



# IMPACT OF DEMOGRAPHIC CHANGE ON INDUSTRY STRUCTURE IN AUSTRALIA

A joint study by the Australian Bureau of Statistics, the Department of Employment and Industrial Relations, the Department of Environment, Housing and Community Development, the Department of Industry and Commerce and the Industries Assistance Commission

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THE USE OF DISAGGREGATED CROSS - SECTION  
DATA IN EXPLAINING SHIFTS IN AUSTRALIAN  
CONSUMER DEMAND PATTERNS OVER TIME

by

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*The views expressed in this paper do not necessarily reflect the opinions of the participating agencies, nor of the Australian government.*



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Table A6

PRICE INDICES, TOTAL PERSONAL CONSUMPTION EXPENDITURE, AND NUMBER OF HOUSEHOLDS,  
AUSTRALIA, 1966-67 TO 1975-76

Year	Price Indices, 1) 1974-75 = 1.000										Total Consumption Households (\$m)	Number of Households (million)
	Food	Cigs. Alc.	Clothing	Housing	Medical	Transport	Luxuries					
1966-67	.616	.614	.585	.563	.500	.625	.591				13,955	3.407
67-68	.637	.636	.598	.587	.523	.639	.610				15,259	3.518
68-69	.644	.648	.609	.613	.542	.661	.629				16,508	3.640
69-70	.659	.666	.627	.647	.570	.682	.652				18,172	3.774
70-71	.688	.711	.652	.699	.581	.720	.703				20,008	3.910
71-72	.710	.754	.690	.752	.663	.767	.739				22,207	4.041
72-73	.762	.791	.731	.798	.695	.785	.783				24,806	4.172
73-74	.904	.863	.829	.867	.799	.846	.855				29,274	4.305
74-75	1.000	1.000	1.000	1.000	1.000	1.000	1.000				35,143	4.443
75-76	1.101	1.239	1.158	1.190	.813	1.159	1.203				41,543	4.565

1) Price indices are national accounts implicit deflators except that the fuel and light component of the consumer price index is used in constructing the index for housing and the medical index is the "health and personal care" section of the CPI.

2) See section 5.1 of text for derivation.

Table A4

ADJUSTED MARGINAL BUDGET SHARES ( $\beta_1$ ),  $w_2$  WEIGHTS, AUSTRALIAN HOUSEHOLDS,  
1974-75.

Commodity	Household Type								
	1	2	3	4	5	6	7	8	9
Food	.0929	.0915	.1000	.0742	.0561	.1274	.0832	.1208	.0561
Cigs., Alc.	.0749	.0565	.1216	.0326	.0627	.0861	.0297	.0923	.0524
Clothing	.0155	.0614	.1096	.1054	.2794	.1239	.1130	.1243	.0513
Housing	.1809	.2328	.1781	.1233	.1357	.1234	.1247	.0703	.0628
Medical	.0264	.0477	.0448	.0368	.0338	.0754	.0494	.0509	.0754
Transport	.1183	.0792	.0682	.1164	.0633	.1275	.1163	.1823	.0742
Luxuries	.4912	.4309	.3776	.5113	.3691	.3363	.4837	.3591	.6277

Table A5

ADJUSTED ESTIMATES OF SUBSISTENCE EXPENDITURE ( $y_1^*$ ),  $w_2$  WEIGHTS,  
AUSTRALIAN HOUSEHOLDS, 1974-75.<sup>1</sup>

Commodity	Household Type								
	1	2	3	4	5	6	7	8	9
Food	374	670	1022	1506	917	1091	1244	1623	636
Cigs., Alc.	179	460	140	510	460	529	516	528	171
Clothing	272	319	157	358	-483	240	280	537	191
Housing	460	557	932	1144	519	339	713	1069	542
Medical	174	219	341	410	373	267	373	486	146
Transport	115	775	822	681	604	1153	585	859	195
Luxuries	-101	-38	480	269	322	907	219	899	-151
Total	1472	2963	3894	4877	2712	4526	3930	6002	1729

<sup>1</sup> In dollars per household per year in 1974-75 prices.

THE USE OF DISAGGREGATED CROSS-SECTION DATA IN EXPLAINING  
SHIFT'S IN AUSTRALIAN CONSUMER DEMAND PATTERNS OVER TIME\*

by

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1. INTRODUCTION

Sociodemographic influences on consumption patterns can be detected with reasonable precision only by using cross-section data. In a previous paper<sup>1)</sup> a preliminary analysis of the ABS Household Expenditure Survey, 1974-75 was undertaken in an attempt to locate significant differences in the consumption patterns of different types of households. Classification was based on household composition and age of family head. Marked differences in consumption patterns were detected. It is the aim of this paper to use the findings to analyse variations in consumption expenditures over time. Attention is confined to comparing actual consumption over the decade 1966-67 to 1975-76 with predictions made on the basis of the cross-section results. The sensitivity of the predictions to demographic and structural changes in the economy is tested. Projections into the future will be undertaken in a later paper.

\* I am indebted to Alexandra Strzelecki for carrying out the computations reported in this paper.

1) Williams, R.A., "Demographic Effects on Consumption Patterns in Australia: A Preliminary Analysis of the ABS 1974-75 Household Expenditure Survey", Impact of Demographic Change on Industry Structure in Australia, Preliminary Working Paper No. SP-11, Industries Assistance Commission, Melbourne (February 1978) pp. 29 (mimeo).

The ABS survey data has been used in a previous paper<sup>1)</sup> to estimate the parameters of the Klein-Rubin utility function (namely, marginal budget shares,  $\beta$ , and subsistence expenditures,  $\gamma$ ) for a number of household types. By estimating within a demand systems context we are able to obtain estimates of price responses. These are clearly necessary for projecting over time.

Cross-section data is inevitably subject to more measurement error than aggregate national accounts data. While the data collected in the 1974-75 survey appears to be of above average quality, a few inconsistencies are present. Expenditure on cigarettes and alcohol, in particular, is seriously underestimated.

In addition, the commodity definitions used in the survey and the national accounts must be reconciled. So before commencing our projections we tie the survey results to the 1974-75 national accounts. That is, we adjust our data and parameter estimates so that our adjusted equations reproduce the 1974-75 expenditures as recorded in the national accounts.

In this paper total private consumption expenditure is treated as exogenous. That is, we take the national accounts figures for total expenditure as given and use them in predicting expenditures on individual commodities over time. However, an important aim of our work is to provide estimates of demand behaviour which are suitable for incorporating into the IMPACT models. In particular the results may be readily incorporated

1) Williams, *op.cit.*

Table A2

AVERAGE BUDGET SHARES AFTER ADJUSTMENT TO NATIONAL AVERAGES,  $w_2$  WEIGHTS, AUSTRALIAN HOUSEHOLDS, 1974-75.

Commodity	Household Type <sup>1</sup>								
	1	2	3	4	5	6	7	8	9
Food	.149	.137	.178	.200	.167	.172	.191	.191	.211
Cigs., Alc.	.091	.090	.081	.071	.105	.098	.077	.091	.076
Clothing	.075	.077	.076	.088	.099	.096	.094	.108	.081
Housing	.227	.218	.207	.183	.158	.104	.151	.121	.187
Medical	.058	.057	.065	.062	.075	.069	.070	.065	.080
Transport	.104	.141	.137	.129	.126	.178	.131	.164	.093
Luxuries	.295	.281	.256	.267	.270	.283	.286	.261	.272

<sup>1</sup> For key to commodity type see Table 2.

