THE IMPACT OF INTRA HOUSEHOLD BALANCE OF POWER ON EXPENDITURE PATTERN: THE AUSTRALIAN EVIDENCE*

PUSHKAR MAITRA
Monash University

RANJAN RAY
University of Tasmania

The collective approach to household behaviour models the household utility function as the weighted average of the utilities of the individual members of the household. These weights, which measure the relative bargaining power of males and females within the household, are generally regarded as fixed and exogenous. The paper extends the collective approach and estimates a model where the weights are endogenously determined. The novelty of the analysis lies in the simultaneous equations estimation of the bargaining power and the budget share equation that allow for the endogeneity of the power variable in the examination of its impact on the budget share of the various items. The estimation is conducted using data from the 1998–99 Australian Household Expenditure Survey data set. The relative bargaining power of males and females have statistically significant effects on household expenditure patterns. The analysis reveals some interesting non-monotonic relationships between relative power and budget shares that vary a great deal between commodities.

I. Introduction

Does the "power" of an individual in making household decisions have an impact on that household's expenditure pattern? Specifically, what is the nature and magnitude of the impact, if any, of changing power relationships inside the household on the budget share of various items in the household's expenditure? What are the principal determinants of the "power" of an individual in making decisions? More fundamentally, what is an appropriate measure of "power"? If, as we report later, the answer to the first question turns out to be positive, then the next two questions acquire considerable policy importance. This paper attempts to answer some of these questions using household level unit record data from Australia.

The traditional models of the household are typically based on the notion that household preferences can be characterised by a single utility function. While this approach has proved useful for its elegance and analytical tractability, the underlying hypothesis of a single utility function encompassing all family members has been increasingly challenged in recent years. Such challenges have included attempts at modelling household utility to incorporate divergent

Correspondence: Ranjan Ray, School of Economics, University of Tasmania, Hobart, Tas 7001, Australia.
Ranjan.Ray@utas.edu.au
* Funding provided by the Australian Research Council Discovery Grant scheme is gratefully acknowledged. Ranjan Ray also acknowledges the funding provided by an ARC Large Grant. The authors thank Gary Deng for his excellent and painstaking research assistance and an anonymous referee for comments on an earlier version. The usual caveat applies.

and conflicting preference of different family members. In particular, Chiappori (1988) and Browning and Chiappori (1998) propose a "collective" approach based on a model of intra household resource allocation that obeys a Pareto efficient sharing rule satisfying certain regularity conditions.[1] According to this framework, household utility is defined as the weighted sum of the utility of individual members of the household. These welfare weights turn out to be proxies for the power of each member of the household.

Basu (2001) has pointed out that a potentially limiting characteristic of these models is that the welfare weights that are assigned to each member are generally regarded as exogenous to the household decision making process. To be a little more specific, consider a household with two members – a man and a woman. Define the Pareto weight of the individual to be $\theta \in [0, 1]$ which, in other words, measures the balance of power within the household. Let z denote the set of variables that determine θ so that the power function can be written as $\theta(z)$. In the traditional collective model of the household, z typically consists of variables that are exogenous to the household. Basu (2001) criticises this assumption and argues that there are reasons to believe that θ might be affected by changes in the household's choice vector. For example, the power of a woman in influencing household decisions is determined by her share of total earnings,[2] which, in turn, depends on the labour supply of the spouses. Since labour supply is a choice variable for the household, θ gets influenced by the household's decision.

This paper examines whether relative spousal power (measured by her/his income share) has an effect on household expenditure patterns. The notion that female income-share has significant effects on household expenditure patterns is nothing new. Hoddinott and Haddad (1995) using data from Cote D'Ivoire find that raising women's share of cash income increases the budget share of food and reduces the budget shares of alcohol and cigarettes. See, also, Phipps and Burton (1998) for Canadian evidence on the differential impact of male and female incomes on household expenditure pattern. Koolwal and Ray (2002), using a woman's educational experience *vis-à-vis* the man's, as a measure of her bargaining power, observe on Nepalese data some interesting non-monotonic relationships between a woman's "power" and the household's expenditure outcomes. More recently, Maitra and Ray (2002) using data from South Africa find that the identity of the income recipient has an important effect on expenditure shares. However, unlike Hoddinott and Haddad (1995) and Phipps and Burton (1998), we, in this paper, allow for the endogeniety of the bargaining power variable and provide evidence on the impact of household characteristics on the intra household balance of power. The 3SLS simultaneous equations estimation procedure, that is used here, not only recognises the endogeniety of the power variable in the budget share regression and also allows for a non-diagonal covariance matrix between the errors of the various equations.

The rest of the paper is organised as follows: Section II lays out the theoretical framework and the estimation methodology. Section III describes the data set used and discusses some of its salient features. The empirical results are presented and discussed in Section IV. Evidence on the robustness of the regression results to the estimation methodology is presented in Section V. The paper ends on the concluding note of Section VI.

[1] See Manser and Brown (1980) and McElroy and Horney (1981) for cooperative bargaining models and Kanbur and Haddad (1994) and Lundberg and Pollak (1994) for non-cooperative bargaining models.
[2] See Blumberg and Coleman (1989), Desai and Jain (1994) and Riley (1997) for sociological and anthropological evidence in support of this proposition.

