



# 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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HOUSEHOLD CONSUMPTION IN AUSTRALIA :  
AN EXAMINATION OF PATTERNS ACROSS  
SOCIO-ECONOMIC CLASSES

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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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2. METHODOLOGICAL CONSIDERATIONS

In this section we consider demand systems derived from the Klein-Rubin (1947-48) utility function

$$U = \sum_{i=1}^n \beta_i \ln (q_i - \gamma_i) \quad (1)$$

where  $q_i$  represents the quantity demanded of the  $i^{\text{th}}$  good and  $\beta_i$ ,  $\gamma_i$  are parameters. Atemporal maximization of (1) subject to the budget constraint yields Stone's (1954) Linear Expenditure System, LES. Intertemporal maximization of (1) subject to a wealth constraint in the manner developed by Lluch (1973) yields the Extended Linear Expenditure System, ELES. In the former the explanatory variables in the demand equations are prices and total expenditure, in the latter total expenditure is replaced by income.<sup>1</sup> In both models, additional explanatory variables may be conveniently introduced by allowing them to influence, in a linear manner, the "subsistence" parameters,  $\gamma_i$ , i.e.,

$$\gamma_i = \sum_{j=0}^m \gamma_{ji} x_{jh} , \quad i = 1, \dots, n , \quad (2)$$

where  $x_{jh}$  is the value of explanatory variable  $x_j$  ( $j = 1, \dots, m$ ) for household  $h$  and  $x_{0h} = 1$  for all  $h$ , i.e.,  $\gamma_{0i}$  is the intercept term.

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1. In Lluch's most general formulation the income variable is current income plus discounted expected future changes in labour income.

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1. INTRODUCTION

The long-term economy-wide model of Australia developed by Dixon, Harrower and Powell (1976) differs from conventional "snapshot" models in that, amongst other things, it specifically allows for the effects of demographic change on demand patterns. This is done (p. 2) by "specifying several 'representative consumers,' one for each socio-economic/demographic group." The aim of this paper is to present empirical estimates of demand parameters for "representative consumers" who appear to differ significantly from others in their consumption behaviour.

Using the 1966-68 Australian Survey of Consumer Expenditures undertaken by Macquarie University, consumers are cross-classified according to the following characteristics: family composition, occupation of household head, age of household head, and whether the wife is working or not. For each household type the systems approach to demand equations is used to obtain estimates of demand responses. The first set of parameter estimates reported are in effect instrumental variable estimates of Engel curves. These values are then combined with additional information from outside the data base to obtain estimates of the "subsistence" parameters of the Klein-Rubin utility function.

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\* All the computer work reported here was efficiently handled by Ellen Hope.

In a cross-section context, assuming all consumers face common prices, ELES and LES collapse to the following linear equations after incorporating (2)<sup>1</sup> :

$$\underline{\text{ELES}} \quad v_{ih}^* = \beta_i^* y_h + \sum_j \delta_{ji}^* x_{jh} + u_{ih} \quad (3)$$

where

$$\delta_{ji}^* = \gamma_{ji}^* - \beta_i^* \sum_i \gamma_{ji}^* \quad (4)$$

and

$$\underline{\text{LES}} \quad v_{ih} = \beta_i v_h + \sum_j \delta_{ji} x_{jh} + \epsilon_{ih} \quad (5)$$

where

$$\delta_{ji} = \gamma_{ji}^* - \beta_i \sum_i \gamma_{ji}^* \quad (6)$$

Additional notation for variables is as follows :  $v_{ih}$  is expenditure on good  $i$  by household  $h$ ,  $v_h = \sum_i v_{ih}$  is total household expenditure,  $y$  is household income and  $u_i$  and  $\epsilon_i$  are error terms. The asterisks on the  $\gamma_{ji}$  indicate that they measure subsistence expenditures in terms of prices ruling during the survey period;  $\beta_i^* = \mu \beta_i$  where  $\mu$  is the marginal propensity to consume.

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1. See Belandria (1971), Howe (1974), Powell (1973, 74) and Williams (1976) for details.

Adding up the ELES expenditure equations (3) yields the aggregate consumption function

$$v_h = \mu y_h + \sum_j \delta_j^* x_{jh} + u_h \quad (7)$$

where

$$\mu = \sum_i \beta_i^* \quad (8)$$

$$\delta_j^* = \sum_i \delta_{ji}^* = (1 - \mu) \sum_i \gamma_{ji}^* \quad (9)$$

and

$$u_h = \sum_i u_{ih} .$$

Elimination of  $y$  from (3) and (7) (ELES) yields LES (5), or more precisely the deterministic part of LES.

The conventional objection raised against estimating (5) (LES) by ordinary least squares (OLS) is that simultaneity problems arise from the presence amongst the explanatory variables of the sum of the dependent variables.<sup>1</sup> The conventional objection to estimating (3) (ELES) by OLS is that in a cross-section context income is measured with error. Liviatan has suggested that the solution to these problems is to estimate (5) by the method of instrumental variables (IV), using measured income as the proxy for total expenditure. In the models presented here we allow other included variables to act as their own instruments. As pointed out in Williams (1976),

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1. See Summers (1959) and Liviatan (1961).

Liviatan's approach is equivalent to unscrambling the coefficients of the LES estimating equations from OLS estimates of ELES. This is the method adopted in this paper.

Denoting OLS estimates by " $\hat{\cdot}$ " and IV estimates by " $\tilde{\cdot}$ " it can be shown that<sup>1</sup> :

$$\tilde{\beta}_i = \hat{\beta}_i^* / \mu \quad (10)$$

and

$$\tilde{\delta}_{ji} = \hat{\delta}_{ji}^* - \hat{\delta}_j^{**} \tilde{\beta}_i \quad (11)$$

### 3. D A T A

The Macquarie expenditure survey includes information on consumption patterns, income, and socio-economic/demographic characteristics of about 5,500 urban households. The approach adopted in this paper is to fit separate sets of demand equations for different household types of "representative consumers." The first criterion used in classification is household composition. Four basic types are considered : one person households, single head households with non-working children, married couples, and married couples with children. These four household types account for about 90 per cent of all households in the sample.<sup>2</sup>

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1. See the Appendix to Williams (1976).

2. Analysis of extended and composite households is left for further work.

Secondly, households are subdivided according to the age of the household head into "young" and "old" households. The break-point used is 35 years. This is obviously somewhat arbitrary, but was chosen primarily so as to ensure that the "young" households did not contain working children.

A third subdivision of households is by occupation of head into white collar (executive, professional, semi-professional, clerical and sales), blue collar (skilled technical, semi-skilled and labourers) and those not in the workforce. Finally, those households in which the wife is working are analysed separately.

