

AN INTEGRATED TEST OF THE UNITARY HOUSEHOLD MODEL:

EVIDENCE FROM PAKISTAN^{*}

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ABSTRACT

The conventional unitary model of household behaviour has been tested in several recent studies using, mostly, data from developed countries. These are generally based on a test of the underlying hypothesis that household members pool their income between themselves so that the household acts as a single individual. There is another hypothesis, underlying the unitary model, that each individual pools her/his income from different sources. This paper proposes a test of both these pooling assumptions in an integrated framework and applies it to Pakistani data. We use a simultaneous equation estimation framework which, besides treating the resource variables and household expenditure as jointly endogenous, also allows for correlation between the errors in the different equations. The results show that the outcome of the test of pooling varies between the poor and non poor households. Moreover, contrary to much of the existing evidence on other countries, there is not much support for the “crowding out” of private remittance by other income (earned or unearned). The paper has both methodological and policy interest that extends beyond the immediate context of Pakistan.

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1. Introduction

In the traditional unitary model of the household, neither the identity of the income recipient nor the income source has any effect on the household's expenditure allocation – all that matters is total household income. These features rest on the twin pooling assumptions underlying the unitary model, namely, that the household pools income between different members and that each member pools the income that she/he receives from different sources. While the former assumption has figured in several recent tests of the unitary model, this is not true of the latter. And, yet, both these assumptions need to hold for the unitary model to be valid. A reason for a possible rejection of the second pooling assumption is the attachment of different motives by the individuals to the different resource inflows. Therefore, while the rejection of income pooling between different income/resource recipients has been linked to unequal intra household bargaining power of the different members, the rejection of income pooling from different sources could reflect unequal or different motives for resource generation by the individual members. If that were the case, then this would be reflected in a rejection of the assumption that these resource inflows are pooled for the purpose of expenditure allocation. The hypothesis of income pooling between different sources has figured indirectly in studies on the crowding out of one resource inflow type by another, but not in the literature on tests of the unitary model. This study contributes to both literatures by testing both the pooling assumptions in a unified framework.

There is now a rapidly expanding literature that tests the assumption of resource pooling within the household. Examples include Schultz (1990), Thomas (1990), Hoddinott and Haddad (1995), Lundberg, Pollak and Wales (1997), Phipps and Burton (1998), Frankenberg and Thomas (2003), and Quisumbing and Maluccio (2003). As pointed out by Schultz (1990) and further discussed by Lundberg, Pollak and Wales (1997), a key limitation of much of this literature is that by lumping together all non-labour income under “unearned income” and conducting pooling tests based on this heterogeneous item, the literature overlooks the fact that unearned income consists of different components (asset returns, public and private transfers) that have different sets of determinants and recipients, have different behavioural and welfare impacts and, most seriously, are simultaneously determined with household outcomes such as expenditure patterns and labour supply by the individual members of the household. By lumping them together, the literature has implicitly assumed pooling of these different components of unearned incomes. Yet in most households the recipients of the different components of unearned income are different individuals (often belonging to different generations), with different preferences and therefore the results might be significantly biased if we assume income pooling accruing from the different sources.

This paper addresses the limitations of the empirical literature on pooling discussed above. In doing so, we distinguish between the two components of non-labour income namely unearned income and private remittance received.¹ This allows the components to have different effects on consumption and labour supply decisions thus avoiding the assumption of pooling of the various components of non-labour income that has characterised the previous literature on this topic. Additionally, we differentiate between the different components of resource inflows based on gender of the recipient. Finally, we adopt a simultaneous equation estimation framework which, besides treating the resource variables and household expenditure as jointly endogenous, also allows for correlation between the errors in the different equations.

This analysis is conducted using a household survey data set from Pakistan. This paper provides a major extension to our earlier paper (Maitra and Ray (2003)), which uses data from South Africa, by disaggregating the various resource inflows based on gender, and providing evidence on changes to the nature and determinants of resource inflows in Pakistan.

¹ Ideally one would have liked to include public transfers received, but in Pakistan, as in many other developing countries, there does not exist any social protection program.

The rest of this paper is organised as follows. Section 2 describes the data set used and presents selected descriptive statistics on the patterns of resource inflow and expenditures. Section 3 describes the theoretical framework and the estimation methodology and sets out the pooling hypotheses to be tested. The results are presented and discussed in Section 4. The concluding comments are presented in Section 5.

2. Data and Selected Descriptive Statistics

The data used in this paper comes from the 1991 Pakistan Integrated Household Survey (PIHS). This survey was conducted jointly by the Federal Bureau of Statistics, the Government of Pakistan and the World Bank as a part of the Living Standard Measurement Study (LSMS) household surveys. The PIHS teams visited 4800 households residing in rural and urban communities. The nation-wide survey gathered individual and household level data using a multi-purpose questionnaire. The Pakistan sample used in this paper consists of 4033 households. More information can be obtained from PIHS (1991).

Table 1 presents descriptive statistics on resource inflows and share of each category (Panel A) and expenditure shares (Panel B) for the PIHS 1991 data set. Following Thomas (1990), all income from agricultural profits and from household enterprises was treated as the unearned income of the household head and has been categorised as male/female unearned income depending on the sex of the household head. This could however somewhat bias the results given the prevalence of male-headed households in Pakistan where only 4% of the households in the sample are female-headed. As is clear from Panel A, not surprisingly unearned male income forms the largest share of household resources. Panel B presents the average expenditure shares using a six-item disaggregation of consumption expenditure: Food, Fuel and Light, Clothing, Health, Education and Other items.² Note that “other items” is regarded as the omitted category in the regressions that follow. Again not surprisingly expenditure on food constitutes the largest share of expenditure, followed by expenditure on other items.

