THE RETAIL GASOLINE PRICE-FIXING CARTEL IN QUEBEC

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Prosecution of the retail gasoline price-fixing cartel in Quebec was the culmination of the largest and one of the most successful criminal investigations in the history of the Competition Bureau of Canada. In June 2008, criminal charges were brought against a number of individuals and companies under Section 45 of the Competition Act. The last trial occurred in late 2019. Prior to the 2009 amendments of the Competition Act, the public prosecutor had to demonstrate that the cartel not only existed, but also had the effect of "unduly" lessening competition—an unsuccessful cartel was not a crime. In this article, I review the empirical challenges and discuss how they were addressed to determine that the cartel did successfully increase prices in the markets under investigation. While the formal charges covered the period from early 2004 to mid-2006, data on price variation indicated that the cartel began in early 2001. Based on a difference-in-differences approach, the best estimate of cartel damages ranges from $18.5M to $42.0M for the period 2001–2006, and from $6.7M to $20.9M for the period 2004–2006. In addition to fines imposed on individuals and companies, numerous individuals received conditional prison sentences.

La poursuite intentée contre le cartel de fixation du prix de détail de l'essence au Québec a été l'aboutissement de l'enquête criminelle la plus vaste et parmi les plus couronnées de succès de toute l'histoire du Bureau de la concurrence du Canada. En juin 2008, des accusations criminelles ont été portées contre plusieurs personnes et entreprises en application de l'article 45 de la Loi sur la concurrence. Le dernier procès a eu lieu à la fin de 2019. Avant les modifications législatives de 2009, le procureur de l'État devait non seulement démontrer l'existence du cartel, mais aussi prouver qu'il avait nui « indûment » à la concurrence : les activités d'un cartel infructueux n'étaient donc pas criminelles. L'auteur examine les difficultés empiriques et montre comment elles ont été abordées pour que l'on puisse déterminer que le cartel avait réussi à faire augmenter les prix sur les marchés visés par l'enquête. Ainsi, on peut constater que si les accusations officielles couvrent la période allant du début de 2004 à la mi-2006, les données sur la variation des prix, elles, laissent entendre que la ruse a commencé au début de 2001. Réalisée selon la méthode des doubles différences, la meilleure estimation des dommages causés par le cartel se chiffre entre 18,5 et 42 millions de dollars pour 2001 à 2006, et entre 6,7 et 20,9 millions de dollars pour 2004 à 2006. Outre les amendes imposées aux personnes et aux entreprises en cause, on compte de nombreuses peines d'emprisonnement avec sursis.

1. Introduction

Triggered by complaints from gas station operators who were harassed by other operators for their unwillingness to participate in a price-fixing scheme, Canada's Competition Bureau (the "Bureau") launched an investigation in 2004 into allegations of collusion and price-fixing by owners of gas stations in four cities in Quebec: Sherbrooke, Victoriaville, Thetford Mines, and Magog.

Prior to the 2009 amendments of the *Competition Act*, it was not unlawful *per se* in Canada to conspire to fix prices.[1] Section 45 of the *Competition Act* required that the conspiracy had the effect of "unduly" preventing or lessening competition.[2] Even when participants in the conspiracy collectively had a significant share of the market in which they operated, it did not automatically follow that harm to competition would make the conspiracy unlawful, since the rules or guidelines for substantiating an undue lessening of competition were far from clear.[3] The amended conspiracy provisions in section 45 of the *Competition Act* limit the criminal offence to so-called "naked cartels," that is, cartels designed to fix prices, allocate markets, or restrict output. Following the 2009 amendments, it is not necessary to demonstrate any anti-competitive effect or undue lessening of competition in order to secure a criminal conviction.[4]

Since the Quebec retail gasoline cartel was a pre-2010 case, the Public Prosecution Service of Canada (the "PPSC") had to show that the cartel not only existed but did have the effect of unduly lessening competition. The existence of the conspiracy was established based on wiretaps of conversations among gas station operators over a two and a half year period, from early 2004 to June 2006. Hence, the proof of the existence of a conspiracy was quite direct. The remaining challenge was to show that the cartel did have an anti-competitive effect, that is, that it resulted in an undue lessening of competition and a significant increase in prices paid by consumers. That is where and when the economist becomes in a sense the law enforcement flag bearer.

On the basis of the wiretap evidence and the results of the economic report ("Boyer Report"[5]) showing that the cartel was indeed successful in unduly lessening competition between gas station operators, the PPSC decided to lay charges of criminal price-fixing against participating service station operators and some higher-up managers. In June 2008, criminal charges were brought against 13 individuals and 11 companies for fixing the price of gasoline at the pump from early 2004 to mid-2006 in four cities in Quebec:

Sherbrooke, Victoriaville, Thetford Mines, and Magog. In total, 39 individuals and 16 companies were charged in connection with the investigation, and 33 individuals and seven companies pleaded guilty or were found guilty and were fined in excess of $4 million.[6] Six individuals were sentenced to terms of imprisonment totalling 54 months.[7] This case is the largest and one of the most successful criminal investigation in the history of the Bureau.[8] The last trial occurred before a jury in the Fall of 2019 in the Criminal and Penal Division of the Superior Court of Quebec.

Challenges

Conspiracies are, by their secret nature, very difficult to detect and prove. And identical or similar prices may also result from generally available information and/or intense competition. The retail gasoline cartel case is interesting because it poses significant and unique empirical challenges:

i) Given that gasoline prices are public and transactions are repeated and numerous, a local (city-wide) cartel cannot raise prices by a large amount. However, artificial price increases may be small (a few cents or less per unit) yet statistically significant. Hence, the cartel impact may be small on any purchase, but may still amount to millions of dollars overall.

ii) Gasoline prices move up and down quickly, often more than once a day. Thus, comparing prices is challenging, especially since prices are typically recorded infrequently only and at times and dates that may differ between markets.

iii) A retail gasoline cartel involving numerous local gas station operators will continuously be vulnerable to defection by one or more participants, which implies that the cartel must be re-established regularly, typically more than once per week.

iv) Accurately assessing damages from the cartel may be challenging because the cartel period used by the antitrust authorities may be different from the beginning or end of the cartel conduct as suggested by economic analysis.

v) Comparing prices in cities where collusion was observed with "but-for" prices from comparable cities is a major challenge to the extent that market conditions in the different cities are difficult to observe and assess.

vi) Finally, estimating damages in a consistent way and determining their statistical significance is difficult because it requires blending different data sources.

To prosecute the cartel, the PPSC required a definition of the relevant market structure and a measure of the market power of participants during the collusion, as well as an economic analysis of prices and volumes in the cartelized and benchmark markets to assess whether the evolution of prices was consistent with the existence of collusion and, if so, to obtain a measure of damages.

Gasoline is a standardized product with a relatively uniform quality. Its market is generally determined by an area around the most used roads, that is, along the main roads of a city or its neighborhoods. In general, drivers are responsive to gasoline prices that they observe during their ride. However, they will not travel long distances—costly in terms of time and gas—simply to find a better price. Therefore, the market is geographically limited to a relatively small area around relevant locations or streets in a city for local trips or around roads used for intercity travel.

The magnitude of damages incurred by consumers depends on the size of the overcharge, i.e., the difference between the inflated price level created by the cartel and the price level that would have prevailed under competition. In order to isolate the impact of the cartel on prices, that is, the price increase considered "abnormal" given general market dynamics, a difference-in-differences analysis was used to compare prices in cartelized cities to those in collusion-free benchmark cities before, during, and after collusion.

In this article, I describe how these empirical challenges were addressed to determine that the cartel had an anti-competitive effect and to estimate damages incurred by consumers. As the author of the economic report, used by the PPSC in criminal court as well as in plea bargaining and out-of-court settlements, I testified in numerous criminal trials. Despite vigorous cross-examinations, as is expected in criminal cases, the defendants and their counsel did not bring forth any rebuttal reports and experts.

Section 2 of this article presents the data sources used in the empirical analysis and their limitations, and Section 3 discusses the market structure and the market power of participants in the different city cartels. Section 4 compares price dynamics using a difference-in-differences analysis between cartelized and benchmark markets to determine whether their comparative dynamics are consistent with collusion in cartelized markets and to identify

the relevant period of collusion. Section 5 presents the cartel-induced impact on prices and the estimation of damages and Section 6 concludes.