Table A3

ADJUSTED INTERCEPT TERMS ( $\alpha_1$ ),  $w_2$  WEIGHTS, AUSTRALIAN HOUSEHOLDS, 1974-75

Commodity	Household Type								
	1	2	3	4	5	6	7	8	9
Food	237.8	399.2	632.5	1143.9	765.3	513.9	917.1	898.2	539.2
Cigs., Alc.	69.3	293.2	-334.3	350.5	289.8	139.3	399.4	-26.3	80.5
Clothing	248.9	137.1	-269.6	-155.8	-1240.8	-320.8	-164.6	-209.7	102.0
Housing	194.0	-132.4	238.3	542.2	150.8	-219.3	223.2	647.0	433.1
Medical	134.8	77.8	166.0	230.3	281.3	-73.9	179.4	180.7	15.5
Transport	-59.0	540.5	556.4	113.2	432.6	576.1	127.6	-235.3	66.5
Luxuries	-824.4	-1313.9	-992.0	-2225.8	-679.2	-616.0	-1681.9	-1257.4	-1235.4

## APPENDIX TABLES

Table A1

2SIS ESTIMATES OF MARGINAL BUDGET SHARES,  $\beta_1$ , AND SUBSISTENCE EXPENDITURES,  $\gamma_1$ , HOUSEHOLDS WITH MORE THAN TWO ADULTS, AUSTRALIA, 1974-75.

Commodity	Household Type 6		Household Type 8	
	$\beta$	$\gamma$	$\beta$	$\gamma$
Food	.1499 (.0156)	1294 (208)	.1414 (.0139)	1945 (211)
Cigarettes, Alcohol	.0593 (.0112)	363 (505)	.0633 (.0081)	365 (123)
Clothing	.1249 (.0157)	223 (210)	.1247 (.0142)	534 (214)
Housing	.1287 (.0171)	337 (228)	.0731 (.0236)	1138 (358)
Durables	.1103 (.0284)	239 (378)	.0688 (.0161)	317 (244)
Medical	.0639 (.0051)	220 (68)	.0429 (.0074)	417 (113)
Transport	.1442 (.0320)	1316 (426)	.2051 (.0175)	962 (265)
Recreation	.1151 (.0109)	351 (146)	.1694 (.0263)	106 (398)
Other	.1037 (.0138)	255 (183)	.1114 (.0185)	414 (280)
Sum	1.000	4599	1.000	6199

Notes: Household type 6 comprises households with more than 2 adults but no children and where the head is aged 45-64 years. Household type 8 comprises households with more than 2 adults, and children, where the head is aged 30-64 years.

Standard errors are given in parentheses. The estimates of subsistence expenditure are in dollars per household per year in 1974-75 prices.

into the economy-wide SNAPSHOT model<sup>1)</sup> in which total expenditure is treated endogenously.

The plan of the paper is as follows. In section 2 we reconcile the coverage of the sample survey with the national aggregates for 1974-75. The adjustments we make to the survey data imply that corresponding adjustments must be made to the parameter estimates. In section 3 the weights attached to each household group are discussed. It is necessary to choose an appropriate weighting pattern which exhausts the population in light of the fact that parameter estimates are not available for all household types. In section 4 the adjustment procedures developed in section 2 are used to derive new parameter estimates. The time series predictions are made in section 5. Finally, in section 6 the work is summarized and conclusions are drawn.

## 2. COVERAGE OF THE SAMPLE SURVEY

In order to use survey data for forecasting national aggregates over time it is necessary to ensure that the number of household types selected covers the population adequately and that any major discrepancies between the survey and national accounts estimates of household expenditures and income in the base year are allowed for. These two issues will now be discussed in turn.

1) The model is set out in P.B. Dixon, J.D. Harrower and A.A. Powell, "SNAPSHOT: A Long Term Economy-Wide Model of Australia: Preliminary Outline", Impact of Demographic Change on Industry Structure in Australia, Preliminary Working Paper No. SP-01, Industries Assistance Commission, Melbourne (February 1976), pp.26 (mimeo)

2.1 Households

The ABS Household Expenditure Survey, 1974-75, distinguishes eight types of household composition and four age classes. Estimates of the number of households in Australia falling in each of these 32 groups may be obtained using the relevant weighting factors supplied by the ABS. 1) Since the sample and associated weights are restricted to city households an assumption is required to derive national estimates. We assume that the average family size of 3.083 for the sample is appropriate for Australia as a whole. 2) The household types and associated frequencies are given in table 1.

In preliminary analysis of the survey data<sup>3)</sup> estimates of consumption patterns were obtained for eleven household types. These household types covered about 75 per cent of households in the population. The major omission was households with more than two adults. Although these households are relatively heterogeneous, they appear to be predominantly middle aged parents with children aged 18 years or over (and thus classified as adults). Of households where the head is aged 45-64 years, one-third have more than two adults (see table 1).

Results are reported in the appendix (table A1) for the consumption patterns of two additional household types: (i) more than two adults with no children, head aged 45-64 years and (ii) more than two adults with children, head aged 30-64 years. 4) Estimates of

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1) These weights were used in the regressions on which this paper is based - see Williams, op.cit.  
 2) In ABS, Household Expenditure Survey, 1975-76 (Preliminary) (Ref.No. 6508.0), the estimated average family size was 3.07 for capital cities and 3.09 for Australia.  
 3) See Williams, op.cit.  
 4) No significant differences were detected in consumption patterns between the age classes 30-44 and 45-64 years.

model. Under the assumption of no relative change, the range of prediction errors in 1971-72 was -5.3 per cent (food) to 4.9 per cent (luxuries). The median absolute prediction error was 3.6 per cent. After allowing for demographic and structural changes the range of prediction errors was -3.7 per cent (food) to 2.9 per cent (transport) and the median absolute value was 2.2 per cent. The reductions were also of the order of 1 to 2 percentage points for 1966-67, but the prediction errors remained relatively large: the median absolute value for the no-relative-change predictions was 9.7 per cent; this was reduced to 8.6 per cent after introducing the demographic and structural changes. Predictions for the first two years of the period (1966-68) were, under all assumptions, markedly worse than those for later years and are suggestive of a once-for-all shift in tastes at this time.

Overall, it may be concluded that, at least at the broad commodity level, cross-section data provides parameter estimates which may be used usefully in predicting over time.<sup>1)</sup> Improvements in predictions can be made by utilizing information on family formation patterns and on changes in income distribution. In using our results for forward prediction, however, account should be taken of some trends in prediction error that have been revealed by backward prediction.

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1) Similar conclusions were reached with U.S. data by H.S. Houthakker and L.D. Taylor, Consumer Demand in the United States: Analyses and Projections, 2nd edition (Cambridge: Harvard University Press, 1970), p.280 and by Lluch, Powell and Williams, op.cit., p.119 with Korean data.

These are the usual assumptions made in projecting nationally consumers' expenditures over time.

Further predictions were made which allowed for demographic and structural changes in the economy over the decade. Demographic changes affect primarily the weights given to each household type when aggregating. The direction of change in expenditure patterns as a result of demographic shifts may be predicted on the basis of estimated average budget shares (for each household type) obtained from the no-relative-change predictions. Allowing for demographic factors improved predictions for nearly all of the seven commodity groups. The predictions for food, housing and luxuries showed the most marked improvements.