Table 1: Selected Descriptive Statistics of the Pakistan data^(a)
Panel A: Resource Components^(b)

	Average			Share		
	All Households	Poor Households	Non-Poor Households	All Households	Poor Households	Non-Poor Households
Male Unearned Income (Rs.)	32442.1300	2270.9330	60491.2300	0.8467	0.8510	0.8436
Female Unearned Income (Rs.)	668.7650	103.8760	1193.9230	0.0340	0.0422	0.0282
Male Earned Income	7981.6540	4.8838	15397.3800	0.0614	0.0015	0.1044
Female Earned Income (Rs.)	878.9821	0.6243	1695.5610	0.0085	0.0002	0.0144
Male Remittances (Rs.)	401.4679	533.4225	278.7943	0.0220	0.0455	0.0051
Female Remittances (Rs.)	281.4238	388.1173	182.2344	0.0274	0.0596	0.0043
Total	42654.4200	3301.8570	79239.1200			

² Other non-food expenditure consists of expenditure on items like washing powder, childcare, religious memberships, donations and domestic servants/household labour.

Panel B: Expenditure Shares

	Average	Poor Households	Non-Poor Households
Food	0.5162	0.5395	0.4946
Clothing	0.0522	0.0549	0.0497
Health	0.0469	0.0493	0.0446
Fuel and Light	0.0578	0.0617	0.0542
Education	0.0300	0.0267	0.0331
Other Items	0.2969	0.2680	0.3238

(a) Source: PIHS (1991)

(b) The resource figures are annual

It is worth emphasizing that private remittances play an important role in terms of its effects on household welfare. For example we find remittances from migrants result in a 2% drop in poverty rates: the poverty rate in the 1991 PIHS sample is 48% when we exclude private remittances, and it falls to 46% when we define total household income to include private remittances received.³ Note, also, that private remittances constitute a larger share of resources for the poor households compared to the non-poor households. Consistent with Engel's Law, the poor households spend a greater share of their budget on food compared to non poor households.

3. Methodology

We start with a very brief description of the non-unitary household model. Consider a household comprising of S members. The utility of each member (u^s) depends on the consumption of all the members of the

household: $x = \sum_{g=1}^G \sum_{s=1}^S x_{gs}$, where g indexes the commodity and s indexes the individual. So we can write

the utility of member s as $u^s = u^s(x; \xi)$ where ξ denotes a set of household characteristics that affects individual utilities. The household welfare function is:

$$W = W \left[\left\{ u^s(x; \xi) \right\}_{s=1}^S \right] \quad (1)$$

and the household maximises W subject to the income constraint:

$$p' \mathbf{x} \leq \sum_{s=1}^S Y_s \quad (2)$$

where p is the price vector, \mathbf{x} is the vector of aggregate demand and Y_s denotes the income (resource inflow) accruing to individual s . Maximising equation (1) with respect to (2) gives us a set of reduced form demand functions for x_{gs} as follows:

$$x_{gs} = x_{gs} \left(\left\{ Y_s \right\}_{s=1}^S; \xi \right) \quad (3)$$

³ The poverty line is constructed taking into account the household size and composition effect as in Maitra and Ray (2003). We use the standard figure of \$1 a day to compute the poverty line.

Following Browning and Chiappori (1998), let us specify W as a weighted function of individual utilities as follows:

$$W = \sum_{s=1}^S \lambda^s u^s(x; \xi); \sum_{s=1}^S \lambda^s = 1 \quad (4)$$

The weights, λ^s , which depend on the income share of s (in addition to prices and household characteristics), will affect the form in which individual income (resource inflow) enters the demand function (equation (3)). More importantly the dependence of λ^s on the distribution of income within the household implies that the marginal impact of resource inflow on demand will vary with the source of the resource.

We do not observe individual consumption levels and so we aggregate equation (3) over the S individuals to obtain the aggregate demand for commodity g as follows:

$$x_g \equiv \sum_{s=1}^S x_{gs} = x_g(\{Y_s\}_{s=1}^S; p, \xi) \quad (5)$$

The dependence of the expenditure outcomes on the identity of the resource recipient implies that

$\frac{\partial x_g}{\partial Y_i} \neq \frac{\partial x_g}{\partial Y_j} \forall g; i, j = 1, \dots, S; i \neq j$. Compare this to the unitary household model where all that matters is

the aggregate resource inflow (from all sources) so that

$$x_g \equiv \sum_{s=1}^S x_{gs} = x_g\left(\sum_{s=1}^S Y_s; p, \xi\right) \quad (6)$$

and $\frac{\partial x_g}{\partial Y_i} = \frac{\partial x_g}{\partial Y_j} \forall g; i, j = 1, \dots, S; i \neq j$. It is clear that equation (6) is a special case of equation (5) when the pooling restrictions hold.

Consider now a special case of this general model with $S = 2$, so that we have a two-person household. Let us index the two members of the household as (male) m and (female) f . This is therefore a household that is stratified by gender. Resources accrue to each member from different sources. The broadest classification is labour or earned income (E) and non-labour income (I). Therefore we can write:

$$Y = Y_m + Y_f \equiv (I_m + E_m) + (I_f + E_f) \quad (7)$$

The demand function (equation (5)) can now be written as:

$$x_g = x_g(I_m, I_f, E_m, E_f; p, \xi) \quad (8)$$

In a single cross-sectional data set p can be taken as constant. Define $b_g = \frac{x_g}{\sum_{g=1}^G x_g}$ as the budget share

of commodity g . In budget share form, the estimating equation, on constant price data, can be written as:

$$b_g = b_g(I_m, I_f, E_m, E_f; \xi) + \varepsilon_g \quad (9)$$

where ξ denotes the set of exogenous variables that affect budget shares and ε_g denotes a random error specific to each budget share. We consider a six-commodity break down of consumer expenditure: food, fuel and light, clothing, health, education and other items.

