ECONOMIC GROWTH CENTER

YALE UNIVERSITY

Box 1987, Yale Station
27 Hillhouse Avenue
New Haven, Connecticut 06520

CENTER DISCUSSION PAPER NO. 669

THE DISTRIBUTION OF INCOME AND EXPENDITURE WITHIN THE HOUSEHOLD

Duncan Thomas

Yale University

July 1992

Note: Center Discussion Papers are preliminary materials circulated to stimulate discussions and critical comments. An earlier version of this paper was prepared for the Conference on Recent Advances in Consumer Analysis, DELTA, Paris, October 1991.

I have benefited from the comments of Harold Alderman, Jere Behrman, Martin Browning, Pierre-André Chiappori, Angus Deaton, T. Paul Schultz and Mark Rosenzweig.

ABSTRACT

Most economic models of the household assume that it may be treated as if all members share the same preferences or one member (a dictator) makes all resource allocation decision. That assumption is tested by asking whether income in the hands of men has the same impact on household commodity demand as income in the hands of women. Drawing on budget data from Brazil, we find that the distribution of income among men and women within the household does affect demand patterns and this is true for both non-labor income as well as total income. Income in the hands of women, relative to men, is associated with a larger increase in the share of the household budget devoted to human capital (household services, health and education) and also leisure (recreation and ceremonies) goods. The proportion of the budget spent on food declines more if the income is in the hands of women although food composition also changes and nutrient intakes rise faster as womens' income increases. When the sample is restricted to only those couples in which both have some income, however, there is little evidence that income in the hands of men and women have significantly different effects on commodity consumption.

KEY WORDS: Intra-household, consumption

1. INTRODUCTION

Over the last two or three decades, a good deal of intellectual effort has been devoted to the study of household consumption behavior and much has been learnt in both developed and developing countries. In this literature, rather little attention has been paid to economic decision-making *within* the household although there has recently been a resurgence of interest in the modelling of intra-household decision-making, at least from a theoretical point of view (see Chiappori, 1988a, 1988b, 1992a, 1992b; McElroy and Horney, 1988; McElroy, 1990). Empirical testing of these models, however, lags far behind.

This paper attempts to delve into the black box of the household and test the hypothesis that households may be treated as if they pool all their income. This may be interpreted as a test for altruism in the household, a test for common preferences of all individuals or a test of the dictatorial model of household decision making. Essentially, we are testing whether a representative agent model is an adequate description of the household in the context of consumer demand analysis. A series of commodity demand functions are estimated which permit income effects to vary depending on the individual to whom the income is attributed. We test whether income in the hands of men has the same impact on commodity demand as income in the hands of women. While the aim of the paper is modest, it strikes us as useful exercise to test this simple hypothesis since even this task presents several empirical problems. The work may be viewed, then, as a precursor to testing alternative models of household resource allocation. Rejection of equality of income effects tells us nothing about the appropriate model and we cannot distinguish among the various models that have recently been proposed in the literature. For recent studies taking a more structural approach that test specific alternatives, see Bourguignon, Browning, Chiappori and Lechène (1991, 1992).

In the first set of tests presented below, we compare the effects on commodity demand of non-labor income in the hands of men and women. Non-labor income, however, accounts for only a fraction of the resources available to a household for consumption; thus we also examine the effects of total (non-labor and labor) income on household consumption patterns. Since leisure and commodity demand should be treated as jointly determined, it is inappropriate to assume labor income is exogenous in this model. Households are assumed to make consumption choices in a static one-period model and therefore it is *maintained* that individual

non–labor income is exogenous in which case it is a valid instrument for total income. The second set of tests examine the impact of total income (treated as endogenous) on household demand. We experiment with identification assumptions and restrict the impact on demand of the education of men and women in the household to work entirely through income.

The empirical results, based on a large budget survey from Brazil, indicate that the common preference (or income pooling) model is rejected: for several (but not all) commodity groups, the effect of additional income in the hands of women is significantly different from the effect of additional money attributed to men. This is true for both non–labor income and (instrumented) total income. For example, an additional crusado in the hands of a woman will raise the share of the household budget spent on human capital goods (education, health and household services) by about four times more than if the additional income is in the hands of a man. Similar patterns emerge for budget shares spent on leisure (recreation and ceremonies). Food shares, and the share of the budget spent on meals away from home, are significantly lower if more income is in the hands of women than men. In contrast, however, the income of women is associated with higher *per capita* calorie and protein intake by household members and these income effects are significantly larger than those for men. Thus, although household food shares decline as women's income rises, the calorie and protein content of food rises. All these results are consistent with other evidence, based on the same data, that indicates resources in the hands of women have a bigger impact on the health of their children than resources in the hands of men. For some goods, the distribution of income within the household has no impact on expenditure shares and this tends to be true for goods that might be thought of as being largely 'public' to the household, such as housing and household goods as well as, perhaps, clothing.

2. MODELS OF HOUSEHOLD BEHAVIOR

We begin with a simple static model of household behavior in which household welfare in any period, W, depends on the utility of each household member, m = 1, ..., M. In turn, each individual's utility function, U_m, depends on the commodity consumption of *all* household members, X_{im}, i=1, ..., G, goods. Utility will also depend on the consumption of leisure by each individual in the household, ℓ_1, ... ℓ_M. A set of individual and household specific characteristics, μ, may affect tastes and therefore utility, $U_m(X, \ell; \mu)$.

If a member, n say, is completely selfish, or has *egotistical preferences* (Chiappori, 1988a), then all elements of X_{im} and ℓ_m, $m \neq n$ will have weight zero in that member's utility function. In general, however, we expect household members to value the consumption of other members in the same household (Becker, 1981) and, indeed, there is some evidence for altruism even beyond the immediate family (Altonji, Hayami and Kotlikoff, 1989; Udry, 1990).

The household welfare function is akin to a Bergson–Samuelson social welfare function and aggregates the individual felicity functions:

$$W = W [U_1(X, \ell; \mu), \ldots U_M(X, \ell; \mu)] \qquad [1]$$

which is maximized subject to the household budget constraint:

$$p X = \Sigma_m [w_m (T - \ell_m) + y_m] \qquad [2]$$

where the vector p is the set of prices of all goods in X; we assume all household members face parametric commodity prices. The price of time for each individual is w_m, and so that individual's total income is given by the value of earned income $w_m(T - \ell_m)$ together with non–labor income, y_m. Household income is simply the sum of all individuals' incomes.

Apart from leisure, however, individual consumption is seldom observed in household budget surveys (but see, for example, Haddad and Kanbur, 1990, for an exception from the Philippines which attempted to measure individual nutrient intake). Instead, budget surveys report total household consumption of each good i, $X_i=\Sigma_m X_{im}$, and, for these goods, it is difficult to assign consumption to each individual without resorting to inherently untestable assumptions (Pollak and Wales, 1979; Deaton *et al.* 1989). Solving the maximization problem [1]–[2], there is a household demand for commodity i:

$$X_i = \sum_m^M X_{im} = g(\, p, y_1, \ldots, y_M, \mu\,) \qquad [3]$$

which depends on all prices, p, household characteristics, μ, and *individual* non-labor incomes, $y_1, \ldots, y_M$.

The simplest static model of the household assumes either that one member *dictates* all allocation decisions in which case the aggregator function W(.) assigns a zero weight to all but that member's utility function. In this case, the demand functions depend not on individual non-labor incomes, but their sum:

$$X_i = g\,(\, p,\ \Sigma_m y_m,\ \mu\,) \qquad [4]$$

Clearly, if all members have the same preferences, or they are *altruistic*,[1] then household demand will depend on total household non-labor income; the (perfect) altruism, common preferences and dictatorial models are, therefore, observationally equivalent, at least in terms of their predictions for the impact of individual income on household commodity demand.

The vast majority of studies of consumer demand have imposed this assumption of common preferences (see Deaton and Muellbauer, 1980; Deaton, 1986; Blundell, 1988 for reviews of the literature) and it is a key assumption in Becker's (1981) discussion of household formation. There has, however, recently been a resurgence of interest in the theoretical literature in the modelling of intra-household decision-making which emphasizes the role of the individual.

