IMPACT OF DEMOGRAPHIC CHANGE ON INDUSTRY STRUCTURE IN AUSTRALIA

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DEMOGRAPHIC EFFECTS ON CONSUMPTION PATTERNS IN AUSTRALIA : A PRELIMINARY ANALYSIS OF THE ABS 1974-75 HOUSEHOLD EXPENDITURE SURVEY

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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DEMOGRAPHIC EFFECTS ON CONSUMPTION PATTERNS IN AUSTRALIA : A PRELIMINARY ANALYSIS OF THE ABS 1974-75 HOUSEHOLD EXPENDITURE SURVEY*

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1. INTRODUCTION

Considerable analysis of the consumption behaviour of different types of Australian households has been carried out using data from the 1966-68 household survey undertaken by Macquarie University.[1] It is the intention of this paper to update these results using data from the 1974-75 Household Expenditure Survey conducted by the Australian Bureau of Statistics (ABS).

Over the eight years from 1966-67 to 1974-75 real personal disposable income per head increased by nearly 40 per cent, and important changes occurred in relative prices. Thus, even within the context of classical demand analysis there are reasons for expecting

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* The data used in this analysis were kindly provided in computer usable form by the Australian Bureau of Statistics. Particular thanks are due to Tony Wood, Director of the Household Expenditure Survey Section, ABS. The reported computations were ably carried out by Alexandra Strzelecki. The work has benefited from discussions with Ashok Tulpule.

1. See, for example, Podder (1971), Kakwani (1976), Williams (1976 b, 1977).

significant changes in consumption patterns. In addition, taste changes, demographic changes, structural shifts in the economy and so forth might also be expected to have altered consumption behaviour.

In previous work by the author,[1] the Macquarie data were used to ascertain how demand by consumers in different socioeconomic groups responds to changes in income and prices. The criteria used to select the household groups were age of household head, number of children in the family, working or non-working wife, and occupational class. If the resulting estimates of income and price responses adequately captured consumer behaviour it would be possible to allow for the changes in income, relative prices and sociodemographic characteristics of the population which have occurred over the past decade, and hopefully to predict current consumption patterns reasonably well on the basis of the 1966-68 information. There are two principal reasons why such an attempt may fail. First, the estimates of the responsiveness of demand to changes in income and prices were obtained using a linear model and the results may not hold up for relatively large changes in income.[2] Second, taste changes would not be allowed for.

In this paper we apply the methodology used for the Macquarie data to the 1974-75 ABS survey. That is, we fit linear expenditure equations separately to groups of relatively homogeneous consumers. As far as possible the definitions of commodities and household types are made comparable for the two data bodies.

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1. See Williams (1976 a, 1976 b, 1977).

2. Although no non-linearities were detected within the 1966-68 sample data - - see Williams (1977).

Appendix : Table A2

COMPARISON OF NATIONAL EXPENDITURE ESTIMATES FROM ABS SURVEY AND NATIONAL ACCOUNTS, AUSTRALIA, 1974-75

Commodity	National Expenditure: ABS Survey [1] ($m)	National Expenditure: National Accounts [2] ($m)
Food	7,329	6,053
Cigarettes,Alcohol	2,094	2,962
Clothing	3,149	3,010
Housing	6,440	6,098
Medical	1,972 [3]	2,266
Durables	3,035	2,860
Transport	5,494	4,892
Recreation	3,076	1,667
Other	3,228	4,733
Total	35,817	34,541

1) Source: ABS, "Household Expenditure Survey, 1974-75, Bulletin 4: Expenditure Classified by Income of Household", April 1977. The sample is estimated to be drawn from 2.6347 million households and 8.1224 million persons. Blowing up by actual population of 13.42 million yields estimate of Australian Households as 4.353 million. Definitions of commodities are as in table A1. Total Expenditure includes net gambling outlays.

2) Source: ABS, "Australian National Accounts, National Income and Expenditure, 1974-75.

Housing = Rent + Gas, electricity, fuel + Postal and telephone services
Recreation = Toys, sporting and travel goods + Entertainment, recreation + Net overseas expenditure
Other = Newspapers, books etc + Other goods + Education services + Financial services + Other services.

3) $1,322 m. excluding personal care items.

2 (contd.)

	Macquarie	ABS
Medical	Medical Goods, Drugs and Remedies Medical, Hospital and Accident Insurance Premiums Contributions to Medical and Hospital Funds Medical, Hospital, Dental and Funeral Expenses MINUS Cash Reimbursements from Medical and Hospital Funds Toilet Goods and Cosmetics Personal Appearance, Care and Maintenance of Personal Items	Medicines, Pharmaceutical Products Doctors' Fees Hospital and Ambulance Charges Other Health Practitioners' Charges Accident and Health Insurance (All figures net of refunds received or expected to be received) Hair Dressing, Beauty Services Toiletries and Cosmetics
Transport	Fares Motor Vehicle Operating Expenses Motor Vehicle Repairs and Maintenance Motor Vehicle Overhead Costs Imputed Value of Service provided by Motor Vehicle	Purchase of Car Purchase of Other Vehicle (net) Petrol and Other Fuels Other Running Expenses of Vehicles Fares
Recreation	Entertainment and Recreational Expenses Toys, Sporting Goods, Hobby Supplies Recreational Overhead Expenses Holiday and Travel Expenses	Photographic and Optical Goods Hobbies, Sports Equipment and Accessories Pets, Pet Food etc. Entertainment and Recreational Services Holidays Net Gambling
Other	Newspapers, Magazines, Books and Stationery Garden Supplies and Florist Goods Miscellaneous Legal, Accounting and Professional Services Education and Tuition	Household Non-Durables Household Domestic Services Books, Newspapers and Magazines Education Other Miscellaneous Goods Miscellaneous Services

