Inequality—Measurement, trends, impacts, and policies

5–6 September 2014 Helsinki, Finland

UNEQUAL PARTNERS: THE DETERMINANTS AND CONSEQUENCES OF INTRA-HOUSEHOLD INEQUALITY IN SOUTH AFRICA[1]

C. Friedrich Kreuser[2,3] and Rulof P. Burger[3,4]

Abstract

This paper estimates the determinants and effects of intra-household inequality for two-adult South African households using cross-sectional data. The behaviour of South African households is confirmed to be consistent with the collective, but not the unitary model of household decision making. Additional refutability tests confirm that our two preferred distribution factors – the local sex ratio and the male's maternal education share – affect consumption decisions via participation in household decisions and not preferences. Increases in the local sex ratio of males to females is found to increase the bargaining power of women, whereas an increase in the male spouse's maternal education share increases the expenditure share allocated to him. In additional tests, females are found to have higher bargaining power when residing in urban areas, when they are the higher earners in the household and when they are the eldest spouse. A testable restriction implied by the collective model and a commonly used demand specification is used to separately identify the effect of distribution factors on female bargaining power and the relative gender preferences for different commodities. We find that female household members have a stronger preference for expenditure on communication, clothing, personal care and medical expenses, while male members have a stronger preference for alcohol and tobacco, food and entertainment.

Keywords: Family economics, South Africa, collective model, unitary model, intra-household decision making

JEL codes: D11, D13

[1] The authors would like to thank Gideon du Rand, Neil Rankin, Servaas van der Berg, Steve Koch and participants at the 2012 ESSA conference and Stellenbosch Economics department seminars for useful feedback on earlier drafts of this paper. All remaining errors are our own.

[2] Corresponding author

[3] Department of Economics, University of Stellenbosch

[4] Centre for the Study of African Economies, Oxford University

1 Introduction

Academic interest in the causes of inequality appears to be on the rise. However, much of this literature ignores the intra-household dimension of inequality. Lise and Seitz (2011) show that this omission can lead to a substantial under-estimation of individual consumption inequality. Although the emphasis on inter- rather than intra-household inequality is often motivated by data constraints, recent advances in the theoretical and econometric modelling of household decision making have made it possible to investigate the nature of such decisions using regular cross-sectional household surveys. In most of our analysis we will use the collective model of household decision making, which provides a tractable theoretical basis from which to study the behaviour of households. It explicitly acknowledges that household members may have conflicting preferences for the allocation of household resources, and that the outcome of household decisions could depend on the relative bargaining power of its members. Our analysis aims to build on recent advances to investigate the determinants of consequences of within-household inequality in a highly unequal society: South Africa.

In this study we model the consumption decisions of South African households using the 2008 wave of the National Income Dynamic Study (NIDS) in an attempt to answer three research questions. First, is the behaviour of South African households consistent with the assumptions of either the unitary or the collective model of household decision making? Secondly, how are household consumption patterns affected by changes in the bargaining power of its members? Finally, which factors affect the bargaining power of household members?

The paper is organised as follows: Section 2 provides a literature review of the unitary and collective models of household behaviour, before the empirical model and hypothesis tests are discussed in section 3. Section 4 describes the NIDS survey data that is in used in the econometric analysis. Section 5 then attempts to answer our three research questions empirically, and also provides some refutability and robustness tests of our identifying assumptions and specification. Section 6 concludes.

2 Models of Intra-Household Decision Making: a Review

2.1 Basic Framework

Theoretical models of household decision making are often framed in the context of a two-person household consisting of a wife (member A) and husband (member B). Household member $m \in \{A, B\}$ consumes a vector of private consumption goods $\boldsymbol{q}^m \in \mathbb{R}_+^n$ and the two members jointly consume public goods $\boldsymbol{Q} \in \mathbb{R}_+^n$. Total household consumption of private goods is $\boldsymbol{q} = \boldsymbol{q}^A + \boldsymbol{q}^B$. The individual utility of each household member is expressed as $u^m(\boldsymbol{q}^A, \boldsymbol{q}^B, \boldsymbol{Q}, \boldsymbol{a})$, where $\boldsymbol{a}$ is a vector of preference factors that directly affect the utility gained from consuming different commodities (such as the member's age or educational attainment, asset ownership and the location of the household). Such a specification encapsulates a wide class of consumption externalities and altruism, including the case of complete selfishness and no externalities. The value of consumption is constrained by the household budget, so that

$$\boldsymbol{p}'(\boldsymbol{q}^A + \boldsymbol{q}^B + \boldsymbol{Q}) = x \quad \text{`} \qquad [1]$$

where $\boldsymbol{p}$ is an n-dimensional price vector, and x is total household income or expenditure. In the absence of observable price variation – the typical case when working with cross-sectional data – the price vector is often normalised to one so that all consumption quantities represent monetary values. This approach will be followed for the remainder of this paper.

