PRICING OF FOREIGN EXCHANGE RATE EXPOSURE IN CANADIAN COMPANIES

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Abstract

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The failure of most previous research to support the widely held view of the pricing of foreign exchange rate exposure can be attributed to inadequate model specification. In this thesis, we adopt both the constant and time-varying model to gauge the extent of the foreign exchange rate pricing among Canadian multinationals.

By using monthly stock returns for the 1996 – 2002 period, we find that Canadian mining firms benefit when the Canadian dollar appreciates against the U.S. dollar. This is contrary to the widely accepted theory that major exporting firms should benefit from the depreciating domestic currency. In addition, we do not find sufficient evidence that mispricing contributes to failures in previous empirical research to find a significant relationship between firm value and exchange rate movements.

Based on the time-varying model, we find that firms with larger proportions of foreign sales relative to total sales are more vulnerable to changes in the bilateral exchange rate while firms with larger foreign production are more negatively affected when the Canadian dollar depreciates. The use of a cross-listing dummy variable indicates that U.S. investors are willing to pay more for Canadian stocks given the positive benefits expected from a depreciating Canadian dollar.

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1. INTRODUCTION

A widely held view is that exchange rate changes should affect firm value. Since the advent of the flexible exchange rate system, multinationals are concerned with the impact of foreign exchange rate risk on their operations, financial performance and standing, and share value. Many firms devote substantial resources to the management of their exposure to foreign exchange rate risk.

According to Adler and Dumas (1984), the concept of foreign exchange risk exposure is arbitrary in the sense that stock prices and exchange rates are determined jointly. Decomposing the value of the firm into a component perfectly correlated with the exchange rate and an orthogonal component does not imply that a causal relationship exists between exchange rates and stock prices. This is a statistical decomposition comparable to others used to study the relationship between the value of an asset and inflation rates, interest rates, and market movements. The degree of association between endogenous variables such as stock prices and exchange rates depends on the nature of the shocks affecting the economy. Hence, foreign exchange rate risk exposure may merely reveal the simultaneous impact of monetary factors on exchange rates and stock prices.

The literature includes many tests of whether or not exchange rate changes are a key factor affecting firm value. Studies by Jorion (1990), Bodnar and Gentry (1993), Amihud (1992), among others, fail to find any significant relation between exchange rate changes and the value of U.S. multinationals. Several explanations are proposed for this

failure to find a significant relationship between the exchange rate exposure and the value of a firm.

First, recent studies find that exchange rate exposure can be time varying. As a result, the unconditional model generally used to separate exchange rate exposure from other risk factors often leads to the misleading conclusion that firm value is insensitive to exchange rate movements. Booth and Rotenberg (1990) examine the economic exposure of exchange rate changes on Canadian forest companies by incorporating time-varying variables such as the proportion of foreign to total sales. Levi (1992) attributes difficulties in empirically estimating exposure to time-varying factors, which in combination determine the sensitivity of firm value to exchange rate changes. Gao (2000) adopts a time-varying model by accounting for information about the foreign sales and foreign production of firms.

Second, the failure to identify any significant contemporaneous relationship between firm value and exchange rate exposure may result from mispricing due to systematic errors by investors in the estimation of the relation between fluctuations in exchange rates and firm value. Such mispricing implies that investors are slow to interpret information regarding the effects of exchange rate movements on firm value. Using a simple trading strategy that consists of selling short the set of firms presently in the sample with an appreciation of the dollar in the previous quarter and buying long the set of firms with the depreciation of the dollar in the previous quarter, Bartov and Bodnar (1994) report significant abnormal returns. Amihud (1992) finds similar results where the strongest effect on the value of exporting companies comes from exchange rate changes that are lagged up to two quarters.

Third, exchange rate fluctuations may affect firm value through different and potentially offsetting channels. Allayannis (1997) points out that aggregating sample firms into the same 2-digit SIC code can mask any significant exchange rate exposure, which may exist at the 4-digit SIC level. Therefore, the failure of empirical studies to document a strong relation between firm value and exchange rate movements may be explained by the offsetting effects of firms engaging in activities that have the opposite signs to exchange rate fluctuations. Hence, testing sample firms at different industry levels should provide concrete evidence whether or not failures of previous empirical work to find a significant link between firm value and exchange rate movements is due to a sample selection bias. Moreover, an insignificant link between these two variables may be a product of successful corporate hedging activities. Since details of corporate hedging activities are generally not available, it is assumed herein that the effects of corporate hedging activities are fully reflected in publicly available corporate information.

Thus, this study addresses each of the above three issues in order to determine whether foreign exchange rate exposure is priced in the stock returns of multinationals, which in turn, would justify the engagement of management in hedging activities. The association between foreign exchange rate exposure and monthly stock returns is examined in the first part of the thesis by adopting the conventional two-factor model in which the return on the market portfolio and unanticipated movements in contemporaneous exchange rates are included as control variables. The analysis is conducted using the bilateral exchange rate between Canada and the U.S. The use of the bilateral exchange rate can be easily justified considering the fact that more than 85% of Canada's trade flow is destined to the United States. Hence, it is reasonable to assume

that Canadian firms potentially have relatively larger foreign exchange rate exposure to the fluctuations between the Canadian dollar and the U.S. dollar. We also include the C-6 exchange rate, which is trade-weighted against Canada's major trading partners in an effort to provide a test of the robustness of our findings.

To address the possibility that mispricing contributes to the unsuccessful attempts of previous empirical research to find a significant contemporaneous relationship between firm value and exchange rate exposure, the conventional two-factor regression analysis is extended to a multi-factor equation with the addition of lagged exchange rate fluctuations of 3-, 6-, 9- and 12-month. This is designed to test if investors are slow to correctly respond to the macroeconomic event (i.e., a change in the exchange rate).

The regression analyses are conducted at the 2-, 3- and 4-digit SIC levels to determine whether the aggregations of individual firms based on the SIC code mask otherwise significant associations between firm value and exchange rate exposure. Previous studies claim that grouping multinationals with different channels of foreign exchange rate exposure could have offsetting effects on firm value, which in turn could lead to insignificant test results.

The determinants of currency exposure for a set of Canadian manufacturers that are involved in foreign operations also are examined. Exchange rate exposure is decomposed into a foreign to total sales variable and a foreign to total assets variable based on the assumption that exchange rate exposure is a linear function of these two variables. Theory predicts that firms with large foreign sales (assets) should benefit (suffer) more from a depreciating domestic currency.

The major contribution of this thesis to the literature is the finding that the foreign exchange rate exposure is time varying rather than constant. By locating the close link between the firm's exchange rate sensitivity exposure and its time-varying variables that reflect changes in foreign operation activities of firms, one can conclude that failures in previous empirical research to find any significant exchange rate exposure among firms, which are not purely domestic (firms engaged in exporting and importing activities) is due to the assumption that the foreign exchange rate exposure is constant. By testing the time-varying exposure model over a longer (seven year) period, we increase the credibility of our results. In contrast, the study by Booth and Rotenberg (1990), only covered one year as the test period. Other contributions of this thesis include the testing of several sources of failures in previous empirical research on this topic so that more confidence can be placed on the inference that past empirical research failures were due to the use of constant and not time-varying exposures to exchange rate exposures among multinationals.

The remainder of this thesis is organized as follows: Section 2 reviews the previous empirical research on the relation between firm value and exchange rate exposure. In section 3, the sample and data are described. In section 4, the test methodology is presented. Section 5 states the hypotheses to be tested and the a priori expectations. Section 6 presents and analyzes the regression results. Section 7 concludes the thesis.

