

Financial Markets and Twentieth Century Industrialization:  
Evidence From U.S. and Canadian Steel Producers<sup>1</sup>

Ian Keay  
Department of Economics  
Queen's University  
Kingston, ON  
K7L 3N6  
ikeay@qed.econ.queensu.ca

AND

Angela Redish  
Department of Economics  
University of British Columbia  
1873 East Mall  
Vancouver, BC  
V6T 1Z1  
anji@econ.ubc.ca

**Queen's Institute for Economics Working Paper # 1003**

<sup>1</sup>The authors thank seminar participants at Queen's University, McGill University and the 2001 C.E.A. Conference for their helpful comments. Franklin Fu provided excellent research assistance. Angela Redish was a visitor at the Bank of Canada during the time that this paper was written. The views expressed in this paper are those of the authors alone and should not be attributed to Bank of Canada. All remaining errors and omissions are the responsibility of the authors.

## **Abstract**

Despite the diverse and developed nature of twentieth century U.S. and Canadian financial markets, the history of both economies is replete with claims of inefficiency and inadequacy among financial intermediaries, particularly the banking sectors. In Canada it has been argued that banks were oligopolistic and favoured an entrenched merchant class over industrialists. In the U.S. the unit banking system has been perceived as unstable and of an inefficiently small scale. This paper examines the experiences of a set of firms from a large and economically important manufacturing industry; primary steel production; in an effort to determine the impact differences in macro financial markets have had on micro financial decision making. We find statistically significant, but not necessarily economically important, relationships among national capital market characteristics, firms' financing decisions, and firms' capital costs.

J.E.L. Classification: N42, N62, G32.

# 1 Introduction

“It is not by augmenting the capital of the country, but by rendering a greater part of that capital active and productive than would otherwise be so, that the most judicious operations of banking can increase the industry of the country.” (Adam Smith, *Wealth of Nations*, 1776, Pg. 419.)

The role played by financial intermediaries in promoting economic development and industrialization has been studied by economists for over 200 years. The correlation between financial and economic development is well established, but the relative importance of the different directions of causation, and the channels thereof, remain at issue.<sup>1</sup> In this paper we investigate the relationship between U.S. and Canadian financial markets and the financing decisions made by U.S. and Canadian steel producers during the years 1910-1990.

Twentieth century U.S. and Canadian capital markets and steel producers have been chosen for study as much for their similarities, as for their differences. Throughout our period of study U.S. and Canadian financial development, industrial structure, technological capabilities, productivity and income performance were very similar. The steel industries in both countries were large, and the intermediate nature of their output made them economically important. In addition, the steel firms in both the United States and Canada produced a relatively homogeneous product, with similar technology and common inputs.<sup>2</sup> The cross-border comparison is illuminating because, despite these common economic, industrial and financial features, the unique characteristics of the two countries' capital markets have had an impact on the financing decisions made by their steel firms, which in turn have had an impact on the firms' capital costs. Our ability to identify relationships among capital market, balance sheet, and capital cost variables, using U.S. and Canadian steel producers as a case study, suggests that a comparison of more diverse industries and nations is likely to reveal even more economically substantive effects.

In Section 2 we briefly review the structure of the financial markets in the United States and Canada through the twentieth century. In particular, we show that U.S. stock and bond mar-

---

<sup>1</sup>The seminal quantitative research on links between financial markets and economic growth includes Patrick, 1966, and Goldsmith, 1969. More recently King and Levin, 1993, Rousseau and Wachtel, 1998, Allen and Gale, 2000, and Fohlin, 2000, have empirically sifted through the various hypotheses. Levine, 1997, provides a survey of this branch of literature.

<sup>2</sup>Keay, 2000A, Table 2 and 4, compares twentieth century Canadian and U.S. income and productivity performance.

kets were larger and more active than Canadian stock and bond markets during the 1910-1990 period. The U.S. and Canadian banking sectors were the largest single financial intermediaries in the two countries, but the Canadian sector was slightly larger, and slightly more active in the corporate capital market. Although quantitatively small, these cross-border differences were statistically distinct.

In Section 3 we document the differences between the U.S. and Canadian steel firms' financing decisions. Using balance sheet and income account data from seven U.S. and four Canadian steel producers over the years 1910-1990, we find significant differences in their financing decisions. The U.S. firms used more formal, long term debt and more retained earnings than their Canadian counterparts. The Canadian firms, on the other hand, used more formal stock issues and more short term debt.

In the fourth section we seek to isolate the relationships between the observed differences in balance sheet composition, national capital market characteristics, firm specific characteristics and macroeconomic variables. We argue that the unique features of the national capital markets can explain some, but not all of the balance sheet differences. Similarly, firm specific and macroeconomic variables can explain some, but not all of the balance sheet differences.

In Section 5 we analyse the relationship between the payments made to the firms' capital owners and their financing decisions. There were significant cross-border differences in government and corporate bond yields, common stocks' dividend-price ratios and the firms' realized capital costs. The U.S. firms paid their capital owners more, per dollar invested, than the Canadian firms, despite the fact that the cost of capital from formal stock and bond markets in the U.S. was relatively low. Although we can identify a significant relationship between balance sheet composition and payments made to the firms' capital owners, this relationship was quantitatively small.

Based on the evidence presented in this paper it is apparent that, in wealthy, industrialized economies with relatively developed economic, industrial and financial institutions, influences that are, at best, only indirectly affected by financial characteristics may dwarf the effects of capital market structure on the cost of capital, and hence, economic growth. Despite this conclusion, we argue that (assumed) exogenous capital market characteristics affected how Canadian and U.S. steel firms financed their investment in a statistically significant way, and these choices had an impact on realized capital costs. Therefore, we suggest that a comparison of more diverse industries and nations is likely to reveal stronger and more economically

relevant connections between financial development and industrialization.

## 2 Financial Markets in the United States and Canada

In his presidential address at the 2001 Economic History Association Meetings, Richard Sylla argued that the defining features of a nation's financial system include the presence of a central bank, a national-convertible currency, limited liability corporations, non-bank intermediaries, a robust banking sector, and active securities markets. Through most of the twentieth century the U.S. and Canada were virtually indistinguishable on the basis of the first four features. The key differences, therefore, between the U.S. and Canadian financial systems were the unique characteristics of the nations' banking industries; Canada has had a relatively stable branch banking system, in contrast to the unit banking system of the U.S.; and the greater depth of U.S. formal securities markets; both stock and bond.<sup>3</sup> In this section we present evidence in support of this distinction between the U.S. and Canadian national capital markets.

In both the United States and Canada the banking sectors have played a much larger role in the transfer of funds from savers to borrowers than any other single financial intermediary. On average over the years 1900-1990, U.S. commercial bank assets equalled 57.6% of G.N.P., while Canadian chartered bank assets exceeded 62.5% of G.N.P..<sup>4</sup> Other large intermediaries in the two countries, such as life insurance companies, have had total assets valued at less than 20% of G.N.P., on average. Furthermore, in contrast to other banking systems, such as those in Germany and Japan, banks in both Canada and the U.S. operated as commercial rather than investment institutions. Figure 1 illustrates the ratio of U.S. and Canadian bank assets relative to G.N.P., for the years 1900-1990. Figure 2 illustrates the ratio of U.S. and Canadian life insurance company assets relative to G.N.P., for the years 1900-1990.

### Insert Figure 1-3

Despite these similarities, there were important cross-border differences in the Canadian and U.S. banking systems. In contrast to the thousands of small, non-branching U.S. banks, the Canada system typically had less than fifteen large, branching banks. In part as a result

---

<sup>3</sup>These two features may be linked. Davis and Cull (1994) have argued that the regulation of the U.S. banking sector led to a greater reliance on, and hence development of, securities markets in the U.S..

<sup>4</sup>The cross-country differences in bank, stock and bond activity illustrated in Figure 1-6 and Table 1 are statistically significant, with at least 90% confidence. A complete Data Appendix, containing details of the construction and sources for all series employed in this paper, is available from the authors. The data sources have not been listed among the references provided at the end of this paper.

Table 1: National Capital Market Summary Statistics

	Canada ( $\sigma$ )	U.S. ( $\sigma$ )
Total Bank Assets/GNP	0.625 (0.147)	0.576 (0.069)
Life Insurance Assets/GNP	0.199 (0.102)	0.194 (0.069)
Number of Banks	14.363 (8.558)	17810.490 (5751.586)
Bank Offices/Capita	0.312 (0.076)	0.190 (0.055)
Corporate Bank Loans/GNP	0.049 (0.029)	0.022 (0.015)
Corporate Stocks/GNP	0.012 (0.010)	0.009 (0.009)
Value Shares Traded/GNP	0.007 (0.004)	0.147 (0.100)
Corporate Bonds/GNP	0.021 (0.013)	0.026 (0.014)

Note 1: Arithmetic averages over the years 1910-1990,  $\sigma$  =Standard deviation.

Note 2: Bank offices/capita=bank offices per 1000 individuals.

Note 3: Value shares traded/GNP covers years 1934-1990 only.

