The Demand for New Motor Vehicles
— Using Australian Consumer Sentiment Measures to Explain and Predict Consumer Behaviour

L. V. Defris, J. S. McDowell, The Demand for New Motor Vehicles, Australian Economic Review, Fourth Quarter, 55-64.

1. Introduction

In Australia, the Institute of Applied Economic and Social Research has conducted quarterly surveys of consumers' attitudes, expectations, and buying intentions since January 1973. Only one other preliminary study has been made by the same authors of the information content of these surveys.1

The analysis of the demand for new motor vehicles, cars and station wagons, represents the first stages of the work on the explanatory and forecasting value of the Institute's Consumer Survey data. This is part of a larger project, which will look at the usefulness of consumer sentiment data for explaining and forecasting total consumption expenditure, expenditure on both durables and non-durables, the level of savings and the demand for particular consumer durables.

In this article we present quarterly demand models of the Australian new car market, using consumer sentiment data, which has only been available from first quarter 1973. In the first part of the article, other studies of motor vehicle demand are briefly reviewed. We then proceed to outline the empirical model used and look at attitudinal variables versus 'objective' variables. The econometric analysis follows and is presented in two stages: first, purely 'attitudinal' models; and second, objective, economic models combined with attitudinal variables. Finally, several important factors emerge from this study and are discussed in our conclusions.

2. Review of Studies of the Demand for Motor Vehicles

The demand for motor vehicles has been widely studied in the United States, United Kingdom, Canada and Australia. Many studies explain and predict this demand purely in terms of such objective economic variables as income, population, credit availability, relative prices and new model introductions. For Australia alone, there are no 'attitudinal' objective variable models. With the exception of Rose, Deli and Packham, and Mumbard, these models arose from macro studies which included an equation for the demand for motor vehicles.

The models differ in four main ways. First, originally most models were market models which have been converted to quarterly models for short-term forecasting purposes. Second, some models use consumer dollar expenditure on motor vehicles while others use physical quantities. Third, some models are single equation models while others are multi-equation models. Fourth, differences arise due to the particular data and methods used. Frequency variables include: income, population, data availability, relative prices, the timing of model introductions and stocks.

During the last 15 years a number of overseas studies have examined the role of consumer sentiment in explaining and predicting consumer expenditure whether or not in part. Among other things, the demand for motor vehicles has received substantial attention. There are a number of studies of motor vehicles for the United States, using data collected by the University of Michigan's Survey Research Center. There have also been two for Canada, one for the United Kingdom, and none so far for Australia. For the most part, the overseas models use single equation models which use the Index of Consumer Sentiment of its countries (composite index of consumer mood) as the measure of consumer sentiment.

Since the development of attitudinal ways in the 1960s, there has been significant controversy concerning the usefulness of these data for explaining and predicting consumer behaviour. However, as the number of observations increased, it became evident.

2. See bibliography for both overseas and Australian studies.
3. As distinct from the subjective, attitudinal, consumer sentiment data.
4. See Bibliography.
hat aggregate consumption models, discretionary spending models, savings equations and indeed motor vehicle models which included measures of consumer sentiment were superior to purely objective models.

3. The Economic Model

Katona's theory simply states that consumption is a function of the ability to buy and the willingness to buy, where the ability may be indicated by variables such as income, the availability of credit and prices, and the willingness may be proxied by consumer sentiment measures. Therefore, we hypothesise that the demand for motor vehicles may be expressed as: \( NR = F(\text{Ability to Buy, Willingness to Buy}) \), where \( NR \) is new registrations of cars and station wagons as this is an analysis of the new car market only. Thus, we are postulating that new registrations of new motor vehicles are a function of the ability to buy (measured in terms of income, credit availability, relative prices), and willingness to buy (measured by our consumer sentiment data).

In the real world of course an effect often may only be produced by its causes after some interval of time. This gives rise to an observable "lag" between a cause and its effects. In this article we take specific account of the likelihood of lags affecting the purchases of motor vehicles.

4. Quarterly Models of New Registrations

Using only Attitudinal Variables

(1) Available Attitudinal Variables

Numerous measures of consumer sentiment can be derived and constructed from Consumer Surveys data. In this analysis both naturally occurring variables and constructed variables are examined for their relative explanatory and forecasting ability in single equation quarterly models.