2. REVIEW OF THE LITERATURE

The theory of market efficiency states that unanticipated events in the economy are instantaneously reflected in security prices. Firms are either directly or indirectly

affected by previously unanticipated movements in exchange rates through various channels of exposure. According to Adler and Dumas (1984), firms whose entire operations are domestic in nature may be affected by exchange rates if currency movements affect their input prices, output prices or demand for their products. Using a partial equilibrium model, Shapiro (1975) examines the impact on the value of multinationals caused by an exchange rate or inflation shock. His findings are consistent with the widely held view that a depreciation of the domestic currency is beneficial for the profitability of the exporting firm. Heckerman (1972) uses the present discounted value (PDV) technique to gauge potential capital gains and losses for foreign exchange movements. These values are substantially different from those measured using traditional accounting techniques. Hodder (1982) proposes an approach to measure a firm's exposure, which depends on the stochastic relationship between the firm's real rate of return and exchange rate movements. Using a simplified two-country model, exposure depends on the extent to which individual asset prices adjust to exchange rate movements, the distribution of such adjustments between countries, and the relationship between domestic inflation and exchange rate movements.

Ceglowski (1989) examines the effects of real exchange and interest rates on domestic sales, exports, and imports for 19 manufacturing industries and selected non-merchandise sectors in the United States. The study includes a simulation of an exogenous dollar depreciation to infer net industry effects of a non-policy induced drop in the value of the U.S. dollar. The results find that the direct impact of the depreciating dollar are concentrated in net exports with only limited effects on home sales, and the indirect impact of the depreciation affect domestic sales, and net trade in both the

merchandise and non-merchandise sectors through the domestic interest rate, and foreign and domestic income and prices.

Based on an examination of the monthly stock returns of 287 sample U.S. multinational companies, Jorion (1990) finds no statistically significant relationship between firm value and exchange rate fluctuations using 20 value-weighted industry portfolios based on 2-digit SIC codes. However, he does find significant cross-sectional differences in firm exposures to currency fluctuations. Firms with the largest amount of foreign sales have the largest exposure coefficients. Jorion (1991) finds no evidence that investors price exchange rate risk, and consequently he finds no support for the contention that corporate hedging activities are in the interests of stockholders. Similarly, Amihud (1992) finds no significant contemporaneous relationship between the value of an equal-weighted portfolio of 32 leading U.S. exporters and exchange rate exposure.

Some studies provide reasons for this limited success in support of a relation between firm value and exchange rate fluctuations. Bartov and Bodnar (1994) attribute the limited success to the existence of mispricing where investors make systematic errors about the price of securities. Amihud (1992) argues that, although changes in exchange rates affect the cash flows of companies and are reported to investors with a lag, their anticipated impact can be promptly incorporated in stock prices. Cumby (1994) reports that Amihud's finding of a lagged relationship is not sufficient evidence to challenge the efficient market hypothesis (EMH) or the rational expectation hypothesis due to a lack of data about the imported inputs and hedging activities of the sample firms.

Other studies focus on possible research design problems as hindrances to identifying a significant relationship between firm value and exchange rate movements.

Bartov and Bodnar (1994) criticize the sample selection procedures used in previous studies. They argue that, since many large exporters are simultaneously significant importers, this could mitigate the otherwise significant association between firm value and exchange rate exposure. To have firms with significant and uniform exchange rate exposure in the sample, Bartov and Bodnar select firms with reportedly significant foreign currency gains or losses in their financial statements that are negatively related to the corresponding changes in the value of the U.S. dollar. According to Allayannis (1997), otherwise significant exchange rate exposure often is masked by aggregating firms into more general industry categories.

Cumby (1994) argues that equity prices and exchange rates are jointly endogenous variables. Hence, shocks of different origin can have very different effects on exchange rates and the rest of the economy. For example, currency appreciation due to a demand shock (such as an investment or export boom) might affect equity values differently than an appreciation due to a monetary contraction. Therefore, the assumption that exchange rate movement is an exogenous variable to a single firm in the economy for the convenience of empirical tests may hinder the identification of a significant relation between firm value and exchange rate fluctuations.

Shapiro (1975) shows that economic exposure to exchange rate changes is very complex so that it is somewhat misleading to judge the extent of exchange rate exposure from evaluating a firm's financial statements. Booth and Rotenberg (1990) use a sample of 156 Canadian companies in the forest industry to isolate the time-varying characteristics of exchange rate exposure. Booth and Rotenberg (1990) find 50 (67) percent of the sample firms have regression coefficients that are significant at the one

(five) percent level. Contrary to prior beliefs, 97.5 percent of the sample firms had negative regression coefficients, which suggest that a devaluation of the Canadian dollar generally adversely affected the firms in the sample. The study finds that exchange rate sensitivity is more pronounced for large firms that are cross-listed on American exchanges, and that larger Canadian firms suffer negative value effects from a depreciation of the Canadian dollar because of shrinking U.S. shareholder interest. A depreciation of the Canadian dollar reduces the U.S. dollar value of Canadian holdings.

Allayannis (1997) shows that the lack of significant evidence of an exchange rate exposure effect is due to the assumption that exchange rate exposure is constant over time. By examining U.S. manufacturers at the 4-digit SIC level, Allayannis (1997) finds strong evidence that the industry exchange rate exposure varies over time in a systematic way with the share of imports and exports in the industry. Gao (2000) adds time-varying variables, such as foreign sales and foreign production, into the estimated relationship. The findings of the Gao study are consistent with those of Allaynnis (1997) in that exchange rate exposure is time varying rather than constant so that incorporating control variables, which vary over time, can result in the detection of a significant relationship between exchange rate fluctuations and firm values. Gao (2000) finds that a depreciation shock to the U.S. dollar has significant positive effects on the abnormal returns of the stocks of multinationals through foreign sales and significant negative returns through foreign production.

With regard to non-U.S. sample firms, He and Ng (1998) examine 171 Japanese multinationals over the period from 1979 to 1993. They find that the extent to which a firm is exposed to exchange rate fluctuations can be explained by the level of its export

ratio and by variables that proxy the hedging needs of the firm. They find that firms with high leverage levels or firms with low liquidity tend to exhibit smaller exposures, and that exchange rate exposures increase with firm size. Doukas, Hall and Lang (1999) use an inter-temporal asset pricing test procedure, which allows risk premia to change over time in response to changes in macroeconomic conditions. Their study finds that the foreign exchange rate risk premium is a significant component of the returns for Japanese stocks. While currency risk exposure has a significant risk premium for multinationals and high exporting companies, its importance is diminished for domestic and low exporting Japanese companies.

Roll (1992) finds that real exchange rates explain a significant portion of common currency denominated national index returns by using daily returns on 24 Financial Times international equity price indexes from 1988 to 1991. He attributes the impact of exchange rates on stock returns to labor productivity shocks, which change the real relative price between domestic and foreign goods. Bodnar and Gentry (1993) examine industry-level exchange rate exposures for Canada, Japan and the USA. By specifying exchange rate exposure as a function of industry characteristics, the study finds that non-traded goods industries gain from an appreciation of the home currency for Canadian and Japanese firms but not for U.S. firms.

Donnelly and Sheehy (1996) find a contemporaneous relation between the market value of 39 of the major exporting companies in the U.K. and the foreign exchange rate. Weak evidence of lagged relationship between these two variables implies that the stock market takes time to incorporate all of the information impounded in foreign currency movements into share prices.

Khoo (1994) concludes that contrary to the traditional belief, the sensitivity of stock returns to exchange rate fluctuations, as well as the proportion of stock returns explained by exchange rate movements, are small for a sample of Australian mining companies. His test uses specific foreign currencies, where the currency selected is for the foreign country that is a large buyer or seller in the market for the good. This ensures that the exchange rate movement effect captures any relevant demand and supply shifts.

Unlike other studies where relatively short-term stock returns are used to proxy for the changes in the market value of the firm, Chow, Lee and Solt (1997) examine exchange rate exposures of U.S. stocks and bonds over 1- to 48-month horizons. The underlying rationale for this test methodology is that if exchange rate changes convey information regarding future interest rates and cash flows over more than one period, the use of short-term asset returns for evaluating exchange rate exposures is misleading. These authors find that a significant positive correlation exists between asset returns and exchange rate exposures for horizons exceeding six months. In addition, exposures differ for bonds compared to stocks in that bonds are responsive to both short- and long-run changes in real exchange rates while stocks are responsive only to long-run changes in real exchange rates.