Structural changes, such as increases in unemployment and increases in social security benefits, affect mainly relative "income" levels of each household type. The direction of change in expenditure patterns in this case depends primarily on differences in marginal budget shares across household types. The incorporation of structural changes resulted in most predicted values being closer to actual expenditures. This was particularly so for luxuries, the largest commodity grouping, where predicted expenditure was lowered by redistributing "income" from households with high marginal budget shares for this commodity class to households with low marginal budget shares. Predicted expenditure on food and clothing was increased closer to actual expenditure.

The most detailed analysis was undertaken for the two years 1971-72 and 1966-67. A census was carried out at the beginning of each of these years and 1971-72 is the base year for the SNAPSHOW

ESTIMATED NUMBERS OF HOUSEHOLDS IN AUSTRALIA (IN THOUSANDS), 1974-75

Table 1

Household Composition	Age of Household Head in Years				Total
	15-29	30-44	45-64	65 and over	
Head only	120	88	230	259	697
2 Adults	364	131	435	309	1,240
Over 2 Adults	41	26	221	57	345
Head and Children	34	80	30	2	145
2 Adults, 1 Child	185	151	123	7	466
2 Adults, 2 Children	154	374	96	3	627
2 Adults, over 2 Children	50	388	72	0	510
Over 3 Adults, Children	24	116	265	8	413
Total	973	1,354	1,471	645	4,443

Notes: The ABS sample was drawn from an estimated population of 2634.7 thousand households. ABS weights provide a breakdown into household types. Figures have been converted to national estimates using the ratio of the average number of persons in Australia in 1974-75 to the number of persons in the population covered by the survey, namely,  $13,696/8,122 = 1.6863$ .

An adult is defined as a person aged 18 years or over.

the marginal budget shares and subsistence expenditures have been obtained using weighted two-stage least squares in the manner detailed in Williams.<sup>1)</sup> The distinguishing features of these two groups are high income and expenditure levels, due partly to an above average number of income earners, and high marginal budget shares for food, reflecting a propensity to eat out.

With the addition of these two household types, estimates are available for thirteen types which cover 85 per cent of households. The major omission is single people aged 65 years and over (6 per cent of the total) for which parameter estimates are unobtainable because these households are concentrated in only two (the lowest) income intervals.

In order to incorporate the demand estimates into the economy-wide model SNAPSHOT it is necessary to reduce the number of household types to a more manageable nine. This is achieved by amalgamating household types which exhibit the smallest differences in income levels and consumption patterns.<sup>2)</sup> One relatively unimportant type (2 adults, 3 or more children, head aged 45-65 years) is eliminated. The nine new groups are given in table 2. The estimated number of Australian households in each group in 1974-75 ranges from 219 thousand (group 7) to 864 thousand (group 3).

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1) Williams, *op.cit.*

2) Aggregation of parameter estimates was undertaken in the manner described in C. Lluch, A.A. Powell and R.A. Williams, *Patterns in Household Demand and Saving* (New York : Oxford University Press, 1977), p.117.

As expected the naive predictions are particularly bad for food, which has an income elasticity well below one, and luxuries, which has an income elasticity well above one.<sup>1)</sup> Our predictions for transport and clothing in 1966-67, however, are noticeably worse than the naive predictions.

#### 6. CONCLUDING REMARKS

In projecting consumer expenditure patterns over time on the basis of disaggregated cross-section results, particular care was taken to ensure consistency of the data sets in the overlap year. The parameter estimates derived from the cross-section data were altered in a corresponding manner so that the estimated model (the linear expenditure system), when aggregated over household types, reproduced the national levels of commodity expenditures in the year of the survey, 1974-75.

The first set of comparisons of predicted and actual allocations of consumers expenditure over the decade 1966-67 to 1975-76 were undertaken on the assumption that for each of the nine household types considered relative mean "income" and relative numbers of households in the group remained constant at 1974-75 levels. These may be termed "no-relative-change" predictions. This procedure is equivalent to using a single set of parameter estimates and assuming an unchanged "income" distribution.

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1) Using weighted estimates of marginal and average budget shares for 1974-75, the estimated "income" elasticities for each commodity are: Food 0.535, Cigarettes and Alcohol 0.877, Clothing 1.281, Housing 0.827, Medical 0.732, Transport 0.760, Luxuries 1.549.

occur for medical and luxuries. The predicted value for medical has been increased as a result of transferring "Income" to household types 2, 6 and 8, who spend relatively more at the margin on medical goods than do the remaining groups (except group 9). Predicted expenditure on luxuries is lowered by transferring "Income" to household types 5, 6 and 8, where the marginal budget shares for luxuries are lowest.

5.5 Comparison of projections

Overall, then, adjustments for structural changes have produced quite considerable improvements in the predictions, particularly for 1971-72. Comparing rows 2 and 5 of table 14, we see that the percentage prediction error for food expenditure in 1971-72 has been reduced from -5.3 per cent to -3.7 per cent, for clothing from -4.6 per cent to -1.8 per cent, for housing from 3.3 to 1.4 per cent and for luxuries from 4.9 to 2.1 per cent. Transport was the only category for which the prediction error worsened - from 0.4 to 2.9 per cent.

In rows 1 and 6 of table 14 are given the prediction errors which would arise if predictions were made using 1974-75 average budget shares (from the national accounts) multiplied by total national consumption in each year. This is the "naive" prediction, which assumes all "income" elasticities are one, all uncompensated own price elasticities are minus one, and all uncompensated cross-price elasticities are zero. In general, our predictions are considerably better than those obtained using average budget shares.

Table 2

DEFINITIONS OF HOUSEHOLD TYPES, AUSTRALIA, 1974-75

Household Type	Number of Adults	Age of head in years	Number of Children	Number of Households ('000)
1	1	15-64	0	438
2	2	15-44	0	495
3	2	15-44	1-2	864
4	2	30-44	3+	388
5	2	45-64	0	435
6	3+	45-64	0	221
7	2	45-64	1-2	219
8	3+	30-64	1+	381
9	2	65+	0	309

1) Defined as person less than 18 years of age.

2.2 Commodities

In the preliminary study it was shown that the ABS Survey estimates of total consumption expenditure were within 5 per cent of national consumption expenditure in 1974-75 but differences were more marked for individual commodity groups.<sup>1)</sup> In particular, expenditure on cigarettes and alcohol was underestimated by 30 per cent in the survey. Expenditure on recreation was over-estimated in the survey by \$1400 million and expenditure on "other" was underestimated by a similar figure. Part of the difficulty here lies in

1) See Williams, op.cit. p.27.

obtained by backward projection of the fully adjusted 1971-72 household consumption shares i.e. adjusted for all three structural changes. As usual, consumption of the other household types is adjusted upwards (by 1.28 per cent). We leave household types 6 and 8 (mature families) unaltered because here consumption levels will also be affected by the longer years of schooling in 1971-72 compared with 1966-67. This affect will tend to offset the changes in the average earnings of wives.