Note 4: With the exception of life insurance assets/GNP, all U.S. series are statistically significantly distinct from Canadian series, with at least 90% confidence.

of this structure, the Canadian banking system was exceptionally stable during the twentieth century. The U.S. system, on the other hand, experienced many bank failures, particularly in the 1920s, 1930s, and again in the 1970s.<sup>5</sup> A second difference has been in the extent to which banks played a role in corporate finance. Figure 3 shows U.S. and Canadian corporate lending by commercial/chartered banks, relative to G.N.P.. We can see that Canadian banks have played a more active role in corporate lending, compared to their U.S. counterparts. New corporate bank loans averaged 4.9% of G.N.P. in Canada, versus 2.2% in the U.S., over the 1910-1990 period.

Turning our attention to formal stock markets, somewhat to our surprise, we find that gross issues of new common and preferred shares by Canadian firms totalled over 1.2% of G.N.P., averaged over the 1910-1990 period. U.S. firms issued new shares totalling only 0.9% of G.N.P., averaged over the same period. From Figure 4, which reports the ratio of gross new corporate share issues to G.N.P., we can see that the difference can be traced almost entirely to the gap in new issues relative to G.N.P. after World War 2. It also appears that many of

<sup>5</sup>Bordo, Rockoff and Redish, 1994, contrast the stability and efficiency of the Canadian and U.S. banking systems over the twentieth century.

the shares formally issued by Canadian firms must have been traded on exchanges outside the country, most likely in the U.S. From Figure 5 we can see that the value of shares traded on all registered exchanges in the U.S., relative to G.N.P., far outweighed the value of shares traded on the Montreal, Toronto and Canadian stock exchanges. Over the years 1934-1990 shares traded on U.S. exchanges exceeded 14.7% of G.N.P., while on Canadian exchanges the value of shares traded averaged just 0.7% of G.N.P.. Canadian firms seem to have relied more heavily on formal stock markets, relative to the U.S. firms, but these markets were not necessarily domestic.

#### **Insert Figure 4-5**

Finally, looking at the role of bond markets in the two countries, the overall picture is one of slightly greater reliance on bond finance in the U.S., relative to Canada. Averaged over the 1910-1990 period, new corporate bond issues equalled 2.6% of U.S. G.N.P., compared to only 2.1% of Canadian G.N.P.. However, from Figure 6 we can see that this difference was driven by the junk bond era in the U.S.. Prior to the 1980s U.S. corporate bond issues were more volatile than Canadian issues, but the time series patterns are remarkably similar.

#### **Insert Figure 6**

In summary, Canadian banks have been relatively large and active in corporate finance, Canadian firms have relied to a greater extent on stock markets, although domestic exchanges have been small, and U.S. firms have had access to deeper bond markets.<sup>6</sup> These distinct differences between the U.S. and Canadian national capital markets have not gone unnoticed by those who have sought to draw connections between economic development and financial intermediation.

In Canada, commentators have argued that the “immature and undeveloped” domestic capital market has starved manufacturers of long term, stable sources of capital. The concern is that the absence of large and efficient stock and bond markets, coupled with discrimination by an oligopolistic banking sector, has forced domestic producers to rely on short term and informal sources for their capital. Canadian firms, therefore, may have had to pay higher risk premia and transactions costs associated with these sources, and their growth may have been

---

<sup>6</sup>These findings are broadly consistent Baskin and Miranti's, 1997, study of the evolution of U.S. securities markets, and with O.E.C.D. figures for non-financial enterprises over the period 1970-1985, reported in Mayer, 1989.

retarded as a result.<sup>7</sup> The evidence presented in subsequent sections of this paper does not support this view.<sup>8</sup>

Canadians' fear that the domestic banking sector has constrained economic growth and industrialization due to its oligopolistic and discriminatory behaviour is not unique. Bliss (1987, Pg. 245) has argued that Canadian banks were, "...no more opposed to industrial development... than (banks) in the United States or Great Britain." The tight regulatory control and branch banking that contributed to Canadians' concerns are exactly the features of the system that U.S. commentators have suggested reduced risk and dampened cyclical behaviour in the Canadian capital market. These same commentators have argued that the U.S. banking sector should bear a considerable burden of blame for some of the more dramatic economic fluctuations in the twentieth century; the Great Depression during the 1930s, and the savings and loan crisis during the 1980s, to name just two.<sup>9</sup>

It is apparent that both increased volatility and constrained growth have been attributed to the distinctive features of the U.S. and Canadian national capital markets. For these claims, and their underlying theoretical hypotheses, to have merit their empirical foundations must be robust. In particular, even if there is little to distinguish the two nations' financial markets, we should be able to identify significant relationships between their banking systems and securities markets, the financial instruments chosen by their firms, and, through a capital cost channel, the investment performance of their firms.

### **3 The Composition of the Firms' Balance Sheets**

Over the period 1910-1990 the U.S. and Canadian manufacturing sectors generated 20-30% of their nation's G.N.P.. The primary iron and steel industries in the two countries accounted for approximately 10-20% of manufacturing value added. The U.S. and Canadian iron and steel industries operated in very concentrated, possibly oligopolistic, output markets. In Canada, four steel producers; Steel Company of Canada (later Stelco), Dominion Foundry and Steel Company (later Dofasco), Algoma Steel Company, and Dominion Steel and Coal Company (later Dosco); dominated the industry throughout the twentieth century. Over three quarters

---

<sup>7</sup>Proponents of this view include Buckley, 1955, Naylor, 1975, Rudin, 1982, and Taylor and Baskerville, 1994.

<sup>8</sup>Critics of the the Canadian capital market failure hypothesis include Drummond, 1962 and 1987, Neufeld, 1972, and Evans and Quigley, 1990.

<sup>9</sup>There is a considerable body of literature linking events in the U.S. banking sector and the decline in output during the Great Depression. The seminal works include Friedman and Schwartz, 1963, and Bernanke, 1983. Others have studied the role played by securities markets in the economic collapse of the 1930s. For an example see White, 1990.



of Canada's steel output was produced by one of these four firms, on average. In the U.S., the steel industry was also highly concentrated. Seven firms; United States Steel, Bethlehem Steel, Inland Steel, Republic Steel, National Steel, American Rolling Mills (later Armco), and Jones and Laughlin (later J. and L.); dominated the U.S. industry to the same extent that the Canadian producers dominated their domestic market.<sup>10</sup> We have chosen to use this industry as the basis for a comparison of Canadian and U.S. manufacturers' capital financing decisions because the steel producers in the U.S. and Canada made up one of the largest individual industries, their supply of intermediate inputs made them vital to the overall performance of their nation's manufacturing sectors, they employed very similar technologies, they experienced very similar total factor productivity performance<sup>11</sup>, they produced products that were close substitutes for one another, and, perhaps most importantly, appropriate data exists over a long time period on a consistent basis.<sup>12</sup>

Steel producers must raise funds to acquire and accumulate plant, machinery and equipment. There are many potential sources for these funds. Firms may use their retained earnings that have been accumulated from past years' profits, they may borrow from banks, other financial intermediaries, their suppliers, governments and, in some cases, their employees, or they may sell various types of bonds and stocks domestically and abroad. Each producer's choice amongst these potential sources of capital will depend on characteristics of that firm's economic environment, which may, or may not, be shared with other producers in the same industry, region, or nation. In this section we argue that over the 1910-1990 period the four Canadian steel producers in our sample were choosing amongst their potential sources of capital in a way that was statistically significantly distinct from the choices being made by the seven U.S. steel producers.

Because each firm made idiosyncratic and fluid capital financing decisions, comparing all potential sources over the entire period is infeasible. Given the data we have access to, we can group capital sources for each firm, in each year, into four consistently defined, and comparable categories.

- Short term debt includes all debt due within 365 days of the firms' financial year-end.

---

<sup>10</sup>For more specific information about the industry and sectoral coverage these eleven firms represent see Keay, 1999, Chapter 2.3.

<sup>11</sup>Keay, 2000B, compares the technology employed by Canadian and U.S. steel firms and their T.F.P. performance over the 1910-1990 period.

<sup>12</sup>This work is part of an ongoing project. In the future we hope to add more firms and industries to our sample in an effort to improve sectoral coverage.

Table 2: Canadian and U.S. Financial Instruments

	Canada ( $\sigma$ )	U.S. ( $\sigma$ )
Debt/Equity	0.423 (0.263)	0.415 (0.151)
Short Term Debt/Assets	0.102 (0.044)	0.070 (0.039)
Long Term Debt/Assets	0.164 (0.070)	0.202 (0.064)
Retained Earnings/Assets	0.402 (0.153)	0.419 (0.175)
Capital Stock/Assets	0.333 (0.143)	0.308 (0.167)

Note: Unweighted arithmetic averages across years and firms,  $\sigma$  = Standard Deviation.

Within this category are sources of capital such as short term bank loans, accounts payable; which include resources lent to the firm by their suppliers; and all debt due within one year; which includes all other short term loans, as well as long term debt that is coming due within one year.

- Long term debt includes all funded debt, bonded debt, and long term debt. Within this category are sources of capital such as long term bank loans and funds raised on formal bond markets.
- Retained earnings include the stock of all accumulated variable profit that has not been paid out to the firms' owners. Within this category are reserve funds such as depreciation reserves, tax reserves, pension reserves, special reserves accumulated for specific projects, and surplus or excess reserves.
- Financial capital stock includes all funds raised through the issuance of common and preferred shares on formal stock markets.