Very simply, the models may be specified as:

\[
\Delta NR_t = f(S_{t-1}, S_{t-2}, \ldots) \]

and

\[
NR_t = f(S_{t-1}, S_{t-2}, \ldots) \]

where \( S_t, \ldots, S_1 \) are various consumer sentiment variables and \( t \) ranges from 0 to 4. Four separate types of Consumer Survey data are used in the empirical analysis:

(i) The Index of Consumer Sentiment—a summary of current consumer sentiment based on 5 survey questions.

(ii) Individual Attitudinal Questions—Favourable responses—Unfavourable responses—Differential responses

(iii) Buying Intentions—proportions of respondents intending to buy specific consumer goods.

(iv) Indexes formed on the basis of the Principal Components analysis carried out by Dr. L. V. Debits and Mr. J. S. McMillan, Australian Economic Review, 27th, p. 35-44.

References:


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out on Survey data by the authors. Indexes may be formed from either standardised survey data (data treated so as to have a mean of zero and a standard deviation of one), or from non-standardised survey data (untreated data).

New registrations (NR) and changes in new registrations ($\Delta NR$) are hypothesised to be functionally related to consumer sentiment both currently and with up to a four quarter lag.

The reason we anticipate lags a priori, is that the structure of many Consumer Survey questions is such as to suggest a lead-time. They involve answers to questions about the future or about things that indicate future developments. They provide data that gives a short look ahead into consumer behaviour.

(2) Methodology and Criteria

The analysis has been based throughout on a simple multiple linear regression model of the form:

$$NR_t = B_0 + B_1 X_1 + B_2 X_2 + \ldots + B_k X_k + \epsilon_t \quad \text{ (similarly for } \Delta NR_t)$$

Since there were only fourteen observations, deseasonalised data was used whenever necessary. This approach was preferred to the use of dummy variables, in order to preserve the degrees of freedom available for the analysis. Since it was desired to introduce lags into the consumer sentiment measure, with an implied loss of observations equal to the lag, it was decided to use leads in the new registrations of one to four quarters instead, thereby maintaining the 14 observations available.

In evaluating the various equations, reference will be made to four indicators of the significance of an equation. These criteria will be the following:

(a) $R^2$ — the coefficient of determination and $\bar{R}^2$ which allows for the number of variables in a regression relative to the number of observations.

(b) The Durbin-Watson statistic (DW).

(c) $t$ values of parameters — a test of the significance of each variable.

(d) Mean absolute deviation

$R^2$ measures the proportion of the total variation in the dependent variable which is accounted for by its relationship with the independent variables.

Besides explaining a good proportion of the variability in the data, however, it is a statistical requirement that the residuals between the model's estimates and the actual data be randomly distributed. A systematic bias in the residuals of a model will show up if there is:

(a) incorrect specification of the form of a model
(b) incorrect specification of lags
(c) omission of certain explanatory variables.

To test the hypothesis that there is no serial correlation in the residuals the DW must fall within a certain range. If not the model should be reviewed, since serious serial correlation casts doubts on the usefulness of the fitted equation.

The mean absolute deviation is the average of the residuals of an equation and is calculated by averaging the residuals' absolute values.

(3) Initial Results

(a) The Index of Consumer Sentiment

In the first stage of the analysis the Index of Consumer Sentiment and changes in the index were examined in relation to new registrations and changes in new registrations.

(b) Individual Attitudinal Questions

NR and $\Delta NR$ were then correlated with individual attitudinal questions, in terms of favourable and unfavourable responses. The correlation coefficients were closely examined.

It was found that for new registrations the largest $r$ value occurred with a two quarter lag on the attitudes, with correlation mainly on the 3 quarter lag. Some individual attitudinal questions had very high correlation coefficients of up to 0.7.

(c) Buying Intentions Questions

With respect to the individual buying intentions questions, some interesting relationships between NR and buying intentions for both cars and other durables was found. However, the correlation coefficients were lower than for the individual attitudinal questions. This was also the case for intentions indexes which were formed on the basis of principal components combination of the various buying intentions ratings for different consumer goods.