3. SAMPLE AND DESCRIPTION OF THE DATA

3.1 The sample companies

The sample consists of Canadian companies that are categorized as mining and manufacturing under the SIC codes from 10 11 to 14 99 for mining and 20 11 through 39 99 for manufacturing. The CanCorp, Company Profile Canada and SEDAR databases are

used for this purpose. The sample period is restricted to the period from January 1996 to December 2002 to conform to the time period for which individual company annual reports are available from the SEDAR online database. Distribution statistics for the sample companies are presented in Table 2.

The mining companies are included in the sample because the conventional belief is that their profitability is especially sensitive to exchange rate fluctuations. In addition, mining companies cannot effect real changes in their operations to mitigate such effects, such as producing a different product mix or moving plants to foreign countries. In contrast, manufacturing companies have relatively more flexibility in undertaking strategic changes in the management of their operations to reduce exchange rate risk exposure. For example, a manufacturing firm can significantly alter the cost structure of its operation by opening a new factory in a country where labor costs are lower. In turn, such flexibility influences the sensitivity of a firm's value to exchange rate movements and will cause such sensitivity to be time varying. Some, or all of these differences, may also be mitigated (enhanced) by relatively greater (lower) use of derivative products for exchange rate risk management by mining versus industrial companies.

The final sample consists of 91 mining and 117 manufacturing companies, which have no missing monthly stock return data from the CFMRC database over the test period from January 1996 to December 2002. Almost 50 percent of the sample mining companies are in the Gold ores industry (SIC 1041). The fortunes of gold exploration companies depend on successful exploration. While the price of gold is denominated in US dollars, South Africa accounts for the greatest portion of all production in non-communist countries. About one fifth of the sample mining firms also operate in the

crude petroleum and natural gas industry. While Canada is one of the largest exporters of liquefied petroleum gas (LPG), Japan, the European community and the USA are the largest importers of both petroleum and LPG.

The use of commodity forward contracts to protect future output prices is common among our sample mining companies. Furthermore, mining companies with foreign exploration properties often have foreign currency hedging programs to limit the potential losses arising from any revenue/expense mismatches. Hence, any finding of an insignificant association between the stock returns of mining companies and their exchange rate exposures may be attributable to successful hedging programs adopted by their managements (Khoo 1994).

Unlike the sample of mining companies, which are concentrated in gold and crude petroleum and natural gas, firms in the manufacturing industry represent more than fifty 3-digit standard industrial classifications. Industries that represent about 10% of the sample include the Lumber and Wood products industry and the Electrical and Electronic Machinery, Equipment and Supplies industry.

Based on the CanCorp Financial database, more than 90 percent of our sample of Canadian manufacturers has substantial exports and only a few of the sample manufacturers are substantial importers. Some companies disclose that more than 90 percent of their exports go to the United States.

Firm level data on foreign and total sales and assets are obtained from the SEDAR online and the Disclosure/Worldscope databases for 68 firms. The advantage of using the annual reports from SEDAR online is the availability of extensive firm level information,

which is often missing from other data sources. The average annual percentage of foreign-to-total sales and production for this sample of 68 firms is reported in table 3.

The unique characteristics of the Canadian economy can be summarized as relatively small and more trade-intensive than the US, which suggests that exchange rate exposure should be of greater significance to participants of the economy. As a result, this allows our examination of the effects of foreign exchange rate exposure on firm value for our sample to serve as a more robust test than previous tests that were conducted using U.S. companies. In turn, this should increase the probability of finding a relationship between firm value and exchange rate risk exposure for a Canadian sample of firms.

3.2 The exchange rate data

We use the bilateral exchange rate between Canadian and U.S. dollars as the primary exchange rate in our tests. The bilateral exchange rate is obtained from the Statistics Canada E-STAT online database. In addition to the bilateral exchange rate, the C-6 exchange rate is used to provide a test of robustness of our findings.

The behavior of the bilateral exchange rate over the sample period from 1996 through 2002 is depicted in figure 1. During this period, the Canadian dollar traded in a wide range from US 0.63 to US 0.76. Several reasons are advanced for the poor performance of the Canadian versus the U.S. dollar for the first half of this sample period. First, lower commodity prices, which began to soften during the summer of 1997 and subsequently weakened significantly as the financial and economic crisis in emerging markets widened and intensified, contributed to the weakening of the Canadian dollar. Second, interest rate reductions by the Federal Reserve Bank and the return of modicum

stability in financial markets permitted the Bank of Canada to reduce Canadian interest rates without undermining confidence in the Canadian dollar. The downward trend of the Canadian dollar continued until early 2002 at which point the Canadian dollar reached a low of 63 cents US. Due to mounting concerns about the weakness of the Canadian dollar, the Bank of Canada attempted to stabilize the Canadian dollar. The Canadian dollar recovered temporarily, reached a high of 66 cents US during 2002, and then fell to approximately 63 cents US until the beginning of 2003.

The C-6 exchange rate is an index of the weighted-average foreign exchange value of the Canadian dollar against major foreign currencies. Weights for each country are derived from Canadian merchandise trade flows with other countries over the three years from 1994 through 1996. The index has a 1992 base (i.e., C-6 = 100 in 1992). The C-6 index broadens the coverage of the old G-10 index to include all the countries in the EMU. It is important to note that an increase in the C-6 exchange rate signifies an appreciating Canadian dollar, which is the opposite to our measure of the bilateral exchange rate that is expressed as the Canadian dollar equivalent of foreign currencies.

The formula for the computation of the C-6 exchange rate is:

$$C6 = 100*(1/((USA^{0.8584})*(Japan^{0.0527})*(UK^{0.0217})*(Sweden^{0.0035})*(Switzerland^{0.0043})*(EMU^{0.0594})))/1.046294$$

where currencies are \$CDN/\$Foreign Currency (prior to 1999 currencies from the individual EMU countries are used).[1]

3.3 Macro-economic variables

The macro-variables used in this thesis are obtained from Statistics Canada's E-STAT online database and CFMRC database. These include Consumer Price Index series

[1] The weight of each country is given by its exponent.

v36397, return on long-term government bonds and return on corporate bonds. The 3-month Treasury bill rate is used as the risk-free rate. For the return on the market portfolio, the value-weighted index from the CFMRC database is used. These market indexes are based on the monthly returns for all domestic common equities listed on the TSE and included in the CFMRC database.

4. TEST METHODOLOGY

4.1. The constant exposure model

Regressing the stock returns of the firm against either the total or the unexpected portion of changes in the exchange rate empirically tests the exposure of firm value to exchange rate fluctuations. In the international business and finance literatures, many models have been proposed to test this relationship.[2] The basic two-factor estimation equation is given by:

$$r_{it} = \alpha_i + \beta_i r_{mt} + \gamma_i \Delta e_t + \varepsilon_{it} \qquad (1)$$

where r_{it} is the return for firm i over period t, r_{mt} is the return on the market portfolio m over period *t-1* to *t*, and Δe_t is the change in the logarithm of the exchange rate from period *t-1* to *t*. This differs from Booth and Rotenberg (1990) who use a single factor model that only accounts for exchange rate changes. Since the coefficients of the exchange rate exposures estimated in both the single and two-factor models are highly correlated (Jorion 1990), the subsequent analysis focuses on results that are also market adjusted.

[2] These studies include Jorion (1990), Jorion (1991), Booth and Rotenberg (1990), and Donnelly and Sheehy (1996).

Since some unobservable nominal or real aggregate shocks may affect both the stock market return and the exchange rate, the endogeneity of exchange rate news may cause bias and inconsistency in the estimates for equation (1). To illustrate potential problems related to endogeneity, suppose that there is a shock in ε_{it}, which affects both the firm's excess return $r_{it} - r_{mt}$ and the exchange rate e_{st}. If this shock is not controlled for in the construction of the exchange rate news variable then Δe_t will be correlated with ε_{it}. In turn, the estimate of γ_i from equation (1) will be biased and inconsistent.

