# **Investigations into the US-Canadian Price Gap**

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#### Abstract

This paper examines the U.S.-Canadian Price Gap by analyzing the common currency relative retail price of several homogenous and tradable goods over the period 2001-early 2013, during which the Canadian dollar appreciated. These goods are agricultural and basic grocery goods, which we gathered from the US Bureau of Statics and Statistic Canada. Good prices for both countries have an increasing trend, but the US prices in Canadian dollars were pushed down by the exchange rate. In spite of decades of increasing integration between the two countries, we document the fact that the law of one price continues to fail for the analyzed food products between U.S. and Canada. Further, we find that the increased competitive pressure associated with a stronger Canadian dollar has not resulted in lower Canadian prices, in fact the prices have increased, thus reflecting a complete lack of exchange-rate pass-through. We use linear regressions to further the analysis based on a mark-up pricing model at the retail sector. We find three factors that especially contribute to the increase of Canadian prices. These factors are the pricing of the manufacturing sector (or the base input sector), wages, and demand. First, the increasing manufacturing sector price increases the cost of inputs, inputs being the food products, which eventually impacts the retail prices. Second, the Canadian wages are increasing, which add cost at the wholesale and retail stages. This increases the marginal cost of both the retail and the manufacturing sector. Third, demand has been steadily increasing over the decade pushing prices up further in part due to an increased mark-up at the manufacturing level. Arbitrage should be offsetting these factors, but curiously it has not been occurring enough to affect the Canadian prices. The Canadian grocery market is in a game of how far prices can be inflated before arbitrage occurs.

**Keywords: Exchange Rate, Price Gap, International Relations** 

#### 1. Introduction:

Cross-border shopping has pervaded the Canadian economy and culture. Canadians can get cheaper prices on many goods in the US. These goods range from clothing to groceries. One Canadian website has an article devoted to how to make the most of cross-border grocery shopping. Canadian shoppers may be outraged with the recent, dramatic changes in price difference. In 2002 Canadians were paying 9% less for their food goods, however, by 2012 Canadians were paying 57% more than Americans for the same set of food goods. Over the same period, the Canadian dollar has greatly appreciated to become near or on par with the US dollar worth, yet Canadian consumers are still paying higher prices for basic goods. The goal of this paper is to examine how and why there is such an enduring price gap between the US and Canada.

#### 2. Relvant Literature

Over the last decade, the Canadian dollar appreciation should have lowered the relative price of Canadian goods with respect to the same goods in the United States, but this has not been the case. Prices in Canada have remained stubbornly high; this violates an important principle in economics, the law of one price. There are two versions of this principle. There is the absolute law of one price, which states that the same good in two different countries will be the same price after adjusting for changes in the exchange rate. However, in this paper, we focus on a broader definition - that is the relative law of one price. According to it, the price of the same good in two different countries will vary proportionally after adjusting for changes in the exchange rate.

Much research has been conducted on the breakdown of international price adjustments and the law of one price. Engel and Rogers<sup>3</sup> conducted research comparing the effect of distance on the price of the same good, including the difference in pricing between US and Canada. They compared price differences of 14 goods in different cities. By comparing prices in US and Canada, they found that cities across the border from each other will have larger price differences than cities the same distance apart in the same country. Their research suggests market segmentation between US and Canada. Rogers and Jenkins <sup>4</sup>conducted research into what may cause the price different between countries. They focused on a comparison between the US and Canada as well as several other OCED countries. For food products, they concluded that sticky prices are the primary source of the differences in price. *Sticky prices* is a term used to describe the sluggishness of a market or a firm to respond to changes that would affect prices. Just like Engel and Rogers, they find that Canadian cities further from the border have higher prices.

