

## **GASOLINE PRICES AND THE IMPACT ON DEMAND**

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## **GASOLINE PRICES AND THE IMPACT ON DEMAND**

### **INTRODUCTION**

Gasoline prices have made headlines repeatedly over the last two years. The high profit margins of some middlemen, such as refiners, are often cited as the reason for high retail prices.<sup>(1)</sup> Rarely mentioned, however, are the positive aspects of high gas prices, particularly the beneficial effect on the environment resulting from reduced gas consumption and a potential decrease in greenhouse gas emissions, which have themselves been in the media spotlight frequently over the same period.

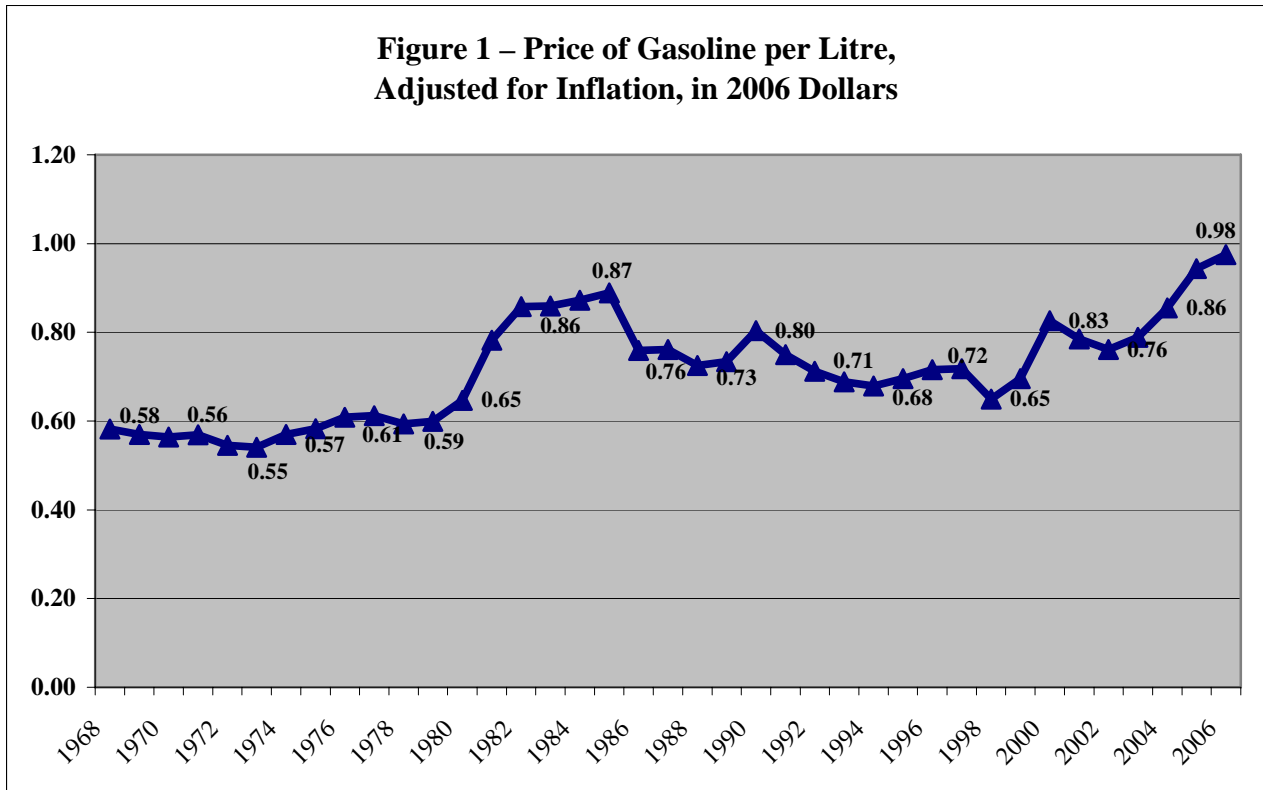
The purpose of this paper is to determine whether demand for gasoline in Canada will be affected by the kind of price increases that have been under way since 2002, and to analyze how gasoline sales may be reduced in times of economic growth. The first part explores the relations between changes in gasoline prices, retail sales and Canadians' disposable income over the last 40 years. The second looks at variations in Canadians' gasoline purchasing power over the years. The last part analyzes some measures that could be used to reduce sales of gasoline in times of economic expansion.

