

THE PRICE ELASTICITY OF DEMAND FOR CIGARETTES

Price elasticity is defined as the percentage change in demand resulting from a one percent change in consumer price. For example, if the price elasticity of cigarette demand was -0.7 , a one percent price increase would cause a 0.7% decrease in demand.

A good understanding of price elasticities is necessary for assessing the full impacts of higher cigarette taxes. If the price elasticity of the demand for cigarettes was found to be high, the percentage increase in government revenues resulting from a tax increase would be substantially less than the percentage increase in the tax, due to sharply reduced volumes.

For the purpose of assessing the short term impacts of cigarette taxes, an assessment of the average price elasticity of the total consumer demand for cigarettes is sufficient. It is not necessary to separate, for example, the reduction in the number of smokers from the daily number of cigarettes smoked: only the total effects are important. Furthermore, it is not necessary to distinguish among the different elasticities of age groups, social groups or between heavy and light smokers.

The average elasticities discussed in the report cannot be used, however, for all purposes. For example, health researchers would wish to know the price elasticity of the demand generated by heavy smokers.

Some researchers have found that the price elasticity of demand in this sector is significantly lower than the average elasticity and, therefore, the impact of price increases on the reduction of health problems might be much less than on the reduction of government revenue.

A review of the literature provided many useful articles on the subject of price elasticity for cigarettes. We focused on the North American literature, since differences between social factors might cause substantially different responses to price changes in Europe as compared to Canada or the United States. A list of the most representative North American articles is included in the report.

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In a review of the Canadian literature, we have found only two studies that reported price elasticities for cigarettes. The first was a paper by Thompson and McLeod, published in 1975 (1) which reported a price elasticity of -0.75. The second Canadian study was carried out by the Ontario Task Force on Smoking and reported in 1980 (2). That study found very similar results: a price elasticity of -0.73.

Using the data bases of these studies, we have refined the methodologies used in the studies, and repeated the analysis with the refined methods. As described in the report, the findings of this analysis confirmed the elasticities found in the earlier studies. Because of the refinements, our analysis produced higher statistical correlations than the previous studies and, therefore, the results of our analysis have not only confirmed the results of the previous work, but also increased our confidence in the reliability of the findings.

We found this particularly encouraging since the U.S. literature reports a very wide range of price elasticities in the various papers listed in the bibliography. In most of the articles, the range is from -0.3 to -0.9, with some reports showing figures even outside this rather wide range.

Because of this wide range, we carried out some analysis of our own and applied the methodology used in our Canadian study to U.S. data. As described in the report, we found slightly higher elasticities for the United States than for Canada. Similarly to the Canadian results, our analysis produced high statistical correlations, and confirmed the results of those U.S. papers that found elasticities near the upper bound of the range indicated above.

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We subsequently re-assessed those U.S. papers that showed particularly low elasticities and tried to identify the reasons for the discrepancies. We could identify several reasons which are outlined in the report.

Summary of Data and Findings

Exhibits 1A and 1B show the annual consumption of cigarettes in Canada and in the United States. The solid line in the diagrams indicates a "saturation" smoking propensity which, after some experimentation, was found to be 14 cigarettes per day per adult male in Canada and 15.5 cigarettes per adult male in the United States.*

Exhibits 1A and 1B clearly show the decline in cigarette consumption during the Depression of the 1930's. Exhibit 1B shows a significant drop in consumption in the United States after 1953 when the link between cigarette smoking and lung cancer was established; curiously, no such decline occurred in Canada. After 1968, consumption dropped visibly in the United States as the result of stepped-up campaigns against smoking and the banning of cigarette advertising on television. In Canada, there was no visible decline of consumption, although the statistical analysis did indicate a trend reversal in the 1970's, as explained in the report. However, the impact of that reversal was compensated by the stimulating effect of declining real prices.

Exhibits 2A and 2B show the "basic" smoking propensities of men, 20 years of age and older. The propensity is expressed as the average number of cigarettes per year, and relates to the entire population in the defined group, i.e. it includes non-smokers. The population in this group excludes, however, the "old" generation defined in the footnote.