Market power allows for the creation of segmented markets. This is well documented in several studies. Pick and Park <sup>5</sup> examined the US agricultural exports. They found price discrimination against Canadian markets for the four agricultural goods studied. They report there is market power present in the international agricultural trade and that large multinational exporting firms dominate the market for chartering and shipping services. Rangan et al. <sup>6</sup> examined the responsiveness of multinational corporations to exchange rate fluctuation. These firms do not always experience the effects of the exchange rate. Rather, they use their profits to cushion against any changes that the exchange rate will have on their prices. Baldwin and Yan<sup>7</sup> had similar findings for manufacturing firms in Canada and the US. These industries did not reflect the exchange rate fluctuations. They conclude that the exporters and industries have market power and are able to adjust to the changing exchange rate, not by adjusting prices, but by squeezing or swelling their profit margins in the short-run. This enables these firms to effectively block competitors. Exporters and other multi-national industries with market power do not adjust to the exchange rate. They have large enough profit margins where they can make profits without adjusting prices.

#### 3. Data

All our data is measured monthly from the January 2001 to April 2013. Analyzing this data over a large time period allowed us to see the effects of a changing exchange rate. The data is on a national scale. We used raw price data of 18 standard grocery goods from both countries. This data is gathered from the Consumer Price Index data from Statistics Canada<sup>8</sup> and the United States' Bureau of Labor Statistics<sup>9</sup>. Both institutions' data is the shelf-price the consumer would see. It is collected from retailers across the country and adjusted for differences in sizes and quality. Each good was selected from a larger list of possible goods because it had a counterpart in the other country, ensuring that the selected goods are homogenous. These goods are listed in their own country's currency. We also collected monthly exchange rate data in \$CAN/\$US.

We also gathered data on Canadian factors that could affect the price gap in order to deepen the analysis. Once again all data was measured monthly from January 2001 to April 2013. We collected data for factors that affect the marginal cost for the retailers and their mark-up, which are described in the next paragraphs.

The marginal cost for the retailers is accounted for using the industry price indexes and wage rates. We collected data on industry price indexes by different categories that fit specifically seven goods and were good proxies for the other eleven goods analyzed. These indices measure the price the retailers would pay for the goods to the food manufacturers. Note that the indexes do not account for the cost of transportation service beyond the factory gate and any distribution services performed by the retail or wholesale trade industries. We used the Canadian food retail wage rate to account for change in labor costs.

Mark-up is affected by the demand for food in conjunction with the structure of the industry. Two determinants of that demand are employee compensation and age of the demographic. Employee compensation is defined as total

benefits, measured in thousands of dollars, per worker, not just covered by wage. The data clearly shows a strong and consistent positive trend in employee compensation over the decade. This variable should account for potential income effects that could have contributed to the non-declining trend of Canadian prices over the decade. To account for potential shifts in taste among the population, we gathered demographic data on the number of people over 55 in Canada (55+year demographic variable) as well as the number of people between 15 and 24 of age. Canadian population is aging and the tastes and preferences of the populace could have changed over time. We also include ages 15-24 demographic to see if the dwindling youth population is having an effect of prices via changes potential in demand.

The structure of the industry is important to control for, since it can modify the magnitude of the markup. We test for market concentration or market power using a variable that we refer to as *ratiolargesales*. Its computed as the ratio of large retailer sales to small retailer sales. The large retailers are 80 large retailers of Canada. They are the largest retail enterprises for their industry. The other retailers are smaller grocery store chains and independent stores that do not include convenience stores. This variable can be used to determine the level of market concentration as it provides the preponderance of large firms in the Industry.

As the entry of larger retailers take place, their sales will also grow at the expense of the other firms, thereby increasing their share of the market with the consequences that it entails. It is not clear, however, that an increasing ratio mean higher prices since larger firms can also benefit from substantial economies of scope and scale.