The new projections incorporating the above estimates of changes in relative consumption levels are given in rows 4, 5 (1971-72) and 9 (1966-67) of table 14. There are some marked improvements in prediction errors for 1971-72, but the projections for 1966-67 are little different from those obtained using 1974-75 relative consumption levels (row 8). Allowance for changes in pension payments between 1971-72 and 1974-75 has noticeably improved predictions of expenditure on clothing and leisure in 1971-72. Lowering household "income" levels for "retired" households (types 1 and 9) in 1971-72 has led to an increase in the predicted aggregate expenditure on clothing and a decrease in the predicted aggregate expenditure on luxuries. This is because these households have very low marginal budget shares for clothing and high marginal budget shares for luxuries. Income has been transferred to households which devote more at the margin to clothing and less to luxuries than do retired households.

Allowing for less unemployment and a lower aggregate saving ratio in 1971-72 has further improved the predictions for all goods except transport (row 5 in table 14). The greatest improvements

the wide variety of expenditure included under "holidays" (and thus under recreation) in the survey. The two commodity groups recreation and other previously proved troublesome when obtaining parameter estimates, particularly of subsistence expenditures. For these reasons we amalgamate recreation and other into a single group, into which we also place durables goods for the reasons advanced in Williams.<sup>1)</sup> This new commodity group will be labelled "luxuries".

Mean consumption expenditure, by household type, on each of the seven commodity groups are given in table 3. These figures may be compared with the estimates derived from the Australian National Accounts which are given in the final columns of table 3. Estimates of household disposable income are also given for comparison.

Under or over estimation of consumption expenditures will distort parameter estimates and lead to biases in projecting over time. To meet this difficulty the cross-section results are adjusted on the assumption that misreporting of expenditure on a commodity is proportional to actual expenditure on the commodity. This is assumed to be true for all household types and income levels, but the proportion varies across commodities. Expenditure on each good is therefore scaled by a factor  $k_i$ , which is calculated as follows.

Let  $v_{ih}$  be the mean recorded expenditure on the  $i$ th good by the  $h$ th household type in the survey;  $w_h$  be the weight attached to the  $h$ th household type in the population, where  $\sum_h w_h = 1$ ; and  $v_i^*$  be average household expenditure on the  $i$ th good from the national accounts. Then the scaling factors,  $k_i$ , are defined as

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1) Williams, op.cit. p.24.

higher in real terms in 1974-75 than in 1971-72. Unemployment, on the other hand, would particularly affect households with young adults and wives able to work. Households with children (types 3, 4 and 7) are likely to be less affected by unemployment, and thus their relative consumption levels in 1971-72 are probably over-estimated by the backward projections of 1974-75 relative consumption levels as presented in table 11.

To allow for unemployment and savings effects the mean household expenditure levels given in the last row of table 11 are altered, somewhat arbitrarily, in the following manner: household types 2, 6 and 8 are increased by 10 per cent, type 5 increased by 5 per cent, type 1 increased by 2 per cent after adjustment for pension changes, and types 3, 4 and 7 are scaled down by 9.4 per cent to ensure that the weighted sum (using  $w_3$ ) of mean consumption expenditures equals the national accounts estimate. <sup>1)</sup>

Structural changes affecting relative consumption levels were unimportant over the period 1966-67 to 1971-72. In both years the household saving ratio was 10 per cent, unemployment rates were similar, and there was no marked change in pension payments as a percentage of personal income or consumption. The percentage of working wives, however, did increase over the period from 28 per cent to 40 per cent of the work force. To allow for this we lower the mean household consumption of two adult households (types 2 and 5) in 1966-67 by 5 per cent as compared with the values

1) Note that household types 6 and 8 are affected by unemployment amongst both young adults and married women. Single persons aged less than 30 years make up only about 20 per cent of household type 1.

Table 3  
MEAN CONSUMPTION EXPENDITURE IN DOLLARS PER HOUSEHOLD PER YEAR, 1974-75

Commodity	Household Type									National Accounts
	1	2	3	4	5	6	7	8	9	
Food	851	1461	1758	2214	1400	2406	1975	2977	1041	1393
Cigs.Alc.	359	562	467	462	514	803	464	827	233	685
Clothing	393	704	647	899	711	1149	829	1443	341	697
Housing	1249	2058	1818	1797	1170	1292	1383	1671	774	1372
Medical	252	435	465	496	450	694	525	730	293	517
Transport	689	1443	1299	1373	1014	2386	1304	2458	495	1103
Luxuries	1595	2492	2103	2465	1883	3286	2457	3386	1165	2143
Total Expenditure	5388	9155	8557	9646	7142	12016	8938	13492	4342	7910
Disposable Income	6116	11330	9221	10418	8803	14479	10392	15671	4917	9605
Av.Family Size	1	2	3.61	5.52	2	3.32	3.44	5.34	2	

Note: Figures refer to mean values for households included in estimation. Except for household type 9, households with income less than \$40 per week are excluded. For key to household types see table 2.

lies about half-way between unity and the national average, we lower the percentage share of total consumption attributable to households of pensionable age in 1971-72 by 1.5 percentage points from the 1974-75 share (see row 2 of table 11). This reduction is split between household type 1 (single persons) and type 9 (couples with head 65 years or more, plus an allocation of old single persons) in the ratio one-third to two-thirds, that is, 0.5 percentage points and 1.0 percentage points respectively. The new  $w_3$  weights are then used to derive new estimates of mean household consumption for groups 1 and 9. The mean consumption levels of the other household groups are scaled up proportionately so that when weighted by  $w_3$  they preserve consistency with the national accounts figures.

To obtain a second set of new consumption levels we attempt to quantify the effects of the lower unemployment and lower saving ratio which existed in 1971-72. 1) In 1974-75 the households with the highest saving ratios were those without children where the head was less than 65 years (types 2 and 5) and those with more than two adults (types 6 and 8). It seems reasonable to postulate that the saving ratios for these groups would be relatively lower in 1971-72 than in 1974-75 and consumption levels relatively higher than those given in table 11. An important consideration here is that the savings required for a deposit on a house or land were

1) The only additional quantitative evidence available is that from the two income surveys conducted by the ABS in 1968-69 and 1973-74 (see ABS, Income Distribution, 1968-69, Consolidated and Revised Edition, Ref. No. 6505.0, and ABS, Income Distribution, 1973-74, Part 2, Ref. No. 6503.0). However, definitional differences, exclusion of single person households, and the fact that only gross income is recorded make them of little use for our purposes.

$$(1) \quad k_i = \frac{v_i^*}{\sum_h w_h v_{ih}} \quad , \quad i = 1, 2, \dots, 7 \text{ goods.}$$

Since the allocation of expenditure across commodities varies by household type, the proportional adjustment to total consumption expenditure will vary by household type. The relevant scaling factor,  $\lambda_h$ , is

$$(2) \quad \lambda_h = \frac{\sum_i k_i v_{ih}}{v_h} \quad , \quad h = 1, 2, \dots, 9 \text{ household types.}$$

Now since our underlying model is linear, namely,

$$(3) \quad v_{ih} = \alpha_{ih} + \beta_{ih} v_h$$

(where  $v_h$  is total expenditure by the  $h$  th household type  $(\sum_i v_{ih})$ ), the above assumptions imply a simple procedure for adapting our parameter estimates, without re-estimating, in a manner which ensures that the model reproduces national expenditure on each good in 1974-75 if total expenditure in that year is given.