For each firm, in each year, the sum of these four categories is, by construction, equal to the firms' total assets. Each firm's debt-equity ratio can be measured as short term plus long term debt, divided by retained earnings plus financial capital stock.

Table 2 reports unweighted arithmetic averages and standard deviations for the four Canadian firms' and seven U.S. firms' debt-equity, short term debt-assets, long term debt-assets, retained earnings-assets, and financial capital stock-assets ratios. If we looked only at the debt-equity ratios, then the Canadian and the U.S. firms look remarkably similar. When av-

eraged across the firms, the Canadians relied on debt to a slightly greater extent than their U.S. counterparts, at the mean of the data. However, when we separate debt into short and long term, and equity into retained earnings and financial capital stock, we find quite dramatic differences between the Canadian and the U.S. firms' financing decisions. In particular, the Canadian firms' mean short term debt-assets ratio was over 45.7% greater than the U.S. firms' mean ratio, while the Canadian firms' long term debt-assets ratio was over 18.8% smaller than the U.S. firms' ratio, at the mean of the data.<sup>13</sup> Short term debt flows from short term bank loans, loans from other intermediaries, loans from suppliers, and loans from other informal sources of capital. It is associated with relatively high risk premia and transactions costs. Long term debt, on the other hand, flows from stable, formal sources, such as bond markets, that are associated with mature and developed capital markets. Therefore, the relative distribution of debt described in Table 2 is what one would expect to find if Canadian banks have been reluctant to make long term commitments to domestic industrialists, and Canadian bond markets have been small and inefficient.

#### **Insert Figure 7-8**

While the restrained use of short term debt by the U.S. firms is consistent with the presence of a large and efficient bond market, the greater use of retained earnings is consistent with the presence of an unstable and inefficient stock market. The Canadian firms in our sample had financial capital stock-assets ratios that were over 8.1% higher than the U.S. firms' ratios, and retained earnings-assets ratios that were almost 4.1% lower, at the mean of the data. Given the size of the stock markets in the two countries, we expected to find that the Canadian producers had been unable, or unwilling, to use share issues as a substantial source of funds, relative to the U.S. producers. The evidence in Table 2 undermines this expectation and suggests that the U.S. firms must have been more reluctant, or constrained in their use formal stock markets as a source of investment funds.<sup>14</sup>

#### **Insert Figure 9-10**

Figures 7-10 illustrate Canadian and U.S. short term debt-assets, long term debt-assets, retained earnings-assets, and financial capital stock-assets ratios, averaged across the firms in

---

<sup>13</sup>A greater reliance on short term debt by the Canadian firms is consistent with qualitative evidence reported in firm histories. See Kilbourn, 1960, Pg. 129 and 224, or McDowall, 1984, Pg. 141-142 and 157.

<sup>14</sup>Tsurumi, 2001, found that, relative to Japanese firms, turn of the twentieth century U.S. manufacturers relied to a greater extent on formal bond markets, rather than stock markets, to fund their investment.

each nation, in each year. In general, we can see that the mean U.S. and mean Canadian ratios have had quite similar time series patterns over the twentieth century. The reliance on short term debt has been increasing among firms in both nations since World War 2, while the reliance on formal share issues has been falling over the same period. The use of long term debt has followed a “U” shaped time series pattern, while the use of retained earnings has followed an inverted “U” shaped time series pattern. Despite the fact that the U.S. firms were increasing their use of short and long term debt throughout most of the post-World War 2 era, after 1950 the Canadian firms employed debt financing to a greater extent in almost every year.<sup>15</sup>

Prior to an investigation of the relationship between the observed differences in financial ratios and capital market characteristics, we must confirm that our casual comparisons of the means and time series patterns reported in Table 2 and Figure 7-10 are not providing a deceptive picture of the evolution of the ratios over the entire period. The presence of statistically significant time trends in the Canadian relative to U.S. ratios, and fairly large standard deviations among the individual series, suggest that more formal statistical tests are required.

The micro-data form a cross section of eleven firms, with an unbalanced time series that spans as many as 88 years (1902-1990 for United States Steel) and as few as 54 years (1936-1990 for Algoma Steel). As we would expect, equation by equation tests, with each of the ratios reported in Table 2 representing an individual equation, reveal the presence of cross-panel heteroskedasticity. The need to perform statistical tests on a nation specific dummy suggests that a fixed effects correction for cross-panel heteroskedasticity is inappropriate. Therefore, prior to estimation, the data have been transformed to facilitate a random effects correction for cross-panel heteroskedasticity.<sup>16</sup> Intuitively, the random effects transformation involves the calculation of a weighted average of within panel and between panel effects. This implies that our transformation requires the determination of the relative importance of each of these effects. We have derived the required weights from initial equation by equation random effects

---

<sup>15</sup>The increasing use of debt financing after 1950 reflects a common trend among a broader cross section of U.S. manufacturing firms. See Ciccolo, 1982, Pg. 70 and Table 4.5.

<sup>16</sup>The econometric techniques employed throughout this paper have been drawn primarily from Greene, 1990, Chapters 14, 16, 17. Equation by equation Hausman specification tests do not call into question the use of a random effects approach at any standard level of significance.

estimates.<sup>17</sup>

$$\mathbf{y}_{ijt}' = \mathbf{y}_{ijt} - \hat{\theta}\bar{\mathbf{y}}_{ij} \quad (1)$$

$i$  =firm identifier;  $j$  =nation identifier;  $t$  =time identifier;  $\mathbf{y}_{ijt}'$  =vector of transformed variables (including dependent, independent and constant variables);  $\mathbf{y}_{ijt}$  =vector of untransformed variables;  $\hat{\theta}$  =within/between weight derived with initial equation by equation estimation;  $\bar{\mathbf{y}}_{ij}$  =vector of firm specific means.

The transformation of the data, rather than direct equation by equation random effects estimates, is necessary because we have assumed that the firms in our sample chose among their four possible sources for capital simultaneously. The alternative would be an iterative and independent decision making process. If our assumption is consistent with reality, then the short term debt-assets, long term debt-assets, retained earnings-assets and financial capital stock-assets ratios have been jointly determined, and they must be estimated as a system of seemingly unrelated regressions.<sup>18</sup> We have employed an iterative feasible generalized least squares technique in the estimation of the system. This technique yields results that are equivalent to maximum likelihood estimation.

For *Test 1* we seek to identify unconditional statistically significant cross-country differences in the firms' financial ratios. In the system of four equations<sup>19</sup> used in *Test 1*, short term debt-assets, long term debt-assets, retained earnings-assets and financial capital stock-assets ratios have been regressed on a constant and a dummy that takes the value one for the four Canadian firms.<sup>20</sup>

$$(\text{Sterm}/\text{Assets})'_{ijt} = C2' + \beta2\text{candum}'_t + e2_t \quad (2)$$

$$(\text{Lterm}/\text{Assets})'_{ijt} = C3' + \beta3\text{candum}'_t + e3_t \quad (3)$$

$$(\text{RE}/\text{Assets})'_{ijt} = C4' + \beta4\text{candum}'_t + e4_t \quad (4)$$

$$(\text{Kstk}/\text{Assets})'_{ijt} = C5' + \beta5\text{candum}'_t + e5_t \quad (5)$$

<sup>17</sup>This approach introduces some unknown degree of inefficiency into our estimates. Unfortunately, it is the only feasible technique, given our data and the issues we seek to address.

<sup>18</sup>Breusch-Pagan tests confirm that, at any standard level of significance, the equations within the systems estimated for this paper are not independent. Tests for equation specific autocorrelation can be rejected at standard significance levels, except where noted.

<sup>19</sup>Debt-equity ratios have not been included in the system. If we believe that the firms chose among their four sources for capital simultaneously, then the inclusion of the debt-equity equation is superfluous. The qualitative results continue to hold with the inclusion of the debt-equity equation.

<sup>20</sup>Because of the data transformation, all four equations can be included in the system. Theoretically, only three of the four equations are linearly independent. The systems have also been run using only three equations at a time. The qualitative conclusions reported in this section are independent of the choice of equations included in the systems.

Table 3: Testing for Unconditional Statistically Significant Differences in Financial Instruments

	<i>Test 1: <math>\widehat{\beta x}</math></i> (P Value)
Short Term Debt/Assets:	0.038 (0.015)
Long Term Debt/Assets:	-0.032 (0.017)
Retained Earnings/Assets:	-0.146 (0.001)
Capital Stock/Assets:	0.019 (0.486)

Note: See equations (2) - (5) in text. Unconditional statistically significant parameter estimates indicate domestically unique financial ratios.

From *Test 1*, in Table 3, we can see that the estimated parameters on the dummy variables are statistically significant, with at least 95% confidence, for the short term debt-assets, long term debt-assets and retained earnings-assets ratios, but not for the financial capital stock-assets ratio.<sup>21</sup> This implies that the Canadian steel producers have traditionally chosen to finance their capital in a manner that has been significantly different from the decisions made by their U.S. counterparts, except with respect to their use of common and preferred shares.

