Exchange Rate Movements and Firm Dynamics in Canadian Retail Industries *†

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Abstract

This paper uses firm-level data to estimate the effects of real exchange rate movements on Canadian retail firms. As consumers living close to the Canada-US border are able to shop on either side of the border, fluctuations in the price of Canadian goods and services relative to U.S. goods, including changes caused by exchange rate movements, can affect the demand faced by retailers. This, in turn, can impact firm survival, size and profitability. Using comprehensive data on Canadian retail firms from 1986 to 1997, a period characterized by large appreciation and then depreciation of the Canadian dollar, we are able to examine not only the exchange rate effects on retail firms overall but also the effects on firms in different industry groups. We focus on three industry groups which are likely to be affected by cross-border shopping: food services and accommodation, grocery stores and gasoline stations, and apparel and general retail. Our findings show mixed effects of real exchange rate movements on firm survival. However, for two different measures of size, (sales and employment), and for profitability, our results indicate adverse effects of a real Canadian currency appreciation. We also find that these effects diminish as firms are located farther away from the border and the rate at which the effects fall differs across industries and measures of firm performance.

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1 Introduction

In this paper, we use firm-level data to quantify the intensive and extensive margin effects of real exchange rate fluctuations on Canadian retailers. We expect an exchange rate movement to have demand-side effects on retailers through its impact on cross-border shopping by Canadian and American consumers and to have supply-side effects through its impact on the price of imported goods that Canadian retailers purchase for resale. Our primary focus is on the demand-side effects and we find significant responses in Canadian retail to real exchange rate movements along the intensive margin.

Previous studies such as Di Matteo and Di Matteo (1996), Ferris (2000), and Timothy and Butler (1995) use data on the number of same day automobile trips across the Canada-U.S. border as a measure of cross-border shopping and document a positive relationship between the number of such trips by Canadians and the relative price of Canadian goods to U.S. goods (the real exchange rate). Figure 1 illustrates this relationship for 1980-2009 for Canadian travelers and shows an opposite and much less pronounced relationship for American travelers. In addition, Chandra et. al. (2010) examine both same-day and overnight trips and find that overnight trips also respond to exchange rate movements in a similar way. Campbell and Lapham (2004) use U.S. county-level data for a subset of retail industries and find significant effects of real exchange rate movements on average employment and the number of retailers for Food Stores, Gasoline Stations, and Eating Places. Using data on Swedish alcohol sales, Asplund et.al. (2007), find significant effects on retailers' sales with those effects diminishing with distance of the retailer from the border.

As cross-border shopping has been an important phenomenon for both Canada and border states, there have been several studies summarizing cross-border shopping patterns between the U.S. and Canada. For example, Ford(1992) reports that a 1991 survey from Ontario, Canada reveals that Canadian consumers living in regions within 30 minutes by driving of the border are the most frequent cross-border shoppers (on a weekly basis) and typically purchase groceries, gasoline, and clothing. Consumers living in regions within 60 minutes by driving are the second most frequent cross-border shoppers and they tend to buy slightly more durable or expensive items when shopping in the United States. Finally, consumers living in regions that are within 90 minutes by driving are also engaged in cross border shopping but in fewer trips and they usually purchase more expensive goods.

There is very little research using firm-level data to measure the impact of exchange rate movements on retailers which experience fluctuations in demand due to cross-border shopping. This paper uses four key indicators of firm performance to quantify these effects: sales, employment, profitability, and probability of survival. We also provide a quantitative investigation of the effects of a retailer's distance from the nearest border crossing on the impact of real exchange rate movements on the measures of firm performance listed above. We provide estimates for all retail firms as well as for retail industries that are more likely to be affected by cross-border shopping: apparel and general retail; grocery stores and gasoline stations; and food services and accommodation. We find that changes in the real exchange rate have a significant and persistent effect on the profitability and size of Canadian retail firms for both the entire retail sector and the sub-groups indicated above. The magnitude of the exchange rate effects on the size measures (sales and employment), and on profitability in general, diminishes for firms located farther away from the border. We also find that the exchange rate effect on employment diminishes quickly while the effect on profitability persists for longer distances and that the rate varies across industry groups. Our results indicate significant adjustment by retail firms at the intensive margin and less so (and perhaps in an opposite direction) on the extensive margin.

More generally, our analysis contributes to the growing empirical literature which provides micro-level analysis of industry dynamics. To date, much of this research has focused on the manufacturing sector while service and retail industries have received less attention. Studies which do focus on retail such as Baldwin and Gu (2008) and Foster et.al. (2002 and 2006) find that the retail industry is characterized by high entry and exit rates and substantial firm heterogeneity in terms of productivity. These findings as well as those in Campbell and Lapham (2004) who study U.S. retail responses to real exchange rate changes suggest that the dynamics of retail industry responses to shocks may differ significantly from manufacturing.

This paper is organized as follows. The next section provides the theoretical motivation underlying our empirical approach. Section Three describes the data used for analysis while Section Four presents the empirical methodology and results. Section Five discusses the economic significance of our results and Section Six summarizes our conclusions.

2 Theoretical Motivation

When consumers must engage in costly travel to purchase goods, the price that they pay to acquire a good includes transportation costs which are positively related to distance between the consumer and the store (see, for example, Berry et al (1997) and Dicken and Lloyd (1990)). Furthermore, in such a setting the spatial extent of the market for a store is limited. Consider, for example, two stores located apart with a continuum of consumers living in areas between the two stores. Given the prices posted at the two stores and transportation costs, there will be a market boundary dividing consumers between the two stores. Hence, if a store reduces its price, it extends its market area: consumers located between the old and new market boundary will buy from this store, leading to a gain in sales.

We can apply this framework to an international setting by considering two countries, Home and Foreign, that share a land border, with stores located in each country. Suppose that consumers in both countries can purchase from both home and foreign stores but must pay a transportation cost to purchase from a store located in a different country. Stores set prices in their local currency. The cost for a home consumer for a product purchased at a foreign store consists of three elements: the store price in foreign currency units, the exchange rate, E, (domestic currency per foreign currency), and a transportation cost which is increasing in the distance between the consumer and the store. Each store sells a differentiated good and stores are indexed by their good f and their distance from the border, d. Increased transportation cost with distance makes consumers living farther away from the border respond less to foreign price changes.

The sales of home firm f located distance d from the border (denoted as Q_{fd}) is expressed as

$$\ln Q_{fd} = \alpha - \beta \ln p_{fd} + \gamma \ln I + h(d) \ln \left(\frac{P}{P^* E} \right) + g(d) \ln I^*, \tag{1}$$

where p_{fd} is the firm's domestic currency price, P is the Home aggregate price index (in domestic currency units), P^* is the Foreign aggregate price index (in foreign currency units), I is Home income, and I^* is Foreign income. The first three terms are standard in demand specifications while the last two terms capture effects due to the presence of cross-border shopping. In particular, the fourth term, $\left(\frac{P}{P^* E}\right)$, is the real exchange rate and is a measure of general price differences between the two countries. The functions $h(d)$ and $g(d)$ capture the impact of firm distance from the border on the importance of foreign

competitors and foreign consumers with $h(\cdot) < 0$, $h'(\cdot) > 0$, $g(\cdot) > 0$, and $g'(\cdot) < 0$. These functions reflect the "exposure" of home firms to cross-border shopping both through the presence of foreign competitors and through the presence of foreign consumers and the assumption is that due to transportation costs, exposure diminishes with distance to the border.[1] Thus, an appreciation of the home currency (a fall in E) lowers the domestic currency price of foreign goods (P^*E), expands the market area of foreign stores and reduces the sales of home stores (to both home and foreign consumers). Due to transportation costs, the sensitivity of demand to exchange rate changes should be mitigated for stores located farther away from the border.

Putting this framework in the Canadian context, a nominal or real appreciation of the Canadian dollar will induce more Canadian consumers to cross-border shop in the US and fewer US consumers to shop in Canada, resulting in a fall in demand for Canadian stores. If the elasticity of demand is decreasing in demand, then this fall in demand will cause Canadian stores to reduce their markup. As a result, a home currency appreciation will lead to a reduction in firm profitability and lower the probability of survival.[2] If the exit rate is low, a currency appreciation will reduce the sales of surviving stores (see Fung (2008)). Thus, the Canadian retail industry will respond to real and nominal exchange rate movements through both the intensive and extensive margins.

In summary, the empirically testable hypotheses resulting from this theoretical framework are as follows: (1) An appreciation of the Canadian dollar reduces the profitability, probability of survival, sales and employment of Canadian retailers while a depreciation has the opposite effect; and (2) The exchange rate effect is less pronounced for stores located farther away from the Canada-US border.

3 Data Description

3.1 Firm-level Data

This paper uses firm-level data from the T2LEAP database. This database was created by linking two underlying sources of data: corporate tax information from "T2" tax forms, and the Longitudinal Employment Analysis Program (LEAP), which obtains its data from firm-specific payroll information

[1] This equation is similar to those specified in Asplund et al (2007).

[2] If stores are heterogeneous with respect to productivity as in Melitz and Ottaviano (2008), the effect of exchange rate movements will be less pronounced for more productive stores.

filed with the Canada Revenue Agency (CRA). Firm names are removed and replaced with numerical identifiers to make the data set anonymous.