* As explained in the report, an examination of historical cigarette consumption by sex and age group indicated that the following broad assumptions provide a reasonably simple model of the relative smoking propensity of population groups: the average number of daily cigarettes by females 20 years and over is one half of the number smoked by the equivalent male group (defined as the "basic" smoking propensity); the propensity of teenagers (15 to 19) is one third of the "basic" propensity; women born before 1896 and men born before 1891 in Canada or 1881 in the United States have negligible smoking propensities.

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Exhibits 2A and 2B also show the real price indices of cigarettes in Canada and in the United States. "Real" is defined as the actual price level of cigarettes related to the price level of all consumer goods combined.

The analysis consisted of finding a correlation between the smoking propensity in the bottom part of Exhibits 2A and 2B and the real price shown in the top part of the Exhibits.

The results of this analysis are shown in Exhibit 3. The mathematical equations used in the analysis are shown in the bottom part of the Exhibit. A more detailed explanation of the approach used in the analysis is provided in the report.

In brief terms, two types of analysis were performed: the first type explored the relation between the annual changes of volumes and prices, the second type explored the relation between the absolute levels of volumes and prices. The first approach provides information on short term elasticities, the second on long term elasticities.

The effects of disposable income were also included in the original equations, but were found to be statistically insignificant. This finding confirmed the results of many other studies reported in the literature.

As shown in Exhibit 3, the short term price elasticity of the demand for cigarettes was found to be approximately -0.75 in Canada and -0.8 in the United States. The long term elasticity was found to be higher: approximately -0.9 in Canada and more than -1.0 in the United States.

In addition to the dependence on price, the annual changes in cigarette volumes also showed a dependence on a trend that could not be explained by price or income. This trend was positive, both in Canada and in the United States** until 1968 but turned negative thereafter in both countries.

** With the exception of the 1953 "scare" in the United States when the trend was interrupted for several years.

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As explained in the report, four data points before 1953 were excluded from the Canadian data. A very strong drop in real prices in 1953 was found to have an overwhelming influence on the results of the statistical analysis and it was felt that these results should not be unduly influenced by a single event. However, inclusion of the first four points in the data series did not change the conclusions of the analysis significantly: it reduced the elasticity figures to a relatively small extent.