The household's objective function is sometimes usefully conceptualised as the weighted average of the members' utilities (Browning, Chiappori, & Lechene, 2006: 9):

$$U(u^A, u^B, \theta) = \theta(x, \boldsymbol{a}, \boldsymbol{z})\, u^A(\boldsymbol{q}^A, \boldsymbol{q}^B, \boldsymbol{Q}, \boldsymbol{a}) + (1 - \theta(x, \boldsymbol{a}, \boldsymbol{z}))u^B(\boldsymbol{q}^A, \boldsymbol{q}^B, \boldsymbol{Q}, \boldsymbol{a}) \quad [2]$$

The Pareto weight, $\boldsymbol{\theta}$, is restricted to the unit interval and represents the decision power or utility weight of member A. Apart from depending on income and preference factors, the Pareto weights can also vary with the bargaining power of individual members, where higher values of θ are associated with more bargaining power for member A. In this regard, we define a vector of distribution factors, $\boldsymbol{z}$, that affect the relative bargaining power of household members without directly affecting either preferences or the budget constraint. Adding the usual set of technical assumptions about individual preferences means that the private good demand for a utility maximising household can be expressed as

$$\boldsymbol{q}^* = \boldsymbol{\xi}(x, \boldsymbol{a}, \boldsymbol{z}) \qquad [3]$$ [5]

The theoretical model is sometimes further simplified by assuming that preferences are separable both in the preferences of the individual members and also between public and private goods. The first separability condition imposes the restriction that

$$u^m(\boldsymbol{q}^A, \boldsymbol{q}^B, \boldsymbol{Q}, \boldsymbol{a}) = \mu^m(w^A(\boldsymbol{q}^A, \boldsymbol{Q}, \boldsymbol{a}), w^B(\boldsymbol{q}^B, \boldsymbol{Q}, \boldsymbol{a}), \boldsymbol{a}) \qquad [4]$$ [6]

which implies that household members care about the utility of their spouse but not about the composition of their private consumption. Such preferences are referred to as caring (Becker, 1991) or non-paternalistic, and rules out any consumption externalities. Separability between private and public goods is imposed by assuming that preferences are of the following form:

$$w^m(\boldsymbol{q}^m, \boldsymbol{Q}, \boldsymbol{a}) = \omega^m(v^m(\boldsymbol{q}^m, \boldsymbol{a}), \boldsymbol{Q}, \boldsymbol{a}) \qquad [5]$$

[5] See Bourguinon *et al* (2009) for proof.

[6] Where w^m is each individual's felicity function as in Bourguignon *et al* (2009: 513).

This implies that the preference ordering between different private goods is unaffected by the consumption levels of public goods.

2.2 The Unitary Model

The simplest and most frequently used model of household decision-making is the unitary model, which assumes that households behave is if the preferences of individual members can be aggregated into a stable household preference relation. This is very convenient, as it means that all of the familiar results of neoclassical consumer theory can now be applied at the level of the household. Specifically, the household's demand for private goods[7] can be expressed as

$$\boldsymbol{q}^* = \boldsymbol{\xi}(x, \boldsymbol{a}) \qquad [6]$$

However, viewing the household as a single utility maximising entity rather than a collection of members with heterogeneous preferences imposes strong restrictions on household behaviour. In terms of the household utility function [2], the unitary model assumes that the Pareto weight does not vary distribution factors. Several theories have attempted to justify this assumption. Samuelson (1956: 10) argues that familial bonds tie the preference relations of different household members into a household welfare function. The welfare function is then achieved through mutual consent that determines each member's deservingness to consume. However, this formulation does not give a clear indication of how consensus is reached (Haddad, Hoddinott, & Alderman, 1997: 5). Other theories have invoked the notion of a household head who behaves like a dictator – perhaps a benevolent patriarch as in Becker (1974) – or members who have identical cardinal preferences (Browning, Chiappori, & Weiss, 2011: 160). However, it is known since Arrow's (1950) Impossibility Theorem that group preferences cannot generally be aggregated to a consistent preference ordering and thus cannot be modelled in the same way. Furthermore, the literature on domestic violence and spousal abuse suggests that the assumptions of either a benevolent dictator or altruism in the household does not generalise to the entire population (Alderman, Chiappori, Haddad, Hoddinott, & Kanbur, 1995: 11).