II. Estimation Methodology

The essence of the collective approach[3] based household models is that allocations within the household are Pareto Efficient. Following Browning and Chiappori (1998), the household's objective function can be written as the weighted sum of utilities of the different members. Consider a household with two members: a man (m) and a woman (f). Assuming that utility depends on both consumption (x) and leisure (l), the household's problem can be written as:

$$\text{Max } \theta U_m(x_m, x_f, l_m, l_f) + (1 - \theta)U_f(x_m, x_f, l_m, l_f) \tag{1}$$

subject to the full income constraint:

$$\sum_{i=m,f} p'x_i \leq \sum_{i=m,f} w_i(T_i - l_i) + I \tag{2}$$

U_i represents the utility of member $i(i = m, f)$, x_i represents a vector of private consumption of individual i, w_i, T_i, l_i represent the wage rate, time endowment and leisure of individual i. Total household unearned income is I and p represents the vector of prices. Note that prices and wages are assumed to be exogenous. The variable $\theta \in [0, 1]$, which denotes the welfare weight of member m, depends on prices, household income and other variables such as household size, socio economic status of the household, etc.

The household level budget share of good $g(b^g)$ can be written as the θ weighted average of the budget shares of that good for the spouses (m, f), namely b_m^g and b_f^g so that $b^g = \theta b_m^g + (1 - \theta)b_f^g$. If we include other household characteristics (such as household size and composition variables) as additional explanatory variables, we can write the estimating equation as follows:[4]

$$b^g = \alpha_0^g + \alpha_1^g\theta + \beta_m^g\theta^2\mu + \beta_f^g(1 - \theta)^2\mu + \gamma^g z + \varepsilon^g; \quad g = 1, \ldots, G \tag{3}$$

where μ denotes household income and z denotes a vector of other household characteristics that potentially affect expenditure patterns within the household.

Turning now to the bargaining power variable, θ, the literature traditionally assumes that it is a function of exogenous variables, which we will call the z-vector, so that $\theta = \theta(z)$. Clearly this is a restrictive assumption and in reality $\theta(z)$ is likely to be endogenous to household decision-making. One of the contributions of this paper is that it provides for the endogenous determination of $\theta(z)$ by allowing the z-vector to include choice variables. θ denotes the male share of household earnings as a measure of male power within the household.[5] Investigation of the impact of θ on budget share is a crucial feature of the present study. However θ, thus defined, could be correlated with the unobserved determinants of budget shares, i.e. θ is potentially endogenous in the budget share equations. Hence, the empirical analysis is based on a 3SLS estimation procedure that allows for the simultaneity and joint endogeniety of θ and the budget shares, b^g.

An important conclusion of the unitary household model is that the power of an individual member of the household does not have any effect on household expenditure patterns. In our framework this implies that θ does not have any effect on the household expenditure patterns.

[3] See Chiappori (1992), Bourguignon, Browning, Chiappori and Lechene (1993), Browning and Chiappori (1998). Strauss, Mwabu and Beegle (2000) provide an excellent summary of the issues involved.

[4] The parameters β_m^g, β_f^g that enter non-linearly in equation (3) are the income coefficients in the budget share equations of, respectively, the male and the female spouse.

[5] As we have noted earlier, there is a fairly large literature in sociology and anthropology that argues that male share of earnings is a good measure of his bargaining power within the household.

The sufficient condition for θ not to have any effect on household expenditure patterns is given by the condition:

$$\alpha_1^g = 0;\ \beta_m^g\theta = \beta_f^g(1-\theta) \tag{4}$$

A test of the unitary model is, hence, a joint test of the null hypothesis, namely, that θ does not have any effect on household expenditure patterns. However, complications arise from the fact that the null hypothesis in equation (4) is data dependent and therefore the test needs to be conducted at different values of θ.

To account for the potential endogeniety of male power in the budget share equations, we jointly estimate male power and the budget shares using 3SLS. This allows us to take into account not only the potential endogeniety of the bargaining power (θ) and the budget share (b^g) variables but also the mutual feedback between the equations via a non diagonal covariance matrix of their residuals. The empirical analysis is based on estimating the following system of equations:

$$\theta = \theta(x) + v_1 \tag{5a}$$

$$b^g = b^g(\theta, z) + v^g;\ g = 1, \ldots, G \tag{5b}$$

where x, z are the vectors of exogenous determinants in the two equations, and v_1, v^g are the stochastic error terms. Note that the bargaining power variable θ affects budget shares in two ways: the first is directly (through the direct inclusion of θ as an explanatory variable in the budget share regressions) and the second is via the income share rule – remember that the incomes of the two members of the household are obtained as $\theta\mu$ and $(1-\theta)\mu$. We would be misinterpreting the results if we ignore this indirect effect.

The set of exogenous explanatory variables in the male power regression (x) include male share of education and the square of the male share of education, the number of and the square of the number of usual residents in the household, log of and the square of the log of household expenditure, and country of birth of the household reference person and the spouse of the reference person in the household.[6] We choose these variables because we expect them to be correlated with relative power within the household. For example relative earning capacity and hence relative bargaining power could be related to the relative educational attainment of the couple. Relative bargaining power could be significantly affected by household size and socio-economic status of the household (captured by total household expenditure). Finally the country of birth of the household reference person and his/her spouse could capture the effect of societal norms and customs on relative bargaining power within the household. The set of exogenous variables included in the budget share equations include household size (number of usual residents in the household), household composition (number of members in the different age sex categories), sex of the household reference person, years of schooling of the male and female adult member of the household and the province of residence.

III. Data and Descriptive Statistics

The data set used in this paper came from the 1998–99 Australian Household Expenditure Survey (HES). The data was collected over the twelve-month period July 1998–June 1999, using

[6] The male share of education is obtained as: $E_m/(E_m + E_f)$, where $E_m(E_f)$ denotes the years of education of the male (female) member of the household.

interviews though participants were also required to record in a diary all their expenditures over a two-week period. Detailed information was collected on expenditure, income and demographic characteristics of a sample of households residing in private dwellings in Australia. The data set excludes individuals residing in special dwellings (like hospital, institutions, nursing homes, hotels and hostels) and dwellings in remote and sparsely populated regions in Australia. Information was collected from all individuals aged 15 and over in the selected households. The full data set consists of 6892 households (and 13 964 persons). For the purposes of this paper we will restrict ourselves to "couple households" with at least one adult reporting non-zero earned income, which leaves us with a data set comprising of 3487 households. For more on the data set used in the paper see ABS (2002).