Over the last decade, several models of labor supply behavior based on bargaining within the household have been suggested; these models rely on some notion of bargaining equilibrium with Nash being by far the most common. (See Manser and Brown, 1980; McElroy and Horney, 1981, 1990; Horney and McElroy, 1988; Bjorn and Vuong, 1984, 1985 for the co-operative case. The non-cooperative case is presented in Ashworth and Ulph, 1981; Bourguignon, 1984 and Ulph, 1988). Other investigations have considered Kalai-Smorodinsky (Manser and Brown, 1980) and Stackelberg (Bjorn and Vuong, 1984, 1985) notions of equilibria. Assuming Nash equilibrium, then the household members maximize the product of the difference between a member's utility and the threat-point utility, V_o^m which depends on prices, non-labor income and, possibly, other characteristics of household members, $\tilde{\mu}$, (which may differ from those characteristics which condition the utility function):

---

[1]If only some members of the household are altruistic, then the preferences of the altruist(s) must dominate: in essence, he or she must behave as a dictator. (Manser and Brown, 1980).

$$\prod_{m}^{M=1} [\, U^m (X, \ell; \mu) - V_o^m (p, y_m; \tilde{\mu}) \,] \qquad [5]$$

The model implies that household commodity demand will depend on prices, non-labor income and household characteristics, μ^*, the union of μ and $\tilde{\mu}$:

$$X_i = g (p, y_1, ..., y_M, \mu^*) \qquad [6]$$

It is, however, not entirely clear how to define threat-point utility: it may be the utility associated with the non-cooperative outcome (Ulph, 1988; Lundberg and Pollak, 1991) or the utility attained if a member quits the household (McElroy, 1990). In the case of the latter, then it is not non-labor income a member receives while a member of the household that affects commodity demand but the income the individual would receive if outside the household. Current non-labor income would be an error-ridden proxy for the latter.

While these models have a good deal of intuitive appeal, Chiappori (1988a, 1988b, 1992a, 1992b) has made the important point that they impose structure on the intra-household allocation process and it is very difficult to test this structure. Clearly failure to reject a bargaining model of household resource allocation does not imply acceptance of the common preference class of models. See also Apps (1982) and the discussion in Kooreman and Kapteyn (1990).

Chiappori (1988a, 1992a) discusses household resource allocation in a broader framework, assuming only that allocations are *Pareto-efficient*. Chiappori (1988a) presents a series of testable parametric and non-parametric restrictions imposed on a demand system under the assumption of common preferences as opposed to Pareto efficiency. Chiappori (1992a) demonstrates that Pareto efficiency implies, and is implied by, the existence of an income sharing rule. Assuming further that one's own consumption is weakly separable from that of other household members, he discusses in detail the case in which there are goods that can be assigned to an individual in the household and demonstrates that it is possible to deduce the income sharing rule, up to a constant factor, from the observed demands for those goods. Apart from leisure demand, however, it is necessary to make an identifying assumption in order to assign commodity consumption to one member or group of members within the household. Using data from Canada (Bourguignon, Browning, Chiappori and Lechène, 1992) and France (Bourguignon, Browning, Chiappori and Lechène, 1991) the empirical implications of this model have been investigated under the assumption that male and female adult clothing (among other goods)

may be treated as assignable goods. Their evidence is apparently consistent with an individual-based model of the household and rejects the model of common preferences.

The important point for this paper is that even in the absence of assignable goods, Pareto-efficiency (or an income sharing rule) implies that household commodity demands depend not on total non-labor income but on its distribution within the household:

$$X_i = g(p, y_1, ..., y_M, \mu) \qquad [7]$$

According to the common preference (altruism or dictatorial) model [4], however, re-arranging the distribution of non-labor income within the household will have no impact on household commodity demands. This is a key prediction of the common preference model, not shared by any of the more general models; it suggests, therefore, a very simple test of the common preference model against a fairly broad class of alternatives, including the bargaining type models and the models proposed by Chiappori and collaborators. Maintaining that non-labor income is exogenous, we will test whether non-labor income attributed to a man in the household has the same impact on commodity demands as non-labor income attributed to a woman in the household.

Typically non-labor income represents only a small fraction of total resources available to a household for consumption. We turn, therefore, to examine the impact on commodity demand of the total income of each individual, Y_m:

$$X_i = g(p, Y_1, ..., Y_M, \mu) \qquad [8]$$

where $Y_m = w_m(T-\ell_m) + y_m$. There are several studies of household resource allocations which examine the impact of male and female income on a variety of household demands (and outputs); for a review, see Blumberg, (1988). Since each household member's utility depends on consumption of their own leisure, and possibly that of other members, it may be inappropriate in this model to assume labor supply, $(T-\ell_m)$, is exogenous and to thus treat total income as predetermined. Intuitively, household members are likely to negotiate over the consumption of goods *and* leisure *simultaneously*.

Under the maintained assumption that current non-labor income *is* exogenous then it is unaffected by current demands and so is a valid instrument for total income. If, however, non-labor income reflects past labor supply behavior then it may not be exogenous; we experiment, therefore, with a range of identifying assumptions. Given a set of instruments, it is possible to determine whether the distribution of total income

within the household affects household demand patterns by testing for the equality of the impact of (instrumented) total income in the hands of different individuals in [8].

Testing for the equality of the effects of non–labor income on household decisions is not new although much of this literature has focussed on assignable goods and, in particular, leisure demand. Using US data (the National Longitudinal Survey), McElroy and Horney (1981) fail to reject the hypothesis that non–labor income accruing to the husband, wife and other members of the household have the same effect on male and female labor supply. In contrast, using household expenditure data from France and Canada, Bourguignon, Browning, Chiappori and Lechène (1991, 1992) reject the model of common preferences.

Using household expenditure data from Thailand, Schultz (1990) demonstrates that a woman's non–labor income has a significantly larger negative effect on the probability that she enters the wage labor force than does her husband's non–labor income. The reverse is true for men. He also examines the impact of non–wage income on fertility rates: more non–labor income in the hands of women tends to (significantly) raise fertility; it is little affected by husband's non–wage income. Schultz (1991) reports that in the United States non–labor income in the hands of a woman reduces the probability of being married (significantly for whites) and also reduces fertility (again, significantly only for whites).

Thomas (1990) reports that in Brazil non–labor income in the hands of women, relative to men, has a bigger impact on a range of health inputs and outcomes (child height, weight for height, survival and nutrient intake). Similar results are reported for child health (survival and immunizations) and schooling in Tamil Nadu, India by Duraisamy (1991). Quisumbing (1991) presents evidence for the Philippines in which assets under the control of men and women have differential impacts on resource flows to their children.

3. DATA

The *Estudo Nacional da Despesa Familiar*, ENDEF, is a large scale household budget survey carried out by the *Instituto Brasilieri de Geografia e Estatistica* from August 1974 through August 1975. Some 55 000 households were included in a budget survey which, in addition to household expenditures, gathered information on income. Each member of the household was asked about their own labor supply, earnings and non-labor income.

It is not obvious how to attribute income from family enterprises to individuals within the household; in this survey, all income was attributed to the 'household head'. This is particularly a problem in the rural sector where many families operate farms; in the urban sector, however, unpaid family workers account for less than 5% of all workers in the survey. The sample is therefore restricted to the 38,000 urban households in the survey and we focus on the incomes of the head and spouse; they will be referred to as the male and female heads. About 18% of all the households in the survey are headed by single females whereas 6% are headed by a single male. There are both a male and a female head in the remaining three quarters of households.

On average, household income is about Cr$27,000 per month[2] and, of that, three quarters is attributed to the male head. This share is very stable across the distribution of household *per capita* expenditure (PCE). Essentially every male head reports at least some income and the average male receives about Cr$28,000 per month. Just over 50% of female heads report some income and among these women, average monthly income is Cr$8,700 which is only one third of the average male income.

About one quarter of total household income is derived from non-labor sources and positive non-labor income is reported by somewhat less than one half (43%) of all male heads and nearly a quarter (23%) of all female heads in the survey. On average, male heads report about Cr$6,500[3] in non-labor income and it makes up about a quarter of their total income. The share of non-labor income in total income of men tends to rise with PCE. In contrast, for women, the share of income from non-labor sources is constant across the

---

[2]Household income is defined here as the income of the male and female heads. Other income is ignored throughout. Inflation was approximately 35% *per annum* during the survey and so all incomes and expenditures have been converted to real values using monthly deflators provided by IBGE.

