STAFF STUDY N

Personal Consumer Expenditures in Canada, 1926-75
Part 1

by

Thomas T. Schweitzer

prepared for the

Economic Council of Canada

PERSONAL CONSUMER EXPENDITURES IN CANADA, 1926-75

Part 1:

Food, Beverages and Tobacco
Clothing, Footwear and Accessories
Gross Rent, Fuel and Light

by

Thomas T. Schweitzer

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1. INTRODUCTION

Personal expenditure on consumer goods and services has amounted to about 60 per cent of Gross National Product in recent years. It is the largest aggregate component of GNP. Its size and composition influence the economic well-being of every Canadian. Its future changes will in turn significantly influence the business life of our country.

In view of these facts, it is surprising and regrettable that research on consumer expenditure has been a relatively neglected field in Canada.[1] It is all the more regrettable because theoretical and empirical research in other countries indicates that there are important *dynamic* factors at work in consumer expenditure, the impacts of which cannot be easily assessed by intuition. At the same time, the ability of business enterprises to adjust to the changing pattern of consumer expenditure will have a major influence on the success of these same enterprises and their employees.

Chapters 2 and 3 of this Study, which discuss the method followed and the problems of estimation, are somewhat difficult and technical. For those who wish to skip these chapters and proceed immediately to our findings, beginning in Chapter 4, the following informal introduction may be useful.

The research addressed itself to a deceptively simple problem: if "normal" or "permanent" personal income after taxes (per capita, adjusted for price changes) changes by 1 per cent, by what percentage will consumption of item i change? If the price of item i changes by 1 per cent relative to the price of total consumer expenditure, what will be the percentage change in the consumption of item i? (In the jargon of the professional economist, what are the elasticities of consumption of item i with respect to "income" and to relative price?) Also, what do these elasticities imply for 1975 – provided the potential consumer expenditure described in *Perspective 1975*[2] is realized.

The expression "deceptively simple" was used intentionally, because the question immediately arises: elasticities – but over what time period? This problem can be illustrated by an example. Assume that "income" rises in some year in which a great number of automobiles are bought by consumers. They will have now a larger number of new cars – in other words, the (depreciated)

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[1]The two studies that contained detailed projections must be regarded as outdated by now. See D. W. Slater, *Consumption Expenditures in Canada,* Royal Commission on Canada's Economic Prospects, May 1957; and R. E. Caves and R. H. Holton, *The Canadian Economy*, Cambridge, Harvard University Press, 1961, Chapter 10.

[2]Economic Council of Canada, Sixth Annual Review, Ottawa, Queen's Printer, 1969.

stock of new cars in the consumers' hands will be high. Even if the new, higher "income" persists next year, it is unlikely that most of the purchasers of the first year will be in the market for cars again in the second year. We must distinguish between the "short-term" elasticity of consumption – *the reaction in the year of change* – and the "long-term" elasticity, the new equilibrium level to which consumption of item *i* would settle down, *after all the dynamic reactions to the initial change have worked themselves through the system,* provided that "income" would remain stable into the indefinite future after the initial change. What we observe in our historical data is the result of these two forces – the short-term effect of this year's change and the long-term effect of all previous changes. These forces sometimes counteract and sometimes reinforce each other. Our task was to distinguish and measure them for the purpose of projecting the structure of consumer expenditure.

In general, the short-term elasticities of durables and semidurables are considerably higher than their long-term elasticities. In 1966, the last year included in our historical analysis, the short-term elasticity of the consumption of men's and boys' clothing with respect to "income" was 2.49. The corresponding long-term elasticity was 0.17! One would expect – and this Study confirms it – that in analysing consumption, one must take into account not only current total consumer expenditure and prices, but also the effects of past consumption, as reflected in the form of stocks in the hands of the consumers and the speed with which these stocks depreciate.

In the case of nondurables and services, the effect of stocks is negligible or nonexistent. Nevertheless here, too, we find that the short- and long-term elasticities differ. It is a case of *habit-formation.* When habit-formation is present, a change of total consumer expenditure does not result in an immediate adjustment of the consumption level of nondurables and services to a new equilibrium. Old habits of consumption linger, and the change goes only part way towards the new equilibrium. Should "income" stabilize at a new and higher level, the consumption of the typical nondurable or service item would continue to rise, though at a decreasing rate, until the effect of past consumption habits has worn off. Only then would the consumption of the nondurable or service level off at the new equilibrium. For instance, in the case of electricity we found that the short-term elasticity with respect to "income" in 1966 was 0.11 while the corresponding long-term elasticity was 2.10.

In Chapter 5, the reader will find a set of statistics: α, β, γ, γ', δ, η, and η'. The symbol α is not meaningful to the nontechnical reader. The meaning of the others is as follows:

- β measures the effect of past consumption on current consumption. Generally it is expected to be negative in the case of a durable or semidurable item, and positive in the case of nondurables and services.
- γ and γ' measure the short- and long-term effect that a one-dollar change of "income" has on the consumption of the item discussed.

δ is the depreciation rate of the stocks in the hands of consumers (in the case of a durable or semidurable item) or the rate at which past consumption habits wear off (in the case of nondurables and services).

η and η' measure the short- and long-term effect of a one-point change in the relative price of the item discussed on the consumption of that item.

Before turning to the discussion of the individual consumer items, it is advisable to read Chapter 4 and the glossary at the beginning of Chapter 5.

The Dominion Bureau of Statistics recently released its decennial revision of the National Accounts.[3] The publication contains major revisions as far back as 1926. The present Staff Study is based on unpublished background data of the revised National Accounts. Chapter 4 of *Perspective 1975*, published in September 1969, contained a summary of consumer-expenditure projections based on the revised data, but this was prepared under considerable time pressure. Findings of the present Study are based on further intensive work and additional information that was not available when *Perspective 1975* was written, and may from time to time deviate somewhat from those reported in the latter publication.

A detailed analysis of the DBS worksheets of the National Accounts, which provide estimates on the various consumer items under 10 main groupings, would involve an extended period of research. Rather than delay the publication of a comprehensive study of all these items, it was decided to publish at this time the analysis of three important groups containing 26 items. These groups deal with

1. Food, Beverages and Tobacco
2. Clothing, Footwear and Accessories
3. Gross Rent, Fuel and Light.

The other seven major groups will be covered in subsequent Staff Studies.

The Houthakker-Taylor[4] model adopted in this Study is only one of the many interesting methods discussed in current economic literature.[5] A comparative evaluation of these methods would be a fascinating and valuable research project that could well repay the considerable time and research input needed. In view of the great dearth of detailed knowledge concerning disaggregated consumer expenditures in Canada, it was thought to be more urgent to have at least the results obtained by the use of one of these modern methods.

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[3]Dominion Bureau of Statistics, *System of National Accounts, National Income and Expenditure Accounts 1926-68*, August 1969.

[4]H. S. Houthakker and L. D. Taylor, *Consumer Demand in the United States, 1929-70*, Cambridge, Harvard University Press, 1966.

[5]See, e.g., R. Stone, A. Brown, and D. A. Rowe, "Demand Analysis and Projections for Britain: 1900-1970", in *Europe's Future Consumption* (J. Sandee, Ed.), Amsterdam, North-Holland Publishing Co., 1964, Chapter 8; A. P. Barten, "Consumer Demand Functions under Conditions of Almost Additive Preferences", *Econometrica*, Vol. 32, April 1964, pp. 1-38; and C. Almon, *The American Economy to 1975*, New York, Harper & Row, 1966, pp. 24-53.

2. THE MODEL

The approach of our Study is that of Houthakker and Taylor,[6] and can be summarized as follows:

Assume for a start that consumer expenditure for a particular good (or group of goods) – say, automobiles – in time period t is determined by the income of the consumers and by the (depreciated) stock of automobiles held by consumers. (This is an extremely simplified assumption. Refinements will be introduced later on.) The starting assumption can be expressed symbolically as:

$$(1) \quad q_t = \alpha + \beta s_t + \gamma x_t$$

where q_t = consumer expenditures on automobiles in constant (1961) dollars per capita of Canada's population during the time interval from t to $t+1$,

s_t = average depreciated inventory of automobiles in the hands of consumers during the interval in constant dollars per capita,

x_t = personal disposable income in constant dollars per capita during the interval.

s_t is usually not known, but it can be eliminated in the following manner:

$$(2) \quad \Delta^* s_t = q_t - w_t$$

where $\Delta^* s_t$ = change in stock of automobiles in the hands of consumers *during* the time period t,

w_t = using up, or "depreciation" of this stock during the same time interval.

Assume further

$$(3) \quad w_t = \delta s_t$$

where δ is a constant depreciation rate. Substituting (3) into (2) gives

$$(4) \quad \Delta^* s_t = q_t - \delta s_t.$$

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[6] *Op. cit.* This work gives the model both in continuous and discrete form. Our summary is in discrete form. It should be pointed out that our notation differs slightly from that of Houthakker and Taylor.

Rearranging (1) we get

$$(5)\quad s_t = \frac{1}{\beta}(q_t - \alpha - \gamma x_t)$$

and substituting (5) into (4),

$$(6)\quad \Delta^* s_t = (1 - \frac{\delta}{\beta})\, q_t + \frac{\alpha\delta}{\beta} + \frac{\gamma\delta}{\beta} x_t.$$

Lagging equation (1) by one time period

$$(7)\quad q_{t-1} = \alpha + \beta s_{t-1} + \gamma x_{t-1}$$

and subtracting (7) from (1) we obtain

$$(8)\quad q_t - q_{t-1} = \beta(s_t - s_{t-1}) + \gamma(x_t - x_{t-1}).$$

Assume that $s_t - s_{t-1}$ can be approximated in the following manner:

$$(9)\quad s_t - s_{t-1} \simeq \tfrac{1}{2}(\Delta^* s_t + \Delta^* s_{t-1}).$$

(The exact equality holds true if the behaviour of the *s* variable is linear within each time period.) Then

$$(10)\quad q_t - q_{t-1} = \frac{\beta}{2}(\Delta^* s_t + \Delta^* s_{t-1}) + \gamma(x_t - x_{t-1}).$$

Substituting (6) into (10) we obtain

$$(11)\quad q_t - q_{t-1} = \frac{\beta}{2}\left[(1 - \frac{\delta}{\beta}) q_t + \frac{\alpha\beta}{\beta} + \frac{\gamma\delta}{\beta} x_t + (1 - \frac{\delta}{\beta}) q_{t-1} + \frac{\alpha\beta}{\beta} + \frac{\gamma\delta}{\beta} x_{t-1}\right] + \gamma(x_t - x_{t-1}).$$

This can be simplified (provided $\overline{\beta - \delta} \neq 2$) to

$$(12)\quad q_t = \frac{\alpha\delta}{1 - \frac{1}{2}(\beta - \delta)} + \frac{1 + \frac{1}{2}(\beta - \delta)}{1 - \frac{1}{2}(\beta - \delta)} q_{t-1} + \frac{\gamma(1 + \frac{1}{2}\delta)}{1 - \frac{1}{2}(\beta - \delta)} x_t - \frac{\gamma(1 - \frac{1}{2}\delta)}{1 - \frac{1}{2}(\beta - \delta)} x_{t-1}.$$

s_t has disappeared from the equation and the remaining variables are now the directly observable quantities q_{t-1}, x_t and x_{t-1}.

It is convenient to express

$$(13)\quad x_t = x_{t-1} + (x_t - x_{t-1})$$

which leads to

$$(14)\quad q_t = \frac{\alpha\delta}{1 - \frac{1}{2}(\beta - \delta)} + \frac{1 + \frac{1}{2}(\beta - \delta)}{1 - \frac{1}{2}(\beta - \delta)} q_{t-1} + \frac{\gamma\delta}{1 - \frac{1}{2}(\beta - \delta)} x_{t-1} + \frac{\gamma(1 + \frac{1}{2}\delta)}{1 - \frac{1}{2}(\beta - \delta)}(x_t - x_{t-1})$$

or simply

$$(14a)\quad q_t = A_0 + A_1 q_{t-1} + A_2 x_{t-1} + A_3 \Delta x_t.$$

Here Δx_t stands for the difference in *x between* the two time periods *t* and *t*–1. The parameters α, β, γ and δ of equation (1) and (3) can be obtained from the coefficients of (14a) as follows:

$$(15)\quad \alpha = \frac{2A_0(A_3-\frac{1}{2}A_2)}{A_2(A_1+1)}$$

$$(16)\quad \beta = \frac{2(A_1-1)}{A_1+1} + \frac{A_2}{A_3-\frac{1}{2}A_2}$$

$$(17)\quad \gamma = \frac{2(A_3-\frac{1}{2}A_2)}{A_1+1}$$

$$(18)\quad \delta = \frac{A_2}{A_3-\frac{1}{2}A_2}$$

β, γ and δ are of particular interest. β, the stock coefficient, can be expected to be negative in the case of consumer durables. However, β is meaningful also in the case of nondurables and services. It should be recalled that in our calculations we never deal with the variable s directly – we infer its existence from the behaviour of the variables used in (14a) and expect a negative β in the case of durables and semidurables on the basis of practical experience. In fact, s can be regarded as an unspecified "state variable", the coefficient of which will normally have a negative sign in the case of those goods where inventories currently in the hands of consumers have a depressing effect on consumer expenditure in the next time period.

We can also visualize cases in which the state variable would normally have a positive coefficient. Essentially, s_t stands for the (not directly measurable) effect of *past* consumer expenditures on *current* expenditures. This can manifest itself in the form of stocks in the hands of consumers, or in the form of consumers' habits. Consumption theory has long postulated the existence of habit formation, i.e., a relevant variable which is not directly measurable, and which will result in a lagged adjustment of consumption to income changes. (It will be demonstrated later that in most cases this is equivalent to $\beta > 0$.) This is particularly true in the case of nondurables and services. Here the nonmeasurable state variable, which in the case of durables stands for physical stocks, represents habit formation, or a psychological stock of habits. Similarly δ, which in the case of durables and semidurables measures the depreciation rate of physical stocks, measures, in the case of nondurables and services, the depreciation or "wearing off" of consumption habits.

It should be pointed out that the above-mentioned dichotomy between "stock affected" durables and semidurables with negative betas on the one hand and "habit affected" nondurables and services with positive betas on the other is an oversimplication. In most cases both the "stock effect" and the "habit effect" are at work simultaneously in the consumption pattern of any consumption item, and β *measures their joint influence.* It would be desirable to separate the "stock effect" from the "habit effect" but we don't know of any model that can accomplish this.

In the case of durables and to a lesser degree of semidurables the stock effect usually predominates and β is, therefore, negative. However, there are cases when a highly successful new durable product breaks into the market. Then a kind of nation-wide habit formation develops and outweighs the stock effect. In such a case a durable good may show a positive β until the market is "saturated". U.S. experience yields a positive β for radio and television receivers, records and musical instruments.[7] Again, nondurable products and services, which for reasons of technology, social and institutional developments or changes in taste have lost favour with the consuming public and are regarded as inferior, may show negative habit formation and thus a negative β . A U.S. example for such a product group is "fuels other than electricity and natural gas, and ice".[8]

γ measures the short-range effect of a unit change in x on q. Short-range in this context means the time unit of observation – in this Study one calendar year. The long-term effect of a change in x can be also calculated. This is the entire change in consumption caused by a once-for-all change in x, including the lagged effects caused by changes of the state variable.

