

THE USEFULNESS OF INDICES OF CONSUMER SENTIMENT  
IN PREDICTING EXPENDITURES

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Abstract

Surveys of consumer attitudes are often used in an attempt to associate shifts in attitudes, expectations, and intentions to purchase decisions. This line of research is based on the premise that changes in attitude precede actual consumer behavior in the marketplace, and also are able to capture a wide variety of "changes" that are often (or may not) be reflected by objective economic measures such as income, unemployment, GNP, prices, etc. It is argued, based on this reasoning, that attitude surveys are able to provide reliable and meaningful measures of consumer attitudes and expectations and can be used in forecasting consumer spending.

Introduction

Since the pioneer studies by George Katona and his colleagues at the Survey Research Center at the University of Michigan in the late '40s, several attempts have been made to measure consumer attitude and purchase intentions and to relate them to actual purchases. However, some of the results obtained have been contradictory, and a controversy has emerged from them regarding the predictive ability of consumer attitudes and intentions in forecasting consumer spending.

This paper begins with a brief overview of the previous research efforts in testing the relationship between anticipatory data and actual purchase behavior. The second section proposes a new procedure for testing the relationship between such data, employing a time series methodology developed by Haugh (1976) and Pierce (1977). Finally, this methodology is applied to data on consumer sentiment, purchase intentions and disposable income to check for relationships that might exist between these variables and retail sales of household appliances.

Previous Research

The general theory of psychological economics proposed by George Katona (1951, 1976) specifies that consumer expenditures are subjected to the influence of two main factors: a subjective one, consumers' "willingness to buy," and an objective factor, "ability to buy." However, ability to buy is most often represented by household disposable income. The "willingness to buy" factor is more complex and is usually a composite measure composed of three unique dimensions:

- Household financial position: the optimism/pessimism across households with regard to their own financial outlook.
- Business outlook: consumers' optimism with regard to business and economic conditions.
- Market conditions: consumers' perceptions of the current state of the discretionary expenditures market.

The standard way to measure the "willingness to buy" factor for individuals is to measure directly their buying plans. This direct approach assumes that consumers, on the basis of their financial conditions, needs, and

sentiments, formulate buying plans that anticipate their actual purchases.

These theoretical concepts served as a catalyst for the development of a program designed to conduct consumer attitude surveys started by the Survey Research Center in 1946. More recently, other institutions have also developed their own surveys based on the same theoretical framework (e.g., National Family Opinion Survey). (The two indices of interest in this paper are the buying intentions index and the consumer sentiment index from NFO.) Past researchers have used these data to test the theoretical concepts from Katona's theory.

Due to the unavailability of sufficient data on a time series basis, the first tests of Katona's concepts were done on a cross-sectional basis across all households in a given period or, at best, compared households across two consecutive time periods. The results from these studies (Tobin 1959, Klein & Lansing 1955) have consistently shown that while buying intentions have a significant effect in explaining actual purchase behavior on an individual basis, information on consumer sentiment does not add significantly in explaining this actual behavior.

However, by comparing cross-sectional results for several different periods, Mueller (1957) concluded that attitudinal variables do contribute significantly for explaining consumer spending providing that the attitudinal data is not highly correlated with income. In cases of high correlation, income dominates the relationship. It was quickly discerned that the usefulness of buying intentions as an indicator of aggregate expenditures, even for the same period of the survey, was limited and that the ultimate test for the predictive ability of intentions and attitudes in forecasting consumer spending must be studied on a time series basis. As George Katona points out (Katona 1979, Katona & Schmiedeskamp 1967), the objective (value) of anticipatory survey data is not to find out which individuals will make a purchase, but to predict trends in aggregate expenditures.