(d) Attitudinal Indexes

Attitudinal indexes, using principal components weights, were constructed. These two types of index: first, the non-standardised version, and second, a standardised version in which weights are determined after allowance was made for both the mean and standard deviations. Both these types of indexes showed that 3 and 4 quarters were again the most important.

(e) Conclusions

In all cases it was found that sentiment at most highly related to levels of new registrations rather than changes in those levels.

Table 1: The Relationship Between New Registrations and the Index of Consumer Sentiment 1/1973 to 2/1976

<table>
<thead>
<tr>
<th>ICS</th>
<th>$R^2$</th>
<th>$\Delta ICS$</th>
</tr>
</thead>
<tbody>
<tr>
<td>NR</td>
<td>0.0380</td>
<td>0.0268</td>
</tr>
<tr>
<td>$\Delta NR$</td>
<td>0.0059</td>
<td>0.3048</td>
</tr>
<tr>
<td>$\Delta NR_{-2}$</td>
<td>0.2695</td>
<td>0.0017</td>
</tr>
<tr>
<td>$\Delta NR_{-3}$</td>
<td>0.3012</td>
<td>0.4607</td>
</tr>
<tr>
<td>$\Delta NR_{-4}$</td>
<td>0.0076</td>
<td>0.1953</td>
</tr>
</tbody>
</table>

$\Delta NR$ = 0.1410 0.1233
$\Delta NR_{-1}$ = 0.0009 0.1117
$\Delta NR_{-2}$ = 0.1249 0.1582
$\Delta NR_{-3}$ = 0.0225 0.3906
$\Delta NR_{-4}$ = 0.3089 0.0255

For details of the construction of these indexes, see L. V. Dolins and J. S. McDonnell, Australian Economic Review, 2/76, p. 35-44.
Whereas models in terms of changes were constructed, these had significantly less explanatory power than models in terms of levels of new registrations and will not be presented here.

As a result of these initial partial correlations it became evident that the analysis of the level of new registrations should continue in two main areas: the individual attitudinal questions and second, the standardized attitudinal indexes. The resulting models will be presented in the following two sections.

(4) Model 1 — Based on Individual Attitudinal Questions

Models were formulated of favourable, unfavourable and different responses, combining variables that had high r values but that were not correlated with each other. If they were intercorrelated the problem of multicollinearity would be encountered. (Multicollinearity occurs when the variables move together so closely that it is impossible to isolate their independent contributions.) Model 1 was developed from these combinations of responses to individual attitudinal questions.

The model states that new registrations in period 1 are a positive function of the news items ratio 3 quarters earlier, a negative function of unfavourable evaluations of the current unemployment situation 4 quarters earlier, and a positive function of unfavourable expectations of the rate of inflation 4 quarters earlier.

In this equation all the variables are significant at the 5 per cent level; the $R^2$ is reasonably high; the DW is too high, suggesting that there is some negative serial correlation in the model. However, the residuals are extremely good with small percentage errors. The mean absolute deviation is 2031 cars.

Chart A compares actual new registrations with predicted registrations on the basis of $r$ and 4 quarter lags in attitudes.

Model 1

$$NR_1 = 57.70 + 3.11 \frac{U/F12}{12} - 0.17 U_8 + (3.6)$$

$$+ 0.67 U_{11} + (3.5)$$

$R^2 = 0.6875$  

Mean Absolute Deviation = 2031 cars

where $U/F12$ is the ratio of unfavourable to favourable news items (question 12); $U_8$ is the proportion of respondents who evaluate current unemployment unfavourably (question 8); $U_{11}$ is the proportion of respondents who hold unfavourable expectations as to the rate of inflation.

The Sales Tax Cut

Because the sales tax reduction on motor vehicles in February 1975 was so effective, a dummy tax variable was introduced into model 1 of the form $1/1975 = -1, 2/1975 = +1, 3/1975 = -1, 4/1975 = +1$ and for other quarters zero.

However, in this model, it was not significant; that is, the attitudinal variables appeared to be doing the work of the tax dummy.