[3]Cr$5,302 divided by 0.81, the proportion of households with a male head.

distribution of PCE, accounting for about 40% of total income. The average female head reports about Cr$1,700 in non-labor income.

Income is notoriously difficult to measure well in expenditure surveys. This may be because respondents do not want to report their income (for fear of reprisals) or because the structure of the survey instruments typically involves only a small number of questions on income but greater detail in expenditures. Whatever the reason, many of the recent studies of consumer behavior have used data only on expenditures. If income is hard to measure accurately, then it is quite likely that income from non-labor sources is even harder to capture.

ENDEF, however, was a very comprehensive and intensive survey with each household being visited on a daily basis for a week by the same enumerator; there is some evidence that enumerators were able to elicit additional information later in the week as households came to view them as less alien (Vasconcellos, 1983). The survey took considerable care in the collection of income and, in particular, non-labor income which was broken down into six categories: income from rents and physical assets; financial assets; pensions; social security and workers compensation; gifts and other irregular income. Pension benefits and social security are likely to be related to previous labor supply choices and so we will also examine the impact of asset income on household commodity demands. While this may be a cleaner measure of non-labor income, we recognize that it, too, potentially reflects previous earnings and savings behavior. Indeed, this is a tough problem to crack, at least with a single cross-section of data. Even information on bequests or dowries as suggested by, for example, Schultz (1990) may not be predetermined in the context of these models of household behavioral choices.

Among the survey respondents, 14% of men and 7% of women report any asset income. It thus accounts for a very small fraction (7%) of total household income, although among those who report any asset income, the amounts are certainly not trivial. We view experiments with the effects of asset income on commodity demand as checks on the robustness of the results based on the broader measure of non-labor income.

The demand functions [3] depend not only on income and prices (which are discussed below) but also on a set of household characteristics, μ, such as household structure. Since we consider the demands of all households in the sample, controls for the presence of a male and female head are included. To pick up scale effects of demand, (the logarithm) of household size is added to the covariates and to permit variation in the

effects of different household compositions, μ includes the proportion of household members in each of five gender–specific age groups.[4]

It is often argued that education of the male and female heads are likely to affect tastes and thus should also enter the demand functions. It might be argued, however, that the impact of education operates only through income, in which case the education of the male and female heads provide a set of over–identifying instruments, in addition to non–labor income, in those models which include total income of the male and female head, [8]. Experiments with this specification are reported below.

Each household in the survey reports both the value and quantity of goods consumed and so it is possible to compute a household specific price for each commodity that it purchases. Since variation in these prices may reflect measurement error and heterogeneity in quality choices, it is not appropriate to treat household level prices as exogenous (Deaton, 1988). Instead, we include market average price indices for twelve commodity groups[5]as well as state and month controls to account for other unobserved heterogeneity in the community environment.

It remains to specify the commodities in the demand system [4]. ENDEF reports expenditures on over 300 different goods over a variable recall period ranging from a week for commonly consumed foods to a year for infrequently purchased goods such as durables and semi–durables. Since a large fraction of households do not purchase many of these goods, estimating demand functions at this level of disaggregation would entail addressing the auxiliary problem of the decision to purchase. (Lee and Pitt, 1983; Wales and Woodland, 1983;

---

[4]The age groups are children aged 0–4, 5–9 and 10–14 years, adults (15–54) and older (than 55) household members. One group must be dropped (older females) leaving 9 composition categories.

[5]It is not obvious how to define market boundaries, at least from an empirical perspective. Using prices on 135 homogeneous commodities (such as black beans; mulatto beans; green corn; corn flour), median prices were computed for each of 23 states, distinguishing metropolitan from non–metropolitan areas. These median prices have then been aggregated into Tornquist price indices based on the shares of the budget spent on that good in each market:

$$\ell np_{GM} = \Sigma_{g \in G} \tfrac{1}{2} (w_{gm} + w_{g\bullet}) (\ell np_{gm} + \ell np_{g\bullet})$$

where the g's are goods within the Gth commodity group, the •'s represent national averages and w_{gm} is the share of expenditure on good g in market m. Price indices are included for 12 commodity groups: cereals, tubers, beans, fruit and vegetables, meat and fish, dairy products, fats, oils, housing, fuel and transport, clothing and personal care items. See Thomas, Strauss and Barbosa (1992) for details.

see Deaton, 1986 for a discussion). We choose, therefore, to focus on a set of aggregates (and sub-aggregates) for which at least most households report non-zero expenditures.

Housing expenditures are either reported by, or imputed for, all urban households in the survey and they account for almost a fifth of the budget of the average household. Food, which is also purchased by virtually every household during the survey week accounts for 40% of the budget. According to the anthropological literature, in Brazil, women tend to have control over food in the home (Neuhouser, 1989); whether this carries over to food purchased outside of the home is not clear. We therefore examine its demand separately (although it is purchased by only 40% of households and accounts for about 4% of the budget).

If adult clothing could be separated between men and women, then it may be an "assignable good" and thus used to identify the household income sharing rule: see Bourguignon, Browning, Chiappori and Lechène (1991, 1992) who examine the demand for these goods, amongst others. In ENDEF, however, it is not possible to unambiguously separate clothing expenditures along gender lines and so this strategy is not possible here. Alcohol, tobacco and clothing have traditionally been treated as "adult goods" in the equivalence scale literature and we have examined them both separately and as an aggregate. All our results for the aggregate carry through to the three commodities separately; in the interests of brevity we report only the aggregate case.

There is some evidence that non-labor income in the hands of women in Brazil has a bigger impact on the health of children in the household than non-labor income in the hands of men. We therefore examine the demand for health services (including medical expenditures) and expenditures on education (including tuition payments, transport to school, school uniforms and items needed at school such as books). Household services (much of which is domestic services but also includes services for labor around the home and other services including telephone charges) are included with health and education as a 'human capital' aggregate. Almost all households purchase at least some of this commodity and it accounts for just under 7% of the budget of the average household. Each of these sub-aggregates is examined separately as well as together.

Expenditures on books, magazines, clubs and other recreation items in addition to expenditures on ceremonies (birthdays, baptisms, weddings and funerals) are grouped together in the leisure aggregate which accounts for about 4% of the budget of the average household. The final category discussed below is household equipment which includes expenditures on linens, furniture, electrical equipment and other semi-durables.

Almost every household spends something on these goods and they account for nearly 8% of the total budget. The remaining 10% of the budget is accounted for by other commodities which are not reported here.

Finally, it is straightforward to generalize the demand model above to include the consumption of not just foods but the nutrients they provide. Thus, we also examine the impact of income on the demand for calories and for protein. In ENDEF, total household consumption of nutrients was measured by weighing the food consumed at each meal (taking care to account for any wastage or left overs) over the course of a week. These data were then converted to nutrient intakes using FAO tables. Every person at each meal is reported and so *per capita* intakes of each nutrient are calculated for each household; see Haddad and Kanbur, (1990) for a recent study using individual nutrient intake information.

4. EMPIRICAL RESULTS

In order to determine whether re-distributing income within an household will affect household consumption patterns, we will test for the equality of the impact of male income, I_m, and female income, I_f, on shares of the household budget allocated to a series of commodities, ω_i. Income effects are allowed to be flexible with polynomials in both incomes, as well as an interaction term, included in the demand functions. Although only income effects are reported below, all regressions include controls, X, for the existence of a male and female head, their education, ℓn household size and proportions of members in 9 age-gender groups, ℓn prices, month dummies and state dummies.

$$\omega_i = \alpha_1 I_f + \alpha_2 I_f^2 + \alpha_3 I_m + \alpha_4 I_m^2 + \alpha_5 I_f I_m + \beta' X + \varepsilon_i \qquad [9]$$

The impact of non-labor income, (setting I = y), on household budget shares is reported in Tables 2 through 4. The two stage least squares estimates using total individual income, (setting I=Y), and treating it as endogenous are reported in the remaining tables. All incomes are measured in millions of crusados. Sample summary statistics are in Appendix Table 1.