Although we have some reservations with respect to equity financing, it appears that the U.S. firms have financed their investment differently than the Canadian firms, with the most obvious difference being the U.S. firms' reluctance to use short term debt. We can statistically test the hypotheses that capital market characteristics, firm specific characteristics, or aggregate macroeconomic performance contributed significantly to these observed cross-country differences in balance sheet composition.

## 4 Explaining Balance Sheet Composition

### 4.1 Capital Market Characteristics

The economic environment in which each of the eleven steel producers included in our sample made their capital financing decisions were time, firm, and nation dependent. These decisions were idiosyncratic, and the determinants of these decisions may also have been idiosyncratic. Therefore, we should expect the importance the firms placed on various explanatory variables to have varied widely across the sample, even within each country, and varied across time for

<sup>21</sup>Complete econometric results are available from the authors for all regressions, and for the specification, autocorrelation and heteroskedasticity tests described in this paper.

each firm. This implies that it is unlikely that any single determinant, including the conditions within the U.S. and the Canadian capital markets, should explain all of the observed cross-country variation in financing decisions.

To formally test for a relationship between (assumed) exogenous domestic capital market characteristics and the capital financing decisions made by the eleven steel producers in our sample<sup>22</sup>, we have returned to the equation systems described in Section 3. We use our cross section-unbalanced time series data to estimate systems of four equations. The data have been transformed to facilitate a random effects correction for cross panel heteroskedasticity prior to the use of an iterative feasible generalized least squares technique to estimate each system. We regress short term debt-assets, long term debt-assets, retained earnings-assets, and financial capital stock-assets ratios on a constant, a dummy that takes the value one for the Canadian firms, and a matrix of control variables.

$$(Sterm/Assets)'_{ijt} = C6' + \beta6candum'_t + \alpha6\mathbf{X}'_{ijt} + e6_t \quad (6)$$

$$(Lterm/Assets)'_{ijt} = C7' + \beta7candum'_t + \alpha7\mathbf{X}'_{ijt} + e7_t \quad (7)$$

$$(RE/Assets)'_{ijt} = C8' + \beta8candum'_t + \alpha8\mathbf{X}'_{ijt} + e8_t \quad (8)$$

$$(Kstk/Assets)'_{ijt} = C9' + \beta9candum'_t + \alpha9\mathbf{X}'_{ijt} + e9_t \quad (9)$$

$\alpha$  = vector of parameters to be estimated;  $\mathbf{X}'_{jt}$  = matrix of control variables.

We perform three separate tests for the presence of relationships between U.S. and Canadian balance sheets and capital market characteristics. Each test controls for a different matrix of U.S. and Canadian capital market features. In *Test 2* our matrix of control variables includes new issues of corporate bank loans, new issues of corporate bonds and new issues of corporate stocks in the U.S. and Canada. Intuitively, this test seeks to determine if differences in the firms' financial decisions remain significant after controlling for differences in U.S. and Canadian bank, bond market and stock market activity in the corporate capital market.

New corporate bank loans, and bond and stock issues have limited explanatory power in equations (6) - (9). However, controlling for cross border differences in these variables does have an effect on the idiosyncrasy of the firms' financing decisions. After controlling for the scale of bank, bond and stock market activity on corporate capital markets, we continue to

---

<sup>22</sup>Because the firms in our sample were a large but incomplete share of the industry they represent, this industry comprised less than 20% of the nations' manufacturing sectors, and the manufacturing sectors were less than one quarter of the aggregate economy, we argue that it is reasonable to assume that our national capital market variables were exogenous, while the firms' financial instruments were endogenous.

Table 4: Testing for Statistically Significant Differences in Financial Instruments, Conditional on Capital Market Characteristics

	<i>Test 2: <math>\widehat{\beta x}</math></i> (P Value)	<i>Test 3: <math>\widehat{\beta x}</math></i> (P Value)	<i>Test 4: <math>\widehat{\beta x}</math></i> (P Value)
Short Term Debt/Assets:	0.020 (0.246)	0.032 (0.040)	0.036 (0.006)
Long Term Debt/Assets:	-0.065 (0.000)	-0.019 (0.204)	-0.023 (0.133)
Retained Earnings/Assets:	-0.042 (0.379)	-0.155 (0.000)	-0.036 (0.171)
Capital Stock/Assets:	0.018 (0.481)	0.010 (0.714)	0.001 (0.963)

Note: A statistically significant parameter estimate indicates domestically unique financial ratios conditional on capital market conditions.

Test 2: Controlling for corporate bank loans, bond issues and stock issues.

Test 3: Controlling for bank assets, life insurance company assets and an aggregate risk premium.

Test 4: Controlling for corporate bond and stock issues, bank assets, life insurance company assets and an aggregate risk premium.

observe statistically significant differences in the long term debt-assets ratios, but there are no longer statistically significant differences in the short term debt-assets, retained earnings-assets, or financial capital stock-assets ratios. The estimated parameters on  $candum'_t$ , and their p values, from *Test 2* are reported in Table 4.

In our third test we seek to expand the scope of our definition of capital market characteristics. In this test we employ more general control variables; total bank assets relative to G.N.P., total life insurance assets relative to G.N.P., and a risk premium, equal to the difference between the average corporate bond yield and the average government bond yield in the two countries.<sup>23</sup> Intuitively, we are testing for the presence of statistically significant differences in balance sheet composition even after controlling for conditions in the two nations' aggregate capital markets.

The more general capital market proxies' explanatory power is also weak in equations (6)-(9). In contrast to *Test 2*, after controlling for differences in the size of the banking sector, the size of the life insurance sector, and a risk premium in the U.S. and Canada, there remain statistically significant differences in the Canadian and the U.S. firms' short term debt-assets and retained earnings-assets ratios, but not in their long term debt-assets or financial capital

<sup>23</sup>We have not included the number of banks or the number of bank offices per capita amongst the explanatory variables in *Test 3* because the series are closely correlated to bank assets relative to G.N.P. We have not included the value of shares traded on formal exchanges relative to G.N.P. amongst the explanatory variables in *Test 3* because the series covers only the years 1934-1990. Tests including these series produce results that are qualitatively consistent with those reported in this paper.



stock-assets ratios. The estimated parameters on  $candum'_t$ , and their p values, from *Test 3* are reported in Table 4.

As a final test of the influence domestic capital market characteristics have had on the steel producers' financial decisions, we control for corporate bank loans, bond market and stock market activity, the size of life insurance companies, and a risk premium for the two countries.<sup>24</sup>

In Table 4 the estimated parameters on  $candum'_t$ , and their p values, from *Test 4* are reported. Again, there are statistically insignificant differences between three of the four financial ratios. After controlling for activity on the corporate capital market, and for general capital market conditions, we can identify a statistically significant difference between the Canadian and the U.S. steel producers' short term debt-assets ratio, but not between their long term debt-assets, retained earnings-assets or financial capital stock-assets ratios.

From *Test 2-4* we can see that differences in U.S. and Canadian capital markets can explain only a sub-set of the observed differences in the firms' financing decisions. Are there other determinants that might be more important? To answer this question we have tested two possible alternative explanations for the observed cross border variations in financing decisions; firm specific characteristics, including size, age, financial distress and ownership type, and macroeconomic conditions, including aggregate and industry performance.<sup>25</sup>

## 4.2 Firm Specific Characteristics and Macroeconomic Variables

Access to formal, stable capital markets is a function of a firm's reputation and how investors perceive its performance. Reputation and perceived performance is based at least in part on a firm's ability to survive and grow, relative to its competitors. Therefore, we have included firm size as a control variable in our system of four equations to test the possibility that the larger producers have been favoured on more formal, stable capital markets, and this has led to the

---

<sup>24</sup>We have left out the variables which are closely correlated with bank activity in the corporate capital market; the share of total bank assets relative to G.N.P., the number of banks and the number of bank offices per capita; and the truncated value of shares traded on domestic exchanges relative to G.N.P. series. Inclusion of these alternate proxies does not substantively affect our qualitative conclusions.

<sup>25</sup>Literature motivated by the search for conditions under which the Modigliani-Miller theorem, 1958 and 1963, might be violated directed our attention toward these alternate determinants of financing decisions. See Stiglitz, 1969, Kraus and Litzenberger, 1973, and Brander and Lewis, 1986. Because we are interested in variations in financing decisions between Canadian and U.S. firms, and the tax treatment of debt and equity has been similar over most of our period of study in the two countries, we do not investigate the possibility that differences in Canadian and U.S. corporate taxation have been responsible for differences in the observed finance decisions. For more detail on the tax treatment of debt and equity in Canada, see Gillespie, 1991, or Perry, 1989.

Table 5: Firm Specific Characteristics, Macroeconomic Performance and Industry Performance

	Canada ( $\sigma$ )	U.S. ( $\sigma$ )
Gross Output	8621.8 (776.7)	11491.2 (2392.1)
Market Share	0.019 (0.008)	0.217 (0.176)
Aggregate Capital Share	0.016 (0.009)	0.201 (0.173)
Firm Age	34.4 (22.5)	42.6 (25.6)
Years in Financial Distress	17.25 (8.221)	19.14 (3.716)
Expected GNP Growth	0.040 (0.005)	0.035 (0.011)
Shocks to Expected GNP Growth	$-9.70e^{-11}$ (0.169)	$7.80e^{-10}$ (0.180)
Expected Relative Price Growth	0.002 (0.014)	0.005 (0.009)
Shocks to Expected Relative Price Growth	$2.23e^{-10}$ (0.101)	$-3.07e^{-10}$ (0.157)

Note 1: Unweighted arithmetic averages across all years and firms, by nation,  $\sigma$  =Standard Deviation.