T2LEAP is a longitudinal data set that provides information on every incorporated Canadian enterprise that legally hires employees (and hence files payroll information with the Canadian Revenue Agency) and, in the same year, files a "T2" corporate income tax return. T2LEAP covers the period 1984 through 1998, and for the purposes of this study data from 1986-1997 are used.[3] This data set contains detailed data on firm characteristics, such as ownership (public or private), location (province and postal code), number of employees, total sales, total assets, equity, and payroll. We are restricted to book values of debt, equity, and assets. As noted above, the frequency of the data is annual. All financial data is converted to real (1986) Canadian dollars using the Consumer Price Index (CPI). The number of employees is measured by average labour units (ALU) which is firm total payroll divided by a weighted average of workers' annual wage in the province, size class, and industry where the firm is located. The ALU can be interpreted as the number of typical workers.

The comprehensive coverage of firms makes it possible to identify firm year of entry and exit using the methodology employed in Baggs (2005). Specifically, a panel of survivors and exiters is constructed using the T2LEAP data as follows. The initial population of firms we consider are those firms which existed in 1986. The sample is augmented in each consecutive year by removing exiting firms and adding new firms. A firm is removed from the sample in year t if year t is the year in which the firm files its last tax return (the T2SUF measure of exit) or if year t is the last year in which the firm employs workers (the LEAP measure of exit). If a firm falls into either of these categories, it is counted as exiting. If a firm has missing data for some year(s) but then reappears in later years, the years of missing data are dropped from our analysis but the firm is not counted as exiting. When the firm reappears in the data it is added back into our unbalanced panel, but not counted as an entrant. A firm enters our sample in the first year it both employs workers and files a tax return.

We assess the exchange rate effect for all retail firms and for three industry groups that are most likely to be affected by cross-border shopping: food services and accommodation; grocery stores and gasoline stations; and apparel and general retail. The choice of the latter two industry groups is partially motivated by evidence from consumer surveys as discussed in Ford (1992) which indicate that the most popular goods

[3]The first (1984) and last (1998) years are dropped because they are partial years only. We use 1985 but when the data are lagged we end up with data from 1986-97.

purchased by Canadian shoppers are gasoline, clothing, and groceries followed by electronics, and small and large appliances. We also expect food services and accommodation industries to be affected as they provide services for the travelers that cross the border.

As mentioned above, the T2LEAP database includes the postal code of the retailer, making it possible to calculate distance from the store to the border and to examine the possibility that firms in different locations may react differently to exchange rate movements. To calculate store distance to the Canada-US land border, we collected the postal code of land border posts from the Canadian Border Services Agency (CBSA) and calculated the distance between a firm and the closest border post.[4] As most of the population and shopping areas in Canada are close to the southern border with the US, we only calculate the distance to that border.

Table 1 presents descriptive statistics of the firm-level data for all retail firms and for each of the industry groups. Column 1 reports the overall descriptive statistics, columns 2 and 3 respectively report the statistics for surviving firms and exits, and column 4 indicates if the mean value of the variable of interest for the survivors is significantly different at the 5% level as compared to the exits. We begin with the statistics for all retail firms, which are summarized in the first section of Table 1. The surviving firms are in general larger, farther away for the border, have lower leverage (debt-assets ratio), and have higher growth rates than exiting firms. Interestingly, divergent from the common pattern found among Canadian manufacturing and other service firms, the surviving firms are *younger* as compared to the exits.[5] Note that although the age difference is statistically significant, the difference in average ages is less than one month for all retail firms. The average younger age of surviving firms is possibly due to the entry of large chain stores in the 1990s (Industry Canada, 2004). The bottom three sections of Table 1 summarize the same variables for our three industry groups. On average, firms in food and accommodation are younger and have higher leverage as compared to the other industry groups. The characteristics of survivors and exits found for all retail firms can also be applied to these three industry groups. When comparing firm size and leverage of retail firms to the statistics for Canadian manufacturing firms reported in Baggs (2005) and Baggs et al (2009), retail firms are on average smaller and have higher leverage as compared to manufacturing firms.

[4]The PCCF+ program was used to calculate the minimum distance between two postal codes.

[5]Studies on Canadian manufacturing firms such as Baggs (2005), Baggs et al (2009) all show that the surviving firms are *older* as compared to the exits. A similar pattern is found for Canadian service sector firms in Baggs et al (2010).

Table 1: Descriptive Statistics

	Overall	Survivors	Exits	Significantly Diff. at the 5% Level?
All Retail Firms				
Observations	1154532	1078415	76117	
Mean No. of Employees	18.91	19.79	6.31	YES
Mean Firm Age	6.28	6.28	6.32	YES
Mean Leverage	0.99	0.88	2.62	YES
Mean Industry Sales Growth	2.42%	2.44%	2.22%	YES
Mean Min. Distance to the Border (KM)	163	164	154	YES
Food Services and Accommodation				
Observations	304211	282026	22185	
Mean No. of Employees	23.13	24.26	8.74	YES
Mean Firm Age	5.88	5.87	6.01	YES
Mean Leverage	1.18	1.05	2.99	YES
Mean Industry Sales Growth	4.22%	4.18%	4.67%	YES
Mean Min. Distance to the Border (KM)	166	167	155	YES
Grocery Stores and Gasoline Stations				
Observations	198497	184510	13987	
Mean No. of Employees	21.06	22.25	5.36	YES
Mean Firm Age	6.21	6.2	6.34	YES
Mean Leverage	0.96	0.83	2.8	YES
Mean Industry Sales Growth	0.23%	0.30%	-0.68%	YES
Mean Min. Distance to the Border (KM)	181	182	164	YES
Apparel and General Retail				
Observations	100270	92150	8120	
Mean No. of Employees	45.42	48.73	7.88	YES
Mean Firm Age	6.3	6.28	6.39	YES
Mean Leverage	0.98	0.82	2.97	YES
Mean Industry Sales Growth	-1.27%	-1.20%	-2.06%	YES
Mean Min. Distance to the Border (KM)	163	164	158	YES

Note: The firm age is truncated at 14 years because the first year that we are able to measure firm age is 1984.

3.2 Aggregate Data

We construct the Canada-US real exchange rate using the nominal exchange rate and aggregate or industry-specific consumer price indexes for each country. We construct measures of domestic market size for a retailer using real GDP (chained 1997 dollars) and population from CANSIMII for the province in which the retailer is located. The CBSA information on border posts not only includes the postal code of border posts but also reports the opposite US port of entry, making it possible to identify the states adjacent to the Canadian border post closest to the Canadian retailer. We measure the size of the U.S. market for a Canadian retailer using real GDP (chained 2000 dollars) and population from the Bureau of Economic Analysis for the adjacent state. We also use relevant Canadian sales tax rates (sum of Provincial Sales Tax, PST, and Goods and Services Tax, GST) and state sales tax rates.

4 Empirical Implementation

Equation (1) forms the basis for the empirical analysis. In the empirical implementation, we assume that the distance function, $h(d)$, which interacts with the real exchange rate takes the form of $h(d) = \lambda_1 + \lambda_2 \ln d$. As a higher value of the real exchange rate implies a lower relative price of foreign goods, we expect $\lambda_1 < 0$ and since that effect should diminish with distance from the border we expect $\lambda_2 > 0$. In addition, we assume that the distance function, $g(d)$, which interacts with foreign income is of form $g(d) = \rho_1 + \rho_2 \ln d$, where we expect $\rho_1 > 0$ and $\rho_2 < 0$. Here, we examine the exchange rate effects on the sales, employment, profits and probability of survival of Canadian retailers.

4.1 Sales and Employment

We begin investigating adjustment on the intensive margin by examining exchange rate effects on firm size measured by sales and by employment. For firm sales, we apply the following equation to an unbalanced panel of surviving firms (i.e., firm in the sample for at least three years):

$$\ln Sales_{ft} = \alpha + (\lambda_1 + \lambda_2 \ln d_{ft}) \ln ER_{it} + \gamma x_{ft-1} + \delta y_{it-1} + \varepsilon_{ft}, \tag{2}$$

where f is a firm index, i is an industry index, and $\ln sales_{ft}$ is the logarithm of the firm's sales in constant 1986 dollars. The variable $\ln ER_{it}$ is industry-specific real Canada-US bilateral exchange rate and is the ratio of the industry-specific Canadian CPI to the US CPI multiplied by the nominal exchange rate (expressed as US dollar per Canadian dollar), thus, an increase in this real exchange rate reflects a real appreciation of the Canadian dollar. The term $x_{ft-1}$is a vector of lagged firm-level controls including age, leverage and size category.[6] The industry and aggregate level controls, y_{fit-1}, include lagged industry sales growth,[7] lagged industry concentration, lagged Canadian GDP, lagged relative provincial GDP for the province in which the firm is located,[8] lagged real GDP of the state adjacent to the closest border post to the firm, and the real interest rate. In addition, we also control for relevant provincial and states sales tax rates. The Canadian sales tax rates we use consists of both provincial and federal sales tax (PST and GST). Although sales tax rates in the US did not change significantly during the period studied, the introduction of the GST in January 1991 increased the relative price of Canadian goods and services and may have led to increased cross-border shopping by Canadian consumers. As the effect of relative sales tax rates and the size of the relevant US market on a Canadian retailer may also depend on the distance between a firm and the border, the GDP of adjacent states and state and provincial tax rates were interacted with distance to the border. Finally, ε_{ft} is an error term.