We use a 12-commodity classification of household expenditure: current housing costs, domestic fuel and power, food and non-alcoholic beverages, tobacco products, clothing and footwear, medical care and health expenses, transport, recreation, personal care, miscellaneous goods and services, and other expenditure. The average budget share of each of these 12 commodities is presented in Table I. The expenditure on food constitutes the larges share of expenditure, followed by expenditure on transport, current housing costs and recreation (ignoring expenditure on other items). Expenditure on other items is the aggregate of household weekly expenditure on household furnishings and equipment, household services and operation, mortgage repayments, other capital housing costs, income tax and superannuation and life insurance. This is the omitted category in all our regressions. The average male earned income is roughly double the average female earned income. Remember that θ is defined as the male share of earned income and the average value of θ is around 0.65. There is also very little difference in the average years of schooling attained by the male and female members of the household.

Table I Descriptive statistics

Variable	*Sample size*	*Mean*	*Standard deviation*
Current housing costs	3487	0.0934	0.0747
Domestic fuel and power	3487	0.0196	0.0140
Food and non-alcoholic beverages	3487	0.1393	0.0649
Alcoholic beverages	3487	0.0196	0.0275
Tobacco products	3487	0.0103	0.0219
Clothing and footwear	3487	0.0326	0.0390
Medical care and health expenses	3487	0.0344	0.0366
Transport	3487	0.1138	0.1037
Recreation	3487	0.0868	0.0713
Personal care	3487	0.0138	0.0159
Miscellaneous goods and services	3487	0.0599	0.0587
Other expenses	3487	0.3764	0.1529
θ	3487	0.6571	0.3190
Female earned income	3487	338.29	348.0713
Male earned income	3487	716.92	605.9781
Male years of schooling	3487	12.5057	2.3369
Female years of schooling	3487	12.1301	2.2511
Male share of schooling	3487	0.5075	0.0469
Per capita income	3487	321.39	180.2046
Total household expenditure	3487	14 4467.80	85 187.8700
Household size	3487	3.5211	1.2286

Note: The expenditure and income figures are weekly amounts and in Australian dollars.

Table II Coefficient estimates of male power

	Male power
Constant	9.902*** (1.554)
Male share of education	−0.973 (1.556)
Male share of education squared	1.607 (1.533)
Log household expenditure	−1.544*** (0.257)
Log household expenditure squared	0.064*** (0.011)
Number of usual residents in the household	0.093*** (0.020)
Number of usual residents in the household squared	−0.009*** (0.003)
Country of birth of household reference person: Australia	−0.005 (0.027)
Country of birth of spouse of household reference person: Australia	−0.020 (0.039)
Country of birth of household reference person: other Oceania	−0.003 (0.030)
Country of birth of spouse of household reference person: other Oceania	−0.000 (0.039)
Country of birth of household reference person: North West Europe	−0.120*** (0.043)
Country of birth of spouse of household reference person: North West Europe	−0.016 (0.026)
Country of birth of household reference person: Southern Europe	0.026 (0.038)
Country of birth of spouse of household reference person: Southern Europe	−0.052* (0.029)
Country of birth of household reference person: South-East Asia	−0.069* (0.039)
Country of birth of spouse of household reference person: South-East Asia	0.055 (0.039)
Number of households	3487

Notes: Standard errors in parentheses.
* Significant at 10%; ** significant at 5%; *** significant at 1%.

IV. Estimation Results

Tables II and III present the 3SLS estimates of the male power (Table II) and the 12 budget share equations (Table III). Note that the budget share estimates of the omitted category (other expenditure) are obtained using the "adding up" condition. Using a standard Breusch-Pagan Test we are able to reject the null-hypothesis of independence of the residuals across the equations.[7] This implies that the OLS estimates will be inconsistent.[8]

The regression results presented in Table II indicate that there is a u-shaped relationship between the log of household expenditure and male power and interestingly an inverse u-shaped relationship between household size and male power. This essentially implies that as household expenditure starts increasing, male bargaining power starts falling but ultimately there is an upward turn. The opposite relationship holds for household size. The coefficient estimates imply that the relationship between the log of household expenditure and male power changes sign once household expenditure increases beyond $173,251.6. What is interesting is that it still covers more than 27 per cent of the households. On the other hand the relationship between household size and male power changes sign once household size increases beyond 5.17 but that covers less than six per cent of the households. The share of education attained by the male member of the household does not have a statistically significant effect on male power. This is possibly a reflection of the fact that there is not much difference between male and female years of education attained and $E_m/(E_m + E_f)$ does not vary a great deal (unlike in many developing countries) and the average value of male share of education is approximately 0.5.

In the conventional unitary household model, the identity of the income recipient is irrelevant in the determination of the household's expenditure outcomes. In other words, a test of H_0:

[7] Breusch-Pagan test of independence: $\chi^2(55) = 25.669$, Pr = 0.0000.
[8] We computed the OLS estimates for the budget share of food and non-alcoholic beverages as a part of examining the robustness of the results to alternative estimation techniques. These results are presented in Table v.