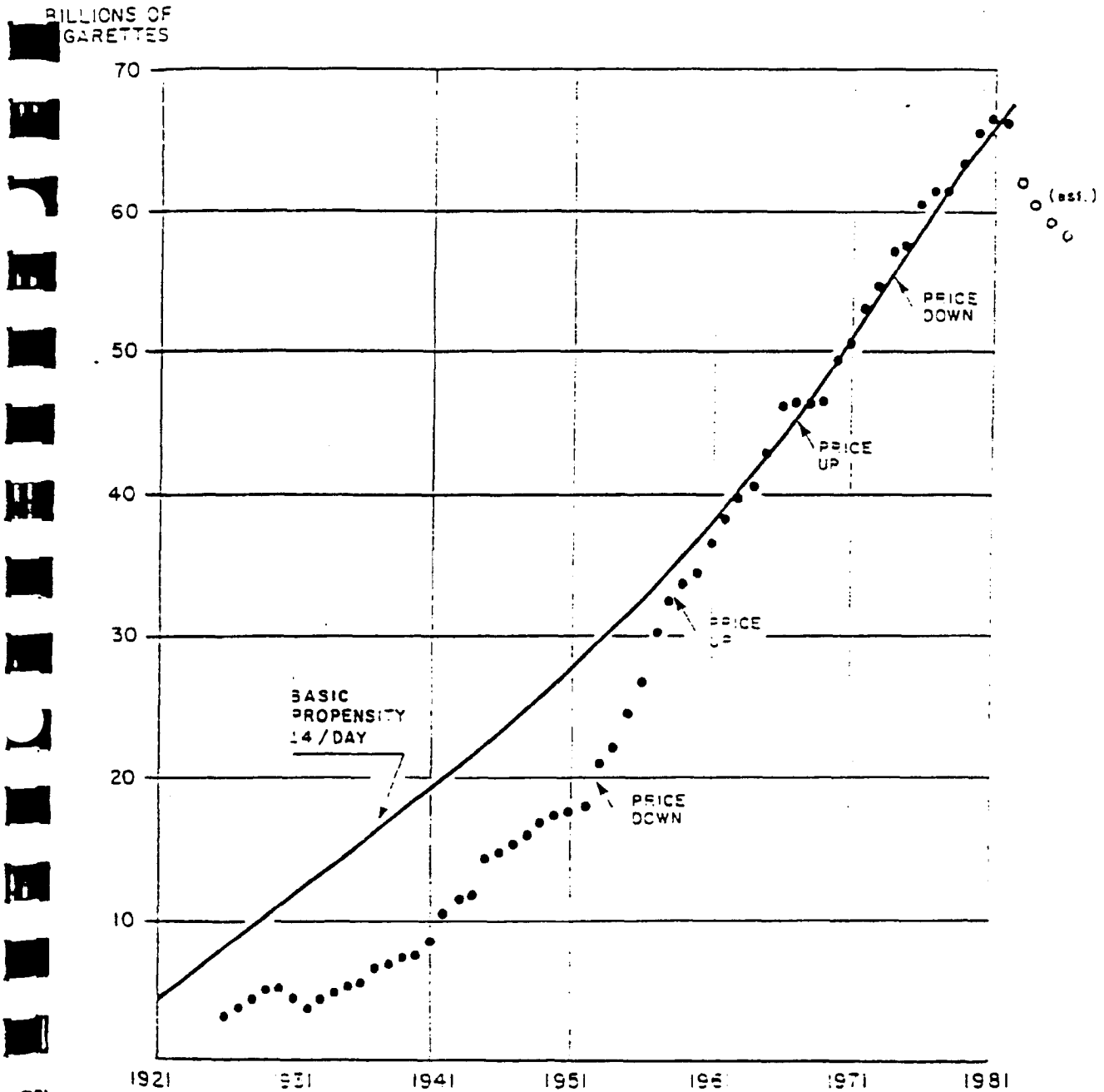
Projections

As outlined in another report, present federal tax regulations tend to perpetuate inflation. The federal tax increases, combined with a sharply reduced rate of general inflation and large increases in cigarette taxes in several provinces, such as Alberta, Ontario and New Brunswick, will cause very significant increases in the real prices of cigarettes in Canada. The estimated increases are shown in Exhibit 2A. It is estimated that the average consumer price of cigarettes will increase from 1982 to 1983 by 10% and from 1982 to 1985 by 25%, even if no further changes are applied to provincial tax regulations. The 1985 price will be significantly higher in real terms than it has been during the past 30 years.

If our findings on elasticities are correct, a 7% drop in cigarette sales can be expected in 1983 and a 12% drop by 1985, compared with 1982. Although there may be some time lag in the actual reaction to price changes, a sharp drop in cigarette sales can be expected in the next few years as indicated in Exhibit 1A.