To multiply  $v_{ih}$  in equation (3) by  $k_i$  implies that the previously estimated coefficients  $(\alpha_{ih}, \beta_{ih})$  should be divided by  $k_i$ . Similarly, to multiply total consumption expenditure,  $v_h$ , by  $\lambda_h$  implies dividing  $\beta_{ih}$  by  $\lambda_h$ . The net effect on the slope coefficient would therefore seem to be a multiplication by

years. The improvements are most marked for food and housing. In both years predicted expenditure on housing is lower using the new weights compared with using  $w_2$ . This is a reflection of the greater weights now given to families with more than two adults (who spend a relatively low proportion of income on housing) and the lower weights given to two person households (who spend a relatively low proportion of income on food).

5.4 Effects of changes in relative total consumption levels

We now turn to an examination of changes in relative total expenditure levels across household types. Three important structural changes which occurred in the Australian economy over the three years from 1971-72 to 1974-75 are likely to have affected relative consumption levels. These changes were: (i) an increase in unemployment from 1-2 per cent of the labour force in 1971-72 to around 4 per cent in 1974-75, (ii) an increase in the household saving ratio from 10.4 per cent to 17.6 per cent, and (iii) an increase in cash benefits for pensioners from \$818.6 million to \$1918.9 million.<sup>1)</sup>

The relative shift in income and consumption in favour of recipients of age and invalid pensions is the easiest to incorporate into our projections. These pensions expressed as a ratio of total personal disposable income rose by 1.2 percentage points over the three years, and expressed as a ratio of total personal consumption expenditure rose by 1.8 percentage points. On the assumption that the average propensity to consume of pensioners

1) See ABS, Social Indicators No.1, 1976, p.73.

$k_i/\lambda_h$ . But this is only an approximation. Average budget shares differ across income classes for a given household type and because of this scaling by  $k_i/\lambda_h$  will not ensure that the marginal budget shares sum exactly to one. Scaled consumption on each commodity equals scaled total consumption at the mean, but not necessarily for each income class. To restore the allocation property we define the adjusted marginal budget shares,  $\beta_{ih}^a$  as

$$(4) \quad \beta_{ih}^a = \frac{k_i \beta_{ih}}{\lambda_h} / \sum_j \frac{k_j \beta_{jh}}{\lambda_h} = \frac{k_i \beta_{ih}}{\sum_j k_j \beta_{jh}}$$

Similarly, we define the adjusted intercept terms,  $\alpha_{ih}^a$  such that the estimated line holds exactly at mean values (denoted by a bar), that is,

$$(5) \quad \alpha_{ih}^a = k_i \bar{v}_{ih} - \beta_{ih}^a (\lambda_h \bar{v}_h)$$

$$= k_i \alpha_{ih} + [k_i \beta_{ih} \bar{v}_h - \beta_{ih}^a \lambda_h \bar{v}_h]$$

The term in square brackets denotes the correction factor which arises because of different consumption patterns across income classes for a given household type. In practice it is relatively unimportant.

The original estimates of  $\alpha$  and  $\beta$  for each household type are given in tables 4 and 5, respectively. Various estimates of the scaling factors ( $k, \ell$ ) are given in the next section.

Estimates of subsistence expenditures are obtained using the procedure adopted in Williams<sup>1</sup>. Firstly, estimates of the Frisch parameter are obtained from

$$(6) \quad \omega_h = 31 (\ell_h v_h / f)^{-.36}$$

where  $f$  is mean family size. Estimates of the adjusted subsistence sum are then calculated as

$$(7) \quad \sum_j \gamma_{jh}^a = \ell_h v_h (1 - |\omega_h|^{-1})$$

Finally, the adjusted estimates of the individual subsistence expenditures are given by

$$(8) \quad \gamma_{ih}^a = \alpha_h^a + \beta_h^a \sum_j \gamma_{jh}^a$$

The one remaining task to make the above procedure operational is to select the household weights,  $w_i$ . It is to this question that we now turn.

1) Williams, *op.cit.*

Table 14

THE EFFECTS OF DEMOGRAPHIC CHANGES AND OF SHIFTS IN RELATIVE CONSUMPTION LEVELS ON DEMAND PATTERNS IN AUSTRALIA, 1966-67 and 1971-72

	Assumptions		Percentage Error in Prediction of Expenditure on Commodity						
	Household Weights	Relative Consumption Levels	Food	Cigs., Alc.	Clothing	Housing	Medical	Transport	Luxuries
<u>1971-72</u>									
1.	abs	1974-75	-5.6	-5.7	-1.6	0.7	2.6	-3.6	7.7
2.	w <sub>2</sub>	1974-75	-5.3	-3.6	-4.6	3.3	-1.8	0.4	4.9
3.	w <sub>3</sub>	1974-75	-4.4	-3.3	-4.2	1.7	-1.5	1.6	4.3
4.	w <sub>3</sub>	1971-72 (a)	-4.2	-3.0	-2.2	1.9	-1.5	1.7	3.1
5.	w <sub>3</sub>	1971-72 (b)	-3.7	-3.0	-1.8	1.4	-0.7	2.9	2.1
<u>1966-67</u>									
6.	abs	1974-75	-18.8	-10.6	-11.4	13.5	15.1	2.5	12.4
7.	w <sub>2</sub>	1974-75	-10.7	-7.3	-15.4	13.0	7.4	9.7	3.5
8.	w <sub>4</sub>	1974-75	-8.8	-6.7	-14.9	9.8	8.3	12.5	1.4
9.	w <sub>4</sub>	1966-67	-8.6	-6.8	-14.8	10.5	8.2	13.0	0.7

Notes: abs denotes forecasts made using average budget shares as in national accounts estimates for 1974-75.

1971-72(a) denotes adjustments for pensions, 1971-72(b) denotes adjustments for pensions, unemployment and saving ratios.

fall (types 2 and 5), and households with more than two adults (types 6 and 8) and single persons (type 1) increase. Notice that household group 9 (retired couples) is left unaltered because the known movements affect the group in opposite directions, namely, a fall in two adult households, and an increase in old single persons who are partly allocated to this group.

Because the 1966 and 1971 census results are directly comparable it is relatively easy to derive new weights for 1966-67 on the basis of the new 1971-72 weights and the intercensal changes. The new 1966-67 weights are labelled  $w_4$  and are given in the last row of table 6. Compared with 1971-72 the proportion of households with more than two adults has increased (types 6 and 8), whereas the proportion of single person households (types 1 and 9) and two person households (types 2, 5 and 9) have decreased. No changes have been made for two adult households with children (types 3, 4 and 7).<sup>1)</sup>

Projections are now carried out for 1971-72 and 1966-67 using the weights which have been altered to reflect demographic changes. In projecting, the household total expenditure estimates have been scaled so that their weighted sum is still equal to the national accounts estimate. The relevant scaling factors are .9900 for 1971-72 and .9681 for 1966-67. The revised projections are given in rows 3 and 8 of table 14 in the form of percentage errors. A comparison with the results obtained using  $w_2$  weights (rows 2 and 7 of table 14) shows that all projections are improved using the  $w_3$  weights except those for medical in 1966-67 and transport in both

1) Families consisting of "head, spouse and children" were 30.6 per cent of the total in 1966 and 30.5 per cent in 1971. A more detailed breakdown is not available.

