Gasoline Empirical Analysis:

Update of Four Elements of the January 2001 Conference Board study:

"The Final Fifteen Feet of Hose: The Canadian Gasoline Industry in the Year 2000"

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Executive Summary

In its examination of the Canadian petroleum market, the Competition Bureau collected price data and conducted an empirical study to test whether the large price increases observed in the spring and summer of 2004 were the results of anti-competitive acts. In particular, the analysis of the Competition Bureau focused on four questions:

a. What is the relationship between Canadian wholesale prices and crude oil prices?
b. What is the relationship between Canadian wholesale prices and American wholesale prices?
c. What is the relationship between retail prices and wholesale prices?
d. Do retail prices change asymmetrically with wholesale price increases or decreases?

This empirical work conducted by the Competition Bureau provides no indication of a deterioration of the competitiveness of the Canadian petroleum market conditions and suggest that the high prices observed in the spring and summer of 2004 were simply the results of particular market conditions. Specifically, the empirical results indicate that there is no unusual pricing behaviour in the Canadian gasoline industry that would support a claim of anti-competitive behaviour.

1. Introduction

On May 4, 2004 the Bureau commenced an examination of the Canadian petroleum market to determine whether recent increases in retail gasoline prices may have resulted from a breach of the *Competition Act*. One of the measures undertaken by the Bureau was to obtain data on retail gasoline, wholesale gasoline and crude oil prices and to determine if the price fluctuations observed in the summer of 2004 were the results of competitive forces or some other factors.

The data analysis has been based on the Conference Board study, 'The Final Fifteen Feet of Hose: The Canadian Gasoline Industry in the Year 2000', released in February 2001 and sponsored by Industry Canada and Natural Resources Canada.

In particular, the analysis of the Bureau focused on four questions:

a. What is the relationship between Canadian wholesale prices and crude oil prices?
b. What is the relationship between Canadian wholesale prices and American wholesale prices?
c. What is the relationship between retail prices and wholesale prices?
d. Do retail prices change asymmetrically with wholesale price increases or decreases?

The next section describes the econometric tests that were conducted, presents the results obtained and offers some comments on our findings. Section 3 provides our general conclusion.

2. Methodology and Results

The empirical tests were conducted for 10 cities across Canada: Saint John, Halifax, Quebec City, Montreal, Ottawa, Toronto, Winnipeg, Regina, Calgary and Vancouver. For each of these cities, we have obtained monthly retail prices from MJ Ervin and monthly wholesale prices from Bloomberg for unleaded regular gasoline. Crude oil prices and American wholesale prices were also obtained from Bloomberg. All prices are expressed in Canadian cents per litre (cpl) and do not include taxes. All Canadian price series and crude oil price series are from January 1996 to November 2004 (107 observations) while all American price series are from January 1998 to November 2004 (83 observations).

a. What is the relationship between Canadian wholesale prices and crude oil prices?

In determining the wholesale-crude oil relationship,[1] in particular during the period of May 2004 to August 2004 when Canadian wholesale prices increased substantially and reached levels of up to 50 cpl, we initially identified key crude oil prices. Based on the discussion found in the Conference Board study regarding the industry structure upstream (p. 1 to 3), we used the West Texas Intermediate Cushing Crude Oil Spot Price for eastern cities and the price of crude oil in Edmonton for western cities.

We then estimated the following equation

$$\Delta W_{it} = \beta_1(\Delta C_t) + \beta_2(\Delta C_{t-1}) + \varepsilon_{it}$$

where ΔW_{it} is the change in the current Canadian wholesale price in city *i* over a one-month period; ΔC_t is the change in the current crude oil price associated with city *i* over a one-month period; ΔC_{t-1} is the change in the crude oil price associated with city *i* over a one-month period lagged by one month; ε_{it} is an error term; and β_1 and β_2 are the coefficients that need to be estimated. We also added a dummy variable to detect whether the relationship between Canadian wholesale prices and crude oil prices changed during the May 2004 to August 2004 period.