While the early time series studies of aggregate spending had shown inconclusive results, subsequent studies have consistently shown that attitudes make a significant contribution in explaining fluctuations in consumer purchases, while intentions do not make any significant contribution (Mueller 1963).<sup>1</sup>

Most of the time series done in this area have proceeded by fitting models explaining discretionary expenditures with the use of objective variables, and then analyzed the effect of including anticipatory variables. If these added variables had a significant contribution in fitting, the data they considered were relevant. A problem with using this procedure is the previously mentioned fact that income and intention are often highly correlated and a problem with multicollinearity is likely to occur when estimating the model. Another important problem with the use of aggregate data on a time

<sup>1</sup>These later results were in direct opposition to the ones from cross-sectional studies, giving rise to a so-called Cross Section-Time Series Paradox. Since then, an extensive literature has been published attempting to explain this paradox.

series basis is the serial correlation usually observed in time series data. One solution used to avoid the autocorrelation problem has been to use data collapsed into large time periods, such as semiannual or quarterly. However, the use of large time intervals tends to obscure the relationships between the various series and may also obscure the strength of the relationships since many are short-lived attitudes.

In the application presented in this paper, the Box and Jenkins (1970) procedure for time series analysis will be used, which is not affected by the serial correlation in the series and then results will feed into a procedure developed by Pierce and Haugh (1977) for detecting relationships between variables that use multicollinearity as a source of information.

#### Methodology

The procedure used to test the relationship between the time series in the application to be presented in the following sections is based on an extension of the ARMA (Auto Regressive-Moving Average) filter developed by Box and Jenkins (1970). In early time series studies, the relationship between two time series was described through the lagged cross-correlation function. However, it is often difficult to interpret such functions due to the fact that the cross correlation for a given lag is usually strongly correlated with the ones for other lags, which produces a smooth cross-correlation function obscuring the real interrelationship between the two series. Haugh and Pierce (1976, 1977) suggest that both series be "prewhitened" using an ARMA filter for each. Then the cross-correlation function can be calculated, based on the resulting residuals from these series, which by definition are not correlated. Both Pierce (1976) and Haugh (1977) have proposed tests for measuring the significance of the cross-correlation function of the residuals. The tests are very similar, with the only difference being that Haugh's test uses a more accurate approximation for the variance of the cross correlations.

However, as Haugh (1976) points out, his test statistic provides better results only for the cases where the number of lags considered in the test is large relative to the number of observations.

Once the relationship between the series has been tested, the best model connecting the series can be identified. Haugh and Box (1977) suggest a two-step procedure through which the best univariate ARMA filter is fitted to each series; the cross-correlation function of the resulting white noise residuals is used to identify the model connecting these residuals; and finally, the identified model is combined with the univariate ARMA model, resulting in the final model relating the original series. This procedure will be used in this paper to investigate the relationship between the NPO variables, consumer sentiment and purchase intentions, and consumer expenditures.

#### Data

To investigate whether consumer's attitudes or intentions can serve as predictors of purchase within Katona's two-factor scheme, disposable income in constant dollars will be used as a measure of consumers' "ability to buy." The "willingness to buy" factor will be measured by two variables: an attitudinal one represented by the Index of Consumer Sentiment and an intentional dimension represented by the Intention to Buy Household Appliances. Both of these indices are collected by National Family Opinion, Inc. The index of consumer sentiment is similar in theory to Katona's measure. The reason for using

National Family Opinion, Inc.'s survey as our data source instead of the traditional index collected by the Survey Research Center is the fact bimonthly data can be used for a longer series and the intentions measure is specific to household appliances, rather than durables in general. The intention to buy household appliances is measured as the percentage of households in the sample which intended to purchase any household appliance within six months after the survey.

The dependent variable to be explained by these measures of "willingness to buy" and "ability to buy" is the actual consumer expenditures on household appliances represented by Retail Sales of Household Appliances in Constant Dollars. These four bimonthly time series were collected for the period Jan/Feb 1970-Jan/Feb 1980.

#### Results

The first step in the model building process is to identify and estimate the best univariate ARMA model for each one. By applying the methodology developed by Box and Jenkins (1970), the following univariate models were obtained:

$$(1 - .469B) \frac{(1-B)x_{1t}}{[.10]^*} = (1 + .55B^6)\mu_{1t} \quad (1)$$

$$\sigma_{\mu_1}^2 = 3519.2$$

$$(1 - .325B - .326B^2) \frac{x_{2t}}{[.12] \quad [1.2]} = \mu_{2t} + \frac{11.25}{[4.0]} \quad (2)$$

$$\sigma_{\mu_2}^2 = 9.13$$

$$(1 - B)x_{3t} = \mu_{3t} \quad (3)$$

$$\sigma_{\mu_3}^2 = 352.5$$

$$(1 - B)x_{4t} = \mu_{4t} \quad (4)$$

$$\sigma_{\mu_4}^2 = 101.0$$

where,  $x_{1t}$  = disposable income in constant dollars at period t

$x_{2t}$  = intention to buy household appliances

$x_{3t}$  = retail sales of household appliances in constant dollars

$x_{4t}$  = index of consumer sentiment

\*Numbers in brackets are the standard deviations for the estimates. All parameters significant on a .05 level.