2. The Data

The data used for the detailed empirical analyses were obtained from two main sources: Kent Marketing Services and the Quebec energy board (Régie de l'énergie du Québec).

Kent Marketing Services (now Kalibrate) compiles detailed quarterly or bimonthly data on gasoline prices and volumes of sales for each gas station in many Canadian cities. We obtained price and volume data from Q1-1993 to Q2-2006 for gas stations in Sherbrooke, Victoriaville, and Thetford Mines, and from Q4-2005 to Q2-2006 for gas stations in Magog. Several cities were chosen to serve as benchmarks. These included Montreal, split into Montreal-Centre and Montreal-South, which are suitable benchmarks due to their size and the reasonable assumption that the effects of collusion in the four cities more than 100 km away cannot significantly affect the general dynamics of Montreal retail gasoline markets. The other city chosen as a benchmark is Saint-Hyacinthe, whose size is similar and location closer to the four cities where collusion was confirmed by wiretaps.

Since the survey by Kent Marketing Services for the Montreal region was conducted on a bimonthly basis, data obtained cover Mar-1993 to Aug-2006 for those two markets; for Saint-Hyacinthe, the quarterly data cover Q1-1993 to Q2-2006. Quantities sold and the dates on which the surveys were conducted vary from year to year and from one city to another. The absence of synchronization makes it more difficult to establish a direct price comparison between different cities.

The Régie de l'énergie du Québec (the "Régie") publishes a newsletter on the prices of petroleum products in Quebec (*Bulletin d'information sur les prix des produits pétroliers*) which provides a weekly survey of prices posted in various regions of Quebec, as well as the legal minimum price as calculated by the Régie for each of these regions.[9] The weekly data on average prices per city is available starting in December 1997. The sample is based on 297 retailers among 4,000 retailers in 187 cities or boroughs and 17 regions. As for the minimum estimated legal price, it is calculated on a weekly basis, using the minimum price at the loading dock on the preceding Thursday and adjusted to each city's specific taxes and transportation costs. This measure is quite useful because it allows us to compare prices between different cities taking into account tax and transportation cost variations between regions over time.

Data supplied by the Régie do not provide any information on price variations between retailers in the same city. Furthermore, the average price is based on a sample that usually includes one or two retailers per city. It is therefore possible that the average price listed by the Régie deviates from the actual average price charged in a specific city.

3. Market Structure and Market Power

Gasoline is a standardized product, even if some consumers may prefer one retailer over another for its location, its ancillary services, or its lower pump price. Different factors come into play with regard to drivers' response to pump prices. The demand elasticity for gasoline at the market-level, i.e., a uniform increase in pump prices across relevant buying locations, is usually low in the short-term, varying between –0.04 and –0.40, but higher in the long-term, varying between –0.23 to –1.37.[10] But it is the retailer-level (or own price) demand elasticity that provides information concerning a retailer's ability to unilaterally increase prices without losing many customers. Retailers' own price elasticity is high and so it is difficult for a single retailer to profitably increase its price.[11]

The only way for retailers to increase their prices above the market equilibrium price is to enter into an implicit or explicit price-fixing agreement, and apply price increases somewhat simultaneously across most, if not all, retailers. However, this then provides each retailer with an incentive to deviate from the collusive agreement and to unilaterally decrease the price at the pump to profit from the high retailer-level elasticity. This is one of the reasons why cohesion in a gas price-fixing agreement is difficult to maintain unless participating retailers agree to exert significant and sustained implementation and organizational efforts. Continued follow-up communication between retailers is therefore necessary to obtain and maintain a price increase above competitive levels as part of collusive activities in a market such as gasoline.

Another important factor that can affect the viability of a gasoline cartel is the ease with which new retailers can enter and exit the market if they become tempted to compete with the cartel to profit from the overcharge created by the cartel. Integrated oil refiner-marketers (such as Shell and Petro-Canada) and independent retailers (such as individual entrepreneurs, Couche-Tard, Olco, and Canadian Tire) are the two distinct groups marketing and selling gasoline in Canada. Based on data from Kent Marketing Services, in September 2005 in Sherbrooke for example, the three main commercial refiners had a 48.5% market share followed by the regional commercial refiners,

Irving Oil and Ultramar, with 35.2% and finally the independent retailers with 16.4%. The presence of integrated refiner-marketers with significant market share can be a major barrier to entry by new independent retailers. Indeed, substantial economies of scale characterize the gasoline retail industry, and economies of scope, such as the possibility of selling ancillary products, are also relevant. The substantial costs incurred in opening a new gas station and the cost of quickly acquiring a profitable market share are therefore significant barriers to entering the market. In recent years, some supermarkets (e.g., Wal-Mart, Costco, Loblaws) have become more visible competitors in the gasoline retail market. These newcomers have sold considerable volumes of gasoline, without necessarily generating profits comparable to those of other types of gas stations, because selling gasoline allows them to drive traffic to their stores and increase sales of their other products.

In essence, the gasoline retail market is not very favorable to the timely arrival of new entrants. The trend over the past decades has rather been a rationalization of retail gasoline networks with a relatively constant decline in the number of gas stations in various cities, including those of interest here.[12] The short-term variation in the number of gas stations is minimal.

We therefore have a market dynamic with the characteristics conducive to accommodate potentially viable cartels, insofar as participants can count on large market shares and on the relative difficulty for new players to enter the market. Another helpful factor would be if cartel participants were able to count on an efficient organization to coordinate decisions, to convince all those involved, and to quickly and accurately observe any deviating behaviour.

In gasoline markets, the relevant geographical distribution of sellers and buyers is practically the same, and so gas stations tend to be near groups of consumers and near main roads used by buyers. Each of the relevant city markets is well-defined by its service stations, with other service stations being sufficiently far away and inaccessible to be considered relevant competitors.

In this case, individual gas stations have no market power. However, the collective market power of the gas stations which are part of the price-fixing cartel is large in each of the four city-markets investigated. Indeed, the market share of gas stations participating in the respective city cartels was 89% (2005) and 87% (2006) in Sherbrooke, 93% (2005 and 2006) in

Thetford Mines, 98% (2005) and 99% (2006) in Victoriaville, and 92% (2006) in Magog.

4. The Dynamics of Price Volatility Across Retailers

Communication between retailers results in a much quicker price adjustment than what we would see if retailers had to find an "equilibrium" by trial and error. Hence, we expect price differences observed between gas stations at a given time to be smaller and less variable in a cartelized market than under normal competition. Indeed, the standard deviation of prices across retailers in cities where a cartel was shown to exist (by wiretapping) fell significantly in early 2001 and remained low compared to benchmark no-cartel cities. This is often considered a cartel marker.

Harrington (2006) for example presents eight collusive markers, defined as "some property of firm behavior which is much more consistent with collusion than with competition." One of his markers is "[i]ncreased uniformity across firms in product price, quality, and the prices for ancillary services."[13] Connor (2005) states that although there are suggestions that price dispersion changes when cartelization of a market occurs, there were few empirical studies of this effect at the time.[14] The results presented in the next section show a statistically significant reduction in the average and variance of the standard deviation of prices across retailers in cartel cities (as identified by wiretaps), not only over time but also in comparison with benchmark/non-cartelized city-markets.

The Boyer Report analyzed the price volatility *between* retailers over time (1993–2006) for Sherbrooke, Thetford Mines, and Victoriaville, and also for Montreal-Centre, Montreal-South, and Saint-Hyacinthe, using retailer-specific data provided by Kent Marketing Services. The standard deviations of prices between retailers from 1993 to 2006 for the different markets considered are illustrated in Figure 1A-1B in the Appendix. The figures show a change in the standard deviation in Sherbrooke, Thetford Mines, and Victoriaville, as of early 2001, compared to the dynamics of the standard deviation in Montreal-Centre, Montreal-South, and Saint-Hyacinthe.

Two statistical tests were conducted to evaluate whether the change in observed dynamics in 2001 is statistically significant. The first test compares the variance of standard deviations from 1993 to 2000 to the variance of standard deviations from 2001 to 2006 in each city market. The second test compares the average of the standard deviations over these two periods in each city market.