Table 2 summarizes the results of estimating equation (2) using panel regressions with firm and province fixed effects. The first two columns consider the sample of all retail firms, while the last three columns report results for the industry groups of interest. As column 1 reports the results without exchange rate-distance interaction term, the coefficient estimate for the exchange rate can be interpreted as an overall effect. Columns 2 to 5 report the results with exchange rate-distance interaction term. In this case, the direct exchange rate effect can be interpreted as the effect for firms located at the border. In all specifications, the coefficient estimate for the exchange rate is negative and significant, indicating a negative effect of real appreciation of the Canadian dollar. The coefficient estimate for the exchange rate-distance interaction term is positive and significant, suggesting that the negative effect on sales of Canadian retailers of a real appreciation diminishes with distance to the border.

Turning our attention to tax rates, we find that higher Canadian sales tax rates are associated with

[6]There are four size categories: size = 1 if the number of employees is below 10; size = 2 if between 10 and 50; size = 3 if between 50 and 100 and size = 4 if above 100.

[7]When computing industry sales, the sales of firm f is excluded.

[8]The (relative) provincial GDP is measured by provincial GDP relative to the the Canadian GDP.

lower sales for Canadian firms, as are higher state sales tax rates. The Canadian tax result is intuitive, although why higher US state taxes would reduce the sales of Canadian firms is somewhat puzzling. Interacting the two tax variables with distance generates predominately positive coefficients, though significant only for the Canadian tax rate for all retail firms and for grocery stores and gasoline. In general, the positive and significant coefficient for all retail firms suggests that higher Canadian sales taxes reduce the sales of Canadian retailers, and this effect is smaller the farther the firm is located from the border. This tentatively suggests that higher Canadian sales tax rates may encourage Canadians located close to the border to cross-border shop, negatively affecting the sales of Canadian firms closest to the US border, but having less effect on firms further away, whose local customers are perhaps less likely to shop in the US. Similarly, higher Canadian sales taxes discourage Americans from crossing the border to shop, most adversely affecting firms close to the border. However, the somewhat marginal significance of the distance and tax interaction in the sub-samples suggests this may not be a particularly significant influence on sales in food and accommodation or apparel and general retail.

We also find that real GDP of adjacent states is positively associated with firm sales for the sample of all retail firms and for food and accommodation, though insignificant for the other two subsamples. The interaction between distance and the GDP of adjacent states is negative and significant in the first three columns and insignificant for the last two columns. This suggests that for all retail firms, and for the food and accommodations sub-sample, higher GDP of an adjacent state increases sales, but this effect is smaller the farther away from the border the firm is located.

Turning to the remaining control variables in our regression, we find a positive association between firm age, firm size and sales. Consistent with the findings in Baggs et al (2010), there is a positive relationship between leverage and sales, implying that firms may expand sales by raising debt. Sales are also positively associated with industry level sales, Canadian GDP, and relative provincial GDP. Sales are negatively associated with higher real interest rates for retail firms overall and for apparel and general retail firms, though positively associated with higher real interest rates for firms in the food and accommodation sector.

Alternatively, we can use the number of employees as the measure of firm size. The equation estimated

is very similar to the equation for sales (equation 2) and it can be specified as:

$$\ln ALU_{ft} = \alpha + (\lambda_1 + \lambda_2 \ln d_{ft}) \ln ER_{it} + \gamma x_{ft-1} + \delta y_{it-1} + \varepsilon_{ft}, \tag{3}$$

Equation (3) is also estimated using panel regressions with fixed effects and the results are reported in Table 3. As in the results with sales, we see a negative and significant effect of currency appreciation on employment in all specifications. For the sample of all retail firms and for groceries and gasoline this effect is significantly smaller the farther the firm is located from the nearest border crossing. The Canadian sales tax, and its interaction with distance, affect employment in the same manner as they affect sales, with the exception of column one, where the higher sales tax increases employment (in the absence of distance interactions). Contrary to the sales results above, the US sales tax coefficients here are consistently positive and the interaction between distance and US sales tax is consistently negative, though significant only in column 2. These results suggest that employment in Canadian retail firms increases as US sales taxes rise, and that this effect is smaller for firms located farther from the border.

The control variables behave largely as in the sales results with a few notable exceptions. First, higher industry sales reduce employment in grocery and gasoline, and apparel and general retail subsamples, though increases employment in retail overall and in food and accommodation. Higher Canadian GDP has little impact on employment in food and accommodation, and higher provincial GDP reduces employment in overall retail firms. Third, the real interest rate has a more consistent negative effect on employment than it did on sales. Finally, higher leverage is negatively associated with firm employment in all specifications. As leverage is positively associated with firm sales but negatively related to firm employment, the results suggest that while firms may raise debt to finance expansion in sales, higher leverage may discourage firms for increasing the number of workers.

Combining the sales and employment results, we find a negative effect of a real currency appreciation on both sales and employment and the effect diminishes with distance to the border. Our findings suggest that the empirical pattern of exchange rate effects on Canadian retailers is consistent with the predictions generated from our theoretical motivation and there is significant adjustment along the intensive margin.

4.2 Profits

We now turn our attention to the exchange rate effect on firm profitability. In the short run, Canadian retailers may absorb adverse changes (such as a higher value of the Canadian dollar) rather than adjusting firm size. To assess how exchange rate movements affect firm profitability, we estimate the following equation:

$$\ln Profit_{ft} = \alpha + (\lambda_1 + \lambda_2 \ln d_{ft}) \ln ER_{it} + \gamma x_{ft-1} + \delta y_{it-1} + \varepsilon_{ft}, \tag{4}$$

where $\ln Profit_{ft}$ is the logarithm of firm profits. The firm and industry level controls are the same as described above with the addition of labour productivity.[9] The labour productivity index is constructed as deviation of the logarithm of sales and labour from a reference firm in the base year (1985). The reference firm has the logarithm of sales and labour at the industry mean.[10] According to Pavcnik (2002), this method is adopted to ensure that the productivity measure is transitive and insensitive to units. As detailed in Baggs and Brander (2006), the profit measure in the T2LEAP data set is accounting profit (taxable profit). When firms experience a loss, the profits are sometimes recorded as zeros since there are no taxable profits, leading to a substantial number of zeros in profit records. A small number of firms do report negative profits but for the firms that reported zero profits, we are unable to tell if the profits were zero or if there was a loss. As a result, the only consistent profit data are for firms with positive profits. Here, we set the zero or negative profits to 1 before taking logs. To deal with the data truncation problem, equation (4) is estimated using random-effects Tobit model and the results are reported in Table 4.

We find a negative and significant real exchange rate effect on firm profits and the effect is smaller for firms located farther away from the border. Higher Canadian sales taxes decrease profits, and this effect is larger for firms farther from the border in the overall retail sample and apparel and general retail, though smaller for grocery and gasoline retailers farther from the border. This is possibly because as sales tax changes are considered permanent and can significantly affect shopping decision for consumers residing in border regions, firms close to the border already may have adjusted employment in response to sales tax changes, reducing their impact on profits, while firms farther away from the border absorb the loss,

[9] Owing to data limitations, the only feasible productivity measure is labour productivity (measured by sales per worker). The inclusion of labour productivity in the sales and employment equations could result in an endogeneity problem, hence this variable was excluded from our earlier analysis.

[10] A more detailed discussion can be found in Good, Nadiri and Sickles (1997).

causing a larger reduction of profits. As in the case of sales, higher US tax rates decrease sales and this effect is larger for firms farther from the border, with the exception of grocery and gasoline retailers. We also see that our results indicate that profits are positively associated with the GDP of the adjacent state but the effect falls with distance from the border.

Turning our attention to the other control variables, profits are positively associated with firm productivity, size, firm age, relative provincial GDP, and industry sales (except for grocery and gasoline). Profits decrease with the real interest rate, industrial concentration (except for grocery and gasoline) and, surprisingly, with Canadian GDP (except for grocery and gasoline).

4.3 Firm Survival

We now turn our attention to the extensive margin, examining the effect of real exchange rate changes on firms' probability of survival. The equation estimated is specified as follows:

$$\Pr(Survive_{ft} = 1) = \Phi\left(\alpha + (\lambda_1 + \lambda_2 \ln d_{ft}) \ln ER_{it} + \gamma x_{ft-1} + \delta y_{it-1}\right) \tag{5}$$

where $Survive_{ft}$ is a 0-1 dummy variable that indicates firm survival at the end of year t. Independent variables are as described in previous sections. The equation is estimated using a probit model. When estimating a probit model, an important issue in the empirical implementation is to estimate the marginal effect of interaction terms. Ai and Norton (2003) and Norton et. al. (2004) discuss that in the case of non-linear models, the coefficients of the interaction terms may not correctly reflect the marginal effect. We compute the marginal effects in interaction terms using methods similar to the ones proposed in Norton et. al. (2004). The computation is summarized in appendix A. Table 5 reports the marginal effects of estimating equation (5).

The results indicate that for the entire retail trade sector and the grocery and gasoline sub-sample, the real exchange rate effect on firm probability of survival is positive. We find that there is little exchange rate effect on probability of survival for food and accommodation firms and a negative and significant impact on firms in apparel and general retail. Next, we examine if the exchange rate effect depends distance to the border. Like the direct effect, the results here are mixed. For all retail firms, appreciations increase the probability of survival and this effect is significantly smaller the farther the firm is located

from the border. The results indicate little association between distance to border and size of exchange rate effect for food and accommodation and apparel and general retail firms, while firms in the grocery and gasoline sector see a larger positive effect of currency appreciation on survival the farther they are from the border.