Other studies, such as Bodnar and Gentry (1993) and Gao (2000), use the excess return version of this two-factor model and the unanticipated portion of the change in exchange rates to test the sensitivity of the value of a firm to exchange rate exposure. This version of the two-factor model is given by:

$$r_{it} - r_{ft} = \alpha_i + \beta_i (r_{mt} - r_{ft}) + \gamma_i \Delta e_{st}^U + \varepsilon_{it} \qquad (2)$$

where r_f is the three-month Treasury bill rate, Δe_{st}^U is the unanticipated news contained in the exchange rate change from period t to period t-1, and all the other terms are as defined earlier.

Two time-series models are used to control for the macroeconomic effects resulting from the exchange rate news in order to obtain unbiased estimates for the unanticipated news contained in exchange rate changes. The time-series models are similar to the model used by Jorion (1991). The resulting measures of Δe_t^U used herein are described below.

4.2 Single- and multi-factor models to obtain the unanticipated portion of exchange rate changes

The first (single-factor) model used to estimate the unanticipated portion of exchange rate changes is given by:

$$\Delta e_{st}^{U} = \Delta e_{st} - (\hat{\alpha}_m - \hat{\beta}_m r_{mt}) \qquad (3)$$

where Δe_{st} is the change in the logarithm of the exchange rate s over the period t-1 to t, and $\hat{\alpha}_m$ and $\hat{\beta}_m$ are obtained from the regression of Δe_{st} against r_{mt}. By conditioning the changes in the exchange rate on the rate of return on the market portfolio, Δe_{st}^{U} captures the unanticipated portion of the changes in the exchange rate. This unanticipated portion is assumed to be free of the effects of the macroeconomic events that also affect market returns. Also, since Δe_{st}^{U} has zero mean by construction, it is a pure innovation.

The regression results for the first measure of unanticipated exchange rate changes, which are based on equation (3), are summarized in Table 4. The regression results in Table 4 indicate that the value-weighted market index is negatively related to the appreciating Canadian dollar based on the bilateral exchange rate. We obtain similar results when the C-6 exchange rate is used instead of the bilateral exchange rate. These findings are statistically supported with significant t-statistics.

One disadvantage of this model (3) is that the exchange rate may proxy for other omitted macro-economic factors, such as inflation risk. Empirical evidence that finds that exchange rate exposure is priced could be interpreted as evidence for this omitted factor possibility. Therefore, an alternative formulation of the unanticipated portion of exchange rate changes is to include additional macroeconomic factors that are believed to influence the overall economy. For this purpose, we begin with the factors used by Chen, Roll, and Ross (1986), Kryzanowski and Zhang (1992) and Koutoulas and Kryzanowski (1996).

The second (multi-factor) model used to estimate the unanticipated portion of exchange rate changes is given by:

$$\Delta e_{st}^{U} = \Delta e_{st} - \left(\hat{\alpha}_m + \sum_{j=1}^{4} \hat{\beta}_j F_{jt}\right) \qquad (4)$$

where F_{jt} are changes in macrofactor j over the period t-1 to t, and all the other terms are as defined below. Thus, this measure of the unanticipated portion of exchange rate changes is taken as the residual of a projection equation of exchange rate change on the five macrovariables. The four macrovariables are: r_{mt} as proxied by the value-weighted stock market return as provided in the CFMRC database; DEI or the change in expected inflation, which is obtained as the difference between the monthly CPI series; DP or the default premium which is computed as the difference between returns on corporate bonds and government bonds; TP or the term premium, which is computed as the difference between the returns on long-term government bonds and T-bills.

The regression results for the second measure of unanticipated exchange rate changes, which are based on equation (4), are summarized in Table 5. Similar to the findings obtained using equation (3), the multi-factor regression analysis indicates a negative association between the value-weighted market index and changes in the bilateral exchange rate. In turn, this implies that one would expect negative (positive) returns on the market index when the Canadian dollar depreciates (appreciates). Based on the Pearson correlation values (Table 6), we note that changes in the consumer price index as well as the term premium are negatively correlated with changes in the bilateral exchange rate. Furthermore, both the changes in monthly consumer price index and the default premium are negatively correlated to the value-weighted market index. When the

C-6 exchange rate replaces the bilateral exchange rate, we still find that positive (negative) market index returns are related to the appreciation (depreciation) of Canadian dollars. The Pearson correlation values indicate that, when the Canadian dollar appreciates against currencies of its major trading partners, the default premium in Canada decreases.

The correlation coefficient between the two measures of the unanticipated portion of the changes in exchange rates is 0.99. This implies that the use of the single factor (the market return), as in equation (3), provides a parsimonious method of obtaining the unanticipated portion of changes in exchange rates. Hence, we use the results obtained from equation (3) in the further analysis as the estimate of unanticipated changes in the exchange rate.

5. HYPOTHESES

5.1 First hypothesis

The first tested hypothesis, H_0^1, is that the (excess) return of a firm is not related to the firm's foreign exchange rate exposure.

To test the first hypothesis, equation (2) is estimated for each firm in the mining and manufacturing firm samples using OLS for both measures of unanticipated changes in exchange rates for both types of exchange rate measures. If the estimated coefficient γ_i in equation (2) is nonzero and significant, this provides evidence that exchange rate exposure is priced. In turn, this implies that the market proxy is not mean-variance efficient. If this is the case, then our expectation is that the γ_i estimate will be positive for major exporting companies, since these companies are expected to benefit from

depreciation in the Canadian dollar. We also conduct a cross-sectional regression analysis to obtain a broader scope of support.

5.2 Second hypothesis

The second tested hypothesis, H_0^2, is that the relationship between the (excess) return of a firm and the firm's foreign exchange rate exposure is masked when firms are examined at too fine of an industry level classification.

Estimating equation (2) using a value-weighted portfolio of the firms in each industry sample tests the second hypothesis. This tests whether the aggregation of firms into industries masks a significant relationship between firm value and exchange rate changes. The results obtained at the individual firm level are then compared to those obtained at the 2-, 3-, and 4-digit industry levels.

5.3 Third hypothesis

The third tested hypothesis, H_0^3, is that any relationship between the (excess) returns of a firm and the foreign exchange rate exposure of that firm is delayed (i.e., not contemporaneous).

The motivation for the third hypothesis is the argument of Bartov and Bodnar (1992) that mispricing is a plausible explanation for the lack of any significant contemporaneous association between changes in firm value and changes in the exchange rate, and of Allaynnis (1997) that a time lag exists from the time exchange rates change and their true effects are known. To test the third hypothesis, lags of 3-, 6-, 9- and 12-months (j = 3, 6, 9, 12 months) in the unanticipated change in exchange rate variable are added to equation (2) to get:

$$r_{it} - r_{ft} = \alpha_i + \beta_i(r_{mt} - r_{ft}) + \sum_j \gamma_{ij}\Delta e^U_{t-j} + \varepsilon_{it}\text{, j = 0, 3, 6, 9 and 12,} \qquad (5)$$

where all the terms are as defined previously.

If any of the estimated coefficients γ_i in equation (5) are nonzero and significant, this provides evidence that exchange rate exposure is priced but with a lag. In turn, this implies that the market proxy is not mean-variance efficient. If this is the case, then our expectation is that an investor can potentially adopt a trading strategy, which can earn an abnormal return.

5.4 Fourth hypothesis

The fourth tested hypothesis, H_0^4, is that the relationship between the (excess) return of a firm and the foreign exchange rate exposure of that firm is masked when the foreign exchange rate exposure of a firm is time-varying.

As noted earlier, any insignificant relation between changes in firm value and the firm's foreign exchange rate exposure may be caused by time–variability in the latter variable (Levi, 1992). Hence, it is important to capture this time-variation in exposures since it may increase our ability to detect the value impact of foreign exchange rate exposure in our tests. To examine this possibility, foreign-to-total sales and production are used herein (as in Gao, 2000) to proxy the time variability of a firm's foreign exchange rate exposure. The use of these two variables can be justified in the sense that the major source of the time variation in the foreign exchange rate exposure comes from changes in real operations over time through exports, imports, and foreign production.

