Working Capital Investment: A Comparative Study – Canada Versus the United States

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This study empirically compares the working capital investment of industrial firms and finds that Canadian firms invest less in working capital than their U.S. counterparts. Matched samples of 8,628 firm-year observations each from Canada and the U.S. are utilized covering the period 1988 to 2016. Compared to their U.S. counterparts, Canadian firms have a significantly lower cash conversion cycle, non-cash working capital to asset ratio and non-cash working capital to sales ratio. The difference in working capital investment is robust to variety of firm, industry and country controls as well as to year and industry fixed effects. The study also investigates the determinants of the lower investment in working capital by Canadian firms and finds that working capital investment is negatively moderated by short-term interest rates and positively associated with international operations. (JEL: G30, G31, G32)

Keywords: working capital management; cash conversion cycle; working capital investment; short-term financial policies

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I. Introduction

Decision-making in the corporate finance field is broadly divided into long-term (capital budgeting and capital structure) and short-term (working capital management) activities. Traditionally, capital

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budgeting and capital structure decisions have received more attention from researchers than working-capital management (Ramiah et al., 2016) notwithstanding the latter being an essential factor to a firm's smooth operation and survival (Smith, 1979). Despite the importance and implications of working capital policies, the literature provides no comparative evidence on such policies. To the best of the author's knowledge, no published study has compared working capital policies of Canadian and U.S. firms. The objective of the paper is to fill the void in the literature by empirically testing for any cross-country differences in working capital investment, as well as determinants of such differences, if any.

Given the fact that multiple firm-, industry- and country-level factors influence working capital decisions, it is challenging to select countries for the purpose of comparative analysis. Selecting countries with substantially different formal and informal institutions and which are geographically distant (such as Canada versus Australia or the UK) may lead to spurious empirical identification. Instead, a comparison of firms' working capital policies between Canada and the U.S. is more appropriate. For instance, geographic proximity of these two countries mitigates concerns that comparison countries are very different from each other with respect to formal and informal institutions. On the other hand, the differences in cultural, firm and country characteristics between Canada and the U.S. provide enough heterogeneity for a robust empirical comparison (Khoury, Smith and MacKay, 1999). More precisely, the aim is to answer the following two questions: 1) Is working capital investment of Canadian firms different from that of U.S. firms as reported by the survey studies?; 2) What are the determinants of working capital investment differences, if any, between Canada and the U.S.?

Optimal working capital is determined through the trade-off between the cost of financing and benefits of investing in working capital. The study predicts that given the positive effects of working capital on firm value and operating profits, as discussed above, a typical firm in Canada or the U.S. has an incentive to invest more in working capital as long as its marginal benefits outweigh the marginal costs. It is argued that the optimal working capital investment will fluctuate at the firm level, irrespective of whether it differs at the country level. This notion is supported by the survey research, which finds both differences and similarities among Canada, the U.S. and Australia (Belt and Smith, 1991; Smith and Belt, 1989; Smith, 1979). Whether or not cross-country

working capital investment is different between Canada and the U.S. is an empirical question explored in this study.

Since working capital accounts such as inventory, receivables and payables are linked to each other (Kieschnick, Laplante and Moussawi, 2013), integrated measures are used, rather than individual proxies, for working capital investment. These include the cash conversion cycle (CCC), the non-cash working capital to sales ratio (WSR) and the non-cash working capital to asset ratio (WAR). The main independent variable is an indicator variable for Canadian firms (*CANADA*) that equals 1 for a firm-year observation of a Canadian firm and 0 for a U.S. firm.

The analysis relies on matched samples of 8,628 firm-year observations each from Canada and the U.S. for the period 1988 to 2016. First, compared to the U.S. sample, both the mean and median working capital investment of Canadian firms are significantly lower across three alternative proxies. For instance, the mean CCC, WSR and WAR are 58.06 (87.82), 0.17 (0.21) and 0.17 (0.23), respectively, for the Canadian (U.S.) sample. Then conditional tests are conducted while controlling for a number of firm, industry and country factors to confirm whether the lower working capital investment of Canadian firms is robust in a multivariable setting. Ordinary least squares and quintile regressions with year and firm fixed effects and firm-level clustering find significantly lower working capital investment by Canadian firms. The differences in mean working capital investment are economically significant as the WAR and WSR difference represent $117.94 million of total assets and $118.12 of total sales, respectively, for an average firm in the sample.

Additionally, since the main analysis concludes that working capital investment is different across Canadian and U.S. firms, firm- and country-level determinants of such differences are explored. Two possible channels are proposed to explain lower working capital investment by Canadian firms relative to U.S. firms. On one hand, the firm-level higher short-term interest cost, on average, would encourage efficient investment in working capital leading to a lower level of working capital investment. Since it is difficult to observe the actual firm-level short-term interest rates for such a large sample due to non-availability of data, an indirect method is applied by using the country-level 3-month T-Bill rate as a proxy for interest rate cost. In other words, the prediction is that higher short-term interest rates moderate the difference in working capital investment between

Canadian and U.S. firms. It is argued that the smaller size of the Canadian economy limits the size of aggregate supply of short-term finance and hence leads to relatively higher short-term interest rates for an average firm in Canada. This argument is further supported by the fact that, compared to the U.S. firms, Canadian firms are smaller and younger, which indirectly suggests that Canadian firms, on average, may pay a higher premium over a country-level policy interest rate such as T-bill rate or bank prime rate.[1] The highly integrated nature of some industry sectors in Canada and the U.S. raises a concern that some Canadian firms may borrow short-term funds in U.S. dollars using a U.S. benchmark policy rate. While this limitation is acknowledged, it is assumed that a much larger proportion of Canadian firms borrow mostly in Canadian dollars and, hence, it is expected that this concern will not qualitatively change the findings.

On the other hand, at the firm level, it is suggested that relatively lower dependence of Canadian firms vis-à-vis U.S. firms on foreign sales is a second channel for lower investment in working capital. It is difficult to predict the impact of international operations on working capital differences between Canada and the U.S. Depending on the specific nature of the firm's operations, it could either increase or decrease optimal working capital investment. For instance, firms with high demand may decide to produce in foreign countries to reduce working capital investment. Alternatively, firms with limited foreign demand may find it optimal to export their products from the home country, which would increase investment in working capital. There is anecdotal evidence reported by CFO magazine that multinational firms invest more in inventories because of international sourcing (Over a Barrel, 2016) or take longer to collect cash because of greater shipping time for intermediate goods between countries.[2] Specifically, the effect of international operations on cross-country differences in working capital investment is investigated as an empirical question.

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1. It is argued that bank prime rate may be a better proxy for short-term interest rates, especially for smaller firms that cannot access the money market. Therefore, the 3-months' T-bill rate is replaced with the bank prime rate to measure country-level short-term interest rates and the results, available upon request, are unchanged. In addition, as pointed out by an anonymous referee, a shift is observed in relative prime rates between Canada and the U.S. during the mid-1990s. To mitigate this concern, the main result in table 4 is re-estimated using two time-series sub-samples (1988-1997 and 1998-2016) and shows qualitatively and quantitatively similar results (not reported for brevity).

2. An anonymous referee provided this anecdotal evidence.

Mean and median regression analyses are used and introduce interaction terms between *CANADA* and the two proposed channels (short-term interest rates and international operations) in addition to control variables, year and industry fixed effects and firm-level clustering. Consistent with expectations, in the mean regressions, negative coefficients are found for the interaction terms between *CANADA* and short-term interest rates for the CCC measure (–1.1390 though insignificant), WAR (–0.0046 significant at the 1% level) and WSR (–0.0034 insignificant). In the median regressions, these interaction coefficients are –0.7273 (insignificant), –0.0064 (significant at the 1% level) and –0.0056 (significant at the 1% level). With respect to the interaction term between *CANADA* and the international dummy, all coefficients are positive and significant at the 1% level in both mean and median regressions. The coefficients for mean (median) regression are 26.6658 (22.0091) for CCC, 0.0466 (0.0483) for WSR and 0.0544 (0.0496) for WAR. These results confirm that lower working capital investment by Canadian firms is moderated by higher short-term interest rates and a lower percentage of international firms operating in Canada.

The robustness of the findings is verified by conducting several complementary tests. Specifically, industry-adjusted values are used for three dependent variables and similar results are found in both mean and median regressions. Next, given a large number of independent variables, Leamer's (1985) extreme bounds analysis (EBA) is used to determine which independent variables are robust and finds that the results are unchanged after excluding the fragile explanatory variables in the multivariable analysis. Then alternative methods are used to calculate the length of the cash conversion cycle (CCC) by replacing average working capital amounts with year-end to compute and test the multivariable specification with this alternative CCC measure. In another robustness check, the difference between the working capital measures in the two countries is used as dependent variables and the results are generally consistent with the findings with respect to the determinants of working capital investment across Canada and the U.S. Moreover, multivariable models are estimated using the raw unmatched sample instead of the matched sample, with 9,602 and 67,820 firm-year observations for Canada and the U.S., respectively. In addition, propensity score matching technique (PSM) based on firm size, leverage and market-to-book is used as an alternative criterion to match the samples in order to mitigate any variation in working capital investment across industries. Finally, the control variables set is supplemented by

including a profitability measure (return on assets) in the conditional analysis. The results for all the robustness tests, though not reported for brevity, are similar to the main findings.