Results for the sales tax variables and their interaction with distance are mixed and not consistently significant. Survival is weakly positively affected by higher Canadian sales taxes, and this effect diminishes with distance from the border in the overall sample and in food and accommodation. Survival for firms in food and accommodation is negatively affected by higher US sales taxes, and this effect is mitigated as the firm gets farther from the border. Our results suggest that firm probability of survival is generally increased with higher labour productivity, larger firm size and higher real interest rates. Survival broadly declines with age, leverage, industrial concentration and relative provincial GDP, though most of these variables demonstrate some mixed signs and weak significance. Overall, our survival results are not strong, and are predominantly inconsistent with the predictions based on our theoretical motivation of cross-border shopping decisions. The exchange rate effect on firm survival will be further discussed in the next section.

Combined with our findings on firm size, these results suggest that firm adjustment to cross-border shopping is primarily along the intensive margin and profits, and that there is less adjustment related to cross-border shopping along the extensive margin.

5 Discussion

We have discussed the impact of real exchange rate movements on Canadian retailers through their effects on the relative price of *final* goods and services and therefore through the consumer cross-border shopping decision. However, there is at least one other channel by which the exchange rate can influence retailers. Canadian retailers sell a substantial amount of imported goods and a higher value of the Canadian dollar can make importing those goods cheaper. If this fall in the cost of inputs leads to a fall in retail prices, then this can mitigate the increase in the relative price of Canadian retail goods and services and lead to less cross-border shopping by Canadian consumers. Therefore, the negative exchange rate effect that we observe may be regarded as the net effect. Unfortunately, due to the lack of firm-level data on their

purchases of imported goods, it is difficult to isolate the effect of changing import prices specifically. To account for the effect of import price changes for goods imported from the US, we include the US Producer Price Index (PPI) multiplied by the nominal exchange rate as a control variable.[11] Table 6 summarizes the results of estimating equation (3) with the US PPI multiplied by the nominal exchange rate as one of the control variables. The coefficient estimates for the real exchange rate variable and for the real exchange rate-distance interaction term maintain the same sign and are (slightly) larger in magnitude for all retail firms, for food services and accommodation, and for apparel and general retail subsamples. The coefficient estimates for the import price control variable are negative and significant for all retail firms as well as for the subsamples of food services and accommodation and apparel and general retail, indicating that higher import prices cause a reduction in employment as it increases the cost of imported goods sold by Canadian retailers.

In addition, firms in metropolitan areas (that are usually within 100-150 KM away from the border) may be affected by factors such as changes in the city population and income. To address any differences between metropolitan and non-metropolitan areas, we also analyze a subset of firms located in non-metropolitan areas by excluding firms located in the Vancouver, Toronto and Montreal metropolitan areas. The results are qualitatively and quantitatively similar to the ones reported.[12]

6 Economic Significance

The empirical findings summarized in Section 4 indicate that a real appreciation of the Canadian dollar reduces the sales, employment and profits of Canadian retail firms and this effect is less pronounced for firms located farther away from the border. There are two important considerations that we have not yet addressed: the *economic* significance of the exchange rate effect and the magnitude at which the exchange rate effect diminishes as firms locate farther away from the border. To assess the economic significance for firms located different distances from the border, we calculate the predicted level of sales, employment and profits with different levels of the real exchange rate for a "fictitious" firm with different distances to the border and all other variables at their means. The calculations are based on estimating

[11] As the import price indexes for imports from the US to Canada in CANSIMII is available only for part of the period studied, we use US PPI converted to Canadian dollars as a proxy of import price from the US.

[12] Results without firms in metropolitan areas are available upon request.

equations (2), (3), and (4) and we compute the predicted values for firms located 1, 8, 25, 50, 100, 200 and 300 kilometres from the border.[13] These distances are chosen to roughly approximate the driving time estimates in Ford (1992).

Table 7 summarizes the predicted quantitative effect of real exchange rate movements on sales.[14] In the first row of each section, we report the predicted sales with the real exchange rate at the 1986 level - the beginning of our sample period. The second row reports the predicted sales with the real exchange rate at the 1991 level - the highest value of the Canadian dollar in our sample period and the third row reports the predicted sales with the real exchange rate at the 1997 level. The Canadian dollar appreciated in real terms by about 23% from 1986 to 1991 and then depreciated by about 20% from 1991 to 1997.[15] For each distance from the border, the table presents the predicted natural log of sales for each time period, the standard error of this estimate, and the percentage change from 1986 to 1991 and from 1991 to 1997 of the dollar value of sales. The first section of Table 7 summarizes the predicted value for all retail firms. For a retail firm located 1km from the border and with other independent variables at means, an increase in the real exchange rate from the 1986 level to the 1991 level reduces sales by 13.44%. The predicted reduction in sales caused by higher value of the Canadian dollar is approximately 2 percentage points smaller if the firm is located 300 kilometres from the border. Going from 1991 to 1997, we see a 20.6% increase in sales as the Canadian dollar depreciates for firms closest to the border and a 16.7% increase in sales for firms 300km away. From these results, we note that the effect of the exchange rate on the dollar value of sales is fairly substantial, and that this effect diminishes with distance from the border, though not dramatically.

The second section of the table reports the results for food and accommodation and the changes in sales are slightly smaller than for all retailers. The third section summarizes the results for for grocery and gasoline firms, and they are slightly larger than the results for all retailers. The last section presents the results for the most affected retail sector in our sample, firms in apparel and general retail. In all cases the effect of the exchange rate diminishes with distance. These firms see a significant sales reduction induced by higher values of the Canadian dollar and this reduction diminishes quite substantially as firms locate farther away from the border. A firm located 1km from the border faces a 23.4% reduction in

[13] We did the same calculations with other distances and those results are available from the authors upon request and are consistent with the trend shown here.

[14] The calculation is based on the coefficient estimates reported in columns 2-5, of Table 2.

[15] Source: Bank of Canada annual noon exchange rate averages.

sales when the Canadian dollar appreciates from its 1986 to 1991 levels, and a firm located 300 kilometres away from the border experiences only a 14.7% reduction - which is 63% of the size of the reduction faced by firms at the border. Similarly, when the exchange rate depreciates from its 1991 to 1997 levels, an apparel and general retail firm located 1km from the border sees a 41.1% increase in sales while an otherwise identical firm 300km away experiences only a 22.9% increase. For these firms, it would appear that sales adjustments based on exchange rate fluctuations are quite substantial, and strongly influenced by proximity to the border - suggesting a significant cross border shopping effect.

Turning our attention to employment adjustment, Table 8 summarizes the predicted real exchange rate effects on employment by distance to the border. For all retailers (top portion of the table), we see that the effects of the exchange rate on employment are noticeably smaller for employment than sales, although they diminish more quickly as firms locate farther from the border. Firms closest to the border see a 8.2% loss of employment in the appreciation period, and a 11.6% gain in employment during a depreciation. Firms 300km away see an effect approximately half that size, losing 4.3% of employees as a result of appreciation and adding 5.8% more employees as a result of depreciation. Comparing the employment changes across industry groups, our results show that when there is a real appreciation of the Canadian dollar, grocery stores and gasoline stations face the largest changes in employment in response to exchange rate fluctuations while food services and accommodation firms encounter the smallest changes. The larger employment adjustment for grocery stores and gasoline stations may be related to the large portion of part-time employees and high employee turnover rates in these industries. A firm in the grocery and gasoline sector located 1km from the border experiences a 14.8% reduction in employment going from 1986 to 1991 exchange rate levels, while an otherwise identical firm located 300 kilometres for the border experiences an employment contraction approximately 1/3 that size (5.8%). During a depreciation, the firm closest to the border adds 23% more employees while a firm 300km away adds only 8%.

Table 9 presents the predicted real exchange rate effects on profits. The changes in profits in response to different levels of the exchange rate are quite substantial, and diminish substantially as firms locate farther from the border. In the aggregate retail sector, firms located 1km from the border see profits contract by 56.2% going from 1986 values of the Canadian dollar to 1991 values. An otherwise identical firm 300km from the border experiences as 35% decline in profits. The difference resulting from currency depreciation is even more dramatic - a 192% increase in profits for a firm closest to the border and a 75%

increase for a firm 300km away. Like the case of sales, apparel and general retail is the most affected subsector, followed by grocery and gasoline and then food and accommodation. For apparel and general retail, firms located 300 kilometres away from the border experience exchange rate effects almost 3 times smaller than firms at the border when the exchange rate depreciates. During an appreciation (going from 1986 to 1991) firms 1km from the border see their profits contract 63.7% while firms 300km away experience a 42% reduction in profits.

Overall, our findings suggest that the real exchange rate effect has substantial implications for the sales, employment and profits of retail firms. The largest adjustment is in profits, suggesting that firms absorb a considerable portion of an exchange rate shock in their mark-ups, followed by sales and then employment. In all cases, the effect of the exchange rate noticeably diminishes as firms locate farther from the border.