### **GASOLINE PRICES, RETAIL SALES AND DISPOSABLE INCOME**

Figure 1 graphs the price of gasoline in Canada from 1968 to 2006.

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(1) Headlines on gasoline prices in 2007: "L'essence coûte-t-elle trop cher?" *La Terre de chez nous*, May 2007; "Les Canadiens paient l'essence trop cher, selon une étude," *Cyberpresse*, 10 May 2007; "Gas industry disputes charges of price gouging," *CBC News*, 30 September 2005; "Consumer group calls for probe into gas prices," *CTV News*, 2 May 2007; "La démesure des pétrolières," *La Presse*, 21 July 2007.



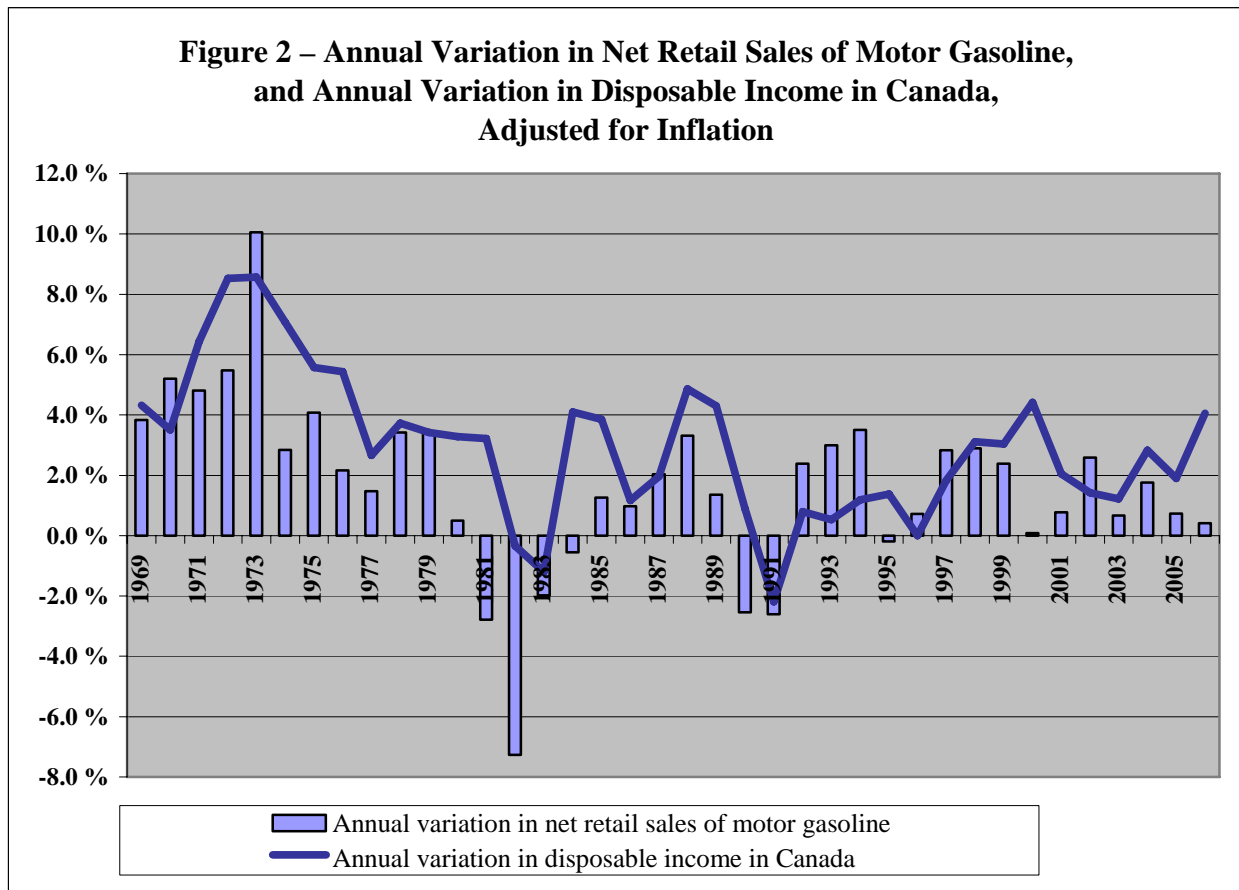
Source: Statistics Canada (Table 326-0009 – Average retail prices of gasoline and fuel oil, by urban centre, in cents per litre; and Table 326-0020 – Consumer Price Index (CPI)). The CPI for the economy as a whole was used to adjust the data for inflation. The average price of regular unleaded gasoline in seven Canadian cities (Halifax, Montréal, Ottawa, Toronto, Winnipeg, Calgary and Vancouver) in 2006 was indexed, using the CPI for gasoline, to determine an annual per-litre price.