Note 2: Gross Output=(net revenue/nominal output price), Market Share=firm share of aggregate gross output, Aggregate Capital Share=firm share of aggregate capital employed, Age=(current year - year of incorporation), Financial Distress=(Wk - government bond yield)  $\leq 0$ , Expected GNP Growth=average over next 5 years, Shocks to Expected GNP Growth=deviations from expectations in current year, Expected Relative Price Growth=average growth rate of nominal output price/WPI over next 5 years, Shocks to Expected Relative Price Growth=deviations from expectations in current year.

observed differences in financing decisions. We have performed the formal statistical test for domestically unique financing decisions using three different firm size control variables; gross output (the firms' net revenue deflated by an industry specific nominal output price index), market share (the firms' gross output divided by the sum of the gross output of all eleven firms included in our sample), and the proportion of aggregate industry capital employed (the firms' real capital input divided by the sum of the real capital inputs of all eleven firms included in our sample).<sup>26</sup> From Table 5 we can see that the U.S. steel producers were more than ten times the size of their Canadian counterparts, on average.

In addition to size, longevity is an important determinant of reputation and perceived performance. Therefore, we have included the firms' ages as a control variable in our system

<sup>26</sup>Our first size variable measures the aggregate size of each firm. It is dependent on annual market fluctuations. Our second size variable measures the relative size of each firm, and is less dependent on annual market fluctuations. Our third size variable provides an alternate relative size measure that is even less dependent on annual market fluctuations.

of equations to test the possibility that the older producers have been favoured on more formal, stable capital markets. Age has been measured as the difference between the date of each firm's first incorporation under its own name and the current year.<sup>27</sup> From Table 5 we can see that the U.S. steel producers were 8.2 years older than the Canadian firms, on average.

The characteristics of the domestic capital markets, the size of the firms and the age of the firms are possible supply side determinants of the financial ratios. We have also considered demand side determinants. In particular, a firm's ability to pay its capital owners at least the domestic, risk-free government bond yield not only acts as a proxy for investors' perceptions of the firm (assuming lenders have perfect foresight), but it also identifies periods of financial distress for the firms. During these times of distress it was typical for the firms to rely very heavily on retained earnings for a short period. As the firms emerged from times of distress they reverted to a more "typical" mix of financial instruments. To control for atypical financial behaviour during times of distress we have included in our system of equations a dummy variable that takes the value one during the years in which the firms' ex post capital costs were less than, or equal to the domestic government bond yield. Most of the firms in the sample were in financial distress during the first half of the 1930s and the early years of the 1980s. From Table 5 we can see that the U.S. firms experienced an additional 1.89 years of financial distress, on average.<sup>28</sup>

Another demand side determinant we consider is the presence of government ownership. Government ownership may distort the profit motivation underlying the financing decisions made by privately owned firms. In general, because the identity of shareholders is never revealed, we have no way of determining the extent of public ownership of any of the firms in our sample. However, we do know that in 1970 a provincial crown corporation, Sidbec, purchased a controlling interest in Dosco, the smallest of the Canadian firms. Throughout the period of public control (1970-1990) there was a wide range of government intervention in Dosco's operations, including direct subsidies, tax expenditures, regional development grants, and investment aid. Dosco's financing decisions changed quite dramatically in 1970, particularly its use of retained earnings.<sup>29</sup> Because it is possible that a publicly controlled firm's incentives

---

<sup>27</sup>In some cases, Algoma for example, data are only available after a major reorganization, merger or initial public offering of debt or equity. The age variable acts as a firm specific, rather than nation specific time trend.

<sup>28</sup>Since our sample is unbalanced, the average number of years in financial distress is slightly misleading. The U.S. firms in our sample were in financial distress an average of 25.1% of the time. The Canadian firms in our sample were in financial distress an average of 27.2% of the time.

<sup>29</sup>A standard Chow test confirms that there was a statistically significant discontinuity in Dosco's retained earnings-assets ratio in 1970.

Table 6: Testing for Statistically Significant Differences in Financial Instruments, Conditional on Firm Specific Characteristics and Capital Market Characteristics

	<i>Test 5: <math>\hat{\beta}x</math></i> (P Value)	<i>Test 6: <math>\hat{\beta}x</math></i> (P Value)
Short Term Debt/Assets:	0.021 (0.127)	-0.012 (0.226)
Long Term Debt/Assets:	-0.019 (0.317)	-0.037 (0.106)
Retained Earnings/Assets:	-0.004 (0.832)	-0.007 (0.805)
Capital Stock/Assets:	-0.057 (0.004)	0.047 (0.114)

Note: A statistically significant parameter estimate indicates domestically unique financial ratios after controlling for firm specific characteristics and capital market characteristics.

Test 4: Controlling for market share, firm age, financial distress, and public ownership.

Test 5: Controlling for market share, public ownership, corporate bond and stock issues, bank assets, life insurance company assets, and an aggregate risk premium.

and optimization problem may be different from its privately owned counterparts, Dosco may be responsible for the statistically significant differences between the Canadian and the U.S. firms' financing decisions. In our system of four equations we have included a public ownership dummy, taking the value one for Dosco during the years 1970-1990, to control for this possibility.

In *Test 5* we control for the four firm specific characteristics; size<sup>30</sup>, age, financial distress and Dosco's public ownership after 1970. We find statistically significant differences in the Canadian and the U.S. financial capital stock-assets ratios, but insignificant differences in the Canadian and the U.S. short term debt-assets, long term debt-assets and retained earnings-assets ratios. This suggests that, like the capital market characteristics, the firm specific characteristics can account for only a sub-set of the observed differences in the firms' financing decisions. The estimated parameters on  $candum'_t$ , and their p values, from the equation system with firm specific controls are reported as *Test 5* in Table 6.

In addition to the firm specific variables, we have controlled for the influence of macroeconomic determinants of the firms' balance sheet composition. Firms form expectations about future market conditions, and they experience shocks to these expectations. If a firm is expecting particularly strong, or weak, market growth and industry performance, this may affect their choice of finance instrument. We would expect that greater uncertainty, greater volatility, or simply reductions in expected revenue, to encourage an increase in the firms' reliance

<sup>30</sup>We report only the results from the use of the market share measure of firm size.

on short term and informal sources of capital financing, particularly retained earnings.

We have modelled the formation of the steel producers' macroeconomic expectations using an AR(3) process to predict domestic G.N.P. five years into the future.<sup>31</sup> We then use the predicted G.N.P. to derive the expected average growth rate over the next five years, and we estimate shocks to these expectations as the amount by which the observed current G.N.P. deviates from the predicted current G.N.P.. From Table 5 we can see that the U.S. steel producers were slightly less optimistic about domestic G.N.P. growth rates, relative to their Canadian counterparts, and they tended to slightly under-estimate future G.N.P..

We have controlled for the possibility that differences in the average expected growth rates of domestic G.N.P., and shocks to these expectations, explain the observed differences in financing decisions. There remains a statistically significant difference between Canadian and U.S. short term debt-assets, long term debt-assets and retained earnings-assets ratios, but no statistically significant difference between Canadian and U.S. financial capital stock-assets ratios, after controlling for differences in aggregate expectations and shocks.

We have repeated this test using nominal output prices for the steel industries, relative to domestic wholesale price indices as industry performance proxies. The average expected growth rate of relative prices, and shocks to these expectations, reflect the predicted performance of the steel industry alone, rather than the performance of the aggregate economy. Again, we have modelled the formation of the steel producers' expectations using an AR(3) process to predict their relative output prices five years into the future.<sup>32</sup> We then use the predicted relative prices to derive the expected average growth rate over the next five years. The shocks in relative prices are again assumed to be current deviations from the predictions. From Table 5 we can see that the U.S. steel producers were slightly more optimistic about the growth of domestic relative output prices, but they tended to slightly over-estimate future industry performance.

We have controlled for the possibility that differences in average expected relative price growth, and shocks to these expectations, explain the observed differences in financing decisions. Like the macroeconomic variables, the industry performance variables do not have any statistically significant effect on the cross border differences in the short or long term

---

<sup>31</sup>At any standard level of statistical significance we can reject the hypothesis that the Canadian and the U.S. expectations and shocks were identical.

<sup>32</sup>At any standard level of statistical significance we can reject the hypothesis that the Canadian and the U.S. expectations and shocks were identical.

debt-assets ratios, but they do have a small effect on the retained earnings-assets ratios.