The unitary model implies that the demand system [6] must satisfy the standard Slutsky conditions: homogeneity, adding-up, symmetry and negative semi-definiteness of the Slutsky matrix. Furthermore, after controlling for total household expenditure the household's demand is unaffected by individual incomes or any other factor that does not directly affect household preferences. Bourguignon, Browning, and Chiappori (2009: 509) formally state this condition as follows: a demand system is compatible with the unitary model if and only if it satisfies [7] for every commodity i and distribution factor $\boldsymbol{k}$.

[7] A similar demand function can be derived for public goods, but in anticipation of our empirical analysis in section 5 we will restrict our attention to the implications for private goods.

$$\frac{\partial \xi_i(x, \boldsymbol{a}, \boldsymbol{z})}{\partial z_k} = 0 \qquad [7]^{8}$$

The unitary model therefore implies that after controlling for $(x, \boldsymbol{a})$ household consumption patterns should not be correlated to the values of $\boldsymbol{z}$. If a change in the bargaining power of household members varies with distribution factors and thereby effects the household's consumption decisions, then it offers evidence against the validity of the unitary model.

The earliest and most commonly used test of the unitary model is the income pooling hypothesis: the source of income should be irrelevant for the outcomes of household consumption decisions. This test is a straightforward application of condition [7] in which some measure of relative income, earnings or wages is taken as the distribution factor. This hypothesis has been rejected for a number of countries, including Canada (Browning & Chiappori, 1998; Fortin & Lacroix, 1997)[9], France (Bourguignon et al., 1993), Brazil (Thomas, 1990), India (Fuwa, Ito, Kubo, Kurosaki, & Sawada, 2006), Nigeria (Aromolaran, 2004), China (Wang, 2014), Bangladesh, Indonesia, Ethiopia (Quisumbing & Maluccio, 2003) and South Africa (Duflo, 2003).

Concerned about the exogeneity[10] of relative incomes in a commodity demand specification (Browning, Bourguignon, Chiappori, & Lechene, 1994: 1078), the more recent literature has preferred to test collective rationality against the unitary model by using distribution factors that are less likely to be correlated with unobservable preferences. These factors have included the relative unearned incomes of household members, (Thomas, 1990), the relative age (Browning et al., 1994) or education of members, marital status (Vermeulen, 2005), background family factors like whether the husband's mother worked (Browning & Bonke, 2009), the local gender ratio (Chiappori, Fortin, & Lacroix, 2002), and institutional variation that affects the cost of divorce or the expected magnitude of alimony and child support payments. The unitary model is also overwhelmingly rejected using this wider range of distribution factors. In what is often regarded as one of the more persuasive tests of the unitary model, Lundberg, Pollak, and Wales (1997) investigate the effect of a policy that changed the recipient of child benefits from fathers to mothers. They find that it coincided with a significant increase in expenditure on both children and women's clothing relative to men's clothing.

---

[8] This is the restriction that results in [3] being written as [6].

[9] Interestingly, Fortin and Lacroix (1997) found that the income pooling hypothesis is not rejected for couples with pre-school age children. Kapan (2009) also finds support for the unitary model when restricting his Turkish sample to traditional, rural households. It is tempting to infer that these cases represent examples of two cases in which the unitary model holds: households in which individuals temporarily have identical cardinal preferences, and in which the household head behaves like dictator.

[10] For example, wage income may be correlated to expenditure on work-related commodities such as clothing, food and transport (Browning et al., 2011: 226). Some authors have also expressed concerns regarding measurement error in the income measure. The resulting attenuation bias should make it more difficult to reject the income pooling hypothesis, which seems not to be a problem in most empirical applications. The potential correlation is why most studies that use relative incomes as distribution factors, thereby testing the income pooling hypothesis, do so conditional on labour supply. See for example Bourguignon *et al* (1994:1078) and Bourguignon *et al* (1993). This is also why the earlier work of Thomas (1990) and Lundberg *et al* (1997) used relative unearned income as distribution factors.