### 4. Models

We use two different models for our analysis of the price gap between the US and Canada. The first model tests if the relative law of one price holds between the two markets. The second model expands on the first model by controlling for a larger set of variables that may affect the price gap. Unless otherwise mentioned, all variables used in the following regressions were first transformed using the logarithmic transform. As a convention, lowercase letters are used when a given variable is in log form but uppercase letters are used otherwise. Because of this log-log setup, coefficients should be interpreted as elasticities. In all cases, the dependent variable is the price gap defined as the log of the Canadian price minus the log of the US price converted in Canadian dollar, that is

$$Gap = p_{CAN} - p_{US} - er.$$

4.1 First Model: Relative Law of One Price:

$$Gap_{t} = \alpha_{0} + \alpha_{1}er + \alpha_{2}p_{US} + \varepsilon_{t}$$

$$\tag{1}$$

Recall that the variables are in log format so the  $\alpha$  are the elasticity of the variables with respect to the price gap.  $\alpha_0$  is the constant er is the exchange rate, and  $p_{US}$  is the price of the US good and  $\varepsilon$  is an error term. If the relative law of one price held, then the price gap would be zero and coefficients of all the variables would be zero, the variables' changes should have no effect on the price gap in any way. Conversely, if the coefficients are not zero then the relative law of one price does not hold between these two countries.

4.2 Second Model: Expanded Multivariate Regression:

$$Gap_{t} = \alpha_{0} + \alpha_{1}S_{t} + \alpha_{2}r_{t} + \alpha_{3}C_{t} + \alpha_{4}y_{t} + \alpha_{5}l_{t} + \alpha_{6}Si_{t} + \alpha_{7}O_{t} + \alpha_{8}er_{t} + \alpha_{9}p_{us(t)} + \varepsilon_{t}$$

$$(2)$$

This is an expansion of the first model. More controls are added in order to more precisely examine what affects the price gap at the retail level. Once again the  $\alpha$ 's are the elasticity of the variables with respect to the price gap. According to economic theory, the product of markup and marginal cost determines the price of a good. In other terms, applying this logic to the price of food in Canada yields P = MARKUP \* MC, MC being marginal cost. Alternatively, in log form, we get  $p_{can} = markup + mc$ , implying that the price gap depends on any factor that affects either the markup or the marginal cost of food retailers. The above equation is set up so that the variables that

affect the markup of retailers are first, and the variables that are part of the marginal cost of retailers are second. The variable s represents the importance of large retailers variable. We do this to observe the effect that market concentration at the retailing stage has on the price gap. c is total employee compensation per worker in real terms. Recall that this figure is for all employees of any industry and includes more than just the hourly wages paid. We use this variable to determine the effect demand may have on the market. Both s and s are age variables. s is for the total population over the age of 55. Canada has an aging population. s is for the total population between the ages 15-24. This is to measure the shrinking youth population and its effect on the gap.

These variables are part of the marginal costs of a grocery store. r is the retail wage rate for grocery stores. Importantly, si is the specific wholesale price index. We use different price indices depending on the type of good. There are nine indices that we use for the eighteen goods. This variable is also a part of the marginal cost effects we are examining on the price gap. This measures the effect a changing US good price has on the price gap. o is the price of oil. This is used to represent transportation costs.  $\varepsilon$  is the error variable.

### 5. Regression Analysis

### 5.1 Relative Law of One Price

The relative law of one price regression results are presented in Tables 1 & 2. The exchange rate coefficient is negative and statistically significant at the 1% level for all goods. This means that for every 10% increase in the exchange rate there is about a 10% decrease in the price gap. If the price gap fully mirrors the changes in the exchange rate this means that the exchange rate is having no effect on the Canadian prices. All of the exchange rate coefficients are statistically significant, which goes against the properties they would have if the relative law of one price held. The US price coefficient is also negative and statistically significant at the 1% level for almost all of the goods. Half of the goods have coefficients ranging from .9-1.1. Therefore, a 10% increase in US price leads to a 10% decrease in the price gap. Again, since the entire change is reflected in the price gap, the US price for these goods has no effect on the Canadian price. Of the other goods, the estimates on round steak, bacon, sugar, and banana are all in the .7 and .8 neighborhoods with statistically significance at the 1% level.