(5) Model 2 — Based on Standardized Attitudinal Indexes

Model 2 uses the sales tax dummy variable along with standardized indexes. An index which had previously been included was found to be redundant when the tax dummy was introduced. In this equation standardized indexes $i_1$ and $i_2$ were significant at the 5 per cent level, $i_3$ at the 10 per cent level. Index $i_1$ closely resembles the news items ratio, $i_2$ the evaluation of unemployment, and $i_3$ the evaluation of intentions for new cars. These variables are very similar to the variables in model 1. $R^2$ is still reasonably good but lower than in model 1. The DW is lower so there does not appear to be serial correlation in the residuals, which are fairly small, recording a mean absolute deviation of 2327 cars. Chart B shows the actual and predicted values of new registrations using model 2.

<table>
<thead>
<tr>
<th>Table 2. Attitudinal Model Forecasts of Registrations of New Cars and Station Wagonas</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td></td>
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<tr>
<td>Model 1</td>
</tr>
<tr>
<td>1976/3</td>
</tr>
<tr>
<td>1976/4</td>
</tr>
<tr>
<td>1977/1</td>
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</tbody>
</table>

Note: Seasonal adjustment factors derived from figures published by the Australian Bureau of Statistics.

Model 2

Standardized Indexes

$$R^2 = 0.83$$  

$D W = 1.73$

Mean Absolute Deviation = 2327 cars

The forecasts of both model 1 and model 2 are set out in Table 2.
Table 3. Intercorrelations of Survey and Economic Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>HDYR</th>
<th>U/V</th>
<th>MVP</th>
<th>CPI</th>
<th>Variable Name</th>
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</thead>
<tbody>
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<td></td>
<td></td>
<td>Model 1</td>
</tr>
<tr>
<td>U/Pt2 (t-1)</td>
<td>0.4181</td>
<td>-0.4128</td>
<td>0.1507</td>
<td>News Items Ratio</td>
<td></td>
</tr>
<tr>
<td>U2 (t-3)</td>
<td>0.4186</td>
<td>0.6936</td>
<td>-0.516</td>
<td>Evaluation of Unemployment</td>
<td></td>
</tr>
<tr>
<td>U11 (t-3)</td>
<td>0.1706</td>
<td>0.2218</td>
<td>-0.2238</td>
<td>Expected Inflation</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td>Model 2</td>
</tr>
<tr>
<td>Index</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Index Make-up</td>
</tr>
<tr>
<td>I1 (t-3)</td>
<td>0.4405</td>
<td>-0.3896</td>
<td>-0.0763</td>
<td>News Items Ratio</td>
<td></td>
</tr>
<tr>
<td>I2 (t-3)</td>
<td>0.3280</td>
<td>0.7295</td>
<td>0.8340</td>
<td>Evaluation of Unemployment</td>
<td></td>
</tr>
<tr>
<td>I8 (t-4)</td>
<td>0.1712</td>
<td>0.1454</td>
<td>-0.3212</td>
<td>Expected Inflation</td>
<td></td>
</tr>
<tr>
<td>Ie (t-3)</td>
<td>0.4268</td>
<td>0.2204</td>
<td>0.5127</td>
<td>Buying Intentions for New Cars</td>
<td></td>
</tr>
</tbody>
</table>

(6) Interrelations of Consumer Sentiment Variables and Economic Variables

If consumer sentiment data is to be used alone it is important to establish the relationship discussed earlier between traditionally accepted and useful, economic data and the consumer sentiment variables.

Table 3 shows the intercorrelations between the consumer sentiment variables of models 1 and 2 and the typical economic variables of, for example, Fisher and Talbot, and Nish.

The table shows clearly the reasons for obtaining such good results with the attitudinal models. The correlation between the evaluation of unemployment and the relative price of motor vehicles is 0.83; the evaluation of unemployment is also highly correlated with the unemployment/vacancies ratio. Similar results are obtained for the news items ratio which shows some correlation with income and the unemployment/vacancies ratio. Expected inflation is not highly correlated with the economic variables. The Index variables used in model 2 also show some high correlations with unemployment and relative prices and to a lesser extent with incomes.

It is important to stress that this table highlights two important features: first, that consumer sentiment variables are useful, in part, as good substitutes for economic variables and second, that they have a considerable and useful lead time over economic variables.