At this point we can conclude that there does not appear to have been a single set of determinants that can explain all of the observed differences between the financing decisions made by the U.S. and Canadian firms. This does not necessarily imply that the determinants we have identified have not played any role in the firms' decision making processes. We only suggest that the choice among financial instruments is a complicated one, that cannot be attributed to a single factor. Indeed, after controlling for differences between two firm specific characteristics; market share and public ownership; and five capital market characteristics; corporate bank loans, bond market and stock market activity, the size of the life insurance sector and a risk premium; there remain no statistically significant differences between the U.S. and Canadian short term debt-assets, long term debt-assets, retained earnings-assets or financial capital stock-assets ratios. We suggest that this combination of determinants can explain all of the observed differences between the firms' financing decisions. The estimated parameters on  $candum'_t$ , and their p values, from the all encompassing *Test 6* are reported in Table 6.

## 5 Realized Capital Costs and Balance Sheet Composition

The evidence described in Sections 2, 3 and 4 supports the suggestion that U.S. and Canadian capital markets had some domestically unique features over the 1910-1990 period, that the U.S. and the Canadian steel firms' made domestically unique capital financing decisions over this same period, and that there was at least a tentative connection between the observed differences in capital markets and the observed differences in balance sheet composition. In this section we investigate the final facet of our argument; we test for common capital costs among the U.S. and the Canadian steel firms in our sample, and we test the strength of the relationship between the firms' capital costs and the composition of their balance sheets.

To raise funds through the issuance of debt or equity a firm must be able to pay a return per dollar of capital employed that is a positive function of the risk and transaction costs faced by potential lenders, and the presence of economic rents. The pressures forcing a specific firm's capital costs to deviate from the corporate average may come through two channels. First, lenders may be able to discriminate among borrowers on the basis of their risk and ability to generate economic rents. This implies that safe, stable borrowers, operating in competitive, rent-free environments will pay a lower return than the corporate average. Although one

expects to observe this discrimination among borrowers in external-formal capital markets, such as bond and stock markets, it is more likely to be both dramatic and firm specific in internal-informal capital markets, such as retained earnings and short term debt.

The second channel through which a firm's capital costs may deviate from the corporate average results from the efficiency-information cost trade-off firms must make when choosing among the sources for their funds. From finance theory we know that firms rank their potential sources for capital on the basis of their ability to access these funds and the returns they must pay for the funds.<sup>33</sup> This ranking stems from the firms' desire to trade-off the cost of information provision against the efficiency of the various capital markets. The theory predicts that firms will pay relatively high returns to internal-informal sources until they are able to afford the information costs associated with the relatively low returns paid on external-formal bond and stock markets. Therefore, firms with relatively high transactions costs may be forced rely more heavily on retained earnings and short term debt, and therefore, pay capital costs in excess of the corporate average.

Because of the nature of the banking sectors and securities markets in the U.S. and Canada, in conjunction with the industrial, tariff and tax policies of Canadian and U.S. governments, and the oligopolistic market structure of the steel industry in both countries, it is likely that the firms in our sample faced imperfectly competitive capital markets, had substantial transactions costs, and enjoyed some input or output market power over the 1910-1990 period. Therefore, we should not be surprised that the firms in our sample paid rates of return that differed from the average corporate rates of return, or that the firms' capital costs were related to their financing decisions.

Ideally we would like to be able to determine each firms' source specific costs of capital. Unfortunately, given our data this is not feasible. However, it is feasible to determine the average payments made to all sources of capital by each firm, in each year. We have calculated these ex post capital costs;  $Wk$ ; as each firms' variable profit; total revenue less sales taxes, excise taxes, labour costs and intermediate input costs; divided by a measure of the current value of each firms' fixed capital stock.<sup>34</sup> This measure represents the average return paid to the owners of the firms' capital, and as such it is equivalent to the actual cost of each dollar of capital employed, regardless of its source.

---

<sup>33</sup>Myers and Majluf, 1984, introduced this "pecking order theory" of corporate finance.

<sup>34</sup>For greater detail on sources and construction, see Keay, 1999, Data Appendix in Chapter 2.

Table 7: Canadian and U.S. Capital Costs

	Canada ( $\sigma$ )	U.S. ( $\sigma$ )
Government Bond Yield	0.054 (0.031)	0.047 (0.026)
Corporate Bond Yield	0.069 (0.027)	0.055 (0.029)
Corporate Stock Yield	0.048 (0.014)	0.047 (0.011)
$Wk$	0.106 (0.056)	0.113 (0.060)
$Wk$ - Gov't Bond Yield	0.053 (0.072)	0.065 (0.078)
$Wk$ - Corp. Bond Yield	0.036 (0.074)	0.057 (0.080)
$Wk$ - Corp. Stock Yield	0.058 (0.059)	0.066 (0.059)

Note 1: Unweighted arithmetic averages across years and firms,  $\sigma$  = Standard Deviation.

Note 2: Government bond yield = average annual, long term.

Note 3: Corporate bond yield = Moody's average annual, AAA.

Note 4: Corporate stock yield = common stocks' dividend : price ratio.

Note 5:  $Wk$  = variable profit/current value fixed capital,  $Wk$  - government bond yield =  $Wkprem1$ ,  $Wk$  - corporate bond yield =  $Wkprem2$ ,  $Wk$  - corporate stock yield =  $Wkprem3$ .

### Insert Figure 11-14

Figure 11 illustrates the annual ex post-realized capital costs, averaged across the firms in each nation. We can see that, although the series are closely and positively correlated throughout the entire 1910-1990 period, after World War 2 U.S. ex post capital costs have been fairly consistently greater than Canadian ex post capital costs.<sup>35</sup> Figures 12, 13 and 14 illustrate Canadian and U.S. long term government bond yields, average corporate bond yields and average corporate stock yields, respectively, over the years 1900-1990. The Canadian and U.S. returns on these external-formal capital markets were closely and positively correlated for all three series, with Canadian government and corporate bond yields being consistently higher, while U.S. stock yields tended to be lower than Canadian until the mid-1960s, but higher through most of the 1965-1990 period.

Table 7 reports unweighted arithmetic averages and standard deviations for long term

<sup>35</sup>Collins and Williamson, 2001, Table 2, illustrate that Canadian construction, machinery, and equipment prices have been substantially higher than U.S. prices since 1850. Keay, 2000B, Table 3, and Wylie, 1989, Pg. 576, argue that costs per unit of capital employed have been substantially higher among Canadian manufacturers, relative to U.S. manufacturers throughout the twentieth century. This implies that relatively low purchase prices have more than offset the relatively high rates of return paid by U.S. producers during the twentieth century.



U.S. and Canadian government bond yields, average corporate bond yields, average corporate common stocks' dividend : price ratios, and the seven U.S. firms' and four Canadian firms' ex post capital costs. The average difference between each firms' ex post capital costs and government bond yields, corporate bond yields and corporate stock yields are also reported for the U.S. and Canadian firms.

The Canadian steel firms paid 0.7% less on an average dollar of capital employed than their U.S. counterparts over the 1910-1990 period, at the mean of the data. This was despite the fact that the returns paid on external-formal capital markets were higher in Canada. Between 1910-1990, Canadian long term government bond yields were 0.7% higher, average corporate bond yields were 1.4% higher and average common stock yields were 0.1% higher, relative to U.S. yields, at the mean of the data. When aggregated across all sources, both the U.S. and Canadian firms paid more than the average corporate bond and stock rates of return for their capital, but the U.S. firms had to pay higher returns and substantially higher premia over the average corporate yields. The U.S. steel producers paid an additional 1.2% over government bond yields, 2.1% over average corporate bond yields and 0.8% over average corporate stock yields, at the mean of the data. The higher U.S. ex post capital costs must stem from relatively high risk and rent premia extracted by lenders, particularly internal-informal lenders, and/or greater reliance on high capital cost, but low transactions cost sources.

To confirm our impressions derived from Figure 11 and Table 7, we have formally tested for statistically significant differences between the U.S. and Canadian capital costs. Despite the fact that simple correlation coefficients between the Canadian and the U.S. series range from 0.648 to 0.976, we find that the mean ex post capital costs, ex post capital cost premia, government bond yields and corporate bond yields have been statistically significantly different in Canada and the U.S. over most of the twentieth century, with at least 95% confidence.<sup>36</sup>

These are not the results we would expect to observe if Canadian producers have been at a disadvantage due to the immature and undeveloped nature of their domestic capital market. However, these results are consistent with the view that the U.S. capital market may have been efficient, but firms that did not exploit its unique features, such as its large, formal stock markets, could find themselves paying relatively high capital costs. We can formally test the possibility that the steel firms' financial decisions were having a significant effect on their

---

<sup>36</sup>We can reject the null that Canadian and U.S. common stock yields were identical with no more than 65% confidence.

capital costs.