According to Lagrange Multiplier tests (Breusch and Pagan, 1980), the assumption of homoskedastic errors is rejected in the regressions. All variance covariance matrices are estimated by the infinitesimal jackknife (Jaeckel, 1974; also called the influence function estimator, Hampel, 1974, and attributed to White, 1980)

which is consistent in the presence of heteroskedasticity. In very large samples, it probably makes sense to adopt a size of test which trades off Type I and Type II errors; we follow the proposal of Schwarz (1978) which will asymptotically pick the model that is *a posteriori* most probable. For a χ^2 test statistic, the critical value is the logarithm of the sample size multiplied by the number of restrictions, r; for our sample, which has close to 39,000 observations, the critical value is 10.57*r. Since the square of a t variate is asymptotically a χ^2_1, the critical value of a t statistic is 3.3 according to the Schwarz criterion.

The impact of non–labor income (broadly defined) on demand is presented in Table 2; regression coefficients underlying the quadratic model are presented in Appendix Table 2. The left hand panel of Table 2 reports coefficient estimates and quasi–t statistics for a model linear in male and female non–labor income (setting α_2, α_4 and α_5 to zero). The right hand panel reports the estimated income effects (evaluated at the mean) for the model [9];[6] χ^2 statistics for joint significance of all three covariates are reported below each income effect. The third column of each panel reports the ratio of the female to male income effects and the χ^2 test for equality of these income effects (or, equivalently for the ratio of effects being equal to unity). Under the Schwarz criterion, the critical value for this test is 10.6 in the linear model and 31.7 in the quadratic model.

The model which is linear in male and female income is rejected in most of the cases and the estimated income effects are substantially different from those based on the quadratic model [9]. The implications of the tests for equality of income effects are, however, quite similar in both the linear and quadratic models. Additional non–labor income in the hands of women increases the budget share spent on housing, education, household services, recreation and, possibly, health. More non–labor income in the hands of men raises the budget share spent on health, household services and leisure. For all these goods, however, the income effects are larger for women than men by a factor of between 3 and 5: the differences are significant for the human capital aggregate (education, health and, in particular, household services) and also for the leisure aggregate (ceremonies and recreation). The household services sub–aggregate comprises largely of payments for domestic services, labor in the home and utilities such as telephones; these are likely to be substitutes for the time of the

[6]Experiments with more flexible polynomial models indicated that cubic terms (and additional interactions) did not significantly improve the explanatory power of the regressions.

female head. Education and recreation expenditures might be viewed as investments in human capital and are directed mostly towards children; health expenditures may also be viewed as investments in human capital.

Some shares must also decline and, it turns out that food shares (both at home and out of the home) as well as the share spent on adult goods[7] decline with income (for both men and women) with the decline being larger for a marginal crusado in the hands of a woman: this difference is significant only for the food shares (at home and away). Although food shares decline with income, food expenditures increase and, furthermore, the composition of food consumption also changes. As income (of men or women) is increased, the *per capita* consumption of both calories and protein increases but the marginal effect of additional non-labor income in the hands of women is significantly larger than the impact of an increase in male income: for calories the income effects differ by a factor of 11. Higher nutrient intakes are likely to be associated with better health (at least in Brazil) and so these results suggest that women tend to allocate resources under their control towards foods which are associated with better health of household members.

Taking the results together, there is some evidence that non-labor income in the hands of women rather than men seems to be associated with more expenditure on investments in human capital and also goods which are substitutes for the woman's own time. These results are consistent with other evidence, based on the same data, which indicates that non-labor income in the hands of women has a bigger effect on the health of her children than income in the hands of men.

Not all estimated income effects differ between men and women. There is no evidence, for example, that rearranging the distribution of (non-labor) income within the household will have any (significant) impact on the shares spent on housing and household goods, both of which are presumably like 'public' goods to household members. In addition, estimated effects of income in the hands of men and women are essentially the same for those goods that are traditionally treated as adult goods, namely alcohol, tobacco and clothing (taken separately or taken together).

Since a large fraction of the survey respondents report no non-labor income, it may be that the estimated income effects largely reflect heterogeneity between those who do have non-labor income and those

[7]Experiments with male and female clothing (to the extent they can be identified in these data) did not indicate any significant differences in the impact of male or female nonlabor income on their expenditures.

who do not. Table 3 reports estimates based on the quadratic regression [9] in non–labor income, but includes, in addition, a pair of indicator functions for whether the male of female reports any non–labor income. Conditional on reporting some non–labor income, the estimated income effects do *not* change dramatically and they are significantly different for men and women in the case of the human capital and leisure goods, food (at home) and also *per capita* protein intake.

As an additional check on the robustness of these results, non–labor income is defined to include only asset income in Table 4. Since fewer than 15% of households report any asset income, its effect on the demands for commodities that are not purchased by (almost) all households will be difficult to estimate: we focus, therefore, on the broader aggregates. It turns out that, qualitatively, the results are in line with those based on the broader definition of income: additional asset income in the hands of women rather than men is associated with larger budget shares on human capital and leisure goods, higher nutrient intakes and lower foods shares. These differences are, however, significant only for food (at home and away) although, perhaps, the differences in income effects on protein intake and human capital border on being significant.

We also tested for differences in the impact on demand of asset and all other non–labor income (non–asset income): their effects are, in general, not significantly different from each other and this is true both for men and for women. This implies that the differences in the effects of male and female income cannot be attributed to differences in the composition of non–labor income, to the extent that heterogeneity in composition is captured by this dichotomy. It is, however, possible that the differences in income effects reflect differences in measurement errors on male and female non–labor income. Although this is very difficult to rule out, there is evidence, using the same data source, that maternal non–labor income has a significant positive effect on the height (given age) of her daughter and no effect on her son, (Thomas, 1991). This, along with the fact that maternal education has a bigger effect on the height of her daughter relative to her son, is *suggestive* that non–labor income, and its distribution, is not pure noise.

The focus thus far has been on non–labor income; would household consumption patterns change if *total* income were to be redistributed from men to women? Table 5 reports the results of estimating the demand functions [8] which are linear (left half) and quadratic (right half) in male and female total income; Appendix Table 2 presents the underlying coefficients for the quadratic model. The instruments include male and female

non-labor income, their quadratics and interactions; the model in the right hand panel of Table 5 is therefore exactly identified.

Raising the income of women will tend to increase budget shares on housing, education, health, household services and recreation; if additional income is in the hands of men, then budget shares on health, household services and recreation will increase. As was the case with non-labor income, the budget shares rise more if additional income is put in the hands of women. Taken together, the estimated male and female income effects are different for both the human capital and leisure aggregates.

Additional income has a negative impact on adult goods -- but the effect is the same independent of to whom the income is attributed. The share of the budget spent on food (at home and away) also declines with income but this decline is significantly greater if additional income is in the hands of women, rather than men. *Per capita* nutrient intakes rise with income at a much faster rate if the income is attributed to women rather than men: this difference is significant for both calorie and protein intakes.

The results for total (labor and non-labor) income are, therefore, very similar to those that examine the impact of only non-labor income. Furthermore, the results for total income are also robust to the inclusion of a dummy for whether or not the individual reported any income (also treated as endogenous with dummies for reporting non-labor income as the instruments). In the case of nutrients, however, female income effects are significantly larger than male effects only for protein intake. (Table 6). Permitting more flexibility in the income responses (by including cubics in male and female income) does not change the thrust of these conclusions.

All the demand functions have included dummies for the education of the male and female heads in order to control for heterogeneity in tastes. If household consumption is affected by education *only* through its impact on earnings and thus income, then education should be excluded from the demand functions and it is a valid instrument for total income. Estimates based on this model are presented in Table 7. Again, relative to men, income in the hands of women are associated with larger increases in the share of the budget spent on human capital goods and leisure and these differences are significant in all cases except housing. Nutrient intakes also rise faster if income is given to women and this difference is significant for both calories and protein. More income under the control of women is associated with higher shares on adult goods but lower shares if

the income is in the control of men: this difference is significant and this is the *only* instance of significantly different income effects on the demand for adult goods. Budget shares on food (at home and away) decline with income and this decline is significantly faster for women.

Table 8 reports estimates of demand functions based on sub–samples of the data. In the left hand panel, only those (29,373) households with both a male and female present are included in the analysis (cutting the sample by a quarter). The results are generally robust to this exclusion although only those income effects on human capital (especially household services) and food shares (in and out of the home) remain significantly different for men and women (under the Schwarz criterion).