The estimations were conducted by Ordinary Least Squares on a city-by-city basis using monthly data from January 1996 to November 2004. The lag on the crude oil price was included to account for the possibility that crude oil prices in the previous month may have an influence on current Canadian wholesale prices. All prices are in Canadian cents per litre (cpl) and do not include tax.

The results are illustrated in Table 1 where t-statistics are in parentheses below the estimated coefficients. We find that current crude oil prices are significant for all cities and that lagged crude oil prices are significant only for western cities. The sum of the coefficients is around 1.2 for eastern cities, 1.35 for cities in the Prairies, and 1.5 for Vancouver. Thus, a one cpl increase (decrease) over a one month period in the crude oil price results in more than a one cpl increase (decrease) in Canadian wholesale prices.

In addition, during the period of May 2004 to August 2004, a change in the relationship was observed for eastern cities and Vancouver but not for cities in the Prairies. This is illustrated in Table 2 (where we only report results for cities that experienced a change in the relationship). During this period of time, wholesale prices in Saint John, Halifax, Quebec, Montreal, Ottawa, Toronto and Vancouver did not increase as much as crude oil prices. The overall effect of a one cent per litre increase (decrease) in the price of crude oil over a one month period resulted in less than a 0.7 cent per litre increase (decrease) in the wholesale prices in those cities during the period of May 2004 to August 2004.

Stated differently, the empirical analysis suggests that wholesale margins decreased in Saint John, Halifax, Quebec, Montreal, Ottawa, Toronto and Vancouver during the period of May 2004 to August 2004. Although wholesale margins also decreased in the Prairies, the change was not statistically significant.

To add confidence to our findings, we tested whether a change in the dummy variable affects our results. For instance, using a dummy that takes a value of one from March 2004 to August 2004 rather than from May 2004 to August 2004 does not change significantly our results. Although the coefficients associated with the variable $\Delta C_{t-1} * D$ are somewhat smaller and become non-significant for Vancouver, the sums of

[1]Since crude oil is the primary input into the production of gasoline, we expect a close and positive relationship between Canadian wholesale prices and crude oil prices.

coefficients found in Table 2 remain less than 1.

As a comparison, the Conference Board study tests the relationship between the wholesale price in New York and the West Texas Intermediate price of crude oil during the period of February 1993 to April 1999. There, it was found that "... a one cent per litre increase (decrease) in the price of crude oil... causes an increase (decrease) of slightly more than one cent per litre in the price of U.S. wholesale gasoline." (p. 59)

As such, our results are similar to those obtained by the Conference Board.[2] They are also similar to the results presented in the Competition Bureau report released May 5, 2003, "Update of Four Elements of the January 2001 Conference Board Study: 'The Final Fifteen Feet of Hose: The Canadian Gasoline Industry in the Year 2000'" where the relationship between Canadian wholesale prices and crude oil prices was tested between January 1991 to March 2003.

As such, we have great confidence in our findings as they are very close to those found in two other studies using different time period and data.

One final point should be mentioned. The large reaction of wholesale prices to crude oil prices is somewhat surprising. Indeed, traditional models of oligopoly behaviour would predict a reduction in margins after an increase in the price of an input; in our case, this would imply that the sum of the estimated coefficients should be less than one. A reason that may explain our results is that the empirical model we use is too simple (recall that the adjusted R^2 we obtain, while higher than the one obtained by the Conference Board, are relatively small). For instance, key variables, such as inventory levels or production adjustment costs, that could have some explanatory power were not included. Another reason is that there may be a difference between the observed rack price and the actual transaction price.

[2]Note that the adjusted R^2 in Tables 1 and 2 are larger than the one obtained in the Conference Board study indicating that our model performs better than the one of the Conference Board. The adjusted R^2 is a measure of goodness-of-fit. It takes a value between 0 and 1, and it measures the proportion of the total variation in the variable we are trying to explain accounted for by variation in the explanatory variables. The closer the value of the adjusted R^2 is to one, the better is the goodness-of-fit.