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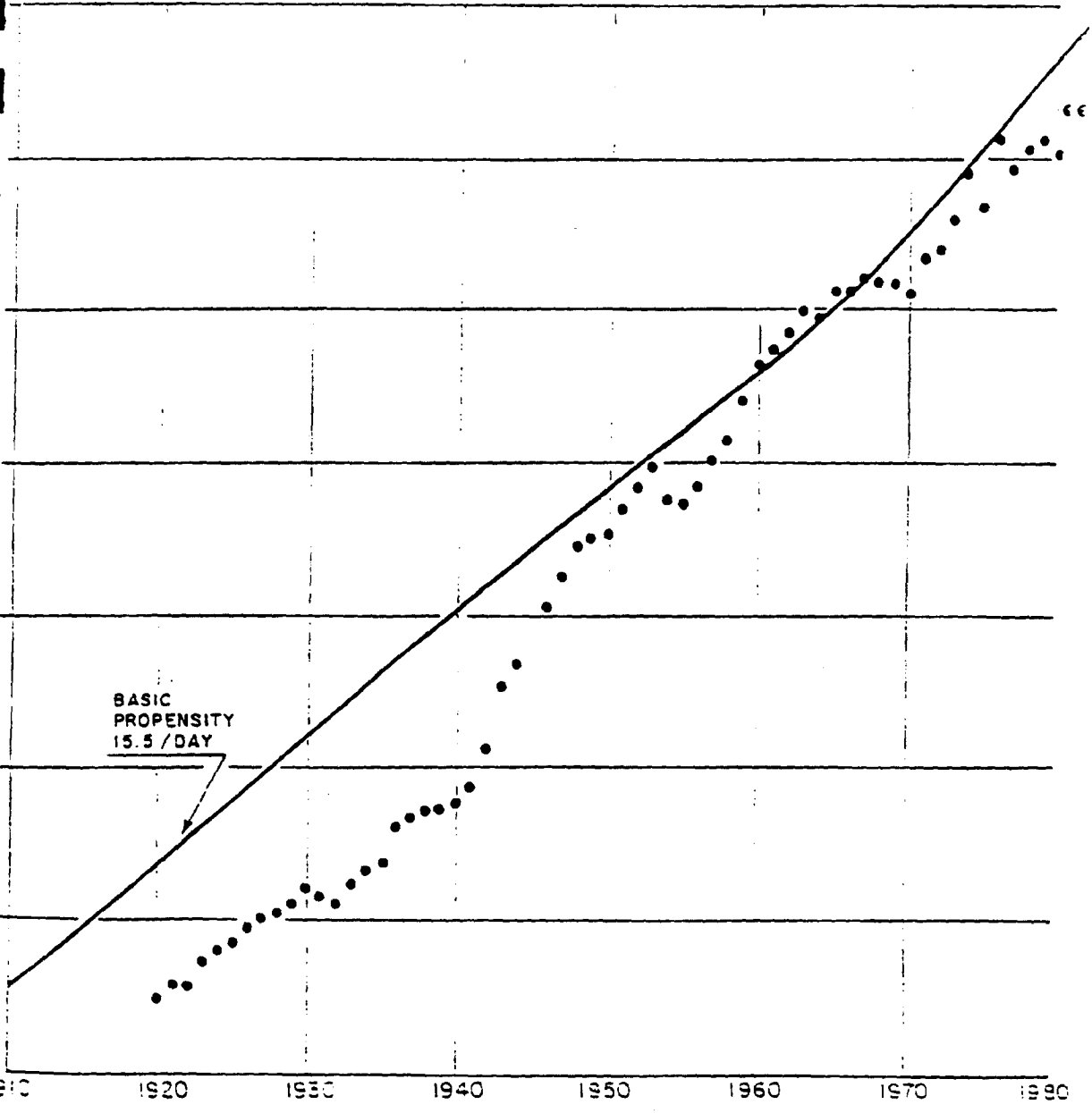
EXHIBIT 1A
CIGARETTE CONSUMPTION
CANADA



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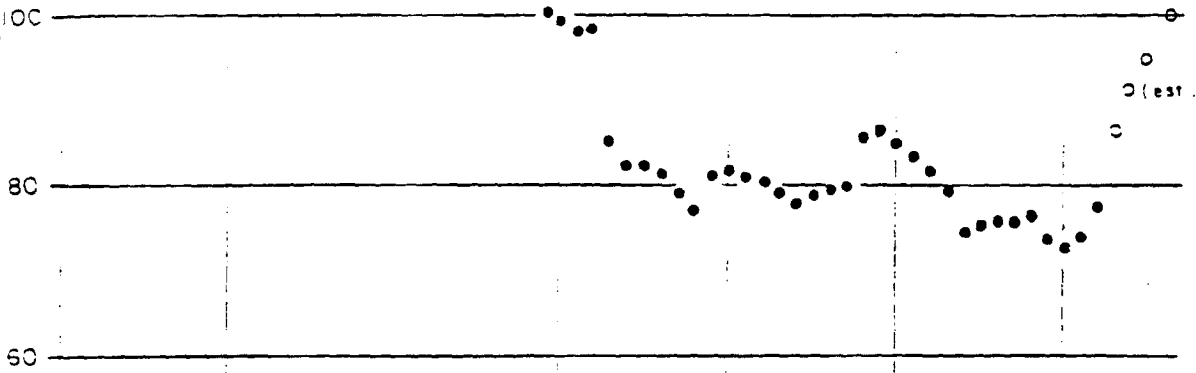
EXHIBIT 18
CIGARETTE CONSUMPTION
U.S.A.