Family size is incorporated directly into the estimating equations by making the subsistence parameters,  $\gamma_i^*$ , a linear function of the number of children in the household - - see equation (2).

Cross-classification of households in the manner described above yields 23 types of "representative consumers" where enough observations exist to permit estimation. These are as follows:

- (i) Three types of one person households : under 35 and working, 35 and over and working, 35 and over and not in workforce ;
- (ii) Two types of single parent households with non-working children classified according to whether the parent is working or not ;
- (iii) Nine classes of married couples : two occupation classes (white collar and blue collar) by two age groups ("young" and "old") by whether the wife is working or not, plus "old" couples where neither person is working ;

(iv) Nine classes of married couples with children : as for (iii) .

A nine commodity classification of expenditures is used<sup>1</sup> :

Food, Cigarettes and Alcohol, Clothing, Household Overheads, Durables, Medical and Chemists' Goods, Transport, Recreation, and Other. The income variable used is household disposable income. No allowance is made for the imputed value of rent for owner-occupied dwellings in the definitions of income and consumption. Expenditure on purchases of motor vehicles is not included in consumption.

#### 4. INSTRUMENTAL VARIABLE ESTIMATES OF ENGEL CURVES

For each of the 23 "representative consumers" defined in the previous section equations (3) were fitted by OLS<sup>2</sup> and IV estimates of the coefficients of (5) were obtained using (10) and (11). Examination of the parameter estimates (and data) disclosed that in some cases consumption patterns were sufficiently similar to permit pooling of data and a reduction in the number of "representative households." Specifically, the findings were as follows :

- (i) For one-person working households the explanatory power of the models was not high and age did not seem to be an important determinant of consumption patterns ;

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1. Specific details of the components of each commodity grouping are given in appendix A.
  2. Since the same explanatory variables appear in each equation, OLS estimation on an equation-by-equation basis is a fully efficient method.

- (ii) For married couples (without children) where the head was under 35 years of age and working, occupation was unimportant but it was necessary to take into account whether the wife was working or not ;
- (iii) For married couples (without children) where the head was 35 years or more and working, occupation of the head was the critical determinant : consumption patterns were influenced much less by whether the wife was working or not ;
- (iv) Findings (ii) and (iii) were also observed for married couples with children.

Taking account of the above results the number of "representative consumers" was reduced to 14 and the equations re-estimated where necessary. Detailed results of these estimates are given in tables 1 - 6. The parameter estimates given are IV estimates of linear Engel curves as specified in (5). An indication of precision of the estimates is given by noting the interval in which the t-value falls, where the t-values are those obtained in estimating the ELES equations (3) by OLS.<sup>1</sup> Characteristics of the data are given in appendix B.

The tabled results represent marginal responses, where the "non-income" effects, such as family size, sum to zero across commodities for a given household type.<sup>2</sup> The estimates do, however, provide an indication of the size of total expenditure elasticities in that the elasticities are greater or less than one according to whether the relevant intercept term is negative or positive.

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1. The t-values on estimates of  $\beta_i^*$  are generally close to those on  $\beta_i$ -estimates. For other coefficients the t-values measure the appropriateness of including explanatory variables other than income in ELES.
  2. This is a property of both IV and OLS estimates of (5).

Table 1 : IV Estimates of Engel Curves : One Person Households<sup>1</sup>

Commodity	Intercept		Marginal Budget Share <sup>2</sup>	
	Working	Not Working	Working	Not Working
Food	192.8	250.1	.156**	.170**
Cigarettes	-118.6	-30.6	.116**	.059**
Clothing	163.9	-80.3	.009	.133**
Housing	104.5	5.4	.130**	.199**
Durables	-270.7	-12.3	.217**	.045**
Medical	173.7	9.6	.013	.099**
Transport	74.3	-10.4	.073**	.045**
Recreation	-340.5	-96.0	.232**	.154**
Other	20.8	-35.6	.054	.097**

- Sample sizes and mean total household expenditure are:  
Working  $n = 182$ ,  $\bar{v} = \$2662$ ; Not Working  $n = 338$ ,  $\bar{v} = \$1214$ .
- One asterisk on a coefficient indicates that the t-value on the ELES slope coefficient  $\beta^*$  is between 1 and 2 ; two asterisks that it exceeds 2 .

Table 2 : IV Estimates of Engel Curves : Single Head Households  
with Non-Working Children<sup>1</sup>

Commodity	Intercept		Marginal Budget Share		Family Size <sup>2</sup>	
	Working Head	Non-Working Head	Working Head	Non-Working Head	Working Head	Non-Working Head
Food	168.0	238.9	.163**	.238**	173.2**	79.3**
Cigarettes	-120.4	16.1	.090**	.006	-5.3	11.0**
Clothing	-167.0	-33.8	.128**	.117*	16.0	-16.0
Housing	435.2	172.8	.050**	.055	-90.3**	23.0**
Durables	265.2	-53.9	.070	.083*	-127.5*	-6.7
Medical	53.0	-96.3	.051*	.145**	14.8	-24.4
Transport	-232.7	-161.3	.137**	.173**	22.6	-35.0
Recreation	-2.2	-25.6	.109*	.061*	-45.2	-6.1
Other	-399.2	-56.9	.203**	.122**	41.5	-25.1

1. Sample sizes and mean total household expenditures are:  
 Working head  $n = 46$ ,  $\bar{v} = \$3057$ ; Non-working head  $n = 60$ ,  
 $\bar{v} = \$2017$ ; in all but 6 and 13 cases respectively, the head  
 is aged 35 years or more. One asterisk on a coefficient  
 indicates that the t-value on the corresponding ELES coeffic-  
 ient is between 1 and 2; two asterisks that it exceeds 2.  
 (No tests are conducted on the intercept.)
2. Explanatory variable is the number of children in household;  
 mean values are 1.78 if head is working, 2.22 if not.

Table 3 : IV Estimates of Engel Curves : Married Couples with  
Head aged 35 years or more Classified by Occupation<sup>1</sup>

Commodity	Intercept		Wife in Workforce <sup>2</sup>		Marginal Budget Share	
	White Collar	Blue Collar	White Collar	Blue Collar	White Collar	Blue Collar
Food	516.3	766.7	-33.0	-6.8	.134**	.080*
Cigarettes	25.9	96.0	34.6	27.4*	.056**	.031
Clothing	-226.6	8.8	-75.5*	-5.3	.155**	.070**
Housing	47.0	78.1	-69.0*	1.1	.099**	.079
Durables	67.3	-404.1	240.8*	62.2*	.094*	.235**
Medical	-42.3	305.5	6.0	28.1	.109**	-.002
Transport	199.6	-8.7	70.6*	35.9*	.042**	.106**
Recreation	-420.8	-361.9	-87.9*	-130.2*	.212**	.205**
Other	-166.5	-480.4	-86.7*	-12.4	.099**	.196**

1. Breakdown is by occupation of household head into White Collar and Blue Collar, with 168 and 327 observations respectively, and mean values for total household expenditure of \$3934 and \$3204. One asterisk on a coefficient indicates that the t-value on the corresponding ELES coefficient is between 1 and 2 ; two asterisks that it exceeds 2. (No tests conducted on the intercept.)
2. Figures represent coefficient on dummy variable which takes the value 1 if wife of household head is working, 0 if not. The mean value of this variable is .26 for white collar households and .27 for blue collar households.