Restricting the sample to the (11,119) households in which both the male and female heads report some income, then differences in the effects of income in the hands of men and women tend to be smaller (and the ratios of income effects are closer to one). For most goods, this reflects (absolutely) larger effects of male income. In fact, income effects are not significantly different for any of the commodities except food eaten away from the home (which accounts for less than 5% of the total budget). These results do not, however, have an unambiguous interpretation. Sidestepping the issue of sample selection and restricting attention to only those households in which both the male and female head report having some income, then this evidence suggests that modelling these households as if the head and spouse share common preferences is consistent with the data. For all other households, however, the model of common preferences is apparently not appropriate.

5. CONCLUSIONS

Most economic models treat the household as a black box: this paper has attempted to poke into that box by examining household commodity demand patterns. We have focussed on the impact of income, distinguishing that attributed to women from that attributed to men. Under a model of (perfect) altruism (or common preferences of all household members), then the distribution of income *within* the household should have no impact on expenditure patterns. Using budget survey data from Brazil, this assumption has been tested both with non-labor income, which is assumed to be exogenous, and with total (labor and non-labor) income. It turns out that under both definitions, income in the hands of women is associated with a larger increase in the share of the household budget devoted to human capital (household services, health and education) and also leisure (recreation and ceremonies) goods. The proportion of the budget spent on food (at home and away) declines more if the income is in the hands of women although food composition also changes with nutrient intakes rising faster as womens' income increases. All these results are robust to a variety of specifications of the basic model. When the sample is restricted to only those couples in which both have some income, then there is little evidence that income in the hands of men and women have significantly different effects on commodity consumption. The results suggest that the key to understanding household resource allocation may lie in a better understanding of household composition patterns and labor supply decisions.

REFERENCES

Altonji, J., F. Hayashi and L. Kotlikoff. 1989. Is the extended family altruisitically linked? Direct tests using micro data. NBER Working Paper 3046.

Apps, P. 1982. Institutional inequality and tax incidence. *Journal of Public Economics*, 18:217–42.

Ashworth, and D. Ulph. 1981. Household models, in C. V. Brown (ed.), *Taxation and Labour Supply*, London: Allen and Unwin.

Becker, G. S. 1981. *A Treatise on the Family*, Cambridge: Harvard University Press.

Bjorn, P. A. and Q. H. Vuong. 1984. Simultaneous equations models for dummy endogenous variables: a game theoretic formulation with an application to labor force participation, working paper, California Institute of Technology.

Bjorn, P. A. and Q. H. Vuong. 1985. Econometric modelling of a Stackelberg game with an application to labor force participation, working paper, California Institute of Technology.

Blumberg, R. 1988., Income under female versus male control: Hypotheses from a theory of gender stratification and data from the Third World, *Journal of Family Issues*, 9.1:51–84.

Blundell, R. 1988. Consumer behaviour: Theory and empirical evidence -- A survey. *Economic Journal*, 98:16–65.

Bourguignon, F. 1984. Rationalité individuelle ou rationalité stratégique: le cas de l'offre familiale de travail. *Revue Economique*, 35:147–62.

Bourguignon, F., M. Browning, P. A. Chiappori and V. Lechène. 1991. Intrahousehold allocation of consumption: a model and some preliminary evidence. Mimeo, DELTA.

Bourguignon, F., M. Browning, P. A. Chiappori, and V. Lechène. 1992. A structural empirical model of within household allocation. Mimeo, University of McMaster.

Breusch T. S. and A. R. Pagan. 1980. The lagrange multiplier test and its applications to model specification in econometrics, *Review of Economic Studies*, 47:225–38.

Chiappori, P. A. 1988a. Rational household labor supply, *Econometrica* 56.1:63–89.

Chiappori, P. A. 1988b. Nash bargained household decisions, *International Economic Review*, 29.4:791–6.

Chiappori, P. A. 1992a. Collective labour supply and welfare. *Journal of Political Economy*, 100.3:437–467.

Chiappori, P. A. 1992b. Traditional versus Collective models of household behavior: What can data tell us? Mimeo, DELTA.

Deaton, A. 1986. Demand Analysis. In Z. Griliches and M. D. Intriligator, eds., *Handbook of Econometrics*, Amsterdam:North Holland.

Deaton, A. 1988. Quantity, quality and spatial variation of prices, *American Economic Review*, 78:418–30.

Deaton, A. and J. Muellbauer. 1980. *Economics and consumer behavior*. New York:Cambridge University Press.

Deaton, A., J. Ruiz-Castillo and D. Thomas. 1989. The influence of household composition on household expenditure patterns: theory and Spanish evidence. *Journal of Political Economy*, 97.1:179-200.

Duraisamy, P. 1991. Child survival, preventive health care and schooling in rural households of Tamil Nadu, India. Mimeo, Yale University.

Haddad, L and R. Kanbur. 1990. How serious is the neglect of intra-household inequality? *Economic Journal*, 100:866-81.

Hampel, F. 1974. The influence curve and its role in robust estimation. *Journal of the American Statistical Association*, 69:383-93.

Horney, M. J. and M. B. McElroy. 1988. The household allocation problem: empirical results from a bargaining model, *Research in Population Economics*, 6:15-38.

Jaeckel, L. A. 1972. Estimating regression coefficients by minimizing the dispersion of residuals, *Annals of Mathematical Statistics*, 42, 1020-1034.

Kooreman, P. and A. Kapteyn. 1990. On the empirical implementation of some game theoretic models of household labor supply. *Journal of Human Resources*, 25.4584-595.

Lee, L. F. and M. Pitt. 1986. Microeconometric demand systems with binding non-negativity constraints: The dual approach. *Econometrica*, 54.5:1237-42.

Lundberg, S. and R. A. Pollak. 1991. Separate spheres bargaining and the marriage market, mimeo.

Manser, M. and M. Brown. 1980. Marriage and household decision making: a bargaining analysis, *International Economic Review*, 21.1:31-44.

McElroy, M. B. 1990. The empirical content of Nash-bargained household behavior, *Journal of Human Resources*, 25.4:1-57.

McElroy, M. B. and M. J. Horney. 1981. Nash bargained household decisions, *International Economic Review*, 22.2:333-50.

McElroy, M. B. and M. J. Horney. 1988. Nash bargained household decisions: Reply, *International Economic Review*, 31.1:237-42.

Neuhouser, K. 1989. Sources of women's power and status among the urban poor in contemporary Brazil, *Signs*, 14.3 685-702.

Pollak, R. and T. J. Wales. 1979. Welfare comparisons and equivalence scales. *American Economic Review*, 69:216-21.

Quisumbing, A. 1992. Intergenerational transfers in Philippine rice villages: gender differences in traditional inheritance customs. Forthcoming, *Journal of Development Economics*.

Schultz, T. P. 1990. Testing the Neoclassical model of family labor supply and fertility, *Journal of Human Resources*, 25.4:599-634.

Schultz, T. P. 1991. Economic aspects of marriage and fertility in the United States. Mimeo, Yale University.

Schwarz, G. 1978. Estimating the dimension of a model. *Annals of Statistics*, 6:461-4.

Thomas, D., J. Strauss and M. Barbosa. 1992. Income and price elasticities of the demand for food, *Pesquisa e Planejamento Economico.*

Thomas, D. 1990. Intra-household resource allocation: an inferential approach, *Journal of Human Resources*, 25.4:635-664, Fall, 1990.

Thomas, D. 1991. Like father, like son or like mother, like daughter: Gender differences in household resource allocations. Mimeo, Yale University.

Udry, C. 1990. Credit markets in Northern Nigeria: Credit as insurance in a rural economy. *World Bank Economic Review*, 4.3:251-270.

Ulph, D. 1988. A general non-cooperative Nash model of household consumption behaviour. Mimeo, Bristol University.

Vasconcellos, M. 1983. *Objetivos, descricao e metodologia usada no ENDEF*, Rio de Janeiro:IBGE.

Wales, T. and A. Woodland. 1983. Estimation of consumer demand systems with binding non-negativity constraints. *Journal of Econometrics*, 21:263-85.

White, H., 1980, A heteroskedasticity-consistent covariance matrix and a direct test for heteroskedasticity, *Econometrica*, 48:817-38.