This study contributes to the extant corporate finance literature in three distinct ways. First, it augments the prior survey research on cross-country comparisons of working capital policies (Khoury, Smith and MacKay, 1999; Belt and Smith, 1991; Smith, 1979) across Australia, Canada and the U.S. These studies document similarities and differences in working-capital policies across countries and across time. Whereas, this paper provides a first statistical comparison of working capital investment and complements the survey evidence with respect to the difference in working capital policies. Firm working capital investment is found to be associated with the country-level factors such as short-term interest rates and whether or not the firm operates abroad. Second, this paper is related to the research stream that explores determinants of working capital policies such as governance, cash flows, public versus private ownership and national culture (Zeidan and Shapir, 2017; Ben-Nasr, 2016; Elo and Tanska, 2016; Gill and Biger, 2013; Anagnostopoulou, 2013; Chiou, Cheng and Wu, 2006). This line of research is extended by identifying two additional determinants, namely short-term interest rates and international operations, which influence the level of working capital investment. Finally, the study provides indirect support to the research exploring the relationship between working capital management and firm value. For instance, Aktas, Croci and Petmezas (2015) argue that working capital investment can have opposing effects on firm value conditional on the net cost-benefit trade-off of investing in individual working capital accounts such as receivables, inventories and payables and report a non-linear relationship between working capital investment and firm value. This paper supplements their results by showing that country-level characteristics (short-term interest rates) and operational structure (international versus domestic) affect the level of working capital investment that maximizes firm value.

The rest of the paper is organized as follows. Section II provides a literature review and Section III discusses sample construction, variables and empirical prediction. Section IV presents the results of comparative analysis and Section V explores the determinants of the difference in working capital investment between Canada and the U.S. Section VI describes the results of the additional tests to confirm the robustness of the analysis. Section VII concludes the study.

II. Literature review

Working capital management involves "day-to-day activity that ensures the firm has sufficient resources to continue the operations and avoid costly interruptions" (Ross et al., 2016: 5) and is important for several other reasons. First and foremost is the fact that corporate firms invest a significant amount in working capital. For example, U.S. firms' had $4.2 trillion invested in working capital at the end of 2011 (Aktas, Croci and Petmezas, 2015). Similarly, during the period 1988 to 2016, an average Canadian (U.S.) firm held 17% (21%) of total sales or 17% (23%) of total assets in non-cash working capital. Working-capital management is also believed to have an impact on a firm's capital structure (Chiou, Cheng and Wu, 2006), suggesting that long-term financial decisions are related to short-term financial decisions. It is further argued that working capital can be used as a backup resource to avoid default (Bierman, Chopra and Thomas, 1975), cash substitute (Bates, Kahle and Stulz, 2009), and alternative source of financing (Fazzari and Petersen, 1993; Eckbo and Kisser, 2013). The extant literature also provides evidence that efficient working capital management has implications for firm value (Albuquerque, Ramadorai and Watugala, 2015; Kieschnick, Laplante and Moussawi, 2013; Almeida and Eid, 2014; Zeidan and Shapir, 2017), profitability (Shin and Soenen, 1998; Deloof, 2003; Lazaridis and Tryfonidis, 2006; García-Teruel and Martinez-Solano, 2007), operating performance (Zeidan and Shapir, 2017; Box et al., 2018), cash flows (Zeidan and Shapir, 2017), governance (Ben-Nasr, 2016; Gill and Biger, 2013), private versus listed firms (Anagnostopoulou, 2013) and national culture (Elo and Tanska, 2016).

Notwithstanding the aforementioned importance, there has been very little research on the comparison, especially statistical, of working capital investment across countries. The only exceptions are surveys comparing working capital policies of Canadian and U.S. firms. For instance, Khoury, Smith and MacKay (1999) surveyed financial executives to compare working-capital practices in Canada, the U.S. and Australia and found similarities and differences across countries as well as across time. In another survey, Belt and Smith (1991) attempted to understand the working capital management for a sample of Australian firms by comparing the results with two previous studies in the U.S. (Smith and Belt, 1989; Smith, 1979), and reported both similarities and differences. This paper argues that survey instruments fail to

appropriately identify cross-country differences in working capital policies for a number of reasons. First, survey results might be biased because there may be differences between what managers say in survey responses and what they actually do (Graham, 2004). Second, the survey methodology is most appropriate for a setting where information or data are unavailable for the population and one needs to generalize the conclusion by exploring a subset of the population (Baker and Mukherjee, 2007; Baker, Dutta and Saadi, 2011). With regard to working capital investment, the data are readily available for publicly listed firms, especially in advanced economies. Moreover, the survey evidence to date has been mixed, suggesting both similarities and differences between Canada and the U.S. Finally, compared to the U.S., the robustness of the Canadian economy during and after the 2008 financial crisis suggests that Canadian firms may behave differently when it comes to managing working capital investment. Taken together, it is important to investigate the cross-country statistical comparison of working capital investment policies.

Finally, the study is relevant to the research stream that explores determinants of investment in working capital. Thus far, there is evidence for a relationship between working capital investment and several factors including firms size, leverage, firm age, fixed asset growth, cash flows, book-to-market, profitability, interest rates, intangible assets, research and development expenses, firm-specific risk, cash reserves, variation in sales, sales growth, ownership structure and industry (Anagnostopoulou, 2013; Aktas, Croci and Petmezas, 2015; Baños-Caballero, García-Teruel and Martínez-Solano, 2010; Ben-Nasr, 2016; Chiou, Cheng and Wu, 2006; Ding, Guariglia and Knight, 2013; Hawawini, Viallet and Vora, 1986; Kieschnich, Laplante and Moussawi, 2006; Shin and Soenen, 1998; Weinraub and Visscher, 1998).[3]

III. Sample, variables and empirical predictions

A. Sample construction

The financial statement data for all listed Canadian and U.S. firms are sourced from Standard & Poor's Compustat fundamental annual files

3. Aktas, Croci and Petmezas (2015) provide a list of factors associated with working capital investment decisions.

for the fiscal years 1988 to 2016.[4,5] Consistent with the extant literature, the focus is on the working capital investments of industrial firms, with financial firms and utilities (Standardized Industry Classification (SIC) Codes 6000 to 6999 and 4900 to 4999) excluded. Firm observations with missing data for fiscal year and stock price are deleted, as are the observations with zero or negative total assets, current assets, current liabilities, receivables and sales. All variables are annual and winsorized at the 1% tails to suppress outliers. This strategy yields a sample of 9,602 and 67,820 firm-year observations for Canada and the U.S., respectively. Given a significant difference in number of firm-year observations between the two countries, the comparison of working capital investment may be biased. It is important to create a matching sample to ensure an unbiased comparison of working capital investment between the two countries. In order to create a matching sample, the PSM technique is used to create a matching nearest neighbor U.S. firm-year observation for each Canadian firm-year observation based on firm size and 2-digit SIC code. This methodology finds a matched pair of cross-country firms having similar firm size and industry segment for a robust comparison. The final sample consists of 8,628 firm-year observations each from Canada and the U.S. over the period 1988 to 2016.[6]

B. Variables

Main variables

The literature has used both individual and integrated measures as

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4. This study uses a common data source for Canadian and U.S. firms to maximize number of observations. Another source for Canadian firms' data is the Financial Post, which annually publishes a list of the Top 500 Canadian firms. The Compustat sample is manually compared with the 2017 FP 500 list to ensure completeness of the Canadian sample; over half of the FP500 Canadian firms were present in the Compustat sample. Several FP500 Canadian firms not present in the sample either belong to the financial/utilities sector (excluded in this study) or are too small to make the FP500 list.

5. The sample period is constrained due to cash flow statement data starting in 1986 in Compustat.

6. In total, there are 564 and 3,246 unique firms from Canada and the U.S., respectively. The lower number of unique Canadian firms in the matched sample is explained by the fact that various yearly observations of one Canadian firm are matched with different U.S. firms across the time period 1988 to 2016. For example, Canadian firm X could match with U.S. firm Y for fiscal year 2000 and U.S. firm Z for fiscal year 2001.

proxies for working capital investment. Petersen and Rajan (1997), Box et al. (2018), and Albuquerque, Croci and Petmezas (2015) explore working capital management by studying individual accounts such as receivables and trade credit. Other studies (Kieschnick, Laplante and Moussawi, 2013; Aktas, Croci and Petmezas, 2015; Ben-Nasr, 2016; Ding, Guariglia and Knight, 2013) have used an integrated measure of non-cash working capital, that is, inventories plus receivables minus accounts payables. Kieschnick, Laplante and Moussawi (2013) argue that the management of working capital accounts cannot be studied in isolation since these accounts are fundamentally linked to each other. For example, a firm's generous trade credit policy would not only result in higher sales and receivables but also necessitate a higher investment in inventory. They suggest using the cash conversion cycle as a measure of net working capital investment because it jointly captures the management of receivables, inventory and payables. Similarly, Aktas, Croci and Petmezas (2015) and Ben-Nasr (2016) use the net working capital to sales ratio and Ding et al. (2013) use the cash conversion cycle as measures for working capital investment. Consequently, for the dependent variable, three integrated proxies are used for working capital investment: the cash conversion cycle (CCC), the net working capital to asset ratio (WAR) and the net working capital to sales ratio (WSR).[7] Since the aim is to discover whether Canadian firms invest differently in working capital than U.S. firms, a Canadian country dummy (*CANADA*) is used as the main independent variable, equal to 1 if the firm-year observation belongs to Canada and 0 otherwise. The variable definitions are provided in the appendix.