The plan of the paper is as follows. In section 2 we briefly outline the model to be used in estimation and explore alternative approaches to estimation. Section 3 is concerned with a description of the data, emphasizing the definitions of expenditure and income which are used. The next two sections discuss empirical results. Estimates of marginal budget shares are presented and discussed in section 4; estimates of "subsistence" parameters are discussed in section 5. In both of the empirical sections the findings are compared with earlier results obtained using the Macquarie data. We conclude in section 6 with a brief summary and suggestions for further work.

2. METHODOLOGY

The oldest method of calculating "income" elasticities from cross-section data is simply to regress the expenditure on each commodity on total expenditure, that is,

$$v_{ih} = \alpha_i + \beta_i v_h + \varepsilon_{ih} \quad (i = 1, \ldots, n) , \qquad (1)$$

where v_{ih} is the expenditure by the h^{th} household on the i^{th} commodity, v_h is total expenditure,

$$v_h = \sum_i v_{ih} , \qquad (2)$$

ε_{ih} is an error term, and (α_i, β_i) are parameters subject to the restrictions that $\Sigma\alpha_i = 0$ and $\Sigma\beta_i = 1$. The weakness of this approach was first analysed in detail by Summers (1959), who pointed out that ordinary least squares estimates of the parameters were inconsistent since

v_h is the sum of the dependent variables in the n-equation system and is correlated with ε_{ih} .

The basic difficulty with the set of equations in (1) is that they are structural equations with an endogenous variable appearing on the right-hand side. A way around the problem is to introduce an aggregate consumption function as another structural equation. For example,

$$v_h = \alpha + \mu y_h + \varepsilon_h \quad , \tag{3}$$

where y is income which is assumed to be exogenous. The $(n + 2)$ equations (1) - (3) now form a simultaneous system in which each equation is just identified. The reduced form of the model is equation (3) plus

$$v_{ih} = \alpha_i^* + \beta_i^* y_h + u_h \quad , \tag{4}$$

where

$$\alpha_i^* = \alpha_i + \alpha\beta_i \quad ;$$

$$\beta_i^* = \mu\beta_i \quad ;$$

$$u_h = (\varepsilon_{ih} + \beta_i \varepsilon_h) \quad .$$

Consistent estimates of the structural parameters could be obtained either by two-stage least squares (2SLS) or indirect least squares. In a just-identified model the two are equivalent. These methods are also equivalent to Liviatan's (1961) instrumental variable (IV) approach in

Appendix : Table A1

COMMODITY DEFINITIONS: MACQUARIE AND ABS STUDIES

Commodity	Macquarie	ABS
Food	Grocery Items	Bread, Cakes and Cereals
	Fruit and Vegetables	Meat and Fish
	Fresh Meat, Fish and Poultry	Dairy Products, Oils and Fats
	Frozen Meat, Fish and Poulty	Fruit and Vegetables
	Food Away from Home	Other Food (including Meals Out)
Cigarettes, Alcohol	Cigarettes, Tobacco and Alcohol	Cigarettes, Tobacco and Alcohol
Clothing	Male Clothing, Shoes and Accessories	Men's Clothing
	Female Clothing, Shoes and Accessories	Women's Clothing
	Materials, Manchester and Haberdashery	Children's Clothing
		Miscellaneous Clothing and Clothing Materials
		Dry Cleaning and Clothing Services
		Footwear
Housing	Actual Rent Paid	Current Housing Costs
	Imputed Gross Rent on Owner-Occupied Dwellings	(Rent, Mortgage Payments, Rates, House Insurance, Repair and Maintenance)
	Fuel, Gas, Electricity and Telephone	Insurance of Contents
		Fuel and Power
		Telephone and Postal
Durables	Minor Durables	Furniture
	Major Household Appliances	Floor Coverings
	Furniture, Furnishings and Floor Coverings	Textiles, Other Household Furnishings
		Household Appliances
		Kitchen, Tableware and Other Utensils
		Television, Radio, Record Players etc.
		Hire of Television
		Radio/T.V. Licence

The two major changes from the results obtained using the 1966-68 Macquarie survey data are :

(1) The average budget shares devoted to food are much lower in the ABS survey as is the estimated "subsistence" expenditure on food as a percentage of total subsistence expenditure ;

(2) the ELES estimates of total subsistence expenditure and the Frisch parameter are more reasonable when ABS data is used, although we still think them inferior to time-series estimates.