Table 1
Regressions Results of the Canadian Wholesale Prices on Crude Oil Prices

City	ΔC_t	ΔC_{t-1}	Sum[a]	Adjusted R^2
Saint John	1.207 (12.934)***	0.098 (1.007)	1.207	0.615
Halifax	1.188 (12.776)***	0.111 (1.148)	1.188	0.61
Quebec	1.209 (12.860)***	0.062 (0.634)	1.209	0.611
Montreal	1.207 (12.843)***	0.065 (0.662)	1.207	0.61
Ottawa	1.203 (12.805)***	0.081 (0.827)	1.203	0.609
Toronto	1.207 (12.290)***	0.078 (0.770)	1.207	0.59
Winnipeg	1.030 (9.642)***	0.319 (2.890)***	1.349	0.483
Regina	1.030 (9.659)***	0.317 (2.880)***	1.347	0.484
Calgary	1.031 (9.650)***	0.315 (2.857)***	1.346	0.483
Vancouver	0.922 (8.524)***	0.604 (5.409)***	1.526	0.48

[a] Sum of significant coefficients only
*** Indicates significance at the 1% level

Table 2
Regressions Results of the Canadian Wholesale Prices on Crude Oil Prices with Dummies
(Except for the Prairies)

City	ΔC_t	ΔC_{t-1}	$\Delta C_t * D$	$\Delta C_{t-1} * D$	Sum[a]	Adjusted R^2
Saint John	1.166 (12.179)***	0.155 (1.573)	0.305 (0.893)	-0.789 (-1.965)*	0.377	0.629
Halifax	1.145 (12.008)***	0.167 (1.704)*	0.326 (0.958)	-0.768 (-1.920)*	0.544	0.624
Quebec	1.167 (12.084)***	0.117 (1.182)	0.321 (0.933)	-0.756 (-1.869)*	0.411	0.624
Montreal	1.166 (12.060)***	0.119 (1.195)	0.318 (0.921)	-0.738 (-1.821)*	0.428	0.622
Ottawa	1.161 (12.032)***	0.136 (1.375)	0.323 (0.939)	-0.760 (-1.880)*	0.401	0.623
Toronto	1.166 (11.537)***	0.135 (1.304)	0.308 (0.855)	-0.785 (-1.853)*	0.381	0.602
Vancouver	0.875 (7.919)***	0.660 (5.843)***	0.455 (1.094)	-0.863 (-1.771)*	0.672	0.499

[a] Sum of significant coefficients only
* Indicates significance at the 10% level
*** Indicates significance at the 1% level

b. What is the relationship between Canadian wholesale prices and American wholesale prices?

Beside crude oil prices, Canadian wholesale prices can also be influenced by American wholesale prices. In determining the Canada-U.S. relationship, in particular during the period of May 2004 to August 2004, we initially identified key American wholesale markets. Because of their proximity to Canadian cities, these American markets could potentially represent a disciplining force on Canadian wholesalers. Table 3 shows Canadian cities included in the current analysis as well as their American counterparts.[4]

We then estimated the following equation

$$\Delta W_{it}^{C} = \beta_1(\Delta W_t^{US}) + \beta_2(\Delta W_{t-1}^{US}) + \varepsilon_{it}$$

where ΔW_{it}^{C} is the change in the current Canadian wholesale price in city *i* over a one-month period; ΔW_t^{US} is the change in the current American wholesale price in the corresponding U.S. city over a one-month period; ΔW_{t-1}^{US} is the change in the previous month American wholesale price in the corresponding U.S. city over a one-month period; ε_{it} is an error term; and β_1 and β_2 are the coefficients that need to be estimated. We also added a dummy variable to detect whether the Canada-U.S. relationship changed during the May 2004 to August 2004 period.