Control variables

Working capital research has shown that several firm-level factors influence working capital policies. It is, therefore, essential to control for such factors to ensure unbiased estimations of country effects on such policies. A recent study by Aktas, Croci and Petmezas (2015), which explores whether working capital management is value-enhancing, provides a set of controls. This study follows theirs and controls for firm size (SIZE), intangible assets (INTANGIBLES), leverage (LEVERAGE), firm age (AGE), research and development

7. In addition, the study compares the scaled proxies for individual working capital investment measures including inventories (INV), payables (A/P) and receivables (A/R) as robustness checks.

expenses (R&D), firm-specific risk (RISK), growth in fixed asset (GFA), cash reserves (CASH RESERVE),[8] variation in sales (SALES VOLATILITY), cash flows (CF), and sales growth (SALES GROWTH). Given the cross-country comparison in this study, it is important to control for country-level heterogeneity for unbiased identification. First, since firms predominantly finance working capital through short-term borrowings or revolving lines of credit, a country-level difference in short-term interest rates may affect working capital policies. In addition, working capital investment can be affected if a firm operates in multiple countries as opposed to only in the domestic market. Therefore, a control for short-term interest rates (*STIR*) and an international dummy (*INTERNATIONAL*) are implemented. Working capital requirements for a typical firm may vary over time as well as across industries (Hawawini, Viallet and Vora, 1986; Weinraub and Visscher, 1998). To ensure robust identification, industry and year fixed effects are included in the multivariate specifications.[9] Finally, since few country-level variables are included that do not vary across firms, it is not possible to include firm fixed effects in this study. However, firm-level clustering is used to mitigate the possibility of unobserved firm fixed effects.

C. Empirical predictions

The literature about cross-country differences in working capital investment is limited to survey studies, the evidence from which is mixed. However, the within-country research, discussed in Section I, identifies several factors including capital structure, cash flows, governance structure and culture as important. Working capital management is a trade-off between the benefits associated with working capital investment and the corresponding costs to finance working

8. Since cash reserves may be correlated to working capital measures, especially cash conversion cycle, cash reserves are excluded in a robustness check and similar results are found.

9. Accounting literature (Weiner, 2005; Bhojraj, Lee and Oler, 2003; Krishnan and Press, 2003) debates the weakness of Standard Industry Classification (SIC) codes to classify industries. Consequently, this study uses three alternative measures, namely, North American Industry Classification System (NAICS), Global Industry Classifications Standard (GICS) and Fama–French 48 Industry Segments, to check the robustness of findings. Specifically, table 4 is estimated using each of these industry measures and results are quantitatively and qualitatively similar (not reported for brevity).

capital. With no financing constraints, a firm will continue to increase investment in working capital if the marginal benefit of additional investment exceeds the marginal cost of additional financing. In theory, all firms should achieve an optimal level of working capital investment. The firm-level or, aggregately, the country-level optimal working capital investment will depend on the firm's cost of financing or the expected benefits from the working capital investment. However, for two reasons it is difficult to predict a priori whether working capital investment of Canadian and U.S. firms is different or similar. One, prior research lacks an evidence-based statistical comparison of cross-country working capital investment. Second, survey studies (Khoury, Smith and MacKay, 1999; Belt and Smith, 1991; Smith and Belt, 1989; Smith, 1979) provide mixed evidence with respect to cross-country differences and/or similarities. Consequently, whether working capital investment is similar or different across Canadian and U.S. firms is an open question best resolved through empirical analysis. Additionally, if the main analysis concludes that working capital investment is different across Canadian and U.S. firms, the firm- and country-level factors explaining such differences will be explored.

IV. Comparison of working capital investment: Canada versus U.S.

The study carries out a broad analysis to investigate similarities or differences in working capital investment between Canadian and U.S. firms. First, the study checks whether the CCC, WSR, WAR, INV, A/P and A/R of Canadian firms are statistically different from those of U.S. firms. The results of univariate differences between the working capital investments of matched Canadian and U.S. firms are reported in table 1, which provides summary statistics including mean, median, minimum and maximum values and number of observations for working capital proxies as well as the control variables.

Lower levels of working capital held by the Canadian firms are observed regardless of the choice of working capital measure. For instance, the mean (median) cash conversion cycle of Canadian firms is 58.05 (54.82) days as opposed to 87.86 (76.74) days for U.S. firms. Similarly, the mean working capital to sales (assets) ratio for the Canadian firms is 17% (17%) compared to 21% (23%) for U.S. firms. The results are similar when individual components of working capital

are compared because Canadian firms have, on average, 3% lower cash and 5% higher payables except for inventories and receivables, which are similar across the two countries. Two possible explanations are proposed for the higher payable ratio for Canadian firms. One, given higher short-term interest rates, Canadian firms use trade credit as an alternative source of short-term financing (Ge and Qiu, 2007). Second, a higher payables ratio among Canadian firms is perhaps a result of relatively more use of short-term paper, receivables factoring and/or asset-based lending in the U.S.[10] However, median inventories are 1% lower for Canadian firms. The other interesting differences are in short-term interest rates, where mean is 17 basis points higher and median is 62 basis points lower for Canada, and the international dummy, which shows that only 7% of Canadian firms report foreign income as opposed to 34% of U.S. firms. Since this study uses a matched sample of Canadian and U.S. firms based on firm size, this measure is approximately similar across the countries. Time-series plots are created of the integrated and individual measures of working capital investment as shown in figures 1 and 2, respectively.

The graphs of the integrated working capital measures generally confirm the differences between Canada and the U.S. and show one interesting trend: the gap between Canadian and U.S. working capital investment has narrowed since the 2008 financial crisis. This could be explained, at least in part, by post-crisis changes in short-term interest rates, which reached record lows in Canada, resulting in a smaller gap between Canada and the U.S. The mean plot of individual measures shows trends similar to the integrated measures with a notable difference in payables. The time-series plots provide initial evidence of working capital investment difference and that Canadian firms seem to invest less in working capital than U.S. firms.

Next, to test the statistical significance of the differences in working capital measures in Canada and the U.S., mean and median difference tests are conducted. Table 2 reports these results.

The results in this table confirm the mean (median) differences in working capital investments because, relative to U.S. firms, Canadian firms have a 29.804- (21.916-) day shorter cash conversion cycle, a 3.5% (3.2%) lower working capital to sales ratio and a 5.4% (6.0%)

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10. Details about factoring or asset-based financing are not observed in these data. However, the main results are robust when the working capital measures are adjusted using the accounts payables net of notes payables-short-term borrowings, which reports use of commercial paper.

TABLE 1. Comparative Summary Statistics

Variable		Obs	Mean	Median	Std. Dev.	Min	Max
CCC	Canada	8,628	58.05	54.82	111.79	(370.18)	533.28
	US	8,628	87.86	76.74	100.34	(370.18)	533.28
WSR	Canada	8,628	0.17	0.16	0.20	(0.54)	1.03
	US	8,628	0.21	0.19	0.16	(0.54)	1.03
WAR	Canada	8,628	0.17	0.15	0.17	(0.20)	0.71
	US	8,628	0.23	0.21	0.17	(0.20)	0.71
CASH	Canada	8,628	0.11	0.05	0.15	0.00	0.79
	US	8,628	0.14	0.07	0.17	0.00	0.79
INV	Canada	8,628	0.16	0.12	0.13	0.00	0.64
	US	8,628	0.16	0.13	0.13	0.00	0.64
A/P	Canada	8,628	0.14	0.12	0.11	0.01	0.56
	US	8,628	0.09	0.07	0.08	0.01	0.56
A/R	Canada	8,628	0.16	0.14	0.12	0.01	0.55
	US	8,628	0.16	0.14	0.11	0.01	0.55
SIZE	Canada	8,628	5.63	5.63	2.05	(0.14)	10.15
	US	8,628	5.75	5.84	2.28	(0.14)	10.15
INTANGIBLES	Canada	8,417	0.10	0.03	0.15	0.00	0.91
	US	7,851	0.12	0.06	0.16	0.00	0.90
LEVERAGE	Canada	8,628	0.24	0.22	0.22	0.00	1.36
	US	8,628	0.24	0.22	0.22	0.00	1.36
AGE	Canada	1,984	20.43	19.78	4.37	9.47	33.41
	US	3,393	23.81	23.61	5.84	3.16	49.41
R&D	Canada	8,628	0.07	-	0.29	0.00	2.29
	US	8,628	0.05	0.00	0.18	0.00	2.29
Risk - CFV	Canada	7,782	0.98	0.17	2.88	0.01	21.62
	US	8,109	0.98	0.20	2.59	0.01	21.62

(*Continued*)

TABLE 1. (Continued)

Variable		Obs	Mean	Median	Std. Dev.	Min	Max
FIXED ASSET GROWTH	Canada	8,148	0.14	0.04	0.47	(0.64)	3.37
	US	8,318	0.14	0.04	0.47	(0.64)	3.37
SALES VOLATILITY	Canada	7,782	0.23	0.17	0.19	0.02	1.21
	US	8,109	0.24	0.18	0.20	0.02	1.21
CF	Canada	8,628	(0.35)	0.20	3.85	(33.74)	6.05
	US	8,628	(0.16)	0.26	3.54	(33.74)	6.05
BTM	Canada	8,623	0.76	0.62	0.96	(4.46)	4.53
	US	8,627	0.57	0.47	0.82	(4.46)	4.53
SALES GROWTH	Canada	8,162	0.16	0.07	0.45	(0.59)	2.92
	US	8,320	0.13	0.07	0.38	(0.59)	2.92
STIR	Canada	8,628	3.43	2.67	2.85	0.20	12.22
	US	8,628	3.26	3.29	2.50	0.01	8.35
INTERNATIONAL	Canada	8,628	0.07	-	0.26	0.00	1.00
	US	8,628	0.34	-	0.48	0.00	1.00

Note: Comparative summary statistics for Canadian and U.S. matched samples from 1988 to 2016 are presented. The variables definitions are as follows: CCC: cash conversion cycle based on average values is the sum of the days sales outstanding (DSO) and days inventory outstanding (DIO) minus days payable outstanding (DPO) as further explained in the appendix; WAR: non-cash working capital scaled by the total assets; WSR: non-cash working capital scaled by the total sales; CASH: cash and marketable securities divided by the total assets; INV: inventories to the total asset ratio; A/P: accounts payable to the total assets ratio; A/R: accounts receivable to the total asset ratio; SIZE: natural log of the total assets; INTANGIBLES: intangible assets divided by the total assets; LEVERAGE: long-term debt plus debt in current liabilities divided by the total assets; AGE: number of year since the initial public offering; R&D: research and development expenses scaled by the sales; Risk – CFV: coefficient of variation in annual cash flow over the past 10 years; FIXED ASSET GROWTH: change in the net property, plant and equipment over the previous fiscal year; SALES VOLATILITY: coefficient of variation in annual sales to total asset ratio over the past 10 years; CF: the sum of income before extraordinary items and depreciation scaled by the net property, plant, and equipment; BTM: total common equity scaled by market capitalization; SALES GROWTH: change in sales over the previous fiscal year; *STIR*: annual percentage interest rates based on 3-month Treasury bill rate; and *INTERNATIONAL*: a dummy variable that equals 1 if firm reports a positive pre-tax foreign income and 0 otherwise. All variables, except age, *STIR*, and *INTERNATIONAL*, are winsorized at the 1%. The table reports the number of observations, means, medians, standard deviations, minimum and maximum values of the variables.