Unfortunately, the problem still remains that it is difficult to get precise estimates of the γ^*-parameters for durables, recreation and other. There is some evidence that durables and recreation are to some extent regarded as substitutes in the satisfaction of the same basic human need. Whilst individual γ^*-estimates for these two goods are poorly determined and erratic, there is a tendency for their sum to remain relatively stable across household types. This tendency is generated, in part, by offsetting signs in the individual parameter estimates (the signs of the γ^*-estimates for durables and recreation are opposite for nine of the eleven household types). Note that a negative γ^*-estimate for a good implies that all uncompensated cross elasticities of demand with respect to its price are positive; that is, substitution effects swamp income effects.[1]

There was also a similar tendency for low marginal budget shares for recreation to be offset by high marginal budget shares for durables, and vice-versa. These considerations suggest that within the directly additive preference framework it might be useful to aggregate durables and recreation into a single commodity.

1. See, for example, Lluch, Powell and Williams (1977), p. 18.

which (1) is estimated using income as an instrumental variable. The equivalence follows from the interpretation of 2SLS, in the just-identified case, as an IV estimator.[1] In terms of our notation the IV estimator of β_i, $\tilde{\beta}_i$ say, is

$$\tilde{\beta}_i = \frac{\Sigma v_i y}{\Sigma v y} \quad ,$$

where lower-case latin symbols in this paragraph only are used to denote deviations from means. Under 2SLS, v in equation (1) is replaced by $\hat{v} = \hat{\mu} y$, where $\hat{\mu}$ is the OLS estimate of μ in equation (3). Denoting the 2SLS estimator of β_i by $\hat{\beta}_i$, we get

$$\hat{\beta}_i = \frac{\Sigma v_i \hat{v}}{\Sigma \hat{v}^2} = \frac{\Sigma v_i y}{\hat{\mu} \Sigma y^2} = \frac{\Sigma y^2}{\Sigma v y} \cdot \frac{\Sigma v_i y}{\Sigma y^2} = \tilde{\beta}_i \quad .$$

The system described above may be interpreted in the context of classical demand analysis. Equations (1) and (4) are the cross-section estimating equations for the linear expenditure system (LES) and the extended linear expenditure system (ELES), respectively, in the absence of price variation across consumers.[2] Under these interpretations

$$\alpha_i = \gamma_i^* - \beta_i \sum_j \gamma_j^* \quad , \tag{5}$$

$$\alpha_i^* = \gamma_i^* - \beta_i^* \sum_j \gamma_j^* \quad , \tag{6}$$

and

1. See, for example, Maddala (1977), p. 235.

2. For details, see Powell (1974), Lluch, Powell and Williams (1977), chapter 2, and Williams (1976 b, 1977).

$$\alpha = (1 - \mu) \sum_j \gamma_j^* \quad , \qquad (7)$$

where $\gamma_i^* = p_i\gamma_i$ represents "subsistence" expenditure on the i^{th} commodity at prices, p_i, prevailing during the survey, and $\Sigma \gamma_j^*$ is total "subsistence" expenditure.

The advantage of a demand systems interpretation is that it permits estimates of price responses to be obtained. Within the context of LES/ELES, the γ_i-parameters are the coefficients of the price terms in the expenditure equations. The advantage of ELES over LES is that it enables estimates of the individual γ_i^* to be obtained from estimates of $(\alpha_i, \beta_i, \mu, \alpha)$ using (6) - (7). On the other hand, in cross-section applications it is frequently found that estimates of γ_i^* obtained in this manner are unacceptably large. An alternative approach is to restrict the "subsistence sum," $\Sigma \gamma_j^*$, to the more reliable values obtained from time-series studies, where price variation occurs within the sample. The most convenient way to do this is to use the relationship between $\Sigma \gamma_j^*$ and the elasticity of the marginal utility of "income" or Frisch "parameter," ω, namely,[1]

$$\Sigma \gamma_j^* = v(1 + \omega^{-1}) \quad . \qquad (8)$$

Time series estimates of ω tend to be relatively stable for given income levels. Before explaining estimation in more detail, however, some discussion of the data is needed.

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1. This approach was used by Ryan (1976), and Williams (1976 b, 1977).

thirty-two types of households were available for analysis. A number of household types defined in this way clearly have very few observations; for example, retired people with children, or young adults with many children. Other household types are extremely heterogeneous in composition (for example, those with three or more adults), while categories such as single people aged over 64 years contain little variation in income. Eliminating these halved the number of household types for which estimates are obtained. The household types remaining, however, accounted for about 75 per cent of the households in the survey, and for a higher percentage of the persons encompassed within it. These first round estimates showed that some household types exhibited very similar consumption patterns. Subsequent amalgamation reduced the number of household types to eleven. It was concluded that further consolidation would hide important differences in expenditure patterns. Of the eleven household types for which results are given, the two which show most similarity are 1 and 2 : two adults with head aged 15-29 and 30-44 respectively. But even here type 1 households have a considerably high "subsistence" expenditure on, and lower marginal budget share for, food.