Table 1
Distribution of income within the household
Total, labor and non-labor income: means and [standard errors]

	Mean for all hhs	% reporting income conditional on in hh		Mean income conditional on reporting some income
Total income	27 006	98.3		27 467
	[390]			[396]
Labor income	20 097	84.7		23 715
	[259]			[302]
Non-labor income	6 909	52.5		6 909
	[232]			[302]
Asset income	1 883	14.8		12 722
	[76]			[500]
Non asset income	5 026	40.9		12 289
	[189]			[457]
Male head				
% exist	81.9			
Total income	23 020	81.1	99.0	28 407
	[382]			[465]
Labor income	17 718	73.1	89.2	24 239
	[258]			[338]
Non-labor income	5 302	35.3	43.1	15 029
	[225]			[629]
Asset income	1 300	11.9	14.5	10 925
	[74]			[603]
Non asset income	4 002	28.7	35.0	13 924
	[184]			[629]
Female head				
% exist	93.5			
Total income	3 986	45.9	49.1	8 676
	[74]			[154]
Labor income	2 379	33.5	35.8	7 111
	[40]			[110]
Non-labor income	1 606	21.6	23.1	7 456
	[59]			[264]
Asset income	531	6.6	7.0	8 045
	[20]			[638]
Non asset income	1 075	12.2	13.1	8 819
	[49]			[389]

Table 2
Effects of male and female income on commodity demand: Non-labor income

	Linear model			Quadratic model (evaluated at mean)		
	Female	Male	Ratio	Female	Male	Ratio
Shares						
Food	-107.67	-21.06	5.11	-246.08	-60.06	4.10
	[4.73]	[2.85]	[12.96]	[305.39]	[128.30]	[143.78]
Meals out	-25.41	-2.55	9.98	-63.44	-7.82	8.12
	[4.29]	[2.55]	[14.38]	[105.85]	[50.95]	[74.03]
Housing	26.62	4.83	5.51	72.43	12.77	5.67
	[2.60]	[2.79]	[4.39]	[32.50]	[14.28]	[21.79]
Human capital	41.88	5.85	7.16	86.79	18.25	4.76
	[4.56]	[2.53]	[14.40]	[146.65]	[78.20]	[103.84]
Education	7.75	0.96	8.03	18.45	2.92	6.31
	[3.63]	[1.71]	[9.37]	[36.72]	[9.06]	[22.32]
Health	13.72	1.55	8.83	22.29	6.44	3.46
	[2.88]	[1.57]	[6.20]	[29.51]	[36.53]	[23.49]
HH Services	20.42	3.33	6.13	46.05	8.89	5.18
	[4.33]	[3.24]	[12.47]	[145.47]	[75.10]	[85.49]
Leisure	31.50	6.63	4.75	58.58	16.06	3.65
	[4.47]	[2.98]	[11.25]	[58.71]	[64.61]	[40.60]
Ceremonies	7.90	-0.11	-69.65	19.80	0.71	27.90
	[2.96]	[0.40]	[8.94]	[28.44]	[11.80]	[26.11]
Recreation	23.60	6.74	3.50	38.79	15.35	2.53
	[3.90]	[3.29]	[6.85]	[37.75]	[63.64]	[28.94]
HH Goods	5.85	0.21	27.68	12.22	1.86	6.56
	[2.03]	[0.27]	[3.53]	[7.56]	[7.55]	[6.08]
Adult goods	-14.42	-4.51	3.19	-17.57	-11.21	1.57
	[5.71]	[3.36]	[11.86]	[29.23]	[38.59]	[1.90]
Nutrient intakes						
ℓn(calories per capita)	1.63	0.16	10.35	1.60	0.14	11.08
	[2.47]	[2.10]	[19.28]	[69.64]	[16.13]	[52.88]
ℓn(protein per capita	3.47	0.54	6.37	3.47	0.59	5.91
	[3.21]	[2.67]	[49.52]	[207.85]	[72.83]	[119.47]

Notes

1. There are 38,799 observations in the sample. In addition to income, each regression includes controls for the existence of a male and female head, their education (three dummies each – literate, completed elementary school and completed secondary school or more), ℓn household size and proportions of members in 9 age–gender groups, ℓn prices, month dummies and state dummies. All incomes are measured in millions of crusados.

2. Human capital goods are education, health and household services. Education includes tuition, uniforms and other schooling expenses. Health includes medications, prescriptions, medical care expenses. Household services include domestice services, labor around the home and utlities such as telephones.

Leisure expenditures include those on ceremonies (baptisms, birthdays, weddings) and recreation (books, magaszines, clubs and sports fees).

Household goods are linens, furniture and other household semi–durables.

Adult goods are alcohol, tobacco and clothing and footwear.

3. Income effects for females and males reported for each commodity; [t statistics] below estimates in linear models; χ^2 tests for joint significance of income covariates below estimates in non–linear models. Ratio of female to male income effects in third column; χ^2 for equality of male and female effects in parentheses below ratio.

4. All tests based on heteroskedasticity consistent estimates of standard errors.

5. By the Schwarz criterion, critical values for χ^2s in the linear model are 10.6 and 31.7 in the quadratic model.

Table 3

Effects of quadratics in non-labor income on commmodity demand: including dummy(1) if report any non-labor income

	Female	Male	Ratio	χ^2(incl dummy)
Shares				
Food	-234.10	-48.45	4.85	
	[379.73]	[658.75]	[147.11]	[160.59]
Meals out	-46.66	-4.57	10.20	
	[182.06]	[121.15]	[54.61]	[70.01]
Housing	73.26	10.53	6.95	
	[32.88]	[42.45]	[21.68]	[24.39]
Human capital	84.71	14.81	5.72	
	[161.07]	[260.83]	[100.30]	[111.99]
Education	18.62	1.94	9.60	
	[36.88]	[64.27]	[24.02]	[35.44]
Health	20.30	4.81	4.25	
	[36.25]	[99.94]	[21.43]	[25.90]
HH Services	45.79	8.07	5.69	
	[154.68]	[154.05]	[82.56]	[83.36]
Leisure	54.79	13.70	4.00	
	[99.60]	[185.11]	[37.05]	[37.87]
Ceremonies	17.60	0.18	98.94	
	[43.73]	[30.40]	[20.93]	[23.86]
Recreation	37.19	13.52	2.75	
	[62.88]	[200.23]	[27.60]	[34.56]
HH Goods	5.74	0.22	25.61	
	[43.73]	[30.37]	[4.62]	[5.27]
Adult goods	-23.72	-11.05	2.15	
	[42.45]	[38.79]	[5.66]	[12.06]
Nutrient intakes				
ℓn(calories per cap)	1.43	0.08	17.75	
	[28.76]	[13.64]	[14.12]	[11.41]
ℓn(protein per cap)	3.39	0.51	6.62	
	[78.75]	[39.78]	[66.98]	[53.59]

Notes: See Table 2.

Table 4
Effects of male and female income on commodity demand: Asset income

	Female	Male	Ratio
Shares			
Food	-486.08	-140.90	3.45
	[149.93]	[171.37]	[64.52]
Meals out	-95.95	-17.20	5.58
	[52.82]	[35.39]	[33.36]
Housing	200.90	68.28	2.94
	[30.05]	[42.86]	[10.82]
Human capital	132.71	44.48	2.98
	[60.68]	[44.65]	[25.05]
Education	17.59	8.69	2.03
	[4.74]	[10.57]	[1.51]
Health	26.16	9.60	2.72
	[4.44]	[9.75]	[4.71]
HH Services	88.95	26.19	3.40
	[63.42]	[97.88]	[29.77]
Leisure	71.59	23.67	3.02
	[19.66]	[18.65]	[16.56]
Ceremonies	8.90	-5.08	-1.75
	[2.63]	[43.25]	[10.61]
Recreation	62.69	28.75	2.18
	[20.32]	[30.28]	[20.10]
HH Goods	-4.75	-10.45	0.45
	[73.98]	[5.29]	[0.99]
Adult goods	-56.12	-24.79	2.26
	[20.35]	[31.79]	[4.37]
Nutrient intakes			
ℓn(calories per cap)	2.63	0.58	4.53
	[23.94]	[26.46]	[12.20]
ℓn(protein per cap)	5.85	1.83	3.19
	[70.16]	[104.81]	[29.47]

Notes: See Table 2.