1920
1930
1940
1950
1960
1970
1980

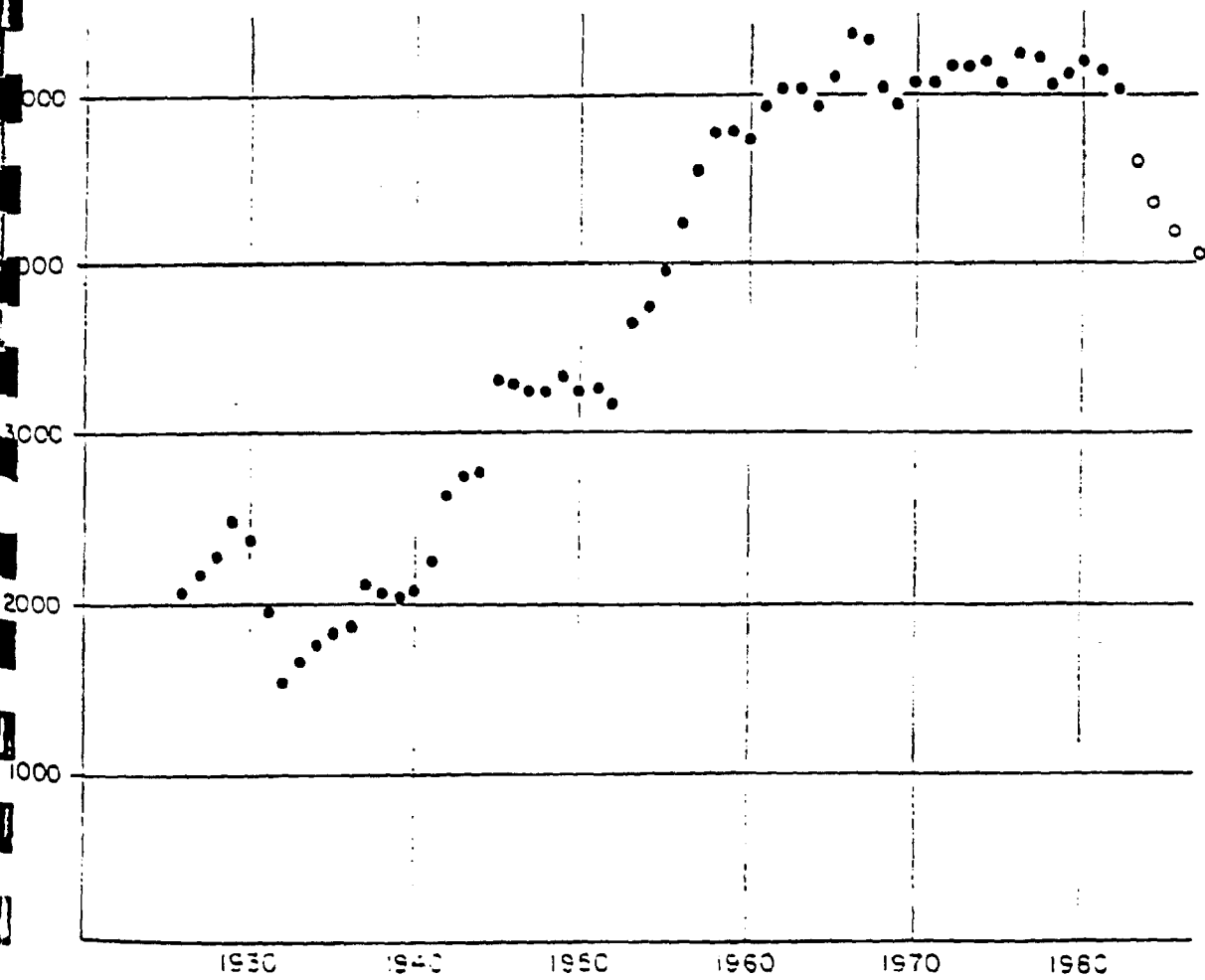


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 CANADA
 REAL PRICE INDEX
 (1949=0)