One criterion for looking at the appropriateness of the model in describing the consumption behaviour of a given household type is to look at the number of significant parameter estimates, β_i, γ_i^*, which occur. Using this criterion both the "best" and "worst" results are achieved for two-adult households : the worst where the head is under 45 years (types 1 and 2), the best where the head is 45 years or over (types 6 and 10). This nicely illustrates the importance of stratifying households by age of head.

Household "subsistence" expenditure on food increases with family size and ranges from around $400 for single person households to $2,200 for household type 9 (old households, 3 or more children). Per capita subsistence expenditure on food is relatively constant, however, once allowance is made for differences in the age of the household head. Where the head is aged 15-44 years, per capita subsistence expenditure on food is estimated to be around $350 (except for type 2). The comparable figure for households where the head is over 44 years of age is around $430. The main differences from the Macquarie findings is that subsistence expenditure on food is now a much lower percentage of total subsistence expenditure, for all household types. In Williams (1977, p. 26) it was reported that subsistence expenditure on food was about 45 per cent of total subsistence expenditure for all household types considered in the Macquarie analysis. In table 5, the corresponding percentage varies from 23 (type 1) to 42 (type 10).

There is a tendency for the γ_i^*-estimates for clothing to increase with family size, particularly for large households. The γ_i^*-estimates for housing tend to be lower for households without children (types 1, 2, 6, 10, 11). Both findings are in accord with the Macquarie results. For households where the head is in the age group 45-64 years, the γ_i^*-estimates for medical expenditure are relatively constant at around $340.

6. CONCLUDING REMARKS

The data base for our analysis consisted of mean household expenditures and income for twelve (gross) income ranges for a number of different household types. Household types were defined in terms of eight family composition categories and four age classes. Potentially, then,

3. DATA

In the ABS Household Expenditure Survey (HES), 1974-75, full information on consumers' expenditure and income was collected from about 9,100 households living in capital cities. Details of sampling procedure and precise definitions of variables are contained in ABS, "Household Expenditure Survey, 1974-75, Bulletin 1."

Expenditure is defined in HES as "actual payments made for goods and services during the reference period regardless of when the items involved were acquired or consumed." The reference period varied directly with the regularity of purchase, being longest for house purchase (two years). Three levels of commodity groups are distinguished : broad (15 groups), medium (100 groups) and fine (300 items). In this paper we are concerned with broad commodity groups and in order to increase comparability with the work done using the Macquarie data the ABS classification is modified to yield the following nine commodity groups : Food, Cigarettes and Alcohol, Clothing, Housing, Durables, Medical, Transport, Recreation and Other. Details are given in appendix table A1. Three important points to note are : (1) In HES, expenditure on housing includes mortgage repayments. In the Macquarie data this was regarded as a capital item, but in our analysis an estimate was made of the imputed rent of owner-occupied dwellings.[1] (2) Similarly, HES includes outlays on purchases of motor vehicles, whereas our studies of the Macquarie data included only an estimate of the services provided by the stock of cars in existence. (3) In rearranging the HES commodity groupings expenditure on "television, radio, record players, etc." has

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1. See Williams (1976 b, 1977).

been moved from recreation to durables. This change is to provide consistency with the Macquarie data and with the classification used in the Australian National Accounts. The differences in the treatment of housing and motor vehicles are less important than it might at first seem because in the Macquarie studies we used data on individual households, whereas for this ABS study we use only averages over groups of households. Interestingly, the ABS survey estimate for housing expenditure, when converted to a national figure, differs from the 1974-75 national accounts estimate by only about 5 per cent, although the methods of calculation are very different. Total consumption expenditure from the ABS survey is within 4 per cent of the national accounts estimate. The ABS survey, however, underestimates expenditure on cigarettes and alcohol by about one-third, and gives a much lower figure for medical care, as the national accounts figures include payments by the Commonwealth Government.[1] A full comparison of the ABS survey and national accounts estimates is given in appendix table A2.

The income measure we use is household personal disposable income, that is, household income less income and other taxes. Household income is defined as "all receipts which were received regularly and were of a recurring nature." It comprises five components : wages and salaries, income from self-employment, government social service benefits, income from investment, and other regular income (including superannuation).

1. Of course if the degree of underestimation is constant across household types and income classes then the effect on parameter estimates is known.

of lifestyles amongst these households. All the γ_i^*-estimates for food, however, are significant. Negative values of γ_i^* are concentrated in the "non-necessity" commodity groups durables and recreation, but no negative values are significantly different from zero. The γ_i^*-estimates lose their "subsistence" interpretation when they are negative, and imply own-price elasticities which are greater than one in absolute value.[1] The γ_i^* results reported in this paragraph virtually duplicate the Macquarie findings as presented in Williams (1977, p. 24).