Table 5
Effects of male and female total income on commodity demand: 2SLS : Instruments-non-labor income

	Linear model			Quadratic model (evaluated at mean)		
	Female	Male	Ratio	Female	Male	Ratio
Shares						
Food	-105.95	-19.39	5.46	-261.10	-66.90	3.90
	[4.85]	[3.69]	[14.85]	[269.45]	[61.31]	[115.95]
Meals out	-24.91	-2.38	10.47	-66.63	-9.22	7.23
	[4.36]	[3.12]	[15.29]	[126.04]	[45.30]	[90.29]
Housing	26.42	4.36	6.06	76.10	13.79	5.52
	[2.63]	[2.96]	[4.72]	[31.89]	[10.83]	[21.60]
Human capital	41.12	5.51	7.46	91.69	21.01	4.36
	[4.64]	[3.16]	[15.55]	[64.87]	[4.14]	[30.06]
Education	7.60	0.90	8.45	19.44	3.39	5.74
	[3.66]	[2.00]	[9.95]	[36.34]	[9.55]	[22.84]
Health	13.39	1.59	8.41	23.89	7.94	3.01
	[2.87]	[2.11]	[6.23]	[30.08]	[36.59]	[25.00]
HH Services	20.14	3.02	6.67	48.45	9.72	4.98
	[4.42]	[3.72]	[13.73]	[143.16]	[47.19]	[93.51]
Leisure	30.87	5.90	5.24	62.20	17.10	3.64
	[4.58]	[3.69]	[13.06]	[61.23]	[41.99]	[45.72]
Ceremonies	7.71	-0.03	-270.92	20.66	1.31	15.76
	[2.97]	[0.11]	[8.86]	[29.48]	[14.63]	[26.75]
Recreation	23.16	5.92	3.91	41.55	15.79	2.63
	[3.98]	[3.94]	[8.25]	[37.93]	[35.53]	[29.09]
HH Goods	5.56	0.29	19.12	13.15	2.74	4.80
	[1.97]	[0.43]	[3.29]	[7.71]	[7.63]	[6.31]
Adult goods	-14.39	-4.04	3.56	-18.77	-11.50	1.63
	[5.71]	[3.72]	[14.22]	[31.49]	[26.81]	[2.25]
Nutrient intakes						
ℓn(calories per cap)	1.63	0.16	10.35	1.68	0.18	9.40
	[2.45]	[1.94]	[32.10]	[69.57]	[17.68]	[53.44]
ℓn(protein per cap	3.47	6.54	6.37	3.66	0.69	5.32
	[2.32]	[2.08]	[51.74]	[201.22]	[66.88]	[130.19]

Notes: See Table 2.

Table 6
Effects of male and female total income on commodity demand: 2SLS : Instruments-non-labor income and education

	Quadratic model (evaluated at mean)		
	Female	Male	Ratio
Shares			
Food	-445.74	-192.91	2.31
	[246.44]	[64.54]	[49.70]
Meals out	-76.64	-16.69	4.59
	[173.00]	[112.34]	[89.69]
Housing	101.80	36.77	2.77
	[63.32]	[43.69]	[27.58]
Human capital	161.48	63.99	2.52
	[237.35]	[61.82]	[89.34]
Education	46.23	21.64	2.14
	[135.44]	[54.70]	[48.19]
Health	34.59	13.66	2.53
	[65.30]	[67.70]	[35.27]
HH Services	80.65	28.69	2.81
	[264.48]	[56.74]	[97.61]
Leisure	80.56	36.11	2.23
	[119.01]	[109.87]	[54.16]
Ceremonies	25.12	6.38	3.94
	[61.99]	[40.59]	[42.49]
Recreation	55.45	29.74	1.86
	[77.54]	[127.72]	[36.39]
HH Goods	23.02	8.98	2.56
	[19.36]	[33.80]	[10.07]
Adult goods	15.12	-4.00	-3.78
	[58.41]	[27.89]	[36.73]
Nutrient intakes			
ℓn(calories per cap)	2.44	0.67	3.66
	[152.64]	[62.12]	[84.83]
ℓn(protein per cap)	5.64	1.95	2.90
	[256.30]	[64.78]	[78.61]

Notes: See Table 2

Table 7
Effects of male and female total income on commodity demand: including dummy(1) if report any income
2SLS : Instruments-non-labor income

	Female	Male	Ratio	χ^2(incl dummy)
Shares				
Food	-351.81	-75.63	4.65	
	[386.92]	[354.88]	[101.07]	[109.52]
Meals out	-72.27	-13.76	5.25	
	[162.36]	[137.70]	[47.72]	[74.34]
Housing	94.32	15.25	6.18	
	[52.10]	[27.19]	[27.10]	[27.10]
Human capital	118.82	23.33	5.09	
	[231.63]	[181.12]	[107.95]	[116.25]
Education	29.21	3.96	7.38	
	[84.87]	[40.85]	[45.43]	[45.52]
Health	33.98	9.16	3.71	
	[77.63]	[90.96]	[28.78]	[47.85]
HH Services	55.63	10.21	5.45	
	[182.52]	[113.72]	[103.79]	[103.82]
Leisure	78.12	19.08	4.10	
	[151.22]	[151.59]	[53.93]	[69.54]
Ceremonies	23.26	1.94	12.00	
	[45.04]	[24.90]	[29.45]	[29.49]
Recreation	54.86	17.14	3.20	
	[121.83]	[160.80]	[36.87]	[60.42]
HH Goods	18.53	4.72	3.93	
	[43.79]	[41.07]	[7.92]	[24.76]
Adult goods	-15.90	-11.01	1.44	
	[30.70]	[26.20]	[0.78]	[4.83]
Nutrient intakes				
ℓn(calories per capita)	1.62	0.14	11.22	
	[33.15]	[14.59]	[16.52]	[17.79]
ℓn(protein per capita)	3.66	0.64	5.73	
	[82.25]	[40.52]	[46.08]	[38.31]

Note: See Table 2.

Table 8
Restricted samples: effects of income on commodity demand: 2SLS : Instruments-non-labor income

	HHs with intact couples as male and female head			Both male and female head report some income		
	Female	Male	Ratio	Female	Male	Ratio
Shares						
Food	-188.35	-65.05	2.90	-210.35	-127.15	1.65
	[99.39]	[60.11]	[36.52]	[61.68]	[198.11]	[11.20]
Meals out	-20.43	-7.60	2.69	-37.77	-20.85	1.81
	[22.37]	[35.77]	[36.94]	[39.09]	[35.87]	[49.16]
Housing	80.76	13.66	5.91	133.14	25.46	5.23
	[12.02]	[10.95]	[7.40]	[22.40]	[15.87]	[22.07]
Human capital	86.76	20.41	4.25	88.52	42.15	2.10
	[34.90]	[30.10]	[30.09]	[31.57]	[49.63]	[6.54]
Education	4.61	3.48	1.33	2.10	4.71	0.44
	[14.01]	[6.74]	[8.79]	[14.75]	[7.38]	[8.93]
Health	22.54	8.02	2.81	22.60	19.35	1.17
	[11.85]	[23.46]	[18.90]	[13.73]	[20.04]	[17.01]
HH Services	59.61	8.91	6.69	63.83	18.09	3.53
	[57.43]	[28.95]	[40.70]	[39.38]	[43.71]	[15.71]
Leisure	48.65	16.05	3.03	46.40	37.83	1.23
	[18.81]	[24.15]	[22.35]	[16.24]	[34.82]	[6.09]
Ceremonies	20.24	1.14	17.79	25.03	2.55	9.80
	[6.38]	[9.16]	[6.78]	[3.83]	[2.84]	[2.58]
Recreation	28.41	14.92	1.90	21.37	35.28	0.61
	[17.39]	[26.52]	[21.35]	[13.99]	[41.66]	[6.51]
HH Goods	-10.15	3.30	-3.07	-26.18	2.86	-9.15
	[8.71]	[3.86]	[9.03]	[9.38]	[1.16]	[6.11]
Adult goods	-39.14	-10.51	3.72	-61.24	-27.11	2.26
	[15.24]	[20.40]	[5.05]	[14.75]	[23.80]	[4.36]
Nutrient intakes						
ℓn(calories per capita)	0.78	0.19	4.13	1.10	0.42	2.59
	[2.15]	[1.04]	[15.56]	[6.52]	[8.93]	[3.49]
ℓn(protein per capita	2.48	0.68	3.67	3.65	1.16	3.14
	[2.31]	[0.90]	[20.21]	[37.45]	[39.73]	[10.71]