Table 4 : IV Estimates of Engel Curves : Other Married  
Couples with Non-Working Wife<sup>1</sup>

Commodity	Intercept		Marginal Budge Share <sup>2</sup>	
	Head < 35	Head Not Working	Head < 35	Head Not Working
Food	645.3	466.4	.071*	.145**
Cigarettes	170.1	-2.1	.004	.043**
Clothing	95.4	-78.3	.032	.108**
Housing	228.3	-10.9	.081*	.132**
Durables	-1386.2	-1.3	.590**	.081**
Medical	169.8	72.5	.028	.051**
Transport	503.3	77.5	-.038	.052*
Recreation	-399.4	-588.9	.190**	.365**
Other	-26.7	65.1	.043**	.022*

1. Sample sizes and mean total household expenditures are:

Head < 35 years, n = 88,  $\bar{v}$  = \$3407; Head not working, n = 314,  
 $\bar{v}$  = \$2146.

2. One asterisk on a coefficient indicates that the t-value on the  
ELES slope coefficient  $\beta^*$  is between 1 and 2; two asterisks  
that it exceeds 2.

Table 5 : IV Estimates of Engel Curves : Married Couples  
with Children where Head aged 35 years or more  
Classified by Occupation<sup>1</sup>

Commodity	Intercept		Wife in Workforce		Marginal Budget Share		Family Size	
	White Collar	Blue Collar	White Collar	Blue Collar	White Collar	Blue Collar	White Collar	Blue Collar
Food	548.5	447.3	-21.5	33.7**	.144**	.171**	85.1**	102.2**
Cigarettes	-140.7	44.0	8.4	26.5**	.081**	.048**	-7.0	-11.4
Clothing	-264.7	-224.5	-3.4	22.6**	.150**	.142**	-1.9*	-6.2**
Housing	224.8	314.5	4.3	33.9**	.042**	.004	-8.6	7.3*
Durables	-133.0	-198.8	44.3	-19.5*	.172**	.185**	-37.6	-38.3
Medical	111.6	84.4	9.5	-7.2*	.067**	.066**	-10.4	0.4**
Transport	17.8	-149.6	-10.1	-29.2*	.087**	.168**	14.6**	-31.4
Recreation	-97.7	-188.2	-53.3	-53.1	.135**	.137**	-39.6*	-33.7*
Other	-264.4	-129.1	22.0*	-7.8*	.122**	.079**	5.4*	11.1**

1. Breakdown is by occupation of household head into White Collar and Blue Collar, with 778 and 1299 observations respectively and mean values for total household expenditure of \$5038 and \$4172. One asterisk on a coefficient indicates that the t-value on the corresponding ELES slope coefficient is between 1 and 2; two asterisks that it exceeds 2. (No tests are conducted on the intercept.)
2. Figures represent coefficient on dummy variable which takes the value 1 if wife of household head is working, 0 if not. The mean value of this variable is 0.20 for white collar households and 0.24 for blue collar households.
3. Explanatory variable is number of children in household; mean values are 2.48 for white collar households and 2.62 for blue collar households.

Table 6 : IV Estimates of Engel Curves : Other Married Couples  
with Children and Non-Working Wife<sup>1</sup>

Commodity	Intercept		Marginal Budget Share		Family-size Effect <sup>2</sup>	
	Head < 35	Head Not Working	Head < 35	Head Not Working	Head < 35	Head Not Working
Food	406.7	288.8	.142 <sup>*</sup>	.219 <sup>**</sup>	116.3 <sup>**</sup>	79.7 <sup>**</sup>
Cigarettes	110.4	-128.1	.017 <sup>*</sup>	.102 <sup>**</sup>	0.7	-19.7
Clothing	-117.0	-159.0	.104	.138 <sup>**</sup>	-2.9 <sup>*</sup>	-2.8
Housing	523.1	215.0	-.018	.056 <sup>*</sup>	-13.4 <sup>*</sup>	-9.2
Durables	-751.8	224.5	.402 <sup>**</sup>	.022	-70.3	15.0
Medical	62.9	22.9	.068 <sup>**</sup>	.070 <sup>*</sup>	1.2 <sup>*</sup>	11.5 <sup>*</sup>
Transport	67.5	-331.1	.091 <sup>**</sup>	.200 <sup>**</sup>	-15.0	-29.6
Recreation	-195.8	-59.2	.125 <sup>**</sup>	.108 <sup>*</sup>	-16.0	-25.3
Other	-105.8	-73.8	.069 <sup>**</sup>	.086 <sup>**</sup>	-0.6 <sup>*</sup>	-19.5

1. Sample sizes and mean total household expenditures are:  
Head < 35 years,  $n = 864$ ,  $\bar{v} = \$3646$ ; Head not working,  $n = 84$ ,  
 $\bar{v} = \$3516$ . One asterisk on a coefficient indicates that the  
t-value on the corresponding ELES coefficient is between 1 and  
2; two asterisks that it exceeds 2. (No tests are conducted  
on the intercept.)
2. Explanatory variables is number of children in household;  
mean values are 2.14 for head < 35 years and 1.70 for head not  
working.

Table 1 contains parameter estimates for single-person households according to whether the person is working or not working. (The latter are almost entirely retired people.) The most noticeable difference between the two sets of estimates is the much lower marginal budget share for durables in the case of non-working persons, although in both categories the estimated total expenditure elasticity for durables exceeds unity. Expenditure on clothes and medical goods appears to be more responsive to income for non-working households : for working people expenditure for each of these two items is almost constant across income classes.

For single-parent households with non-working children (table 2) the marginal budget shares for workers and non-workers are closer together than is the case for single-person households. Nevertheless, some differences occur : for non-working heads the marginal budget shares are noticeably higher for food and medical goods and lower for "other." For both classes the expenditure elasticity exceeds unity for clothing, transport, recreation and other. Irrespective of whether the head is working or not, the primary effect of an increase in family size is to increase expenditure on food, and to reduce expenditure on most other goods, especially durables and recreation.