Let us define long-term equilibrium in which q, s and x all remain constant over time and denote these long-term levels as $\hat{q}$, $\hat{s}$ and $\hat{x}$. Then $\Delta^*\hat{s} = 0$ and it follows from (4)

$$(19) \quad \hat{q} = \delta \hat{s}.$$

Substitution of (19) into (1) yields

$$(20) \quad \hat{q} = \alpha + \frac{\beta}{\delta}\hat{q} + \gamma \hat{x}$$

and assuming $\beta \neq \delta$

$$(21) \quad \hat{q} = \frac{\alpha\,\delta}{\delta - \beta} + \frac{\gamma\,\delta}{\delta - \beta}\hat{x}.$$

The derivative of $\hat{q}$ with respect to $\hat{x}$ is then

$$(22) \quad \gamma' = \frac{\gamma\,\delta}{\delta - \beta},$$

the long-term coefficient.

It should be pointed out that γ and γ' *are not elasticities.*[9] Since equation (1) is a linear model, the elasticities will therefore be different at each point along the curve.[10] However, it is easy to calculate the short- and long-term elasticities once γ and γ are obtained. In most cases γ and δ will be positive. From this it follows that a negative β (i.e., "stock effect" predominates) will result in $\gamma' < \gamma$, and a positive β (i.e., "habit formation" predominates) in $\gamma' > \gamma$. A positive β is thus equivalent to a lagged adjustment of consumption to income changes, while a negative β implies an initial overshooting of the equilibrium consumption level, followed by subsequent correction.

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[7] Houthakker and Taylor, *op. cit.*, p. 130.

[8] *Ibid.*, p. 90.

[9] The short-term elasticity with respect to x is defined as $\frac{\partial p}{\partial x}\cdot\frac{x}{q}$ and the long-term elasticity as $\frac{\partial \hat{q}}{\partial \hat{x}}\cdot\frac{\hat{x}}{\hat{q}}$. (Here ∂ means the partial derivative. It should not be confused with the depreciation rate of equation (3) and passim.)

[10] In Chapter 5 we have calculated the elasticities for the mean of the historical range and also for the most recent time period of the regression fit (i.e., 1966).

Additional variables can be introduced into an equation of the type (1). For instance, the introduction of relative price p (implicit price deflator of the product group divided by implicit price deflator of total consumer expenditures) leads to

$$(23)\quad q = \alpha + \beta s_t + \gamma x_t + \eta p_t \text{ (the structural equation),}$$

$$(23a)\quad q_t = A_0 + A_1 q_{t-1} + A_2 x_{t-1} + A_3 \Delta x_t + A_4 p_{t-1} + A_5 \Delta p_t \text{ (the estimating equation).}$$

By analogy we obtain counterparts to (17) and (22):

$$(24)\quad \eta = \frac{2\,(A_5 - \tfrac{1}{2} A_4),}{A_1 + 1}$$

$$(25)\quad \eta' = \frac{\eta\,\delta}{\delta - \beta} \text{ (see footnote 11).}$$

[11]By analogy to footnote 9 the elasticities with respect to p are $\frac{\partial q}{\partial p} \cdot \frac{p}{q}$ and $\frac{\partial \hat{q}}{\partial \hat{p}} \cdot \frac{\hat{p}}{\hat{q}}$.

3. ASPECTS OF ESTIMATION

The Problem of Over-identification

With the introduction of the additional variable p a complication arises because δ becomes over-identified. In addition to

$$(18)\quad \delta = \frac{A_2}{A_3 - \frac{1}{2}A_2},$$

(23) and (23a) yield

$$(26)\quad \delta = \frac{A_4}{A_5 - \frac{1}{2}A_4}.$$

These two estimates of δ are not necessarily the same. In order to derive a unique estimate of δ , which yields also a unique estimate of δ and β , we set

$$(27)\quad \frac{A_2}{A_3 - \frac{1}{2}A_2} = \frac{A_4}{A_5 - \frac{1}{2}A_4}, \text{ i.e., } A_2A_5 = A_3A_4 .$$

This is an additional nonlinear restriction which has to be imposed on equation (23a), when performing our least-squares estimate. The method employed in this Study is that of D. W. Marquardt.[12]

The Problem of Autocorrelation

In estimating least-squares regressions of the type (23a) which contains a lagged dependent variable, one frequently encounters a high degree of autocorrelation in the residuals. This is undesirable for a variety of statistical reasons. Houthakker and Taylor adopted the method developed by L. D. Taylor and T. A. Wilson for dealing with this problem.[13]

To summarize its essential point, we assume that the error term u_t of equation (23a) can be approximated by the expression

$$(28)\quad u_t = \lambda u_{t-1} + \epsilon_t$$

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[12] D. W. Marquardt, "An Algorithm for Least-Squares Estimation of Nonlinear Parameters", *Journal of the Society for Industrial and Applied Mathematics*, Vol. 1, No. 2, June 1963.

[13] For a detailed description see L. D. Taylor and T. A. Wilson, "Three Pass Least Squares: A Method for Estimating Models with a Lagged Dependent Variable", *Review of Economics and Statistics*, Vol. XLVI, No. 4, Nov. 1964.

where ϵ_t is independently distributed, i.e., $E(\epsilon_t \epsilon_{t'}) = 0$ for all t and t' $(t \neq t')$. The method consists of computing a time-series for u_{t-1} (hereafter referred to as the three-pass variable) and introducing it as an additional variable in (23a).[14]

When preparing a projection, the value of the three-pass variable for the first projection time unit can be obtained from the last observation of the historical period. For subsequent time units the historical mean of the three-pass variable should be used.[15]

Special Cases

Equation (23a) is a very flexible framework for analysing consumer expenditure. This can be demonstrated by discussing some special cases, many of which we have encountered in our work:

1) $A_1 = 1$.
This implies $\beta = \delta$. See equations (16) and (18). In this case q_{t-1} can be carried over to the left side of the equation (23a) and the equation is estimated with Δq as dependent variable. The long-run coefficients γ' and η' and the corresponding elasticities can no longer be estimated, due to the required division by $\delta - \beta$ in equation (22). The equation, however, can still be used for projection purposes.

2) $A_2 = A_4 = 0$
This implies $\delta = 0$. See equation (18). In this case omit x_{t-1} and p_{t-1} from the equation. The long-run interpretation breaks down, because according to (21) this case implies $\hat{q} = 0$, which is implausible.

3) $A_1 = 0$.
This implies $\delta = \beta + 2$. See equation (16). If this occurs when $A_2 = A_3$ and $A_4 = A_5$ (see below), the case reduces itself to an ordinary static equation.

4) $A_2 = A_3, A_4 = A_5$.
This implies $\delta = 2$. Only current income and price are included in the equation. Equation (19) shows that δ can also be regarded as a consumption-inventory ratio. In this case $\delta = 2$ would arise when a commodity of the lifetime of one year is bought once a year.
A more useful interpretation, however, is the following: Houthakker and Taylor have demonstrated[16] that $\delta = 2$ is equivalent to the classical distributed-lag model of Koyck,

$$(28) \quad q_t = \alpha + \beta \sum_{i=0}^{\infty} \psi^i x_{t-i}.$$

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[14]The three-pass method, for which Houthakker and Taylor claim good small-sample properties, has been subject to criticism in recent statistical literature. Nevertheless, the forthcoming second edition of Houthakker and Taylor, in which they re-estimate their equations on the basis of the revised U.S. National Accounts data, uses the three-pass method.

[15]Houthakker and Taylor, *op. cit.*, p. 50.

[16]*Ibid.*, pp. 25-27.

5) $A_3 = A_5 = 0$.
This implies $\delta = -2$. Only lagged values of income and price are included in the equation. This is equivalent to the Koyck-type model

$$(29)\quad q_t = \alpha + \beta \sum_{i=0}^{\infty} \psi^{i-1} x_{t-i}\,.$$

In this case the short-term income coefficient can be negative and the long-term coefficient positive.
6) δ is very large.
This is the "Bergstrom case"[17] (named after A. R. Bergstrom of the London School of Economics), which arises when A_2 (A_4) does not significantly differ from $2A_3$ ($2A_5$). It is equivalent to a model which assumes that the consumer is attempting to change his actual level of consumption towards a desired level which is determined by his income (and by other relevant variables). This can be expressed in algebraic form as:

$$(30)\quad \Delta q = \theta(\tilde{q} - q)$$
$$\tilde{q} = \xi + x$$

where $\tilde{q}$ is the desired level of consumption. Assuming

$$(32)\quad q_t - q_{t-1} = \tfrac{1}{2}(\Delta^* q_t + \Delta^* q_{t-1})$$

the estimating equation becomes

$$(33)\quad q_t = A_0 + A_1 q_{t-1} + A_2(x_t + x_{t-1})\,.$$

From (33) follows that

(34) the constant term $\xi = \dfrac{A_0}{1 - A_1}$

(35) the adjustment coefficient $\theta = \dfrac{2(1 - A_1)}{1 + A_1}$.

(36) the income coefficient $\mu = \dfrac{2A_2}{1 - A_1}$.

After inclusion of the price term, the estimating equation becomes

$$(37)\quad q_t = A_0 + A_1 q_{t-1} + A_2(x_t + x_{t-1}) + A_3(p_t + p_{t-1})$$

and by analogy to (36)

(38) the price coefficient $\lambda = \dfrac{2A_3}{1 - A_1}$

[17] *Ibid.*, pp. 27-28.

4. THE DATA FOR ESTIMATION AND PROJECTION

The data on consumption are on a per capita constant (1961) dollar basis and are derived from unpublished DBS worksheets and computer outputs of the 1969 historical revision of National Accounts.[18] The method in this Study is that of time series analysis, using in the main the period 1926-66, with the war years 1940-45 omitted. In a few instances where circumstances justified it, additional years were omitted. These cases will be clearly indicated in the discussion of the individual consumer items.

The most important independent variable, x, is total consumer expenditure per capita, in constant dollars. This is a better approximation to "normal" or "permanent" income than is the "measured" income reported by DBS.[19]

Starting with 1961 it was necessary to make an adjustment to the published DBS personal consumer expenditure data. From 1961 on, DBS has transferred a part of medical care and health expenses from personal consumer expenditures to government expenditures (namely, hospital insurances and medicare). This causes a discontinuity in the published personal consumer data. To avoid the discontinuity, we have transferred hospital insurance and medicare back into personal consumer expenditure.

In this Study, p stands for the relative price of the product group investigated, i.e. the implicit price deflator of the group divided by the implicit price deflator of total consumption expenditure.

We made frequent use of a dummy variable d with the value 0 in the 1926-39 period and with the value 1 in 1946-64. This dummy variable is assumed to measure the influence on social, institutional and taste changes between the prewar and postwar period.

The three-pass least-squares method was adopted whenever the coefficient of the three-pass variable was larger than its standard error or if the Durbin-Watson statistic of ordinary least squares was outside the range 1.6 and 2.4. This occurred in 11 instances out of 24 consumer items.

Whenever additional variables have been used, their explanation will be given in the discussion of the individual product group.

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[18]In classifying consumer expenditure items and deciding which should be regarded as durables, semidurables, nondurables or services, DBS has in the main followed the recommendations of the United Nations document: *Proposal for Revising the SNA*, 1952, E/CN. 3/345.

[19]For the concept of permanent income see M. Friedman, *The Theory of the Consumption Function*, Princeton, Princeton University Press, 1957.

In general, we retained a variable whenever its coefficient was larger than its standard error. However, this rule was not observed rigidly, but tempered by judgment. Also, a variable was omitted if the sign of its coefficient was judged incorrect on basic theoretical reasoning. The most frequent occurrence of this kind was that of a positive coefficient for p.[20]

Projections of the individual consumption items by our equations would not forcibly add up to total consumption, even if we had derived equations for all components of consumer expenditure. A method to solve this problem by adjusting total consumer expenditure until the components add up to the original unadjusted consumer expenditure is described in Houthakker and Taylor.[21]

TABLE 1

VALUES OF INDEPENDENT VARIABLES, 1968 AND 1975

Variable	1968	1975	Method of Interpolation
x (in 1961 dollars)	$1,784.06	$2,355.50*	exponential
p of item 0111	101.6	101.6	linear
0112	97.6	97.6	"
0113	101.6	101.6	"
0121	113.5	113.5	"
0122	98.7	98.7	"
0130	107.1	107.1	"
0212	99.5	92.5	"
0213 + 0214	99.5	99.5	"
0222	109.9	123.9	"
0231	107.6	114.6	"
0232	107.1	114.1	"
0233	121.3	142.3	"
1210	122.2	143.2	"
0322 + 0323	83.6	69.6	"
1311	92.3	92.3	"
1312	92.3	92.3	"
1313	92.3	92.3	"
1316	130.2	158.2	"
Farm population as percentage of total pop.	8.94	6.40	"
Armed forces as percentage of total pop.	0.48	0.34	"
Population aged 20 + as percentage of total pop.	58.44	61.11	"
Full-time university enrolment as percentage of total pop.	1.31	2.22	"
Population weighted degree days*	7,825	7,721	

*This value is equivalent to that given in 1967 dollars in *Perspective 1975, op. cit.*, p. 55.

**For discussion of this variable see analysis of Gas and Other Fuels (Item 0322 + 0323).

[20]We have calculated only the standard errors of the coefficients of the estimating equations. It would be, of course, desirable to obtain also the standard errors of the structural equations, but lack of time and resources have made this impossible.

[21]*Op. cit.*, pp. 52-53.

Our regression analysis is based on the period 1926-66. We have omitted from our analysis the available data for 1967 and 1968 in order to be able to test the forecasting ability of our regressions (see Chapter 7). However, we have used the 1968 DBS data as the starting point of our projections to 1975.

To prepare these projections, it was necessary to make certain assumptions regarding the future course of the independent variables. These assumptions are summarized in Table 1. The historic means of the three-pass variables, needed for projection purposes, are to be found in Table 2.

TABLE 2

HISTORIC MEAN OF THE THREE-PASS VARIABLES

Item	Mean
0111	–45.19
0112	– 4.98
0113	+ 1.73
0211	– 1.97
0212	+ 1.55
0213 + 0214	– 0.48
0215	– 0.01
0221	+ 1.82
0310	– 4.38
0321	– 2.96
1313	– 0.24

The DBS consumer expenditure data contain much valuable and useful material. At the same time DBS would be the first to agree that there is scope for improvement, particularly at the widely disaggregated level. In general, DBS follows the reasonable practice of devoting more resources to the estimation of big and important consumer items than to the smaller ones. While in theoretical economic work it is not regarded as fair play to criticize the underlying data, in applied work it is necessary to point out such weaknesses in order to warn the private and public policy-makers. We shall point out some of our doubts in the discussion of the individual consumer items. Two general remarks have to be made, however, at the very beginning.