The estimations were conducted by Ordinary Least Squares on a city-by-city basis using monthly data from January 1998 to November 2004. The lag on the American wholesale price was included to account for the possibility that American wholesale prices in the previous month may have an influence on current Canadian wholesale prices. All prices are in Canadian cpl and do not include tax.

Table 3
Pairing of Canadian Cities with American Cities

Canadian Cities	American Cities
Saint John	New York City
Halifax	New York City
Quebec	Albany
Montreal	Albany
Ottawa	Albany
Toronto	Buffalo
Winnipeg	Grand Forks
Regina	Grand Forks
Calgary	Grand Forks
Vancouver	Seattle

[4]The pairing of Canadian cities and American cities that we have chosen is similar to the pairing found in 'July 1999 Gasoline Price Increases: A Competition Bureau Examination Report'. It is important to note that the Conference Board relied solely on wholesale prices in New York. As such, our estimators should be better than the one used by the Conference Board.

The results are illustrated in Table 4 where t-statistics are in parentheses below the estimated coefficients. We find that current and lagged American wholesale prices are significant for all cities. The sum of the coefficients is lower than one for all cities. Thus, a one cpl increase (decrease) over a one-month period in wholesale prices in the United States results in less than a one cpl increase (decrease) in Canadian wholesale prices.

When testing the relationship between Canadian wholesale prices and the wholesale price in New York City over the period of May 1993 to April 1999, the Conference Board found that "The sum of the coefficients is close to one for most cities, with the exception of Calgary, Regina and Winnipeg." (p. 59)[5]

The closer relationship between Canadian wholesale prices and American wholesale prices found by the Conference board, when compared to our results, may be explained by changes in environmental regulations that took place in and after 2000 in both Canada and the United States making the market somewhat less integrated. These effects were not picked up in the Conference Board study given the time period covered by the analysis.

In addition, during the period of May 2004 to August 2004, a change in the relationship was only observed between Winnipeg, Regina, Calgary and Grand Forks. This is illustrated in Table 5 (where we only report results for cities that experienced a change in the relationship). During this period of time, wholesale prices in those Canadian cities were not as close to their American counterpart as usual. The average differential of -0.15 cpl turns into a differential of +0.28 cpl. Hence, during the period of May 2004 to August 2004, we find that a one cpl increase (decrease) in wholesale prices in Grand Forks resulted in more than a one cpl increase (decrease) in wholesale prices in Winnipeg, Regina and Calgary.

In other words, the empirical analysis suggests a fairly close relationship between Canadian wholesale prices and American wholesale prices. It also suggests that the relationship changed during the period of May 2004 to August 2004 but only in the Prairies. This may be explained by "... the greater difficulty in obtaining imported wholesale gasoline [in the Prairies] from the United States compared with the situation in eastern Canada and Vancouver" (Conference Board, p. 59); this may be especially true in period of short supply.

To add confidence to our findings, we tested whether a change in the dummy variable affects our results. Using a dummy that takes a value of one from March 2004 to August 2004 rather than from May 2004 to August 2004 does not change the results.

Finally, it must be noted that the structure of the Canada-U.S. relationship is different between eastern cities and western cities. The change in the current American wholesale price is larger for eastern cities than for western cities and the change in the lagged American wholesale price is negative for eastern cities while it is positive for western cities. This may be an indication that the North American wholesale gasoline markets are divided not along a North-South line but rather along an East-West line.

[5] It should be noted that the adjusted R^2 in Tables 4 and 5 are larger than those obtained in the Conference Board study. This is not surprising as our matching of cities is better than the one used by the Conference Board.