Non-labour income (I) can be disaggregated between unearned income (U) and private remittance (R). Distinguishing between the male and female recipients of non-labour income, we have:

$$\begin{aligned} I_m &\equiv U_m + R_m \\ I_f &\equiv U_f + R_f \end{aligned} \quad (10)$$

Allowing for the possibility that the above two components of non-labour income have different effects on consumption decisions, we can rewrite the budget share equations (equation (9)) in more general form as follows:

$$b_g = b_g(U_m, U_f, R_m, R_f, E_m, E_f; \xi) + \varepsilon_g \quad (11)$$

Note that the above budget share equations constitute a significant generalisation of that conventionally estimated in the framework of the unitary model:

$$b_g = b_g^R(Y; \xi) + \varepsilon_g \quad (12)$$

where $Y = U_m + U_f + R_m + R_f + E_m + E_f$. The restrictive nature of equation system (12), (compared to

(11)), can be seen from the fact that it assumes $\frac{\partial b_g^R}{\partial U_m} = \frac{\partial b_g^R}{\partial R_m}$; $\frac{\partial b_g^R}{\partial U_f} = \frac{\partial b_g^R}{\partial R_f}$, in addition to the restriction of the irrelevance of the identity of the resource recipient in expenditure decisions mentioned earlier.

Endogeneity Issues

While estimation of equation (11) is relatively straight forward (typically as a system of equations), one needs to be careful about potential endogeneity issues. The resource inflow variables could be correlated with the unobserved determinants of expenditure share and ignoring this correlation might result in inconsistent estimates.

Since individuals choose their hours of work given the market wage rate, earned income is likely to be endogenous in the budget share equations. Moreover, the labour supply of an individual within the household (and hence the earned income) and the consumption of commodity g by the household both depend on the non-labour income accruing to individuals in the household, conditional on household characteristics. Further, private remittances and assets (unearned income) depend on the earned income of the different members of the household. Finally, earned income of individual m could in principle depend on the earned income of individual f and vice-versa. In other words, a successful modelling/estimation strategy needs to recognise the joint endogeneity of the various resource inflows and allow for their mutual dependence.

Private remittances in Pakistan mainly take the form of cash or goods transfer from one member of the family to another. According to the 1998 census records, some 10 million people, or 8 per cent of the population of Pakistan, were internal or international migrants. Migration from Pakistan to developed countries has largely been by young men from better off and upwardly mobile families and communities, but has also included displaced people and members of religious and ethnic communities that have faced social and political discrimination in Pakistan. There is also a trend towards greater numbers of less educated young men migrating to developed countries and overstaying their visitor visas; these migrants are less likely to be

able to settle in the destination country or to bring their families with them; many end up in low-paying service sector jobs. Savings remitted by Pakistani migrants abroad constitute the largest single source of foreign exchange earnings for the country, equivalent to 10 per cent of GNP in the 1980s. There is a fair body of work that argues that private remittances received by the household is negatively related to the amount of pre-transfer household income (see Cox, 1987, Cox, Eser and Jimenez, 1998). This suggests that private remittance received by the household should depend on other resource inflows. We therefore allow remittances to depend on unearned and earned income and also on social pension received by the household.

Unearned income typically comprises of asset earnings and is the result of past and current decisions made by the household. While unearned income has traditionally been treated as exogenous, this assumption is open to question. We depart from this practice and treat male and female unearned income as endogenous and jointly determined with the other resource inflows and the budget shares. Essentially unearned income could be correlated with past labour supply and, through persistence of preferences, over time with current labour supply and earnings.

There is likely to be a two-way relationship between earned income and private remittance received. That earned income could affect remittance is fairly straight forward – remittance is generally negatively related to earned income of the household (see, for example, Maitra and Ray, 2003). Additionally, private remittance received by the household might have adverse incentive effects on the employment choice of working age adults.

The full set of estimating equations can be written as follows:

$$\begin{aligned}
U_m &= U_m(\underline{U}_f, \underline{E}_m, \underline{E}_f; \xi_1) + \varepsilon_1 \\
U_f &= U_f(\underline{U}_m, \underline{E}_m, \underline{E}_f; \xi_2) + \varepsilon_2 \\
E_m &= E_m(\underline{U}_m, \underline{U}_f, \underline{R}_m, \underline{R}_f, \underline{E}_f; \xi_3) + \varepsilon_3 \\
E_f &= E_f(\underline{U}_m, \underline{U}_f, \underline{R}_m, \underline{R}_f, \underline{E}_m; \xi_4) + \varepsilon_4 \\
R_m &= R_m(\underline{U}_m, \underline{U}_f, \underline{E}_m, \underline{E}_f, \underline{R}_f; \xi_5) + \varepsilon_5 \\
R_f &= R_f(\underline{U}_m, \underline{U}_f, \underline{E}_m, \underline{E}_f, \underline{R}_m; \xi_6) + \varepsilon_6 \\
b_g &= b_g(\underline{U}_m, \underline{U}_f, \underline{E}_m, \underline{E}_f, \underline{R}_m, \underline{R}_f; \xi_7) + \varepsilon_{6+g}; g = 1, \dots, G-1
\end{aligned} \tag{13}$$

where the endogenous variables have been underlined. ξ_1, \dots, ξ_7 denote the set of exogenous explanatory variables included in each regression. These include household composition, age, sex and educational attainment of the household head, educational attainment of the most educated male/female member of the household and household assets. Note that all the resource inflow variables have been expressed in “per adult equivalent” terms of the household.