4.1 The Collusive City Markets

Table 1 (all tables are in the Appendix) shows that the two statistical tests for Sherbrooke are conclusive and the differences between the average and variance of the standard deviation in the two periods are significant. The standard deviation of prices between retailers has gone from an average level of 1.02 before 2001 to 0.44 after 2001, which represents a statistically significant decrease in the price dispersion of more than 50%. We also observe a statistically significant stabilization, with the variance of the standard deviation decreasing from 0.69 to 0.09.

The average standard deviation of prices between retailers in Thetford Mines fell from 0.49 for 1993–1999 to 0.33 for 1999–2006 and that, along with this decrease, there was a statistically significant decline in the variance of the standard deviation of prices between retailers, from 0.14 to 0.07 between the two periods.

For Victoriaville, a change in price dynamics occurred in early 2001, not in terms of the average standard deviation (similar for 1993–2000 and 2001–2006), but in terms of a statistically significant drop in the variance of standard deviations from 0.21 to 0.03.

Price data for the city of Magog do not allow for a temporal analysis, but it is worthwhile to mention that in the last quarter of 2005 prices were identical for all 13 retailers and, in the first two quarters of 2006, 11 of the 12 retailers listed identical prices.

To interpret the trends observed, namely the decrease in standard deviations of prices between retailers and their stabilization after 2001, we must compare them with what happened in the benchmark markets.

4.2 The Non-Collusive City-Markets

For Montreal-Centre, the average standard deviation of prices between retailers *increased* from 1.98 for 1993–2000 to 2.79 for 2001–2006, a statistically significant increase (see Table 1). The variance of standard deviations decreased slightly from 0.91 to 0.89 between the two periods, a non-significant difference. The dynamics of price variation therefore contrast starkly with those observed in collusive cities.

The average standard deviation of prices between retailers in Montreal-South increased from 1.53 CPL for 1993–2000 to 1.81 for 2001–2006, and the variance of standard deviations of prices between retailers decreased

from 0.81 to 0.64. In both cases, the differences are not statistically significant. Again, the dynamics of the standard deviation of prices between retailers contrast with those observed in cartelized cities.

For Saint-Hyacinthe, the average standard deviation of prices between retailers increased from 0.27 for 1993–2000 to 0.52 for 2001–2006 (not statistically significant at 5%), and the variance of standard deviations increased from 0.13 to 0.35, which is a statistically significant increase. Once again, the dynamics of the standard deviation of prices between retailers in Saint-Hyacinthe contrast with the those observed in collusive cities.

4.3 Conclusions from the Analysis of Between-Retailer Price Dispersion

The data analyses and statistical tests indicate that the cartelized city-markets of Sherbrooke, Thetford Mines, and Victoriaville displayed very different dynamics of price dispersion between retailers, contrasting with the price dispersion observed in the benchmark markets of Montreal-Centre, Montreal-South, and Saint-Hyacinthe.

The between-retailer standard deviations of prices actually decreased significantly in 2001, and remained consistently lower afterwards for all cities where collusive activities were shown to exist by wiretap evidence. Conversely, the between-retailer standard deviations of prices in benchmark markets actually increased after 2001, sometimes statistically significantly, and the level of price dispersion generally increased over time.

The dynamics of price dispersion in the Sherbrooke, Thetford Mines, and Victoriaville city-markets starting in 2001 are consistent with what one would expect in collusive markets. The significant drop in the standard deviation of prices across retailers is an indicator, or marker, of the beginning of a cartel. Hence, the data indicate that the cartel conduct likely started in 2001, rather than in 2004, the starting year of the cartel period used by the Bureau and for which legal documents and wiretap evidence (covering the 2004–2006 period) confirmed the existence of the city-market cartels.

Interestingly, under cross-examination by Government prosecutors, one of the defendants admitted in court that they did indeed begin to fix prices in 2001.[15] If one were to take the period of collusion as alleged in the legal proceedings, namely 2004 to 2006, and compare it with the previous, presumably non-collusive, period 2001–2004, one would find no statistically significant indication of a price-fixing conspiracy *because* that collusion already existed during the period 2001–2004. Hence the false conclusion

would be that no lessening of competition is observed, erroneously exonerating defendants and criminal cartel conduct that harmed consumers.

This situation is of course not specific to this case. Misdating a cartel might lead one to erroneously conclude that the cartel had little or no effect, to overestimate prices but-for the cartel conduct, and to underestimate overcharges due to the cartel.[16]

> "When assessing damages using a before-during or a before-during-after approach, the beginning and end points of the damages period must be identified. However, the beginning and the end of the damages period alleged in many cases may not accurately reflect the actual beginning or end of the alleged unlawful conduct. For example, in price-fixing class action cases, the plaintiffs' attorneys often choose the beginning and end dates for the 'class period' before discovery is undertaken. Moreover, the beginning or end of the effects of the alleged unlawful conduct may not coincide with the beginning or end of the conduct itself. The effects might occur later, end earlier, or last longer than the conduct. *Experts should rely on the evidence developed in discovery, market facts, and the analysis of liability experts when determining the relevant starting and ending dates for calculating damages.*" (emphasis added)[17]

5. Economic Impact and Damage Assessment

In this section, I will assess whether the evolution of retail gasoline prices observed in the cities in question is consistent with the existence of a collusive price-fixing system, and whether a statistically significant economic impact of the cartel on consumer prices can be quantified.

5.1 Analysis of Observed Average Prices

The impact of the cartel can be assess by contrasting the change in the level of the observed average price in colluding markets with the corresponding price in benchmark markets. To compare prices in different cities, I use weekly data supplied by the Régie on the average price per city and on the minimum price per region for the 1998–2006 period. Montreal (Centre and South combined) is used as a benchmark market, which provides a reasonable baseline for obtaining a conservative estimate of the economic impact of the price increases observed in the cartelized cities.[18]

To compare the dynamics of the Régie's average prices for different cities, prices were adjusted to take into account changes in cost dynamics using the Régie's minimum prices.[19] For example, suppose the average price for regular gasoline is 75 cents in Victoriaville and 72 cents in Montreal. If

the minimum price (which is set based on the price per liter, as well as on tax and transportation costs) is 65 cents for Victoriaville and 63 cents for Montreal during the same period, that means that the differences in supply costs would justify a 2-cent price difference (65 cents versus 63 cents). The average price of 75 cents in Victoriaville can therefore be associated with an equivalent average price of 73 cents in Montreal. The cost-adjusted difference in average prices between the two cities is then 1 cent (73 cents versus 72 cents).

The abrupt change in prices, which subsequently persisted over many years, seems to indicate that systematic price increases occurred in some cities independent of general market trends. These changes in dynamics are more precisely illustrated and statistically tested by a difference-in-differences analysis of prices (adjusted for costs) comparing the two markets over time, expressed in terms of percentages of the price in the benchmark city. If we apply this difference-in-differences approach using Montreal as a benchmark city, we tend to see larger price differences between 2002 to 2005 than before, despite particularly low prices in Montreal at the beginning of the time period.

Figure 2A shows the results of a comparison of all cartelized cities with Montreal as a percentage of the pump price in Montreal.[20] The moving average line illustrates the aggregate effect of the four cities studied and represents the average price difference between these four cities and Montreal over the preceding four quarters.

Statistical analyses can verify whether this increase in the difference of average prices corresponds to a larger price increase than could be expected based on normal variation. Table 2 shows the difference in the average price difference between Sherbrooke, Victoriaville, Thetford Mines, and Magog on one hand and Montreal on the other, showing that the difference, expressed in percentage of the Montreal pump price, rose from 2.22% between 1998 and 2000 to 3.51% between 2001 and 2006, and that the increase in this difference is statistically significant. Therefore, from 2001 to 2006, there was, on average, an aggregate 1.29 percentage point increase in the pump price in these cities compared to Montreal.

For a more detailed analysis, each city can be compared separately to assess the economic impact (price increase) associated with its cartel. In Sherbrooke, the price difference adjusted for cost differences went from 1.14% to 3.51%, a statistically significant increase representing 2.37% of the pump price in Montreal. The case of Thetford Mines is a bit more complex.