First, current dollar expenditures on the individual consumption items as reported by DBS do *not* contain the retail sales tax. The price deflators, on the other hand, *do* contain the tax. To this extent the real expenditures on items subject to the tax are under-reported.

Second, total consumer expenditure contains an item called "Miscellaneous Goods and Adjusting Entries". Under this heading are reported (among others) those consumer expenditures that DBS cannot at this time – for one reason or another – assign to the individual disaggregated items. This item has grown very rapidly since 1951:

MISCELLANEOUS GOODS AND ADJUSTING ENTRIES

	Index 1961=100
1951	39.2
1961	100.0
1968	162.5

Ultimately a large part of "Miscellaneous Goods" will be assigned to individual consumer items. In the meantime, however, these items remain under-reported.

5. EXPENDITURE EQUATIONS AND PROJECTIONS FOR DETAILED ITEMS OF EXPENDITURE

Glossary

d.	durable consumer good expenditure.
s.d.	semidurable consumer good expenditure.
n.d.	nondurable consumer good expenditure.
s.	consumer service expenditure.
q_t	consumer expenditure on the item in question in constant (1961) dollars per capita in year t.
Δq_t	$q_t - q_{t-1}$
x_t	total consumer expenditure in constant (1961) dollars in year t.
Δx_t	$x_t - x_{t-1}$
p_t	relative price of the item in year t (1961=100), i.e., implicit price index of the item divided by the implicit price index of total consumer expenditure multiplied by 100.
Δp_t	$p_t - p_{t-1}$.
d_t	prewar-postwar dummy (takes value 0 in the period 1926-39 and value 1 in the period 1946-66).
z_t	three-pass variable.
$\bar{R}^2$	coefficient of multiple determination corrected for degrees of freedom.
S.E.E.	standard error of estimate.
D-W	Durbin-Watson coefficient.
α	intercept in structural equation.
β	state variable coefficient in structural equation.
γ	short-run total consumer expenditure coefficient of structural equation.
γ'	long-run total consumer expenditure coefficient of structural equation.
δ	depreciation rate.
η	short-run relative price coefficient of structural equation.

Personal Consumer Expenditures

η'	long-run relative price coefficient of structural equation.
ξ	intercept in Bergstrom model.
θ	adjustment coefficient in Bergstrom model.
μ	total consumer expenditure coefficient in Bergstrom model.
λ	relative price coefficient in Bergstrom model.
A_0	intercept in estimating equation.
A_1	coefficient of q_{t-1} in estimating equation.
A_2	coefficient of x_{t-1} in estimating equation.
A_3	coefficient of Δx_t in estimating equation.
A_4	coefficient of p_{t-1} in estimating equation.
A_5	coefficient of Δp_t in estimating equation.
A_6	coefficient of d_t in estimating equation.
A_7	coefficient of z_t in estimating equation.
A_8	coefficient of other variables in estimating equation.

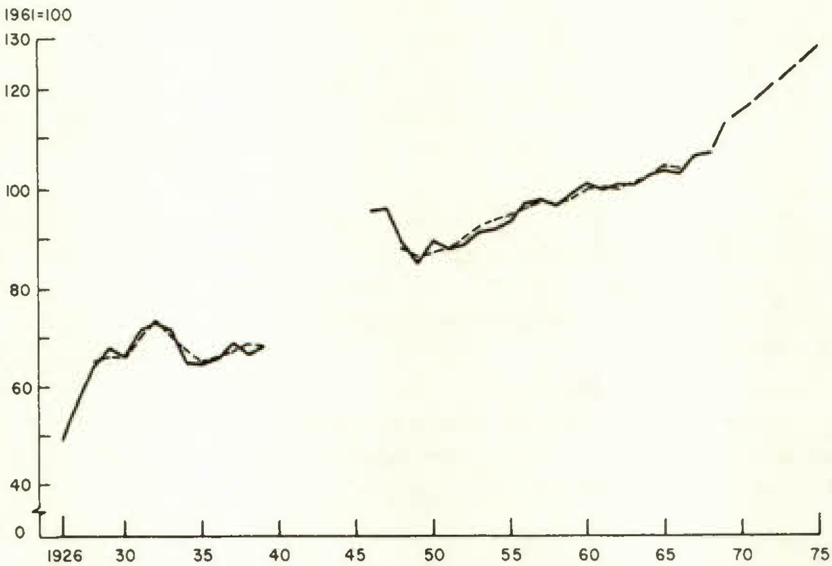
Numbers in parentheses under coefficients are the respective standard errors.

——— Solid line on charts = observed magnitudes.

- - - - - - Short broken line on charts = calculated historical magnitudes.

— — Long broken line on charts = projected magnitudes.

0111 FOOD PURCHASED AT RETAIL (n.d.)



$$q_t = +\ 240.44438 + 0.06162q_{t-1} + 0.07202x_t - 1.29217p_t$$
$$\quad (27.49432) \quad (0.08522) \quad (0.00686) \quad (0.18954)$$
$$+\ 51.12235d_t + 0.49402z_t$$
$$\quad (6.83378) \quad (0.14920)$$

$\alpha = +\ 226.4888$		$\bar{R}^2$	$= 0.992$
$\beta = +\ 0.2322$		$S.E.E.$	$= 3.33$
$\gamma = +\ 0.0678$	$\gamma' = +\ 0.0768$	$D\text{-}W$	$= 2.42$
$\delta = +\ 2$			
$\eta = -\ 1.2172$	$\eta' = +\ 1.3770$		

Consumption Elasticities

with respect to	short-term	long-term
x at mean	+ 0.34	+ 0.39
x in 1966	+ 0.43	+ 0.49
p at mean	- 0.54	- 0.61
p in 1966	- 0.48	- 0.55

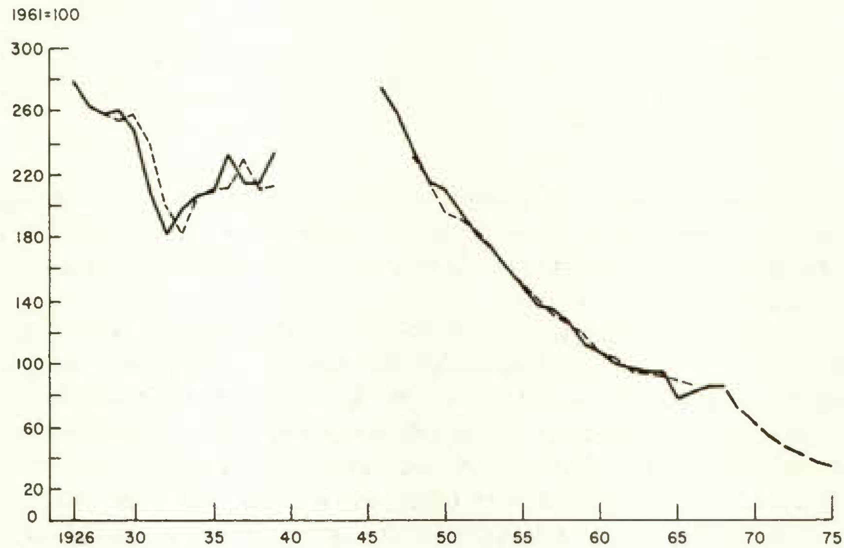
	Real Consumption (1961=100) per capita	aggregate
1968	107.7	122.5
1975	128.7	164.3
1975/1968	+ 19.6%	+ 34.2%

It is surprising to see that the real consumption of this item peaked out during the depth of the Great Depression and then went into a sharp decline. As the current dollar expenditure does not reveal a similar pattern, the suspicion arises that the deflator is not very reliable in the 1926-39 period. Again it is strange that real consumption reached a level in 1947 which, in spite of the substantial real income increase of the postwar period, was not regained until 1956.

Under such circumstances it is understandable that A is smaller than its standard error – a very rare occurrence indeed. However, if we omit q_{t-1} from the estimating equation, the fit deteriorates substantially.

Otherwise the equation looks attractive. β is positive, as expected in the case of a nondurable, and consumption of food as a distributed-lag function of permanent income ($\delta = 2$) is not unreasonable. It is interesting to see that consumption of food is more elastic with respect to p than to x.

0112 FOOD PRODUCED AND CONSUMED ON FARMS (n.d.)



$$q_t = -\underset{(1.86448)}{2.32260} + \underset{(0.10572)}{0.67619}q_{t-1} + \underset{(0.02242)}{0.03290}p_{t-1}$$

$$+ \underset{(0.03635)}{0.12556}\,(\text{farm pop. as \% of total pop.}) + \underset{(0.16290)}{0.22320}z_t$$

$\alpha = +\ 1.3856$ $\qquad\bar{R}^2 = 0.959$

$\beta = -\ 2.3864$ $\qquad S.E.E. = 0.75$

$\gamma =$ $\qquad\gamma' =$ $\qquad D\text{-}W = 1.78$

$\delta = -\ 2$

$\eta = -\ 0.0196$ $\qquad\eta' = +\ 0.1016$

Consumption Elasticities

with respect to	short-term	long-term
x at mean		
x in 1966		
p at mean	− 0.20	+ 1.04
p in 1966	− 0.37	+ 1.93

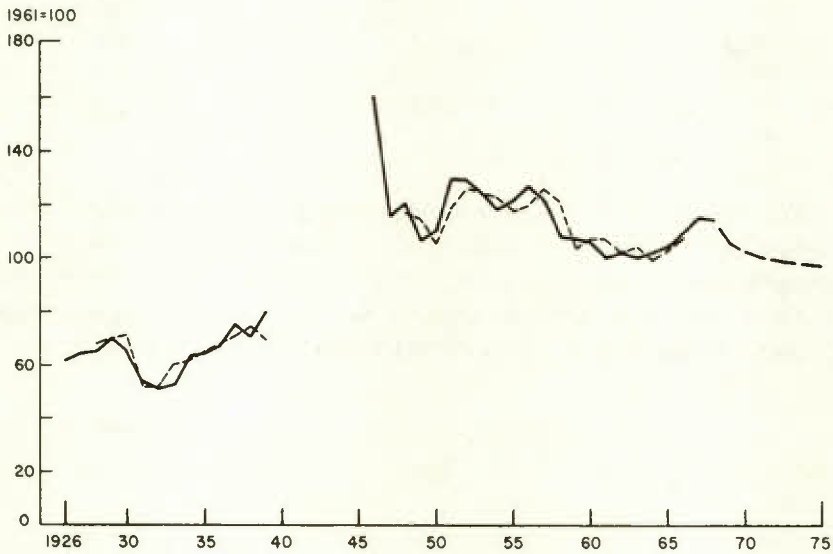
	Real Consumption (1961=100) per capita	aggregate
1968	86.7	98.4
1975	34.7	44.2
1975/1968	- 60.0%	- 55.1%

In principle it would be desirable to express q_t and x_t in terms of per capita of farm population. However, this was not possible for x_t, so we used data per capita of total population and introduced an auxiliary variable, farm population as a percentage of total population.

In our initial experiments it was found that the x variables had a negative sign. Also x_{t-1} was highly (negatively) correlated with farm population as a percentage of total population ($R = -.97$). We decided to omit the x variables.

It is unusual to find a p variable with positive sign, but its acceptance can be justified in this instance. The price of food is an indicator of the financial situation of farmers. A relative rise in food prices can, over the short term, reduce the consumption of this item, as it does with most other consumer items, but over the long run it is equivalent to a rise in farm incomes, justifying the positive long-term elasticities with respect to p. $\bar{R}^2$ is on the low side compared with the fit of the other regressions, but this should not surprise us, given an imputed item that is difficult to estimate.

0113 OTHER FOOD (n.d.)



$$q_t = +\ \underset{(0.27731)}{0.39834}q_{t-1} + \underset{(0.00740)}{0.01838}p_{t-1} + \underset{(0.01707)}{0.06864}\Delta p_t$$

$$+\ \underset{(0.59357)}{1.04996}\,(\text{armed forces as \% of total pop.}) + \underset{(0.34751)}{0.55981}z_t$$

$\alpha =\ \ 0$		$\bar{R}^2 = 0.949$
$\beta =\ \ 0.5514$		$S.E.E. = 0.32$
$\gamma =$	$\gamma' =$	$D\text{-}W = 2.12$
$\delta = +\ 0.3091$		
$\eta = +\ 0.0850$	$\eta' = +\ 0.03544$	

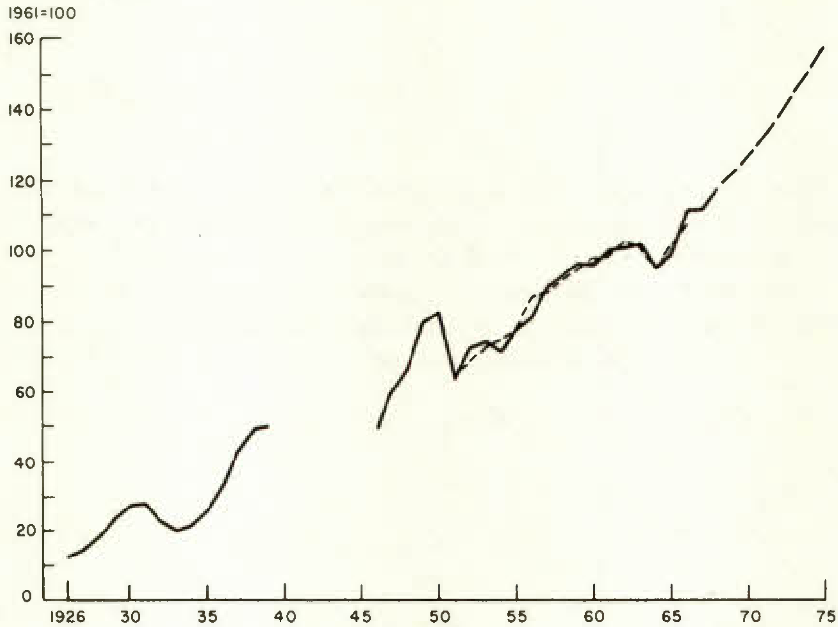
Consumption Elasticities

with respect to	short-term	long-term
x at mean		
x in 1966		
p at mean	+ 1.58	+ 0.66
p in 1966	+ 1.52	+ 0.64

	Real Consumption (1961=100) per capita	aggregate
1968	113.6	129.1
1975	96.6	123.2
1975/1968	- 15.0%	- 4.6%

The bulk of this item consists of meals provided by employers to employees (including the armed forces). Under such circumstances it is not surprising that the x variables showed coefficients smaller than their standard errors. The positive p coefficients make sense when we consider that in periods of high food prices, employees are more likely to take advantage of meals offered by employers.