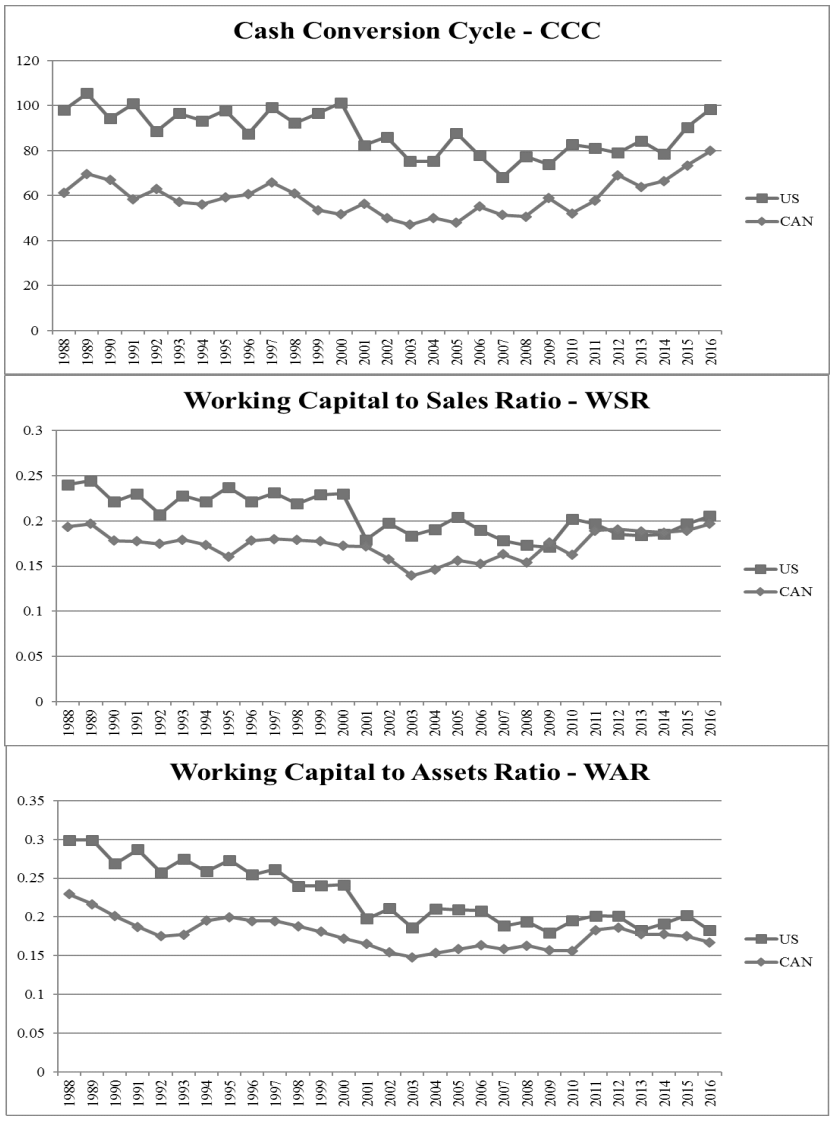


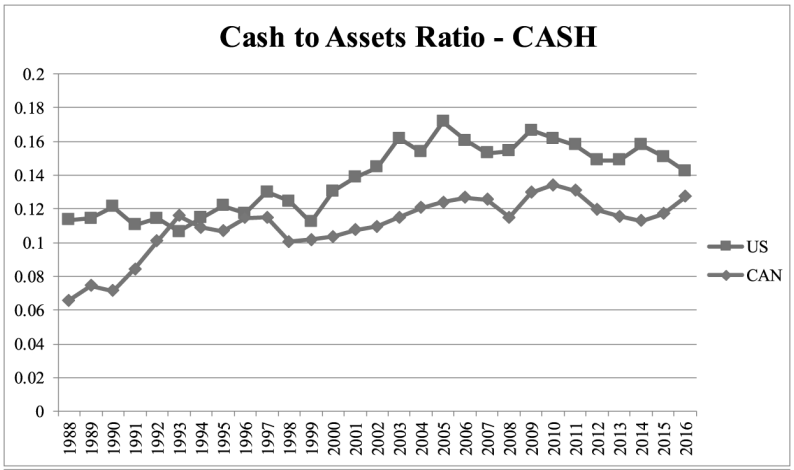
FIGURE 1.— Time Series Comparison of Working Capital Measures – Canada versus U.S.

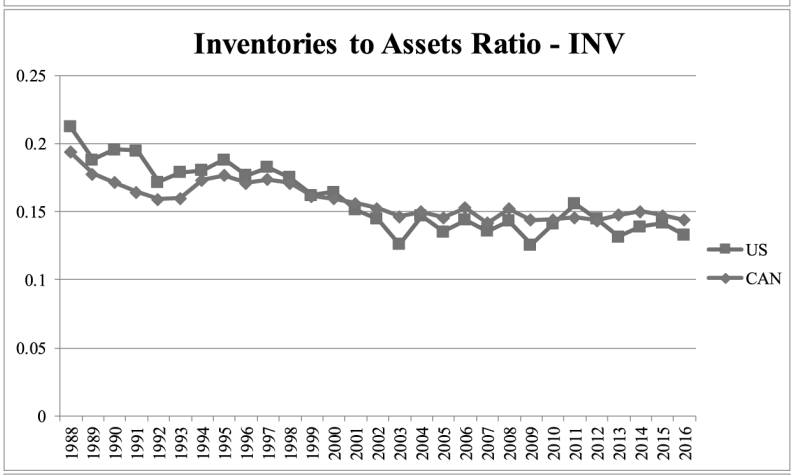
lower working capital to assets ratio, with all differences significant at the 1% level. The results for the individual working capital components show that, compared to U.S. firms, Canadian firms have 0.4% (0.6%) lower inventories, 5.2% (5.1%) higher payables and 0.1% (0.1%) lower receivables and the differences are again significant at the 1% level, except for receivables where both mean and median differences are insignificant. The comparison of control variables for Canadian and U.S. firms (not reported) indicates significant differences for most variables. In particular, compared to U.S. firms, Canadian firms are younger, have lower cash holdings, intangible assets, leverage, sales volatility and cash flows, and higher research and development expenditures, fixed asset growth, book-to-market ratio, sales growth and interest costs. The results show that, compared to U.S. firms, very few Canadian firms report foreign income. Taken as a whole, this analysis confirms heterogeneity of firm- and country-level characteristics between Canada and the U.S., and suggests the need to control for these factors to ensure robust support for the initial findings.

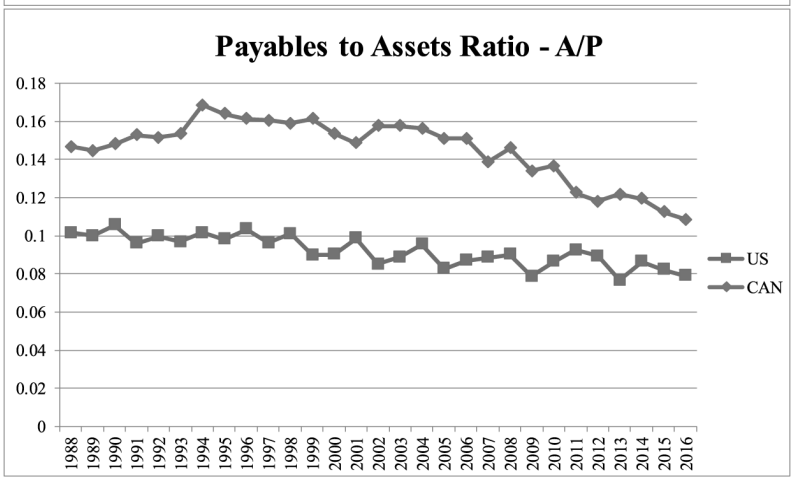
Spearman rank correlations are computed between the working capital investment proxies and control variables in order to see the unconditional effects of various control variables on working capital investment in each country. The rank correlations for the selected variables are reported in table 3.