Estimation

Tables 2 and 3 present the 3SLS estimation results using the PIHS (1991) data set. Here equation (13) is estimated as a system of 11 equations using 3SLS, which allows us to account for the endogeneity of the resource inflow variables and also the feedback between the error terms. Using a Breusch-Pagan Test we are able to reject the null hypothesis of a diagonal covariance matrix of the error terms: the Breusch-Pagan statistics are obtained as 1233.308 with 55 degrees of freedom ($p = 0.0000$)

Resource Pooling

Besides investigating the behavioural and welfare consequences of the different resource inflow variables, this paper also tests an important consequence of the unitary household models, namely the validity of the pooling hypothesis relating to the 2 non-labour income components: unearned income and private remittances. The different pooling hypotheses that we test in this paper are:

- (i) Men pool their unearned income and remittances received (i.e., $U_m + R_m$ appear in the set of explanatory variables rather than the three separately).
- (ii) Similarly for women: $U_f + R_f$
- (iii) Pooling of unearned income from the different sources i.e., $U = U_m + U_f$ appears on the right hand side rather than U_m and U_f separately.
- (iv) Pooling of remittances: $R = R_m + R_f$

The pooling hypotheses (i) – (iv) are specified as testable restrictions on the parameters of the budget share equations. Following Phipps and Burton (1998) we introduce square and interaction terms in the non-labour income components to ensure that the pooling hypothesis is not rejected because of mis-specified linearity.⁴

Let f_g^R denote the resource dependent component of the budget share equation for commodity g . Then f_g^R can be specified as follows:

$$\begin{aligned}
 f_g^R = & \beta_{1g}U_m + \beta_{2g}U_f + \beta_{3g}R_m + \beta_{4g}R_f + \beta_{5g}E_m + \beta_{6g}E_f \\
 & + \beta_{7g}(U_m)^2 + \beta_{8g}(U_f)^2 + \beta_{9g}(R_m)^2 + \beta_{10g}(R_f)^2 \\
 & + \beta_{11g}(E_m)^2 + \beta_{12g}(E_f)^2 + \beta_{13g}(U_m * U_f) + \beta_{14g}(R_m * R_f) \\
 & + \beta_{15g}(E_m * E_f) + \beta_{16g}(U_m * R_m) + \beta_{17g}(U_f * R_f)
 \end{aligned} \tag{14}$$

The pooling hypotheses referred to as $H_A - H_E$ below imply the following restrictions on the parameters of the budget share equations:

$$H_A : \text{Males' Pooling of non-labour income from the different sources: } \beta_{1g} = \beta_{3g}; \beta_{7g} = \beta_{9g} = \beta_{16g}/2$$

$$H_B : \text{Females' Pooling of non-labour income from the different sources: } \beta_{2g} = \beta_{4g}; \beta_{10g} = \beta_{12g} = \beta_{17g}/2$$

$$H_C : \text{Pooling of Male and Female unearned income: } \beta_{1g} = \beta_{2g}; \beta_{7g} = \beta_{8g} = \beta_{13g}/2$$

$$H_D : \text{Pooling of Male and Female private remittance received: } \beta_{3g} = \beta_{4g}; \beta_{9g} = \beta_{10g} = \beta_{14g}/2$$

We also conduct a “full” joint test of no source or gender effect as follows:

$$\begin{aligned}
 & \beta_{1g} = \beta_{2g} = \beta_{3g} = \beta_{4g}; \\
 & \beta_{7g} = \beta_{8g} = \beta_{9g} = \beta_{10g} \\
 & = \beta_{13g}/2 = \beta_{14g}/2 = \beta_{16g}/2 = \beta_{17g}/2
 \end{aligned}$$

⁴ The null hypothesis that the squared and the interaction terms are jointly equal to zero is always rejected.

4. Results

In Tables 2 and 3 we present the 3SLS estimates using the PIHS (1991) data set. Due to space constraint, we present only the parameter estimates and standard errors of the coefficients of the resource inflow variables. The full set of results is available on request.

There is no evidence of either complementarity or substitutability between male and female unearned income as the 3SLS regression results show that female (male) unearned income does not have a statistically significant effect on male (female) unearned income. Both female and male earned income have a positive and statistically significant effect on male unearned income and more interestingly female earned income actually has a stronger effect on male unearned income compared to male earned income. It is however worth noting that neither male nor female earned income has a statistically significant effect on female unearned income.

Turning to the coefficient estimates for male and female earned income, we find that while male unearned income has a positive and statistically significant effect on both male and female unearned income, female unearned income does not have a statistically significant effect on either male or female earned income. This is possibly a reflection of the fact that female unearned income does not constitute a big part of total household income in Pakistan (see Table 1). There is evidence of significant complementarity between male and female earned income. In the context of Pakistan we do not find any evidence of crowding out of earned income as a result of remittances received by the households.

We find that generally neither unearned nor earned income of the different members of the households has a statistically significant effect on male and female private remittance received. The only exception is female unearned income, which has a positive and statistically significant effect on female remittances received. The overall statistical non-significance of the other resource inflow variables on remittances received is an interesting result. The literature has generally argued that private remittances received by the households in many developing countries are negatively related to pre-transfer household income (see Cox, 1987, Cox, Eser and Jimenez, 1998). In the context of Pakistan we do not find any evidence of such a negative relationship.