Table 1. the first eight goods using the relative law of one price regression

	Round Steak	Sirloin Steak	Stewing Beef	Ground Beef	Bacon	Butter	Flour	Banana	Grapefruit
Exchange Rate	-0.901***	-1.072***	-1.044***	-0.972***	-1.035***	-0.936***	-1.088***	-0.769***	-1.097***
	(0.0905)	(0.145)	(0.102)	(0.0824)	(0.0917)	(0.0528)	(0.0919)	(0.0930)	(0.202)
US Price	-0.860***	-0.915***	-0.968***	-0.963***	-0.741***	-1.012***	-0.669***	-0.757***	-0.110
	(0.0632)	(0.0611)	(0.0444)	(0.0680)	(0.0644)	(0.0110)	(0.0556)	(0.110)	(0.0900)
Constant	0.00209	0.00197	0.00258	0.00465**	0.00108	0.00285***	0.00108	0.00215	-0.000338
	(0.00163)	(0.00254)	(0.00195)	(0.00191)	(0.00171)	(0.000919)	(0.00185)	(0.00234)	(0.00451)
Observations	147	147	147	147	147	130	147	147	145
R-squared	0.707	0.715	0.819	0.720	0.671	0.976	0.703	0.471	0.147

Note: For all tables robust standard errors in parentheses \*\*\* p<.01, \*\* P<.05, \* p<.1

Table 2. The Second Eight Goods Using The Relative Law Of One Price Regression

	Orange	Potato	Sugar	Pork Chop	Chicken	Processed Cheese	Eggs	Orange Juice	Peanut Butter
Exchange Rate	-0.848***	-1.266***	-1.003***	-0.987***	-0.938***	-0.882***	-0.976***	-1.017***	-0.999***
	(0.238)	(0.368)	(0.0529)	(0.0808)	(0.0785)	(0.0704)	(0.0495)	(0.0644)	(0.146)
US Price	-1.090***	-0.197	-0.758***	-0.801***	-0.926***	-1.018***	-1.009***	-0.992***	-0.0419**
	(0.0535)	(0.195)	(0.0810)	(0.0984)	(0.0974)	(0.0531)	(0.0173)	(0.0692)	(0.0205)
Constant	0.00424	-0.00164	0.000923	0.000766	0.00313*	0.00118	0.00359***	0.00178	0.000755
	(0.00655)	(0.00554)	(0.00133)	(0.00170)	(0.00170)	(0.00122)	(0.00108)	(0.00149)	(0.00212)
Observations	128	147	147	147	147	147	147	147	128
R-squared	0.768	0.153	0.714	0.600	0.644	0.796	0.967	0.745	0.459

### 5.2 Multivariate Regression

The second regression results are presented in Tables 3 & 4. The most notable result from these regressions is that the effects of the exchange rate and US price are not diminished.

Both the exchange rate and the US price have elasticities close to 1. The price gap still increases and decreases at the same rate as the US price and exchange rate. This suggests that the additional variables included in these regressions are not the cause behind the failure of the law of one price. This confirms that the markets are very segmented by the border. Despite this, it is instructive to examine the role of these additional variables on the gap.

The demand variables, importance of large retailers, employee compensation, total population over 55, and total population between the ages 15-24, do not have much effect on the price. The importance of large retailers variable has coefficients all floating around 0 with only 2 statistically significant values. The increasing market concentration is not a reason for the increasing price gap, which suggests that large retailers are able to compete with lower prices. The compensation is only statistically significant for two goods. The changing demographic and its demands contribute very little to the price gap overall. Turning to the marginal cost variables, the retail wage rate does not have any effect on the gap except for chicken. The specific index has seven statistically significant coefficients, but most of the coefficients could be statistically the same as .1 or .2, suggesting that retailers have a limited ability to pass on higher prices to consumers. This conclusion combined with the exchange rate and US price elasticity suggests that the two markets of the US and Canada are very segmented. The inclusion of the most important determinants of pricing within Canada did not get us closer to the law of one price. This suggests that the origin of the incomplete pass-through of the exchange rate is due to a lack of arbitrage between the prices between the two countries, not within Canada.

Table 3. The First Eight Goods Of The Multivariate Regression.