First, the study finds that three aggregate measures of working capital investment are highly and significantly correlated; the correlation between working capital measures ranges from 0.65 to 0.91 and all coefficients are significant at the 5% level. Second, with the exception of two variables (short-term interest rates and intangibles), the study finds that the direction of correlation is mostly the same for Canadian and U.S. firms; however, the magnitudes of the correlations vary between the Canadian and U.S. data. The correlation between the cash conversion cycle and short-term interest rate is negative and significant for Canada (–0.05) and positive and significant for the U.S. (0.04). The correlation between the working capital to sales ratio and intangibles is positive and significant for the U.S. (0.433) and negative but insignificant for Canada (–0.0038). Overall, the correlation analysis confirms firm- and country-level heterogeneity among the interactions of control variables and necessitates a conditional analysis for robust identification.

Finally, a conditional analysis is conducted to investigate differences or similarities between the working capital policies of Canadian and


Cash to Assets Ratio - CASH
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016
US
CAN


Inventories to Assets Ratio - INV
0.25
0.2
0.15
0.1
0.05
0
1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016
US
CAN


Payables to Assets Ratio - A/P
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016
US
CAN

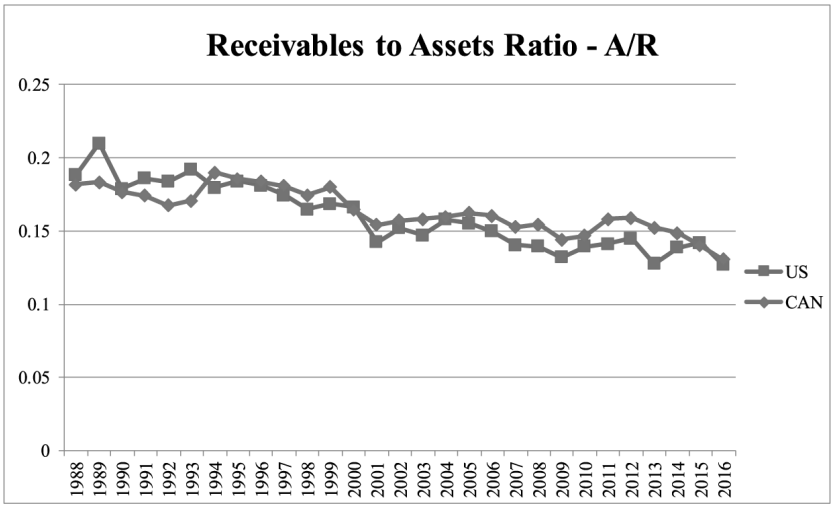


FIGURE 2.— Time Series Comparison of Working Capital Measures – Canada versus U.S.

U.S. firms using the following multivariable specification.

$$WCM_{it} = \beta_0 + \beta_1 CANADA + \beta_2 CONTROLS_{it} + \varepsilon_{it} \qquad (1)$$

where WCM_{it} is the year t working capital measure for firm i, $CANADA$ is a dummy for Canadian firms, which equals 1 if firm-year observation belongs to a Canadian firm and 0 otherwise, $CONTROLS_{it}$ is the set of control variables for firm i in year t, and β_i and ε_{it} are model parameters. In this specification, the main parameter of interest is β_1. A significant β_1 will suggest that working capital investment of Canadian firms differs from that of U.S. firms, whereas an insignificant β_1 will confirm the similarities of working capital investment between these two countries. In addition, the sign of β_1, if significant, will indicate a lower or higher working capital investment across the two countries. For instance, a negative (positive) and significant value for this parameter will indicate that, compared to U.S. firms, Canadian companies invest less (more) in working capital. The study estimates model (1) independently with mean and median values. The results are reported in table 4.

The results confirm significant differences in working capital

investment between Canadian and U.S. firms; the coefficient for the *CANADA* dummy is negative and significant regardless of the choice of working capital investment proxy and the type of regression, suggesting that Canadian firms invest less in working capital. For example, the *CANADA* dummy coefficients in mean and median regressions for CCC are –49.6765 and –28.4566 in Panels I and II, respectively, and both are significant at the 1% level. Similarly, the mean regression coefficient for WSR (WAR) is –0.0571 (–0.0622) and the median regression coefficient is –0.0477 (–0.0425), all significant at the 1% level. The working capital investment differences between Canada and the U.S. are economically significant as well. For example, in the mean regressions, compared to the U.S. sample, the Canadian CCC is 49 days shorter and the WAR and WSR are 5.7% and 6.2% lower, respectively. This translates into values of $117.94 million in total assets and $118.12 million in total sales for an average firm in the sample.

The results for the control variables are generally consistent with prior studies (Baños-Caballero, García-Teruel, and Martínez- Solano, 2010; Kieschnich, Laplante and Moussawi, 2013; Chiou, Cheng and Wu, 2006) that have used working capital as the dependent variable to explore the determinants of working capital investment. The study finds that size and leverage are negatively related to working capital investment, while firm age and book-to-market are positively associated. The coefficients for fixed asset growth and short-term interest rate are mixed and mostly insignificant.

Previous empirical studies do not provide the direction of the correlation between working capital investment and cash reserves, intangible assets, research and development, firm-specific risk, sales volatility, sales growth and the international dummy. The results are, however, consistent with theory and intuition as the study finds a negative correlation between working capital investment and cash reserves, intangible assets, research and development expenses, firm-specific risk and sales volatility measures. The correlation between working capital and international dummy is mixed because it is positive for working capital to asset ratio but negative for cash conversion cycle and working capital to sales ratio, whereas it is insignificant between working capital and sales growth.

Taken as a whole, this section strongly confirms differences in working investment and that compared to the U.S., an average firm in Canada invests much less in working capital.

TABLE 2. Mean and Median Difference Tests

A.

Variable		Obs	Mean	Difference	P-Value
CCC	Canada	8,628	58.06	29.804***	0.0000
	US	8,628	87.82		
WSR	Canada	8,628	0.17	0.035***	0.0000
	US	8,628	0.21		
WAR	Canada	8,628	0.17	0.054***	0.0000
	US	8,628	0.23		
CASH	Canada	8,628	0.11	0.024***	0.0000
	US	8,628	0.14		
INV	Canada	8,628	0.16	0.004*	–0.0540
	US	8,628	0.16		
A/P	Canada	8,628	0.14	–0.052***	0.0000
	US	8,628	0.09		
A/R	Canada	8,628	0.16	–0.001	–0.4600
	US	8,628	0.16		

A.

Variable		Obs	Median	Difference	P-Value
CCC	Canada	8,627	54.83	21.916***	0.0000
	US	8,627	76.74		
WSR	Canada	8,627	0.16	0.032***	0.0000
	US	8,627	0.19		
WAR	Canada	8,627	0.15	0.06***	0.0000
	US	8,627	0.21		
CASH	Canada	8,627	0.05	0.022***	0.0000
	US	8,627	0.07		
INV	Canada	8,627	0.12	0.006***	0.0137
	US	8,627	0.13		
A/P	Canada	8,627	0.12	–0.051***	0.0000
	US	8,627	0.07		
A/R	Canada	8,627	0.14	0.001	0.3137
	US	8,627	0.14		

Note: The table reports the results of mean and median difference tests for working capital measures for Canadian and U.S. matched samples from 1988 to 2016. The variable definitions are provided in table 1. The difference column represents the mean or median value of the U.S. sample minus the mean or median value of the Canadian sample. The significance of the difference in mean values uses the T-test with unequal variance and the significance of difference in median values uses the Mann–Whitney test. The final column reports the p-values. Note that ***, **, * show the difference in means or medians is significant at 1%, 5% and 10%, respectively.

TABLE 3. Correlations

Variables		CCC	WSR	WAR	CASH	INV	A/P	A/R
CCC	Canada	1						
	US	1						
WSR	Canada	0.8981*	1					
	US	0.9103*	1					
WAR	Canada	0.7142*	0.7478*	1				
	US	0.6530*	0.6995*	1				
CASH	Canada	0.0018	0.0039	–0.1697*	1			
	US	0.0928*	0.0335	–0.1332*	1			
INV	Canada	0.5236*	0.4462*	0.7389*	–0.1853*	1		
	US	0.5241*	0.4795*	0.7911*	–0.1349*	1		
A/P	Canada	–0.2324*	–0.2481*	0.1554*	–0.1417*	0.4491*	1	
	US	–0.1683*	–0.1298*	0.3192*	–0.1906*	0.5101*	1	
A/R	Canada	0.1883*	0.3116*	0.5802*	–0.1015*	0.3254*	0.5017*	1
	US	0.2727*	0.3977*	0.6826*	–0.1091*	0.3682*	0.4745*	1
SIZE	Canada	–0.0584*	–0.0672*	–0.1767*	–0.1706*	–0.2563*	–0.3080*	–0.2643*
	US	–0.1456*	–0.1771*	–0.2746*	–0.2105*	–0.2516*	–0.2579*	–0.2770*
INTANGIBLES	Canada	–0.0196	–0.0038	0.0002	–0.0501*	–0.0457	0.0686*	0.1052*
	US	0.0254	0.0433*	–0.0837*	–0.2026*	–0.1415*	–0.1290*	0.0116
LEVERAGE	Canada	–0.1586*	–0.1350*	–0.1091*	–0.4971*	–0.0491*	0.1216*	0.0484*
	US	–0.1603*	–0.1210*	–0.1013*	–0.5345*	–0.0740*	0.0281	–0.0675*
AGE	Canada	0.0608*	0.0551*	0.0683*	–0.0441	0.0717*	–0.0086	0.0092
	US	0.0695*	0.0757*	0.1266*	–0.1481*	0.1115*	0.0801*	0.0831*

(*Continued*)

TABLE 3. (Continued)