Gasoline prices broke records in 2005 and 2006, exceeding even the levels reached in the early 1980s. Given these peaks, some observers might seek to make a connection between the drop in sales that occurred in the first half of the 1980s, when prices were high, and the increase in sales since 2002. However, the situation is fundamentally different, since the early 1980s were a period of economic recession. One of the features of an economy in recession is a reduction in the use of transportation, both freight and other forms, which in turn reduces gasoline sales.

In fact, as Figure 2 shows, the reduction in disposable income<sup>(2)</sup> that is common in times of recession is usually accompanied by a reduction in net retail sales of motor gasoline.<sup>(3)</sup>

(2) Since this discussion focuses on factors that might reduce net retail sales, it uses total disposable income rather than disposable income per resident.

(3) Statistics Canada defines retail sales of motor gasoline as “[a]ll sales of motor gasoline (including additives) to retail outlets, including marinas, irrespective of type of ownership or operations including own brands, subsidiary brands, the known or authoritative estimate of retail sales of jobbers, resellers, agents etc.” (<http://www.statcan.ca/english/freepub/45-004-XIE/2007002/technote2.htm>).



Source: Statistics Canada (Table 134-0004 – Supply and consumption of refined petroleum products; and Table 380-0004 – Seasonally adjusted disposable income, annual rate). Net retail sales of motor gasoline between 1968 and 1980 were derived from data on domestic sales of motor gasoline. The coefficient of correlation between net retail sales of gasoline and domestic sales of gasoline between 1980 and 2006 was 96%. Disposable income was adjusted for inflation, using the CPI.

This does not mean that demand for gasoline is not price-sensitive. The data in Figure 2, however, indicate that in the last 40 years, a spontaneous and significant reduction in gasoline sales occurred in Canada only in times of recession and thus of shrinking disposable income.<sup>(4)</sup> The findings of J. Agras and D. Chapman<sup>(5)</sup> and of J.E. Hughes et al.<sup>(6)</sup> indicate,

(4) Technically, the definition of “recession” is based on the trend in gross domestic product in real terms, not on disposable income. However, a recession is usually accompanied by a reduction in disposable income in real terms.

(5) J. Agras and D. Chapman, “The Kyoto Protocol, CAFE Standards and Gasoline Taxes,” *Contemporary Economic Policy*, Vol. 17, No. 3, July 1999, pp. 296–308.

(6) J.E. Hughes, C.R. Knittel and D. Sperling, “Evidence of a Shift in the Short-Run Price Elasticity of Gasoline Demand,” Centre for the Study of Energy Markets, University of California, Berkeley, 2007.

among other things, a preponderance of income effect<sup>(7)</sup> over price effect<sup>(8)</sup> on demand for gasoline in the short term.<sup>(9)</sup> Note that data obtained by Agras and Chapman<sup>(10)</sup> indicate that in the longer term, price effect becomes stronger and rivals the income effect, whereas Hughes et al.<sup>(11)</sup> did not estimate income effect or price effect in the longer term. It therefore seems important, in the light of these findings, to assess the effect of an increase in gasoline prices on quantities sold in relation to the economic situation – specifically, the variations in Canadians’ disposable income. The relationship between Canadians’ disposable income and gasoline prices might be referred to as Canadians’ gasoline purchasing power, which is the subject of the next part of this paper.

## **CANADIANS’ GASOLINE PURCHASING POWER**

Few people recall that the price of gasoline was relatively high in 1968, given the prevailing economic situation. As Figure 1 shows, the inflation-adjusted price was 58 cents per litre, one of the lowest prices of the period under study (1968–2006). But Canadians’ gasoline purchasing power was much weaker in 1968 than it was in 2006. In fact, if Canadians had spent all their disposable income on purchases of gasoline in 1968, they could have bought 477 billion litres. In 2006, the figure was 857 billion litres.