The regressions also control for household characteristics. Let us briefly discuss some of these results.⁵ Male earned income is significantly higher when the highest education attained by the most educated male in the household is completed primary school or higher. An increase in the total number of adult working age males in the household increases male earned income, but an increase in the total number of adult working age females in the household reduces male earned income. Interestingly an increase in the total number of children, the total number of adult working age male and the total number of elderly males in the household all significantly increase total female earned income. Not surprisingly female earned income is significantly higher for female headed households. Finally female earned income is significantly higher for households where the highest education attained by the most educated female in the household is secondary schooling or higher.

Unearned male income of the household is significantly lower for households residing in Sindh and the North West Frontier Province (relative to households residing in the province of Punjab). Unearned male income is significantly lower for households that have no toilet facilities and is significantly higher for households that have a phone. On the other hand female unearned income is significantly higher if the main source of drinking water is tap inside the house and is significantly lower if the house has a phone.

⁵ These results are not presented but are available on request.

Table 2: 3SLS estimates of Resource Inflows (All Households)

	Male Unearned Income	Female Unearned Income	Male Earned Income	Female Earned Income	Male Remittances	Female Remittances
Male Unearned Income		9.03e-06 (4.48e-04)	0.0190*** (0.0028)	0.0039*** (0.0006)	-0.0001 (0.0002)	4.71e-06 (2.20e-04)
Female Unearned Income	0.1018 (0.6296)		-0.0669 (0.1078)	-0.0057 (0.0211)	-0.0026 (0.0092)	0.0226*** (0.0084)
Male Earned Income	0.7090*** (0.1022)	-0.0016 (0.0028)		0.1487*** (0.0028)	-0.0017 (0.0015)	-0.0020 (0.0014)
Female Earned Income	3.5280*** (0.5164)	-0.0056 (0.0141)	3.8130*** (0.0716)		0.0008 (0.0076)	0.0002 (0.0069)
Male Remittances			-0.2421 (0.1986)	0.0107 (0.0391)		0.0091 (0.0155)
Female Remittances			-0.2905 (0.2250)	0.0038 (0.0442)	0.0113 (0.0194)	
Observations	4025	4025	4025	4025	4025	4025

Regressions control for other household characteristics. The full set of estimates is available on request.
Standard errors in parentheses

* Significant at 10%; ** significant at 5%; *** significant at 1%

Male remittances received by the household are significantly lower for households residing in Sindh and Balochistan (relative to households residing in Punjab). An increase in the number of adult males and females in the household and an increase in the number of elderly females in the household all significantly increase male remittances received, while an increase in the number of children in the household significantly reduce the amount of male remittances received. An increase in the number of elderly females in the household increases but an increase in the number of elderly males in the household decreases the amount of female remittance received by the household. Finally and not surprisingly, female remittance received is significantly higher for female headed households.

Table 3 presents the corresponding budget share estimates on the six-item classification of household expenditure: food, fuel and lighting, clothes, health, education and omitted category of “other commodities”. While not many of the resource inflow variables are statistically significant, those that are tell an interesting story.

An increase in male unearned income has a negative and statistically significant effect on expenditure share of food. This is simply a reflection of the Engle curve effect – households with more male unearned income are typically richer households and these households spend a significantly lower portion of their total expenditure on food. An increase in male unearned income on the other hand has a positive and statistically significant effect on the expenditure share of education. This reflects the fact that households with higher male unearned income are typically the richer households. One could argue therefore that one reason for low school enrolment rates in Pakistan and generally low educational attainment in that country is simply the resource constraint. A more surprising result is that male unearned income has a negative and (weakly) statistically significant effect on the household expenditure on health. Female unearned income generally does not have a statistically significant effect on household expenditure patterns, with the only exception being the negative and statistically significant effect of female unearned income on the expenditure share of fuel and lighting.

Table 3: 3SLS estimates of Expenditure Shares (All Households)

	Food	Fuel and Lighting	Clothes	Health	Education
Male Unearned Income	-6.44e-06*** (1.65e-06)	-1.66e-07 (2.71e-07)	-1.88e-07 (1.18e-07)	-6.68e-07* (3.87e-07)	7.68e-07*** (2.76e-07)
Female Unearned Income	-1.68e-04 (1.04e-04)	-4.32e-05** (1.71e-05)	2.37e-06 (7.43e-06)	-1.40e-05 (2.44e-05)	2.39e-05 (1.73e-05)
Male Earned Income	-1.55e-05 (1.57e-05)	4.22e-06 (2.57e-06)	8.36e-07 (1.12e-06)	1.62e-06 (3.67e-06)	2.79e-06 (2.61e-06)
Female Earned Income	-7.50e-05 (6.89e-05)	-1.31e-05 (1.13e-05)	6.67e-06 (4.92e-06)	-6.53e-06 (1.62e-05)	2.76e-05** (1.14e-05)
Male Remittances	3.81e-04 (2.89e-04)	8.64e-05* (4.74e-05)	-2.01e-05 (2.06e-05)	7.04e-05 (6.76e-05)	-2.24e-05 (4.82e-05)
Female Remittances	-6.94e-04** (2.99e-04)	-8.07e-05 (4.91e-05)	-8.74e-06 (2.13e-05)	-1.79e-04** (7.01e-05)	7.30e-05 (5.00e-05)
Observations	4025	4025	4025	4025	4025
$U_m = R_m$ (and Interactions): $\chi^2(3)$	1.80	3.34*	0.94	1.11	0.23
$U_f = R_f$ (and Interactions): $\chi^2(3)$	8.72**	0.90	0.42	19.64***	1.49
$U_m = U_f$ (and Interactions): $\chi^2(3)$	3.28	6.23**	0.12	0.30	1.76
$R_m = R_f$ (and Interactions): $\chi^2(3)$	101.27***	3.46	4.51	6.63**	2.25
Overall Equality of Effect of all Resource Inflows: $\chi^2(10)$	17.41***	8.46*	5.72	11.99**	3.40

Regressions control for other household characteristics and square of the resource inflow variables and interactions. The full set of estimates is available on request.