Table 4
Regressions Results of Canadian Wholesale Prices on American Wholesale Prices

City	ΔW_t^{US}	ΔW_{t-1}^{US}	Sum[a]	Adjusted R^2
Saint John	0.953 (22.153)***	-0.160 (-3.664)***	0.793	0.86
Halifax	0.945 (22.788)***	-0.153 (-3.633)***	0.792	0.866
Quebec	0.993 (39.698)***	-0.112 (-4.432)***	0.881	0.951
Montreal	0.992 (39.664)***	-0.110 (-4.342)***	0.882	0.951
Ottawa	0.993 (39.985)***	-0.102 (-4.072)***	0.891	0.952
Toronto	1.063 (44.189)***	-0.204 (-8.374)***	0.859	0.961
Winnipeg	0.599 (14.792)***	0.252 (6.191)***	0.851	0.745
Regina	0.599 (14.761)***	0.252 (6.169)***	0.851	0.744
Calgary	0.560 (14.829)***	0.251 (6.166)***	0.811	0.745
Vancouver	0.592 (16.903)***	0.169 (4.830)***	0.761	0.79

[a] Sum of significant coefficients only
*** Indicates significance at the 1% level

Table 5
Regressions Results of Wholesale Prices in the Prairies on Wholesale Prices in Grand Forks

City	ΔW_t^{US}	ΔW_{t-1}^{US}	$\Delta W_t^{US} * D$	$\Delta W_{t-1}^{US} * D$	Sum[a]	Adjusted R^2
Winnipeg	0.569 (14.262)***	0.262 (6.514)***	0.455 (2.834)***	-0.087 (-0.551)	1.286	0.768
Regina	0.569 (14.229)***	0.262 (6.490)***	0.456 (2.832)***	-0.086 (-0.547)	1.287	0.767
Calgary	0.570 (14.296)***	0.261 (6.485)***	0.454 (2.830)***	-0.085 (-0.543)	1.285	0.768

[a] Sum of significant coefficients only
*** Indicates significance at the 1% level

c. What is the relationship between Canadian retail prices and Canadian wholesale prices?

In determining the relationship between Canadian retail prices and Canadian wholesale prices, we estimated the following equation

$$\Delta R_{it} = \beta_1(\Delta W_{it}) + \beta_2(\Delta W_{it-1}) + \beta_3(\Delta W_{it-2}) + \beta_4[(R_{it-1} - W_{it-1}) - (R_i - W_i)^*] + \varepsilon_{it}$$

where ΔR_{it} is the change in the retail price over a one-month period in city i; ΔW_{it} is the change in the wholesale price over a one-month period in city i; ΔW_{it-1} and ΔW_{it-2} are the changes in the wholesale price over a one-month period in city i lagged by one and two months, respectively; $[(R_{it-1} - W_{it-1}) - (R_i - W_i)^*]$ is an error-correction term for city i that is explained below; ε_{it} is an error term; and, $\beta_1, \beta_2, \beta_3$ and β_4 are the coefficients that need to be estimated.

The intuition behind this equation is that changes in retail prices should be influenced by changes in wholesale prices and by retail margins. Indeed, if retailers are operating with low margins, the change in retail price in reaction to a change in wholesale price may differ when compared to situations where retail margins are high.[6] For instance, if retail margins are high (low) and wholesale prices increase by one cpl, then retailers may adjust retail prices by less (more) than one cpl.

To capture this potential effect, the error-correction term was included in the estimations. It represents the difference between the one-period lag of the retail margin and what is referred to as the market outcome margin. The market outcome margin is a measure of average margins over periods where retail margins generally moved in the same direction (i.e., increased, decreased or remained constant). Given the intuition outlined above, the sign of the error-correction term should be negative. For example, if retail margins were high (when compared to their average over a given period of time) in the previous month, then an increase in wholesale prices should result in a small increase in current retail prices when compared to a situation where retail margins were low in the previous month.

The estimations were conducted by Ordinary Least Squares on a city-by-city basis using monthly data from January 1996 to November 2004. All prices are in Canadian cpl and do not include tax. The results are illustrated in Table 6 where t-statistics are in parentheses below the estimated coefficients.

We find that current and lagged (of one period) wholesale prices as well as the error-correction term are highly significant. As expected, wholesale prices have a strong positive impact on retail prices whereas the error-correction term coefficients are all negative.