Table 3 contains estimates for "old" married couples (i.e., head 35 years or more) classified by whether the head is a white collar or blue collar worker. The marginal budget shares for food and clothing are appreciably higher for white collar workers, while those for durables, transport and other are higher for blue collar workers. These findings are a little surprising in view of the higher mean incomes of white collar workers.<sup>1</sup> In the regressions for both occupational classes, a dummy

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1. It would seem that high income white collar workers (i.e., managerial and professional) dress more expensively and dine out more than their more lowly paid brethren, whereas for blue collar workers additional income is devoted to electrical goods and cars.

variable is introduced to allow for the influence of a working wife. As mentioned earlier the effect is relatively unimportant here. Indeed, the coefficient of the dummy variable is never significantly different from zero at the 5 per cent level. The point estimates show that for those couples where both are working, expenditure on durables is substantially higher and expenditure on recreation and other is lower than where only the head is working.

For "young" married couples (i.e., head less than 35 years) it was not possible to get meaningful parameter estimates where the wife was working. The results given in table 4 are thus confined to households with non-working wives. For completeness, estimates are also given in table 4 for married couples where neither person is working. Estimation using data for "young" couples where the wife is not working produces a very high estimate of the marginal budget share for durables of 0.590 with a t-value of 4.38. The most apparent feature of the estimates for couples where neither is working is the high marginal budget for recreation of 0.365 (with a t-value of 8.10).

Tables 5 and 6 repeat for families, i.e., married couples with children, the estimates given in tables 3 and 4 for couples.<sup>1</sup> For "old" families, the presence of a working wife does not significantly influence

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1. No account is taken in tables 5 and 6 of whether any children are working. For household heads less than 35 years of age such considerations are irrelevant. For household heads over 35 years of age and working, the percentage of households containing at least one working child are : white collar households 27 per cent, blue collar households 40 per cent. The results obtained after excluding households with working children are given in table C1 in appendix C. The only major changes in results are : the marginal budget shares are now determined with less precision for blue collar workers; the Engel curves for transport become flatter, especially for blue collar households; and the Engel curves for the category "Other" become steeper. For households where neither parent works (table 6), 68 per cent contain working children. Unfortunately the sample here is too small to permit further subdivision and estimation.

consumption patterns for white collar workers (see table 5), but for blue collar workers it leads to significant increases (at the 5 per cent level) in expenditure on food, cigarettes and alcohol, clothing and housing, and significant reductions in expenditure on less essential commodities. These results for blue collar workers are somewhat perverse<sup>1</sup> and are opposite to those obtained for married couples without children (table 3).

Taking tables 3 and 5 together we find that compared with married couples the marginal budget shares for white collar families are higher for durables and transport and lower for housing, medical goods and recreation. Comparing blue collar families with couples, the marginal budget shares for food, clothing and transport are higher for the former, whereas those for recreation and other are lower. The marginal budget shares for transport and, to a much lesser extent, durables are higher for blue collar families than for white collar families. A similar effect was previously noted for married couples. The  $\beta$ -estimate for clothing is again slightly higher for families where the head is a white collar worker, but for food the  $\beta$ -estimate for families is now higher for blue collar workers than for white collar workers.

Family size effects for "old" families (table 5) are similar to those found for single parent households : increases in family size lead to large and significant increases in expenditure on food with compensating reductions in expenditure on most other commodities.

Again the model was unable to accurately measure demand responses for "young" households where the wife is working. Results for "young" families with non-working wives are given in table 6. As with

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1. The results still hold when families with working children are excluded, except for transport where the effect changes from negative to positive - - see table C1 in appendix C.

married couples, the estimate of the marginal budget share for durables is particularly high : 0.402 with a t-value of 8.17. For families where neither parent is working (table 6), the marginal budget share for transport is large (0.200) and significant (t-value is 5.88).

A convenient way of summarizing patterns in demand behaviour across types of "representative consumers" is to plot sets of Engel curves. For illustrative purposes attention is focussed on two commodities : food, because of its importance in the household budget, and durables, because of substantial variations in expenditure on this item.

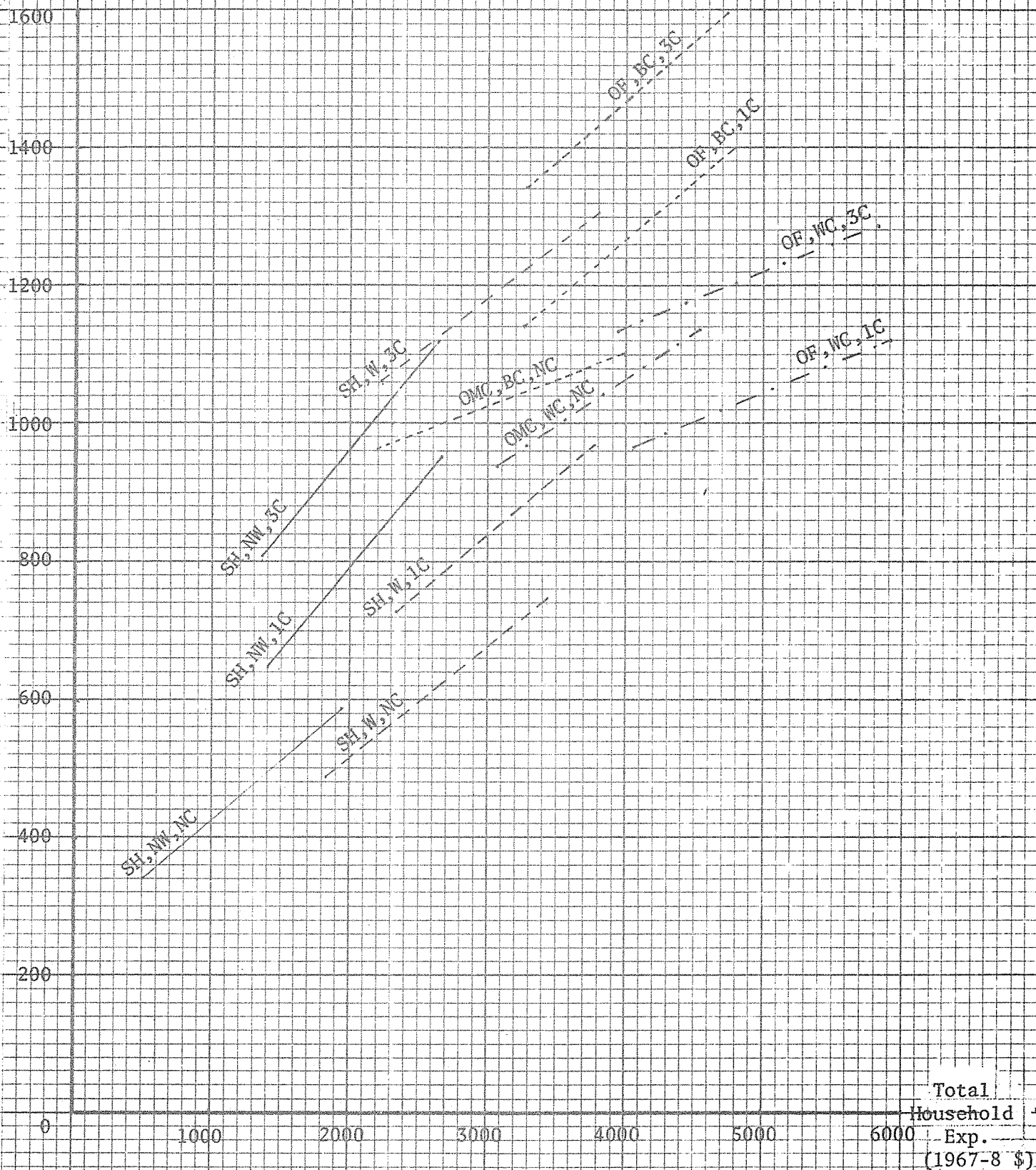
Engel curves for food for 12 representative consumers are given in figure 1. They are a subset of those households for which numerical estimates are given in tables 1 - 6. The lines are drawn such that the mid-point represents mean values of expenditure (food and total) for that particular group of households. Four basic household types are considered. In order of increasing mean total expenditures they are :