Indeed, the previous analysis showed a marked downward trend and a stabilization of the price dispersion between retailers, starting as early as 1998 in Thetford Mines. Unfortunately, the data of the Régie is not available before 1998 and it is therefore impossible for us to perform a difference-in-differences analysis adjusted for differences in costs between Thetford Mines and Montreal (or any other reference city) before and after 1998. In Victoriaville, from January 2001 to December 2004, the relative price increase compared to Montreal is statistically significant,[21] with the average price difference increasing from 2.50% to 4.45%, a 1.95 percentage point increase in the pump price during that period. For Magog, there is not enough data per retailer to allow an analysis of the price dispersion dynamics between retailers, so we cannot estimate how long any potential collusion might have lasted. However, there was a small increase in average monthly prices in Magog compared to Montreal starting in 2001—after adjusting for cost differences. This 1.56 percentage point increase in the pump price in Magog is statistically significant.

As mentioned before, Montreal appears to provide a reasonable and conservative baseline for estimating the relative price increases observed in cities where collusion did take place (confirmed by wiretap evidence). However, other reference cities could also be used. Choosing these cities is not an easy task because suitable benchmark cities must be representative of the market, must not be involved in price fixing activities and, if possible, have a market structure resembling those of the cartel cities.

Saint-Hyacinthe appears to provide another reasonable benchmark. Its price dynamics appear relatively similar to those of Montreal, despite its smaller size and geographical location. The price dispersion between retailers in Saint-Hyacinthe does not seem to systematically decrease over the time period of interest. Using Saint-Hyacinthe instead of Montreal as the benchmark city results in relative price increases in the cartelized cities that are larger and statistically significant. This is essentially due to the fact that gasoline in Montreal was relatively inexpensive at the beginning of the sample.

Using Saint-Hyacinthe as the benchmark city, the average monthly, cost-adjusted price difference in Sherbrooke goes from –1.95% between 1998 and 2000 to +1.43% between 2001 and 2006, which is a statistically significant increase of 3.38 percentage points of the pump price in Saint-Hyacinthe. In Thetford Mines, the price different increased by 2.54 percentage points during the same time period; Victoriaville showed a 2.33 percentage points increase and Magog, a 2.92 percentage point increase in the cost-adjusted

price difference. All of these increases are statistically significant. (See Table 2).

To assess the robustness of the observed cartel effect and to rule out any unique effect of the selected benchmarks, three additional cities of interest were compared because of their geographical location, their size and the breadth of their market: Trois-Rivières, Drummondville and Québec City.

The first two cities yielded results similar to those found with Montreal and Saint-Hyacinthe as benchmarks. For Québec City, we did not find the same trends because its pump prices had also greatly increased in comparison to those in Montreal after 2000. The effect of the relative price increase observed in comparison to Montreal (and to other benchmark cities) was counterbalanced by the price increase in Québec City. The reason for this unexpected result is a major price war taking place in Québec City during this period,[22] followed by a price correction around 2001.[23] Hence, comparing the relative price changes of the cartelized cities with Québec City would yield a biased and misleading estimate of the economic impact of the cartel.

5.2 Estimation of Damages

Estimating damages due to cartel activity is a challenging task. Even in cases where a cartel has been found guilty by the court, fines imposed in accordance with applicable guidelines are primarily a deterrence tool rather than an estimate of the harm or damages caused by the cartel.[24] For instance, the European Commission Fining Guidelines[25] consider the proportion of sales of goods or services to which the infringement relates, multiplied by the duration of the infringement, "*an appropriate proxy to reflect the economic importance of the infringement as well as the relative weight of each undertaking in the infringement,*" which can reach 30% of sales plus or minus some aggravating or mitigating factors. Hence the fine is not *directly* related to the value of harm and damages caused for the reason that estimating harm and damages is very difficult.

In this case, damages were estimated as follows. Prices and volumes of gasoline sold per retailer since the last price reading came from retailer-level data supplied by Kent Marketing Services and were aggregated to obtain an annual estimate for the volumes sold in each city.

Multiplying these volumes by the *incremental* price differential observed in comparison to the benchmark city during the period for which collusion is presumed—as compared to the usual differential during the period before the collusion appeared, i.e., the difference-in-difference —provides

an estimate of the annual damages incurred by consumers in each of the affected cities.

This estimated overcharge is consequently based on the chosen benchmark city. In our analysis, the incremental difference is generally lower with Montreal used as a benchmark and higher with Saint-Hyacinthe, primarily because the prices in Montreal were particularly low at the end of 1998. The reported estimates of economic damages for these two reference cities show the breadth of the economic impact as well as the sensitivity of the estimate to the choice of the benchmark city.

Moreover, choosing January 2001 as starting date for the collusion is, of course, somewhat arbitrary. It seems more likely that the quick and continued price increase in 2000 and 2001, after the 1999 Asian economic crisis and before the 2001 economic crisis, led to increased communication between retailers seeking to standardize price variations in periods of great volatility. These relations were maintained afterwards, which helped sustain the artificial price increases over the next few years. The collusion and price-fixing phenomena were certainly progressive, yet they seem to have become systematic in nature as of early 2001 and were particularly noticeable from 2002 to the end of 2004.

To fully account for variations in the scope of the potential effect of collusion activities over time, the economic impact is estimated by city and year.

This analysis brings together information from many sources: annual average prices for the benchmark cities calculated using the data supplied by the Régie de l'énergie, annual price differences adjusted for costs (taxes and transportation) as provided by the Régie, and gasoline volumes sold in each of the cities aggregated from retailer-level data provided by Kent Marketing Services. Moreover, all of the estimates are based on regular gas price volumes only. In our sample, this always makes up more than 80% of the gasoline bought and sold, so the estimation of the economic impact based on this data is an *underestimate* of the total impact.

Since the volumes for Magog are only available for one quarter in 2005 and two quarters in 2006, the volumes for the other years were extrapolated on the assumption that they followed the same temporal dynamics as those in Sherbrooke, the closest city with available data.

For Thetford Mines, determining the period of the collusion and the relative price increase is tricky because the analysis indicated that the price fixing system was in place from the beginning of the time period for which price

data for comparisons between cities was available. Without data available for a period of time preceding the collusion, it is not possible to obtain an estimate of the incremental price increase due to cartel conduct. In this context, a conservative estimation, *underestimating* the extent of the damages, can however be obtained as follows. Suppose that we use the period 1998–2000 during which the large price increase which followed the Asian crisis could dampen the effects of existing collusion as a temporal no-cartel reference,[26] and the "abnormal" price differentials of 2001–2006 as an indication of the extent of the price surcharge (as the difference-in-differences) that retailers in Thetford Mines were generally able to maintain. This imperfect measurement gives us a lower bound estimate of the economic impact of the cartel in Thetford Mines.[27]

Estimated damages are reported in Table 3. For an illustration of how damages were calculated, consider for example the amount of $1,353,244 estimated for the city of Sherbrooke in 2005. To calculate this amount of damages, a few intermediate numbers are required. First of all, we need the historical price difference between Montreal and Sherbrooke adjusted for differences in taxation and other costs before the alleged collusion. For this, we can use the average of the adjusted price differences in percentages between Sherbrooke and Montreal for the years 1998 to 2000. This average is 1.1%. That means that, historically, prices were 1.1% higher in Sherbrooke than in Montreal. In 2005, I calculated that this difference was 2.2%, or 1.1 percentage points higher than the normal historical difference, which is the difference-in-differences. Therefore, prices in Sherbrooke were 1.1 percentage point higher than their normal level, using Montreal as a baseline. The average price of gas in Montreal in 2005 was $0.974, so we can calculate the overcharge, in cents per litre, that Sherbrooke customers paid for their gasoline, $0.01 per litre ($0.974 * 1.1%). Gas customers in Sherbrooke paid 1 cent per litre extra for each litre bought in 2005. Since they bought 135,277,507 litres in 2005, the amount of is $1,353,244 ($0.010003 * 135,277,507 litres).

Instead of Montreal, we could use Saint-Hyacinthe as the benchmark city, where the historical price difference between Sherbrooke and Saint-Hyacinthe was –3.2% whereas the difference in 2005 was 1.7%. Hence, in 2005, prices in Sherbrooke were 1.7% – (–3.2%) = 4.9 percentage point higher than their historical value when using Saint-Hyacinthe as the benchmark city. The cartel overcharge therefore is $0.973 * 4.9% = 4.8 cents per litre. By applying this difference to the volume of regular gas bought and sold in Sherbrooke in 2005, the amount of damages is $6,368,861 ($0.04708 * 135,277,507 litres).