Variables		CCC	WSR	WAR	CASH	INV	A/P	A/R
R&D	Canada	0.1931*	0.2311*	0.0969*	0.4057*	0.0784*	0.0878*	0.2246*
	US	0.3702*	0.3555*	0.0410*	0.5130*	0.0092	–0.1276*	0.0719*
Risk – CFV	Canada	0.0741*	0.1046*	0.0764*	0.4751*	0.1063*	0.1873*	0.1797*
	US	0.2241*	0.2262*	0.1904*	0.4572*	0.1548*	0.1402*	0.2571*
FIXED ASSET GROWTH	Canada	0.0271	0.0227	–0.0339	–0.0928*	–0.1036*	–0.1216*	–0.0775*
	US	–0.0269	–0.0217	–0.0505*	–0.0948*	–0.0553*	–0.0911*	–0.0729*
SALES VOLATILITY	Canada	–0.0644*	–0.0782*	0.1541*	0.0185	0.2307*	0.2909*	0.2730*
	US	–0.1256*	–0.1140*	0.1471*	0.0703*	0.1879*	0.3615*	0.2347*
CF	Canada	0.0780*	0.1024*	0.2871*	–0.0222	0.1726*	0.0667*	0.2154*
	US	0.0764*	0.0521*	0.1385*	0.0685*	0.0227	–0.1049*	0.1212*
BTM	Canada	0.2514*	0.2146*	0.2656*	–0.1486*	0.1802*	–0.0893*	0.0407
	US	0.1031*	0.1245*	0.1641*	–0.1920*	0.1001*	–0.0386*	0.0416*
SALES GROWTH	Canada	0.0021	0.0272	–0.0003	–0.0206	–0.0541*	–0.0563*	0.0095
	US	–0.0031	0.0065	–0.0189	0.0320	–0.0431*	–0.0560*	–0.0132
STIR	Canada	–0.0500*	–0.0396	–0.0212	–0.1072*	–0.0379	0.0723*	0.0330
	US	0.0410*	0.0918*	0.1451*	–0.0965*	0.1141*	0.1290*	0.1456*
INTERNATIONAL	Canada	0.0734*	0.0958*	0.0834*	0.0604*	–0.0024	–0.0638*	0.0922*
	US	0.1329*	0.1196*	0.0385*	0.0742*	0.0223	–0.0501*	0.0610*

Note: The table reports the Spearman rank correlation between the variables for Canadian and U.S. samples. Note that * shows that the correlations are significant at the 5% level.

TABLE 4. Difference in Working Capital Policies – Canada Versus U.S.

Variable	CCC		WAR		WSR	
	I	II	I	II	I	II
CANADA	–49.6765***	–28.4566***	–0.0571***	–0.0477***	–0.0622***	–0.0425***
	(–11.33)	(–15.32)	(–11.22)	(–12.21)	(–8.74)	(–11.43)
SIZE	0.7945	–1.9618***	–0.0137***	–0.0166***	–0.0008	–0.0055***
	(0.67)	(–3.79)	(–9.26)	(–14.98)	(–0.44)	(–5.84)
INTANGIBLES	–35.5503***	–17.6551***	–0.2422***	–0.2221***	–0.1213***	–0.0431***
	(–2.72)	(–3.35)	(–18.47)	(–21.26)	(–5.29)	(–4.33)
LEVERAGE	–57.3363***	–17.3045***	–0.0793***	–0.0661***	–0.0685***	–0.0394***
	(–5.55)	(–4.08)	(–6.85)	(–7.04)	(–4.04)	(–5.32)
AGE	–0.1301	0.3193**	0.0011***	0.0013***	–0.0003	0.0007***
	(–0.42)	(2.45)	(2.97)	(4.67)	(–0.54)	(2.72)
R&D	–16.7871	4.9150	–0.0512***	–0.0513***	–0.0325	0.0194
	(–0.97)	(0.38)	(–5.84)	(–4.65)	(–1.11)	(0.60)
Risk – CFV	–2.6736**	–1.6789***	–0.0006	–0.0010	–0.0011	–0.0028***
	(–2.34)	(–2.98)	(–0.61)	(–0.94)	(–0.66)	(–2.78)
FIXED ASSET GROWTH	2.2522	1.0967	–0.0068	–0.0084**	0.0007	0.0057
	(0.48)	(0.55)	(–1.49)	(–2.25)	(0.09)	(1.34)
CASH RESERVE	–65.4428***	–35.6076***	–0.3490***	–0.3205***	–0.1594***	–0.1335***
	(–4.64)	(–4.92)	(–23.88)	(–31.65)	(–6.66)	(–10.51)
SALES VOLATILITY	–58.1469***	–40.5247***	–0.0390***	–0.0008	–0.1246***	–0.0902***
	(–6.42)	(–11.31)	(–3.27)	(–0.08)	(–8.48)	(–12.24)
CF	1.3780	1.9239***	0.0031***	0.0034***	0.0021	0.0029***
	(1.46)	(3.37)	(3.86)	(3.84)	(1.38)	(2.84)

(*Continued*)

TABLE 4. (Continued)

Variable	CCC		WAR		WSR	
	I	II	I	II	I	II
BTM	12.5683***	5.8046***	0.0123***	0.0047**	0.0214***	0.0126***
	(6.41)	(7.73)	(4.73)	(2.53)	(6.11)	(11.58)
SALES GROWTH	–3.0227	–1.5247	–0.0007	0.0014	0.0068	0.0043
	(–0.43)	(–0.65)	(–0.12)	(0.30)	(0.53)	(1.00)
STIR	0.3929	2.3797	0.0033	0.0018	–0.0007	0.0021
	(0.13)	(1.55)	(0.87)	(0.75)	(–0.14)	(0.89)
INTERNATIONAL	–7.7420**	0.6790	0.0066	0.0115***	–0.0151***	0.0023
	(–2.09)	(0.36)	(1.37)	(3.15)	(–2.64)	(0.64)
CONSTANT	192.5168***	209.2676***	0.3462***	0.4524***	0.4894***	0.4476***
	(3.75)	(5.82)	(5.22)	(3.92)	(6.48)	(9.45)
YEAR FIXED EFFECTS	Yes	Yes	Yes	Yes	Yes	Yes
INDUSTRY FIXED EFFECTS	Yes	Yes	Yes	Yes	Yes	Yes
FIRM LEVEL CLUSTERING	Yes	Yes	Yes	Yes	Yes	Yes
Adj./Pseudo R-Squared	0.2532	0.1919	0.4948	0.3377	0.2545	0.2051
N	4477	4477	4477	4477	4477	4477

Note: The regression results are based on matched samples of Canadian and U.S. firms from 1988 to 2016 using PSM based on firm size and industry. The variable definitions are provided in table 1. The dependent variables are the three alternative measures of the working capital management. The estimation uses the pooled sample of Canadian and U.S. firms and includes country dummy *CANADA* as main explanatory variable, which equals 1 if the observation belongs to the Canadian sample and 0 otherwise. Specifications in Model I use OLS Regressions and specifications in Model II use Quintile/Median Regressions. All specifications control for year and industry fixed effects and firm-level clustering. The results report the coefficients, t-statistics (in parentheses), adjusted (OLS Models) or Pseudo (Median Models) R-Squared, and the number of observations. Note: ***, **, * show statistical significance at 1%, 5%, and 10% levels, respectively.

V. Determinants of working capital differences

With working capital investment differing significantly between Canada and the U.S., the reasons for the difference are explored. As noted earlier, the article argues that optimal investment in working capital is a trade-off between the cost of financing it and the benefit of investing in it. Consequently, the study explores two possible channels of working capital investment differences between Canada and the U.S. One, the smaller size of the Canadian economy relative to the U.S. economy generates a much smaller aggregate supply of short-term capital to finance operations, increasing the average short-term cost of capital in Canada. This argument is partially supported in the univariate comparison, which shows that compared to the U.S., the average Canadian short-term interest rate (*STIR*) is 17 basis points higher. The study predicts that higher short-term interest rates in Canada contribute to the difference in working capital investment between Canadian and U.S. firms. A higher short-term interest rate typically increases the cost of, for example, the revolving lines of credit typically used to finance working capital (Aktas, Croci and Petmezas, 2015). It is therefore anticipated that higher short-term interest rates negatively influence working capital investment in Canada. Second, the study suggests as a second channel for lower investment in working capital the relatively lower dependence of Canadian vis-à-vis U.S. firms on foreign sales. Borrowing from Albuquerque, Ramadorai and Watugala (2015) who assessed the extent of the trade credit effect on a firm's stock return based on its international sales exposure, this study uses the international operations dummy as a proxy for foreign sales. Albuquerque, Ramadorai and Watugala (2015) do not report the effect of foreign sales on trade credit (an independent measure of working capital investment). Indeed, it is difficult a priori to anticipate the effect of international operations on working capital investment. The nature of international operation may increase or decrease working capital investment. For instance, an international firm, as opposed to a similar firm with only domestic operations, needs to maintain relatively higher inventories in the home country to accommodate longer shipping times for its goods to foreign customers. Likewise, it may take longer for an international firm to collect receivables from a foreign customer, resulting in a higher working capital investment in receivables. Even if the firm offers the same credit terms to international and domestic customers, the extended transit time for international shipping will delay the start-time of the credit period. On the other hand, an international firm may be able to finance trade credit in the foreign country at a lower cost and/or produce or store finish goods inventory in a foreign country close to its foreign customers to reduce investment in inventory. Such

strategies may result in a lower investment in trade credit and in the cash conversion cycle. However, since the univariate analysis shows that compared to the U.S., fewer firms in the Canadian sample have international operations (34% and 7%, respectively), the study predicts that international operations increase working capital investment.