Regarding the evidence for developing countries, Thomas (1993) finds that Brazilian households in which females earn more non-labour income spend a larger share of their budgets on housing, health, education, household services and recreation, while less is spent on food and alcohol. The lower expenditure on food is also found to be correlated with increased expenditure on food groups associated with better health outcomes (Thomas, 1993: 123). Fuwa *et al.* (2006) consider the effect of the parental characteristics on intra-household resource allocation in rural India. They also find evidence against the unitary model. Households where the male's father is relatively better educated, wealthier and alive spent more on male clothing, alcohol and tobacco, and less on female clothing and children goods. Aromolaran (2004) also rejects the income-pooling hypothesis using Nigerian household data. Evidence is found that female income share (which is instrumented due to endogeneity concerns) is associated with lower calorie consumption. Wang (2014) estimates the effect of a Chinese housing reform in which property rights were transferred to individuals. Households in which the property is owned by the woman spend less on cigarettes and alcohol and have girls with a higher weight-for-age. Bobonis (2009) uses the Mexican PROGRESA program and local rainfall shocks as distribution factors, and finds that higher female income is associated with more spending on children and female clothing (Bobonis, 2009: 456).

We are aware of at least four studies that have attempted to test the unitary model for South African households. Maitra and Ray (2003) find that labour income, private transfers or public transfers do not have the same effect on expenditure outcomes, and interpret this as evidence against the unitary hypothesis. They use a 3SLS estimator to address the endogeneity of their income measures, but use instrumental variables that are generally not interpretable as distribution factors. The one possible exception is the gender of the household head: they find that male-headed households spend less on entertainment, clothing and child care, and more on food, education and fuel increases. Quisumbing and Maluccio (2003) reject the unitary hypothesis for South Africa (as well as for Bangladesh, Indonesia and Ethiopia). They find that households spend more on education if the wife had more assets at marriage and less on alcohol and tobacco if the husband is better educated. However, their results may be called into question by the use of education as a distribution rather than a preference factor, or the weak instruments used for asset ownership. Gummerson and Schneider (2013) find that households in which the wife receives a higher share of total income tend to spend more on food and less on alcohol, although their analysis ignores the endogeneity of income. The strongest evidence against the unitary model is provided by Duflo (2003), who shows that young girls who live in South African households where the state social old age pension is received by grandmothers rather than grandfathers are expected to have significantly better height-for-age ratios.

Overall, it seems reasonable to conclude that there is substantial empirical evidence against the unitary model across a number of countries, and that this evidence is robust to the choice of distribution factors. Apart from requiring implausible assumptions and implying behavioural restrictions that are rejected by the data, the unitary model is also highly restrictive as a tool for studying intra-household inequality. This derives from the fact that it views the household decision making process as a black box (Chiappori, 1997: 51) that fails to acknowledge the heterogeneous preferences of its members.

It is worth emphasising that the evidence against the unitary model does not in itself provide evidence in favour of any other theoretical model of household decision-making. Many studies that reject the unitary model continue to interpret the implications of their results from a household bargaining perspective, without testing the implied restrictions of such models (as discussed below). Where studies do not explicitly test the restrictions of the collective model, it impossible to know whether the household behaviour implied by the reduced form estimates is rationalisable in a bargaining model or any other model of household decision making. Our own analysis in section 5 will address this shortcoming by attempting to recover estimates of the effect of distribution factors on household expenditure decision that are nested within the collective model. This approach has the advantage of making explicit that such an effect is actually the product of two effects, each of which can be separately estimated: the effect of distribution factors on household bargaining power, and the effect of bargaining power on household decisions.

2.3 The collective model

Many of the shortcomings of the unitary model are addressed by the collective model. This was first proposed by Manser and Brown (1980) and recognises that households consist of individuals with potentially conflicting preferences on how total household expenditure should be allocated. Instead of assuming that these individual preferences can be arbitrarily aggregated into a simple household preference relation, the collective model assumes that the outcome of household decisions is Pareto efficient (Chiappori, 1988: 64). Although somewhat contentious[11], the efficiency assumption has been motivated by arguing that household members have an incentive to take advantage of mutually beneficent opportunities and that cooperation can be enforced by repeated interactions, altruism or social norms. An important difference between the unitary and collective models is that whereas the decision weights in equation [2] are assumed to be constant in the former[12], these weights are allowed to vary with distribution factors in the latter. This provides a channel through which the bargaining power of individual members can affect household consumption outcomes, although only through the one-dimensional effect it has on the decision weights. In this case the general solution [3] to the household demand functions in equation can be expressed more restrictively as:

$$\boldsymbol{q}^* = \boldsymbol{\xi}\big(x, \boldsymbol{a}, \theta(x, \boldsymbol{a}, \boldsymbol{z})\big) \qquad [8]$$

[11] It has been shown that inefficient outcomes can obtain in the case of decisions that are made infrequently (Lundberg & Pollak, 1993) or in environments characterised by commitment failure, asymmetric information or social norms that preclude the exploitation of the division of labour (Udry, 1996).