7 Conclusion

This paper has empirically investigated the impact of swings in the bilateral real exchange rate between the U.S. and Canada on Canadian retail firms. We are particularly interested in the possibility that exchange rate movements can influence consumer decisions to shop across the Canada-US border and that this, in turn, affects the demand facing Canadian retailers. The results in Campbell and Lapham (2004) suggest that such a demand shock induced by real exchange rate fluctuations cause retail industries located in border counties to adjust the number of establishments and the average size of the establishments. Studying the sales of alcohol in Sweden, Asplund et al (2007) find that the sensitivity of sales to foreign price diminishes with distance to the border but the effect extends to inland regions. As most Canadian cities are located within 300 kilometres of the Canada-US border, adjustments of Canadian retail firms to demand shocks can be an interesting lens through which to observe the impact of changes in relative prices (including those caused by nominal exchange rate changes) on the behaviour of retail firms in different industries. This paper investigated three important empirical issues: (1) the relative importance of the extensive and intensive margins as channels by which retail industries adjust to demand shocks; (2) when a substantial portion of firms are located within 300 kilometres from the border, the extent of an industry-wide impact; and (3) the rate at which the magnitude of the exchange rate effect diminishes

for retailers located farther from the border and whether this rate varies across industries.

Using detailed firm-level data that covers all incorporated Canadian retail firms that hire employees, we are able to examine exchange rate effects for all retail firms and three industry groups that are most likely to be affected by cross-border shopping. Our empirical results suggest that there are significant and negative effects of higher values of the Canadian dollar on Canadian retailers' sales, employment and profits. The size of the exchange rate effects diminishes as firms are farther away from the border. The negative association between distance to border and the size of the exchange rate effects indicates that the exchange rate effect on retail firms is likely to be associated with consumer cross-border shopping decisions. Our findings also show that the speed at which the exchange rate effect diminishes depends on the variable and industry of interest. The size of the exchange rate effect on employment diminishes at a strikingly faster speed as compared to effect on sales and profits. A surprising empirical finding is that our results indicate a small positive effect of the exchange rate on firm survival but our time period of study was one in which there was significant restructuring of the Canadian retail industry and so this result requires further investigation.

Appendix

A Interaction Effects

Since we face the case of four interaction terms, we modify the one-interaction term case derived in Ai and Norton (2003) and Norton et. al. (2004) to incorporate additional interaction terms. Consider the case of four interaction terms: distance-exchange rate, distance-Canadian sales tax, distance-US sales tax and distance-adjacent state GDP growth. For simplicity, we use x to represent independent variables that are related to the interaction terms and use j or k to index these variables. Specifically, x_1 denotes distance, x_2 the exchange rate, x_3 Canadian sales tax, x_4 US sales tax and x_5 GDP growth of adjacent US states. Equation (5) can be specified alternatively as:

$$\Pr(survive_{ft} = 1) = \Phi\left(\sum_{j=1}^{5} \theta_j x_j + \sum_{j=2}^{5} \theta_{1j} x_1 x_j + \gamma x_f + \delta y_i\right) = \Phi(.) \tag{6}$$

where t is dropped for simplicity, $\Phi(.)$ is standard normal cumulative distribution and $x_1 x_j, j = 2, 3, 4, 5$ denote the term interacting distance with the exchange rate ($j = 2$), Canadian sales tax ($j = 3$), US sales tax ($j = 4$) and GDP growth of adjacent US states ($j = 5$).[16] x_f and y_i denote control variables that are not related to the interaction terms. The interaction effect should be the cross derivative of function $\Phi(.)$ Thus, the interaction effect of distance (x_1) and x_k should be specified as:

$$\frac{\partial^2 \Phi(.)}{\partial x_1 \partial x_k} = \theta_{1k}\Phi'(.) + (\theta_1 + \sum_{j=2}^{5} \theta_{1j} x_j)(\theta_k + \theta_{1k} x_1)\Phi''(.),\ k = 2, 3, 4, 5. \tag{7}$$

According to Ai and Norton (2003) and Norton et al (2004), most of the packaged commands in statistics softwares treat the interaction terms as one variable, not a product of two. As a result, the reported marginal effect only contains the first term on the right hand side. However, the interaction effect should contain an additional term, $(\theta_1 + \sum_{j=2}^{5} \theta_{1j} x_j)(\theta_k + \theta_{1k} x_1)\Phi''(.)$. Using equation (7), we estimate the correct marginal effects of interaction terms for the case of four interaction terms.[17]

As distance is interacted with the other four variables, the direct marginal effect of distance should

[16] Here, coefficients of key variables are denoted by θ instead of β as used in the previous sections because the notations are changed for convenience of presentation.

[17] Equation (7) is a modified version of equation (2) of Ai and Norton (2003).

also be affected by the level of the variables that distance is interacted with. Therefore, the marginal effect of distance should be specified as:

$$\frac{\partial \Phi(.)}{\partial x_1} = (\theta_1 + \sum_{j=2}^{5} \theta_{1j} x_j)\Phi'(.). \tag{8}$$

It follows that the marginal effect of the exchange rate, Canadian sales tax, US sales tax and GDP growth of adjacent states can be specified as:

$$\frac{\partial \Phi(.)}{\partial x_k} = (\theta_k + \theta_{1k} x_1)\Phi'(.), \;\; k = 2, 3, 4, 5. \tag{9}$$

Equations (8) and (9) are used to estimate the marginal effect of distance, the exchange rate, distance, Canadian sales tax, US sales tax and GDP growth of adjacent US states.[18] The results of estimating equations (7) to (9) are reported in Table 5.

[18]The specification of marginal effects of distance, the exchange rate, sales taxes, and GDP growth of adjacent US states in equations (8) and (9) are similar to the expression discussed in Brambor et al (2005)

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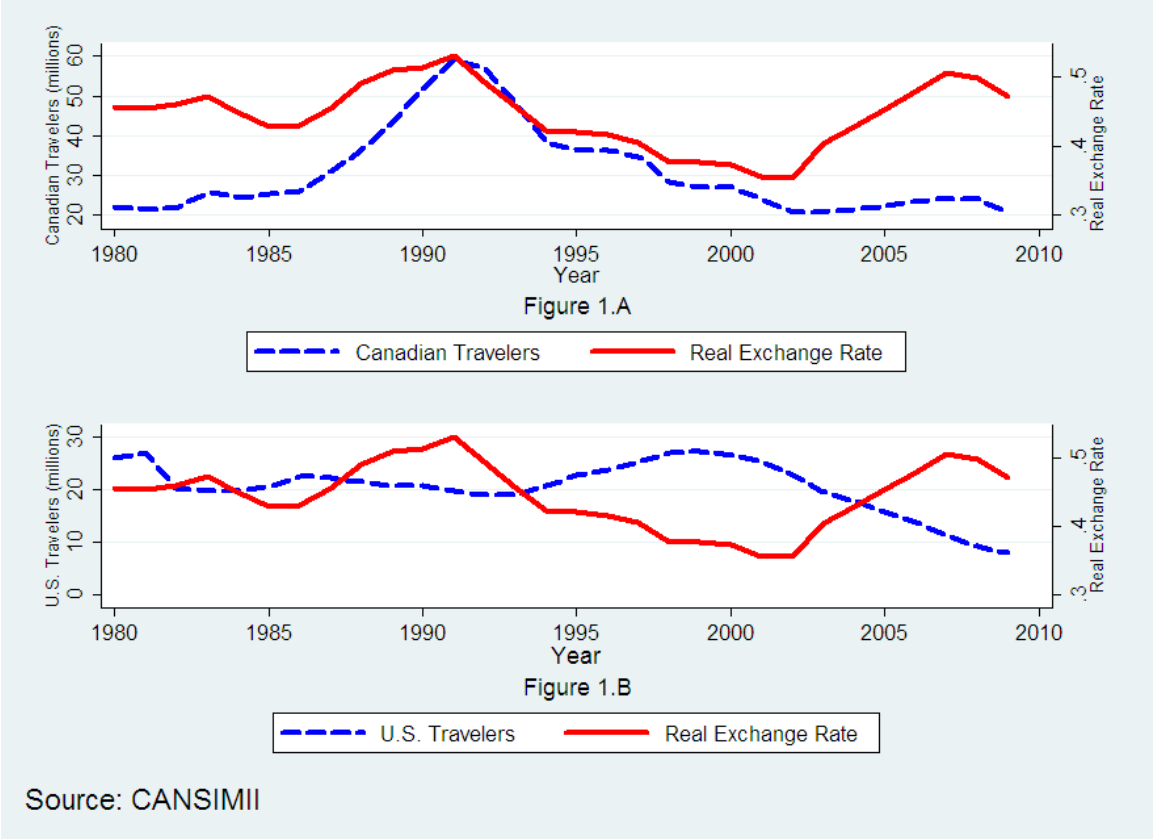