For certain cities, cartel damages are zero in some years, possibly due to price wars. Consider for example Victoriaville in 2006. Historically, the difference between Victoriaville and Montreal was 2.8% whereas in 2006 the difference was 1%. Consequently, in Victoriaville in 2006, prices were 1.8 percentage point *lower* than their historical value when Montreal is the benchmark city. During this year, there was a breakdown in the efficiency of collusion and consumers incurred no damages as a result of the city-cartel in 2006.

Table 3 shows the estimates of the economic impact of relative price increases which, for the period 2001 to 2006 range from $14.3M to $30.7M for Sherbrooke, from $592.3K to $2.5M for Thetford Mines, from $2.2M to $5.0M for Victoriaville and from $1.4M to $3.7M for Magog. In aggregate for these four cities, the damages caused by collusion are between $18.5M and $42.0M. For the years 2004 to 2006, the cartel period covered by the lawsuits filed by the public prosecutor, the estimation of damages ranges from $5.8M to $15.9M for Sherbrooke, from $153.5K to $1.3M for Thetford Mines, from $247.8K to $1.6M for Victoriaville and from $513.8K to $2.0M for Magog. In aggregate, for these four cities, the damages caused by collusive activities amount to an estimated total ranging from 6.7M$ to 20.9M$.

Some related literature

For comparison purposes, it is interesting to note that Wang (2008) described in detail the collusion dynamics and the phenomenon of price increases in a cartel case involving gas stations in Australia.[28] Among other things, the author had information on calls between retailers and the corresponding price variations spanning 90 days to identify the scale of the cartel-induced price increases. Wang isolated 16 "successful" price increases over a period of 90 days. The author also estimated that the price increases were, on average, 6.9 Australian cents per litre (approximately 6.3 Canadian cents per litre). If we aggregate this information by supposing, for example, that these artificial increases diminished and disappeared over 3 days following their implementation, we get an average increase of 2.24 CPL (in Canadian dollars) over the time period studied. This average increase is similar to my estimations here, which varies between 1 and 5 CPL, depending on the city and year.

Erutku and Hildebrand (2010) use a difference-in-differences approach for the period from June 2005 to May 2007, spanning one year before and one year after the announcement of the investigation by the Competition

Bureau, to derive a statistically significant price reduction in Sherbrooke of 1.75 CPL post-announcement, which translates into two million dollars in damages for the last year of the conspiracy.[29]

Clark and Houde (2013, 2014) provide a fascinating and detailed analysis of the internal working of the Quebec gasoline cartel, that is, the explicit mechanisms that were used by participants to obtain the allegiance of a large majority of station operators and to prevent defections.[30] Given the heterogeneity of gas stations, both in term of size and services provided, some form of transfer from weaker to stronger members of the cartel had to be imagined and executed. Those transfers originated through delayed price increases and decreases across participants favoring stronger players, generating short-term price discrepancies lasting a few minutes and yielding significant benefits to late movers. This set of peculiar mechanisms appear well-suited for collusion in markets where price posting is the norm.

6. Conclusion

The results of these descriptive analyses and regression analyses are consistent with a presumption of collusion in the cities of Magog, Sherbrooke, Thetford Mines and Victoriaville. Indeed, the level of price variation between retailers in cartel cities shows particular dynamics, which appear to be contrary to economic conditions and to dynamics observed in non-cartel cities of Montreal Centre, Montreal South, and Saint-Hyacinthe. Retailer-level prices from 1993 to 2006 highlight a change in pricing and a decrease and stabilization of between-retailer price variation starting in 1998 in Thetford Mines, and in 2001 in Sherbrooke and Victoriaville. For the benchmark cities, on the contrary, the price variation between retailers was either stable or on the rise during this period. This is consistent with a presumption of collusion and price fixing activities in cartel cities during these periods, as direct contact between retailers favours convergence towards the collusive price, while the search for a new equilibrium in a competitive market goes through a trial and error process.

Independent gas stations have no market power, but gas stations that are united by a price fixing agreement, as identified in the wiretap evidence, have a great deal of market power, as we see in all four cartel markets studied. Indeed, the market shares of the gas stations for which we have direct or indirect proof of participation in the cartel are around 90% (and above).

As for the impact of these activities on the gas prices paid by consumers, comparisons of price level using a difference-in-differences analysis make it clear that there was a relative price increase in the cartel cities compared

to the benchmark cities—even after adjusting for differentials in intertemporal cost fluctuations. For Sherbrooke and Magog, these relative price differences systematically appear and are statistically significant for the entire post-2001 period. This period corresponds to the one for which we see a decrease and a significant stabilization of the price divergence between retailers, confirming that the two phenomena are linked. For Victoriaville, the results are similar except that the price increase slows down during 2005, a sign that the cartel may have encountered some difficulties due to the market's high volatility that year. For Thetford Mines, the available data does not allow us to isolate a difference-in-differences in prices as the data indicates that that cartel's starting date was 1998, which corresponds to the beginning of our pricing data.

These relative price increases during periods for which we observed decreases and stabilizations in the price dispersion between retailers allow us to estimate the aggregate economic impact of cartel price fixing operations. Aggregate damages of the four city-cartels are between $18.5M and $42.0M for the period 2001–2006. For the period 2004–2006, the aggregate damage estimate is between $6.7M and $20.9M. The collusion period starting in 2001 as identified in the Boyer Report through an analysis of price variation was confirmed in court by the admission of one or the defendants under cross-examination, and the economic expert evidence provided in the Boyer Report was unrefuted.