With respect to the empirical methodology, the following model is expected to determine the effect of short-term interest rates and international operation on the difference between the working capital investment of Canadian and U.S. firms.

$$WCM_{it} = \gamma_0 + \gamma_1 CANADA + \gamma_2 CANADA * STIR_{jt} \quad (2)$$
$$or\ INTERNATIONAL_{it} + \gamma_3 CONTROLS_{it} + \varepsilon_{it}$$

where WCM_{it}, $CANADA$ and $CONTROLS_{it}$ are as defined above. $STIR_{jt}$ is the short-term interest rate in year t for country j, and $INTERNATIONAL_{it}$ is a dummy for international operations, which equals 1 if firm i reports foreign income in year t and 0 otherwise, and γ_i and ε_{it} are model parameters. Here, γ_2, the coefficient for the interaction term between the $CANADA$ dummy and short-term interest rates/international dummy is of interest, and a significant value of this parameter will confirm if the working capital difference between Canada and the U.S. is affected by short-term interest rates and/or international operations. In particular, a negative (positive) and significant γ_2 coefficient will support the argument that short-term interest rates (international operations) decrease (increase) the working capital investment of Canadian firms. The results are reported in table 5.

The findings for mean and median regressions shown in Panels I and II, respectively, support both arguments. The interaction term between short-term interest rates and the three proxies for working capital investment are negative and generally significant, except for the CCC measure, which is insignificant. These results provide support for the conjecture that higher short-term interest rates lead to the lower working capital investment. For the international dummy, the interaction terms for all three proxies of working capital investment are positive and significant at the 1% level. This finding confirms that working capital investment is influenced by the international status of industrial firms. Given that, compared to the U.S., a smaller proportion of Canadian firms have international operations, the study concludes that Canadian firms are able to maintain a lower working capital investment than their U.S. counterparts.

TABLE 5. Determinants of Difference in Working Capital Policies – Canada Versus U.S.

Variable	CCC		WAR		WSR	
	I	II	I	II	I	II
CANADA	–50.2419***	–29.3287***	–0.0517***	–0.0392***	–0.0608***	–0.0343***
	(–8.52)	(–10.01)	(–7.39)	(–7.47)	(–6.28)	(–6.80)
STIR	0.8841	1.9141	0.0048	0.0026	0.0005	0.0011
	(0.28)	(1.24)	(1.27)	(1.08)	(0.10)	(0.41)
*STIR * CANADA*	–1.1390	–0.7273	–0.0046***	–0.0064***	–0.0034	–0.0056***
	(–0.75)	(–0.92)	(–2.61)	(–4.62)	(–1.32)	(–4.23)
INTERNATIONAL	–12.1089***	–3.1823*	–0.0007	0.0043	–0.0238***	–0.0057
	(–3.03)	(–1.67)	(–0.13)	(1.00)	(–3.76)	(–1.61)
*INTERNATIONAL * CANADA*	26.6658***	22.0091***	0.0466***	0.0483***	0.0544***	0.0496***
	(3.01)	(3.40)	(4.22)	(5.65)	(4.44)	(5.66)
SIZE	0.8830	–2.0984***	–0.0134***	–0.0160***	–0.0006	–0.0058***
	(0.75)	(–4.46)	(–9.11)	(–14.29)	(–0.32)	(–6.33)
INTANGIBLES	–34.7789***	–15.1064***	–0.2409***	–0.2178***	–0.1197***	–0.0445***
	(–2.66)	(–4.07)	(–18.37)	(–20.36)	(–5.23)	(–4.46)
LEVERAGE	–57.7316***	–20.5534***	–0.0802***	–0.0661***	–0.0694***	–0.0399***
	(–5.59)	(–5.12)	(–6.94)	(–6.44)	(–4.09)	(–4.95)
AGE	–0.1412	0.2963**	0.0010***	0.0010***	–0.0003	0.0008***
	(–0.45)	(2.40)	(2.81)	(3.49)	(–0.62)	(3.32)
R&D	–16.3824	1.4861	–0.0505***	–0.0520***	–0.0317	0.0232
	(–0.95)	(0.11)	(–5.77)	(–4.53)	(–1.08)	(0.73)
Risk – CFV	–2.7457**	–1.6218***	–0.0007	–0.0013	–0.0013	–0.0026***
	(–2.40)	(–2.60)	(–0.76)	(–1.16)	(–0.75)	(–2.69)
FIXED ASSET GROWTH	2.0569	0.9353	–0.0071	–0.0084**	0.0003	0.0078*
	(–2.40)	(–2.60)	(–0.76)	(–1.16)	(–0.75)	(–2.69)

(*Continued*)

TABLE 5. (Continued)

Variable	CCC		WAR		WSR	
	I	II	I	II	I	II
CASH RESERVE	–65.0401***	–37.3080***	–0.3479***	–0.3180***	–0.1584***	–0.1398***
	(–4.62)	(–5.55)	(–23.83)	(–28.58)	(–6.62)	(–11.53)
SALES VOLATILITY	–58.0464***	–41.3820***	–0.0385***	0.0060	–0.1243***	–0.0920***
	(–6.41)	(–14.93)	(–3.23)	(0.71)	(–8.47)	(–11.65)
CF	1.3760	1.7334***	0.0031***	0.0031***	0.0021	0.0030***
	(1.45)	(2.97)	(3.85)	(3.76)	(1.38)	(2.89)
BTM	12.4477***	6.5942***	0.0120***	0.0043**	0.0212***	0.0114***
	(6.35)	(10.48)	(4.63)	(2.43)	(6.03)	(10.32)
SALES GROWTH	–3.4426	–2.9676*	–0.0017	0.0002	0.0058	0.0022
	(–0.48)	(–1.89)	(–0.28)	(0.07)	(0.46)	(0.52)
CONSTANT	194.3455***	220.6769***	0.3533***	0.4803***	0.4947***	0.4639***
	(3.76)	(5.68)	(5.34)	(4.13)	(6.55)	(7.12)
YEAR FIXED EFFECTS	Yes	Yes	Yes	Yes	Yes	Yes
INDUSTRY FIXED EFFECTS	Yes	Yes	Yes	Yes	Yes	Yes
FIRM LEVEL CLUSTERING	Yes	Yes	Yes	Yes	Yes	Yes
Adj./Pseudo R-Squared	0.2540	0.1928	0.4969	0.3409	0.2562	0.2074
N	4477	4477	4477	4477	4477	4477

Note: The regression results are based on matched samples of Canadian and U.S. firms from 1988 to 2016 using PSM based on firm size and industry. The variable definitions are provided in table 1. The dependent variables are the three alternative measures of the working capital management. The estimation uses the pooled sample of Canadian and U.S. firms and includes country dummy CANADA as main explanatory variable, which equals 1 if the observation belongs to the Canadian sample and 0 otherwise. Specifications in Model I use OLS Regressions and specifications in Model II use Quintile/Median Regressions. All specifications control for year and industry fixed effects and firm-level clustering. The results report the coefficients, t-statistics (in parentheses), adjusted (OLS Models) or Pseudo (Median Models) R-Squared, and the number of observations. Note: ***, **, * show statistical significance at 1%, 5%, and 10% levels, respectively.

TABLE 6. Difference in Industry-Adjusted Working Capital Policies – Canada Versus U.S.

	Adj-CCC		Adj-WAR		Adj-WSR	
Variable	I	II	I	II	I	II
CANADA	–20.2759***	–8.1865***	–0.0099*	–0.0063*	–0.0343***	–0.0245***
	(–4.68)	(–3.93)	(–1.96)	(–1.71)	(–4.85)	(–6.00)
SIZE	0.8564	–2.0413***	–0.0132***	–0.0172***	–0.0009	–0.0057***
	(0.74)	(–3.83)	(–9.02)	(–16.50)	(–0.49)	(–5.86)
INTANGIBLES	–30.1710**	–11.3101**	–0.2355***	–0.1997***	–0.1145***	–0.0250***
	(–2.34)	(–2.20)	(–17.70)	(–20.82)	(–5.03)	(–3.01)
LEVERAGE	–51.7746***	–19.7098***	–0.0661***	–0.0589***	–0.0608***	–0.0403***
	(–5.16)	(–4.53)	(–5.79)	(–6.86)	(–3.66)	(–5.64)
AGE	–0.0392	0.4022***	0.0012***	0.0013***	–0.0002	0.0008***
	(–0.13)	(2.93)	(3.25)	(4.83)	(–0.40)	(3.09)
R&D	–7.5043	7.2849	–0.0401***	–0.0451***	–0.0211	0.0227
	(–0.45)	(0.58)	(–4.65)	(–6.09)	(–0.74)	(0.73)
Risk – CFV	–2.4521**	–1.8191***	–0.0004	–0.0015	–0.0009	–0.0026***
	(–2.21)	(–2.98)	(–0.45)	(–1.63)	(–0.54)	(–2.68)
FIXED ASSET GROWTH	2.8963	1.4660	–0.0060	–0.0066**	0.0018	0.0050
	(0.63)	(0.75)	(–1.32)	(–2.44)	(0.23)	(1.11)
CASH RESERVE	–64.2758***	–35.9665***	–0.3448***	–0.3197***	–0.1550***	–0.1327***
	(–4.64)	(–4.95)	(–23.50)	(–31.53)	(–6.55)	(–12.58)
SALES VOLATILITY	–57.7626***	–37.7587***	–0.0409***	0.0032	–0.1260***	–0.0885***
	(–6.53)	(–11.24)	(–3.53)	(0.33)	(–8.67)	(–11.16)
CF	1.3343	1.9109***	0.0030***	0.0032***	0.0020	0.0028***
	(1.43)	(4.12)	(3.77)	(3.85)	(1.33)	(3.27)

(*Continued*)

TABLE 6. (Continued)