- (i) Single head units where the head is not working ;
- (ii) Single head units where the head is working ;
- (iii) "Old" married couples, with or without children, where the head is a blue collar worker ;
- (iv) "Old" married couples, with or without children, where the head is a white collar worker.

For types (iii) and (iv) the curves are plotted only for households where the wife is not working - - food consumption is relatively invariant to whether the wife is working or not. Three curves are plotted for each of the four basic household types according to whether the number of children is zero, one or three.

Household  
Exp. on Food  
(1967-8 \$)

Figure 1 : Engel Curves for Food, Selected Household Types



NOTATION:

Basic household type : SH=Single Head; OMC=Old Married Couples; OF=Old Family  
 Occupation of head : NW=Not Working; W=Working; BC=Blue Collar Worker; WC=White Collar Worker  
 Number of children : NC=No Children; 1C=One Child; 3C=Three children  
 Status of wife : Not working in all relevant cases.

The overall impression conveyed by figure 1 is of a fall in the marginal budget share for food as "income" increases, with the exception of "old" blue collar families. There is a kink in the Engel curve for single parent households when one moves from non-working to working heads, i.e., the marginal budget share becomes noticeably lower.

The effect on food consumption of an increase in family size is positive, as expected, and relatively large. The only (slight) irregularity that occurs is for "old" white collar households where the Engel curve for childless couples lies above that for households with one child.<sup>1</sup> However, this could be explained in terms of an income effect: mean total expenditure is higher for families than for childless couples. It seems that at least for food expenditure it would be a reasonable approximation to pool data for comparable households irrespective of whether there were children or not. This particularly applies to working single head households where the Engel curve for one-person households is parallel to those for single parent households and the marginal effect on food consumption of moving from no children to one child is almost identical to that of having an additional child after the first. Note also that family size effects tend to be greatest for single head households.

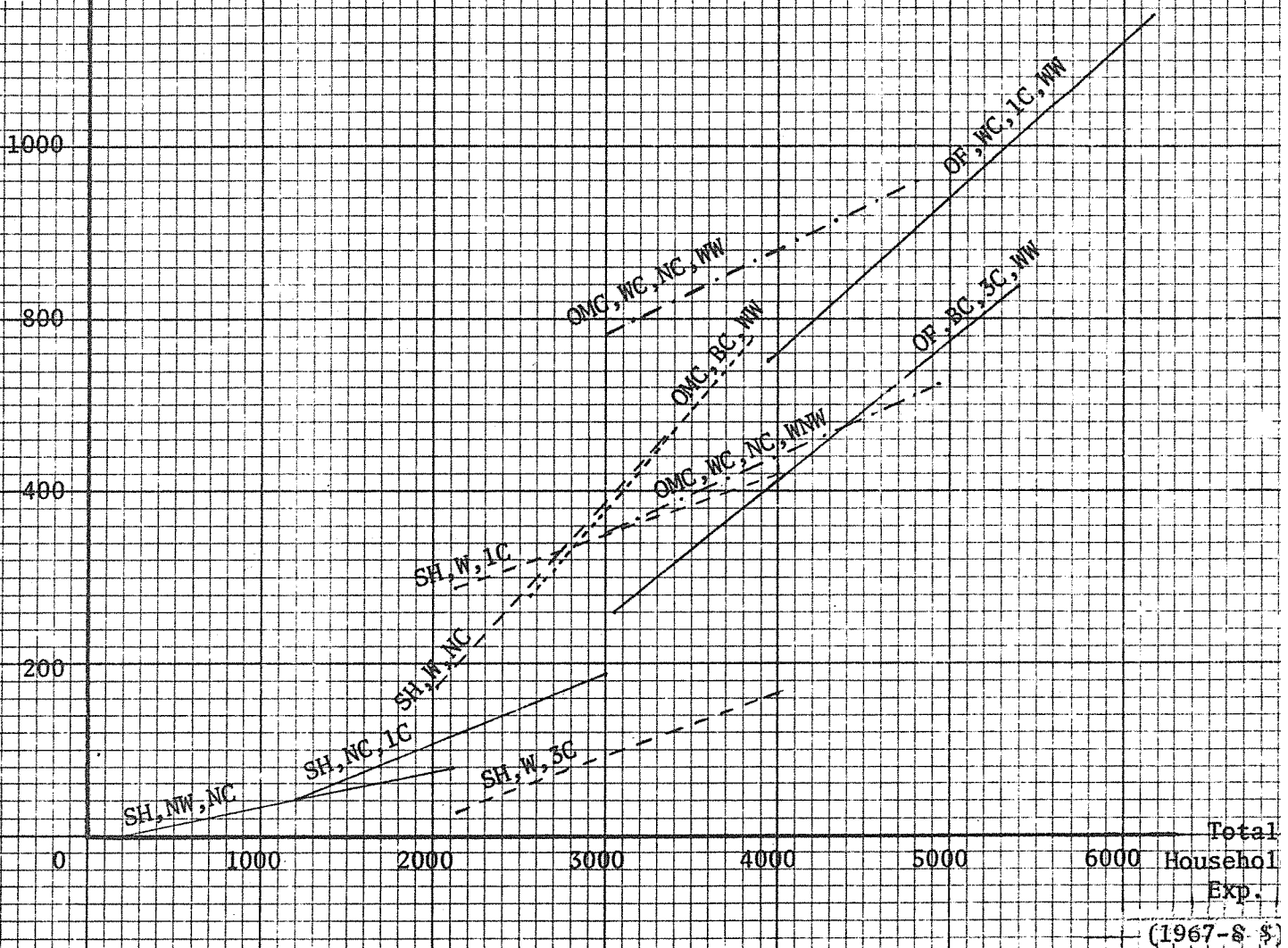
Engel curves for durables for 9 representative consumers are plotted in figure 2. Again attention is confined to the four basic types of households analysed in figure 1. The overall picture presented by the graph is one of a higher marginal budget share for durables at higher "income" levels. The family size effect in moving from one to more than one child is always in the direction of lowering expenditure on durables at a

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1. Recall that regression lines for households with no children are always estimated separately from households with children. However, for households with children the  $\beta_1$ -estimates are constrained to be the same irrespective of the number of children.