7. Appendix

Figure 1A: Standard Deviation of Prices Between Retailers in Cartel Cities

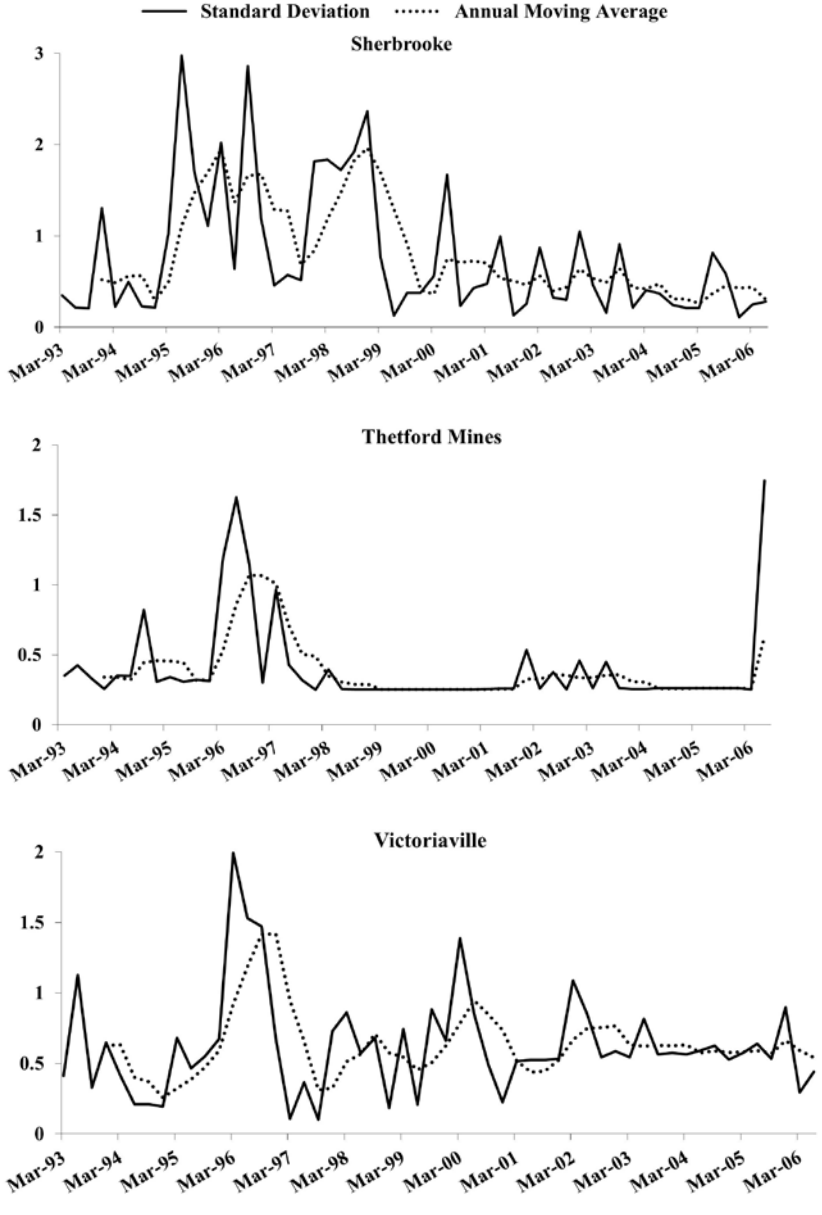

Figure 1B: Standard Deviation of Prices Between Retailers in Benchmark Cities

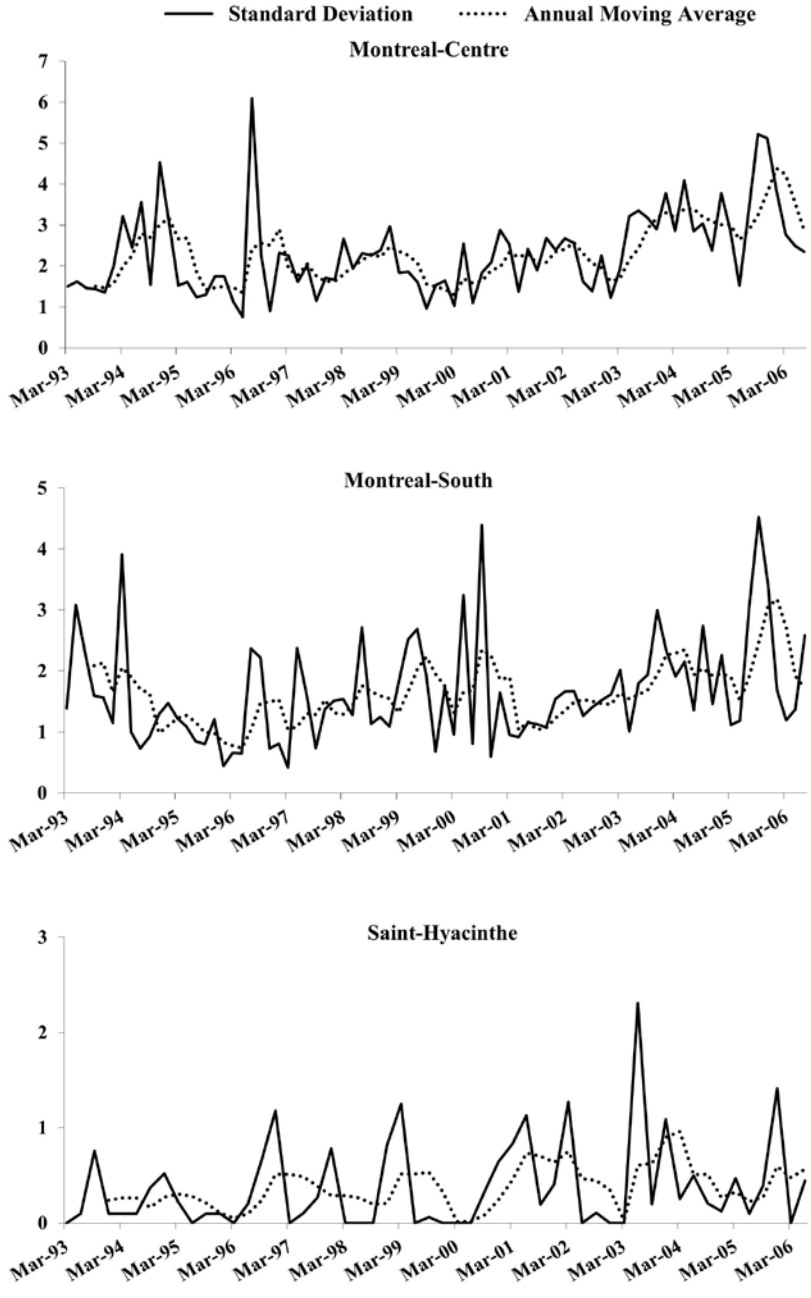

Table 1: Statistical Tests on the Standard Deviation of Prices Between Retailers

Cartel Cities	Sherbrooke		Thetford Mines		Victoriaville	
	1993–2000	2001–2006	1993–1998	1999–2006	1993–2000	2001–2006
Average of Standard Deviation	1.02	0.44	0.49	0.33	0.65	0.61
Variance of Standard Deviation	0.69	0.09	0.14	0.07	0.21	0.03
Number of Observations	32	22	24	30	32	22
t-Test for Difference in Average						
t-Statistic	**3.62**		1.82		0.45	
p-value	**0.001**		0.077		0.33	
F-Test for Difference in Variance						
F-Statistic	**7.79**		**1.92**		**7.31**	
p-value	**0.000**		**0.048**		**0.00**	

Note: Results in bold represent a statistically significant difference at the 5% level, i.e., the p-value is less than 0.05.

Benchmark Cities	Montreal-Centre		Montreal-South		Saint-Hyacinthe	
	1993–2000	2001–2006	1993–1998	1999–2006	1993–2000	2001–2006
Average of Standard Deviation	1.98	2.79	1.53	1.81	0.27	0.52
Variance of Standard Deviation	0.91	0.89	0.81	0.64	0.13	0.35
Number of Observations	47	34	47	34	32	22
t-Test for Difference in Average						
t-Statistic	**-3.76**		-1.48		-1.74	
p-value	**0.00**		0.14		0.09	

F-Test for Difference in Variance			
F-Statistic	1.03	1.26	**0.37**
p-value	0.48	0.24	**0.01**

Note: Results in bold represent a statistically significant difference at the 5% level, i.e., the p-value is less than 0.05.

Figure 2A: Dynamics of the Average Monthly Cost-Adjusted Difference in Prices Between Cartel Cities and Montreal (South and Centre)

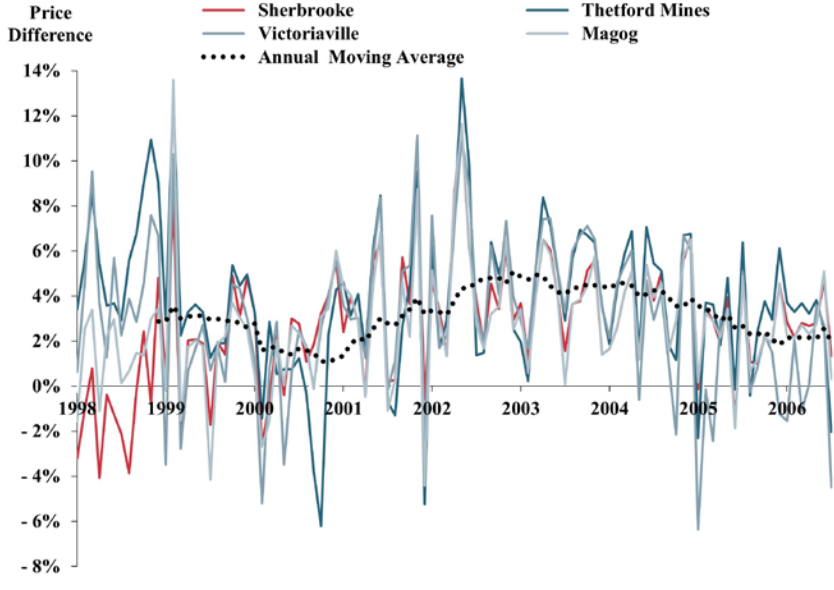

Figure 2B: Dynamics of the Average Monthly Cost-Adjusted Difference in Prices Between Cartel Cities and Sainte-Hyacinthe