Age of household head again influences "subsistence" expenditures. For households consisting of only two adults, the γ_i^*-estimates for clothing and recreation are lower for the two oldest age groups (45-64, 65 years and over). For households with a given number of children, the γ_i^*-estimates for food, clothing and recreation are higher for old households (head 45-64 years) than for young households, but lower for durables, although the γ_i^*-estimates for durables are badly determined. Note that the estimates of the subsistence sum are similar for both young and old households with a given number of children so that the differences in the γ_i^*-estimates would seem to largely reflect age differences in children. The results for durables and recreation are opposite to those found in the Macquarie study.[2] Bearing in mind the results for marginal budget shares for these two goods as reported in section 4, we can say that using ABS data the Engel curves for recreation become flatter as the household ages, whereas those for durables become steeper; using Macquarie data the Engel curves swivel in the opposite directions.

1. See, for example, Lluch, Powell and Williams (1977), p. 18.
2. See Williams (1977), p. 24.

Table 5

2SLS ESTIMATES OF SUBSISTENCE EXPENDITURES, γ_i^*, AUSTRALIAN HOUSEHOLDS, 1974-75

Commodity	Household Type										
	Young					Old					Single
	1	2	3	4	5	6	7	8	9	10	11
Food	674	1170	1102	1364	1804	1109	1399	1623	2196	891	434
	(215)	(126)	(141)	(185)	(188)	(97)	(208)	(134)	(520)	(47)	(118)
Cigarettes, Alcohol	282	438	209	-85	356	323	404	320	316	151	162
	(139)	(165)	(91)	(204)	(65)	(150)	(154)	(115)	(185)	(61)	(70)
Clothing	350	255	-16	335	341	-531	190	385	518	223	334
	(206)	(337)	(118)	(142)	(207)	(418)	(212)	(279)	(380)	(102)	(116)
Housing	769	12	926	1001	1193	545	1023	430	838	626	529
	(395)	(859)	(230)	(257)	(225)	(112)	(405)	(236)	(293)	(173)	(254)
Durables	-712	-426	612	484	-92	114	-105	123	-537	-606	-20
	(1089)	(1168)	(394)	(393)	(465)	(219)	(606)	(326)	(488)	(542)	(340)
Medical	161	260	303	273	350	324	318	327	363	148	166
	(86)	(151)	(67)	(107)	(59)	(78)	(128)	(92)	(150)	(101)	(59)
Transport	959	725	777	1155	755	699	372	1022	896	305	179
	(543)	(463)	(262)	(389)	(428)	(77)	(266)	(290)	(233)	(172)	(205)
Recreation	187	585	44	-301	21	-66	320	-18	356	204	-336
	(374)	(523)	(188)	(360)	(300)	(181)	(556)	(331)	(305)	(174)	(502)
Other	324	64	-170	105	189	242	-206	229	365	174	117
	(255)	(311)	(160)	(207)	(138)	(153)	(541)	(354)	(377)	(84)	(294)
Sum	2994	3083	3787	4331	4917	2760	3715	4450	5310	2115	1567

Notes: Estimates are in dollars per household per year in 1974-75 prices. Standard errors are given in parentheses. For key to code for household types see table 1.

The ABS survey contains detailed information on the sociodemographic attributes of households. This information is used here to partition households into relatively homogeneous groups. The attributes used in classification are age of household head, and family size and composition. Four categories for age of head were available : 15-29 years, 30-44, 45-64, and 65 years and over. In the empirical section of the paper an attempt is made to ascertain to what extent consumption patterns differ across the four age groups and whether in some cases they may be combined. In our Macquarie studies the sample was partitioned into only three classes, using 35 and 65 years as the break points.

The ABS data provided to us distinguished eight types of household composition. In this paper we exclude households with more than two adults, and single parent households. The households excluded are either very heterogeneous in composition or show limited income variation within the group. In either case it is not possible to obtain reliable parameter estimates. About 7000 households remain after these exclusions.

The eleven household types for which estimates are presented are given in table 1. Household type 1, for example, refers to couples without children where the head is aged 15 to 29 years. For each household type we have mean household consumption expenditures and mean household disposable income for twelve (gross) income classes. In addition we have the weights needed to convert the sample cell means to population values. If simple random sampling had been used these weights would just be the inverse of the sampling fraction. In practice a variable sampling fraction was used but the weights give an approximate guide to the number of observations which have been averaged in each income class.

Table 1

DEFINITIONS OF HOUSEHOLD TYPES

Household Type	Number of Adults	Age of Head in years	Number of Children	Number of income classes
1	2	15-29	0	10
2	2	30-44	0	11
3	2	15-44	1	33
		15-29	2	
4	2	30-44	2	11
5	2	30-44	3 or more	11
6	2	45-64	0	11
7	2	45-64	1	11
8	2	45-64	2	11
9	2	45-64	3 or more	11
10	2	65 or more	0	12
11	1	15-64	0	24

Notes: Adults are persons aged 18 years and over.
Children are persons under 18 years of age.

yields $\omega = -1.81$. The next step is to take account of the fact that the data used in this paper relate to household expenditure by socio-economic group and not GNP shares. This is done by scaling the intercept in (9) so that $\omega = -1.81$ at the mean per capita expenditure ($2,671) for all households in the ABS survey. This yields

$$\omega = -31.0\ (v/f)^{-.36} \quad , \tag{10}$$

where f = family size. Equation (10) is used to derive the value of ω for each household type. The estimates are given in line 5 of table 4. They range from - 2.04 to - 1.41. Estimates of $\Sigma\gamma_j^*$ are then obtained using equation (8) and these are reported in line 6 of table 4.