5.5 Fifth hypothesis

The fifth tested hypothesis, H_0^5, is that the cross-listing status of Canadian firms in the U.S. stock market affects stock prices when the value of the Canadian dollar changes against the U.S. dollar.

The fourth and fifth hypothesis are tested by regressing the values of foreign to total sales, production and a dummy variable, which is equal to 1 if the stock is cross-listed in the U.S. stock market, against the estimated sensitivity to foreign exchange rate fluctuations γ_i in equation (2). By adding a dummy variable to our tests, we attempt to capture the clientele effect that was first reported by Booth and Johnston (1984). The estimation specification is given by:

$$\hat{\gamma}_i = \alpha_i + \eta_{it} FS_{it} + \kappa_{it} FP_{it} + \delta_{it} dummy_i + \varepsilon_{it} \qquad (6)$$

In (6), FS_{it} is the percentage of foreign to total sales for firm i in year t, and FP_{it} is the percentage of foreign to total production for firm i in year t. Due to data availability, we use foreign to total assets as a measure to gauge the level of foreign production. If any of the estimated coefficients η_{it} *and* κ_{it} in equation (6) are nonzero and significant, this provides evidence that the exchange rate exposure is time-varying and sales and production allocations of multinationals are the two main factors underlying exchange rate exposure. More specifically, we would expect that firms with larger proportions of foreign to total sales would be more sensitive to foreign exchange rate changes and would benefit from the depreciating Canadian dollar (more positive coefficients), while those with larger proportions of foreign to total production would have more negative exchange rate effects (more negative coefficients). To test whether or not cross-listed firms have more pronounced sensitivity to exchange rate exposure than firms that are not cross-listed, a dummy variable is added. This dummy variable equals 1 if the firm is cross-listed in the US stock market and is equal to 0 otherwise. As Booth and Rotenberg (1990) point out, a large U.S. clientele effect would exist if investing in Canadian firms becomes

unattractive due to the depreciation in Canadian dollars. If correctly captured, this U.S. clientele effect is most consistent with a more negative dummy coefficient.

6. EMPIRICAL FINDINGS

6.1 Contemporaneous exposure to bilateral exchange rates

6.1.1 Canadian mining companies

Time-series regression analysis for the 91 mining companies reveals that there is ample empirical evidence that the (excess) return of a firm is related to the firm's foreign exchange exposure. As reported in Table 7, the results of the cross-sectional regression analysis find a significant negative bilateral exchange rate exposure among Canadian mining companies. The reported regression coefficient of the bilateral exchange rate exposure is a significant -2.58. This result implies that, on average, a 1% depreciation of the Canadian dollar against the U. S. dollar causes the monthly stock return of Canadian miners to decrease by 2.58%. The regression coefficients for 18 of the 91 sample miners (19.78%) are statistically significant at the 5% confidence level when the value-weighted market index is used. All of the coefficients are negative, which implies that the depreciating (appreciating) Canadian dollar lowers (increases) the returns of these firms. This finding is consistent with the results obtained by Booth and Rotenberg (1990) that used the bilateral exchange rate to test the significance of foreign exchange rate exposure. In their equal-weighted portfolio regression, Booth and Rotenberg find that a one percent depreciation of the Canadian dollar on average was associated with a 2.29 percent fall in value for their sample of 156 Canadian firms when the exchange rate entering the regression was expressed as Canadian cents per US dollar. Booth and Rotenberg (1990)

argue that it is common practice for Canadian companies to issue U.S. dollar denominated debt to finance new projects. Therefore, the depreciating Canadian dollar harms the profitability of firms by increasing the interest payments on U.S. dollar denominated debt. Another possible explanation is that most of the mining companies do have facilities in the United States where they incur costs in U.S. dollars. Hence, a decreased Canadian dollar results in higher cash outflows, which in turn decrease the stock price of the firm. In addition, a depreciating Canadian dollar makes Canadian firms that are cross-listed in U.S. stock markets unattractive as investments for U.S. investors.

6.1.2 Canadian mining industries

The regression results in Table 8 provide very limited evidence that Canadian mining industries at the 2- and 4-digit SIC level are exposed to the bilateral exchange rate changes between Canada and the U.S. Although the signs of regression coefficients are negative when both the value- and equal-weighted market indexes are used, these coefficient estimates lack statistical significance. However, regression analysis at the 4-digit SIC level exhibits improving test results (i.e. larger absolute values of the t-statistics) compared to those at the 2-digit SIC level except for Gold ores industry (SIC 1041). However, firms in the Gold ores industry account for almost half of the sample mining firms. This finding conforms to our second hypothesis that the relationship between the (excess) returns of a firm and the foreign exchange exposure of that firm are masked when firms are examined at the industry level. Hence, aggregating sample firms into groups of more broad industry classifications may account for past failures to find a significant relationship between the return of a firm and its exposure to the foreign exchange rate.

6.1.3 Canadian manufacturing companies

Regression analysis results for the sample of 117 Canadian manufacturing firms indicate that the effects of foreign exchange rate exposure on the returns of the sample manufacturers are marginal. The cross-sectional regression results, which are reported in Table 9, indicate that a negative but insignificant association exists between the monthly company stock return and the changes in the bilateral exchange rate. When a time-series regression analysis is conducted at the individual firm level, the findings for only 11 out of 117 manufacturing firms (9.4%) show significant exposure to the bilateral exchange rate at the 5% confidence level when the value-weighted market index is used. Similarly, 10 out of the 11 significant estimates reveal a negative relation to the bilateral exchange rate exposure when the value-weighted index is used. The, the manufacturing firms in the sample benefit (suffer) from an appreciating (depreciating) Canadian dollar. Similar findings are obtained for the cross-section regression analysis on the Canadian manufacturing firms. On average, Canadian manufacturing firms suffer .35% in their monthly stock prices when the Canadian dollar depreciates by 1%. However, unlike the findings for the mining firms, this sensitivity estimate is not statistically different from zero. This result signals the need for further investigation as to why Canadian manufacturers are not significantly exposed to the bilateral exchange rate between Canada and U.S. even though most of the exports of Canadian manufacturers are destined for the U.S.

6.1.4 Canadian manufacturing industries

The regression results, which are reported in Table 10, reveal very limited evidence as to whether Canadian manufacturing industries at the 2- and 3-digit SIC levels

are exposed to changes in the bilateral exchange rate between Canada and the U.S. None of the regression coefficients using the 2- and 3-digit classifications are statistically significant. Contrary to the findings using the sample of mining companies, the evidence is inconclusive as to whether grouping the sample companies at different industry classification levels has any effect on the results. One can argue that the use of the more broad 3-digit SIC level when aggregating the sample of manufacturing firms may have reduced the sample size to an inadequate size for comparing its performance against that when the 4-digit SIC level is used.

6.2 Lagged exposure to unanticipated changes in foreign rates

We find some evidence with respect to mispricing for the sample of mining firms. Table 11 summarizes the regression results for the relationships with lagged exchange rate exposure for the sample of mining firms. The cross-sectional regression results obtained from equation (5) indicate that mining companies have significant exposure to past changes in the bilateral exchange rate. More specifically, monthly stock returns of the sample of mining companies are negatively related to changes in the bilateral exchange rate when lagged 3, 9 and 12 months. Most surprisingly, current stock prices of the sample of mining companies are significantly influenced by the decrease in the Canadian dollar against the U.S. dollar which occurred 12 month ago. On average, a 1% decrease in the value of the Canadian dollars one year ago causes the current stock prices of mining firms to fall by 1.44%. This result is significant at a 1% confidence level. We also notice that all the regression coefficients of the current changes in the bilateral exchange rate are negative.