2SIS ESTIMATES OF ENGEL INTERCEPTS,  $\alpha_1$ , AUSTRALIAN HOUSEHOLDS, 1974-75

Commodity	Household Type								
	1	2	3	4	5	6	7	8	9
Food	263.1	478.4	733.2	1378.5	925.9	604.0	1108.1	1068.7	749.0
Cigs.Alc.	81.0	206.2	-263.6	246.3	203.2	90.9	282.9	-27.3	72.8
Clothing	309.6	138.8	-314.5	-177.6	-1312.8	-351.5	-179.8	-239.2	111.7
Housing	234.3	-158.5	200.2	566.0	152.3	-254.3	231.1	685.2	485.0
Medical	131.2	65.5	133.8	197.3	244.4	-73.7	154.1	151.2	10.4
Transport	-29.9	625.8	626.7	113.4	500.3	653.2	139.5	-309.2	123.8
Luxuries	-989.8	-1356.1	-1115.9	-2322.7	-713.1	-668.8	-1735.3	-1329.9	-1551.8

Source: Williams op.cit. and appendix table A1. For key to household types see table 2

Table 5

2SIS ESTIMATES OF MARGINAL BUDGET SHARES,  $\beta_1$ , AUSTRALIAN HOUSEHOLDS 1974-75

Commodity	Household Type								
	1	2	3	4	5	6	7	8	9
Food	.1091	.1074	.1198	.0866	.0664	.1499	.0970	.1414	.0673
Cigs.Alc.	.0515	.0388	.0853	.0223	.0435	.0593	.0203	.0633	.0368
Clothing	.0156	.0617	.1124	.1054	.2834	.1249	.1129	.1247	.0527
Housing	.1883	.2421	.1891	.1276	.1424	.1287	.1289	.0730	.0667
Medical	.0223	.0403	.0387	.0310	.0288	.0639	.0415	.0429	.0651
Transport	.1335	.0893	.0785	.1306	.0720	.1442	.1303	.2051	.0855
Luxuries	.4797	.4204	.3761	.4964	.3635	.3291	.4690	.3496	.6257

Source: Williams op.cit. and appendix table A1. For key to household types see table 2.

3. SELECTION OF HOUSEHOLD WEIGHTS

The difficulty in selecting weights to denote the numerical importance of a household type in the population is that parameter estimates are available for only 85 per cent of total households. The simplest procedure would be to allocate the remaining 15 per cent of households proportionally amongst the households for which estimates are available. Such a procedure is followed in obtaining the first set of weights,  $w_1$ , except that they are based on households included in the regression runs, that is, households with gross incomes below \$40 per week are excluded except for household type 9.<sup>1)</sup> The values of  $w_1$  for each household type are given in the first row of table 6.

Table 6  
HOUSEHOLD WEIGHTS, AUSTRALIA

Weight Year	Household Type <sup>1)</sup>								
	1	2	3	4	5	6	7	8	9
$w_1$ 1974-75	.0967	.1345	.2371	.1071	.1188	.0613	.0535	.1050	.0860
$w_2$ 1974-75	.1292	.1175	.2049	.1148	.1031	.0777	.0543	.0930	.1056
$w_3$ 1971-72	.140	.100	.205	.110	.090	.090	.050	.110	.105
$w_4$ 1966-67	.125	.095	.205	.110	.090	.103	.050	.122	.100

1) See table 2 for code to household types.

It might be preferable, however, to recognize that over one-third of households (259 thousand) for which estimates are not available are single persons aged 65 years or over. These households are likely to have consumption patterns which are closer to certain

1) For the reasons, see Williams, *op.cit.* p.11.

definition. In the survey, two adult households comprised 27.9 per cent of the total. One person households are directly comparable. Single persons 45 years and over are a noticeably larger proportion of total households in the 1971 census as compared with the survey (13.3 per cent in 1971; 11.0 per cent in 1974-75).

The proportion of families with more than two adults fell between the 1966 and 1971 censuses by between 2 and 2<sup>1</sup>/<sub>2</sub> percentage points.<sup>1)</sup> It appears that this trend continued in the period 1971 to 1974-75, but precise measurement is not possible because of the difference between the census and sample definitions of an adult. In 1971, families consisting of "head, spouse and other adults" comprised 9.8 per cent of the total. To this must be added a proportion of families defined as "head and other adults" (5.2 per cent of total). In the 1974-75 survey only 7.8 per cent of households consisted of more than two adults. Similarly, in the 1971 census families consisting of "head, spouse, children and other adults" and "head, children and other adults", comprised 12.6 per cent of total families. In the survey, households consisting of three or more adults with children made up only 9.3 per cent of total families.

On the basis of the above information the household weights for 1971-72 are altered from  $w_2$  to the new values,  $w_3$ , given in the third row of table 6. The figures are only approximations but the movements are in the directions indicated. Thus two adult households

1) See ABS, *Social Indicators*, No.1, 1976, p.6. An exact figure cannot be obtained because the category "head and other adults" (no spouse) is not subdivided between "one other" and "more than one other".

With respect to the first assumption, in Williams<sup>1)</sup> evidence was presented that some parameters have changed over the period between the Macquarie survey (1966-68) and the ABS survey (1974-75). In particular, the Y-estimates for food appear to have declined relative to other Y-estimates.

Clearly assumptions (ii) and (iii) are incorrect and we need to explore how sensitive the projections are to variations in these assumptions. We will confine our analysis to projections for the years 1971-72 and 1966-67, for which census data is available on the proportion of households of various types.

5.3 Demographic effects

The published data on households from the 1966 and 1971 census<sup>2)</sup> is not directly comparable with our definitions of household types. This is because in the census (i) adults are defined as persons 16 years and over compared with 18 and over in the survey and (ii) a basic subdivision is one based on whether the household contains a spouse, whereas in the survey only the number of adults is specified. Nevertheless a few general conclusions emerge.

The proportion of two person households was lower in 1971 than in 1974-75 (and lower again in 1966), particularly where the head is aged less than 30 years. In the 1971 census, 21.3 per cent of families were defined as "head and spouse only", but a further 5.2 per cent of families were defined as "head and other adults" which would include "two adult" households on the survey

types of included households. In particular, they are likely to exhibit consumption patterns which are closer to other single households and retired married couples than to other household types. Furthermore, of the 230 thousand single persons aged 45-64 years, 60 thousand had incomes below \$40 per week and were excluded from the regressions.<sup>1)</sup>

Thus we first modify the weights by regarding the 319 thousand (259 + 60) "retired" single persons as a separate group. Mean consumption expenditures and disposable income for this group are given in the first row of table 7. Note that the mean expenditures

Table 7

MEAN EXPENDITURES AND DISPOSABLE INCOME FOR SINGLE PERSONS AND RETIRED MARRIED COUPLES, AUSTRALIA, 1974-75

Household Type	Mean Consumption Expenditures in Dollars per Year					Total Disposable Income			
	Food	Alc.	Clothing	Housing	Medical				
Retired Single	573	87	186	548	136	128	506	2164	2232
1 (new)	763	273	327	1027	215	511	1250	4366	4885
9 (new)	893	187	292	702	243	379	956	3652	4066

Notes: Retired married couples are defined as those where the head is 65 years of age or more. Retired single persons are defined as those aged 65 years or more or those aged 44-64 but with gross incomes less than \$40 per week. For original definitions of type 1 and type 9 see table 2. The new estimates for these two types are obtained by weighting the original estimates in table 3 by 0.683 and the retired single estimates by 0.317.