Figure 2 : Engel Curves for Durables, Selected Household Types

Household  
Exp. on  
Durables  
(1967-8 \$)



## NOTATION:

Basic household type : SH=Single Head; OMC=Old Married Couple; OF=Old Family

Occupation of head : NW=Not Working; W=Working; BC=Blue Collar Worker; WC=White Collar Worker

Number of children : NC=No Children; 1C=One Child; 3C=Three Children

Status of wife : WW=Working Wife; WNW=Wife Not Working.

given income level; this effect is particularly strong in the case of working single parent households. For (old) married couples without children there is a pronounced increase in expenditure on durables when the wife is working. Finally, there is considerable uniformity in Engel curves for working families : family size, working wife and occupational effects are relatively small and all Engel curves lie between the near parallel lines on the right of the graph.

#### 5. CALCULATION OF SUBSISTENCE PARAMETERS

It is not possible to obtain estimates of individual subsistence expenditure coefficients,  $\gamma_{ji}^*$ , (see equation (2)) from the coefficients of Engel curves without utilizing additional outside information. This is because for each set of Engel curves enforcement of the budget constraint makes one equation redundant : for all variables other than total expenditure the estimated coefficients sum to zero over commodities.<sup>1</sup> One additional piece of information is required for each explanatory variable (including the constant) other than total expenditure. The alternative ways of introducing outside information are discussed in Williams (1976).

If measurement error in income is thought to be relatively unimportant then all the additional information required to unscramble the estimates of subsistence coefficients may be obtained from the OLS estimates of the ELES aggregate consumption function (7). However, it is clear from the data (see appendix B) that income is underestimated in this survey and therefore ELES estimates will be inconsistent. Of course the magnitude of the biases is still an open question.

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1. See Howe (1974), Muellbauer (1974), Powell (1973, 1974) and Williams (1976).

Another option available is to use independent estimates of the expenditure elasticity of the marginal utility of expenditure,  $\omega$ , which under LES/ELES is related to the subsistence sum as follows :

$$\omega = -v(v - \sum_i \gamma_i^*)^{-1} \quad (12)$$

where  $\sum_i \gamma_i^*$  is total "subsistence expenditure." A number of time series studies for Australia have yielded estimates of  $\omega$  of around - 2.5.<sup>1</sup> However, this is an average estimate and there is considerable empirical evidence<sup>2</sup> to support Frisch's (1959) conjecture that the absolute value of  $\omega$  falls as income increases. In an international comparison of estimates of  $\omega$  obtained from time series estimation of ELES, Lluch and Williams (1974) estimated that the elasticity of  $-\omega$  with respect to per capita "income" (as measured by per capita GNP) was around - 0.36. Using this figure and forcing the estimate of  $\omega$  to be - 2.5 at mean per capita total expenditure,  $\bar{v}^*$ , of the sample ( $\bar{v}^* = \$1122$ ) yields

$$\omega = - 31 \bar{v}^{*-0.36} \quad (13)$$

Equation (13) could thus be evaluated at mean per capita total expenditure for each type of "representative consumer" and associated values of  $\sum_i \gamma_i^*$  obtained using (12). For those equations which involve no additional explanatory variables this is sufficient to identify all the parameters. For the other equations additional information is required. If it is thought

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1. See Tran Van Hoa (1968), Lluch and Powell (1975), Lluch and Williams (1974, 1975), and Powell (1966).

2. See de Janvry, Bieri and Nuñez (1972), Lluch and Powell (1975), and Lluch and Williams (1974, 1975).

that  $\omega$  is influenced only by income levels then judicious use of (13) would still be sufficient to identify all parameters, provided mean total expenditure estimates were available for each value taken by the explanatory variables. The limitation of this approach is that there is some evidence (see Williams (1975)) of non-income effects on  $\omega$ , at least for developing countries.

In this paper we proceed in two ways to obtain estimates of subsistence-sum coefficients,  $\sum_i \gamma_{ji}^*$ . First, we present in table 7 the relevant estimates obtained from OLS estimation of ELES. Second, we use (12) - (13) to obtain estimates of  $\sum_i \gamma_i^*$  and, where relevant, combine this with ELES estimates of family size effects to obtain estimates of  $\sum_i \gamma_{ji}^*$  from

$$\sum_i \gamma_i^* = \sum_i \gamma_{0i}^* + \bar{x}_2 \sum_i \gamma_{2i}^* , \quad (14)$$

where  $\bar{x}_2$  is mean household size. The first method yields higher estimates of total "subsistence expenditures," which frequently exceed actual expenditure. Notice that an increase in the number of children always increases total subsistence expenditure except in one case (single parent), where the t-value is below unity.

Estimates of "subsistence expenditure" on individual commodities may be obtained by using the results presented in tables 7 or 8 with those given in tables 1 - 6. The relevant formula is (6). For illustrative purposes we give such estimates for food and durables in tables 9 and 10, which are based on table 8, i.e., using assumed values of  $\omega$ .

Table 7 : OLS Estimates of Subsistence Sum Coefficients,

$$\sum_i \gamma_{ji}^*$$

from ELES<sup>1</sup>

Household Type <sup>2</sup>	mpc	Intercept $\sum \gamma_{0i}^*$	Working Wife $\sum \gamma_{1i}^*$	Family Size $\sum \gamma_{2i}^*$
<u>1. Single Person</u>				
Working	.3842	2747.3		
Not-Working	.2307	1248.5		
<u>2. Single Parent</u>				
Working	.6443	4748.3		-412.1 <sup>++</sup>
Not-Working	.5400	1629.4		396.7
<u>3. Old Married Couples</u>				
White Collar	.5287	3688.3	-300.7 <sup>++</sup>	
Blue Collar	.3157	3179.6	379.8 <sup>+</sup>	
<u>4. Other Married Couples</u>				
Young	.3687	3483.6		
Not-Working	.2878	2256.3		
<u>5. Old Families</u>				
White Collar	.3867	4400.8	348.1 <sup>†</sup>	201.2
Blue Collar	.2725	3508.3	521.4	227.5
<u>6. Other Families</u>				
Young	.4749	3573.5		227.7 <sup>†</sup>
Not-Working	.3585	2723.8		357.8 <sup>†</sup>

1. Values are coefficients in  $\gamma_i^* = \sum_j \gamma_{ji}^* x_{jh}$ ,  $i=1, \dots, n$ .

All estimates are significant at the 5 per cent level except those denoted by † and ++ where the (absolute) t-values are between 1 and 2, and less than 1 respectively.