5. The Role of Objective Variables in Anticipatory Models

(1) Initial Theoretical Considerations

The forecasting models that have so far been outlined utilise solely consumer attitudinal data. Only models which maximise the proportion of variance in new registrations that can be explained by using consumer sentiment data alone have been constructed. At this stage we will incorporate objective economic variables into our models in an attempt to isolate in part the independent influence of consumer sentiment on fluctuations in durable demand. However, they will be allowed to remain in a model only if they make a significant contribution to the explanatory power of that model. If they fail this test their role may be taken by an attitudinal variable. Our period of analysis is generally restricted to a fairly unusual and turbulent 14 quarter period and thus many quite reasonable variables could fail to prove to have a significant effect on motor vehicle sales in this short term.

Chart C, which traces seasonally adjusted quarterly registrations from 1959, shows that our 14 quarter period may be taken to be not untypical of the entire period. That is, trend factors appear to exert a continuing influence on new registrations. On the other hand it could also be argued from the chart that this period is quite untypical of the longer period and there was during 1973 a stop upwards in demand which has since plateaued and, right up to the present time, trend factors had little or no influence on the demand for new motor vehicles.

Whichever hypothesis is considered more acceptable it would be unlikely that separate influences of long term trends such as real income could be isolated from the short term factors such as change in consumer sentiment. If this is true then we can allow for long term trend factors in estimating their effects over a much shorter period and then removing these effects from the analysis by calculating the long term trend. Inspecting a number of possible trend factors the second alternative was selected as the most useful and the resultant residuals were used in the analysis. The trend factors were then re-estimated by regressing the original sales data on trend, the residuals and seasonality components. Finally, we estimated trend by regressions over our 14 quarter period which tested various lagged combinations of trend variable against consumer sentiment data. Thus we ran regressions over our 14 quarter period which tested various lagged combinations of trend variable against consumer sentiment data.
Table 4. The Regressions of New Registrations and Objective Economic Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>POP</th>
<th>REAL</th>
<th>U/V1</th>
<th>U/V1-2</th>
<th>U/V1-3</th>
<th>REAL</th>
<th>M.V.</th>
<th>LGS</th>
<th>PRICES</th>
<th>( R^2 )</th>
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<tr>
<td>Run</td>
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<td>0.91</td>
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<td>(3) X² X</td>
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<td>(4) X²</td>
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<td>0.81</td>
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<td>(5) X²</td>
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<td>0.81</td>
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<td>(6) X² X X</td>
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<td>(7) X²</td>
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<td>(8) X² X X</td>
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<td>(9) X²</td>
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<td>(11) X²</td>
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<tr>
<td>(12) X²</td>
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<td>0.90</td>
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<tr>
<td>(13) X²</td>
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<td></td>
<td>0.89</td>
</tr>
</tbody>
</table>

Table 4 sets out the economic variables that were used in the trend tests, with X² indicating whether the variable was significant in the particular regression and X showing that it was included but not significant.

The trend equation still requires further work, particularly with regard to the leads and lags. The DW is fairly low on all these equations which indicates that there is positive serial correlation and this may be due to lagged relationships.

However, the \( R^2 \)'s are quite high and equations 11 and 12 will be examined further.

Equation 11 uses population as the only explanatory variable. This equation appears as an uncomplicated way of detrending motor vehicle sales because it is fairly easy to predict for forecasting purposes, it has a high \( R^2 \) and wipes out other trend variables when they are included in an equation with it, since it dominates the relationship. Equation 11 may be written as

\[
NR_t = -142,862 + 1.3415 \text{Population}_t \quad (-14.7) \quad (23.8)
\]

\( R^2 = 0.69 \) \( D \text{W} = 0.63 \)

Mean Absolute Deviation = 5602

This equation summarises the trend factors using population alone and when applied over our 14 quarter period yields the following 'predictions' and consequent residuals from actual new registrations. The residual average is to be 5602 in error over the period.

Chart D graphs these residuals and shows the strong effect of the 1975 tax cuts in pulling sales forward to the first half of 1976 from the second half of that year. In addition if the trend growth in registrations evident since 1959 is still continuing, sales during 1975 and 1976 were generally well above trend.