0121 NONALCOHOLIC BEVERAGES (n.d.)



$$q_t = +\ 10.43649 + 0.28870 q_{t-1} + 0.00981 x_{t-1} + 0.01262 \Delta x_t$$
$$\quad (4.00625) \quad (0.21215) \qquad (0.00261) \qquad (0.00178)$$
$$- 0.11553 p_{t-1} - 0.14873 \Delta p_t$$
$$\quad (0.03788) \qquad (0.02152)$$

$\alpha = +\ 12.7523$
$\beta = +\ 0.1662$
$\gamma = +\ 0.0120$ $\quad \gamma' = +\ 0.0138$
$\delta = +\ 1.2701$
$\eta = -\ 0.1412$ $\quad \eta' = -\ 0.1624$

$\bar{R}^2 = 0.958$
$S.E.E. = 0.52$
$D\text{-}W = 2.28$

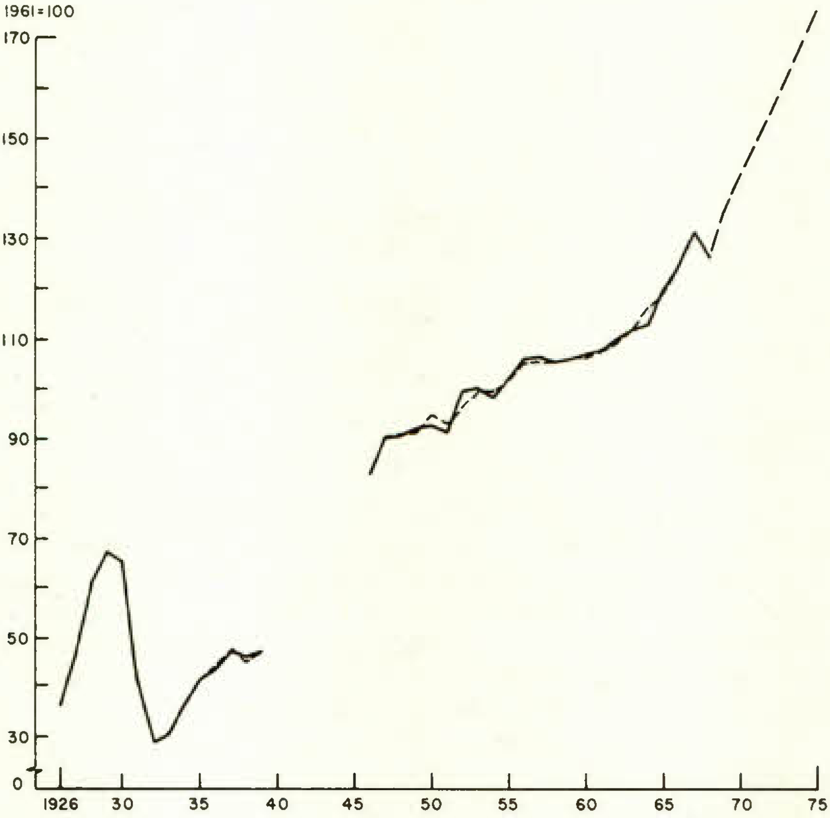
	Consumption Elasticities	
with respect to	short-term	long-term
x at mean	+ 1.01	+ 1.16
x in 1966	+ 1.04	+ 1.20
p at mean	- 0.94	- 1.08
p in 1966	- 0.81	- 0.93

	Real Consumption (1961=100) per capita	aggregate
1968	118.7	135.0
1975	158.7	202.7
1975/1968	+ 33.8%	+ 50.1%

The deflator of this item is the wholesale price of sugar in the 1926-48 period. We decided to estimate our regression for the period 1949-66 only, when the deflator was the retail price of soft drinks.

Our results seem plausible. β is positive, as expected in the case of a nondurable item. The elasticities are relatively high – nonalcoholic beverages are clearly not necessities, but bordering on luxury goods.

0122 ALCOHOLIC BEVERAGES (n.d.)



$$q_t = -45.73944 + 0.32561q_{t-1} + 0.02299x_{t-1} + 0.03261\Delta x_t$$
$$\quad (19.61450) \quad (0.13324) \quad (0.00510) \quad (0.00661)$$

$$-0.06046p_{t-1} - 0.08574\Delta p_t + 8.0376d_t$$
$$(0.04282) \quad (0.04904) \quad (2.4200$$

$$+ 0.78402\,(\text{pop. aged 20+ , as \% of total pop.})$$
$$(0.32798)$$

$\alpha = -\ 63.3691$		$\bar{R}^2 = 0.997$
$\beta = +\ 0.0715$		S.E.E. $= 0.72$
$\gamma = +\ 0.0319$	$\gamma' = +0.0341$	D-W $= 2.26$
$\delta = +\ 1.0890$		
$\eta = -\ 0.0838$	$\eta' = -\ 0.0896$	

Consumption Elasticities

with respect to	short-term	long-term
x at mean	+ 0.88	+ 0.94
x in 1966	+ 0.90	+ 0.96
p at mean	- 0.19	- 0.21
p in 1966	- 0.14	- 0.16

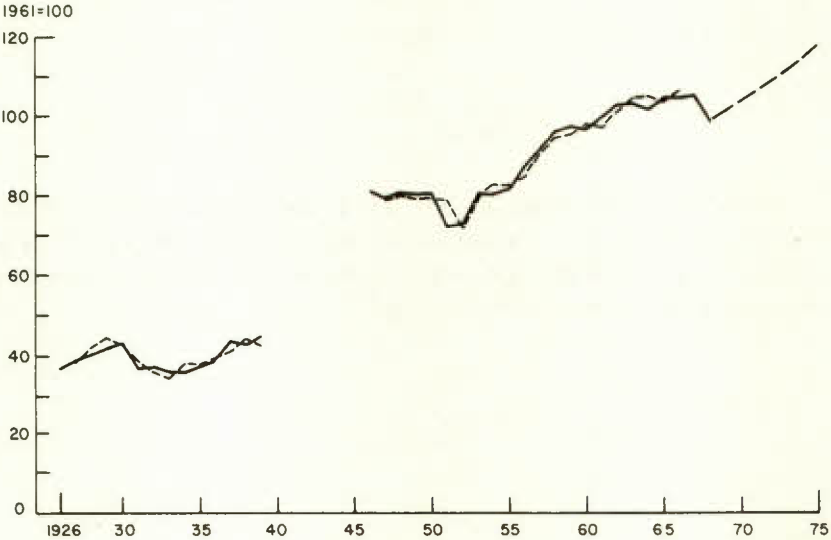
Real Consumption (1961=100)

	per capita	aggregate
1968	118.3	134.5
1975	167.4	213.7
1975/1968	+41.5%	+58.9%

For the 1926-39 period Canadian consumption has been estimated on the basis of apparent disappearance (i.e., production plus imports minus exports). During the U.S. prohibition, export to the United States was illegal and therefore does not appear in our National Accounts. In consequence Canadian consumption is inflated by the amount of bootlegging, resulting in absurdly high figures for the 1926-33 period. To avoid such distorting effects, the data pertaining to the prohibition years have been omitted from our calculations.

The low value of β is surprising. If it were possible to analyse beer and spirits consumption separately, the results might shed some light on this puzzle. However, the lack of price information for the complete time-span made such disaggregation impossible.

0130 TOBACCO



$$q_t = +\ 9.11427 + 0.87489q_{t-1} + 0.00219x_{t-1} + 0.00668\Delta x_t$$
$$\quad (3.63750) \quad (0.04205) \quad (0.00131) \quad (0.00479)$$
$$-\ 0.07016p_{t-1} - 0.21375\Delta p_t$$
$$(0.02658) \quad (0.05038)$$

$\alpha = +\ 24.7604$		$\bar{R}^2 = 0.993$
$\beta = +\ 0.2592$		$S.E.E. = 0.91$
$\gamma = +\ 0.0060$	$\gamma' = +\ 0.0175$	$D\text{-}W = 2.34$
$\delta = +\ 0.3927$		
$\eta = -\ 0.1906$	$\eta' = -\ 0.5608$	

Consumption Elasticities

with respect to	short-term	long-term
x at mean	+ 0.22	+ 0.66
x in 1966	+ 0.23	+ 0.68
p at mean	– 0.73	– 2.16
p in 1966	– 0.43	– 1.27

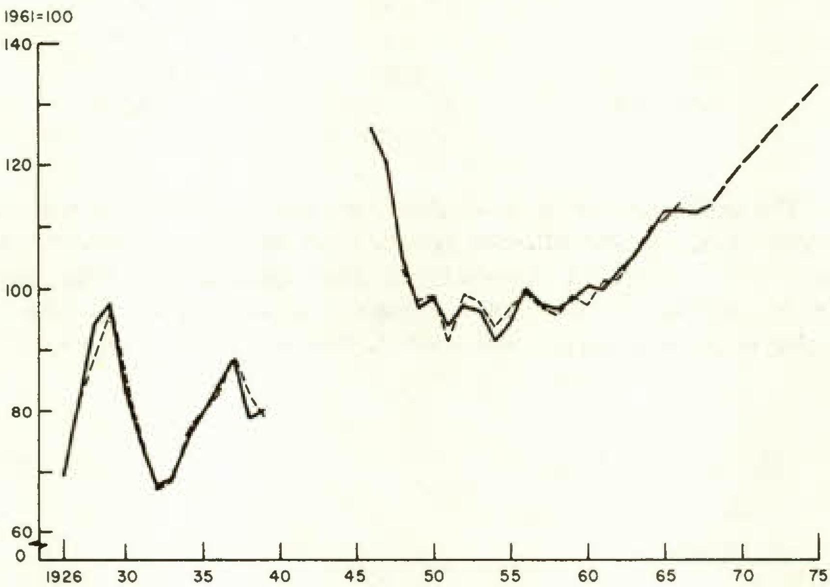
Personal Consumer Expenditures

	Real Consumption (1961=100) per capita	aggregate
1968	98.8	112.3
1975	118.1	150.8
1975/1968	+ 19.6%	+ 34.2%

This is one of the few major items which show a higher long-term elasticity with respect to p than to x. Also our analysis suggests that in the long run, tobacco consumption decreases more than proportionally when its relative price increases. These results are confirmed by U.S. findings.[22]

[22] L. D. Taylor, "Projecting Consumer Expenditures in 1970, A Final Report", mimeo., p. 29.

0211 MEN'S AND BOYS' CLOTHING (s.d.)



$$q_t = +\ 7.88083 + 0.68123 q_{t-1} + 0.00117 x_{t-1} + 0.04512 \Delta x_t$$
$$\quad (1.05713) \quad (0.05134) \quad (0.00072) \quad (0.00363)$$
$$+\ 0.35837 z_t$$
$$(0.16628)$$

$\alpha = +\ 356.3465$		$\bar{R}^2 = 0.972$
$\beta = -\ 0.3529$		$S.E.E. = 0.63$
$\gamma = +\ 0.0530$	$\gamma' = +\ 0.0037$	$D\text{-}W = 2.27$
$\delta = +\ 0.0263$		
$\eta =$	$\eta' =$	

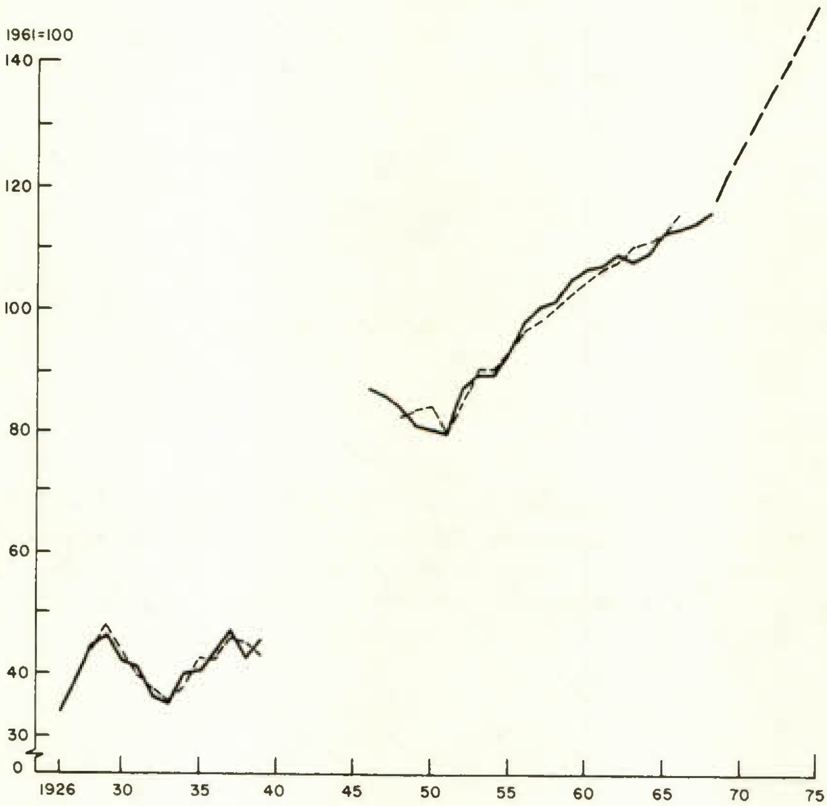
Consumption Elasticities

with respect to	short-term	long-term
x at mean	+ 1.95	+ 0.14
x in 1966	+ 2.49	+ 0.17
p at mean		
p in 1966		

	Real Consumption (1961=100)	
	per capita	aggregate
1968	113.8	129.5
1975	133.4	170.3
1975/1968	+ 17.2%	+ 31.5%

The coefficients of the p variables were positive and smaller than their standard errors. The large difference between short- and long-term elasticities with respect to x is noteworthy. Apparently Canadians spend heavily on this item in years of large increases of x, but the long-term growth is quite moderate. β is negative, as one would expect with a semidurable item, but δ proved surprisingly low.

0212 WOMEN'S AND CHILDREN'S CLOTHING (s.d.)



$$q_t = +\ 0.67980q_{t-1} + 0.00970x_{t-1} + 0.04405\Delta x_t + 4.42290d_t + 0.28233z_t$$
$$(0.13824) \qquad (0.00409) \qquad (0.00678) \qquad (2.30546) \qquad (0.25322)$$

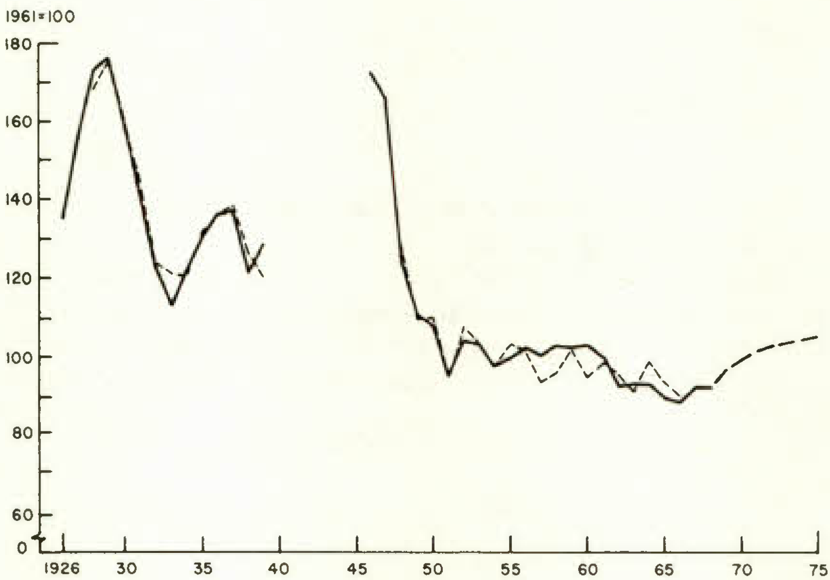
$\alpha = 0$		$\bar{R}^2 = 0.996$
$\beta = -\ 0.1337$		$S.E.E. = 1.22$
$\gamma = +\ 0.0467$	$\gamma' = +\ 0.0303$	$D\text{-}W = 1.86$
$\delta = +\ 0.2475$		
$\eta =$	$\eta' =$	

with respect to	Consumption Elasticities short-term	long-term
x at mean	+ 1.17	+ 0.76
x in 1966	+ 1.15	+ 0.75
p at mean		
p in 1966		

	Real Consumption (1961=100) per capita	aggregate
1968	108.7	123.7
1975	142.5	182.0
1975/1968	+ 31.1%	+ 47.1%

It is not surprising to find with this item that the p variables had coefficients smaller than their standard errors – nor that the long-term elasticities are higher than in the case of men's and boys' clothing. It is gratifying to find β negative again, as befits a semidurable item, and the magnitude of δ is much more reasonable than that of men's and boys' clothing.

