent regional management to retain control.

CONCLUSION

The price and quality of its raw materials undermined the profitability of Scotia's operation even before the Great War. Resources, which were so important to the success of any iron and steel company and which even at the outset were of marginal quality in Nova Scotia, were being depleted. This insight does not imply that Scotia's owners and managers were trapped in a resource-determined predicament to which they were unable to respond. Quite the contrary. An appreciation for the difficult and long-term nature of the challenge enables us to recognize the considerable sophistication and success of Scotia's response.

Scotia's experience also confirms the need to strike a careful interpretive balance in the larger question of resource and structural influences. On the one hand, corporate size, structure, and control changed and the changes mattered. On the other hand, corporate structure reflected a clear strategy for adapting to and surviving in a particular economic environment. The latter was conditioned in an important way by the resource base. The economic environment and the interplay

106. PANS, MG 1, vol. 175, "BESCO" file, minutes of special shareholder meeting.

107. V. Southey, "The History and Problems of the Wabana Submarine Iron Mines," *Transactions of the Canadian Institute of Mining and Metallurgy* 72 (1969): 45-70. It appears that NSSC had more and better ore in its share of the Wabana bed, while DISC's coal reserves were clearly superior. See PANS, MG 1, vol. 175, "BESCO" file, McKelvie to Crockard, 15 Feb. 1918 and Crockard to McKelvie, 19 Feb. 1918; *CL*, 9 Aug. 1915, Cantley to Stairs; Billy Senator MacDonald diary.

between environment and business strategy are more significant than is recognized in the structuralist view.

This new interpretative balance differs from a one-dimensional staple approach as well as the structuralist view. Resource considerations are emphasized in the former, of course, but the fundamentally interesting and important elements in the Scotia story involve the interplay of business strategy and economic environment rather than resource determinism by itself.

It is worth noting also that the experience of this one firm or even the entire iron and steel industry leads to few conclusions about the regional dimensions of industrialization in general. There are two reasons for this. First, most other types of manufacturing activity can flourish in the absence of primary iron and steel production; the secondary iron and steel industry, for example, expanded quickly in all regions of Canada before the primary industry's "takeoff" during the 1890s.¹⁰⁸ Secondly the steel industry is sufficiently different in its nature that it would be dangerous to generalize from its example. The price and quality of resources mattered more for this industry than for others. Hence, the experience of iron and steel does not rule out the possibility that structural analysis may yet prove helpful in understanding one or more Canadian industries during the early decades of this country's industrialization.

108. G. Bertram, "Economic Growth in Canadian Industry, 1870-1915: The Staple Model and the Take-Off Hypothesis," *Canadian Journal of Economics and Political Science* 29 (1963): 162-84.