Thus far all that has been done is to use equation 11 to detrend new registrations. The next step in the analysis is to explore the process further...
the residuals of equation 11 in terms of consumer survey data. To this end both standardised and non-standardised indexes for favourable, unfavourable and differentiated responses were examined for their correlations with new registrations.

As in the models discussed earlier in the article, the indexes with 3 and 4 quarter lags proved to be the most highly correlated. In other words, the effects of consumer attitudes are reflected in new registrations 3 or 4 quarters later.

A dummy variable was introduced to allow for the effects of the tax cut in the first half of 1975. This proved a very successful variable, which, however, forced many of the indexes into insignificant roles.

The most successful combination is detailed below. It consists of standardised index 2 and index 4 constructed from differenced responses to survey questions, lagged 3 quarters. The equation has a high $R^2$ of 0.82.

All the variables are significant and the DW indicates that serial correlation is no longer present. The mean absolute deviation of the average amount by which we are amiss in estimating new registrations for the past 14 quarters is 2669 cars or just 2 per cent of quarterly registrations.

$$\text{NR}_t = -1342.6 + 7696 DT_1 - 1721.7 PC2_{t-3} + 2290.6 PC4_{t-3}$$

$$R^2 = 0.82, \quad D W = 2.1$$

Mean Absolute Deviation = 2669 cars.

Looking back to Table 4, we see that equation 12 is another successful trend equation. It includes a variable for motor vehicle prices relative to the consumer price index as well as population and has an $R^2$ of 0.90.

Equation 12 may be written more explicitly as:

$$\text{NR}_t = -145,236 + 2,1075 \text{ Population}\text{ } (15.9) + 22,4112 \text{ M V Price Index}\text{ } (2.5)$$

$$R^2 = 0.90, \quad D W = 0.66$$

Mean Absolute Deviation = 5314.

In equation 12 all the variables are significant at 5 per cent level, the $R^2$ is high at 0.90 but the DW is very low, indicating significant positive serial correlation. The mean absolute deviation is high at 5314 cars.

When examining the residuals the best explanatory factor was the single favourable non-standardised index, PC1, lagged 3 quarters, and this is incorporated in the following equation.

$$\text{NR}_t = 2815.5 + 7393 DT_1 - 164.9 PC1_{t-3}$$

$$R^2 = 0.78, \quad D W = 1.66$$

Mean Absolute Deviation = 2769 cars.

This equation also has a fairly high $R^2$ of 0.78. The D.W. indicates no serial correlation and the typical size of the deviation is 2769 cars, higher than in any of the other models.

Forecasts

In order to forecast new registrations from these models it is necessary to first forecast the population. For these forecasts, population growth was estimated at 0.175 per cent per quarter, or 0.7 per cent per annum.

Forecasts of the relative price of motor vehicles were also necessary. For the purposes of the exercise the forecasts used were 3.7 per cent in September, and 2.2 per cent thereafter. The September figure is inflated by the increases due to the introduction of emission controls although this change could be treated as a quality change. Once again the figures were adjusted by the ABS seasonal factor. The forecasts, seasonally adjusted and otherwise worked out in Table 5.

Chart E sets out actual and predicted registrations by these two models as also the forecasts outside the time period analysed.

(3) The Second Alternative

In this section we test an assumption made earlier that trend factors affecting registrations would not show up as a trend term and that we would need a longer term in order to estimate it.

If economic variables are to be used directly in a short term demand theory that ability to buy and willingness to buy both operate at the same time. So both types of variables should be included in the equations. This objective was tested along with consumer survey data in a series of regressions to determine the most satisfactory combinations. Various combinations of the variables were tried together with combinations of the useful terms in economic variables of Table 5 which were tested in regressions over the 14 quarters to the second quarter of 1976.

As we had suspected, long-term factors such as household disposable income and population became significant relationships, their part being taken by the constant term. Only if this was the case they become significant. One variable consistently emerge as the ratio of the vehicle price index and the consumer price index lagged 4 quarters. This obviously assumes even greater significance.