1) Williams, op.cit.  
 2) ABS, Social Indicators, No.1, 1976, p.6.

1) In no other case was the exclusion of this income class of such importance.

are approximately one-half of the values for retired married couples (type 9, table 3) except for housing, and approximately one-third of the values of other single persons (type 1, table 3) except for food and medical, where the percentage is higher than one-third.

Allocating retired single persons proportionally to household types 1 and 9 lowers mean expenditures and income for these two groups. The results are given in rows 2 and 3 of table 7. The marginal budget shares for household types 1 and 9 are not altered. To ensure that the Engel curves still pass through the sample mean values the intercept terms,  $\alpha_i$ , must be altered for household types 1 and 9. The new estimates are given in table 8.

Table 8

REVISED ESTIMATES OF INTERCEPT TERMS,  $\alpha$ , FOR HOUSEHOLD TYPES 1 and 9, AUSTRALIA, 1974-75

Household Type	Food	Cigs.	Alc.	Clothing	Housing	Medical	Transport	Leisure
1	286.7	48.2	258.9	204.9	117.6	-71.9	-844.4	
9	647.2	52.6	99.5	458.4	5.3	66.8	-1329.1	

In deriving our second set of weights we make further allocations based on similarities of family composition and expenditure. In these cases changes in income and expenditure are relatively unimportant so we leave them unaltered. The allocations are: (i) household type 4 is assumed to represent all households consisting of two adults and three or more children, (ii) household type 6 represents all households consisting of three or more adults with no children,

constant). 1) The percentage errors for each commodity are given in table 13.

The projections show that for all commodity groups other than leisure the greatest error occurs in 1966-67, the year furthest from the estimation year. The model underestimates consumption on food, cigarettes and alcohol, and clothing, and the degree of underestimation increases with time (projecting backwards). Expenditure on housing is over-estimated and the degree of overestimation increases with time. Overall, the projections are noticeably worse in the first two years, i.e. 1966-68. This is suggestive of changes in tastes and once-for-all shifts in consumption shares. It would therefore appear that the Macquarie data, which was collected over the period 1966-68, must be used circumspectly.

The above projections have been based on three crucial assumptions:

- (i) it is appropriate to represent the consumption patterns of a given household type over time by a linear model in prices and 'income' with fixed coefficients;
- (ii) the percentages of households in the nine groups remain constant;
- (iii) relative total consumption levels of each household group remain constant.

1) Both weighting patterns were used to predict expenditures in 1966-67 but as for 1971-72 the results were very similar.

Table 12

ACTUAL AND PROJECTED CONSUMPTION EXPENDITURES,  
(MILLIONS OF DOLLARS), AUSTRALIA, 1971-72

	Commodity							
	Cigs. Food Alc.	Clothing	Housing	Medical	Transport Luxuries Total			
Actual	4144	2037	1987	3825	1415	3215	5584	22207
Projected ( $w_2$ )	3924	1964	1895	3948	1390	3229	5859	22207
Percent Error	-5.3	-3.6	-4.6	3.3	-1.8	0.4	4.9	

carry out projections of consumption expenditures for each year of the period 1966-67 to 1975-76. Projections are made using the second weighting pattern,  $w_2$ , and associated consumption shares (assumed

Table 13

PERCENTAGE ERROR IN PROJECTING CONSUMPTION EXPENDITURES,  
AUSTRALIA, 1966-67 TO 1975-76

Year	Commodity						
	Food	Cigs. Alc.	Clothing	Housing	Medical	Transport Luxuries	
1966-67	-10.7	-7.3	-15.4	13.0	7.4	9.7	3.5
67-68	-8.8	-7.1	-12.7	11.8	6.4	4.0	4.1
68-69	-7.5	-6.6	-9.8	9.2	4.8	2.1	4.3
69-70	-6.6	-5.9	-6.9	7.9	4.6	-0.9	4.2
70-71	-5.0	-5.6	-6.4	5.2	-0.9	-1.5	5.9
71-72	-5.3	-3.6	-4.6	3.3	-1.8	0.4	4.9
72-73	-4.0	-2.8	-3.9	2.3	-2.7	1.0	3.8
73-74	-1.0	-1.9	-5.6	1.9	0.9	0.1	1.9
74-75	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75-76	0.4	0.9	6.4	-2.5	-10.3 <sup>1)</sup>	2.2	0.4

1) 1975-76 price index for medical falls by 18.7 percent owing to the introduction of Medibank.

(iii) household type 7 also represents households of the same composition where the head is aged 65 years or more, (iv) household type 8 represents all households consisting of 3 or more adults with children, and (v) single parent households are allocated proportionally to those household types which do not have more than two adults or more than two children. Combining these allocations with the allocation of retired single persons yields the second set of weights,  $w_2$ , which are given in the second row of table 6. The  $w_2$  weights are lower than the  $w_1$  weights for household types 2, 3, 5, 8 and higher for the remaining five types.

4. ADJUSTED PARAMETER ESTIMATES

We now proceed to obtain adjusted parameter estimates for each set of weights. First, the commodity scaling factors,  $k_1$ , are calculated according to equation (1). The estimates are given in table 9.

Table 9

COMMODITY SCALING FACTORS,  $k_1$ , AUSTRALIAN HOUSEHOLDS, 1974-75

Weights	Commodity						
	Food	Cigs.Alc.	Clothing	Housing	Medical	Transport Luxuries	
$w_1$	0.7942	1.3359	0.9220	0.8823	1.0952	0.8152	0.9466
$w_2$	0.8223	1.4045	0.9601	0.9277	1.1413	0.8557	0.9889

Values of  $k_1$  less than (greater than) one imply that the survey expenditure estimates overstate (understate) the national accounts estimates. Expenditure on food shows the greatest overstatement in

the survey; expenditure on cigarettes and alcohol the greatest understatement.

The next step is to obtain adjusted estimates of total expenditure for each household type. These are given in the first two columns of table 10 for the two weighting patterns. Expressing these as a ratio of recorded total consumption expenditure (table 3) yields the scaling factor,  $l_h$ , (see equation (2)). The estimates are given in columns (3) and (4) of table 10. The values of  $l$  are always less than unity but uniformly higher under the second weighting pattern. The overestimation of total consumption in the survey can be explained by the omission of households not living in capital cities. 1) The higher values of  $l$  for the second set of weights occur because low income households are more accurately represented than in the first set of weights. The average budget shares calculated from the adjusted consumption data, using  $w_2$  weights, are given in the appendix, table A2.

The remaining columns of table 10 contain adjusted estimates of the Frisch parameter and total subsistence expenditure calculated according to formulas (6) and (7) respectively. On the basis of the information contained in table 10 and tables 4, 5 and 8, adjusted estimates of marginal budget shares and subsistence expenditures on individual goods may be obtained using equations (4), (5) and (8). These adjusted estimates, obtained using  $w_2$  weights, are given in the appendix: the intercept terms in table A3, marginal budget shares in table A4, and subsistence expenditures in table A5.

1) In ABS, Household Expenditure Survey, 1975-76, Preliminary, (Ref. No. 6508.0), p.5, it is estimated that average consumption expenditure for all Australian households (excluding localities with a population of less than 500) is about 6 per cent below the figure for households living in the capital cities.