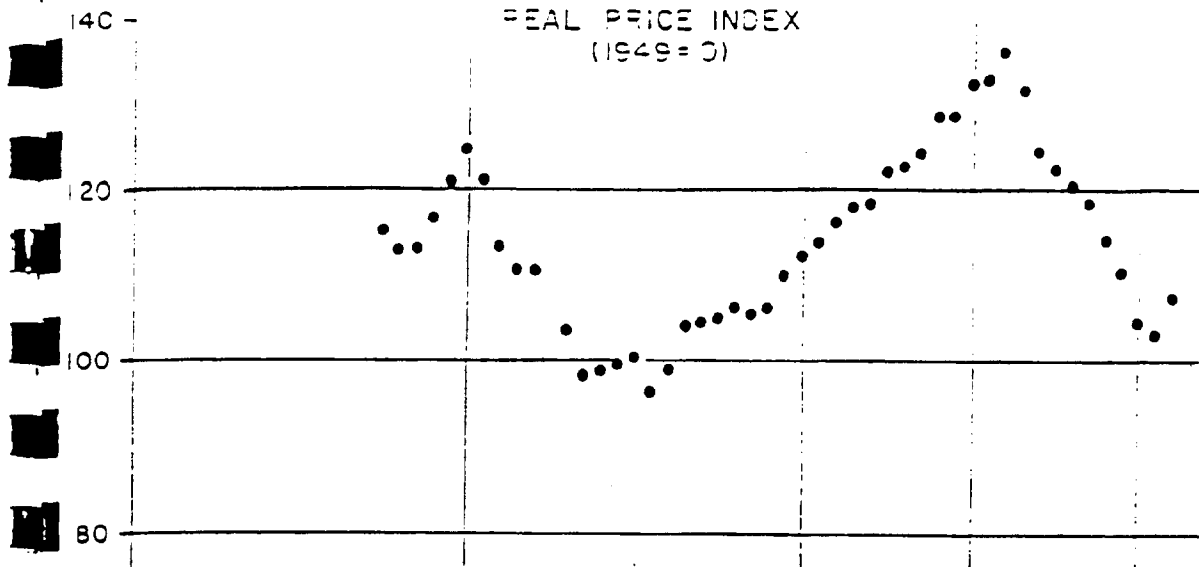


BASIC PROPENSITY (PER YEAR)