Table III 3SLS budget share estimates

	Housing	*Fuel and power*	*Food*	*Alcohol*	*Tobacco*	*Clothing and footwear*	*Health*	*Transp.*	*Recr.*	*Personal care*	*Misc.*
θ	0.590***	0.191***	0.994***	0.000	0.075***	–0.021	0.128***	–0.324***	–0.084*	0.028**	–0.019
	(0.069)	(0.018)	(0.094)	(0.019)	(0.016)	(0.027)	(0.028)	(0.077)	(0.050)	(0.011)	(0.040)
$\theta(\theta\mu)$	–0.409***	–0.125***	–0.673***	–0.009	–0.053***	0.009	–0.091***	0.073	0.022	–0.026***	–0.015
	(0.048)	(0.013)	(0.065)	(0.013)	(0.011)	(0.019)	(0.019)	(0.053)	(0.035)	(0.008)	(0.028)
$(1-\theta)((1-\theta)\mu)$	0.866***	0.278***	1.418***	–0.004	0.102***	–0.057	0.179***	–0.626***	–0.159	0.030	–0.045
	(0.138)	(0.036)	(0.186)	(0.038)	(0.033)	(0.054)	(0.055)	(0.154)	(0.101)	(0.023)	(0.081)
Log (number of usual residents)	–0.070***	–0.006***	–0.000	–0.000	–0.007***	0.024***	–0.006**	0.026***	0.012**	0.002*	0.027***
	(0.007)	(0.002)	(0.009)	(0.002)	(0.002)	(0.003)	(0.003)	(0.007)	(0.005)	(0.001)	(0.004)
One or more aged 0–2	0.015**	–0.009***	–0.064***	–0.005**	–0.003**	0.002	–0.013***	0.005	–0.015***	–0.006***	–0.017***
	(0.007)	(0.002)	(0.009)	(0.002)	(0.002)	(0.003)	(0.003)	(0.008)	(0.005)	(0.001)	(0.004)
One aged 2–4	0.009	–0.004***	–0.037***	–0.005***	–0.002	–0.005**	–0.006**	–0.015**	–0.003	–0.002**	–0.014***
	(0.006)	(0.002)	(0.008)	(0.002)	(0.001)	(0.002)	(0.002)	(0.007)	(0.004)	(0.001)	(0.004)
Two or more aged 2–4	0.020*	–0.008***	–0.059***	–0.010***	–0.003	–0.015***	–0.014***	–0.005	0.012	–0.006***	–0.031***
	(0.012)	(0.003)	(0.016)	(0.004)	(0.003)	(0.005)	(0.005)	(0.014)	(0.009)	(0.002)	(0.008)
One aged 5–9	0.011**	–0.004***	–0.028***	–0.004***	–0.000	–0.006***	–0.007***	–0.008	–0.007*	–0.004***	–0.013***
	(0.005)	(0.001)	(0.007)	(0.002)	(0.001)	(0.002)	(0.002)	(0.006)	(0.004)	(0.001)	(0.003)
Two or more aged 5–9	0.018**	–0.003	–0.029***	–0.003	0.001	–0.009***	–0.009***	–0.022***	–0.011*	–0.006***	–0.017***
	(0.007)	(0.002)	(0.010)	(0.002)	(0.002)	(0.003)	(0.003)	(0.008)	(0.006)	(0.001)	(0.004)
One or more aged 10–12	0.015***	–0.001	–0.011*	–0.004***	–0.000	–0.004**	–0.005**	–0.022***	0.003	–0.001	0.004
	(0.005)	(0.001)	(0.006)	(0.001)	(0.001)	(0.002)	(0.002)	(0.006)	(0.004)	(0.001)	(0.003)
One or more aged 13–14	0.022***	0.005***	0.024***	–0.006***	0.000	–0.007***	–0.000	–0.032***	–0.007	–0.001	0.008**
	(0.006)	(0.001)	(0.007)	(0.002)	(0.001)	(0.002)	(0.002)	(0.006)	(0.004)	(0.001)	(0.003)
Household reference person: male	–0.057***	–0.021***	–0.114***	–0.002	–0.008***	–0.008**	–0.015***	0.034***	–0.001	–0.005***	–0.001
	(0.010)	(0.003)	(0.013)	(0.003)	(0.002)	(0.004)	(0.004)	(0.011)	(0.007)	(0.002)	(0.006)
Years of schooling of male member	–0.001	–0.001***	–0.002*	–0.001***	–0.001***	0.000	–0.000	–0.002*	0.002***	–0.000**	0.002***
	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)

Table III *Continued*

	Housing	*Fuel and power*	*Food*	*Alcohol*	*Tobacco*	*Clothing and footwear*	*Health*	*Transp.*	*Recr.*	*Personal care*	*Misc.*
Years of schooling of female member	0.001	–0.000	0.001	–0.000*	–0.001***	0.000	–0.000	–0.003***	–0.000	0.000**	0.001
	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
Resident of Victoria	–0.019***	0.008***	0.012**	–0.001	0.000	0.000	–0.003*	0.011**	0.007**	0.000	0.001
	(0.005)	(0.001)	(0.006)	(0.001)	(0.001)	(0.002)	(0.002)	(0.005)	(0.003)	(0.001)	(0.003)
Resident of Queensland	–0.000	–0.004***	–0.006	–0.000	0.000	–0.003	–0.002	–0.004	0.009**	–0.002**	0.002
	(0.005)	(0.001)	(0.007)	(0.001)	(0.001)	(0.002)	(0.002)	(0.006)	(0.004)	(0.001)	(0.003)
Resident of South Australia	–0.006	0.006***	0.005	–0.003	–0.000	–0.002	–0.002	–0.011	0.012**	–0.001	0.007*
	(0.007)	(0.002)	(0.009)	(0.002)	(0.002)	(0.003)	(0.003)	(0.008)	(0.005)	(0.001)	(0.004)
Resident of Western Australia	–0.019***	0.005***	0.005	0.003	0.002	–0.005**	0.000	0.013*	0.011**	–0.001	0.000
	(0.006)	(0.002)	(0.008)	(0.002)	(0.001)	(0.002)	(0.003)	(0.007)	(0.005)	(0.001)	(0.004)
Resident of Tasmania	–0.025***	0.006***	–0.016*	–0.002	–0.001	–0.000	–0.002	0.001	0.017***	–0.001	0.006
	(0.007)	(0.002)	(0.009)	(0.002)	(0.002)	(0.003)	(0.003)	(0.008)	(0.005)	(0.001)	(0.004)
Resident of Northern Territory	0.024***	0.005***	0.013	0.004**	0.004**	–0.013***	–0.006**	–0.005	0.014***	–0.002	–0.002
	(0.007)	(0.002)	(0.009)	(0.002)	(0.002)	(0.003)	(0.003)	(0.008)	(0.005)	(0.001)	(0.004)
Resident of ACT	–0.010	0.002	–0.020*	–0.005*	0.000	–0.001	–0.006	0.018*	0.012*	0.000	0.003
	(0.009)	(0.002)	(0.011)	(0.002)	(0.002)	(0.004)	(0.004)	(0.010)	(0.007)	(0.001)	(0.005)
Constant	–0.173***	–0.071***	–0.388***	0.041***	0.001	0.030*	–0.020	0.370***	0.115***	0.002	0.017
	(0.044)	(0.012)	(0.059)	(0.012)	(0.010)	(0.017)	(0.018)	(0.049)	(0.032)	(0.007)	(0.026)
Number of households	3487	3487	3487	3487	3487	3487	3487	3487	3487	3487	3487