Table 11

ESTIMATES OF MEAN HOUSEHOLD CONSUMPTION EXPENDITURE AND CONSUMPTION SHARES FOR NINE HOUSEHOLD TYPES, AUSTRALIA, 1971-72

	Household Type									Total
	1	2	3	4	5	6	7	8	9	
Consumption $w_1$	.0607	.1426	.2332	.1182	.0990	.0852	.0550	.1630	.0431	1.000
Share $w_2$	.0685	.1303	.2107	.1324	.0897	.1129	.0584	.1508	.0464	1.000
Mean Household Consumption (\$ per year)	3451	5827	5404	6065	4578	7641	5652	8532	2753	5495
	2914	6092	5649	6337	4783	7983	5905	8912	2414	5495

Notes: Household types are defined in table 2. The  $w_1$  and  $w_2$  refer to alternative weighting patterns which are given in table 6.

total number of households to the various household types. Notice that the consumption shares for household types 1 and 9 are similar for each weighting pattern: while the second weighting system allocates considerably more households to groups 1 and 9 it also lowers the mean household expenditure of these two groups.

The two sets of weighting patterns yielded virtually identical predictions. Reported results are confined to those obtained using  $w_2$ . They are given in table 12. The smallest prediction error occurs for transport (0.4 per cent) and the largest for food (-5.3 per cent).

It is difficult to comment on the explanatory power of a model if projections are confined to one time period. We next

prior to 1974-75 by projecting backwards the estimates for that year. In projecting back we use published population estimates <sup>1)</sup> and assume that the average family size increases by 0.05 per annum. The latter figure compares with the intercensal estimate of 0.041 between the 1971 and 1966 census. The resultant estimates of total households are given in appendix table A5.

5.2 Predictions using 1974-75 weights

Since the base year of the SNAFSHOT model is 1971-72, predictions of expenditures for this year will be made first. In our first set of projections for 1971-72 we use the two sets of household weights,  $w_1$  and  $w_2$ , which were derived above on the basis of 1974-75 data. In otherwords, the distribution of household types is assumed constant. Furthermore, the consumption share of each household type is assumed to be unchanged from 1974-75. <sup>2)</sup> This is equivalent to assuming that mean total consumption for each household type in 1971-72 is equal to the corresponding mean value in 1974-75 scaled down by the ratio of national private consumption expenditure in the two years (since the household weights are assumed to be the same). The consumption shares and mean consumption per household are given for the nine household types in table 11. Alternative estimates are given for the two weighting patterns  $w_1$  and  $w_2$ . The weighting patterns are used to allocate the estimated

1) Taken from ABS, Population and Vital Statistics (Preliminary), September 1977 (Ref. No. 3211.0). Population estimates for 1966-71 have been revised upwards by 1.4 per cent to reflect under-estimation at the 1971 census.

2) The consumption share is the number of households of type h multiplied by mean consumption expenditure of that household type divided by total national consumption expenditure.

ESTIMATES OF TOTAL EXPENDITURE, SUBSISTENCE EXPENDITURE AND CONSUMPTION  
SCALING FACTOR,  $\lambda$ , FOR NINE HOUSEHOLD TYPES, AUSTRALIA, 1974-75,  
BASED ON ALTERNATIVE ESTIMATES OF HOUSEHOLD WEIGHTS <sup>1)</sup>

Table 10

Household Type	Total Expenditure <sup>3)</sup>		Scaling factor, $\lambda$		Frisch Parameter <sup>4)</sup>		Subsistence Sum <sup>3)</sup>	
	$w_1$	$w_2$	$w_1$	$w_2$	$w_1$	$w_2$	$w_1$	$w_2$
1	4968	4195	.9220	.9608	-1.45	-1.54	1542	1471
2	8387	8770	.9161	.9579	-1.54	-1.51	2941	2962
3	7779	8133	.9091	.9504	-1.96	-1.92	3810	3897
4	8730	9122	.9050	.9457	-2.19	-2.15	4744	4879
5	6589	6885	.9226	.9640	-1.68	-1.65	2667	2712
6	10999	11492	.9154	.9564	-1.68	-1.65	4452	4527
7	8137	8500	.9104	.9510	-1.89	-1.86	3832	3930
8	12282	12829	.9103	.9509	-1.91	-1.88	5852	6005
9	3963	3474	.9127	.9513	-2.02	-1.99	2001	1728

1) Weights  $w_1$  and  $w_2$  are as in table 6.  
2) As defined in table 2.  
3) Dollars per year.  
4) Calculated using equation 6. Family sizes as in table 3 except for household type 9 which is 2 for  $w_1$  and 1.68 for  $w_2$ .

The parameter estimates have been adjusted such that with the associated set of weights, and with total consumption and total number of households in Australia in 1974-75 given, the basic model will predict exactly the 1974-75 national expenditure on each commodity. We now explore how well the model tracks actual expenditures on the seven commodities in earlier years.

### 5. PREDICTIONS OF EXPENDITURES

In this section we examine the predictive ability over time of the parameters estimated from the 1974-75 cross-section data. Specifically, we look at the extent to which the estimates may be used to explain actual expenditures on the seven commodity groups over the decade 1966-67 to 1975-76. In so doing we explore the sensitivity of the predictions to demographic and structural changes in the economy.

#### 5.1 Methodology

In all predictions we assume that the parameter estimates remain unchanged. For each household type, then, projected expenditure on good  $i$  in the forecast year,  $f$ , is obtained from the underlying linear expenditure model, i.e.,

$$V_{ih}(f) = \gamma_{ih} P_{ih}(f) + \beta_{ih} (V_h(f) - \sum_j \gamma_{jh} P_{jh}(f))$$

Price estimates for each year (1974-75 = 1.000) are obtainable from the implicit deflators in the national accounts, supplemented by sub-sections of the consumer price index. The price indexes are given in appendix table A6. Direct estimates of  $V_h(f)$  are not available. They must be approximated using total national consumption expenditure in the forecast year, the  $V_h$  values for 1974-75, and knowledge of structural changes which occurred in the economy.

To aggregate forecasts for each household type, estimates of the number of households falling into each category are required. Estimates at the end of 1965-66 and the end of 1970-71 are available from census data. The estimates of total households from the censuses, however, are not consistent with the estimates derived from the 1974-75 household survey which were discussed in section 2. The survey-based estimate of 4.443 million households and the June 1971 census estimate of 3.671 million households<sup>1)</sup> together imply an annual rate of growth in households of 5.6 per cent over the period. The comparable figure for population growth was only 1.6 per cent.<sup>2)</sup> Since all that matters in our analysis is the rate of change in the number of households,<sup>3)</sup> we derive new estimates of household numbers

1) See ABS, Social Indicators, No.1, 1976, p.6.

2) Using revised population estimates as at September 1977. The population estimate for June 1971 was revised upwards by 1.4 per cent in the light of the 1976 census results (see ABS, Population and Vital Statistics (Preliminary), September 1977, (Ref.No.3211.0)). Underestimation of households in 1971 would have been greater because single and two person households are more likely to be understated than are larger households.

3) The forecasts would be unaffected by a constant scaling of household numbers in each year (this would involve re-working the estimates in section 4). However, if the rate of change in household numbers is over-estimated, the rate of change in mean household consumption is under-estimated and this affects predictions.