2. Numbers refer to tables 1 - 6 .

Table 8 : Estimates of Subsistence Sum Coefficients,  $\sum_i \gamma_{ji}^*$ ,  
Using Assumed Values of the Frisch Parameter,  $\omega$

Household Type <sup>1</sup>	$-\omega$	$\sum \bar{\gamma}_i^{*2}$	Intercept ( $\sum \gamma_{0i}^*$ )	Family Size ( $\sum \gamma_{2i}^*$ )
<u>1. Single Person</u>				
Working	1.81	1191	1191	
Not-Working	2.41	710	710	
<u>2. Single Parent</u>				
Working	2.12	1615	2349	-412.1
Not-Working	2.67	1262	381	396.7
<u>3. Old Married Couples</u>				
White Collar: Wife NW	2.05	1944	1944	
White Collar: Wife W	1.95	2113	2113	
Blue Collar: Wife NW	2.22	1664	1664	
Blue Collar: Wife W	2.07	1907	1907	
<u>4. Other Married Couples</u>				
Young	2.13	1807	1807	
Not-Working	2.51	1291	1291	
<u>5. Old Families</u>				
White Collar: Wife NW	2.50	2958	2452	201.2
White Collar: Wife W	2.38	3176	2700	201.2
Blue Collar: Wife NW	2.72	2551	1942	227.5
Blue Collar: Wife W	2.55	2798	2241	227.5
<u>6. Other Families</u>				
Young	2.70	2296	1809	227.7
Not-Working	2.63	2179	1571	357.8

- Numbers correspond to tables 1 - 6. Wife NW denotes Wife Not-Working, Wife W denotes Wife Working.
- Total subsistence sum. Where children are present it represents the value at mean family size for the particular household type.

Table 9 : Estimates of Subsistence Expenditure on Food,  $\gamma_1^*$ ,  
in 1967/8 Australian Dollars<sup>1</sup>

Household Type	Number of Children					Households with Children	
	0	1	2	3	4	* $\gamma_{01}$	* $\gamma_{21}$
<u>Single Head</u>							
Working	379	657	763	869	975	550.9	106.0
Not-Working	370	503	677	851	1024	329.6	173.7
<u>Old Couples &amp; Families</u>							
White Collar : Wife NW	777	1016	1130	1244	1358	901.6	114.1
White Collar : Wife W	766	1030	1144	1258	1372	915.8	114.1
Blue Collar : Wife NW	900	921	1062	1203	1344	779.4	141.1
Blue Collar : Wife W	912	1005	1146	1288	1429	864.2	141.1
<u>Other Couples &amp; Families</u>							
Young : Wife NW	774	812	961	1110	1258	663.6	148.6
Not-Working	654	791	949	1107	1265	632.8	158.1

1. Based on tables 1 - 6, 8 and equation (6) in text. Last two columns refer to intercept and coefficient of number of children in equation for subsistence expenditure on food in regressions where children are present. These estimates are used to calculate the entries in the four columns to the left. Entries for zero children are based on separate regressions. Wife NW denotes wife Not Working; Wife W denotes wife Working.

Table 10 : Estimates of Subsistence Expenditure on Durables,  $\gamma_5^*$ , in 1967/8 Australian Dollars<sup>1</sup>

Household Type	Number of Children					Households with Children	
	0	1	2	3	4	$\gamma_{05}^*$	$\gamma_{25}^*$
<u>Single Head</u>							
Working	-12	273	117	-39	-196	429.6	-156.3
Not-Working	20	4	30	56	83	-22.3	26.2
<u>Old Couples &amp; Families</u>							
White Collar : Wife NW	250	286	283	279	277	288.7	-3.0
White Collar : Wife W	507	373	370	367	364	375.7	-3.0
Blue Collar : Wife NW	-13	164	168	172	176	160.5	3.8
Blue Collar : Wife W	106	200	204	208	211	196.3	3.8
<u>Other Couples &amp; Families</u>							
Young : Wife NW	-320	-3	18	39	60	-24.6	21.2
Not-Working	103	282	305	328	351	259.1	22.9

1. Based on tables 1-6, 8 and equation (6) in text. Last two columns refer to intercept and coefficient of number of children in equation for subsistence expenditure on food in regressions where children are present. These estimates are used to calculate the entries in the four columns to the left. Entries for zero children are based on separate regressions. Wife NW denotes wife Not Working; wife W denotes wife Working.

Table 9 shows that estimates of "subsistence expenditure" on food always increase with family size, as expected. The marginal effect on "subsistence expenditure" of an additional child after the first lies in the range \$110 - \$170 for all household types. The separate regressions for households with and without children yield consistent results in that moving from a given household type without children to the same household type with one child always produces an increase in "subsistence expenditure" on food. This marginal effect tends to be greater than the marginal effect on subsistence of additional children, implying the existence of economies of scale.

The estimates for "subsistence" expenditure on durables given in table 10 portray a somewhat different picture. The estimates are, as expected, considerably lower than for food, and for low income groups close to zero (or negative) : single parents, young families, blue collar couples where the wife is not working. The highest estimates occur for white collar families where the wife is working. The marginal effect of children is relatively small except in one case where the parameters are not well determined (single working parents).

## 6. CONCLUDING REMARKS

In this paper the relationships between two demand systems, ELES and LES, have been used to obtain instrumental variable estimates of Engel curves for about fourteen "representative consumers." Two important findings emerge : for "young" families it is important to classify according to whether the wife is working or not; for "old" families the key factor influencing consumption patterns appears to be occupational category, in particular, whether the household head is a white or blue collar worker.

These results hold for couples without children as well as for those with children. Unfortunately, however, the model does not capture consumption patterns of young households where both husband and wife are working. It is likely that a more thorough treatment of expenditure on housing and durables is required for this and some other household types.

By interpreting Engel curve estimates within the framework of demand systems based on the Klein-Rubin utility function it was possible to obtain estimates of "subsistence" expenditures on commodities. The difficulty here is that owing to measurement error in income it is necessary to either use inconsistent estimates of the "subsistence-sum" parameters, or else obtain such estimates from outside the sample. The difficulty with the latter approach is that little hard information exists on how key parameters vary with socio-economic and demographic factors. What is required for more reliable estimates of "subsistence" expenditure is more accurate data on the average and marginal propensity to save for different types of consumers in the community. Within the context of ELES/LES, knowledge of these two parameters enables an estimate to be obtained of the Frisch parameter, and thus of total subsistence expenditure.