Notes: Standard errors in parentheses.
* Significant at 10%; ** significant at 5%; *** significant at 1%.
Omitted category: other expenditure.

$\partial b^g/\partial\theta = 0$, i.e. of the hypothesis that a change in the male's share of household earnings (θ) has no impact on budget share (b^g), constitutes a convenient test of the unitary household model. In the collective household model, a change in θ affects household expenditure pattern by: (1) altering the income of the household, and (2) modifying the household preferences in favour of that of the partner who now has a greater "say" in the household decisions. In Basu's extension of the collective household model (Basu 2001) that endogenises θ, (1) and (2) feed through to θ itself which, in turn, leads to a further change in household preferences. The traditional version of the collective household model ignores this recursive effect due to its assumption of exogenous and non-changing θ and, consequently, distorts the impact of θ on budget share, b^g, even though it allows $\partial b^g/\partial\theta \neq 0$, unlike the unitary household model.

In view of the presence of linear and quadratic terms involving θ in the budget share equation, b^g, (see equation (3)), it is not possible to make inference on the sensitivity of b^g to θ by simply examining the statistical significance of the linear coefficient estimate, $\hat{\alpha}_1^g$. To do so, we need to impose and do a joint test ($\chi^2(2)$) of the two restrictions, given by equation (4), which will ensure $\partial b^g/\partial\theta = 0$. Table IV contains the computed χ^2 values, for each item and at a selection of θ values. A comparison with the critical ($\chi^2(2)$) values shows that there is widespread rejection of the hypothesis of insensitivity of budget share, b^g, to the male bargaining power, θ. This is consistent with the Indian evidence presented in Lancaster, Maitra and Ray (2004). Interestingly the null hypothesis that male power does not matter is not rejected for alcoholic beverages, clothing and footwear, recreation (for values of θ less than 0.4) and for miscellaneous expenditure (for value of θ less than 0.5). It is worth noting that, consistent with our results, Phipps and Burton (1998) also found, on Canadian data, that they were unable to reject the idea of income pooling, underlying the unitary household model, in case of alcohol though unlike Phipps and Burton (1998) we reject the notion of income pooling for tobacco, food and transport.

To obtain a clearer picture as to how the budget share is affected by changes in θ, we present in Figure 1 the predicted values of the budget shares as we vary θ over the interval [0, 1]. The values of the other explanatory variables are held constant at the respective sample means. Not surprisingly there is significant non-linearity in the effect of θ on the predicted budget shares. The budget shares of alcoholic beverages, clothing and footwear, transport, recreation and miscellaneous goods and services personal care follow an inverted u-shape. However, with the exception of clothing and footwear the predicted budget share at $\theta = 1$ exceeds that at $\theta = 0$. On the other hand the predicted budget share of current housing costs, domestic fuel and power, food and non-alcoholic beverages, tobacco, health expenses and personal care generally increase as θ increases over the interval [0, 1] and finally the predicted budget share of other expenses falls as θ increases over the interval [0, 1]. So while the present results for the major items are generally supportive of the previous rejections of the unitary household model, they also point to non-monotonic relationships between budget share of such items and bargaining power that appears to have been overlooked in much of the previous literature. This suggests a more complex relationship between household spending and a spouse's share of earnings than is appreciated in the literature.

Turning back to the 3SLS estimates of the budget shares (Table III), the following results are worth noting.

1. We find that household size generally has a statistically significant effect on the budget shares – the exceptions are food and non-alcoholic beverages and alcoholic beverages. However the sign of the coefficient varies. An increase in household size increases the budget share of clothing and footwear, transport, recreation, and miscellaneous goods and services but decreases the budget shares of current housing costs, domestic fuel and power, tobacco and medical care and health expenses.