Figure 1: Real Exchange Rate Movements and Same Day Cross-Border Trips

Table 2: Firm Sales

Model: Panel Regression with Fixed Effect

	ALL Retail Firms		Food Services and Accommodation	Grocery Stores and Gasoline Stations	Apparel and General Retail
	(1)	(2)	(3)	(4)	(5)
Exchange Rate	-0.650**	-0.754**	-0.634**	-0.962**	-1.388**
= ln(ER_{it})	(0.014)	(0.037)	(0.068)	(0.100)	(0.129)
Exchange Rate*Distance		0.023**	0.027*	0.040*	0.098**
		(0.007)	(0.014)	(0.020)	(0.024)
Canadian Sales Tax	-0.289**	-0.654**	-1.251**	-2.951**	-1.072*
= ln(1+GST+PST)	(0.056)	(0.147)	(0.249)	(0.722)	(0.457)
US Sales Tax	-0.409	-1.813+	-3.220*	7.379	-4.233+
= ln (1+Tax)	(0.319)	(0.927)	(1.407)	(5.566)	(2.304)
Canadian Sales Tax*Distance		0.078**	0.075	0.382*	0.062
		(0.030)	(0.050)	(0.149)	(0.092)
US Sales Tax*Distance		0.305	0.337	-1.403	0.397
		(0.188)	(0.293)	(1.247)	(0.516)
Distance	0.132**	0.160**	0.167+	-0.042	0.108
=ln(Distance)	(0.050)	(0.051)	(0.087)	(0.135)	(0.166)
Real Interest Rate	-0.006**	-0.006**	0.004**	-0.003	-0.007**
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Leverage	0.053**	0.053**	0.026**	0.103**	0.037**
ln (Leverage in year t-1)	(0.004)	(0.004)	(0.005)	(0.010)	(0.012)
Size Category	0.335**	0.335**	0.314**	0.366**	0.348**
	(0.004)	(0.004)	(0.006)	(0.009)	(0.015)
Age	0.059**	0.059**	0.008	0.063**	0.141**
ln(age in years)	(0.004)	(0.004)	(0.006)	(0.009)	(0.014)
Industrial Concentration	-0.573**	-0.573**	-0.845**	-0.226*	0.334**
3-digit CR4 (year t-1)	(0.027)	(0.027)	(0.083)	(0.092)	(0.062)
Industry Sales	0.236**	0.236**	0.323**	0.075*	-0.032
ln(sales in t-1), 3-digit SIC	(0.012)	(0.012)	(0.047)	(0.035)	(0.029)
Canadian GDP	1.457**	1.450**	0.604**	1.539**	2.004**
=ln(Canadian GDP in year t-1)	(0.048)	(0.048)	(0.117)	(0.086)	(0.194)
Relative Provincial GDP	0.331**	0.331**	0.264**	0.194*	0.578**
	(0.041)	(0.041)	(0.085)	(0.085)	(0.147)
GDP of Adjacent State	0.069**	0.086**	0.080*	0.018	0.069
= ln(State GDP in year t-1)	(0.021)	(0.022)	(0.036)	(0.058)	(0.084)
GDP of Adjacent State*Distance	-0.009*	-0.013**	-0.014+	0.003	-0.009
	(0.004)	(0.004)	(0.008)	(0.012)	(0.014)
Time Trend	YES	YES	YES	YES	YES
=1 if year=86, =12 if year=97					
Firm Fixed-Effects	YES	YES	YES	YES	YES
Provincial Fixed Effects	YES	YES	YES	YES	YES
Observations	918891	918891	243588	162551	77160
R-squared	0.085	0.086	0.095	0.098	0.148

Robust standard errors (corrected for clustering at the firm level) in parentheses

** significant at 1% level. * significant at 5% level. + significant at the 10% level.

Table 3: Firm Employment

Model: Panel Regression with Fixed Effects

	ALL Retail Firms		Food Services and Accommodation	Grocery Stores and Gasoline Stations	Apparel and General Retail
	(1)	(2)	(3)	(4)	(5)
Exchange Rate	-0.273**	-0.444**	-0.142**	-0.834**	-0.305**
= $\ln ER_{it}$	(0.011)	(0.029)	(0.055)	(0.072)	(0.116)
Exchange Rate*Distance		0.038**	-0.000	0.091**	0.026
		(0.006)	(0.011)	(0.014)	(0.022)
Canadian Sales Tax	0.288**	-0.300**	-1.395**	-1.265**	-1.177**
=ln(1+GST+PST)	(0.043)	(0.116)	(0.209)	(0.368)	(0.406)
US Sales Tax	1.843**	2.975**	0.479	8.558*	3.194
=ln(1+ Sales Tax)	(0.211)	(0.553)	(1.011)	(4.362)	(2.213)
Canadian Sales Tax*Distance		0.128**	0.209**	0.203**	0.261**
		(0.023)	(0.042)	(0.075)	(0.079)
US Sales Tax*Distance		-0.249*	-0.119	-0.873	-0.553
		(0.116)	(0.204)	(0.846)	(0.441)
Distance	0.073*	0.082*	0.009	0.031	-0.100
=ln(Distance in t)	(0.035)	(0.035)	(0.065)	(0.072)	(0.121)
Real Interest Rate	-0.011**	-0.011**	-0.019**	0.003*	-0.029**
=Canadian prime rate in year t	(0.000)	(0.000)	(0.001)	(0.002)	(0.002)
Leverage	-0.046**	-0.046**	-0.043**	-0.023**	-0.061**
=ln(leverage in t-1)	(0.002)	(0.002)	(0.004)	(0.006)	(0.008)
Size Category	0.430**	0.430**	0.414**	0.397**	0.501**
	(0.003)	(0.003)	(0.005)	(0.006)	(0.014)
Age	0.071**	0.071**	0.011*	0.054**	0.130**
ln(age in years)	(0.003)	(0.003)	(0.005)	(0.007)	(0.013)
Industrial Concentration	-0.221**	-0.223**	-0.523**	0.275**	0.163**
3-digit CR4 (year t-1)	(0.021)	(0.021)	(0.076)	(0.062)	(0.053)
Industry Sales	0.079**	0.079**	0.305**	-0.111**	-0.173**
ln(sales in t-1), 3-digit SIC	(0.010)	(0.010)	(0.043)	(0.023)	(0.026)
Canadian GDP	0.754**	0.751**	-0.152	1.323**	1.837**
=ln(Canadian GDP in year t-1)	(0.037)	(0.037)	(0.098)	(0.061)	(0.169)
Relative Provincial GDP	-0.077**	-0.075**	0.057	-0.001	0.109
	(0.025)	(0.025)	(0.038)	(0.050)	(0.091)
GDP of Adjacent State	0.038**	0.037*	0.028	0.033	-0.041
= ln(State GDP in year t-1)	(0.015)	(0.015)	(0.028)	(0.031)	(0.059)
GDP of Adjacent State*Distance	-0.006*	-0.006+	-0.001	-0.001	0.008
	(0.003)	(0.003)	(0.006)	(0.006)	(0.011)
Time Trend	YES	YES	YES	YES	YES
=1 if year=86, =12 if year=97					
Firm Fixed-Effects	YES	YES	YES	YES	YES
Provincial Fixed Effects	YES	YES	YES	YES	YES
Observations	919496	919496	243764	162623	77208
R-squared	0.108	0.108	0.131	0.109	0.159

Robust standard errors (corrected for clustering at the firm level) in parentheses

** significant at 1% level. * significant at 5% level. + significant at the 10% level.

Table 4: Firm Profit

Model: Panel Tobit with Random Effects

	ALL Retail Firms		Food Services and Accommodation	Grocery Stores and Gasoline Stations	Apparel and General Retail
	(1)	(2)	(3)	(4)	(5)
Exchange Rate	-2.643**	-4.313**	-2.784**	-4.986**	-5.288**
= $\ln ER_{it}$	(0.027)	(0.069)	(0.146)	(0.158)	(0.261)
Exchange Rate*Distance		0.360**	0.416**	0.319**	0.429**
		(0.014)	(0.029)	(0.029)	(0.050)
Canadian Sales Tax	-0.537**	0.249	-5.246**	-4.207**	0.685
=ln(1+GST+PST)	(0.103)	(0.241)	(0.554)	(0.641)	(0.765)
US Sales Tax	-0.386	-2.872**	-22.347**	4.955+	-15.730**
=ln(1+ Sales Tax)	(0.246)	(0.716)	(2.040)	(2.569)	(2.783)
Canadian Sales Tax*Distance		-0.143**	-0.563**	0.551**	-0.479**
		(0.046)	(0.102)	(0.123)	(0.134)
US Sales Tax*Distance		0.483**	2.847**	-1.707**	2.131**
		(0.146)	(0.401)	(0.563)	(0.540)
Real Interest Rate	-0.017**	-0.017**	-0.034**	-0.003	-0.005
=Canadian prime rate in year t	(0.002)	(0.002)	(0.004)	(0.005)	(0.005)
Distance	0.097**	0.180**	0.251**	0.060	0.176+
=ln(Distance in t)	(0.034)	(0.036)	(0.083)	(0.068)	(0.103)
Labour Productivity	0.529**	0.529**	0.548**	0.576**	0.541**
= $\ln(sales_{t-1}/alu_{t-1})$	(0.003)	(0.003)	(0.008)	(0.007)	(0.010)
$-\ln(sales_{85}/alu_{85})$					
Size Category	0.803**	0.802**	0.772**	0.853**	0.855**
	(0.005)	(0.005)	(0.010)	(0.010)	(0.015)
Age	0.035**	0.036**	-0.058**	0.000	0.036*
ln(age in years)	(0.005)	(0.005)	(0.011)	(0.010)	(0.016)
Industrial Concentration	-1.123**	-1.133**	0.352**	2.315**	0.107
3-digit CR4 (year t-1)	(0.032)	(0.032)	(0.095)	(0.197)	(0.086)
Industry Sales	0.268**	0.268**	0.211**	-1.100**	-0.000
ln(sales in t-1), 3-digit SIC	(0.006)	(0.006)	(0.015)	(0.070)	(0.019)
Canadian GDP	-0.493**	-0.427**	-5.712**	0.866**	-0.323
=ln(Canadian GDP in year t-1)	(0.094)	(0.094)	(0.225)	(0.187)	(0.374)
Relative Provincial GDP	0.264**	0.273**	0.427**	0.045	0.169**
	(0.021)	(0.021)	(0.047)	(0.040)	(0.056)
GDP of Adjacent State	0.046**	0.046**	0.148**	0.015	0.158**
= ln(State GDP in year t-1)	(0.013)	(0.015)	(0.036)	(0.027)	(0.044)
GDP of Adjacent State*Distance	-0.007*	-0.007*	-0.017*	0.004	-0.013
	(0.003)	(0.003)	(0.008)	(0.006)	(0.009)
Time Trend	YES	YES	YES	YES	YES
=1 if year=86, =12 if year=97					
Industry Fixed-Effects	YES	YES	YES	YES	YES
Provincial Fixed Effects	YES	YES	YES	YES	YES
Observations	922350	922350	244787	163212	77412
Log Likelihood	-1.604e+06	-1.603e+06	-433398	-276197	-129282

Robust standard errors (corrected for clustering at the firm level) in parentheses
** significant at 1% level. * significant at 5% level. + significant at the 10% level.