Using equation by equation generalized least squares, with explicit controls for cross-panel heteroskedasticity and within panel autocorrelation (where necessary), we have regressed the natural logarithm of the firm specific ex post capital costs on a constant and the natural logarithm of the firm specific short term debt-assets ratios, multiplied by nation specific dummy variables.<sup>37</sup> We have repeated the exercise using the long term debt-assets, retained earnings-assets and financial capital stock-assets ratios as independent variables. The presence of statistically significant parameter estimates on the financial ratios suggests support for claims of a connection between balance sheet composition and capital costs. The parameter estimates associated with each financial ratio also represent the elasticity of ex post capital costs with respect to these ratios.

$$\begin{aligned} \ln Wk_{ijt} = & C10 + \epsilon_{st}^{cda} (candum_{jt} \times \ln(Sterm/Assets)_{ijt}) \\ & + \epsilon_{st}^{us} (usdum_{jt} \times \ln(Sterm/Assets)_{ijt}) + e10_t \end{aligned} \quad (10)$$

$$\begin{aligned} \ln Wk_{ijt} = & C11 + \epsilon_{lt}^{cda} (candum_{jt} \times \ln(Lterm/Assets)_{ijt}) \\ & + \epsilon_{lt}^{us} (usdum_{jt} \times \ln(Lterm/Assets)_{ijt}) + e11_t \end{aligned} \quad (11)$$

$$\begin{aligned} \ln Wk_{ijt} = & C12 + \epsilon_{re}^{cda} (candum_{jt} \times \ln(RE/Assets)_{ijt}) \\ & + \epsilon_{re}^{us} (usdum_{jt} \times \ln(RE/Assets)_{ijt}) + e12_t \end{aligned} \quad (12)$$

$$\begin{aligned} \ln Wk_{ijt} = & C13 + \epsilon_{ks}^{cda} (candum_{jt} \times \ln(Kstk/Assets)_{ijt}) \\ & + \epsilon_{ks}^{us} (usdum_{jt} \times \ln(Kstk/Assets)_{ijt}) + e13_t \end{aligned} \quad (13)$$

Table 8 reports the estimated elasticity of ex post capital costs with respect to the financial ratios for each country, and the statistical significance of these estimates. We can see that, in general, the elasticity estimates are quite small, ranging in absolute value from 0.102 to 0.334. It is also apparent that the firms from both nations experienced falling ex post capital costs when they increased their use of formal capital instruments; long term debt, and common and preferred shares; and rising ex post capital cost when they increased their use of informal capital instruments; short term debt and retained earnings.

The results reported in Table 8 may be muted because ex post capital costs capture the average corporate rates of return from bond and stock markets, which are exogenous from

---

<sup>37</sup>  $candum_t$  takes the value one for the four Canadian firms and the value zero otherwise.  $usdum_t$  takes the value one for the seven U.S. firms and the value zero otherwise.

Table 8: Elasticity of Capital Costs With Respect to Financial Ratios

	Canada (P Value)	U.S. (P Value)
$\widehat{\epsilon}_{st}$	0.162 (0.006)	0.168 (0.000)
$\widehat{\epsilon}_{lt}$	-0.183 (0.001)	-0.189 (0.000)
$\widehat{\epsilon}_{re}$	0.334 (0.000)	0.277 (0.000)
$\widehat{\epsilon}_{ks}$	-0.210 (0.001)	-0.102 (0.097)

Note 1: See equations (10) - (13) in text.

Note 2:  $\epsilon_{st} = \% \Delta Wk / \% \Delta st$ ,  $\epsilon_{lt} = \% \Delta Wk / \% \Delta lt$ ,  $\epsilon_{re} = \% \Delta Wk / \% \Delta re$ ,  $\epsilon_{ks} = \% \Delta Wk / \% \Delta ks$ .

Note 3:  $st$  = short term debt/assets,  $lt$  = long term debt/assets,  $re$  = retained earnings/assets,  $ks$  = financial capital stock/assets.

each individual firms' point of view, and the average premia paid in excess of these returns. We would not expect each firm's financing decisions to have any effect on the average rate of return paid on all corporate bonds or stocks, but we should expect the firms' financing decisions to have an effect on the premia paid in excess of these average rates of return. In an effort to isolate the endogenous component of ex post capital costs, we have repeated our formal statistical tests with the inclusion of the natural logarithm of the premia paid by the firms in excess of the long term government bond yield;  $lnWkprem1_{ijt} = lnWk_{ijt} - lnGovt_{jt}$ ; the average corporate bond yield;  $lnWkprem2_{ijt} = lnWk_{ijt} - lnBond_{jt}$ ; and the average corporate stock yield;  $lnWkprem3_{ijt} = lnWk_{ijt} - lnStk_{jt}$ ; as dependent variables.

$$lnWkprem_{ijt} = C14 + \eta_{st}^{cda} (candum_t \times ln(Sterm/Assets)_{ijt}) + \eta_{st}^{us} (usdum_t \times ln(Sterm/Assets)_{ijt}) + e14_t \quad (14)$$

$$lnWkprem_{ijt} = C15 + \eta_{lt}^{cda} (candum_t \times ln(Lterm/Assets)_{ijt}) + \eta_{lt}^{us} (usdum_t \times ln(Lterm/Assets)_{ijt}) + e15_t \quad (15)$$

$$lnWkprem_{ijt} = C16 + \eta_{re}^{cda} (candum_t \times ln(RE/Assets)_{ijt}) + \eta_{re}^{us} (usdum_t \times ln(RE/Assets)_{ijt}) + e16_t \quad (16)$$

$$lnWkprem_{ijt} = C17 + \eta_{ks}^{cda} (candum_t \times ln(Kstk/Assets)_{ijt}) + \eta_{ks}^{us} (usdum_t \times ln(Kstk/Assets)_{ijt}) + e17_t \quad (17)$$

Table 9 reports the elasticity of the capital cost premia with respect to the short term debt-assets, long term debt-assets, retained earnings-assets and financial capital stock-assets

Table 9: Elasticity of Ex Post Capital Cost Premia With Respect to Financial Ratios

	<i>Wkprem1</i>		<i>Wkprem2</i>		<i>Wkprem3</i>	
	Canada (P Value)	U.S. (P Value)	Canada (P Value)	U.S. (P Value)	Canada (P Value)	U.S. (P Value)
$\widehat{\eta}_{st}$	0.315 (0.004)	0.191 (0.024)	0.466 (0.000)	0.297 (0.001)	0.116 (0.212)	0.044 (0.533)
$\widehat{\eta}_{lt}$	-0.017 (0.869)	-0.301 (0.001)	-0.023 (0.828)	-0.202 (0.023)	-0.087 (0.277)	-0.191 (0.008)
$\widehat{\eta}_{re}$	0.563 (0.000)	0.225 (0.022)	0.869 (0.001)	0.375 (0.007)	0.358 (0.005)	0.369 (0.001)
$\widehat{\eta}_{ks}$	-0.029 (0.828)	-0.072 (0.519)	-0.052 (0.685)	-0.136 (0.269)	-0.200 (0.031)	-0.120 (0.206)

Note 1: See equations (14) - (17) in text.

Note 2:

$$\eta_{st} = \% \Delta Wkprem / \% \Delta st, \eta_{lt} = \% \Delta Wkprem / \% \Delta lt, \eta_{re} = \% \Delta Wkprem / \% \Delta re, \eta_{ks} = \% \Delta Wkprem / \% \Delta ks.$$

ratios. We can draw two conclusions from these estimated elasticities. First, the isolation of the endogenous component of ex post capital costs has very little effect on the qualitative conclusions that flowed from our consideration of Table 8, regardless of how we define the premia. All of the signs on the estimated elasticities remain the same, the estimates remain quantitatively small, and the statistical significance of the estimated elasticities do not change dramatically, with the exception of  $\eta_{ks}$  for all three Canadian and U.S. premia, and  $\eta_{lt}$  for all three Canadian premia. Our second conclusion is that, despite the fact that the firms' financial ratios have, in general, been statistically significant determinants of capital costs and capital cost premia, there remains a large unexplained portion of the firms' returns paid per dollar of capital employed.

We can perform a rough counterfactual experiment in an effort to determine the extent to which differences in the composition of the U.S. and Canadian steel producers' balance sheets can explain differences in their capital costs. If we assume that our estimated elasticities are fixed and we allow the U.S. firms to adopt the Canadian firms' financial ratios, we would observe virtually no change in U.S. ex post capital costs, or capital cost premia, at the mean of the data.

If the U.S. firms had mirrored the Canadian producers financial decisions, their ex post capital costs would have increased by 9.05%, at the mean of the data. This result is driven by the fact that, even though the U.S. counterfactual capital costs would have fallen had they adopted the Canadian firms' equity financing, they would have risen by even more if they had adopted the Canadian firms' higher short term debt-assets ratios, and lower long term debt-

assets ratios. Even if we assume the most favourable balance sheet composition for the U.S. firms; the retention of U.S. debt financing with the introduction of Canadian equity financing; the U.S. firms' ex post capital costs would have fallen by just 2.18%, less than half of the Canada-U.S. capital cost differential, at the mean of the data. When we perform our rough counterfactual experiment with the three ex post capital cost premia we derive a similar result. Had the U.S. steel producers adopted Canadian equity financing while maintaining their own debt financing, their capital cost premia would have fallen by between 2.63% and 1.50%, less than one sixth of differentials in Canada-U.S. capital cost premia. It is apparent that the observed differences in balance sheet composition can account for very little of the observed differences in capital costs, or capital cost premia.

## 6 Conclusions

Over the 1910-1990 period the structure and performance of the U.S. and Canadian aggregate economies, steel industries and capital markets were very similar. Despite the similarities, there were domestically unique features of the nations' capital markets; banks were the largest intermediaries in the U.S. and Canada, but the Canadian banking sector was more active in corporate finance; U.S. stock exchanges dwarfed Canadian exchanges, but U.S. firms were not as active in the issuance of equities as Canadian firms; and; U.S. firms were more active in the issuance of bonds, relative to their Canadian competitors. These distinctive features of the U.S. and Canadian capital markets had an impact on the sources of funds available for investment among our sample of steel producers in the two countries.