Standard errors in parentheses

* Significant at 10%; ** significant at 5%; *** significant at 1%

Earned income, irrespective of whether accruing to males or females, generally does not have a statistically significant effect on household expenditure patterns. The only exception is that female earned income has a positive and statistically significant effect on the expenditure share of education. This again is an interesting and not a particularly surprising result. Women who earn more are likely to be more educated and are thus likely to have more information on the benefits of investing in the children's education. In addition, an increase in female earned income is typically likely to be associated with an increase in the relative bargaining power of women within the household. It has also been argued that in many developing countries an increase in the relative bargaining power of women within the household is typically associated with an increase in the share of expenditure allocated to the human capital formation of the next generation (see Schultz, 2002).

Male private remittances received do not have a statistically significant effect on the expenditure shares of any of the commodities, however female private remittances received has a negative and statistically significant effect on the expenditure share of food and also the expenditure share of health.

Let us now turn to the coefficient estimates of the exogenous variables that are included as additional explanatory variables in the expenditure share regressions.⁶ The expenditure shares of food and fuel and lighting are significantly higher for female headed households. The expenditure shares of food, clothes and health are significantly higher while the expenditure share of fuel and lighting is significantly lower for rural households. There are significant regional differences in expenditure patterns – the province dummies are

⁶ Again the results are not presented but are available on request.

generally statistically significant, though the signs change. Many of the household composition variables also have statistically significant effects on expenditure shares. In particular it is worth noting that an increase in the total number of children in the household significantly reduces the expenditure share of fuel and lighting but significantly increases the expenditure share of clothes and education.

Does Poverty Status Matter?

One interesting question that is worth examining is whether the relationship between the different resource inflow variables and the effect of resource inflows on household expenditure patterns depends on the poverty status of the household. To do this we conduct separate 3SLS estimation of the set of equations in (13) but this time we stratify the households by poverty status. The regression results are presented in Tables 4 (resource inflows) and 5 (expenditure shares). In each case Panel A presents the coefficient estimates (and standard errors) for the poor households and Panel B presents those for the non-poor households. Let us start with the estimates for resource inflows (Table 4). There are some very interesting differences between the poor and non-poor households. For the poor but not for the non-poor households we find that both male and female private remittances are negatively and statistically significantly related to male unearned income of the household. Given that male unearned income comprises of more than 84% of total household resources, the results imply that the negative relationship between private remittances and pre transfer household income that has been obtained in the literature exists for the poor but not for the non-poor households. For the non-poor but not for the poor households male unearned income has a positive and statistically significant effect on both male and female earned income. Finally again for the non-poor, but not for the poor households, we find that earned income (both male and female) has a positive and statistically significant effect on male unearned income.

Turning to the expenditure share regression results (Table 5) we again find some very interesting differences between poor and non-poor households. For the sub-sample of poor households, an increase in male unearned income is associated with an increase in the expenditure share of food but, for the sub-sample of non-poor households, an increase in male unearned income is associated with a decrease in the expenditure share of food. For the sub-sample of poor households, an increase in the male unearned income is associated with a decrease in the expenditure share of education, but for the sub-sample of non-poor households an increase in male unearned income is associated with an increase in the expenditure share of education. These results again point to the importance of household resource constraints on educational attainment of children. For poor households, female remittance received has very significant effects on household expenditure patterns. The regression results presented in Panel A show that for poor households, an increase in female remittances received significantly increases the expenditure share of clothes and education but results in a significant decrease in the expenditure share of food, fuel and lighting and health. The effects of female remittance received on household expenditure patterns are considerably weaker for the non-poor households (see Panel B). For the poor households, male remittances have a less significant effect on household expenditure patterns, particularly when compared to the effects of female remittances. For the non-poor households on the other hand male remittances have a stronger effect on household expenditure patterns, compared to female remittances. In particular it is worth noting that for non-poor households, an increase in male remittance received has a negative and statistically significant effect on the expenditure share of education. There is no such effect for the poor households. For the poor households earned income never has a statistically significant effect on household expenditure patterns. While the results are generally similar for the non-poor households, there is one exception. We find that for non-poor households an increase in male earned income has a positive and statistically significant effect on the expenditure share of fuel and lighting.

Table 4 Panel A: 3SLS estimates of Resource Inflows (Poor Households)

	Male Unearned Income	Female Unearned Income	Male Earned Income	Female Earned Income	Male Remittances	Female Remittances
Male Unearned Income		0.0005 (0.0048)	-0.0019 (0.0014)	-0.0001 (0.0003)	-0.1593*** (0.0438)	-0.0789** (0.0359)
Female Unearned Income	0.0006 (0.1178)		0.0016 (0.0069)	-0.0001 (0.0014)	-0.0503 (0.2175)	-0.1246 (0.1776)
Male Earned Income	-0.5671 (0.3903)	0.0208 (0.0787)		0.1700*** (0.0032)	-0.0555 (0.7213)	-0.1264 (0.5892)
Female Earned Income	-0.2641 (1.9715)	-0.0335 (0.3973)	4.3453*** (0.0820)		-0.4677 (3.6412)	-0.3768 (2.9746)
Male Remittances			-0.0001 (0.0008)	-0.0000 (0.0002)		-0.0008 (0.0198)
Female Remittances			-0.0002 (0.0010)	-0.0000 (0.0002)	-0.0015 (0.0310)	
Observations	1940	1940	1940	1940	1940	1940