The individual γ_i^* are obtained by combining these values of $\Sigma\gamma_j^*$ with the two-stage least squares estimates of α_i and β_i, using equation (5). The estimates are reported in table 5, together with estimates of their asymptotic standard errors.[1] Only about 50 per cent of the γ_i^*-estimates are significant, where significance is defined as occurring when the point estimate exceeds twice its estimated standard error. The estimates are particularly bad for durables, recreation, and other, where all but one of the 33 values are insignificant. The γ_i^*-estimates for two-adult households, head 15-44 years (types 1 and 2) are particularly badly determined. This probably reflects the heterogeneity

1. The estimate of $\Sigma\gamma_j^*$, $\Sigma\hat{\gamma}_j^*$ say, is treated as a constant in calculation of standard errors. That is,

$$\text{var}\ \hat{\gamma}_i = \text{var}\ \hat{\alpha}_i + 2(\Sigma\hat{\gamma}_j^*)\ \text{cov}\ (\hat{\alpha}_i, \hat{\beta}_i) + (\Sigma\hat{\gamma}_j^*)^2\ \text{var}\ \hat{\beta}_i \ .$$

It follows that the reported standard errors will underestimate the "true" values.

The estimates of the Frisch parameter now all have the correct negative sign and are closer in magnitude to the absolute values of around 2 which are usually found in Australian time-series studies.[1] Five of the eleven ω-estimates are around 4 to 5 in absolute value, these being concentrated in households where the head is aged 45-64 years. The lowest Macquarie estimate, in absolute value, reported in Williams (1977) was 15. Looking at it from the subsistence expenditure side, the ABS data yields much more acceptable estimates of the subsistence sum, $\Sigma\gamma_j^*$, than did the Macquarie data. It is difficult to explain the improvement, but it may be that measurement error in income is less important in the ABS data.

Although the estimates of $\Sigma\gamma_j^*$ and $-\omega$ represent an improvement on previous cross-section work with Australian data, they are still unacceptably large. We still give a higher reliability rating to estimates of ω obtained from time-series data. We therefore proceed to replace the ELES estimates of ω and $\Sigma\gamma_j^*$ with estimates from time-series studies. The method used follows that employed in Williams (1976 b, 1977). Using time-series estimates of ELES for 14 countries, Lluch, Powell and Williams (1977, pp. 74-82) arrived at the following relationship between ω and GNP per head in 1970 U.S. dollars, X :

$$\omega = -36X^{-.36} \quad . \tag{9}$$

In the World Bank Atlas, 1976, Australia's GNP per head in 1974-75 is estimated to have been $5,640 in 1975 U.S. dollars. This converts to $4,078 in 1970 U.S. dollars.[2] Substituting this value of X into (9)

1. See Powell (1966), Tran Van Hoa (1968) and Lluch, Powell and Williams (1977), chapter 3.

2. Deflating by the change in the U.S. implicit GNP deflator over the period 1970-75, as reported in IMF Statistics. Almost the same result is achieved using the change in consumer prices.

Early in the analysis it became clear that the consumption and savings behaviour of households in the lowest income class (gross income less than $40 per week) was unusual, except for households where the head was aged 65 years or more. In particular, mean expenditure was usually higher than the next two or three higher income classes, expenditure on cigarettes and alcohol being particularly high. It seems that a significant proportion of these households were financing a "high income" lifestyle from assets. For this reason they are excluded from the analysis with the exception mentioned above.

Key characteristics of the data are given in table 2. The highest household incomes are enjoyed by young couples without children (types 1 and 2), households where the percentage of working wives tends to be high. Couples without children (types 1, 2, 6 and 10) tend to exhibit the highest average propensities to save. On the expenditure side, the proportion of total expenditure devoted to food increases with family size and age of household head. The average budget share for clothing is higher where the household head is aged 45-64 years (around 10 per cent), but it is not much influenced by family size. Expenditure on housing and durable goods is a higher proportion of the budget for young families. Persons living alone devote high budget shares to recreation (12 per cent).