U.S. steel firms used more long term debt, relative to short term debt, and more retained earnings, relative to financial capital stock, than Canadian steel firms during the 1910-1990 period. These differences in the firms' financial structures reflected not only differences in the nations' banking sectors, and relatively active bond issuance and inactive share issuance in the U.S., but also the relative size, age, financial stability, and extent of private ownership of the firms. The unique features of the steel firms' balance sheets were, therefore, a (partial) reflection of domestic capital market characteristics and firm specific characteristics.

The connection between capital markets and balance sheets is important because the composition of the firms' balance sheets was a significant determinant of the returns they paid on each dollar of capital they have employed. When averaged across all sources, the U.S. firms

paid slightly more per dollar of capital employed and substantially more in excess of government bond yields, corporate bond yields and corporate stock yields, than the Canadian firms, over the 1910-1990 period. Among both the U.S. and Canadian steel producers, increased reliance on short term debt, relative to long term debt, and retained earnings, relative to financial capital stock, was associated with higher capital costs and capital cost premia.

The evidence presented in this paper, therefore, indicates that over most of the twentieth century U.S. and Canadian capital markets had domestically unique features, U.S. and Canadian steel firms' balance sheets had domestically unique features, U.S. and Canadian steel firms' capital costs were not equal, and there were statistically significant relationships among the observed cross-border differences. However, statistical significance does not imply that the relationships among the variables were economically substantial; we cannot distinguish between the U.S. and Canadian firms' use of formal stock markets; we cannot control for all of the observed balance sheet differences with variables describing national capital market characteristics; and the vast majority of capital cost differentials between the U.S. and Canada remain unaffected by changes in the composition of the firms' balance sheets.

We are left with three conclusions. First, the underlying causes of the cross-border differences in North American steel producers' financial ratios remain complicated and open to various interpretations. Second, a substantial portion of the cross-border differences in North American steel producers' capital costs remains unexplained. These two conclusions imply that, if we believe that the bridge between capital markets and industrialization is the choice of financial instruments and the cost of capital among manufacturing firms, then evidence drawn from twentieth century U.S. and Canadian steel producers cannot support claims of an economically important relationship. However, our final conclusion focuses on the fact that the quantitatively small connection between capital market characteristics, balance sheets and capital costs from our comparison of two wealthy, industrialized nations, with very similar industrial structure, technology, income and economic-cultural-legal institutions, is statistically significant. The significance of the connection in our case study suggests that these relationships are likely to have been very robust, and substantially more important among more diverse nations, industries, or time periods.

## References

- [1] Allen, F., D. Gale (2000), *Comparing Financial Systems*, Cambridge, M.I.T. Press.
- [2] Baskin, Jonathan, Paul Miranti (1997), *A History of Corporate Finance*, Cambridge MA, Cambridge University Press.
- [3] Bernanke, Benjamin (1983), “Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression”, *American Economic Review*, **73**, Pg. 257-276.
- [4] Bliss, Michael (1987), *Northern Enterprise: Five Centuries of Canadian Business*, Toronto, McClelland and Stewart.
- [5] Brander, James A., Tracey R. Lewis (1986), “Oligopoly and Financial Structure: The Limited Liability Effect”, *American Economic Review*, **76**, Pg. 956-970.
- [6] Buckley, Kenneth (1955), *Capital Formation in Canada, 1890-1930*, Toronto, University of Toronto Press.
- [7] Ciccolo, John H. (1982), “Changing Balance Sheet Relationships in the U.S. Manufacturing Sector, 1926-1977”, in *The Changing Role of Debts and Equity in Financing U.S. Capital Formation*, Benjamin M. Friedman (ed.), Chicago, Chicago University Press.
- [8] Collins, William J., Jeffrey G. Williamson (2001), “Capital Goods Prices and Investment, 1870-1950”, *Journal of Economic History*, **61**, Pg. 59-94.
- [9] Drummond, Ian M. (1962), “Canadian Life Insurance Companies and the Capital Market, 1890-1914”, *Canadian Journal of Economics and Political Science*, **28**, Pg. 204-224.
- [10] Drummond, Ian M. (1987), *Progress Without Planning: The Economic History of Ontario From Confederation to the Second World War*, Toronto, University of Toronto Press.
- [11] Evans, L.T., N.C. Quigley (1990), “Discrimination in Bank Lending Policies: A Test Using Data From the Bank of Nova Scotia, 1900-1937”, *Canadian Journal of Economics*, **23**, Pg. 210-225.
- [12] Fohlin, Caroline (2000), *Economic, Political and Legal Factors in the Development of Financial Systems: International Patterns in Historical Perspective: Social Science Working Paper Number 1089*, Pasadena, California Institute of Technology.

- [13] Friedman, Milton, Anna Schwartz (1963), *A Monetary History of the United States* Princeton, Princeton University Press.
- [14] Gillespie, W. Irwin (1991), *Tax, Borrow and Spend: Financing Federal Spending in Canada, 1867-1990*, Ottawa, Carleton University Press.
- [15] Goldsmith, R. (1969), *Financial Structure and Development*, New Haven, Yale University Press.
- [16] Greene, William H. (1990), *Econometric Analysis*, New York, Macmillan.
- [17] Keay, Ian (1999), *Assessing the Performance of Canada's Manufacturers: Firm Level Evidence From 1902-1990*, Unpublished U.B.C. Doctoral Dissertation.
- [18] Keay, Ian (2000A) "Relative Productivity Performance: Canadian and American Manufacturing Firms, 1907-1990", *Canadian Journal of Economics*, **33**, Pg. 1049-1068.
- [19] Keay, Ian (2000B) "Scapegoats or Responsive Entrepreneurs: Canadian Manufacturers, 1907-1990", *Explorations in Economic History*, **37**, Pg. 217-240.
- [20] Kilbourn, William (1960), *The Elements Combined: A History of the Steel Company of Canada*, Toronto, Clarke-Irwin.
- [21] King, Robert G., Ross Levin (1993), "Finance and Growth: Schumpeter Might Be Right", *Quarterly Journal of Economics*, **108**, Pg. 717-737.
- [22] Kraus, Alan, Robert H. Litzenger (1973), "A State-Preference Model of Optimal Financial Leverage", *Journal of Finance*, **33**, Pg. 911-922.
- [23] Levin, Ross (1997), "Financial Development and Economic Growth", *Journal of Economic Literature*, **35**, Pg. 688-726.
- [24] Mayer, Colin (1989), "Financial Systems, Corporate Finance and Economic Development", in *Asymmetric Information, Corporate Finance and Investment*, R. Glenn Hubbard (ed.), Chicago, Chicago University Press.
- [25] McDowall, Duncan (1984), *Steel at the Sault: Francis H. Clergue, Sir James Dunn, and the Algoma Steel Corporation, 1901-1956*, Toronto, University of Toronto Press.



- [26] Modigliani, Franco, Merton Miller (1958), “The Cost of Capital, Corporation Finance and the Theory of Investment”, *American Economic Review*, **48**, Pg. 261-297.
- [27] Modigliani, Franco, Merton Miller (1963), “Corporate Income Taxes and the Cost of Capital: A Correction”, *American Economic Review*, **53**, Pg. 433-443.
- [28] Naylor, R.T. (1975), *The History of Canadian Business, 1867-1914, Volume 1*, Toronto, James Lorimer.
- [29] Neufeld, Edward P. (1972), *The Financial System of Canada: Its Growth and Development*, Toronto, Macmillan.
- [30] Patrick, H. (1966), “Financial Development and Economic Growth in Underdeveloped Countries”, *Economic Development and Cultural Change*, **9**, Pg. 174-189.
- [31] Perry, J. Harvey (1989), *A Fiscal History of Canada: The Post-War Years*, Toronto, Canadian Tax Foundation.
- [32] Rousseau, Peter L., Paul Wachtel (1998), “Financial Intermediation and Economic Performance: Historical Evidence from Five Countries”, *Journal of Money, Credit and Banking*, **30**, Pg. 657-678.
- [33] Rudin, R. (1982), “Montreal Banks and Urban Development in Quebec, 1840-1914”, in *Shaping the Urban Landscape: Aspects of the Canadian City*, G. Stelter, A. Artibise (eds.), Ottawa, Carleton University Press.
- [34] Stiglitz, Joseph E. (1969), “A Re-Examination of the Modigliani-Miller Theorem”, *American Economic Review*, **59**, Pg. 784-793.
- [35] Taylor, Graham D., Peter A. Baskerville (1994), *A Concise History of Business in Canada*, Toronto, Oxford University Press.
- [36] White, Eugene (1990), “The Stock Market Boom and Crash of 1929 Revisited”, *Journal of Economic Perspectives*, **4**, Pg. 739-756.
- [37] Wylie, Peter (1989), “Technological Adaptation in Canadian Manufacturing, 1900-1929”, *Journal of Economic History*, **49**, Pg. 569-591.