Table 5: Firm Probability of Survival

Model: Probit

	ALL Retail Firms		Food Services and Accommodation	Grocery Stores and Gasoline Stations	Apparel and General Retail
	(1)	(2)	(3)	(4)	(5)
Exchange Rate	0.022**	0.022**	0.008	0.031**	-0.036*
= $\ln ER_{it}$	(0.003)	(0.003)	(0.006)	(0.008)	(0.016)
Exchange Rate*Distance		-0.002**	0.008	0.012**	-0.004
		(0.002)	(0.005)	(0.004)	(0.009)
Canadian Sales Tax	0.037**	0.044**	-0.001	0.053*	0.02
=ln(1+GST+PST)	(0.008)	(0.010)	(0.020)	(0.026)	(0.044)
US Sales Tax	-0.015	-0.026	-0.097**	0.06	-0.051
=ln(1+ Sales Tax)	(0.014)	(0.018)	(0.037)	(0.069)	(0.079)
Canadian Sales Tax*Distance		-0.019**	-0.024*	-0.013	-0.002
		(0.005)	(0.010)	(0.011)	(0.022)
US Sales Tax*Distance		0.035**	0.125**	-0.101**	0.075
		(0.010)	(0.020)	(0.040)	(0.043)
Distance	-0.0004	-0.0004	-0.002*	-0.001	-0.004
=ln(Distance in t-1)	(0.0003)	(0.0005)	(0.0010)	(0.0010)	(0.0030)
Real Interest Rate	0.003**	0.003**	0.003**	0.001	0.002
=Canadian prime rate in year t	(0.0003)	(0.0003)	(0.0010)	(0.0010)	(0.0010)
Labour Productivity	0.016**	0.016**	0.017**	0.014**	0.027**
$= \ln(sales_{t-1}/alu_{t-1})$	(0.0004)	(0.0004)	(0.0010)	(0.0010)	(0.0020)
$- \ln(sales_{85}/alu_{85})$					
Size Category	0.028**	0.028**	0.029**	0.030**	0.029**
	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)
Age	-0.012**	-0.012**	-0.017**	-0.014**	-0.014**
ln(age in years)	(0.0004)	(0.0004)	(0.0010)	(0.0010)	(0.0020)
Leverage	-0.032**	-0.032**	-0.026**	-0.029**	-0.047**
=ln(leverage in t-1)	(0.001)	(0.001)	(0.001)	(0.002)	(0.004)
Industrial Concentration	-0.033**	-0.033**	-0.020**	0.051**	-0.021**
3-digit CR4 (year t-1)	(0.002)	(0.002)	(0.006)	(0.020)	(0.009)
Industry Sales Growth	0.005	0.005	-0.033**	0.013**	0.025*
sales growth in 3-digit SIC	(0.003)	(0.003)	(0.005)	(0.005)	(0.010)
Canadian GDP	0.013**	0.015	-0.033	-0.036	0.052
=ln(Canadian GDP in year t-1)	(0.015)	(0.015)	(0.028)	(0.035)	(0.066)
Relative Provincial GDP	-0.021**	-0.019**	-0.012	-0.05	0.079
	(0.015)	(0.015)	(0.026)	(0.036)	(0.056)
GDP Growth of Adjacent State	-0.01	-0.009	-0.032	0.013	-0.028
= State GDP Growth in year t-1	(0.014)	(0.014)	(0.025)	(0.032)	(0.053)
GDP of Adjacent State*Distance	0.021**	0.015**	0.029*	-0.004	0.021
	(0.008)	(0.008)	(0.014)	(0.018)	(0.030)
Industry Fixed-Effects	YES	YES	YES	YES	YES
Provincial Fixed Effects	YES	YES	YES	YES	YES
Observations	1046795	1046795	215025	145891	89419
Log Likelihood	-229822	-229813	-70098	-44338	-22310

Marginal effects are reported.
Robust standard errors (corrected for clustering at the firm level) in parentheses
** significant at 1% level. * significant at 5% level. + significant at the 10% level.

Table 6: Firm Employment (with USPPI)

Model: Panel Regression with Fixed Effects

	ALL Retail Firms	Food Services and Accommodation	Grocery Stores and Gasoline Stations	Apparel and General Retail
	(1)	(2)	(3)	(4)
Exchange Rate	-0.476**	-0.170**	-0.696**	-1.181**
= $\ln ER_{it}$	(0.032)	(0.058)	(0.077)	(0.137)
Exchange Rate*Distance	0.038**	0.000	0.091**	0.036
	(0.006)	(0.011)	(0.014)	(0.022)
Canadian Sales Tax	-0.285*	-1.452**	-1.419**	-0.600
=ln(1+GST+PST)	(0.116)	(0.207)	(0.368)	(0.413)
US Sales Tax	3.012**	0.449	8.564*	3.199
=ln(1+ Sales Tax)	(0.553)	(1.011)	(4.366)	(2.209)
Canadian Sales Tax*Distance	0.128**	0.207**	0.203**	0.247**
	(0.023)	(0.042)	(0.075)	(0.079)
US Sales Tax*Distance	-0.251*	-0.114	-0.872	-0.558
	(0.116)	(0.204)	(0.845)	(0.439)
Distance	0.082*	0.010	0.031	-0.094
=ln(Distance in t)	(0.035)	(0.065)	(0.072)	(0.121)
US PPI in Cdn Dollar	-0.056**	-0.085**	0.178**	-0.993**
=ln(US PPI in t-1)	(0.021)	(0.032)	(0.036)	(0.075)
Real Interest Rate	-0.012**	-0.021**	0.007**	-0.043**
=Canadian prime rate in year t	(0.000)	(0.001)	(0.002)	(0.002)
Leverage	-0.046**	-0.043**	-0.023**	-0.060**
=ln(leverage in t-1)	(0.002)	(0.004)	(0.006)	(0.008)
Size Category	0.430**	0.414**	0.397**	0.499**
	(0.003)	(0.005)	(0.006)	(0.014)
Age	0.070**	0.011*	0.055**	0.136**
ln(age in years)	(0.003)	(0.005)	(0.007)	(0.013)
Industrial Concentration	-0.227**	-0.539**	0.275**	0.198**
3-digit CR4 (year t-1)	(0.021)	(0.077)	(0.062)	(0.053)
Industry Sales	0.080**	0.310**	-0.112**	-0.210**
ln(sales in t-1), 3-digit SIC	(0.010)	(0.043)	(0.023)	(0.025)
Canadian GDP	0.778**	-0.190*	1.152**	2.803**
=ln(Canadian GDP in year t-1)	(0.040)	(0.097)	(0.068)	(0.190)
Relative Provincial GDP	-0.074**	0.059	-0.000	0.104
	(0.025)	(0.038)	(0.050)	(0.091)
GDP of Adjacent State	0.037*	0.027	0.034	-0.043
= ln(State GDP in year t-1)	(0.015)	(0.028)	(0.031)	(0.059)
GDP of Adjacent State*Distance	-0.006+	-0.001	-0.001	0.007
	(0.003)	(0.006)	(0.006)	(0.011)
Time Trend =1 if year=86, =12 if year=97	YES	YES	YES	YES
Firm Fixed-Effects	YES	YES	YES	YES
Provincial Fixed Effects	YES	YES	YES	YES
Observations	919496	243764	162623	77208
R-squared	0.108	0.131	0.109	0.161

Robust standard errors (corrected for clustering at the firm level) in parentheses