In the late 1960s, the ability to pay for gasoline was constantly increasing, although it was low in relation to its current level. Figure 3 shows the change in Canadian consumers’ gasoline purchasing power from 1968 to 2006. The growth in that purchasing power means that disposable income in percentage terms was rising more quickly than the price of gasoline. From the late 1960s to the start of the 1980s, the growth in purchasing power was due primarily to the increase in disposable income, since the price of gasoline remained relatively stable during that period (see Figures 1 and 2). It seems therefore that the income effect, and thus sustained economic growth, contributed most to the rise in gasoline sales from 1968 to 1980. Based on the data for the late 1960s, it is difficult to explain the trajectory of gasoline

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(7) That is, the effect on gasoline sales of a change in Canadians’ income.

(8) That is, the effect on sales of a change in the price of gasoline.

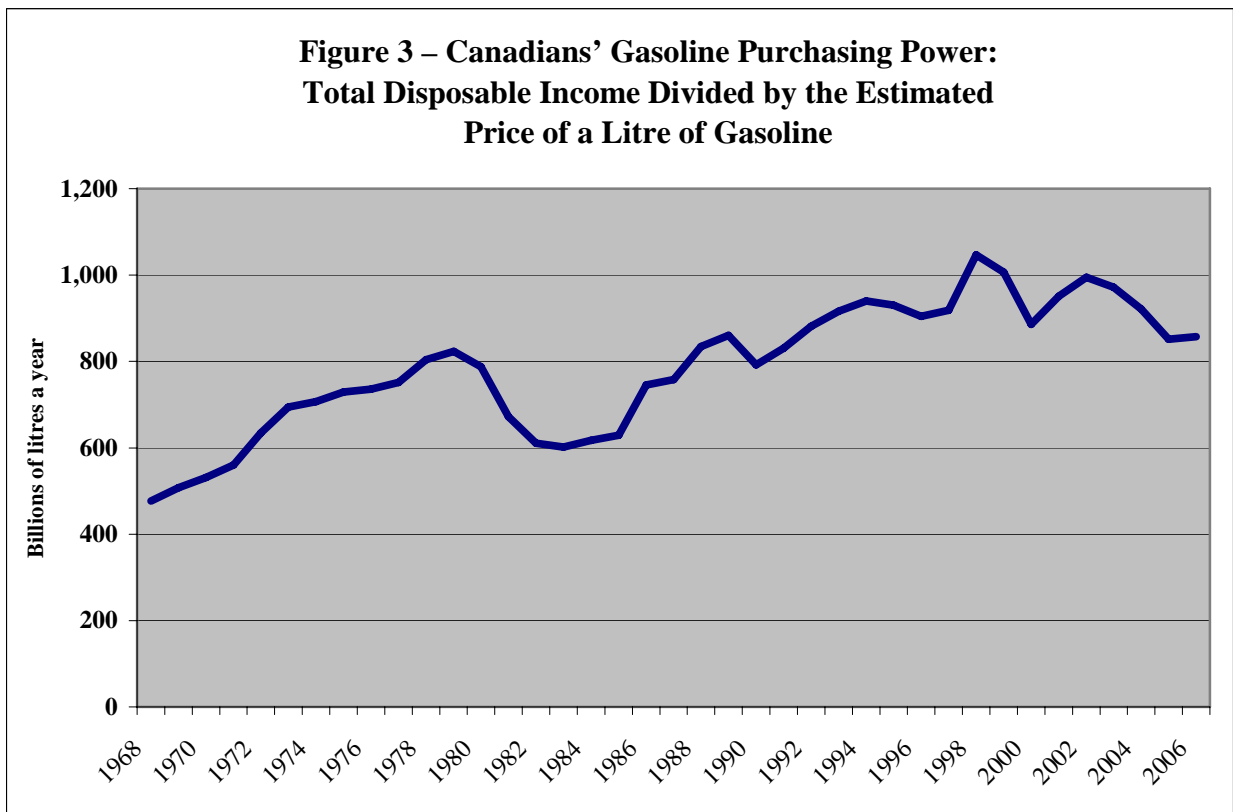
(9) This preponderance means that an increase of 1% in disposable income would have a positive effect on gasoline sales exceeding, in percentage terms, the negative effect of an increase of 1% in the retail price of gasoline.