0213 + 0214 NOTIONS AND PIECE GOODS (s.d.)



$$q_t = +\ 1.13762 + 0.57594 q_{t-1} + 0.01429 \Delta x_t - 0.02682 \Delta p_t$$
$$\quad (0.72811) \quad (0.10708) \quad (0.00272) \quad (0.01791)$$

$$- 0.99921 d_t + 0.02619 \text{ (rel. price of women's clothing)}$$
$$\quad (0.21195) \quad (0.00903)$$

$$+ 0.45694 z_t$$
$$\quad (0.18724)$$

α = indefinite		$\bar{R}^2$ = 0.962
β = − 0.5382		*S.E.E.* = 0.37
γ = + 0.0181	γ' =	*D-W* = 1.71
δ = 0		
η = − 0.0340	η' =	

Consumption Elasticities

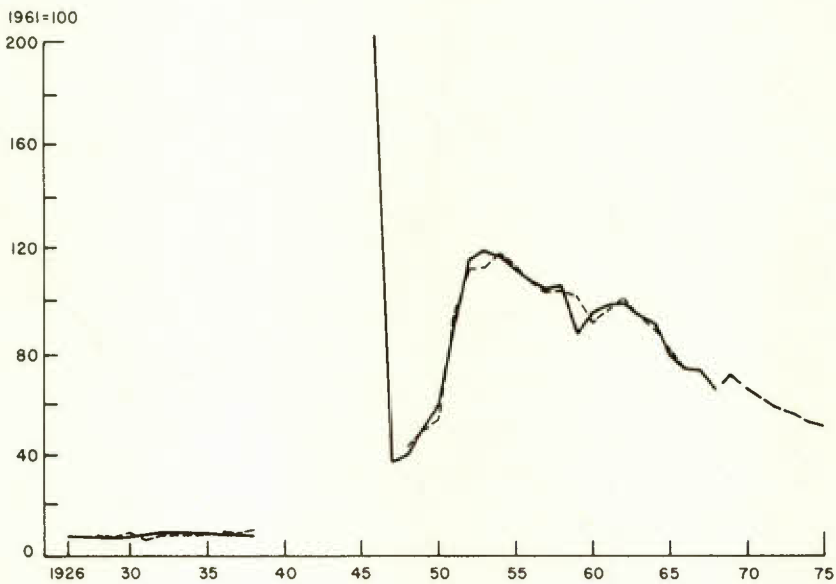
with respect to	short-term	long-term
x at mean	+ 2.12	
x in 1966	+ 4.19	
p at mean	− 0.39	
p in 1966	− 0.47	

	Real Consumption (1961=100) per capita	aggregate
1968	92.5	105.1
1975	105.4	134.5
1975/1968	+ 14.1%	+ 28.0%

Notions and piece goods have the same deflator in our National Accounts. We decided to pool the two series.

The coefficients of x_{t-1} and p_{t-1} were smaller than their respective standard errors. These variables were accordingly discarded. The introduction of the relative price of women's clothing was prompted by the hypothesis that its magnitude has a significant effect on home sewing and accordingly on the purchase of notions and piece goods.

0215 CLOTHING IN KIND, ARMED FORCES (s.d.)



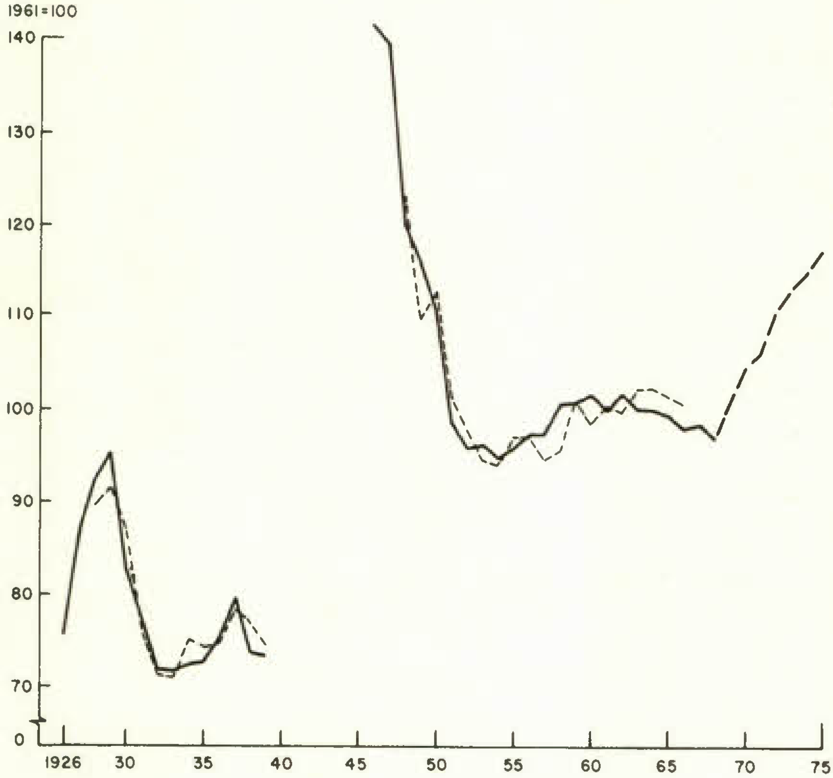
$$q_t = +\ 0.00970 - 0.35103 q_{t-1} + 1.08191\ (\text{armed forces as \% of total pop.}) + 0.75554 z_t$$
$$\qquad (0.00663) \quad (0.12359) \quad (0.09977) \quad (0.13271)$$

$\bar{R}^2 = 0.992$
$S.E.E = 0.02$
$D\text{-}W = 2.56$

	Real Consumption (1961=100) per capita	aggregate
1968	66.0	76.0
1975	50.9	65.6
1975/1968	– 22.9%	– 13.7 %

We did not think that this insignificant item (in peace time) deserved intensive research input.

0221 FOOTWEAR (s.d.)



$$q_t = + 3.14649 + 0.72746q_{t-1} + 0.00054x_{t-1} + 0.01680\Delta x_t$$
$$(0.67731) \quad (0.06011) \quad (0.00047) \quad (0.00322)$$
$$+ 0.25424z_t$$
$$(0.19564)$$

$\alpha = + 111.7156$		$\bar{R}^2 = 0.957$
$\beta = - \quad 0.2830$		$S.E.E. = 0.53$
$\gamma = + \quad 0.0191$	$\gamma' = + 0.0020$	$D\text{-}W = 2.04$
$\delta = + \quad 0.0326$		
$\eta =$	$\eta' =$	

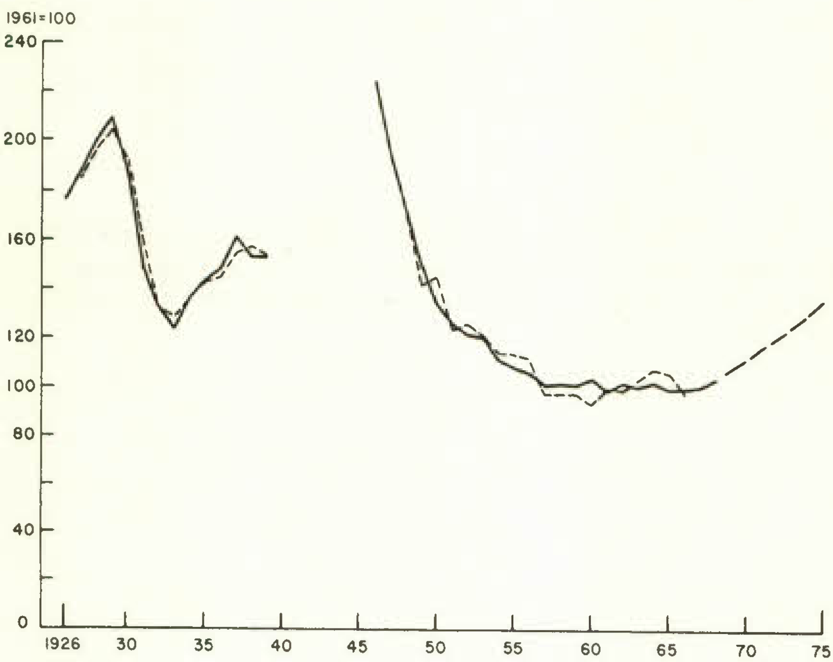
	Consumption Elasticities	
with respect to	short-term	long-term
x at mean	+ 1.19	+ 0.12
x in 1966	+ 1.70	+ 0.18
p at mean		
p in 1966		

Real Consumption (1961=100)

	per capita	aggregate
1968	+ 97.0	110.3
1975	117.3	149.7
1975/1968	+ 20.9%	+ 35.7%

The coefficients of the *p* variables were smaller than their respective standard errors and were therefore omitted. The behaviour of this consumption item shows a remarkable similarity to that of men's and boys' clothing (0211). The comments on that item apply here also.

0222 SHOE REPAIR (s.d.)



$$q_t = + 0.16124 + 0.91251 q_{t-1} + 0.00251 \Delta x_t - 0.02729 \Delta p_t - 0.13324 d_t$$
$$\quad (0.07385) \quad (0.03595) \quad (0.00039) \quad (0.00653) \quad (0.03238)$$

α = indefinite
$\beta = - 0.0915$
$\gamma = + 0.0026$ $\quad \gamma' =$
$\delta = - 0$
$\eta = - 0.0285$ $\quad \eta' =$

$\bar{R}^2 = 0.973$
$S.E.E. = 0.07$
$D\text{-}W = 1.81$

Consumption Elasticities

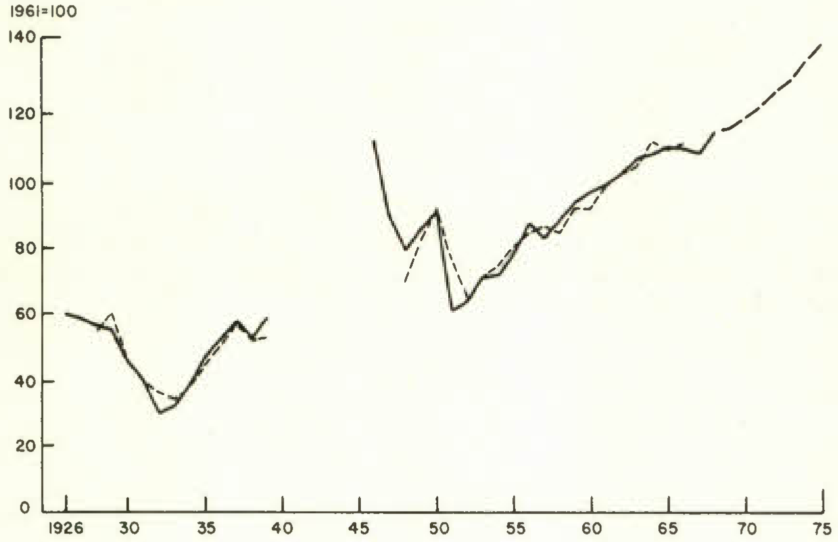
with respect to	short-term	long-term
x at mean	+ 1.68	
x in 1966	+ 3.61	
p at mean	– 2.43	
p in 1966	– 2.46	

	Real Consumption (1961 = 100) per capita	aggregate
1968	104.0[23]	118.1
1975	136.3	174.3
1975/1968	+ 31.0%	+ 47.0%

The coefficients of x_{t-1} and p_{t-1} were smaller than their respective standard errors. The short-term elasticities are surprisingly high. Since 1961 the current dollar expenditures of this series are estimated by DBS on the basis of shoe sales, a questionable procedure.

[23]The current official figure is 130.6. However this is the result of an error at DBS and will be corrected in subsequent revisions (telephone information from Mr. J. O'Day, National Accounts, DBS, 2 Oct. 1969).

0231 LUGGAGE AND LEATHER GOODS (s.d.)



$$q_t = +\ 0.23227 + 0.25916q_{t-1} + 0.00049x_{t-1} + 0.00204\Delta x_t$$
$$(0.13302)\quad (0.23370)\quad (0.00017)\quad (0.00038)$$

$$-\ 0.00234p_{t-1} - 0.00972\Delta p_t + 0.67738z_t$$
$$(0.00165)\quad (0.00621)\quad (0.32931)$$

$\alpha = +\ 1.3465$		$\bar{R}^2 = 0.959$
$\beta = -\ 0.9027$		$S.E.E. = 0.07$
$\gamma = +\ 0.0028$	$\gamma' = +\ 0.0007$	$D\text{-}W = 1.56$
$\delta = +\ 0.2740$		
$\eta = -\ 0.0136$	$\eta' = -\ 0.0032$	

Consumption Elasticities

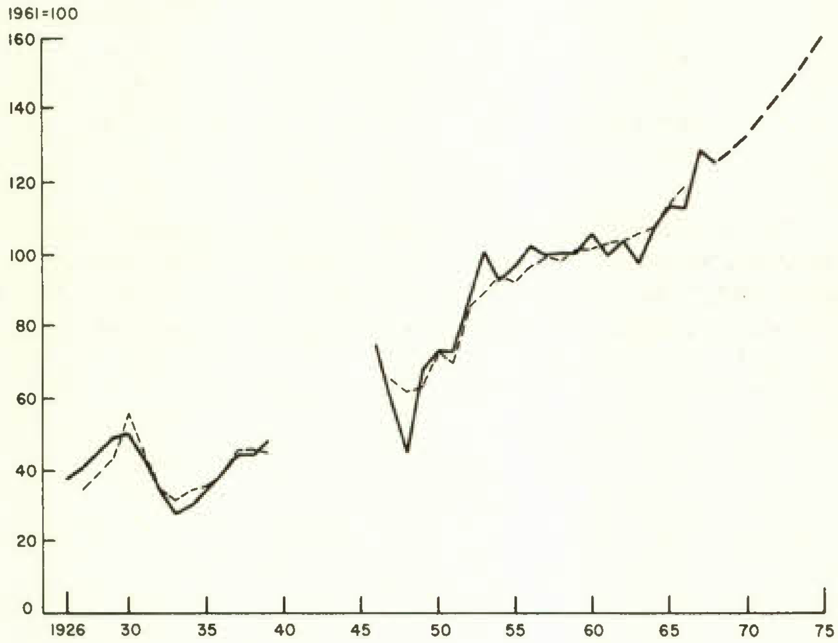
With respect to	short-term	long-term
x at mean	+ 3.13	+ 0.73
x in 1966	+ 3.18	+ 0.74
p at mean	– 1.29	– 0.30
p in 1966	– 0.94	– 0.22

	Real Consumption (1961=100)	
	per capita	aggregate
1968	114.8	130.9
1975	140.7	179.7
1975/1968	+ 22.6%	+ 37.3%

The fit of this equation is not entirely satisfactory. However, it must be kept in mind that the current dollar series of this item is deflated by the price deflator of footwear (0221) and this may make it impossible to obtain a better equation. The Houthakker and Taylor study for the United States had also great difficulties with this item.[24]

[24] *Op. cit.*, p. 68.