	Round Steak	Sirloin Steak	Stewing Beef	Ground Beef	Bacon	Butter	Flour	Bananas	Grapefruit
Importance of Large Retailers	-0.0510*	-0.0122	-0.00549	0.000811	-0.0185	-0.00893	-0.0411*	-0.0247	0.0880
	(0.0276)	(0.0336)	(0.0293)	(0.0264)	(0.0269)	(0.0117)	(0.0243)	(0.0301)	(0.0653)
Employee Compensation	0.319	-1.062***	-0.0807	-0.153	-0.274	-0.0214	0.242	-0.289	-0.491
_	(0.349)	(0.308)	(0.467)	(0.580)	(0.234)	(0.116)	(0.221)	(0.272)	(0.639)
Age 15-24 Population	-1.430	1.757	-0.195	-1.250	0.678	1.604	-0.940	-1.301	7.255
	(3.366)	(5.118)	(3.686)	(3.708)	(3.905)	(2.221)	(3.765)	(4.835)	(9.256)
Age 55over Population	-12.08*	1.247	-12.95**	-15.52**	3.995	-2.752	6.213	-9.010	30.99*
	(6.392)	(6.609)	(6.056)	(6.145)	(5.871)	(2.508)	(5.715)	(7.914)	(16.31)
Oil Price	-0.0320	0.0567	-0.0130	-0.0304	0.0158	0.0285**	0.0314	0.00373	0.0628
	(0.0204)	(0.0343)	(0.0258)	(0.0239)	(0.0221)	(0.0127)	(0.0238)	(0.0434)	(0.0569)
Retail Wage	0.0657	0.117	-0.0960	-0.124	0.0455	0.0599	0.0175	-0.186	0.574
	(0.162)	(0.301)	(0.172)	(0.167)	(0.229)	(0.0782)	(0.218)	(0.263)	(0.434)
Specific Index	0.323**	0.0899	0.380**	0.138**	-0.0297	0.145*	0.0946	-0.0767	-0.0224
	(0.129)	(0.148)	(0.156)	(0.0632)	(0.0457)	(0.0807)	(0.142)	(0.423)	(0.767)
Exchange Rate	- 1.019***	-0.910***	- 1.111***	-1.038***	- 0.977***	-0.893***	1.051***	- 0.757***	-0.928***
	(0.119)	(0.145)	(0.133)	(0.0934)	(0.106)	(0.0514)	(0.103)	(0.119)	(0.232)
US Price	- 0.905***	-0.916***	- 0.965***	-0.978***	- 0.753***	-1.012***	- 0.712***	- 0.761***	-0.151*
	(0.0588)	(0.0628)	(0.0441)	(0.0527)	(0.0684)	(0.0103)	(0.0529)	(0.114)	(0.0907)
Constant	0.0347*	-0.000693	0.0378**	0.0478***	-0.00958	0.00865	-0.0158	0.0284	-0.0887*
	(0.0177)	(0.0187)	(0.0167)	(0.0167)	(0.0164)	(0.00686)	(0.0154)	(0.0220)	(0.0453)

Table 4. the second eight goods of the multivariate regression.