(10) Agras and Chapman (1999).

(11) Hughes et al. (2006).

sales in relation to Canadians' relatively weak ability to pay for gasoline in a given year. Changes over time in gasoline purchasing power and their underlying causes<sup>(12)</sup> are probably more important factors.

As Figure 3 shows, Canadians' gasoline purchasing power fell suddenly in the early 1980s. The decrease was attributable to the combined effect of a drop in disposable income and a rise in gasoline prices. Thus, both income effect and price effect had a downward impact on gasoline sales during that period – indicating that this is the type of scenario most likely to produce a sudden drop in gasoline sales. Despite the drop, it should be noted that Canadians' gasoline purchasing power in 1983 was higher than in 1968. This fact underlines, once again, that it is more important to focus on changes in Canadians' purchasing power than on the absolute level of that power in a given year.



Source: Statistics Canada. Canadians' gasoline purchasing power was calculated by dividing the total disposable income of Canadians by the estimated price of gasoline. The sources are the same as for Figures 1 and 2.

(12) That is, the rise or fall in disposable income, or the rise or fall in gasoline prices, or the combined effect of both.



The situation in the early 1990s is interesting in that it seems to confirm the power of the income effect in the short term, in accordance with the findings of Agras and Chapman<sup>(13)</sup> and Hughes et al.<sup>(14)</sup> While the reduction in Canadians' purchasing power was relatively modest in the early 1990s (see Figure 3), gasoline sales were affected in 1990 and 1991 (-2.5% and -2.6%, according to Figure 2) by the economic recession of the early 1990s, which led to a reduction in Canadians' disposable income in real terms.

On the basis of Figure 3, it may also be assumed that the reduction in Canadians' gasoline purchasing power since 2002 has probably helped to restrain the rise in net retail gasoline sales during the same period (+0.7% in 2005 and +0.4% in 2006), despite a favourable context of economic growth. Analysis of net retail sales of gasoline per resident (as opposed to the aggregate level) shows that sales per resident dropped 0.2% and 0.6%, respectively, in 2005 and 2006. This very modest drop in demand, despite a price increase of some 40%, is doubtless attributable to the offsetting effect of disposable income per resident, which had grown 16% since 2002. The fact that gasoline sales were not seriously disrupted seems to indicate, therefore, that the income effect is more important in the short term than the price effect.

If it is assumed that the income effect and the price effect are the same in the long term, a permanent drop in gasoline sales would occur only if Canadians' gasoline purchasing power declined. Unless such a reduction resulted from a prolonged economic recession that eroded Canadians' disposable income over the years, the question arises as to how their purchasing power might be curtailed in a period of economic growth. That question is addressed in the next part of this paper.

## **REDUCING GASOLINE SALES IN TIMES OF ECONOMIC GROWTH**

In times of economic expansion, when disposable income is rising, an increase in gasoline prices could reduce Canadians' gasoline purchasing power. An external geopolitical crisis, such as a war or an embargo, or a geological one such as is outlined in the "peak oil" theory, could trigger a rapid increase in the retail price. It remains to be seen whether such a crisis would be a catalyst for an economic recession and thus reduce gasoline sales even more, as happened in the early 1980s. In such circumstances, gasoline sales would fall under the combined effect of high prices and shrinking disposable income.

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(13) Agras and Chapman (1999).

(14) Hughes et al. (2006).

Aside from the possibility of a geopolitical or geological crisis affecting the supply of crude oil, the use of fiscal measures to influence demand would be one way of reducing gasoline consumption in a context of economic growth. For example, if the aim is to reduce gasoline sales by reducing Canadians' gasoline purchasing power, direct action to influence the retail price through adjusting gasoline taxes would be a fiscal option. Assuming again that the income effect and the price effect on demand for gasoline are the same in the long term, this would mean that gasoline taxes would have to be adjusted so that the increase in the retail price was greater than the increase in disposable income in the long term.