0232 PRECIOUS STONES, OTHER JEWELLERY, WATCHES AND RINGS (s.d.)



$$q_t = +\ 4.65463 + 0.39458 q_{t-1} + 0.00354 x_{t-1} + 0.00609 \Delta x_t$$
$$\quad (1.50775) \quad (0.14415) \quad (0.00088) \quad (0.00145)$$

$$-\ 0.05176 p_{t-1} - 0.08903 \Delta p_t$$
$$\quad (0.01470) \quad (0.02562)$$

$\alpha = +\ 8.1446$		$\bar{R}^2 = 0.962$
$\beta = -\ 0.0486$		$S.E.E. = 0.41$
$\gamma = +\ 0.0062$	$\gamma' = +\ 0.0058$	$D\text{-}W = 1.69$
$\delta = +\ 0.8196$		
$\eta = -\ 0.0906$	$\eta' = -\ 0.0855$	

Consumption Elasticities

with respect to	short-term	long-term
x at mean	+ 1.27	+ 1.20
x in 1966	+ 1.21	+ 1.14
p at mean	− 1.77	− 1.67
p in 1966	− 1.08	− 1.02

	Real Consumption (1961=100)	
	per capita	aggregate
1968	125.2	142.4
1975	160.0	204.3
1975/1968	+ 27.8%	+ 43.4%

The low (absolute) value of β and the high value of δ are surprising. We can only speculate that this may be due to the rapidly growing consumption of costume jewellery and inexpensive watches in the postwar period.

0233 JEWELLERY REPAIR AND ENGRAVING (s.d.)

$$q_t = +\ 0.20993 + 0.86219 q_{t-1} - 0.00039 x_{t-1} + 0.00239 \Delta x_t$$
$$\qquad (0.10498) \quad (0.02660) \qquad (0.00009) \qquad (0.00026)$$

$$+\ 0.00375 p_{t-1} - 0.02294 \Delta p_t$$
$$(0.00140) \qquad (0.00429)$$

$\alpha = -\ 1.4912$		$\bar{R}^2 = 0.981$
$\beta = -\ 0.2992$		$S.E.E. = 0.05$
$\gamma = +\ 0.0028$	$\gamma' = -\ 0.0028$	$D\text{-}W = 1.95$
$\delta = -\ 0.1512$		
$\eta = -\ 0.0267$	$\eta' = +\ 0.0272$	

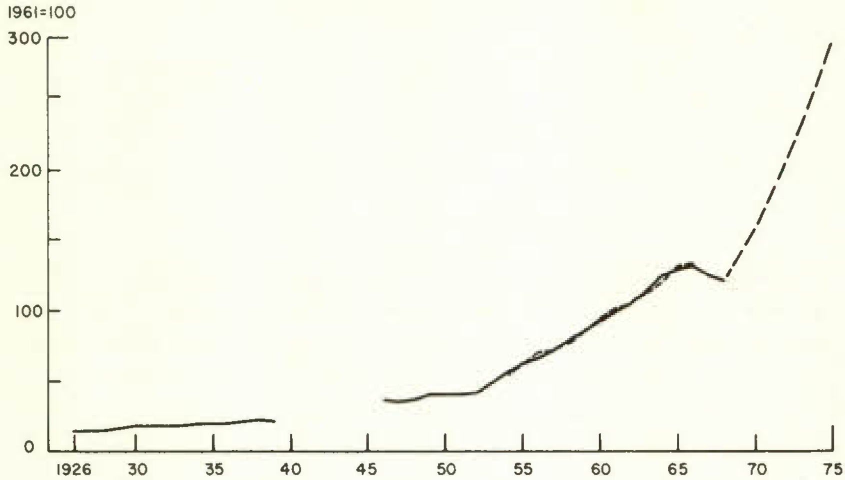
Consumption Elasticities

with respect to	short-term	long-term
x at mean	+ 3.05	− 3.11
x in 1966	+ 9.08	− 9.27
p at mean	− 2.08	+ 2.13
p in 1966	− 5.91	+ 6.03

	Real Consumption (1961=100)	
	per capita	aggregate
1968	96.3	109.1
1975	61.1	77.8
1975/1968	– 36.5%	– 28.7%

Although at first sight β, δ and the elasticities look odd, they can be rationalized. A substantial part of this item consists of watch repairs. Once a watch is repaired, further repair may be unnecessary for a long time. This would explain the negative β. Also, rising repair costs (the relative price of this item rose from 73.5 in 1946 to 114.6 in 1966) and the success of inexpensive watches may have swung demand from repair to purchase of new watches. The high elasticities in 1966 are due to the linear model applied to a strongly declining consumption. Since 1961, DBS projects the current dollar series of this item on the basis of jewellery sales.

0310 WATER CHARGES (n.d.)



$$q_t = +\ 2.86525 + 1.06450 q_{t-1} - 0.11249 \text{ (farm pop. as \% of total pop.)} + 0.30783 z_t$$
$$(1.12303) \quad (0.17739) \quad (0.05018) \quad (0.19676)$$

$\bar{R}^2 = 0.993$
$S.E.E. = 0.12$
$D\text{-}W = 1.46$

	Real Consumption (1961=100) per capita	aggregate
1968	122.1	138.8
1975	288.6	368.2
1975/1968	+ 136.4%	+ 165.4%

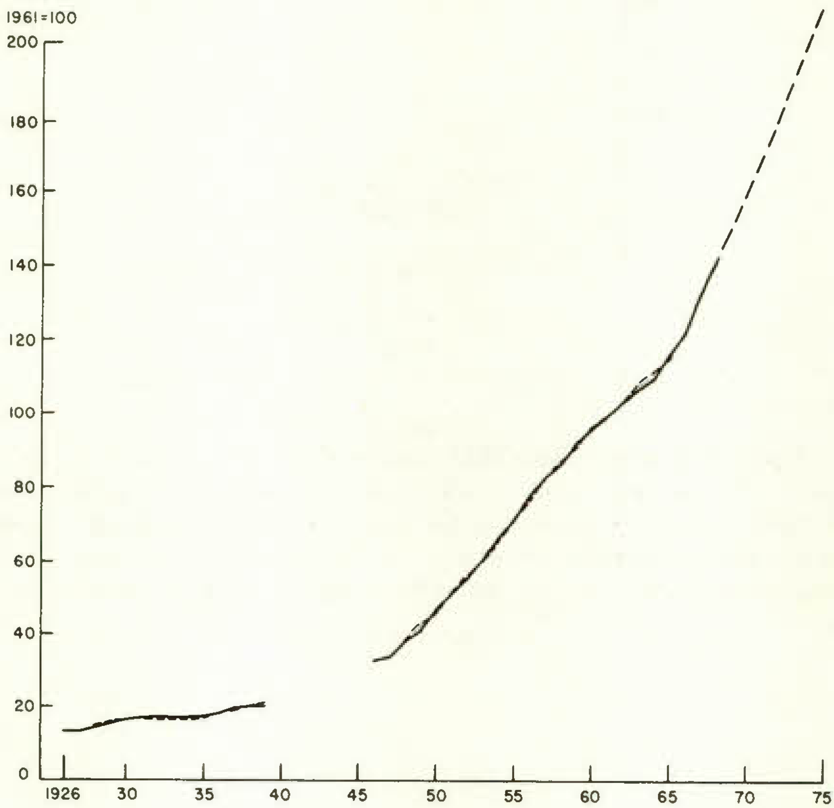
The DBS method of estimating expenditures on this item from 1952 on is not consistent with the method applied to the 1926-51 period. We have decided to base our regression on the 1952-66 period alone.

There is a further significant change in the trend of this item since 1966. We have been informed by DBS that substantial revisions of the data can be expected for recent years.[25]

The introduction of farm population as an explanatory variable was prompted by the hypothesis that the nonfarm population is a bigger consumer of public utility services than farm population.

[25]Telephone information, Mr. J. O'Day, National Accounts, DBS, 17 Nov. 1969.

0321 ELECTRICITY (n.d.)



$$q_t = +\ \underset{(0.04175)}{0.90465q_{t-1}} + \underset{(0.00035)}{0.00277x_t} - \underset{(0.00638)}{0.04685} \text{ (farm pop. as \% of total pop.)}$$

$$+\ \underset{(0.11241)}{0.16301z_t}$$

$\alpha = 0$		$\bar{R}^2 = 0.999$
$\beta = +\ 1.8999$		$S.E.E. = 0.16$
$\gamma = +\ 0.0015$	$\gamma' = +\ 0.0291$	$D\text{-}W = 2.16$
$\delta = 2$		
$\eta =$	$\eta' =$	

	Consumption Elasticities	
with respect to	short-term	long-term
x at mean	+ 0.15	+ 2.96
x in 1966	+ 0.11	+ 2.10
p at mean		
p in 1966		

	Real Consumption (1961=100)	
	per capita	aggregate
1968	142.0	161.5
1975	211.5	270.1
1975/1968	+ 49.0%	+ 67.2%

The p and x variables were highly correlated ($R = -0.93$), so we decided to delete p from our regression. Consumption of electricity as a distributed-lag function of x ($\delta = 2$) is plausible, and so is the low short-term and high long-term elasticity. Farm population as percentage of total population was introduced on basis of the assumption that urbanization has a major effect on electricity consumption.

0322+0323 GAS AND OTHER FUELS (n.d.)

$$q_t = +\,0.56377q_{t-1} + 0.00438x_t - 0.08576p_t - 1.13291d_t$$
$$\qquad (0.05973) \qquad (0.00135) \qquad (0.01822) \qquad (0.64735)$$
$$+\,0.00218\,(\text{degree days})$$
$$(0.00039)$$

$\alpha = \quad 0$		$\bar{R}^2 = 0.967$
$\beta = +\,1.4421$		$S.E.E. = 0.68$
$\gamma = +\,0.0028$	$\gamma' = +\,0.0100$	$D\text{-}W = 1.78$
$\delta = +\,2$		
$\eta = -\,0.0548$	$\eta' = -\,0.1966$	

Consumption Elasticities

with respect to	short-term	long-term
x at mean	+ 0.11	+ 0.41
x in 1966	+ 0.13	+ 0.47
p at mean	– 0.23	– 0.83
p in 1966	– 0.13	– 0.48

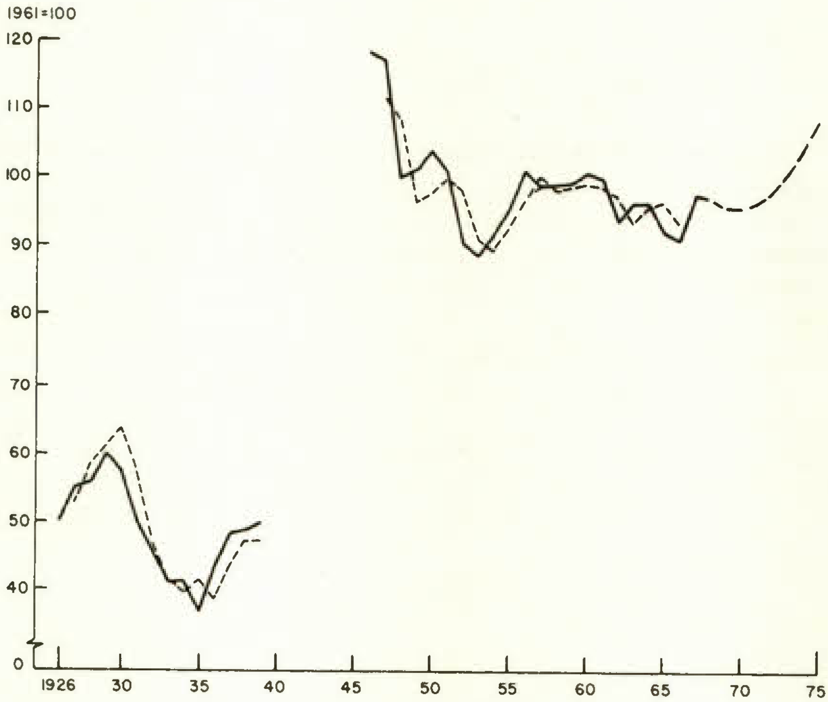
	Real Consumption (1961=100)	
	per capita	aggregate
1968	125.1	142.3
1975	151.5	193.4
1975/1968	+ 21.1%	+ 35.9%

The construction of the Trans-Canada pipeline has increased the consumption of gas in a major way, at the expense of other fuels. Since the decision to build the pipeline was not a direct economic decision of private consumers, our model cannot incorporate it in any convenient way, and therefore the data for gas and for other fuels have been treated as one consumption item.

The severity of winter obviously has considerable influence on the consumption of fuel and gas. We therefore introduced an appropriate variable, degree days, to measure this severity. The variable is the sum of the differences between actual daily average temperature 65°F, summed over all the days in which the daily average temperature was *below* 65°F.

After removal of the effect of the severity of winter, it is reasonable to find that q_t is a function of a distributed lag of x and p. Short-term elasticities with respect to x and p are quite low, and this is quite reasonable. Even over the long term, one would expect q_t to grow less than proportionately to x. The negative coefficient of d probably measures the increased efficiency of our heating equipment.