Compared with the Macquarie data,[1] the average budget shares for food are considerably lower in the ABS survey. For comparable households, the highest value in the ABS survey is equal to the lowest value in the Macquarie survey (23 per cent). The higher budget

1. See Williams (1977), p. 14.

Table 2

CHARACTERISTICS OF DATA, ABS HOUSEHOLD SURVEY, AUSTRALIA, 1974-75

	Household Type										
	Young					Old					Single
	1	2	3	4	5	6	7	8	9	10	11
Family Size	2	2	3.31	4	5+	2	3	4	5+	2	1
Mean Income ($)	11268	11500	8823	9745	10418	8803	10161	10690	10924	4917	6116
Mean Expenditure ($)	8751	10254	8190	9039	9645	7142	8539	9451	10899	4342	5388
Average Prop.Save	.223	.108	.071	.072	.074	.189	.160	.116	.002	.117	.119
Average Budget Shares											
Food	.160	.159	.199	.214	.230	.196	.215	.228	.232	.240	.158
Cigarettes,Alcohol	.059	.066	.055	.054	.048	.072	.051	.053	.042	.054	.067
Clothing	.079	.072	.073	.079	.087	.100	.088	.099	.098	.078	.073
Housing	.230	.212	.230	.191	.186	.164	.152	.158	.126	.178	.232
Durables	.106	.122	.095	.080	.080	.086	.087	.058	.127	.097	.077
Medical	.046	.051	.055	.054	.051	.063	.060	.058	.055	.067	.047
Transport	.171	.127	.152	.151	.142	.142	.148	.144	.119	.114	.128
Recreation	.079	.094	.063	.089	.081	.092	.099	.087	.073	.076	.119
Other	.070	.099	.079	.088	.095	.087	.101	.116	.128	.096	.101

Notes: For key to household types see table 1. All figures are weighted averages. Income is defined as household disposable income expressed at an annual rate; total consumption expenditure is also expressed at an annual rate. Households with gross incomes below $2080 are excluded.

Table 4

ESTIMATES OF THE MARGINAL PROPENSITY TO CONSUME, μ, TOTAL SUBSISTENCE EXPENDITURE, $\Sigma\gamma_j^*$, AND THE FRISCH PARAMETER, ω, AUSTRALIA, 1974-75

	Household Type										
	Young					Old					Single
	1	2	3	4	5	6	7	8	9	10	11
1. Mean Expenditure ($)	8751	10254	8190	9039	9645	7142	8539	9451	10899	4342	5388
ELES Estimates											
2. μ	.3308 (.0408)	.6467 (.1352)	.4055 (.0325)	.5059 (.0925)	.5470 (.0409)	.4819 (.0344)	.5673 (.0854)	.5860 (.0502)	.9239 (.1814)	.5000 (.0461)	.6115 (.0918)
3. $\Sigma\gamma_j^*$	7507 (855)	7972 (5611)	7758 (671)	8317 (2491)	8713 (1289)	5597 (760)	6412 (2487)	7698 (1691)	10588 (37722)	3768 (670)	4241 (1844)
4. ω	-7.0	-4.5	-19.0	-12.5	-10.3	-4.6	-4.0	-5.4	-35.0	-7.6	-4.7
Time Series Estimates											
5. ω	-1.52	-1.43	-1.86	-1.92	-2.04	-1.63	-1.77	-1.89	-1.95	-1.95	-1.41
6. $\Sigma\gamma_j^*$	2994	3083	3787	4331	4917	2760	3715	4450	5310	2115	1567

Notes: Mean expenditure and estimates of $\Sigma\gamma_j^*$ are in dollars per household per year in 1974-75 prices. Standard errors, where applicable, are given in parentheses. For key to code for household types see table 1.

shares for transport and housing in the ABS survey are probably largely due to differences in definitions of expenditure.

4. ESTIMATES OF MARGINAL BUDGET SHARES

Estimates of marginal budget shares for the eleven household types listed in table 3 were obtained using weighted two-stage least squares. The method was to perform two successive weighted least squares regressions, where the weights used were the inverses of the population "blow-up" factors as discussed in section 3. The first stage yielded predicted values of v from equation (3). These predicted values were then used in equation (1) to obtain consistent estimates of the β_i. At the second stage the standard errors were corrected to incorporate the correct estimate of the standard error of estimate.[2]

The number of observations (on group means) used in each regression is given in the last column of table 1. Data is potentially available for 12 income classes for each household type but for all but type 10 the lowest income class has been omitted for reasons given in the previous section. The third lowest income class in household type 1 has also been omitted owing to an exceedingly high value for durable good expenditure.

All of the 99 estimates of the marginal budget shares reported in table 3 lie between 0 and 1 ; 86 per cent of them are significantly different from zero at the 5 per cent level. The β_i-estimates for food

1. See Williams (1977), p. 14.

2. See, for example, Maddala (1977), p. 239.

with family size. Elsewhere the family size effect is irregular. No strong patterns emerged in the Macqarie study either.[1]

5. ESTIMATES OF SUBSISTENCE PARAMETERS

As explained in section 2, estimates of the subsistence parameter, γ^*, may be obtained either directly from cross-section estimates of ELES, or indirectly using time-series estimates of the Frisch parameter. The ELES estimates may be obtained by either substituting consistent estimates of α_i, β_i and $\Sigma\gamma_j^*$ into equation (5) or by substituting consistent estimates of α_i^*, β_i^* and $\Sigma\gamma_j^*$ into equation (6). These two methods are equivalent. Here it is more convenient to use equation (5), where consistent estimates of α_i and β_i are obtained by two-stage least squares estimation of (1), and $\Sigma\gamma_j^*$ is obtained from OLS estimation of equation (3) using (7) to unscramble. These estimates of $\Sigma\gamma_j^*$, and also of the marginal propensity to consume, μ, are given in lines 2 and 3 of table 4. The implied values of the Frisch parameter, ω, are given in line 4.