Variable	Adj-CCC		Adj-WAR		Adj-WSR	
	I	II	I	II	I	II
BTM	12.8263***	7.1758***	0.0133***	0.0054***	0.0220***	0.0125***
	(6.65)	(12.04)	(5.12)	(3.61)	(6.31)	(10.39)
SALES GROWTH	–2.7561	–0.5562	–0.0006	0.0003	0.0069	0.0042
	(–0.40)	(–0.25)	(–0.10)	(0.08)	(0.55)	(1.21)
STIR	0.9018	0.8247	0.0044	0.0018	–0.0000	0.0033
	(0.29)	(0.59)	(1.16)	(0.64)	(–0.01)	(1.09)
INTERNATIONAL	–6.3032*	1.7238	0.0096**	0.0178***	–0.0122**	0.0018
	(–1.73)	(0.90)	(2.01)	(5.01)	(–2.17)	(0.50)
CONSTANT	9.5152	51.6335	0.1034	0.3052**	0.1026	0.0569*
	(0.19)	(1.47)	(1.55)	(2.22)	(1.38)	(1.69)
YEAR FIXED EFFECTS	Yes	Yes	Yes	Yes	Yes	Yes
INDUSTRY FIXED EFFECTS	Yes	Yes	Yes	Yes	Yes	Yes
FIRM LEVEL CLUSTERING	Yes	Yes	Yes	Yes	Yes	Yes
Adj./Pseudo R-Squared	0.1010	0.047	0.2764	0.173	0.1010	0.061
N	4477	4477	4477	4477	4477	4477

Note: The regression results are based on matched samples of Canadian and U.S. firms from 1988 to 2016 using PSM based on firm size and industry. The variable definitions are provided in table 1. The dependent variables are adjusted values of the three alternative measures of the working capital management. The estimation uses the pooled sample of Canadian and U.S. firms and includes country dummy *CANADA* as main explanatory variable, which equals 1 if the observation belongs to the Canadian sample and 0 otherwise. Specifications in Model I use OLS Regressions with adjusted dependent variables actual minus the mean industry value of the dependent variables) and specifications in Model II use Quintile/Median Regressions with adjusted dependent variables (actual minus the median industry value of the dependent variables). All specifications control for year and industry fixed effects and firm level clustering. The results report the coefficients, t-statistics (in parentheses), adjusted (OLS Models) or Pseudo (Median Models) R-Squared, and the number of observations. Note: ***, **, * show statistical significance at 1%, 5%, and 10% levels, respectively.

VI. Additional results and robustness checks

This section discusses additional tests to ensure the robustness of the findings.[11] First, the current specification assumes that industry effects are similar between Canada and the U.S. This is a plausible assumption given the highly integrated supply chain between the two countries. Nevertheless, to address this concern industry-adjusted values of the dependent variables are used. Specifically, the three working capital measures are adjusted by subtracting mean (median) industry (using 2-digit SIC code) value from the actual value and then running mean (median) regressions. The results reported in table 6 are similar to those in table 4 as there is a negative and significant *CANADA* dummy for mean and median regressions.

Second, since the multivariable specifications in this study include a large number of control variables, it is important to study whether the explanatory variables are robust. Leamer's (1985) extreme bounds analysis (EBA) mitigates this concern with a 95% confidence interval. EBA estimates extreme values of the coefficient of interest using all possible linear combinations regressions. The estimated coefficient of the explanatory variable being tested is robust if it falls within the EBA estimated extreme values (minimum and maximum coefficients) and does not change sign at the extreme values. The analysis shows that extreme bounds for three variables (AGE, GFA and SALES GROWTH) do not exist across all three working capital measures. In addition, four variables (INTANGIBLES, RISK-CFV, R&D and CASH RESERVE) are fragile because analysis does not find extreme bounds for at least one of the working capital measures. The remaining explanatory variables are found to be robust. Consequently, the study re-estimates Specification 1 twice by excluding three and seven fragile variables. The findings are quantitatively and qualitatively very similar to those reported in table 4.

Third, an alternative measure is used for the cash conversion cycle. Consistent with most of the literature, this cycle is calculated using the average of the beginning and ending values of working capital accounts, such as inventory, receivables and payables. In an alternative measure, the cash conversion cycle is computed using only the year-end values of the working capital accounts and repeated for the estimation of Models 1 and 2. The results are very similar to the findings reported in tables 4 and 5.

Fourth, instead of the matched sample with the PSM technique, the

11. The results of these robustness tests, except for the first one, are not reported here but are available upon request.

original raw sample uses 9,602 and 67,820 firm-year observations for Canada and U.S., respectively, and repeats the complete analysis. Again, the results are qualitatively and quantitatively similar to the findings from the matched sample.

Next, an alternative method would be to match the firms using additional firm characteristics. Therefore, the study uses PSM for firm size, leverage and book-to-market to create a matched sample and re-estimate the complete set of results. Similar results are obtained with this alternative matching strategy. Finally, Baños-Caballero, García-Teruel and Martínez-Solano (2010) and Chiou, Cheng and Wu (2006) report a relationship with mixed findings – between working capital investment and firm-level profitability (return on assets). This study adds profitability as a control and re-estimates Models 1 and 2. The results are once again similar.[12]

VII. Conclusion

This appears to be the first study to statistically compare working capital policies of Canadian and U.S. firms using a matched sample over a long time period. The study uses the propensity score matching technique – based on firm size and industry – to find a closest U.S. neighbor for each Canadian firm-year observation to compare working capital investment between the two countries. The findings show that, compared to the U.S. sample, Canadian firms have a substantially lower cash conversion cycle, working capital to asset ratio and non-cash working capital to sales ratio. These differences are not only statistically significant but also economically important. The analysis also confirms that the difference in working capital investment is robust to a number of firm, industry and country controls as well as to year and industry fixed effects. The results are robust to a variety of complementary tests. Finally, the study confirms that lower working capital investment in Canada is affected by higher short-term interest rates and smaller international operations.

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12. Cross-country differences are created in working capital measures (defined as the difference between dependent variable values of U.S. and Canadian firms) and are used as dependent variables in multivariable regressions. Two alternative specifications, one including differences in all explanatory variables and the other just with Canadian data for the explanatory variables, find the results (not reported) generally similar to the main findings.

Appendix. Variable definitions

Variables	
Dependent variables:	Definitions (Compustat is the source of variables shown in "italics".)
CCC	Cash conversion cycle: cash conversion cycle based on average of beginning and ending values and is the sum of days' sales outstanding (DSO) and days inventory outstanding (DIO) minus the days' payable outstanding (DPO) times 365, where: DSO: average receivables (*rect*) divided by the sales (*sale*) DIO: average inventories (*invt*) divided by the cost of goods sold (*cogs*) DPO: average payables (*ap*) divided by the purchases (*Δinvt+cogs*)
WSR	Working capital to sales ratio: non-cash working capital scaled by the total sales (*sales*), where: non-cash working capital is receivables (*rect*) plus inventories (*invt*) minus payables (*ap*).
WAR	Working capital to assets ratio: non-cash working capital scaled by the total assets (*at*)
Working capital accounts:	
CASH	Cash: cash and marketable securities divided by total assets (*che*/*at*)
INV	Inventories: inventory to total assets ratio (*ivnt*/*at*)
A/R	Receivables: accounts receivable to total assets ratio (*rect*/*at*)
A/P	Payables: accounts payable to total assets ratio (*ap*/*at*)
Main Independent Variable:	
CANADA	Country dummy for Canada: indicator variable for Canada, which equals 1 if the firm-year observation belongs to a Canadian firm and 0 if the firm-year observation belongs to a U.S. firm.

(*Continued*)

Appendix. (Continued)

Variables	
Controls:	Definitions (Compustat is the source of variables shown in "italics".)
SIZE	Firm size: natural log of book value of the total assets ln (*at*)
INTANGIBLES	Intangible assets: intangible assets divided by the total assets (*intan*/*at*)
LEVERAGE	Book leverage: long term debt plus debt in current liabilities divided by total assets ((*dlttq*+*dlcq*)/*atq*))
AGE	Firm age: number of year since initial public offering on June 1, 2017 (*ipodate*)
R&D	Research and development: research and development expenditure to sales ratio (*xrd*/*sale*) (set to 0 if *xrd* is missing)
Risk – CFV	Cash flow volatility: coefficient of variation in cash flow from operations during last 10 years, where: Cash flow is: income before extraordinary items plus depreciation scaled by net property, plant and equipment ((*ib*+*dp*)/*ppent*)
GROWTH in FIXED ASSET (GFA)	Fixed asset growth: change in the net property, plant and equipment over the previous fiscal year ($(ppent_{t-1}-ppent_{t-2})/ppent_{t-2}$)
CASH RESERVE	Cash reserve: ratio of cash and short-term investment to total assets (*che*/*at*)
SALES VOLATILITY	Sales volatility: coefficient of variation in annual sales to total asset ratio over the past 10 years
CF	Cash flows: the sum of income before extraordinary items and depreciation scaled by the net property, plant, and equipment ((*ib*+*dp*)/*ppent*)
BTM	Book-to-market: total common equity scaled by market capitalization (*ceq*/(*prcc_f* **csho*)), where: *prcc_f* is fiscal year-end stock price and *csho* is common shares outstanding
SALES GROWTH	Sales growth: change in sales over the previous fiscal year ($(sale_t-sale_{t-1})/ sale_{t-1}$)
STIR	Short-term interest rates: annual percentage interest rates based on 3-month Treasury bill rate
INTERNATIONAL	International dummy: indicator variable that equals 1 if firm reports a positive pre-tax foreign income and 0 otherwise (if *pifo*>0)

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