Table 5. Forecasts of Registrations of Cars and Station Wagon on Models on Equation 11 and Equation 12

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Seasonally Adjusted</th>
<th>Seasonal</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/1976</td>
<td>117,400</td>
<td>111,402</td>
</tr>
<tr>
<td>1/1977</td>
<td>116,519</td>
<td>112,459</td>
</tr>
</tbody>
</table>
Table 6. Forecasts of Registrations of New Cars and Station Wagons

<table>
<thead>
<tr>
<th>Seasonally Adjusted</th>
<th>Including Seasonal Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1976/3</td>
<td>111,271</td>
</tr>
<tr>
<td>1976/4</td>
<td>109,382</td>
</tr>
<tr>
<td>1977/1</td>
<td>107,835</td>
</tr>
</tbody>
</table>

Thus, here we see more of the independent complementary contribution of consumer sentiment data becoming evident. Some of the factors which determine ‘ability to buy’ are having a significant measurable effect on new registrations. In the final equation below we only end up with motor vehicle price effects but they are particularly interesting because they are doing a job similar to that of the sentiment variables earlier. They are acting in both capacities. In other words while increases in motor vehicle prices for a given level of income would undoubtedly affect the ability of people to buy cars, a change in their price would also have an effect on willingness to buy.

The equation below presents one successful combination of economic and sentiment variables. All variables are significant at the 5 per cent level. While the $R^2$ of 0.85 is satisfactory, a DW of 2.6 is inconclusive. A tax dummy is included. The sentiment variables are the two which appear in the equation 11 model of the previous section. They are the second and fourth indexes formed from standardised difference responses to survey questions.

The forecasts of this model are given in Table 5.

\[ NR_t = 198.203 + 6.328 DT_t - 1.537 PC2_t - 2.316 PC4_t - 92.230 MVP_t - 2.6 \]

Whereas most previous studies, in the United States, the United Kingdom, and Canada which included data on consumer sentiment used the Index of Consumer Sentiment or its counterpart, we have utilised a number of other measures of consumer sentiment. The results support the case for consumer attitudes as expressed in individual questions and attitudinal indexes as the key consumer sentiment measures for explaining and predicting registrations of new cars and station wagons.

Some possible measures such as buying intentions and the buying intentions index were not so highly correlated. The Index of Consumer Sentiment also seemed less relevant to this project than some of the other measures.

6. Conclusions

It is clear that much research still needs to be done in testing the predictive value of consumer sentiment data yielded by the Institute’s Survey of Consumer Attitudes. Analysis is at present inhibited by the shortness of the time series available. It is therefore important to emphasize that even this study is still in its infancy, since the results have not been tested for their stability, accuracy and adaptability to a reasonable time period. We have presented 5 different models, any one of which could prove to be the most stable and adaptable in a changing environment. Even these 5 are by no means complete but it is felt that these approaches are promising.

At this stage in the development of forecasting models of the demand for durables, the analysis leads to several important conclusions.

1. It has been shown that Australian measures of consumer sentiment, derived from quarterly surveys of consumers, are capable of explaining a significant part of the variation in the demand for new passenger vehicles in the short term.

2. This has been the case both with the purely attitudinal models which were used as substitutes for purely objective models and the combined objective-attitudinal models, where the consumer sentiment data acted in its more correct theoretical role, as a complement to economic variables in providing measures of consumers’ willingness to buy durables.

3. Most models in the past have focused examining the usefulness of attitudinal variables in a more ad hoc context, perhaps in adding on the Index of Consumer Sentiment to a well-developed objective model. In this study the value of consumer sentiment data has been examined more systematically.

4. Both the attitudinal and combined model provide strong competition in terms of a plausible power to the more complex objective models and the potential predictive value of the equations shown here are good since they include several lags. This means that, unlike most objective models, the models presented here generally do not need to initial predict values for their independent variable before forecasting new registrations.

5. Whereas many overseas studies try to explain consumer sentiment (that is, the Index of Consumer Sentiment) in objective terms we have not done this, since we have no measures of consumer sentiment and the importance and composition of these will vary according to the type of economic behavior we are trying to explain and predict.
Objective Variable Models

United States


United Kingdom


Canada


Australia


Anticipatory Studies with Models for Motor Vehicle Demand

United States


United Kingdom


Canada