The estimated values for the marginal propensity to consume and the Frisch parameter are an improvement on those obtained using the Macquarie data. The highest value of μ reported in Williams (1977) was 0.497, but most μ-estimates reported in table 4 exceed this value. Nevertheless, the estimates are still lower than the values obtained in time-series work (with the exception of household type 9 where $\hat{\mu} = .92$).

1. See Williams (1977, p. 18).

Table 3

2SLS ESTIMATES OF MARGINAL BUDGET SHARES, β_i, AUSTRALIAN HOUSEHOLDS, 1974-75

Commodity	Household Type: Young 1	2	3	4	5	Old 6	7	8	9	10	Single 11
Food	.1262 (.0230)	.0635 (.0114)	.1194 (.0154)	.1203 (.0181)	.0866 (.0169)	.0664 (.0121)	.0899 (.0217)	.1053 (.0124)	.0595 (.0169)	.0673 (.0091)	.1091 (.0204)
Cigarettes, Alcohol	.0411 (.0149)	.0334 (.0149)	.0550 (.0100)	.1215 (.0200)	.0223 (.0059)	.0435 (.0200)	.0072 (.0161)	.0355 (.0107)	.0257 (.0145)	.0368 (.0116)	.0515 (.0120)
Clothing	.0594 (.0221)	.0672 (.0305)	.1388 (.0129)	.0810 (.0140)	.1054 (.0187)	.2834 (.0523)	.1157 (.0221)	.1096 (.0259)	.0993 (.0298)	.0527 (.0196)	.0156 (.0200)
Housing	.2166 (.0422)	.3015 (.0776)	.2180 (.0251)	.1546 (.0251)	.1276 (.0203)	.1424 (.0140)	.0568 (.0423)	.2127 (.0219)	.0955 (.0230)	.0667 (.0333)	.1883 (.0438)
Durables	.2841 (.1166)	.2331 (.1054)	.0378 (.0430)	.0503 (.0385)	.1819 (.0419)	.1132 (.0274)	.1750 (.0634)	.0851 (.0302)	.3444 (.0383)	.4617 (.1042)	.1131 (.0587)
Medical	.0418 (.0092)	.0369 (.0136)	.0329 (.0073)	.0457 (.0105)	.0310 (.0053)	.0288 (.0097)	.0399 (.0134)	.0433 (.0085)	.0426 (.0118)	.0651 (.0193)	.0223 (.0102)
Transport	.0933 (.0581)	.0798 (.0419)	.1069 (.0286)	.0447 (.0381)	.1306 (.0385)	.0720 (.0200)	.1842 (.0278)	.0677 (.0268)	.0707 (.0182)	.0855 (.0332)	.1335 (.0354)
Recreation	.0874 (.0400)	.0522 (.0472)	.1064 (.0205)	.2355 (.0353)	.1598 (.0270)	.1645 (.0226)	.1091 (.0581)	.1684 (.0307)	.0779 (.0239)	.0558 (.0334)	.2554 (.0867)
Other	.0501 (.0273)	.1323 (.0261)	.1848 (.0175)	.1465 (.0203)	.1547 (.0278)	.0858 (.0192)	.2221 (.0565)	.1724 (.0328)	.1845 (.0296)	.1082 (.0161)	.1112 (.0508)

Notes: Estimates of asymptotic standard errors are given in parentheses.
The household type codes are explained in table 1.

are all significant at the 1 per cent level. Overall, the β-values are determined with more precision than were those based on the Macquarie data as reported in Williams (1977, pp. 15 and 17). This is particularly so for housing, and cigarettes and alcohol.

Only a few patterns emerge when comparing estimates for young households (head 15-44 years) with those for old households (45-64 years). Where children are present there is a tendency for older families to have lower marginal budget shares for recreation and higher marginal budget shares for durables than comparable young families. These findings are the exact opposite of those found with the Macquarie data![1] Possible explanations for the different results include the differences in the break points between young and old families (35 years was used in the Macquarie paper), the use of individual household observations in the Macquarie data, and the introduction of colour television in 1974-75. Comparing young and old households consisting of just two adults, the results show that the β_1-estimates are higher among young households for housing and durables, and lower for clothing and recreation. Retired couples (type 11), however, have a very high β-value for durables, although the estimate for housing is very low.

The number of children in the household exerts few regular influences on estimates of the marginal budget shares. For young households there is a tendency for the β-values for recreation to increase with family size and those for housing to decrease with family size. For old households there is a tendency for the β-value for clothing to decrease

1. See Williams (1977), p. 15.