Starting with wholesale prices, we see that the sum of the significant coefficients are close to one for most cities. As such, a one cpl increase (decrease) in wholesale prices results in an increase (decrease) of one cpl in retail prices. However, the sum of significant coefficients for Saint John, Halifax and Regina is close to or less than 0.90 whereas the sum of the significant coefficients for Vancouver is higher than 1.20. These results seem to indicate competitive retail markets as the cost passthrough rate is close to one.

Turning to the findings associated with the error-correction term, we see that adjustments in retail prices following a change in wholesale prices are different whether retail margins are high or low. For instance, if retail margins are above the market outcome margin, then an increase in wholesale prices may not be

[6] For instance, high (low) retail margins could correspond to situation where a high (low) degree of market power is being exercised.

completely reflected in the retail prices and we should observe lower retail margins. Conversely, if retail margins are below the market outcome margin, then an increase in wholesale prices may trigger a larger increase in retail prices and we should observe higher retail margins.[7]

Once again, our results are similar to those obtained in the Conference Board study and in the Competition Bureau report of 2003.[8] The former analysis covers the period of January 1991 to March 2000 while the latter covers the period of January 1991 to March 2003.

We also use another specification to test the relationship between wholesale prices and retail prices in Canada. Indeed, because of the nature of the error-correction term, it could potentially capture the effects of the price fluctuations observed in 2004. As such, it would be difficult to detect any changes, if any, in the relationship between wholesale prices and retail prices in Canada during that period of time. Therefore, we omitted the error-correction term and estimated instead the following equation

$$\begin{aligned}\Delta R_{it} = {} & \beta_1(\Delta W_{it}) + \beta_2(\Delta W_{it-1}) + \beta_3(\Delta W_{it-2}) \\ & + \beta_4(\Delta W_{it}) * D + \beta_5(\Delta W_{it-1}) * D + \beta_6(\Delta W_{it-2}) * D \\ & + \varepsilon_{it}\end{aligned}$$

where ΔR_{it}, ΔW_{it}, ΔW_{it-1}, ΔW_{it-2} and ε_{it} are as before; β_1 to β_6 are the coefficients that need to be estimated; and, *D* is a dummy variable that takes a value of one from May 2004 to August 2004 (note that using a dummy variable that takes a value of one from March 2004 to August 2004 does not change the results).

The estimations were conducted by Ordinary Least Squares on a city-by-city basis using monthly data from January 1996 to November 2004. All prices are in Canadian cpl and do not include tax.

The results are illustrated in Table 7 where t-statistics are in parentheses below the estimated coefficients.

We find no changes in the relationship between wholesale prices and retail prices from May 2004 to August 2004 except for Ottawa, Toronto and Winnipeg where retail margin increased during that period of time (i.e., that retail prices increased more than wholesale margins).[9] However, it must be noted that retail margins in Winnipeg and Toronto were particularly low when compared to other cities in the months preceding the price increases (i.e., the result for Winnipeg and Toronto may reflect the omission of the error-correction term) and that retail margins in Ottawa fell substantially in September and October of 2004.

Therefore, the empirical analysis suggests no systematic changes in the relationship between retail prices and wholesale prices during the period of March or May 2004 to August 2004. The observed changes may simply reflect abnormal conditions existing prior to the period of interest.

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[7]Alternatively, if retail margins are above (below) the market outcome margin and if wholesale prices are decreasing, then retail prices will be lowered by more (less) than the fall in wholesale prices.

[8]Note that the adjusted R^2 in Table 6 are larger than those obtained in the Conference Board study.

[9]One modification to our results is observed when using a the March 2004 to August 2004 dummy variable: the relationship between wholesale prices and retail prices does not change in Toronto.