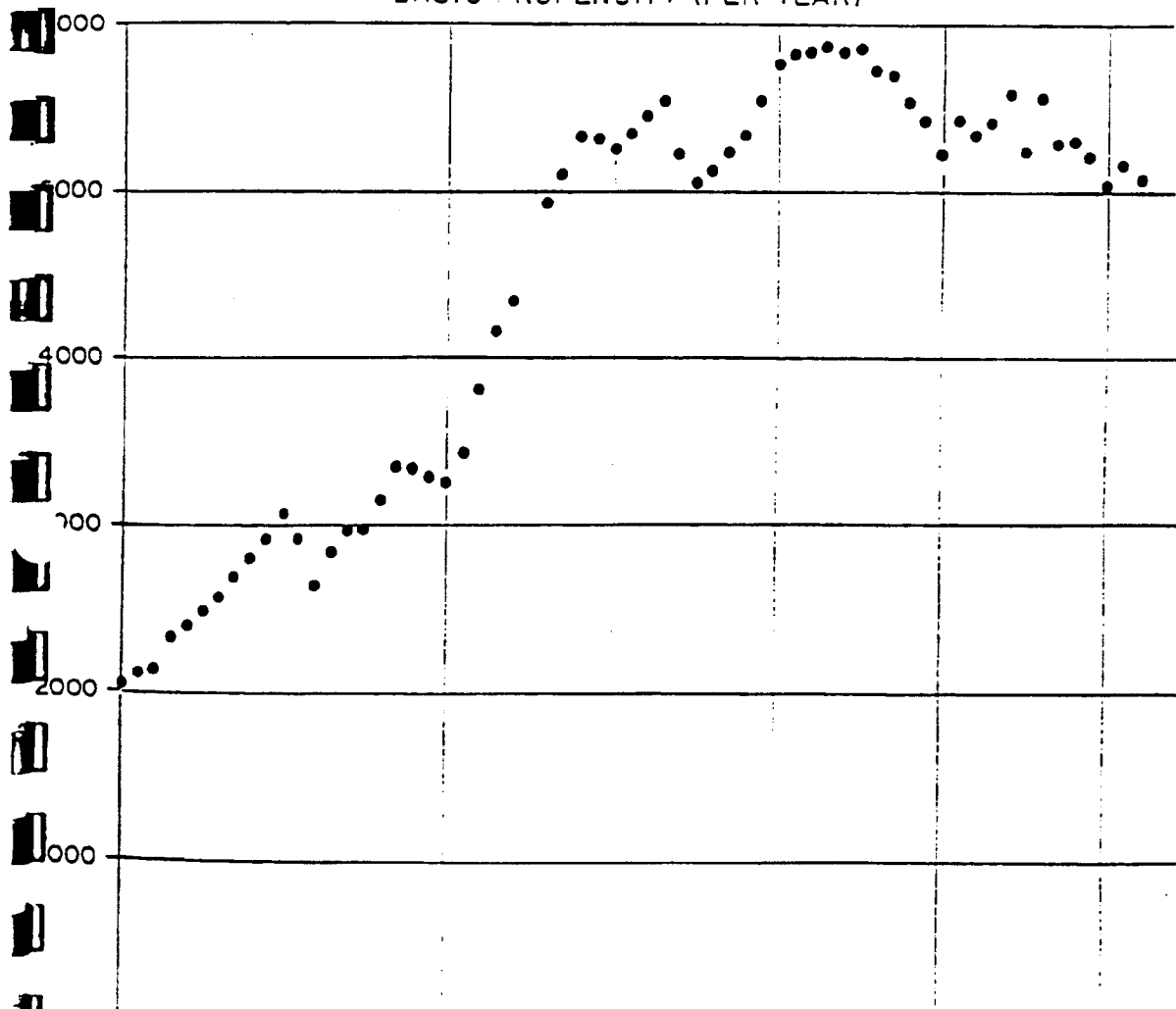


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EXHIBIT 23
U.S.A.
REAL PRICE INDEX
(1949=100)



BASIC PROPENSITY (PER YEAR)



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PRICE ELASTICITIES AND GROWTH TRENDS

	<u>EQUATION (1)</u> (Long term)			<u>EQUATION (2)</u> (Short term)		
	α	C_1	C_2	α	C_1	C_2
<u>CANADA</u>						
1951 - 1982	-0.96	12.0%	-1.2%	-0.77	12.3%	-0.7%
<u>U.S.A.</u>						
1916 - 1982	-1.08	12.6%	-2.6%	-0.79	12.2%	-1.9%

α : Price Elasticity
 C_1 : Annual Growth Trend Before 1969
 C_2 : Annual Growth Trend From 1969

PROPOSED ELASTICITIES FOR CANADA:

Short Term: $\alpha = -0.75$
 Long Term: $\alpha = -0.9$

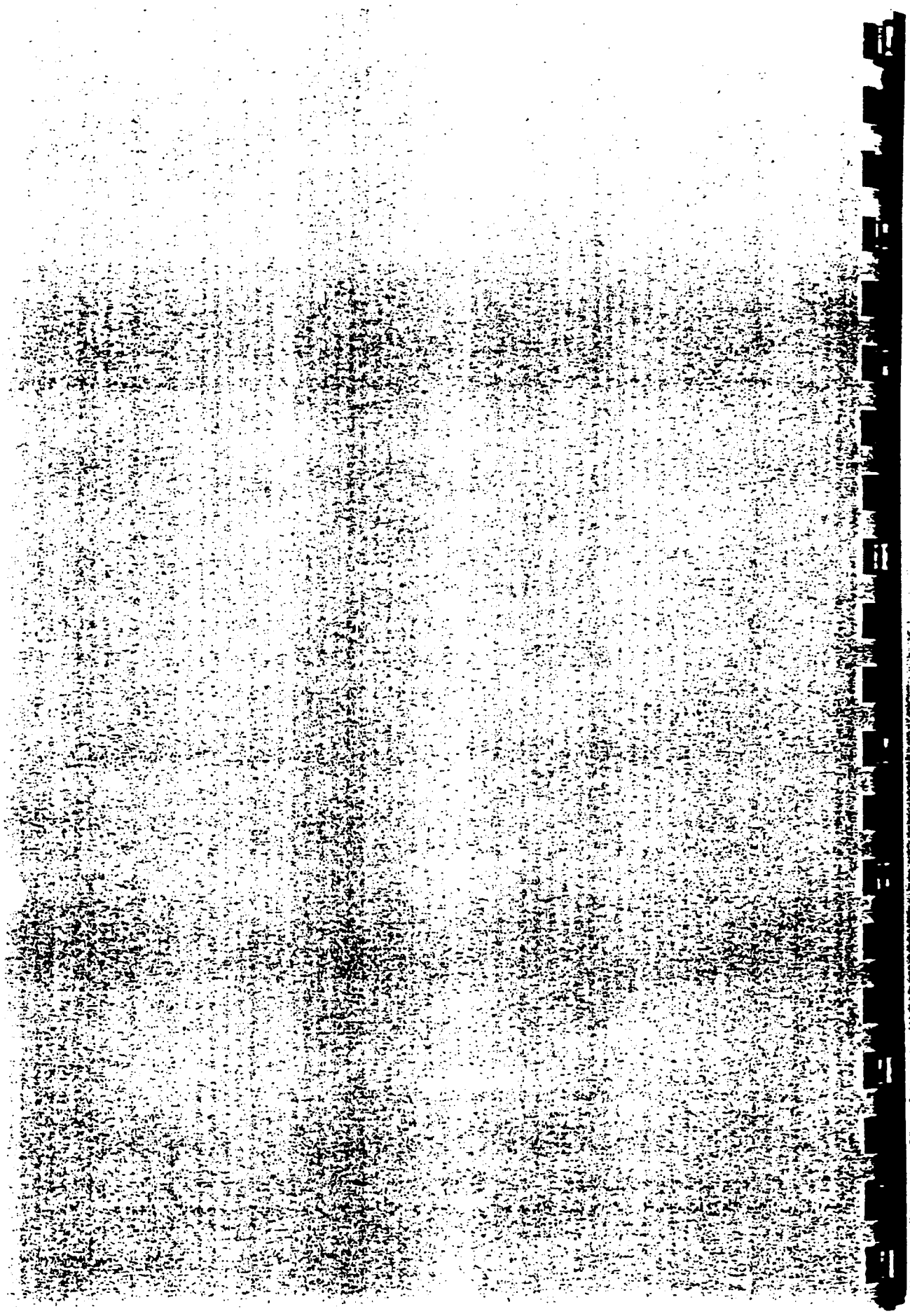
$$(1) \quad V_n = V_0 (1+c)^n \left(\frac{P_n}{P_0} \right)^\alpha$$

V_n = Smoking propensity per male adult* in year n
 V_0 = "Basic" smoking propensity in year 0
 P_n = Cigarette price in year n
 P_0 = Cigarette price in year 0

$$(2) \quad \frac{V_n}{V_{n-1}} = (1+c)^2 \left(\frac{P_n}{P_{n-2}} \right)^\alpha$$

* Average annual number of cigarettes smoked by all males in population between age 20 and limiting age defined in text.

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BATCo document for Province of British Columbia 20 April 1999



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