Table IV Does male power matter? Tests at different values of θ

	Housing	*Fuel and power*	*Food*	*Alcohol*	*Tobacco*	*Clothing and footwear*	*Health*	*Transp.*	*Recr.*	*Personal care*	*Misc.*
$\theta = 0.0$	252.44***	396.45***	442.60***	0.48	97.28***	3.51	84.71***	17.94***	2.89	50.72***	0.57
$\theta = 0.1$	261.58***	416.99***	463.03***	0.31	100.84***	3.49	87.38***	19.05***	3.13	50.58***	0.37
$\theta = 0.2$	271.32***	440.94***	486.02***	0.14	104.54***	3.43	90.05***	21.79***	3.62	49.75***	0.23
$\theta = 0.3$	279.49***	465.83***	508.18***	0.01	107.41***	3.27	91.87***	27.77***	4.56	47.44***	0.32
$\theta = 0.4$	279.83***	482.08***	518.09***	0.07	106.83***	2.92	90.63***	39.77***	6.32**	42.20***	0.98
$\theta = 0.5$	258.79***	464.83***	488.58***	0.57	97.31***	2.26	81.90***	60.79***	9.24**	32.21***	2.75
$\theta = 0.6$	203.63***	382.72***	389.50***	1.76	74.03***	1.37	62.18***	87.56***	12.72***	18.41***	5.85**
$\theta = 0.7$	133.58***	257.36***	251.83***	3.20	45.19***	0.71	38.78***	105.00***	14.71***	8.06**	8.90**
$\theta = 0.8$	88.23***	162.07***	155.10***	4.09	26.90***	0.63	24.69***	104.58***	14.29***	6.43**	10.26**
$\theta = 0.9$	73.73***	119.73***	117.64***	4.34	21.42***	0.89	21.13***	94.61***	12.70***	10.19**	10.18***
$\theta = 1.0$	75.45***	109.83***	113.72***	4.27	22.60***	1.22	22.76***	83.56***	11.09***	15.08***	9.53**

Notes: * Significant at 10%; ** significant at 5%; *** significant at 1%.
Omitted category: other expenditure.