Note: See Table 2. 29,273 households in sample of intact couples; critical value of χ^2 for equality of effects is 30.9. 11,119 households in sample of income recipients; critical value of χ^2 is 27.9

Appendix Table 1
Means and standard errors of covariates

	Mean	Std. err.	%>0
Expenditure shares			
food	40.88	0.0902	98
meals out	4.24	0.0477	41
housing	18.53	0.0613	100
human capital	6.77	0.0348	94
education	1.89	0.0162	62
health and medical	3.43	0.0245	84
hh services	1.45	0.0145	60
leisure	3.93	0.0286	81
ceremonies	1.49	0.0172	56
recreation	2.44	0.0217	71
hh goods	7.79	0.0374	99
adult goods	13.10	0.0440	99
log(calorie intake)	7.61	0.0014	
log(protein intake)	6.44	0.0018	
Household characteristics			
Male head			
(1) exists	0.818	0.0019	
(1) literate	0.36	0.0024	
(1) complete elem educ	0.20	0.0020	
(1) complete second educ	0.15	0.0017	
Female head			
(1) exists	0.935	0.0012	
(1) literate	0.39	0.0024	
(1) complete elem educ	0.22	0.0020	
(1) complete second educ	0.13	0.0017	
Household composition			
log(hhsize)	1.38	0.0030	
# males aged 0-4/hh size	0.059	0.0005	
# females aged 0-4/hh size	0.057	0.0005	
# males aged 5-9/hh size	0.051	0.0005	
# females aged 5-9/hh size	0.051	0.0005	
# males aged 10-14/hh size	0.049	0.0005	
# females aged 10-14/hh size	0.050	0.0005	
# males aged 15-54/hh size	0.262	0.0010	
# females aged 15-54/hh size	0.291	0.0010	
# males aged ge 55/hh size	0.052	0.0007	
# males aged ge 55/hh size	0.129	0.0010	
Community characteristics : ln(prices)			
price agg for cereals	0.057	0.0006	
price agg for tubers	0.025	0.0011	
price agg for sugar	-0.055	0.0005	
price agg for bean	0.042	0.0008	
price agg for fruit & veges	0.024	0.0009	
price agg for meat & fish	0.043	0.0002	
price agg for dairy	-0.001	0.0003	
price agg for fats	-0.015	0.0002	
price agg for oils	-0.017	0.0004	
price agg for housing	0.683	0.0029	
price agg for fuel/transport	-0.050	0.0008	
price agg for clothing	0.173	0.0007	
price agg for clean/p_care	0.020	0.0005	

Appendix Table 2
Estimated coefficients on income in OLS and 2SLS regressions

	FEMALE				MALE					
	linear		quadratic		linear		quadratic		interaction	
	coeff	s.e.	coeff	s.e.	coeff	s.e.	coeff	s.e.	coeff	s.e.
OLS estimates										
Food	-248.99	[16.54]	271.34	[44.03]	-60.82	[5.52]	13.09	[1.68]	384.59	[72.61]
Meals out	-64.16	[6.95]	74.55	[16.01]	-7.98	[1.15]	1.77	[0.32]	91.46	[30.87]
Housing	72.97	[12.96]	-91.32	[20.98]	12.87	[3.42]	-2.68	[0.88]	-46.08	[40.55]
Human capital	87.81	[7.40]	-87.70	[11.70]	18.52	[2.56]	-4.16	[0.75]	-139.41	[18.70]
Education	18.67	[3.24]	-20.96	[5.34]	2.98	[1.11]	-0.66	[0.25]	-27.91	[14.82]
Health	22.65	[5.08]	-16.18	[10.09]	6.55	[1.33]	-1.63	[0.35]	-58.53	[12.35]
HH Services	46.49	[4.05]	-50.55	[7.25]	8.99	[1.15]	-1.87	[0.40]	-52.97	[8.98]
Leisure	59.44	[8.41]	-51.99	[13.07]	16.31	[2.41]	-3.16	[0.52]	-130.45	[23.56]
Ceremonies	20.02	[3.86]	-23.29	[5.05]	0.76	[0.75]	-0.28	[0.17]	-28.06	[15.36]
Recreation	39.42	[7.35]	-28.71	[11.34]	15.55	[2.23]	-2.88	[0.48]	-102.39	[19.30]
HH Goods	12.57	[6.03]	-11.59	[8.98]	1.96	[1.98]	-0.55	[0.44]	-58.05	[27.15]
Adult goods	-17.61	[5.14]	6.61	[7.92]	-11.24	[1.88]	2.25	[0.52]	4.50	[28.64]
2SLS estimates: instruments = non-labor income										
Food	-270.02	[19.06]	289.62	[46.50]	-68.66	[12.12]	13.33	[1.86]	287.51	[61.93]
Meals out	-68.75	[6.61]	78.33	[12.80]	-9.56	[1.78]	1.90	[0.31]	65.04	[13.24]
Housing	77.80	[13.96]	-94.99	[21.65]	14.07	[4.28]	-2.65	[0.87]	-40.80	[26.45]
Human capital	94.83	[12.86]	-93.91	[24.14]	21.63	[16.60]	-4.34	[3.49]	-104.12	[52.18]
Education	20.08	[3.53]	-22.15	[5.80]	3.50	[1.38]	-0.69	[0.26]	-20.15	[8.28]
Health	24.93	[5.38]	-18.42	[9.88]	8.15	[2.14]	-1.77	[0.37]	-42.86	[9.03]
HH Services	49.82	[4.39]	-53.34	[7.36]	9.97	[1.78]	-1.88	[0.39]	-41.11	[6.21]
Leisure	64.77	[8.79]	-56.98	[13.41]	17.61	[3.47]	-3.13	[0.61]	-91.69	[16.11]
Ceremonies	21.30	[3.99]	-24.31	[5.02]	1.41	[0.87]	-0.37	[0.17]	-19.63	[9.15]
Recreation	43.47	[7.74]	-32.66	[11.70]	16.20	[3.18]	-2.76	[0.58]	-72.06	[14.14]
HH Goods	14.12	[6.45]	-13.11	[9.51]	2.92	[2.31]	-0.67	[0.45]	-37.24	[16.50]
Adult goods	-19.11	[5.46]	8.12	[8.04]	-11.65	[2.33]	2.12	[0.48]	11.89	[17.33]
2SLS estimates: instruments = total income										
Food	-465.93	[33.91]	522.37	[83.94]	-197.71	[27.67]	43.96	[6.09]	696.04	[186.98]
Meals out	-79.56	[6.50]	91.10	[13.54]	-17.24	[1.80]	3.71	[0.37]	95.16	[20.52]
Housing	105.43	[13.43]	-127.88	[24.39]	37.60	[5.92]	-8.23	[1.44]	-113.17	[48.42]
Human capital	168.25	[12.23]	-181.24	[23.74]	65.59	[9.55]	-14.78	[2.23]	-231.41	[41.53]
Education	48.33	[4.90]	-55.80	[10.75]	22.16	[3.41]	-5.12	[0.78]	-71.63	[14.99]
Health	36.35	[4.90]	-31.92	[8.87]	14.07	[2.18]	-3.17	[0.42]	-65.11	[13.69]
HH Services	83.58	[6.06]	-93.51	[13.43]	29.37	[4.25]	-6.49	[1.09]	-94.67	[16.21]
Leisure	84.50	[8.41]	-80.61	[15.36]	37.04	[4.61]	-7.75	[0.78]	-143.09	[25.96]
Ceremonies	26.14	[3.54]	-30.11	[4.98]	5.59	[1.21]	-1.60	[0.28]	-34.26	[9.47]
Recreation	58.35	[7.19]	-50.50	[12.82]	30.46	[3.63]	-6.15	[0.56]	-108.83	[21.58]
HH Goods	24.75	[6.19]	-25.64	[10.09]	9.34	[2.06]	-2.20	[0.38]	-66.47	[25.95]
Adult goods	16.35	[5.32]	-33.59	[6.58]	-3.85	[1.54]	0.27	[0.37]	-41.80	[16.54]