Table 6
Regressions Results of Canadian Retail Prices on Canadian Wholesale Prices
with Error-Correction Term

City	ΔW_{it}	ΔW_{it-1}	ΔW_{it-2}	Sum[a]	Error-Correction Term	Adjusted R^2
Saint John	0.602 (14.188)***	0.270 (4.902)***	-0.025 (-0.593)	0.872	-0.443 (-5.236)***	0.785
Halifax	0.687 (19.151)***	0.223 (4.956)***	0.018 (0.501)	0.91	-0.504 (-6.749)***	0.85
Quebec City	0.790 (15.770)***	0.276 (5.061)***	0.082 (1.599)	1.066	-0.443 (-5.489)***	0.783
Montreal	0.876 (20.114)***	0.120 (4.410)***	-0.003 (-0.059)	0.996	-0.752 (-7.679)***	0.849
Ottawa	0.935 (22.988)***	0.105 (2.545)**	0.061 (1.470)	1.04	-0.401 (-5.056)***	0.851
Toronto	0.956 (25.030)***	0.116 (3.072)***	-0.019 (0.471)	1.072	-0.536 (-6.223)***	0.877
Winnipeg	0.757 (12.315)***	0.399 (6.374)***	-0.080 (-1.273)	1.156	-0.292 (-4.068)***	0.737
Regina	0.777 (17.340)***	0.175 (3.695)***	-0.094 (-2.128)**	0.858	-0.550 (-6.000)***	0.838
Calgary	0.724 (17.566)***	0.298 (6.282)***	-0.081 (-1.902)*	0.941	-0.602 (-6.510)***	0.87
Vancouver	0.947 (13.412)***	0.146 (2.093)**	0.133 (1.878)*	1.226	-0.341 (-4.634)***	0.703

[a] Sum of significant coefficients only

* Indicates significance at the 10 % level

** Indicates significance at the 5 % level

*** Indicates significance at the 1 % level

Table 7
Regressions Results of Canadian Retail Prices on Canadian Wholesale Prices without Error-Correction Term

City	ΔW_{it}	ΔW_{it-1}	ΔW_{it-2}	$\Delta W_{it} * D$	$\Delta W_{it-1} * D$	$\Delta W_{it-2} * D$	Adjusted R^2
Saint John	0.601 (11.270)***	0.461 (8.980)***	-0.036 (-0.658)	0.165 (1.143)	0.046 (0.299)	-0.033 (-0.232)	0.725
Halifax	0.677 (14.259)***	0.437 (9.531)***	-0.035 (-0.730)	0.125 (0.980)	-0.042 (-0.306)	0.149 (1.181)	0.784
Quebec	0.790 (12.608)***	0.440 (7.271)***	-0.002 (-0.027)	0.142 (0.823)	-0.093 (-0.491)	0.121 (0.711)	0.720
Montreal	0.872 (14.260)***	0.319 (5.392)***	-0.130 (-2.073)**	0.164 (0.969)	0.026 (0.139)	-0.020 (-0.120)	0.758
Ottawa	0.892 (18.056)***	0.172 (3.593)***	0.008 (0.152)	0.322 (2.364)**	0.087 (0.587)	0.148 (1.101)	0.822
Toronto	0.959 (19.392)***	0.119 (2.505)**	-0.074 (-1.460)	0.078 (0.571)	0.274 (1.855)*	0.157 (1.165)	0.833
Winnipeg	0.695 (10.009)***	0.495 (7.470)***	-0.193 (-2.735)***	0.542 (2.869)***	0.148 (0.783)	0.304 (1.652)	0.717
Regina	0.810 (14.495)***	0.317 (5.946)***	-0.141 (-2.482)**	0.121 (0.795)	-0.018 (-0.116)	0.156 (1.056)	0.780
Calgary	0.753 (14.412)***	0.498 (9.982)***	-0.202 (-3.791)***	0.126 (0.887)	-0.082 (-0.572)	0.168 (1.213)	0.817
Vancouver	1.011 (12.222)***	0.169 (2.080)**	0.127 (1.521)	-0.390 (-1.557)	0.108 (0.464)	-0.094 (-0.411)	0.642

[a] Sum of significant coefficients only
*** Indicates significance at the 1% level
** Indicates significance at the 5% level
* Indicates significance at the 5% level

d. Do retail prices change asymmetrically with wholesale price increases and decreases?