In contrast, we do not find evidence as to whether mispricing exists for the sample of Canadian manufacturing firms. Table 12 summarizes the regression results for various lagged exchange rate exposures for the manufacturing firms. All the regression coefficients of the lagged exchange rate exposure variables are insignificant except for the bilateral exchange rate exposure with a 9-month lag. Unlike the case of the sample of mining companies, Canadian manufacturers do not seem to be exposed to unanticipated changes in the bilateral exchange rate in general.

6.3 Determinants of exchange rate exposure

In order to assess whether or not exposure coefficients are related in a reasonable way to a number of intuitively relevant variables, we examine the equation (6) using 68 firm level data items obtained from both the SEDAR online and the Disclosure/Worldscope database. Firm level foreign to total sales and total asset data are collected and pooled across the 68 firms and then are regressed on each individual firm's sensitivity to the exchange rate exposure estimates obtained from equation (2).

Contrary to previous findings for the constant exposure model, the time-varying regression model reveals that manufacturing firms are sensitive to bilateral exchange rate exposure through different channels of foreign operation. More precisely, firms with larger proportions of foreign to total sales benefit more from the depreciating Canadian dollar. This finding is highly significant (1% confidence level). This result confirms that using time-varying variables, which take into account management's changing overseas strategies, can yield more precise estimates of the firm's foreign exchange rate exposure. The signs of coefficients for both foreign sales and production variables are consistent with the prediction of the theory. On average, a 1% increase in foreign to total sales

across Canadian manufacturers increases the sensitivity to the bilateral exchange rate among these firms by .05358%. On the other hand, the time-varying regression analysis indicates that firms with larger foreign production are more negatively affected when the Canadian dollar depreciates. However, this finding is not statistically significant.

The time-varying regression analysis is also conducted annually in order to observe any trend in the sensitivity of foreign exchange rate exposure. As predicted by the theory, we find that the coefficient estimates for the foreign to total sales variable are positive across the seven-year sample period. Positive coefficients imply that the higher the value of foreign sales, the more sensitive the firm is to changes in the bilateral exchange rate. However, we can not draw any conclusion as to whether Canadian manufacturers are becoming more sensitive to depreciation/appreciation of the Canadian dollar through channel of overseas activities as time passes. While the coefficient estimates for the foreign to total assets variable are negative in two out of the seven years, these two estimates are not statistically significant.

To separate the effects of large U.S. shareholder interest run-off due to the depreciation in the Canadian dollar, we include a dummy variable to capture the negative clientele effects from the Canadian dollar depreciation on the exchange rate sensitivity of Canadian manufacturers. Our expectation for the dummy variable is similar to that for the foreign to total assets variable. Our expectation is that the coefficient for the dummy variable will be more negative the larger the U.S. shareholder interest (i.e., when the stock of the company is cross-listed in the U.S. stock market).

Contrary to our expectation, the cross-sectional regressions yield a positive coefficient estimate for the dummy variable. This result indicates that Canadian

manufacturers that are cross-listed in the U.S. stock market benefit more when the Canadian dollar depreciates. When the cross-sectional regression is conducted annually, the dummy variable continues to have positive coefficients for all sample years. This suggests that U.S. investors are willing to pay more for Canadian stocks given the positive benefits expected from a depreciating Canadian dollar.

7. CONCLUSION

In this thesis, we measure the extent of foreign exchange rate exposure for samples of Canadian mining and manufacturing firms using both the constant and time-varying exposure models. Based on the assumption of constant exchange rate exposure, Canadian mining (and not manufacturing) firms are sensitive to fluctuations in the bilateral exchange rate. However, this finding has to be interpreted with caution since more precise measures of exposure are probably needed to adequately study the true foreign exchange rate exposure of Canadian manufacturers.

By adopting the time-varying model, we were able to examine two channels of foreign operations that expose a firm's value to the foreign exchange rate exposure of that firm. As predicted by the literature, firms with larger proportions of foreign sales relative to total sales are more vulnerable to changes in the bilateral exchange rate. In other words, by selling more overseas, firms benefit more when the Canadian dollar depreciates against the U.S. dollar. In contrast, firms that have higher proportion of their production facilities overseas suffer more when the Canadian dollar depreciates against the U.S. dollar. However, this latter relationship is not significant at conventional levels.

We believe that the use of a relatively poor proxy for foreign production may contribute to this insignificant finding.

The addition of the dummy variable to our time-varying model captures the run-off effects of U.S. investors when the Canadian dollar depreciates in value relative to the U.S. dollar. However, contrary to our a priori expectations that stocks of Canadian firms become less attractive to U.S. shareholders when the Canadian dollar decreases in value, our findings indicate that U.S. investors interpret the decrease in the value of the Canadian dollar as a good sign. Thus, they are willing to pay more for these stocks.

In future research, one can examine differences in business cycle and economic conditions between Canada and the U.S. as contributing sources to our finding. It is possible that U.S. investors could put more faith in Canadian stocks when the Canadian dollar depreciates if these investors view the Canadian economy to have better prospects compared to the U.S. economy in the near future.

To sort out what truly contributes to the failures in the literature to discover a significant exchange rate exposure among multinationals, we also assess the possibility of mispricing and sample selection biases. By adding lagged exchange rate exposure variables to the constant exposure model, we conclude that mispricing cannot be counted as one of the sources of failure in past empirical studies. In contrast, we find that sample selection problems help to explain how otherwise significant exchange rate exposure is masked when the sample is aggregated to more general industry classifications. However, this result should be interpreted with caution since we only test the hypothesis across two industries (mining and manufacturing), and only firms in the mining industry exhibit improved results when the 4-digit SIC level is used instead of the 2-digit SIC level.

The major contribution of this thesis is that it examines the impact of controlling for many of the problems that have been identified in the literature so that the tests for significant exchange rate exposures across multinationals are unambiguous. By comparing the impact of adjusting for known testing problems, we find that approaches that allow for time-varying risk exposures are more suitable to measure the scope of foreign exchange rate exposure across multinational firms.

Table 1. Weights assigned to the C-6 exchange rate

This table gives the weights assigned in the computation of the C-6 exchange rate.

Currency	Weightings
United States	0.8584
EMU Countries	0.0594
Japan	0.0527
United Kingdom	0.0217
Switzerland	0.0043
Sweden	0.0035

Table 2. Distribution of sample companies at 2-digit SIC level

This table summarizes the distribution of the samples of mining and manufacturing firms at the 2-digit SIC level.

SIC	Industry description	Number of firms
10	Metal mining	59
13	Oil and gas extraction	26
14	Mining and quarrying of nonmetallic minerals except fuels	6
20	Food and Kindred products	11
21	Tobacco manufacturers	1
22	Textile mill products	2
23	Apparel and other finished products made from fabrics and other similar materials	1
24	Lumber and wood products, except furniture	12
25	Furniture and fixtures	1
26	Paper and allied products	8
27	Printing, publishing and allied industries	6
28	Chemicals and allied products	13
30	Rubber and miscellaneous plastics products	4
32	Stone, clay, glass and concrete products	4
33	Primary metal industries	11
34	Fabricated metal products, except machinery and transportation equipment	3
35	Machinery, except electrical	14
36	Electrical and electronic machinery, equipment and supplies	15
37	Transportation equipment	8
38	Measuring, analyzing and controlling instruments; Photographic, medical and optical goods; Watches and clocks	3

Table 3. Average proportions of foreign-to-total sales and production for the sub-sample of Canadian firms

This table reports the average annual foreign to total sales and assets data for the sample of 68 Canadian manufacturers used in equation (6).

Year	Foreign to total sales	Foreign to total assets
1996	0.53	0.43
1997	0.56	0.38
1998	0.57	0.33
1999	0.59	0.33
2000	0.61	0.36
2001	0.61	0.34
2002	0.62	0.32

Table 4. Single-factor estimations using unanticipated exchange rate changes

This table reports the coefficient estimates and their corresponding t-values, and the adjusted R-square values for the regressions for equation (3) for the monthly changes in the bilateral exchange rate against the value-weighted monthly market index return. *, ** and *** indicates significance at the 0.10, 0.05 and 0.01 levels, respectively. α_m and β_m are the intercept and the slope for the regressions of equation (3), respectively.