Table 4 Panel B: 3SLS estimates of Resource Inflows (Non-Poor Households)

	Male Unearned Income	Female Unearned Income	Male Earned Income	Female Earned Income	Male Remittances	Female Remittances
Male Unearned Income		0.0001 (0.0005)	0.0160*** (0.0039)	0.0041*** (0.0008)	0.0000 (0.0002)	-0.0000 (0.0002)
Female Unearned Income	0.2016 (0.9810)		0.0037 (0.1675)	-0.0486 (0.0331)	-0.0010 (0.0079)	0.0246*** (0.0087)
Male Earned Income	0.5832*** (0.1424)	-0.0001 (0.0034)		0.1493*** (0.0039)	-0.0009 (0.0012)	-0.0020 (0.0013)
Female Earned Income	3.6280*** (0.7122)	-0.0257 (0.0170)	3.7722*** (0.0989)		0.0001 (0.0058)	0.0019 (0.0064)
Male Remittances			-0.4420 (0.4884)	0.0073 (0.0969)		-0.0013 (0.0254)
Female Remittances			-0.5778 (0.4387)	0.0185 (0.0870)	-0.0011 (0.0208)	
Observations	2085	2085	2085	2085	2085	2085

Regressions control for other household characteristics. The full set of estimates is available on request.

Standard errors in parentheses

* Significant at 10%; ** significant at 5%; *** significant at 1%

Table 5 Panel A: 3SLS estimates of Expenditure Shares (Poor Households)

	Food	Fuel and Lighting	Clothes	Health	Education
Male Unearned Income	6.47e-04*** (1.24e-04)	1.12e-04*** (3.43e-05)	2.00e-05 (2.04e-05)	9.45e-05* (5.22e-05)	-1.37e-04*** (3.36e-05)
Female Unearned Income	-2.58e-04 (5.88e-04)	5.78e-06 (1.63e-04)	-8.58e-05 (9.66e-05)	5.35e-05 (2.48e-04)	-7.95e-06 (1.60e-04)
Male Earned Income	0.00e+00 (0.00e+00)	0.00e+00 (0.00e+00)	0.00e+00 (0.00e+00)	0.00e+00 (0.00e+00)	0.00e+00 (0.00e+00)
Female Earned Income	0.00e+00 (0.00e+00)	0.00e+00 (0.00e+00)	0.00e+00 (0.00e+00)	0.00e+00 (0.00e+00)	0.00e+00 (0.00e+00)
Male Remittances	5.33e-05 (1.08e-04)	6.35e-05** (2.99e-05)	-2.00e-05 (1.77e-05)	2.47e-05 (4.54e-05)	-2.35e-05 (2.92e-05)
Female Remittances	-1.89e-04*** (7.04e-05)	-3.30e-05* (1.95e-05)	2.06e-05* (1.16e-05)	-9.08e-05*** (2.97e-05)	7.72e-05*** (1.91e-05)
Observations	1940	1940	1940	1940	1940
$U_m = R_m$ (and Interactions): $\chi^2(7)$	33.62***	10.00***	6.93*	4.80	21.25***
$U_f = R_f$ (and Interactions): $\chi^2(7)$	4.20	2.71	7.68**	10.70**	12.79***
$U_m = U_f$ (and Interactions): $\chi^2(3)$	31.61***	11.26**	2.43	3.82	20.46***
$R_m = R_f$ (and Interactions): $\chi^2(3)$	7.56**	4.81*	2.51	7.51**	16.20***
Overall Equality of Effect of all Resource Inflows: $\chi^2(25)$	91.37***	7.68*	14.86*	28.17***	59.36***

Regressions control for other household characteristics and square of the resource inflow variables and interactions. The full set of estimates is available on request.

Standard errors in parentheses

*Significant at 10%; ** significant at 1%

Table 5 Panel B: 3SLS estimates of Expenditure Shares (Non-Poor Households)

	Food	Fuel and Lighting	Clothes	Health	Education
Male Unearned Income	-5.99e-06*** (1.22e-06)	2.09e-07 (3.18e-07)	-1.70e-07 (1.31e-07)	-3.13e-07 (3.21e-07)	9.33e-07** (4.23e-07)
Female Unearned Income	-4.99e-05 (8.21e-05)	-3.66e-05* (2.13e-05)	-3.63e-06 (8.79e-06)	6.75e-06 (2.16e-05)	8.22e-06 (2.84e-05)
Male Earned Income	-6.71e-06 (7.17e-06)	4.97e-06*** (1.87e-06)	-2.00e-07 (7.70e-07)	1.54e-06 (1.89e-06)	3.13e-06 (2.49e-06)
Female Earned Income	-2.92e-05 (3.18e-05)	-7.33e-06 (8.26e-06)	4.72e-06 (3.41e-06)	-2.03e-06 (8.37e-06)	1.57e-05 (1.10e-05)
Male Remittances	2.02e-04 (2.34e-04)	-1.14e-04* (6.12e-05)	-1.84e-06 (2.51e-05)	7.32e-06 (6.16e-05)	-2.21e-04*** (8.13e-05)
Female Remittances	-6.47e-05 (1.98e-04)	-5.36e-05 (5.19e-05)	-1.39e-05 (2.13e-05)	-5.11e-05 (5.23e-05)	-3.62e-05 (6.91e-05)
Observations	2085	2085	2085	2085	2085
$U_m = R_m$ (and Interactions): $\chi^2(7)$	1.34	3.46*	0.00	0.02	7.39***
$U_f = R_f$ (and Interactions): $\chi^2(7)$	0.39	0.14	0.30	1.56	0.53
$U_m = U_f$ (and Interactions): $\chi^2(3)$	0.82	2.95*	0.15	0.11	0.07
$R_m = R_f$ (and Interactions): $\chi^2(3)$	1.20	4.22	0.98	0.99	6.37**
Overall Equality of Effect of all Resource Inflows: $\chi^2(25)$	2.22	7.00	2.63	1.86	13.55***

Regressions control for other household characteristics and square of the resource inflow variables and interactions. The full set of estimates is available on request.