** significant at 1% level. * significant at 5% level. + significant at the 10% level.

Table 7: Predicted Exchange Rate Effect on Sales by Distance to the Border

	Predicted Value of ln *Sales*													
	1KM	Change (%)	8KM	Change (%)	25KM	Change (%)	50KM	Change (%)	100KM	Change (%)	200KM	Change (%)	300KM	Change (%)
All Retail Firms														
1986	6.118		6.156		6.179		6.192		6.205		6.218		6.225	
	(0.035)		(0.019)		(0.011)		(0.006)		(0.003)		(0.006)		(0.009)	
1991	5.974	-13.443	6.021	-12.646	6.049	-12.199	6.065	-11.935	6.081	-11.662	6.097	-11.397	6.106	-11.237
	(0.035)		(0.019)		(0.011)		(0.006)		(0.003)		(0.007)		(0.009)	
1997	6.161	20.575	6.196	19.137	6.217	18.365	6.229	17.904	6.241	17.433	6.254	16.976	6.261	16.707
	(0.035)		(0.019)		(0.011)		(0.006)		(0.003)		(0.006)		(0.009)	
Food and Accommodation														
1986	5.793		5.835		5.860		5.875		5.889		5.904		5.912	
	(0.058)		(0.032)		(0.018)		(0.010)		(0.007)		(0.012)		(0.017)	
1991	5.671	-11.441	5.724	-10.479	5.755	-9.941	5.774	-9.616	5.792	-9.299	5.810	-8.972	5.821	-8.771
	(0.059)		(0.033)		(0.018)		(0.011)		(0.008)		(0.013)		(0.017)	
1997	5.828	17.046	5.868	15.419	5.891	14.534	5.905	14.008	5.918	13.485	5.932	12.953	5.940	12.637
	(0.059)		(0.032)		(0.018)		(0.011)		(0.007)		(0.012)		(0.017)	
Grocery and Gasoline Stations														
1986	6.699		6.586		6.524		6.486		6.448		6.388		6.388	
	(0.248)		(0.176)		(0.162)		(0.166)		(0.178)		(0.213)		(0.213)	
1991	6.514	-16.831	6.417	-15.498	6.364	-14.760	6.331	-14.299	6.299	-13.843	6.267	-11.450	6.248	-13.116
	(0.249)		(0.176)		(0.162)		(0.166)		(0.179)		(0.199)		(0.213)	
1997	6.753	26.972	6.636	24.384	6.571	22.986	6.531	22.140	6.492	21.300	6.453	20.466	6.430	19.985
	(0.247)		(0.175)		(0.162)		(0.166)		(0.178)		(0.198)		(0.213)	
Apparel and General Retail														
1986	6.157		6.138		6.130		6.124		6.118		6.112		6.108	
	(0.103)		(0.057)		(0.032)		(0.018)		(0.010)		(0.020)		(0.028)	
1991	5.891	-23.348	5.911	-20.308	5.924	-18.584	5.931	-17.527	5.938	-16.448	5.945	-15.363	5.949	-14.717
	(0.104)		(0.058)		(0.033)		(0.020)		(0.012)		(0.020)		(0.028)	
1997	6.236	41.128	6.206	34.192	6.190	30.539	6.181	28.364	6.171	26.226	6.161	24.123	6.155	22.900
	(0.104)		(0.058)		(0.033)		(0.019)		(0.012)		(0.020)		(0.029)	

Standard errors (estimated using delta method) are reported in parentheses

Table 8: Predicted Exchange Rate Effect on Employment by Distance to the Border

Predicted Value of ln *Employment*

	1KM	Change (%)	8KM	Change (%)	25KM	Change (%)	50KM	Change (%)	100KM	Change (%)	200KM	Change (%)	300KM	Change (%)
All Retail Firms														
1986	1.975		1.973		1.973		1.973		1.973		1.972		1.972	
	(0.022)		(0.012)		(0.007)		(0.004)		(0.002)		(0.004)		(0.006)	
1991	1.890	-8.149	1.903	-6.761	1.912	-5.984	1.916	-5.522	1.921	-5.039	1.926	-4.572	1.928	-4.295
	(0.023)		(0.012)		(0.007)		(0.004)		(0.002)		(0.005)		(0.006)	
1997	2.000	11.639	1.994	9.494	1.992	8.329	1.990	7.638	1.988	6.930	1.986	6.247	1.985	5.844
	(0.022)		(0.012)		(0.007)		(0.004)		(0.002)		(0.004)		(0.006)	
Food and Accommodation														
1986	2.288		2.315		2.330		2.339		2.348		2.357		2.362	
	(0.040)		(0.022)		(0.013)		(0.007)		(0.005)		(0.008)		(0.011)	
1991	2.261	-2.693	2.288	-2.693	2.303	-2.703	2.312	-2.713	2.321	-2.722	2.330	-2.713	2.335	-2.713
	(0.040)		(0.003)		(0.013)		(0.008)		(0.006)		(0.009)		(0.012)	
1997	2.296	3.593	2.323	3.603	2.338	3.614	2.347	3.624	2.356	3.634	2.365	3.634	2.371	3.634
	(0.041)		(0.023)		(0.013)		(0.008)		(0.005)		(0.008)		(0.011)	
Grocery and Gasoline Stations														
1986	2.335		2.267		2.230		2.208		2.185		2.163		2.150	
	(0.197)		(0.134)		(0.111)		(0.104)		(0.103)		(0.110)		(0.117)	
1991	2.175	-14.760	2.144	-11.609	2.127	-9.832	2.116	-8.735	2.106	-7.624	2.096	-6.499	2.090	-5.842
	(0.197)		(0.134)		(0.111)		(0.103)		(0.103)		(0.110)		(0.117)	
1997	2.382	22.986	2.304	17.339	2.261	14.351	2.235	12.581	2.209	10.816	2.183	9.101	2.168	8.112
	(0.197)		(0.134)		(0.111)		(0.104)		(0.103)		(0.110)		(0.117)	
Apparel and General Retail														
1986	1.859		1.814		1.789		1.774		1.759		1.743		1.735	
	(0.077)		(0.043)		(0.025)		(0.014)		(0.009)		(0.015)		(0.021)	
1991	1.800	-5.673	1.766	-4.706	1.746	-4.171	1.734	-3.844	1.723	-3.517	1.711	-3.188	1.704	-2.985
	(0.077)		(0.043)		(0.026)		(0.159)		(0.011)		(0.015)		(0.021)	
1997	1.876	7.864	1.829	6.449	1.801	5.675	1.785	5.211	1.769	4.739	1.753	4.279	1.744	4.008
	(0.078)		(0.044)		(0.025)		(0.015)		(0.010)		(0.016)		(0.022)	

Standard errors (estimated using delta method) are reported in parentheses

Table 9: Predicted Exchange Rate Effect on Profits by Distance to the Border

Predicted Value of $\ln Profit$

	1KM	Change (%)	8KM	Change (%)	25KM	Change (%)	50KM	Change (%)	100KM	Change (%)	200KM	Change (%)	300KM	Change (%)
All Retail Firms														
1986	4.126		4.104		4.094		4.088		4.081		4.074		4.070	
	(0.020)		(0.012)		(0.008)		(0.006)		(0.005)		(0.006)		(0.007)	
1991	3.300	-56.216	3.421	-49.470	3.490	-45.343	3.531	-42.673	3.572	-39.872	3.613	-36.928	3.637	-35.144
	(0.022)		(0.013)		(0.009)		(0.007)		(0.006)		(0.007)		(0.008)	
1997	4.370	191.567	4.306	142.177	4.273	118.759	4.252	105.649	4.231	93.305	4.210	81.702	4.198	75.242
	(0.021)		(0.012)		(0.008)		(0.007)		(0.006)		(0.007)		(0.008)	
Food and Accommodation														
1986	3.773		3.769		3.770		3.770		3.769		3.768		3.768	
	(0.050)		(0.030)		(0.021)		(0.016)		(0.014)		(0.016)		(0.018)	
1991	3.239	-41.327	3.401	-30.768	3.493	-24.187	3.548	-19.884	3.602	-15.346	3.657	-10.542	3.689	-7.596
	(0.051)		(0.031)		(0.022)		(0.018)		(0.017)		(0.018)		(0.020)	
1997	3.930	99.551	3.878	61.027	3.852	43.161	3.835	33.282	3.818	24.098	3.801	15.523	3.791	10.783
	(0.053)		(0.032)		(0.022)		(0.017)		(0.015)		(0.016)		(0.019)	
Grocery and Gasoline Stations														
1986	3.974		3.913		3.880		3.860		3.840		3.819		3.808	
	(0.116)		(0.070)		(0.050)		(0.043)		(0.043)		(0.050)		(0.056)	
1991	3.019	-61.515	3.085	-56.295	3.122	-53.144	3.144	-51.110	3.166	-48.998	3.189	-46.789	3.201	-45.458
	(0.119)		(0.072)		(0.051)		(0.045)		(0.044)		(0.051)		(0.057)	
1997	4.256	244.595	4.158	192.268	4.104	167.059	4.071	152.768	4.039	139.265	4.006	126.483	3.987	119.328
	(0.117)		(0.071)		(0.051)		(0.044)		(0.044)		(0.050)		(0.056)	
Apparel and General Retail														
1986	4.726		4.589		4.516		4.471		4.425		4.380		4.354	
	(0.066)		(0.040)		(0.027)		(0.021)		(0.018)		(0.020)		(0.023)	
1991	3.713	-63.676	3.747	-56.902	3.768	-52.674	3.780	-49.898	3.791	-46.964	3.803	-43.848	3.810	-41.946
	(0.065)		(0.040)		(0.029)		(0.024)		(0.026)		(0.023)		(0.025)	
1997	5.025	271.434	4.838	197.636	4.737	163.610	4.675	144.856	4.613	127.436	4.551	111.235	4.514	102.304
	(0.074)		(0.045)		(0.031)		(0.025)		(0.021)		(0.023)		(0.026)	

Standard errors (estimated using delta method) are reported in parentheses