1210 DRESSMAKING AND TAILORING (s)



$$q_t = +\ 0.54484 + 0.67295 q_{t-1} + 0.00029 (x_t + x_{t-1})$$
$$\quad (0.19392) \quad (0.08715) \qquad (0.00009)$$
$$-\ 0.00474 (p_t + p_{t-1})$$
$$(0.00170)$$

$\theta = +\ 0.3909$ | $\bar{R}^2 = 0.973$
$\xi = +\ 1.6661$ | $S.E.E. = 0.06$
$\mu = +\ 0.0018$ | $D\text{-}W = 1.84$
$\lambda = -\ 0.0290$

Consumption Elasticities

with respect to	short-term	long-term
x at mean	+ 1.78	
x in 1966	+ 2.32	
p at mean	– 2.24	
p in 1966	– 2.52	

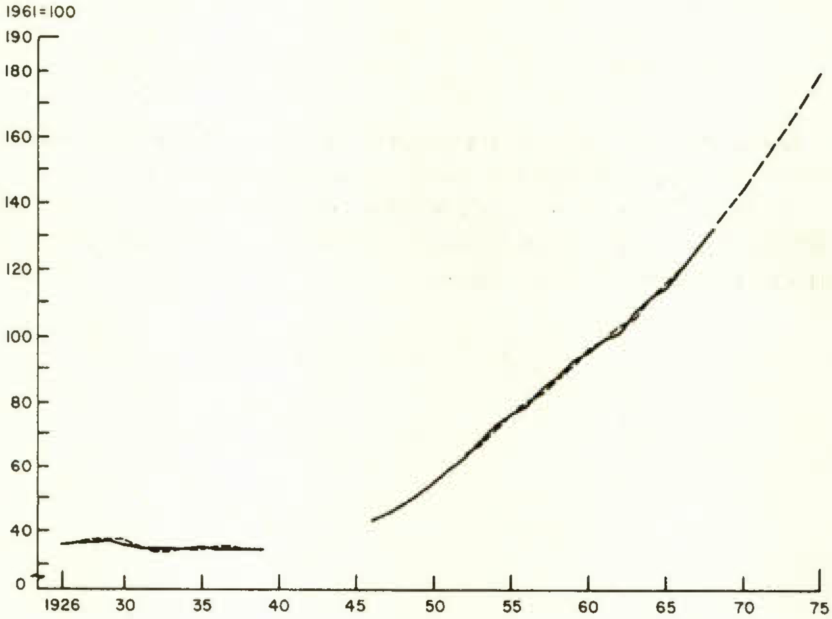
Personal Consumer Expenditures

	Real Consumption (1961=100) per capita	aggregate
1968	97.2	110.4
1975	108.5	138.6
1975/1968	+ 11.6%	+ 25.5%

This is the only consumption item encountered in this Study that resulted in a Bergstrom model.

The high elasticities seem to be intuitively right – in particular the ones with respect to *p*. In our opinion, this small and unimportant item does not justify a major research input.

1311 GROSS RENTS, IMPUTED (s)



$$q_t = +\ 10.25882 + 0.94242 q_{t-1} + 0.01095 x_t - 0.13252 p_t$$
$$\quad\quad (9.46165) \quad (0.04771) \quad\quad (0.00603) \quad\quad (0.06581)$$

$\alpha = +\ 5.2815$		$\bar{R}^2 = 0.999$
$\beta = +\ 1.9407$		$S.E.E. = 1.43$
$\gamma = +\ 0.0056$	$\gamma' = +\ 0.1901$	$D\text{-}W = 2.26$
$\delta = +\ 2$		
$\eta = -\ 0.0682$	$\eta' = -\ 2.3015$	

Consumption Elasticities

with respect to	short-term	long-term
x at mean	+ 0.07	+ 2.29
x in 1966	+ 0.06	+ 1.96
p at mean	– 0.08	– 2.76
p in 1966	– 0.04	– 1.30

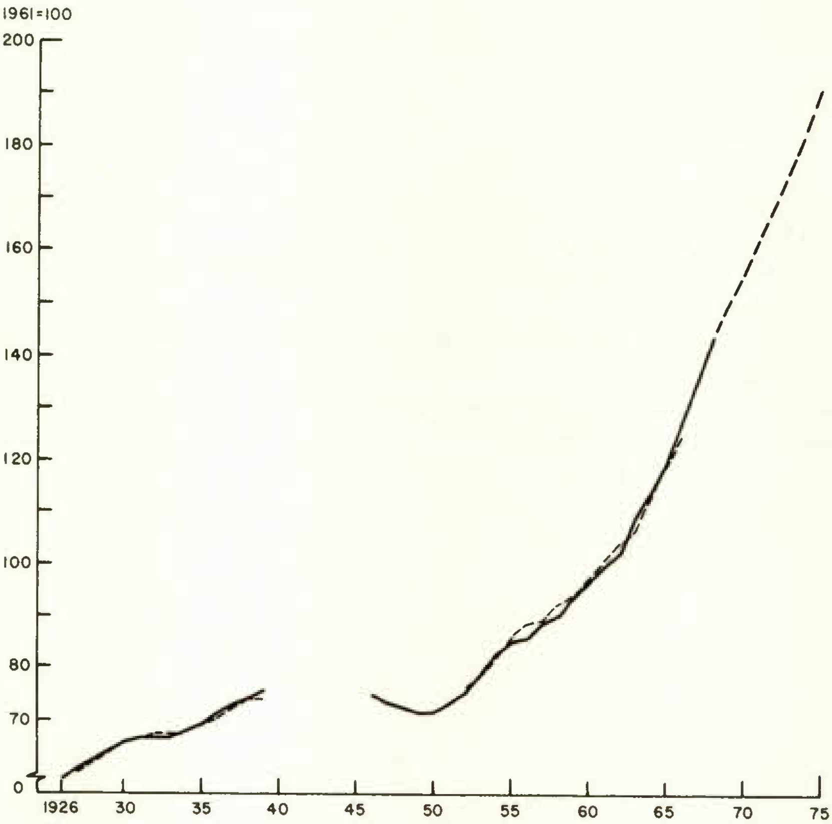
	Real Consumption (1961=100) per capita	aggregate
1968	133.5	151.8
1975	180.8	230.9
1975/1968	+ 35.4%	+ 52.0%

Besides the war years, we also omitted the period 1946-49 from the calculation of this equation, because rent controls were then in force.

The fit of this equation is excellent; q_t as a distributed-lag function of x and p is plausible. The low short-term elasticities look reasonable and the high long-term elasticities are confirmed by U.S. results.[26]

[26] L. D. Taylor, *op. cit.*

1312 GROSS RENTS, PAID (s)



$$\Delta q_t = + \; 0.00207 x_t \; - \; 0.00802 p_t$$
$$(0.00030) \qquad (0.00316)$$

$\alpha = \; 0$		$\bar{R}^2$	$= 0.570$
$\beta = + \; 2$		$S.E.E.$	$= 0.68$
$\gamma = + \; 0.0010$	$\gamma' =$	$D\text{-}W$	$= 1.51$
$\delta = + \; 2$			
$\eta = - \; 0.0040$	$\eta' =$		

Consumption Elasticities

with respect to	short-term	long-term
x at mean	+ 0.02	
x in 1966	+ 0.02	
p at mean	– 0.01	
p in 1966	– 0.01	

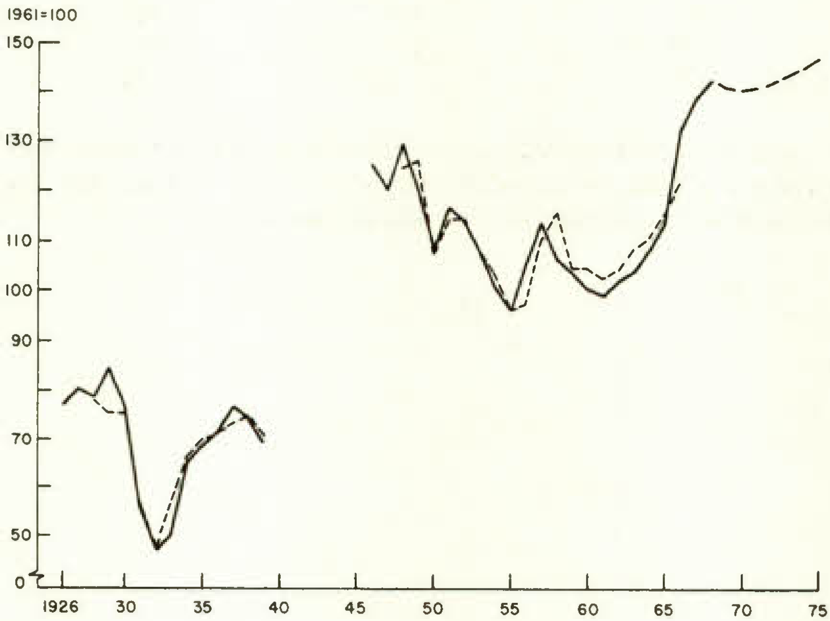
	Real Consumption (1961=100) per capita	aggregate
1968	143.9	163.6
1975	190.7	243.4
1975/1968	+ 32.5%	+ 48.8%

1946-49 has been omitted from the calculation of this equation (see text to Gross Rents, Imputed, No. 1311).

The low $\bar{R}^2$ is due to the estimation in first difference form. In level terms the $\bar{R}^2$ is over .99.

It is regrettable that the coefficient of q_{t-1} appeared regularly as not significantly different from unity, thus forcing us to use Δq_t as the dependent variable. For projection purposes the equation is no less useful, but it becomes impossible to calculate the long-term elasticities.

1313 IMPUTED LODGING N.E.S. (s)



$$q_t = +\ 2.55470 \underset{(1.01868)}{} + \underset{(0.14848)}{0.58175 q_{t-1}} + \underset{(0.00008)}{0.00019 x_{t-1}} + \underset{(0.00023)}{0.00038 \Delta x_t}$$

$$- \underset{(0.00693)}{0.01747 p_{t-1}} - \underset{(0.00554)}{0.03480 \Delta p_t} + \underset{(0.22837)}{0.53388 z_t}$$

$\alpha = +\ 4.8215$		$\bar{R}^2 = 0.959$
$\beta = +\ 0.1411$		$S.E.E. = 0.10$
$\gamma = +\ 0.0004$	$\gamma' = +\ 0.0005$	$D\text{-}W = 1.72$
$\delta = +\ 0.6700$		
$\eta = -\ 0.0330$	$\eta' = -\ 0.0418$	

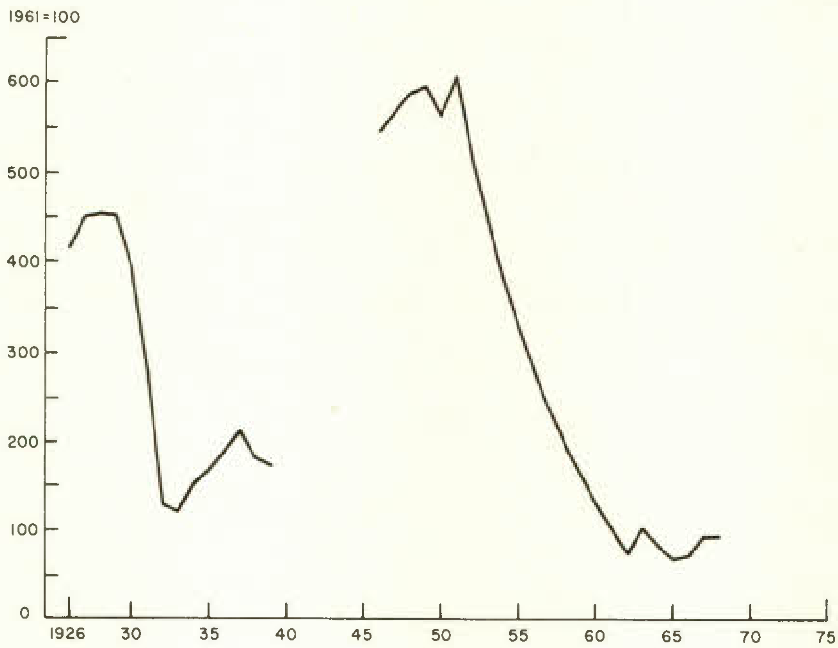
Consumption Elasticities

with respect to	short-term	long-term
x at mean	+ 0.21	+ 0.26
x in 1966	+ 0.25	+ 0.31
p at mean	− 1.82	− 2.30
p in 1966	− 1.24	− 1.57

	Real Consumption (1961=100)	
	per capita	aggregate
1968	142.9	162.4
1975	147.3	188.1
1975/1968	+ 3.1%	+ 15.6%

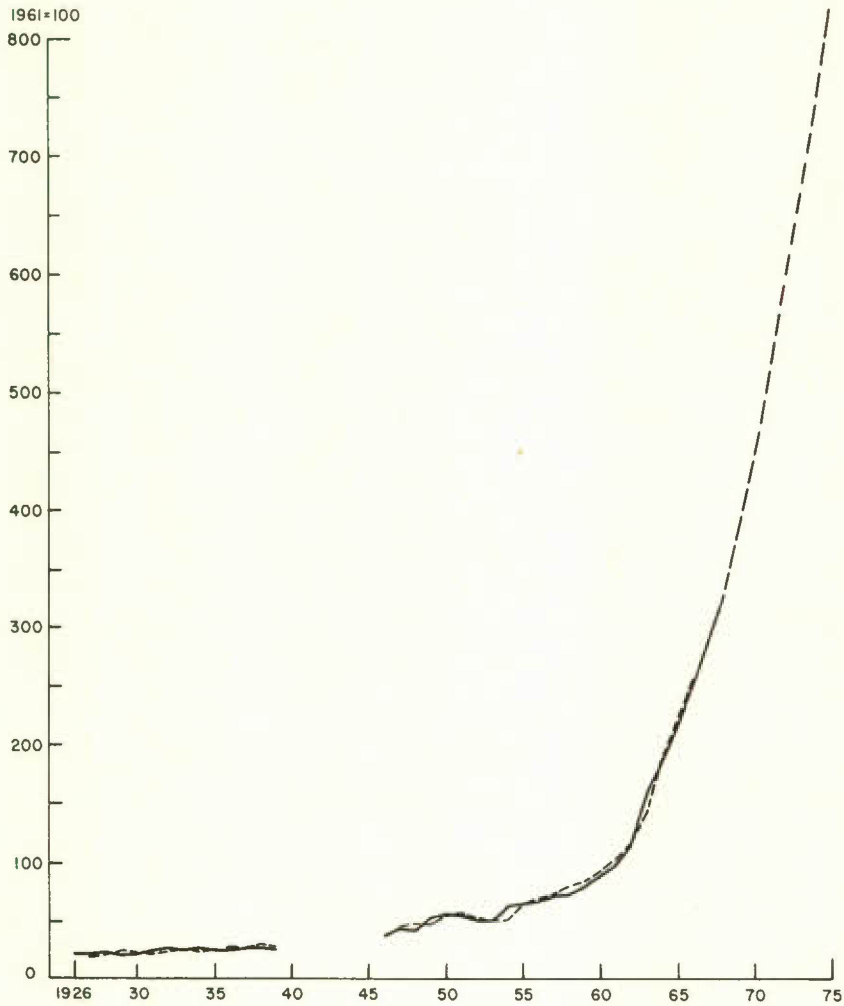
More research effort could have yielded a better result for this item. $\bar{R}^2$ is on the low side and the very high elasticities with respect to p are puzzling. But the item is small and the historical data probably not very reliable.

1314 LODGING PAID (s)



While there is no analysis of this item, we have inserted the Chart to explain why we regard the data too unreliable to justify analysis.