Standard errors in parentheses

* Significant at 10%; ** significant at 5%; *** significant at 1%

Tests of Resource Pooling

Tables 3 and 5 also presents the χ^2 values for testing the hypothesis of pooling non-labour income by source (unearned income and private remittances) and gender of the recipient (male or female). Five different test results are presented in each case: tests by gender that the source does not matter (separate tests for males and females, each distributed as $\chi^2(3)$), tests by source that the gender of the recipient does not matter (separate tests for the two components of non-labour income, each distributed as $\chi^2(3)$) and finally a joint test that neither the source nor the gender of the recipient matters (distributed as $\chi^2(10)$).⁷ What is really interesting is that barring minor exceptions, the null hypothesis that the source of the resource inflow and/or the gender of the recipient does not matter cannot be rejected. When we stratify the households by poverty status, we find not surprisingly that the results on resource pooling are quite different between poor and non-poor households. For the poor households but not for the non-poor households the null hypothesis that the source of the resource inflow and/or the gender of the recipient does not matter is generally rejected.

What these results essentially imply is that for the poor households, the null hypothesis of the unitary household model is almost always rejected – the gender of the recipient and the source of the resource inflow do matter. This still leaves open the possibility that the households are operating Pareto Efficiently. We examine this issue using a more general test of the Pareto Efficient Collective household model as suggested by Chiappori (1988). This test suggests that in an efficient household, the ratio of the marginal propensity to consume a particular good out of one income source to the marginal propensity to consume a particular good out of a different income source should be equal (up to a random variation) across all goods and all income sources. We conduct these Chiappori tests assuming linearity i.e., ignore the squared and interaction terms.⁸ What we essentially test is:

$$\frac{\partial b_i / \partial X_m}{\partial b_i / \partial X_f} = \frac{\partial b_j / \partial Z_m}{\partial b_j / \partial Z_f}; \forall (i, j); X, Z = U, P, R \quad (15)$$

This is a non-linear Wald test. The overall test for Pareto Efficiency (across all combinations of goods and income source) is convincingly rejected for the sub-sample of poor but not for the sub-sample of non-poor households and also not for the sample of all households. This is not surprising since for the non-poor and all households we are generally unable to reject the resource-pooling hypothesis. Since unitary households are Pareto Efficient, this implies that the non-poor households set are behaving as if they are unitary households. For the pooled data set we tested the null hypothesis that the marginal propensities to consume out of the different income sources are equal. Again and not surprisingly we are never able to reject the null hypothesis of equality of marginal propensity to consume out of male and female income. These results therefore corroborate the results on resource pooling that we discuss above.

The central message of these results is that, in conducting the tests of pooling of male and female non-labour income, it is important to distinguish between the various components of non-labour income. It is quite possible for pooling to be rejected in regard to one component of non-labour income, but not the others. The above results also underline the need to test for another type of pooling not performed before, namely, the pooling of the individual components of male and female non-labour income. The latter pooling is implicitly assumed in the literature.

⁷ In many cases however we had to drop some of the constraints because of collinearity. Hence often the tests are not distributed as per theoretical prediction.

⁸ While there is likely to be some omitted variable bias in the estimates, we could not compute the corresponding Chiappori tests for the full specification because of convergence problems.

5. Summary and Conclusion

This paper uses data from Pakistan to revisit the notion of resource pooling – resources from different sources and accruing to different members are pooled in order to achieve the various household outcomes. The study extends our earlier work (Maitra and Ray (2003)) by introducing gender based disaggregation of resource inflows. Our analysis shows that the source of the resource does matter for the expenditure outcome and that the different resource inflow variables have significantly different impacts on the variables of interest (the expenditure shares). The identity of the resource recipient within the household also affects the outcome. There are significant differences between poor and non-poor households in terms of how resource inflows interact with each other and how they affect household expenditure patterns.

The distinguishing features of this paper include the following. First, each income stream is distinguished by the gender of the income recipient in keeping with the spirit of non-unitary household models that has characterised much of the recent literature on household behaviour. Second, we distinguish between the different sources of non-labour income, namely, unearned income and private remittances that have been lumped together in previous studies. Moreover, we recognise the joint endogeneity of such resource inflows in the tests of income pooling conducted here. Third, following from the two issues raised above, we test the hypothesis of income pooling not only between men and women, as several studies have done recently, but, also, pooling of the two components of non-labour earnings, mentioned above, separately for men and women. To the best of our knowledge, no previous study has tested for this latter type of pooling, preferring to simply assume it.

The results of this paper have wider implications than the immediate context of Pakistan. The methodology used in this paper is quite general and can be applied to any form of stratification within the household. We have illustrated the issues by stratifying the households on the basis of gender of the members (and aggregating the resources accruing to different members belonging to the same gender). It is possible to conduct a similar analysis by stratifying the household on the basis of generation (or age). Given the structure of residency in many developing countries where members of multiple generations co-reside, this could be another important form of stratification. That however is left for future research.

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