α_m	t-value	β_m	t-value	Adjusted R^2
0.002	2.08**	-0.095	-4.71***	0.204

Table 5. Multi-factor estimations using unanticipated exchange rate changes

This table reports the coefficient estimates and their corresponding t-values, and the adjusted R-square values for the regressions for equation (4) for the monthly changes in the bilateral exchange rate against the value-weighted monthly market index return, and four other macroeconomic variables. *, ** and *** indicates significance at the 0.10, 0.05 and 0.01 levels, respectively. α_m is the intercept of equation (4) and β_1, β_2, β_3 and β_4 are the slopes for the value-weighted market index, changes in the expected inflation, default premium and term premium, respectively.

α_m	t-value	β_1	t-value	β_2	t-value	β_3	t-value	β_4	t-value	Adj.R^2
0.645	1.44	-0.098	-4.73***	-0.522	-0.66	-0.259	-0.69	-0.039	-0.455	0.188

Table 6. Pearson correlation matrix for the macroeconomic variables

This table reports the Pearson correlations for each paring of macroeconomic variables used in the equation (4).

	Value-weighted market index	Change in expected inflation	Default premium	Term premium
Value-weighted market index	1	-0.097	-0.176	0.105
Change in expected inflation		1	0.272	0.071
Default premium			1	-0.364
Term premium				1

Table 7. Contemporaneous exposure to the bilateral exchange rates for the mining firms

This table reports the coefficient estimates and their corresponding t-values, and the adjusted R-square values for the cross-sectional regression for equation (2). The cross-sectional regression is conducted by regressing the monthly stock return of individual firms against the value-weighted monthly market index return and changes in the bilateral exchange rate. *, ** and *** indicates significance at the 0.10, 0.05 and 0.01 levels, respectively. α_i is the intercept, β_i is the slope for the value-weighted market index, and γ_i is the slope for the unanticipated changes in the bilateral exchange rate for equation (2).

α_i	t-value	β_i	t-value	γ_i	t-value	Adjusted R^2
0.009	2.71***	0.716	11.20***	-2.586	-7.39***	0.028

variable	95% Confidence limits	
α_i	0.003	0.016
β_i	0.591	0.841
γ_i	-3.272	-1.900

Note: We find similar results using the C-6 exchange rate.

Table 8. Contemporaneous exposure to the bilateral exchange rates for firms in various mining industries

This table reports the coefficient estimates and their corresponding t-values, and the adjusted R-square values for the cross-sectional regressions for equation (2). Each cross-sectional regression is conducted by regressing the monthly portfolio return of industries at 2- or 4-digit SIC levels against the value-weighted monthly market index return and changes in the bilateral exchange rate. *, ** and *** indicates significance at the 0.10, 0.05 and 0.01 levels, respectively. α_i is the intercept, β_i is the slope for the value-weighted market index, and γ_i is the slope for the unanticipated changes in the bilateral exchange rate for equation (2).

Industry level

Industry code	α_i	t-value	β_i	t-value	γ_i	t-value	Adjusted R^2
10	-0.014	-0.83	0.670	2.21**	-0.624	-0.38	0.035
1021	-0.022	-1.14	0.104	0.29	-3.237	-1.66	0.010
1041	-0.013	-0.82	0.673	2.20**	-0.565	-0.34	0.035
1311	0.032	1.44	1.112	2.74***	-2.588	-1.16	0.076

Table 9. Contemporaneous exposure to the bilateral exchange rate for firms in manufacturing

This table reports the coefficient estimates and their corresponding t-values, and the adjusted R-square value for a regression for equation (2) for the monthly stock returns of manufacturing firms against the value-weighted monthly market index returns and changes in the bilateral exchange rate. *, ** and *** indicates significance at the 0.10, 0.05 and 0.01 levels, respectively. α_i is the intercept, β_i is the slope for the value-weighted market index, and γ_i is the slope for the unanticipated changes in the bilateral exchange rate for equation (2).

α_i	**t-value**	β_i	**t-value**	γ_i	**t-value**	**Adjusted R^2**
0.007	1.63	0.870	10.62***	-0.353	-0.79	0.015

variable	**95% Confidence limits**	
α_i	-0.002	0.016
β_i	0.710	1.031
γ_i	-1.232	0.526

Note: We find similar results using the C-6 exchange rate.

Table 10. Contemporaneous exposure to the bilateral exchange rate for firms in various manufacturing industries

This table reports the coefficient estimates and their corresponding t-values, and the adjusted R-square values for regressions for equation (2) for the monthly portfolio returns of industries against the value-weighted monthly market index returns and changes in the bilateral exchange rate. *, ** and *** indicates significance at the 0.10, 0.05 and 0.01 levels, respectively. α_i is the intercept, β_i is the slope for the value-weighted market index, and γ_i is the slope for the unanticipated changes in the bilateral exchange rate for equation (2).

Industry code	α_i	t-value	β_i	t-value	γ_i	t-value	Adjusted R^2
20	-0.002	-0.15	0.975	4.79**	0.734	0.66	0.205
208	0.015	1.27	-0.061	-0.29	1.188	1.02	-0.010
209	0.001	0.03	0.625	2.25**	0.975	0.64	0.040
241	-0.005	-0.38	0.622	2.49**	-1.801	-1.32	0.067
242	-0.001	-0.07	0.794	3.78***	-0.396	-0.34	0.130
261	0.000	0.03	0.151	3.52***	-1.019	-0.57	0.114
262	-0.036	-1.51	1.875	4.26***	-2.706	-1.12	0.173
267	-0.011	-0.79	0.236	0.94	-1.030	-0.75	-0.007
271	0.001	0.07	0.704	2.87***	-0.320	-0.24	0.070
273	0.027	1.77*	0.258	0.90	0.435	0.28	-0.014
275	-0.041	-2.23**	0.251	0.73	-0.034	-0.02	-0.018
281	0.006	0.33	0.319	0.96	-0.043	-0.02	-0.013
283	0.012	0.51	1.087	2.59	0.795	0.35	0.055
287	-0.003	-0.18	0.476	1.71*	1.377	0.91	0.021
289	0.014	0.53	0.785	1.61	-2.500	-0.93	0.017
30	-0.011	-0.45	1.344	3.01***	-1.426	-0.58	0.082
308	-0.005	-0.32	1.109	3.60***	-2.684	-1.59	0.140
331	-0.007	-0.58	0.780	3.47***	-0.153	-1.24	0.122
353	0.001	0.05	2.008	5.45***	-0.358	-0.18	0.250
356	0.019	1.58	0.750	3.36***	-0.512	-0.42	0.102
366	-0.012	-0.45	1.206	2.40**	-1.04	-0.38	0.045
367	-0.025	-1.49	1.785	5.79***	2.482	1.47	0.289
371	0.007	0.42	1.728	5.44***	-0.577	-0.33	0.250

Table 11. Lagged exposure to the bilateral exchange rate for mining firms

This table reports the coefficient estimates and their corresponding t-values, and the adjusted R-square values for the cross-sectional regressions for equation (5) for the monthly stock returns of individual firm against the value-weighted monthly market index returns and changes in the bilateral exchange rate. *, ** and *** indicates significance at the 0.10, 0.05 and 0.01 levels, respectively. α_i is the intercept, β_i is the slope for the value-weighted market index, and γ_{ij} is the slopes for the unanticipated changes in the bilateral exchange rate for equation (5).

α_i	β_i	γ_{ij} $j=0$	γ_{ij} $j=3, 6, 9, 12$	Adj.R^2
0.010 (2.80***)	0.734 (11.38***)	-2.617 (-7.4***)	-0.756 (-2.17***)	0.028
0.009 (2.73***)	0.711 (11.10***)	-2.650 (-7.5***)	-0.461 (-1.33)	0.028
0.010 (2.8***)	0.705 (10.99***)	-2.588 (-7.4***)	-0.619 (-1.78*)	0.028
0.010 (2.90***)	0.744 (11.58***)	-2.490 (-7.1***)	-1.444 (-4.10***)	0.030

Note: t- values are in the parenthesis.