APPENDIX A

COMMODITY CLASSIFICATION

1. Food
  - 1.1 Grocery Items
  - 1.2 Fruit and Vegetables
  - 1.3 Meat, Fish and Poultry (Fresh and Frozen)
  - 1.4 Food Away from Home
  
2. Cigarettes, Alcohol and Tobacco
  - 2.1 Cigarettes, Alcohol and Tobacco
  
3. Clothing
  - 3.1 Male and Female Clothing
  - 3.2 Materials, Manchester and Haberdashery
  
4. Household Overheads
  - 4.1 Rent Paid
  - 4.2 Rates
  - 4.3 Fuel, Gas, Electricity and Telephone
  - 4.4 Insurance Premiums
  
5. Durables
  - 5.1 Hardware, etc.
  - 5.2 Major Household Appliances
  - 5.3 Furniture, Furnishings and Floor Coverings

6. Medical and Chemists' Goods

- 6.1 Toilet Goods and Cosmetics
- 6.2 Personal Appearance, Care and Maintenance of Personal Items
- 6.3 Medical Goods, Drugs and Remedies
- 6.4 Medical, Hospital and Accident Insurance Premiums
- 6.5 Net Contributions to Medical and Hospital Funds
- 6.6 Medical, Hospital, Dental, Funeral Expenses

7. Transport

- 7.1 Fares
- 7.2 Motor Vehicle Operating Expenses
- 7.3 Motor Vehicle Repairs and Maintenance
- 7.4 Motor Vehicle Overhead Costs

8. Recreation

- 8.1 Entertainment and Recreational Expenses
- 8.2 Toys, Sporting Goods, Hobby Supplies
- 8.3 Recreational Overhead Expenses
- 8.4 Holiday and Travel Expenses

9. Other

- 9.1 Newspapers, Magazines, Books and Stationery
- 9.2 Garden Supplies and Florists' Goods
- 9.3 Miscellaneous
- 9.4 Legal, Accounting and Professional Services
- 9.5 Education and Tuition

APPENDIX BCHARACTERISTICS OF DATATable B1 : Single Head Households (tables 1 and 2)

	<u>Single Person</u>		<u>Single Parent</u>	
	<u>Working</u>	<u>Not Working</u>	<u>Working</u>	<u>Not Working</u>
No. observations	182	338	46	60
Mean no. children			1.78	2.22
Mean income (\$)	2526	1097	2528	1598
Mean total exp. (\$)	2662	1214	3057	2017
<u>Average Budget Shares</u>				
Food	.228	.376	.319	.444
Cigarettes	.071	.034	.047	.026
Clothing	.071	.067	.083	.083
Housing	.169	.204	.140	.165
Durables	.116	.035	.082	.049
Medical	.079	.106	.077	.070
Transport	.101	.036	.074	.055
Recreation	.104	.075	.082	.041
Other	.061	.068	.097	.066

Table B2 : Married Couples (tables 3 and 4)

	Head < 35		Head ≥ 35		Neither Working
	Wife Not Working	Wife Working	White Collar	Blue Collar	
No. observations	88	180	168	327	314
Mean income (\$)	3277	4558	4221	3040	1873
Mean total exp. (\$)	3407	4185	3934	3205	2146
<u>Av. Budget Shares</u>					
Food	.260	.243	.263	.319	.362
Cigarettes	.054	.051	.065	.064	.042
Clothing	.061	.082	.092	.072	.072
Housing	.148	.133	.106	.103	.127
Durables	.183	.193	.126	.114	.080
Medical	.078	.078	.099	.096	.085
Transport	.109	.101	.098	.106	.089
Recreation	.072	.080	.100	.081	.091
Other	.035	.039	.051	.045	.052

Table B3 : Married Couples with Children (tables 5 and 6)

	Head < 35		Head ≥ 35		Neither Working
	Wife Not Working	Wife Working	White Collar	Blue Collar	
No. observations	864	109	778	1297	84
Mean no. children	2.14	2.05	2.48	2.62	1.70
Mean income (\$)	3188	3805	5148	4016	3842
Mean total exp. (\$)	3646	4058	5038	4172	3516
<u>Av. Budget Shares</u>					
Food	.322	.311	.294	.344	.340
Cigarettes	.047	.055	.050	.053	.056
Clothing	.070	.081	.097	.086	.092
Housing	.117	.111	.083	.086	.112
Durables	.154	.145	.129	.113	.093
Medical	.086	.081	.084	.086	.082
Transport	.101	.104	.097	.110	.091
Recreation	.062	.063	.094	.068	.079
Other	.040	.049	.073	.054	.055

## APPENDIX C

Table C1 : Estimates of Engel Curves : Married Couples with Non-Working Children where Head aged 35 years or more, Classified by Occupation<sup>1</sup>

Commodity	Intercept		Wife in Workforce <sup>2</sup>		Marginal Budget Share		Family Size <sup>3</sup>	
	White Collar	Blue Collar	White Collar	Blue Collar	White Collar	Blue Collar	White Collar	Blue Collar
Food	500.6	514.7	7.6	36.7**	.1516**	.1591**	79.4**	88.3**
Cigarettes	-75.7	118.6	24.4	32.2**	.0660**	.0260	-9.3	-13.4*
Clothing	-156.0	-164.2	14.5	42.2**	.1226**	.1236**	1.0	-6.6*
Housing	196.8	405.7	-31.1	43.9**	.0530**	-.0191	-9.5	5.7
Durables	-174.1	-392.4	41.0	-26.5*	.1833**	.2283**	-29.8	-21.6
Medical	121.1	36.9	-0.8	-40.7	.0626**	.0776**	-5.8	1.9**
Transport	128.1	167.0	12.2	21.6*	.0519**	.0662*	19.7**	-15.8
Recreation	-108.2	-241.5	-81.1	-60.1	.1415**	.1536**	-45.0*	-32.5*
Other	-432.6	-444.7	13.2	-49.4*	.1674**	.1847**	-0.6	-6.1**

1. Breakdown is by occupation of household head into White Collar and Blue Collar with 567 and 772 observations respectively, and mean values for total household expenditure of \$4851 and \$3753. One asterisk on a coefficient indicates that the t-value on the corresponding ELES slope coefficient is between 1 and 2; two asterisks that it exceeds 2. (No tests are conducted on the intercept.)
2. Figures represent coefficient on dummy variable which takes the value of 1 if wife of household head is working, 0 if not. The mean value of the variable is 0.19 for white collar households and 0.24 for blue collar households.
3. Explanatory variable is number of children in household; mean values are 2.48 for white collar households and 2.56 for blue collar households.

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