Price asymmetry in retail gasoline pricing refers to the phenomenon of retail prices responding more strongly to increases in wholesale prices than to decreases. This could be explained by a number of reasons including, but not limited to, the existence of market power, supply adjustment costs and long-term agreements.

To test for the presence of asymmetry, we estimated the following equation

$$\Delta R_{it} = \beta_1(\Delta W_{it}) + \beta_2(\Delta W_{it} \times D) + \varepsilon_{it}$$

where ΔR_{it} is the change in the retail price over a one-month period in a city *i*; ΔW_{it} is the change in the wholesale price over a one-month period in city *i*; *D* is a dummy variable that is equal to one if the variation in wholesale prices is positive and to zero if it is not; ε_{it} is an error term; and, β_1 and β_2 are the coefficients that need to be estimated. The dummy variable is included to isolate the impact of wholesale price increases. Hence, if there is some sort of asymmetry, i.e., if retail prices vary differently following an increase or a decrease in wholesale prices, then the coefficient associated with the variable including the dummy variable, *D*, should be statistically significant.

The estimations were conducted by Ordinary Least Squares on a city-by-city basis using monthly data from January 1996 to November 2004. All prices are in Canadian cpl and do not include tax.

The results are illustrated in Table 8 where t-statistics are in parentheses below the estimated coefficients. For all cities, except Winnipeg, coefficients for the dummy variable are not statistically significant. This implies that there is no evidence of asymmetry, i.e., retail prices adjust in the same manner following a decrease or an increase in wholesale prices. However, this is not the case for Winnipeg where retail prices increase faster after an increase in wholesale prices than they decrease after a drop in wholesale prices (a priori, we have no explanations to explain why this is the case).

Except for Winnipeg, results are similar to those found in the Conference Board study (which covered the period of January 1991 to March 2000 and in the Competition Bureau report of 2003 (which covered the period of January 1991 to March 2003).[10]

[10]Note that the adjusted R^2 in Table 8 are larger than those obtained in the Conference Board study which covered the period of January 1991 to March 2000 and are generally higher than those obtained in the Competition Bureau report of 2003.

Table 8
Results of the Asymmetry Regressions

City	ΔW_{it}	$\Delta W_{it} * D$	Adjusted R^2
Saint John	0.559 (6.113)***	0.134 (1.057)	0.478
Halifax	0.667 (7.597)***	0.028 (0.231)	0.54
Quebec City	0.751 (7.778)***	0.092 (0.688)	0.573
Montreal	0.886 (9.850)***	0.041 (0.336)	0.668
Ottawa	0.859 (13.040)***	0.135 (1.487)	0.799
Toronto	0.910 (14.005)***	0.111 (1.240)	0.815
Winnipeg	0.692 (6.414)***	0.297 (1.952)*	0.541
Regina	0.871 (10.906)***	0.020 (0.176)	0.697
Calgary	0.819 (8.883)***	0.070 (0.541)	0.618
Vancouver	0.857 (7.728)***	0.182 (1.216)	0.609

* Indicates significance at the 10 % level
*** Indicates significance at the 1 % level

3. Conclusion

This reports presents four tests that were conducted to analyse various relationships in the Canadian gasoline industry. While the tests are based on those found in the Conference Board study released in 2001, they have been modified to look at whether the relationships changed in an unusual way during the spring and summer of 2004 when large price increases (at wholesale and retail) were observed.

We found no unusual price behaviour in the Canadian gasoline industry, that is we found no evidence of price effects that could have been explained by anticompetitive behaviour.

While some of the results vary slightly from city to city, this is not unexpected as each market is characterized by its own specific competitive situation.