The autocorrelation functions of the residuals for these models were tested and found to be insignificant with an alpha level of .05, leading to accepting the null hypothesis of serial independence of residuals.

The second step involves taking the residuals obtained from the univariate ARMA models and cross correlating them.

The portmanteau statistics computed for lags from -5 to +5 for each series-pair were:

$$S_{12}(5) = 11.8$$

$$S_{23}(5) = 10.1$$

$$S_{13}(5) = 24.2$$

$$S_{24}(5) = 18.2$$

$$S_{14}(5) = 24.5$$

$$S_{34}(5) = 14.1$$

where  $S_{ij}(5)$  is the portmanteau statistic accumulating cross correlations between residual series  $i$  and  $j$  over lags from  $-5$  to  $+5$ .

By testing these statistics with a  $\chi^2_{\alpha=.05}$  with 11 degrees of freedom ( $\chi^2_{.05} = 19.7$ ), it was concluded that only  $S_{13}(5)$  and  $S_{14}(5)$  are statistically significant at the .05 level. Therefore, the only significant relationships among the four series tested are between disposable income and retail sales, and disposable income and consumer sentiment. Considering the values of the cross correlations for those pairs, the conclusion is that along with the contemporaneous relationship (lag - 0), disposable income drives retail sales with a one-period lag, and consumer sentiment drives disposable income with a one-period lag.

For an additional verification of the relationship among the four time series, a multivariate ARMA model was fitted to the series. In this model, the significant cross correlations between each pair of series (even between the series for which the hypothesis of independence was not rejected on the previous test) were taken into account. Since the contemporaneous relationships (zero lag) have no predictive value, only the lagged cross correlations were considered in fitting the model. The model fitted, considering all the short-term lagged relationships among the four time series, is presented in Figure 1. From the cross correlations of the resulting

FIGURE 1  
MULTIVARIATE MODEL

$$(1 - .501B)(1-B)x_{1t} = 2.346B x_{4t} + (1 + .493B^6)a_{1t}$$

$$\begin{matrix} [.087]^* & [.635] & [.104] \end{matrix}$$

$$\sigma_{a_1}^2 = 2886.7$$

$$(1 - .300B - .355B^2)x_{2t} = .05B x_{3t} + a_{2t} + 10.77t$$

$$\begin{matrix} [.118] & [.117] & [.020] & [.831] \end{matrix}$$

$$\sigma_{a_2}^2 = 8.2$$

$$(1 - B)x_{3t} = .095B a_{1t} + a_{3t}$$

$$[.043]$$

$$\sigma_{a_3}^2 = 333.9$$

$$(1 - B)x_{4t} = a_{4t}$$

$$\sigma_{a_4}^2 = 101.0$$

\*Figures within brackets are standard deviations of estimates. All parameters significant on a .05 level.

errors, it was clear that all the information about the short-term relations among the series was accounted for, resulting in residual series that are not only white noises, but also independent from each other.

The results from the multivariate model are generally compatible with the results from the independence tests. The main distinction is the multivariate model establishes a relationship between the first differences of the retail sales series and the residuals from the disposable income series, rather than the original series.

## Concluding Remarks

The results obtained from this analysis were, to some extent, consistent with the results from previous research using the time series approach. Disposable income predicts retail sales with a one period lag and disposable income is driven by consumer sentiment with a one period lag. This implies consumer sentiment indirectly predicts actual purchases. Also in accordance with previous research, these tests did not reject the hypothesis of independence between intentions and actual sales. Therefore, the conclusions from these tests are that intentions to buy do not contribute in explaining actual purchase behavior, while consumer sentiment is related to future purchases but only indirectly through disposable income. The authors are presently involved in a more extensive investigation of the use of consumer sentiment data, using monthly data and economic variables to eliminate model specification problems due to omitted variables.

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