1315 BOARD AND LODGING IN UNIVERSITIES (s)



$$q_t = -\underset{(0.05371)}{0.16852} + \underset{(0.08759)}{0.94718}q_{t-1} + \underset{(0.00007)}{0.00013}x_t - \underset{(0.03144)}{0.08879}d_t$$

$$+ \underset{(0.0769)}{0.2465}\text{ (full-time university enrolment as \% of total pop.)}$$

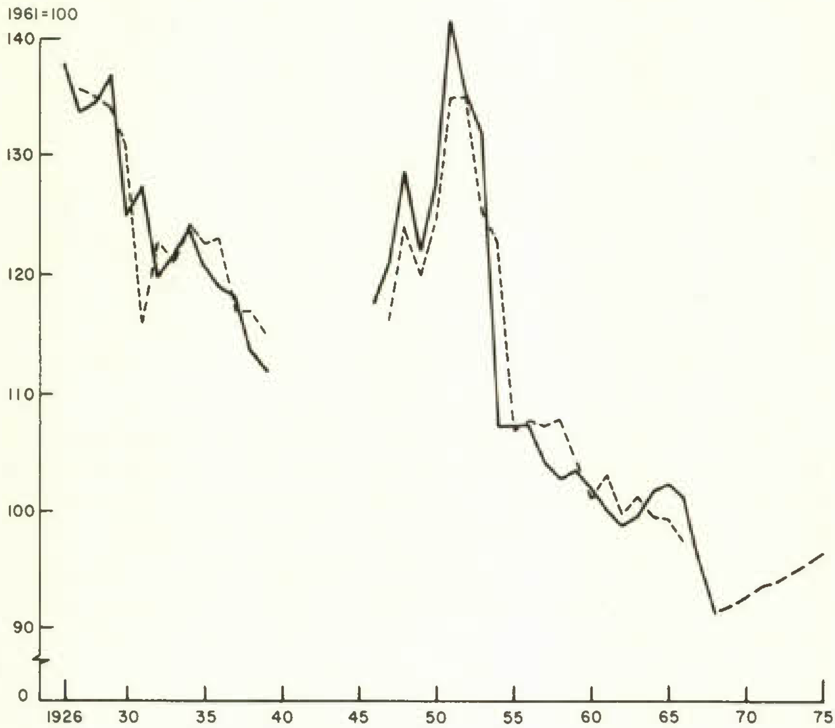
$\alpha = -\ 0.0865$		$\bar{R}^2 = 0.991$
$\beta = +\ 1.9458$		$S.E.E. = 0.03$
$\gamma = +\ 0.0001$	$\gamma' = +\ 0.0026$	$D\text{-}W = 1.89$
$\delta = +\ 2$		
$\eta =$	$\eta' =$	

	Consumption Elasticities	
with respect to	short-term	long-term
x at mean	+ 0.23	+ 8.50
x in 1966	+ 0.10	+ 3.55
p at mean		
p in 1966		

	Real Consumption (1961=100)	
	per capita	aggregate
1968	329.2	372.7
1975	825.0	1,047.7
1975/1968	+ 150.6%	+ 181.1%

We have introduced full-time university enrolment as a percentage of total population as an auxiliary variable into this equation. The p variables had positive coefficients and were therefore omitted. Expenditure on this item as a distributed-lag function of x seems reasonable, as do the low short-term and high long-term elasticities. It should be kept in mind that this item has an extremely strong upward trend. This explains the high long-term elasticity at the mean. The elasticity in 1966 is much more reasonable.

1316 HOUSE MAINTENANCE REPAIRS (s)



$$q_t = +\ 0.48812 + 0.83956 q_{t-1} + 0.00115 \Delta x_t - 0.05288 \Delta p_t$$
$$(0.20192) \quad (0.06899) \quad (0.00065) \quad (0.01205)$$

α = indefinite		$\bar{R}^2$ = 0.858
β = − 0.1744		$S.E.E.$ = 0.12
γ = + 0.0012	γ' =	$D\text{-}W$ = 2.34
δ = 0		
η = − 0.0575	η' =	

Consumption Elasticities

with respect to	short-term	long-term
x at mean	+ 0.48	
x in 1966	+ 0.91	
p at mean	− 1.59	
p in 1966	− 2.92	

	Real Consumption (1961=100)	
	per capita	aggregate
1968	91.2	103.7
1975	96.2	122.9
1975/1968	+ 5.5%	+ 18.6%

A poor fit, derived from poor data. Consumption of this item seems to depend much more on p than on x. The negative β is unusual with a service item, but perhaps the effect of house maintenance repairs can be regarded as durable.

6. DISCUSSION OF RESULTS

In Chapter 5 we have analysed 24 consumer expenditure items – nine non-durables, nine semidurables and six services. As pointed out in Chapter 2, we should in general expect durables and semidurables to show negative betas, and nondurables and services, positive betas. The consumption equations yield the results summarized in Table 3.

TABLE 3

SIGN OF BETA BY CONSUMER ITEM

Item		Positive	Negative	Not Applicable
Semidurables				
0211	Men's & Boys' Clothing		x	
0212	Women's & Children's Clothing		x	
0213 + 0214	Notions & Piece Goods		x	
0215	Armed Forces Clothing			x
0221	Footwear		x	
0222	Shoe Repair		x	
0231	Luggage, etc.		x	
0232	Jewellery, etc.		x	
0233	Jewellery Repair		x	
Nondurables				
0111	Food at Retail	x		
0112	Farm Food		x	
0113	Other Food		x	
0121	Nonalcoholic Beverages		x	
0122	Alcoholic Beverages	x		
0130	Tobacco	x		
0310	Water Charges			x
0321	Electricity	x		
0322 + 0323	Gas & Other Fuels	x		
Services				
1210	Dressmaking, etc.			x
1311	Gross Rents, Imputed	x		
1312	Gross Rents, Paid	x		
1313	Imputed Lodging, N.E.S.	x		
1315	Board & Lodging, University	x		
1316	House Maintenance Repairs		x	

We find that 18 items out of 24 have betas with expected signs, in two more (0215 Armed Forces Clothing, and 0310 Water Charges) there is no beta, because neither the x nor the p variables enter the equation, and one item (1210 Dressmaking and Tailoring) took the form of the Bergstrom model.

Among the "unexpected" signs we find Food Produced and Consumed on Farms (0112), which has a long-term declining trend, and Other Food (0113), where the decision of employers, not that of the consumers, has a decisive influence. Only in the case of House Maintenance Repairs (1316) do our results run counter to our theoretical expectations.

x, obviously the most important variable, was accepted in 20 instances. In two more (0113 Other Food, and 0310 Water Charges) it was not significant, in one it had the wrong sign (0215 Armed Forces Clothing), and in one it was collinear with some other variable that was deemed more important to retain (0112 Food Produced and Consumed on Farms).

p appears in 17 equations – in four instances with positive sign. In three instances it was rejected because it was not significant, in three more because it had the wrong sign, and in one because it was collinear with some other variable.

Auxiliary variables – other than the prewar-postwar dummy – appear in nine equations. They are mostly of a demographic nature.

The results of the goodness of fit are summarized in Table 4.

TABLE 4

$\bar{R}^2$ OF THE EQUATIONS

$\bar{R}^2$	Frequency
0.85 – 0.90	1
0.90 – 0.95	1
0.95 – 0.96	5
0.96 – 0.97	3
0.97 – 0.98	4
0.98 – 0.99	0
0.99 +	10
Total	24

The forecasting ability of our equations over the period 1966-68 will be discussed in Chapter 7.

7. FORECASTING THE 1966-68 PERIOD

Our regressions are calculated on data for the 1926-66 period.

To test the forecasting ability of the Houthakker-Taylor model, we have attempted to forecast the consumption of the items discussed in this Study for the 1966-68 period. We have also computed forecasts by means of two naive methods:

Naive I: The per capita real consumption of each item will grow in the two-year period 1966-68 by the same percentage as the corresponding percentage increase in the preceding period of equal length, i.e., 1964-66.

Naive II: The per capita real consumption of each item will grow in the two-year period 1966-68 at the same rate as per capita real total consumer expenditure.

The results of these calculations are contained in Table 5.

TABLE 5

ACTUAL AND FORECASTED PERCENTAGE CHANGES, 1966-68

	Item	Actual	H–T*	Naive I	Naive II
0111	Food Purchased at Retail	+ 4.11	+ 7.67	+ 0.40	+5.67
0112	Food Produced & Consumed on Farms	+ 3.67	–11.74	–12.24	+5.67
0113	Other Food	+ 3.80	– 7.11	+ 7.65	+5.67
0121	Nonalcoholic Beverages	+ 6.27	+ 3.48	+17.60	+5.67
0122	Alcoholic Beverages	+ 1.46	+ 7.07	–12.24	+5.67
0130	Tobacco	– 6.06	– 0.30	+ 2.85	+5.67
0211	Men's & Boys' Clothing	+ 0.81	– 0.37	+ 3.70	+5.67
0212	Women's & Children's Clothing	+ 2.57	+ 5.31	+ 3.75	+5.67
0213 + 0214	Notions & Piece Goods	+ 4.19	+ 3.77	– 4.91	+5.67
0215	Armed Forces Clothing	–12.50	– 5.00	–18.37	+5.67
1210	Dressmaking & Tailoring	+ 6.15	– 0.77	– 5.11	+5.67
0221	Footwear	– 1.13	+ 2.49	– 2.01	+5.67
0222	Shoe Repair	+ 4.03	– 2.42	– 3.12	+5.67
0231	Luggage & Leather Goods	+ 4.73	– 0.68	+ 1.37	+5.67
0232	Jewellery	+11.14	+ 7.78	+ 4.82	+5.67
0233	Jewellery Repair	– 5.45	–21.82	– 3.51	+5.67
0310	Water Charges	– 7.31	+13.83	+ 4.88	+5.67
0321	Electricity	+15.83	+11.84	+10.63	+5.67
0322 + 0323	Gas & Other Fuels	+ 4.54	+ 5.96	+ 4.66	+5.67
1311	Gross Rents, Imputed	+ 9.56	+ 9.21	+ 8.24	+5.67
1312	Gross Rents, Paid	+12.65	+ 8.43	+11.47	+5.67
1313	Imputed Lodging N.E.S.	+ 7.01	+ 4.06	+22.62	+5.67
1315	Board & Lodging in Universities	+29.51	+33.61	+34.07	+5.67
1316	House Maintenance Repairs	– 9.92	–11.57	– 0.41	+5.67

*Houthakker and Taylor.

A convenient summary measure of the quality of forecasts is Theil's U.[27] This measure is defined as

$$U = \sqrt{\frac{\Sigma (P_i - A_i)^2}{A_i^2}}$$

where P_i is the predicted change of item i and A_i the observed change. It is obvious that U equals zero in the case of a perfect forecast, equals unity in the case of a forecast that is no better than a "no change" prediction, and is bigger than unity if the forecast is worse than a "no change" prediction.

After weighting our forecasts by the relative importance of the consumer items investigated (1966 weights), we have calculated the following U values:

Houthakker-Taylor	$U = 0.59$
Naive I	$U = 0.79$
Naive II	$U = 0.70$

As pointed out in Chapter 4, the DBS data are more reliable for big items than for small ones. We have recalculated the U statistics for the "important" items – defining as "important" those which amounted to at least 0.5 per cent of total Consumer Expenditure in 1968 (Items 0111, 0121, 0122, 0130, 0211, 0212, 0221, 0232, 0321, 0322 + 0323, 1311 and 1312). Using only the " important" items, we obtained

Houthakker-Taylor	$U = 0.48$
Naive I	$U = 0.74$
Naive II	$U = 0.67$

Two conclusions can be drawn from this Chapter:

1. The Houthakker-Taylor method has acquitted itself reasonably well.
2. The quality of forecasts depends crucially on the quality of historical data. The users of DBS material (and these could include all public and priviate economic policy-makers) should encourage DBS further to improve the quality of its disaggregated estimates.

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[27] For a detailed description see H. Theil, *Applied Economic Forecasting*, North-Holland Publishing Co., Amsterdam, 1966, pp. 26-43.

8. DISCUSSION OF PROJECTIONS

The total projected growth of the individual consumer items dealt with in this Study for the 1968-75 period is contained in Table 6.

TABLE 6

PROJECTED PERCENTAGE GROWTH, 1968-75

No.	Item	Percentage Change 1968-75
1315	Board & Lodging in Universities	+181.1
0310	Water Charges	+165.4*
0321	Electricity	+ 67.2
0122	Alcoholic Beverages	+ 58.9
1311	Gross Rents, Imputed	+ 52.0
0121	Nonalcoholic Beverages	+ 50.1
1312	Gross Rents, Paid	+ 48.8
	Total Consumer Expenditure	+ 48.2
0222	Shoe Repair	+ 47.0
0212	Women's & Children's Clothing	+ 47.1
0232	Precious Stones, Other Jewellery, etc.	+ 43.4
0231	Luggage & Other Leather Goods	+ 37.3
0322 + 0323	Gas & Other Fuels	+ 35.9
0221	Footwear	+ 35.7
0111	Food at Retail	+ 34.2
0130	Tobacco	+ 34.2
0211	Men's & Boys' Clothing	+ 31.5
0213 + 0214	Notions & Piece Goods	+ 28.7
1210	Dressmaking & Tailoring	+ 25.5
1316	House Maintenance Repair	+ 18.6
1313	Imputed Lodging	+ 15.6
0113	Other Food	– 4.6
0215	Armed Forces Clothing	– 13.7
0233	Jewellery Repair & Engraving	– 28.0
0112	Food Produced & Consumed on Farms	– 55.1

*However, we have reason to believe that the true consumption of water has been substantially under-reported for 1968. The true growth of water consumption is more likely to be in the +60 per cent range.

Table 6 indicates that among the items discussed in this Study the highest growth rate can be expected among those connected with higher education, housing, and beverages. Clothing items are expected to grow slightly more slowly than total real consumer expenditure, followed by food purchased at retail. There are also four items that are expected to decline in absolute volume. Most of these items are crucially influenced by decisions of groups other than Canadian consumers (see the detailed discussion of these items).

The projection of the three major sections can be summarized as follows:

		Millions of 1961 Dollars		1968-75 Percentage
		1968	1975	Change
Section I	Food, Beverages & Tobacco	8,025.7	10,845.4	+ 35.1
Section II	Clothing, Footwear & Accessories	2,998.7	4,193.7	+ 39.9
Section III	Gross Rent, Fuel & Light	6,969.9	10,690.5*	+ 53.4

*This includes Lodging Paid (1314), for which no equation was calculated. For the purpose of this summary we assumed that the per capita expenditure on this item would be the same in 1975 as it was in 1968.

Expressed as percentage of (adjusted) total consumer expenditure we obtain:

		1968	1975	Change in Percentage
Section I	Food, Beverages & Tobacco	21.7%	19.8%	– 1.9
Section II	Clothing, Footwear & Accessories	8.1%	7.6%	– 0.5
Section III	Gross Rent, Fuel & Light	18.8%	19.5%	+ 0.7

It must be emphasized that the DBS data are subject to future revisions. These revisions will necessarily influence the projected growth rate of the items and to a lesser extent also the projected 1975 levels. This Study reflects the status of the data as of June 1969.

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Personal Consumer Expenditures in Canada, 1926-75
Part 1

by Thomas T. Schweitzer

Economic Council of Canada