Table 12. Lagged exposure to the bilateral exchange rate for manufacturing firms

This table reports the coefficient estimates and their corresponding t-values, and the adjusted R-square values for the cross-sectional regressions for equation (5) for the monthly stock returns of individual firm against the value-weighted monthly market index returns and changes in the bilateral exchange rate. *, ** and *** indicates significance at the 0.10, 0.05 and 0.01 levels, respectively. α_i is the intercept, β_i is the slope for the value-weighted market index, and γ_{ij} is the slopes for the unanticipated changes in the bilateral exchange rate for equation (5).

α_i	β_i	γ_{ij} $j=0$	γ_{ij} $j=3, 6, 9, 12$	Adj.R^2
0.007 (1.62*)	0.868 (10.51***)	-0.348 (-.78)	-0.108 (0.24)	0.014
0.007 (1.61)	0.876 (10.68***)	-0.284 (-.63)	-0.523 (1.17)	0.015
0.007 (1.52)	0.885 (10.76***)	-0.352 (-.78)	-0.863 (-1.94**)	0.015
0.007 (1.69*)	0.881 (10.69***)	-0.316 (-0.70)	-0.549 (-1.23)	0.015

Note: t- values are in the parenthesis.

Table 13. Time-varying exposure to the Bilateral Exchange rate

This table reports the coefficient estimates and their corresponding t-values, and the adjusted R-square values for the regressions for equation (6). Foreign to total sales and assets are regressed against the bilateral exchange rate exposure coefficients obtained from equation (2). *, ** and *** indicates significance at the 0.10, 0.05 and 0.01 levels, respectively. α_i is the intercept, and η_i, κ_i, and δ_i are the slope for the foreign to total sales, foreign to total assets and cross-listing dummy variable respectively, for equation (6).

α_i	**t-value**	η_i	**t-value**	κ_i	**t-value**	δ_i	**t-value**	**Adj.R^2**
-0.075	-7.16***	0.054	3.32***	-0.000	-1.29	0.089	8.62***	0.165

variable	**95% Confidence limits**	
α_i	-0.960	-0.055
η_i	0.022	0.085
κ_i	-0.001	-0.000
δ_i	0.069	0.109

Note: We find similar results using the C-6 exchange rate.

Table 14. Time-varying exposure to the Bilateral Exchange rate

This table reports the coefficient estimates and their corresponding t-values, and the adjusted R-square values for the regressions for equation (6). Foreign to total sales and assets are regressed against the bilateral exchange rate exposure coefficients obtained from equation (2). The cross-sectional regression is conducted year by year. *, ** and *** indicates significance at the 0.10, 0.05 and 0.01 levels, respectively. α_i is the intercept and η_i, κ_i, and δ_i are the slope for the foreign to total sales, foreign to total assets and cross-listing dummy variable respectively, for equation (6).

1996								
α_i	**t-value**	η_i	**t-value**	κ_i	**t-value**	δ_i	**t-value**	**Adj.R^2**
-0.052	-1.69*	0.015	0.30	-0.001	-0.03	0.091	3.11***	0.102
variable				**95% Confidence limits**				
α_i				-0.114		0.009		
η_i				-0.082		0.112		
κ_i				-0.091		0.088		
δ_i				0.032		0.149		
1997								
α_i	**t-value**	η_i	**t-value**	κ_i	**t-value**	δ_i	**t-value**	**Adj.R^2**
-0.055	-1.85**	0.016	0.33	0.019	0.42	0.092	3.10***	0.128
variable				**95% Confidence limits**				
α_i				-0.114		0.005		
η_i				-0.080		0.112		
κ_i				-0.072		0.110		
δ_i				0.033		0.152		
1998								
α_i	**t-value**	η_i	**t-value**	κ_i	**t-value**	δ_i	**t-value**	**Adj.R^2**
-0.093	-3.41***	0.069	1.57	0.042	0.95	0.076	2.68***	0.158
variable				**95% Confidence limits**				
α_i				-0.148		-0.039		
η_i				-0.019		0.157		
κ_i				-0.047		0.131		
δ_i				0.019		0.133		

1999								
α_i	t-value	η_i	t-value	κ_i	t-value		t-value	Adj.R^2
-0.073	-2.49***	0.054	1.19	-0.000	-1.30	0.082	2.96***	0.148
variable				95% Confidence limits				
α_i				-0.132		-0.015		
η_i				-0.037		0.145		
κ_i				-0.000		0.000		
δ_i				0.027		0.138		
2000								
α_i	t-value	η_i	t-value	κ_i	t-value	δ_i	t-value	Adj.R^2
-0.075	-2.65***	0.037	0.82	0.036	0.81	0.080	2.70***	0.130
variable				95% Confidence limits				
α_i				-0.131		-0.019		
η_i				-0.053		0.127		
κ_i				-0.052		0.125		
δ_i				0.020		0.139		
2001								
α_i	t-value	η_i	t-value	κ_i	t-value	δ_i	t-value	Adj.R^2
-0.098	-3.43***	0.071	1.57	0.041	0.95	0.078	2.60***	0.171
variable				95% Confidence limits				
α_i				-0.156		-0.041		
η_i				-0.019		0.161		
κ_i				-0.045		0.126		
δ_i				0.018		0.137		
2002								
α_i	t-value	η_i	t-value	κ_i	t-value	δ_i	t-value	Adj.R^2
-0.089	-3.16	0.054	1.25	0.039	0.84	0.081	2.77***	0.159
Variable				95% Confidence limits				
α_i				-0.145		-0.033		
η_i				-0.033		0.141		
κ_i				-0.054		0.131		
δ_i				0.024		0.140		

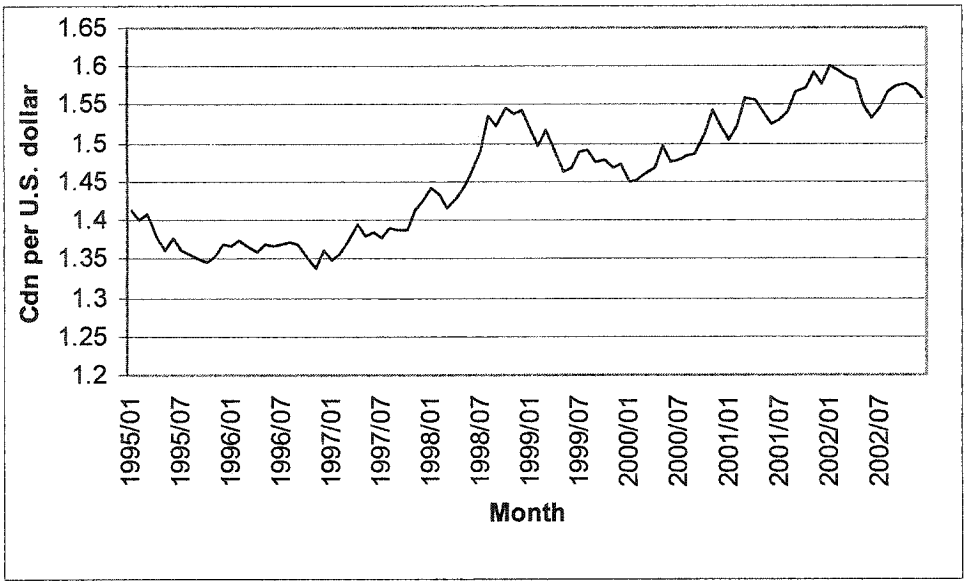

Figure 1. Bilateral exchange rate in terms of Canadian dollars in terms of one US dollar

The above figure represents changes in the bilateral exchange rate between Canadian and U.S. dollars. The exchange rate is quoted as Canadian dollar equivalent per U.S. dollar.

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