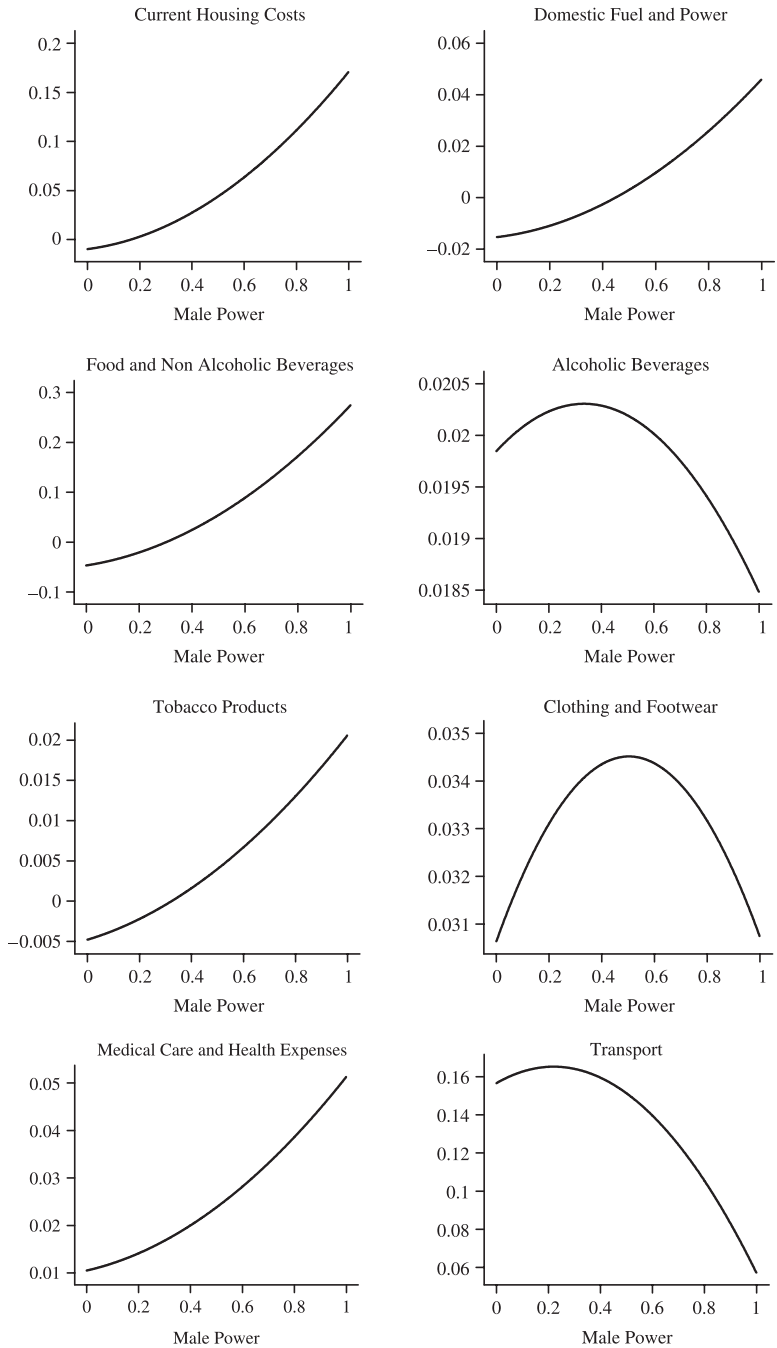

Figure 1. Effect of male power on predicted budget shares

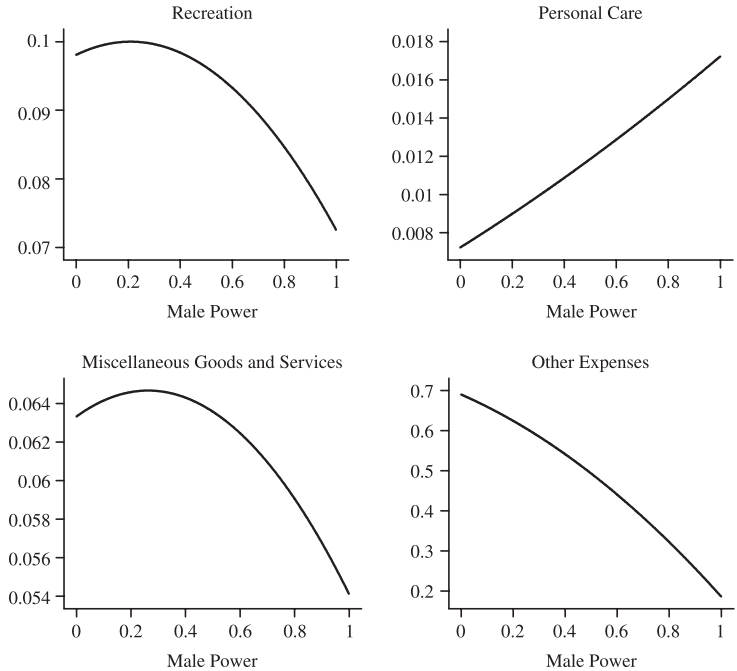

Figure 1. *Continued*

2. Relative to the residents of New South Wales, the residents of Victoria spend more on domestic fuel and power, food, transport and recreation but less on current housing costs and health care and medical expenditures. On the other hand relative to residents of New South Wales, residents of Queensland spend less on domestic fuel and power and miscellaneous goods and services but more on personal care.
3. Households where the reference person is male (i.e. male headed households) spend more on transport but significantly less on most of the other expenditure categories.
4. An increase in the years of education of the male adult member of the household significantly increases the expenditure share of domestic fuel and power, food and non-alcoholic beverages, alcohol, tobacco recreation and miscellaneous expenditure. An increase in the number of years of education of the female adult member of the household has a similar impact on expenditure shares though the effects are no longer statistically significant in many cases.

V. Robustness

We now turn to the issue of how robust our results are to the estimation methodology used. To examine the robustness of the results we computed the 2SLS, the SURE and the (equation by equation) OLS estimation regressions. In Table V we present the regression results for the budget shares of food and non-alcoholic beverages. The coefficient estimates are quite sensitive to whether we account for the potential endogeneity of male power or not. For example the coefficient estimate of θ is significantly higher in the 3SLS and 2SLS estimation of the budget share of food (0.994 and 0.864 respectively) compared to those obtained using SUR or OLS

Table V Budget share of food. Robustness of results to alternative estimation techniques

	3SLS	*2SLS*	*SURE*	*OLS*
θ	0.994***	0.863***	0.015**	0.015**
	(0.094)	(0.097)	(0.007)	(2.20)
$\theta(\theta\mu)$	–0.673***	–0.721***	–0.170***	–0.170***
	(0.065)	(0.066)	(0.010)	(16.46)
$(1-\theta)((1-\theta)\mu)$	1.418***	1.500***	–0.175***	–0.175***
	(0.186)	(0.194)	(0.019)	(8.99)
Log (number of usual residents)	–0.000	0.012	0.013***	0.013***
	(0.009)	(0.009)	(0.004)	(3.23)
One or more aged 0–2	–0.064***	–0.067***	–0.016***	–0.016***
	(0.009)	(0.010)	(0.004)	(4.46)
One aged 2–4	–0.037***	–0.037***	–0.011***	–0.011***
	(0.008)	(0.008)	(0.003)	(3.16)
Two or more aged 2–4	–0.059***	–0.062***	–0.009	–0.009
	(0.016)	(0.018)	(0.007)	(1.27)
One aged 5–9	–0.028***	–0.029***	–0.011***	–0.011***
	(0.007)	(0.008)	(0.003)	(3.46)
Two or more aged 5–9	–0.029***	–0.030***	–0.006	–0.006
	(0.010)	(0.011)	(0.004)	(1.37)
One or more aged 10–12	–0.011*	–0.012*	–0.009***	–0.009***
	(0.006)	(0.007)	(0.003)	(2.75)
One or more aged 13–14	0.024***	0.026***	0.005	0.005
	(0.007)	(0.008)	(0.003)	(1.56)
Household reference person: male	–0.114***	–0.121***	–0.015***	–0.015***
	(0.013)	(0.014)	(0.003)	(5.26)
Years of schooling of male member	–0.002*	–0.000	–0.002***	–0.002***
	(0.001)	(0.001)	(0.000)	(4.03)
Years of schooling of female member	0.001	–0.001	–0.002***	–0.002***
	(0.001)	(0.001)	(0.001)	(3.23)
Resident of Victoria	0.012**	0.012*	0.009***	0.009***
	(0.006)	(0.007)	(0.003)	(3.00)
Resident of Queensland	–0.006	–0.006	0.001	0.001
	(0.007)	(0.007)	(0.003)	(0.34)
Resident of South Australia	0.005	0.005	0.005	0.005
	(0.009)	(0.010)	(0.004)	(1.16)
Resident of Western Australia	0.005	0.005	0.000	0.000
	(0.008)	(0.009)	(0.004)	(0.13)
Resident of Tasmania	–0.016*	–0.017*	–0.005	–0.005
	(0.009)	(0.010)	(0.004)	(1.25)
Resident of Northern Territory	0.013	0.013	0.001	0.001
	(0.009)	(0.010)	(0.004)	(0.32)
Resident of ACT	–0.020*	–0.022*	–0.011**	–0.011**
	(0.011)	(0.013)	(0.005)	(2.00)
Constant	–0.388***	–0.304***	0.214***	0.214***
	(0.059)	(0.062)	(0.009)	(23.36)
Does male power matter? Tests at different values of θ[#]				
$\theta = 0.0$	442.60***	120.40***	224.31***	111.45***
$\theta = 0.1$	463.03***	115.88***	200.08***	99.41***
$\theta = 0.2$	486.02***	109.77***	167.28***	83.11***
$\theta = 0.3$	508.18***	101.55***	123.26***	61.24***
$\theta = 0.4$	518.09***	91.33***	68.47***	34.02***
$\theta = 0.5$	488.58***	81.79***	17.35***	8.62***
$\theta = 0.6$	389.50***	80.60***	10.93***	5.43***
$\theta = 0.7$	251.83***	93.28***	78.9***	39.20***
$\theta = 0.8$	155.10***	111.73***	177.80***	88.34***
$\theta = 0.9$	117.64***	126.18***	255.24***	126.82***
$\theta = 1.0$	113.72***	135.04***	302.75***	150.42***
Number of Households	3487	3487	3487	3487

Notes: Absolute value of t-statistics in parenthesis. Standard errors in parentheses.
* Significant at 10%; ** significant at 5%; *** significant at 1%.
[#] χ^2 tests for 3SLS, 2SLS and SURE and F tests for OLS.