	Orange Juice	Potatoes	Sugar	Pork Chops	Chicken	Processed Cheese	Eggs	Oranges	Peanut Butter
The Importance of Large Retailers	0.0298	-0.0383	-0.00750	0.00835	-0.0136	0.0558***	-0.0148	0.0519	-0.000608
	-0.021	(0.0589)	(0.0174)	(0.0273)	(0.0259)	(0.0177)	(0.0133)	(0.110)	(0.0327)
Employee Compensation	-0.0893	-0.619	-0.0212	-0.527*	0.329	-0.0999	0.0964	-0.204	0.490
	(0.193)	(0.599)	(0.191)	(0.270)	(0.205)	(0.157)	(0.118)	(0.966)	(0.370)
Age 15-24 Population	0.843	6.140	-3.568	1.077	1.673	2.546	-2.791	27.37*	1.857
	(3.226)	(11.87)	(3.282)	(4.348)	(4.022)	(3.186)	(2.655)	(13.95)	(4.836)
Age 55over Population	-2.461	7.939	5.367	2.935	7.337	3.405	-1.723	13.00	-1.460
	(6.424)	(19.02)	(4.811)	(6.480)	(5.764)	(3.959)	(3.218)	(27.61)	(7.655)
Oil Price	0.0239	-0.0350	-0.0198	-0.0189	0.0117	0.0101	0.0170	-0.0697	0.00877
	(0.0202)	(0.0913)	(0.0157)	(0.0260)	(0.0263)	(0.0123)	(0.0129)	(0.0786)	(0.0352)
Retail Wage	0.0253	-0.311	0.0117	-0.0172	0.445***	-0.0555	-0.166	-0.0869	-0.153
	(0.137)	(0.533)	(0.120)	(0.155)	(0.157)	(0.113)	(0.101)	(0.643)	(0.266)
Specific Index	0.296	1.076	0.186**	0.0388	0.00747	0.114	0.178**	0.934	-0.555**
	(0.271)	(1.005)	(0.0746)	(0.0415)	(0.114)	(0.143)	(0.0798)	(1.133)	(0.253)
Exchange Rate	- 0.957***	- 1.296***	- 1.060***	- 1.013***	- 0.917***	-0.853***	-0.966***	- 0.960***	-0.996***
	(0.0841)	(0.380)	(0.0574)	(0.108)	(0.0930)	(0.0758)	(0.0584)	(0.314)	(0.177)
US Price	- 0.975***	-0.227	- 0.791***	- 0.792***	- 0.936***	-1.005***	-1.014***	- 1.091***	-0.0478**
	(0.0704)	(0.223)	(0.0808)	(0.105)	(0.101)	(0.0579)	(0.0177)	(0.0578)	(0.0222)
Constant	0.00724	-0.0264	-0.0118	-0.00660	-0.0193	-0.00945	0.00989	-0.0498	0.00419
	(0.0177)	(0.0531)	(0.0122)	(0.0177)	(0.0163)	(0.0108)	(0.00899)	(0.0765)	(0.0214)

### 6. Conclusion

The US and Canada are each other's largest agricultural trading partner. The North American Free Trade Agreement, commonly known as NAFTA, has been hailed for eliminating barriers to trade and investment between U.S., Canada, and Mexico. Signed in 1994, the agreement has had plenty of time for results to be seen in the three economies. The Canadian dollar's decade of appreciation to almost par with the US dollar, should have integrated the goods' prices between the two countries. Our research has found the opposite. Even with a decade to adjust, the Canadian prices do not reflect the increased strength of the Canadian dollar; the prices have remained stagnant or became even slightly higher due to changes in other Canadian specific variables. The point is that neither the US price nor the exchange rate has any effect on the Canadian price. The price gap between the two countries cannot be attributed to any demand or marginal cost differences that may occur between the two countries. Market power would explain this segmentation between markets. We found that it is not the Canadian retailers' market power increasing the prices. Even the Canadian manufacturers prices do not have much impact on the Canadian good price. There is a lack of arbitrage between the two countries. Arbitrage occurs when a firm takes advantage of a large price difference to enter a market and undercut competition prices. In other words, why hasn't a firm bought US goods and sold them in Canada for less than the Canadian price but more than the US price for a tidy profit? A lack of arbitrage would be expected for a short-term examination, but not for an examination lasting a decade like ours. This suggests the market power could be inherent between the US exporters and the Canadian importers likely because of the muted market's natural response to over-inflated prices, i.e. no grey markets. After examining the US-Canadian price gap, rather than integration of markets, we found that the US and Canadian markets are very segmented.

Canada should investigate both US and Canada exporters and importers for signs of market power. It should implement policies that make it harder for companies to price to market. As far as domestic policy recommendations, we agree with Nicolas Li's recommendations. He recommends that Canada should increase competition within its own country to lower the prices. The elimination of quota systems, license requirements, for dairy, poultry and egg producers would allow free-entry into these markets. Free-entry is key for a competitive market. Li also suggests that Canada should implement policies that encourage foreign businesses to invest and enter the Canada manufacturer's market would also help. Encouraging more entry into that market will create more market competition.

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