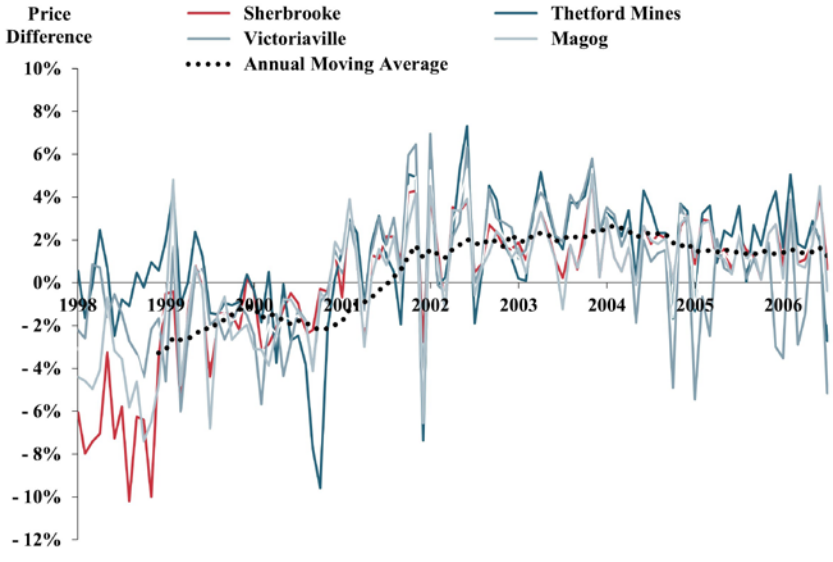

Table 2: Statistical Tests for the Average Cost-Adjusted Difference of Pump Prices Between Cartel and Benchmark Cities

Benchmark: Montreal	All Cartel Cities		Sherbrooke		Victoriaville		Magog	
	1998–2000	2001–2006	1998–2000	2001–2006	1998–2000	2001–2004	1998–2000	2001–2006
Average Price Difference	2.22%	3.51%	1.14%	3.51%	2.50%	4.45%	1.74%	3.29%
Number of Observations	36	67	36	67	36	48	36	67
t-Test for Difference in Prices								
t-Statistic	**-2.33**		**-4.55**		**-2.80**		**-2.79**	
p-value	**0.022**		**0.000**		**0.006**		**0.006**	

Notes: The average price difference is expressed as a percentage of the pump price in the benchmark city Montreal (Montreal-South and Montreal-Centre combined). Results in bold represent a statistically significant difference at the 5% level, i.e., the p-value is less than 0.05.

Benchmark: Sainte-Hyacinthe	All Cartel Cities		Sherbrooke		Thetford Mines		Victoriaville		Magog	
	1998–2000	2001–2006	1998–2000	2001–2006	1998–2000	2001–2006	1998–2000	2001–2006	1998–2000	2001–2006
Average Price Difference	-1.40%	1.39%	-1.95%	1.43%	-0.73%	1.81%	-1.26%	1.07%	-1.66%	1.25%
Number of Observations	36	67	36	67	36	67	36	67	36	67
t-Test for Difference in Prices										
t-Statistic	**-11.09**		**-10.20**		**-6.58**		**-6.76**		**-9.90**	
p-value	**0.000**		**0.000**		**0.000**		**0.000**		**0.000**	

Notes: The average price difference is expressed as a percentage of the pump price in the benchmark city Sainte-Hyacinthe. Results in bold represent a statistically significant difference at the 5% level, i.e., the p-value is less than 0.05.

Table 3: Estimate of the Economic Damages Due to Overcharges by City and Year (2001–2006) With Respect to Benchmark Cities Montreal and Saint-Hyacinthe

City		1998	1999	2000	2001	2002	2003	2004	2005	1H-2006
Montreal	Price (CPL)	55.8	63.3	77.3	73.7	71.6	76.3	85.4	97.4	103.9
Saint-Hyacinthe	Price (CPL)	57.6	64.1	78.2	73.8	73.0	77.2	86.5	97.3	104.1
Sherbrooke										
Sales Volume		130,400,331	123,127,718	126,571,318	130,504,228	137,612,137	136,390,077	135,557,643	135,277,507	68,213,375
Differential - Montreal		-0.7%	2.2%	1.9%	3.2%	4.9%	3.9%	3.8%	2.2%	3.0%
Differential - Saint-Hyacinthe		-6.8%	-1.5%	-1.2%	1.2%	2.0%	1.8%	1.8%	1.7%	2.1%
Thetford Mines										
Sales Volume		16,663,486	17,036,094	16,289,432	17,618,087	17,858,259	17,824,594	17,830,695	17,750,979	7,999,771
Differential - Montreal		6.2%	4.0%	0.3%	3.1%	5.4%	5.0%	4.5%	2.7%	3.4%
Differential - Saint-Hyacinthe		0.0%	0.3%	-2.8%	1.1%	2.5%	2.9%	2.5%	2.2%	2.5%
Victoriaville										
Sales Volume		40,694,195	41,441,588	43,962,601	43,021,184	43,637,565	44,278,938	47,960,702	49,726,497	23,380,383
Differential - Montreal		4.4%	2.0%	1.1%	3.7%	5.4%	5.2%	3.4%	0.3%	1.0%
Differential - Saint-Hyacinthe		-1.8%	-1.8%	-2.1%	1.7%	2.6%	3.2%	1.4%	-0.2%	0.1%
Magog										
Sales Volume		23,204,970	21,910,795	22,523,590	23,223,458	24,488,323	24,270,856	24,122,723	24,072,872	12,313,014
Differential - Montreal		1.5%	2.2%	1.5%	2.7%	4.7%	3.6%	3.8%	2.1%	2.9%
Differential - Saint-Hyacinthe		-4.5%	-1.5%	-1.7%	0.7%	1.8%	1.6%	1.7%	2.0%	1.6%

Notes: Data for 2006 cover only for the first half of 2006. Sales volumes for 1998-2005 in Magog are estimated assuming an evolution similar to Sherbrooke.

	Average Price Differential (1998–2000)	Total $ 2001–2006	Total $ 2004–2006	2001	2002	2003	2004	2005	1H-2006
Damages with Montreal Benchmark									
Sherbrooke	1.1%	14,346,392	5,795,820	2,031,262	3,675,421	2,843,889	3,126,114	1,353,244	1,316,462
Thetford Mines	3.5%	592,261	153,493	-	238,080	200,687	153,493	-	-
Victoriaville	2.8%	2,184,629	247,817	286,171	824,149	826,491	247,817	-	-
Magog	2.0%	1,412,867	513,754	124,840	470,707	303,566	368,235	31,812	113,707
		18,536,148	6,710,884	2,442,273	5,208,357	4,174,634	3,895,660	1,385,055	1,430,169
Damages with Sainte-Hyacinthe Benchmark									
Sherbrooke	-3.2%	30,678,554	15,929,823	4,248,776	5,231,275	5,268,679	5,811,456	6,368,861	3,749,506
Thetford Mines	-0.9%	2,543,013	1,323,382	252,790	443,755	523,086	512,898	532,043	278,441
Victoriaville	-1.0%	5,022,500	1,604,751	847,534	1,143,785	1,426,430	971,697	369,614	263,440
Magog	-1.8%	3,739,972	2,042,372	423,687	645,146	628,767	727,713	879,952	434,707
		41,984,039	20,900,328	5,772,787	7,463,961	7,846,963	8,023,764	8,150,472	4,726,093

ENDNOTES

[*] Marcel Boyer is Emeritus Professor of Economics, Université de Montréal; Associate Member, Toulouse School of Economics; Fellow of CIRANO and the C.D. Howe Institute; and Academic Affiliate, Analysis Group. He served as an expert witness for the Commissioner of Competition in this matter. He would like to thank Lisa Pinheiro and Anne Catherine Faye for their valuable help in preparing this article.

[1] The amendments were included as part of the *Budget Implementation Act, 2009*, and received royal assent on March 12, 2009. They came into force one year later.

[2] *Competition Act*, RSC 1985, c. C-34, s. 45

[3] Marcel Boyer, Thomas W. Ross & Ralph A. Winter., "The Rise of Economics in Competition Policy: A Canadian Perspective" (2017) 50:5 Can J Economics 1489; Tim Kennish & Thomas W. Ross, "Toward a New Canadian Approach to Agreements Between Competitors,"(1997) 28 Can Bus LJ 22; Paul S. Crampton & Joel T. Kissack, "Recent Developments in Conspiracy Law and Enforcement: New Risks and Opportunities" (1993) 38:3 McGill LJ 569.