(0.015 in both cases). Does that however mean that ignoring the potential endogeneity of θ results in under-estimation of the effect of male power on the expenditure share of food? The answer is no: remember that simply by looking at the coefficient estimate of θ we cannot really say anything regarding the impact of male power. To do so we need to conduct the joint tests (equation (4)) at the different values of θ. As before, the null hypothesis that male power does not matter is strongly rejected at every value of θ and for every specification.

VI. Conclusion

This paper examines the impact of changes in the bargaining power of adult members on a household's expenditure allocation. Since the conventional unitary model assumes that there is no impact, the statistical significance of this impact or otherwise constitutes a test of the unitary versus collective model of the household. This study on Australian Household Expenditure data, besides providing Australian evidence on this issue (see also Blacklow and Ray 2003), contains some new methodological and empirical features: first, we extend the collective models of the household, that have been proposed recently, by allowing the welfare weights to be determined from the data rather than fixed *a priori*; second, we allow these welfare weights to depend not only on the earnings share that has been conventionally used but also on additional variables such as the educational experiences of the adults, household income and household size; third, the study provides Australian evidence on the effect of "spousal power" on household expenditure patterns. The overall message from these results is that the bargaining power of the adult member does affect expenditure pattern and that the income-pooling hypothesis underlying the unitary model is rejected by the data. The paper provides evidence of non-monotonic relationships between the budget share of an item and bargaining power. It is interesting to note (see Figure 1) that the nature of these relationships varies a great deal between items.

References

ABS 2002, '1998–99 Household Expenditure Survey Australia Confidentialised Unit Record File (CURF), technical paper. second edition.

Basu, K. 2001, 'Gender and Say: A Model of Household Behaviour with Endogenously Determined Balance of Power', mimeo, Cornell University.

Blacklow, P and Ray, R. 2003, 'Intra-Household Resource Allocation, Consumer Preferences and Commodity Tax Reforms: Australian Evidence', *The Economic Record*, vol. 79(247), pp. 425–433.

Blumberg, R. and Coleman, M. 1989, 'A Theoretical Look at the Gender Balance of Power in the American Couple', *Journal of Family Issues*, vol. 10, pp. 225–250.

Bourguignon, F., Browning, M., Chiappori, P.A. and Lechene, V. 1993, 'Intrahousehold Allocation of Consumption: Some Evidence on French Data', *Annales d'Economie et de Statistique*, vol. 29, pp. 137–156.

Browning, M. and Chiappori, P.A. 1998, 'Efficient Intra Household Allocations: A General Characterisation and Empirical Tests', *Econometrica*, vol. 66(6), pp. 1241–1278.

Chiappori, P.A. 1988, 'Rational Household Labour Supply', *Econometrica*, vol. 56(1), pp. 63–89.

—— 1992, 'Collective Labour Supply and Welfare', *Journal of Political Economy*, vol. 100(3), pp. 437–467.

Desai, S. and Jain, D. 1994, 'Maternal Employment and Family Dynamics: The Social Context of Women's Work in Rural South India', *Population and Development Review*, vol. 20, pp. 115–136.

Hoddinott, J. and Haddad, L. 1995, 'Does Female Income Share Influence Household Expenditures? Evidence from Cote d'Ivoire', *Oxford Bulletin of Economics and Statistics*, vol. 57(1), pp. 77–95.

Kanbur, R. and Haddad, L. 1994, 'Are Better Off Households More Unequal or Less Unequal: A Bargaining Theoretic Approach to "Kuznets" Effects at the Micro Level', *Oxford Economic Papers*, vol. 46(3), pp. 445–458.

Koolwal, G. and Ray, R. 2002, 'Estimating the Endogenously Determined Intra Household Balance of Power and its Impact on Expenditure Pattern: Evidence from Nepal', Washington DC, World Bank.

Lancaster, G., Maitra, P. and Ray, R. 2004, 'Endogenous Intra Household Balance of Power and its Impact on Expenditure Patterns: Evidence from India', Discussion Paper 2004–04 of School of Economics, University of Tasmania.

Lundberg, S. and Pollak, R.A. 1994, 'Non Cooperative Bargaining Models of Marriage', *American Economic Review: Papers and Proceedings*, vol. 84(2), pp. 132–137.

Maitra, P. and Ray, R. 2002, 'Household Resources, Expenditure Patterns and Resource Pooling: Evidence from South Africa', mimeo, University of Tasmania.

Manser, M. and Brown, M. 1980, 'Marriage and Household Decision Making: A Bargaining Analysis', *International Economic Review*, vol. 21(3), pp. 31–44.

McElroy, M. and Horney, M. 1981, 'Nash Bargained Household Decisions', *International Economic Review*, vol. 22(2), pp. 333–350.

Phipps, S.A. and Burton, P.S. 1998, 'What's Mine Is Yours? The Influence of Male and Female Incomes on Patterns of Household Expenditure', *Economica*, vol. 65(260), pp. 599–613.

Riley, N. 1997, 'Gender, Power and Population Change', *Population Bulletin*, vol. 52, pp. 1–46.

Strauss, J., Mwabu, G. and Beegle, K. 2000, 'Intrahousehold Allocations: A Review of Theories and Empirical Evidence', *Journal of African Economies*, vol. 9 (AREC Supplement 1), pp. 83–143.