For example, if the experience of the last 10 years suggests that Canadians' total disposable income will increase during the next 10 years at a compound annual rate of 4.7% (not adjusted for inflation), then – other things being equal – the price of gasoline would need to rise at an annual rate exceeding 4.7% in order to reduce gasoline sales in Canada. The increase in retail gasoline prices would depend on the desired extent of the reduction in gasoline sales. For instance, if an annual increase of 7% in the retail price were considered necessary (in a context of 4.7% compound annual growth in disposable income) in order to achieve the goal of reducing total gasoline sales, the price of gasoline would practically double over 10 years. As this example makes clear, such a goal represents a major challenge.

An adjustment in gasoline taxes could have a progressive effect, in the sense that consumers' gasoline purchasing power could be reduced gradually year over year. This would involve a period of transition, unlike the "oil shock" of the early 1980s when Canadians' gasoline purchasing power fell 27% in four years. Moreover, such a policy would do much to relieve uncertainty about future price levels, and would enable the public to make more informed choices about new vehicle purchases or future modes of transport. Lastly, this option has the advantage that the heaviest users of fossil fuels would bear the environmental cost of the use of gasoline.

Among the drawbacks of such a policy, it should be noted that higher taxes often penalize households on the basis of their location. With respect to additional annual tax costs in absolute terms, a person living far from the workplace and driving an economy car could be at a disadvantage in relation to someone living close to the workplace and driving, say, an SUV. Moreover, higher taxes tend to penalize low-income families, which spend a higher proportion of their income on gasoline.

There are other fiscal measures governments can adopt in order to reduce gasoline consumption. For example, tax credits or rebates on the purchase of hybrid vehicles, and additional licence fees for cars based on cubic capacity, are also ways of influencing Canadians' choices. Such measures have already been put in place by a number of North American jurisdictions. However, this type of program differs fundamentally from an increase in gasoline taxes, and for a number of reasons. First, unlike an increase in consumption taxes, it has no direct effect on Canadians' gasoline purchasing power. Second, it affects the type of vehicle purchased, but not necessarily the chosen mode of transport: bicycle or public transit rather than a car, in the case of individuals, and rail rather than truck for businesses. Lastly, in the case of tax credits or rebates on hybrid vehicles, the entire community contributes to this kind of subsidy, including people who have decided to do without a car – which is not the case with gasoline taxes.

## CONCLUSION

This analysis indicates that it would probably be necessary to reduce Canadians' gasoline *purchasing power* in the long term, in order for price increases actually to reduce the consumption of gasoline in Canada over a long period.<sup>(15)</sup> This means, in concrete terms, that the price of gasoline would have to increase more quickly than disposable income.

Faced with such a situation, Canadians could find themselves having to choose between, on the one hand, reducing their spending on other activities (such as recreation), or, on the other, gradually moving towards types of vehicles or modes of transport that are more economical and energy-efficient. The latter choice would eventually reduce total gasoline sales nationwide.

In a recession, purchasing power is often reduced significantly by the drop in disposable income, which can lead more or less automatically to a reduction in gasoline sales. However, in times of economic expansion, with a concomitant sustained increase in disposable income – as is currently the case – a reduction in purchasing power can be achieved through an increase in gasoline prices. Setting aside the possibility of a sudden drop in supplies of crude oil, which would keep the increase in gasoline prices constantly above the growth in disposable

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(15) This can be inferred in part from the fact that countries with lower gasoline prices tend to record more vehicle kilometres travelled per capita, and higher consumption per kilometre travelled (T. Litman, *Transportation Elasticities: How Prices and Other Factors Affect Travel Behavior*, Victoria Transport Policy Institute, Victoria, B.C., 2008, p. 21).

income, adjusting gasoline taxes is a tool governments could use to help reduce gasoline sales in Canada.

While this paper focuses on how the interaction between prices and disposable income affects gasoline sales, there are obviously a number of other factors that can affect gasoline sales. Fiscal measures, such as tax credits for the purchase of energy-efficient vehicles, or new regulations setting tougher fuel economy standards for automakers, or any technological progress that makes hybrid or diesel vehicles less expensive than conventional gasoline-powered cars, are other examples of factors that could affect total gasoline consumption in Canada in the years ahead. Consequently, if Canadians' gasoline purchasing power, which has dropped slightly since 2002, were to resume the upward trend of the last 40 years, then fiscal measures, vehicle fuel economy standards or technological advances could become increasingly important as ways of stabilizing or reducing gasoline sales in Canada.

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