[4] Adam Fanaki, "Recent Reforms to Canada's Competition Act: The First Year (and a Half)" (Paper delivered at the CBA Annual Fall Conference, Gatineau, 30 September 2010) [unpublished].

[5] The Boyer Report was completed in July 2007, one year after the confirmation by the Bureau that an investigation was under way, but officially signed in July 2008 and, from then on, shared with all parties in court cases as well as in out-of-court plea bargaining negotiations. See *La Reine c Gosselin,* 2013 QCCS 1223 at para 97.

[6] Irving Oil Ltd. was charged in 2017 for retail price maintenance in Thetford Mines and Sherbrooke. These charges relate to the *Competition Act* that was in force before the 2009 amendments that decriminalized price maintenance.

[7] For more detailed information on the "Quebec Gasoline Price-Fixing Cartel," see the Bureau's website at: <http://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/eng/03079.html#Quebec>. The internal working of the cartels, including extensive communications among members and the price adjustments that supported the collusion by controlling deviations, was studied by Clark and Houde (2013, 2014). Erutku and Hildebrand (2010) derived an estimate of the price overcharge and the ensuing damage for one year (2005–2006) in the city of Sherbrooke. I discuss those results below.

[8] "The Bureau is increasingly making use of wiretaps in its investigations – a tool that played an important part in the largest criminal investigation in the history of the Bureau, which concluded this summer with new criminal charges laid against individuals and companies accused of fixing the price of gasoline in Quebec." Melanie L. Aitken (Address delivered at the CBA Annual Fall Conference, Gatineau, 30 September 2010); In the Competition Bureau submission to the OECD Competition Committee Roundtable on Cartels, Oct. 13 2013, one reads: "This investigation of retail gas prices in Quebec has been one of the Bureau's most

successful cases to date." (Compeition Bureau, "Ex Officio Cartel Investigations and the Use of Screens to Detect Cartels, DAF/COMP" (2013) at 95, online (pdf): <https://www.oecd.org/daf/competition/exofficio-cartel-investigation-2013.pdf>.)

[9] Régie de l'énergie Quebec, "Produits Petroliers", Website : *Régie de l'énergie Quebec* <http://www.regie-energie.qc.ca/energie/petrole_tarifs.php>.

[10] See California Energy Commission, "MTBE Phase Out in California" (2002), online (pdf): *California Energy Commission* <www.energy.ca.gov/reports/2002-03-14_600-02-008CR.PDF>. These estimates are consistent with the estimate of short term demand elasticity of –0.2 in the Boyer Report. Other studies confirm such estimates, for example, those by the Organisation for Economic Co-operation and Development (OECD) and by Dahl and Sterner. See Organisation for Economic Co-operation and Development (OECD),"Behavioral responses to Environmentally-Related Taxes" (2000), online (pdf): <https://one.oecd.org/document/COM/ENV/EPOC/DAFFE/CFA(99)111/FINAL/en/pdf>; see also Carol Dahl & Thomas Sterner,"Analyzing Gasoline Demand Elasticities: A Survey." (1991) 13:3 Energy Economics 203

[11] Wang (2008) finds that the retailer-level elasticity can reach values of –18. See Zhongmin Wang, "Collusive Communication and Pricing Coordination in a Retail Gasoline Market," (2008) 32:1 Rev Industrial Organization 35.

[12] Andrew Eckert & Douglas S. West, "Rationalization of Retail Gasoline Station Networks in Canada" (2005) 26:1 Rev Industrial Organization 1.

[13] Joseph E. Harrington Jr, "How Do Cartels Operate?" (2006) 2:1 Foundations and Trends in Microeconomics 1.

[14] Connor (2006) discusses four empirical studies of cartels where this was observed, including most prominently in a bid-rigging cartel in frozen fish is the clearest case. See also Luke M. Froeb, Rosa Abrantes-Metz & Chris T. Taylor, "Variance and Smoothness Screens for Collusion," (Address delivered at the Second Annual Meeting of the International Industrial Organization Conference, Chicago, Illinois 9 April 2004)[unpublished].

[15] In the court case *La Reine c. Les Pétroles Global inc.* (Cour Supérieure du Québec, chambre criminelle et pénale 2015 QCCS 1618), Justice Tôth writes in his April 17 2015 sentencing (following the guilty ruling of August 9 2013): (translation)

> "[61] Prof. Boyer observed, from 2001, price dynamics in target markets which contrasted with the reference markets and which could not be explained by local conditions. Collusion was the most plausible explanation, confirmed by investigations and searches by the Competition Bureau.
> [62] The evidence at trial, particularly the testimony of Pierre Bourassa, demonstrated that Professor Boyer was right. The collusion started around that time."

[16] See for example H. Peter Boswijk, Maurice J. G. Bun, & Maarten P. Schinkel, "Cartel Dating" (2019) 34:1 J Applied Econometrics 26; Kai Hüschelrath, Kathrin Müller, & Tobias Veith,"Concrete Shoes for Competition: The Effect of the German Cement Cartel on Market Price," (2012) 9:1 J Competition L & Economics 97.

[17] See American Bar Association, *Econometrics: Legal, Practical, and Technical Issues*, 2nd ed (Chicago, IL: ABA Publishing, 2014). The approach taken in the Boyer Report provides a good illustration that follows this recommendation.

[18] Using Saint-Hyacinthe as a benchmark provides similar results.

[19] Minimum prices are only available by region. The price adjustment can consequently not be as precise when specific changes in a city occur (such as, for example, changes in local taxation rules). Yet, unless there have been measures which could justify price increases, this adjustment is a good indication of the cost changes for retailers in a specific region, especially when we are interested in changes in price dynamics (unexplained increases), rather than differences in levels (which are constant over time).

[20] The analysis was also carried out in cents per litre with a similar result.

[21] Between 2001 and 2006 however, these numbers do not show a statistically significant difference, which is easy to understand since the lower price level (more intense competition due to the breakdown of the cartel) started again in 2005.

[22] Christos Constantatos, "Les guerres de prix entre les stations d'essence dans la région de Québec en 2000: signe d'anomalie au fonctionnement du marché?" (2001) at 4, online (pdf) : *Université Laval* <http://www.regie-energie.qc.ca/audiences/3457-00/Preuveetmemoires/Caa/Preuve-21fev.pdf>.

[23] In 2000, the profit margins had become so low in Québec City that the Régie de l'énergie accepted an addition of 3 cents per litre on the price during a period of 3 months as requested by the retailers in December 2000. See Régie de l'Énergie du Québec,"Analyse des impacts de l'exercice des pouvoirs de la Régie de l'énergie sur les prix et les pratiques commerciales de la vente au détail d'essence ou de carburant diesel" (2004) at 8, online (pdf) :<www.bibliotheque.assnat.qc.ca/01/PER/794146/2004.pdf>.

[24] Marcel Boyer et al,"Challenges and Pitfalls in Cartel Fining," (2018) 31:1 Can Competition L Rev 50.

[25] The European Commission Fining Guidelines are described in Guidelines on the method of setting fines imposed pursuant to Article 23(2)(a) of Regulation No 1/2003. Fining rules are similar in other jurisdictions.

[26] We observe a relative price correction in Thetford Mines in comparison to Montreal and in comparison to Saint-Hyacinthe during this time period.

[27] Data in Table 3 for Thetford Mines correspond to these lower bound estimates.

[28] Zhongmin Wang, "Collusive Communication and Pricing Coordination in a Retail Gasoline Market," (2008) 32:1 Rev Industrial Organization 35.

[29] Can Erutku & Vincent A. Hildebrand,"Conspiracy at the Pump" (2010) JL & Economics 53:1 223.

[30] Robert Clark & Jean-Francois Houde, "Collusion with Asymmetric Retailers: Evidence from a Gasoline Price-Fixing Case" (2013) 5:3 American Economic J: Microeconomics 97; Robert Clark & Jean-Francoius Houde, "The Effect of Explicit Communication on Pricing: Evidence from the Collapse of a Gasoline Cartel" (2014) LXII: 2 J Industrial Economics 191.