[12] Although the unitary model assumes that these weights are constant, it is impossible to test whether or not the weights depend on expenditure in the absence of observable price variation (Bourguignon et al., 2009: 509). This is why the test for the unitary model requires observing at least one distribution factor to investigate whether the weights are constant.

where $\theta(.)$ is a single, real-valued function. This imposes an important constraint that can be used to test the validity of the collective model: any combination of values of $\boldsymbol{z}$ that yields the same value of θ must also produce the same consumption outcomes. The ratio of effects of two distribution factors z_1 and z_k on the demand for commodity i is

$$\frac{\partial q_i/\partial z_k}{\partial q_i/\partial z_1} = \frac{\theta_k}{\theta_1} \equiv \kappa_k \quad \forall\, i \qquad [9]$$

where $\theta_k \equiv \frac{\partial \theta}{\partial z_k}$. The κ_k parameter can be interpreted in terms of power compensation: it represents the increase in z_1 required to offset the effect of an increase in z_k on intra-household bargaining power. Under the assumptions of the collective model, this ratio only depends on the effect of the distribution factors on the utility weight and not on the specific commodity. This provides cross-equation restrictions, known as *the proportionality property*, which can be used to test the validity of the collective model:

$$\frac{\partial q_i/\partial z_k}{\partial q_i/\partial z_1} = \frac{\partial q_j/\partial z_k}{\partial q_j/\partial z_1} \quad \forall\, i, j \qquad [10]$$

Collective rationality requires that the ratio of effects of any two distribution factors must be the same across all commodities. This is straightforward to test once demand system $\boldsymbol{q}$ has been parameterised. Note that although the unitary model can be tested with a single distribution factor, at least two distribution factors are required in order to test proportionality property [10]. The ratio κ_k is also of interest, as it represents the change in z_1 that is required to offset the effect of an increase in z_k on the relative bargaining power of household members.

One frequently used example of a collective model introduces the notion of a sharing rule to explain how household decisions are made. This model is less general than what is required to derive the proportionality property and requires the stronger assumptions of caring and separable individual preferences discussed in section 2.1. In this more restrictive collective setting households are assumed to behave as if making decisions according to a two-stage process. In the first (sharing) stage, the household decides how total private expenditure is allocated to each of its members.[13] The outcome of this process, the sharing rule, depends on the relative bargaining power of each member, as well as total household income and individual preferences. Formally, member A receives $x^A = \rho(x, \boldsymbol{a}, \boldsymbol{z})$ of discretionary expenditure while member B receives the remaining $x^B = x - \rho(x, \boldsymbol{a}, \boldsymbol{z})$. In the second (consumption) stage each member then allocates their share of total expenditure to consumption items according to their own preferences. The private good demand function for each member therefore satisfies

$$\max v^m(\boldsymbol{q}^m, \boldsymbol{a}) \text{ subject to } \boldsymbol{p}'\boldsymbol{q}^m = x^m \qquad [11]$$

The outcome of this model will clearly be Pareto efficient and hence implies proportionality property [10]. However, this model also implies additional restrictions on household behaviour. Consider the effect

[13] Technically, this stage coincides with the joint decision regarding how much to spend on pure public goods.

of a distribution factor that empowers household member A via an increase in the value z_k while leaving total expenditure unchanged. The effect on household demand for commodity i is:[14]

$$\frac{\partial q_i}{\partial z_k} = \left(\frac{\partial q_i^A}{\partial \rho} - \frac{\partial q_i^B}{\partial \rho}\right)\frac{\partial \rho}{\partial z_k} \quad [12]$$

Under the maintained hypotheses of caring and separable preferences and collective rationality, the effect of z_k on q_i is now the product of two effects, each of which is of considerable interest. The second term, $\frac{\partial \rho}{\partial z_k}$, represents the effect of a distribution factor on the sharing rule. Estimates of this term can tell us how intra-household inequality (and hence the welfare of individual members) responds to changes in environment factors, which can help us understand the nature of the household bargaining process. The first term, $\frac{\partial q_i^A}{\partial \rho} - \frac{\partial q_i^B}{\partial \rho}$, represents the difference in the income elasticities of commodity i for the household members. If member A's demand for normal good *i* is more income sensitive than that of member B, then an increase in the share of expenditure allocated to member A will lead to an increase in household consumption of this commodity. In this case member A is sometimes said to "care more" about the expenditure on this commodity. The ability to estimate the differential income sensitivity of the different goods therefore allow us to identify which goods women have a stronger preference for than men. It is important to note, from the perspective of our identification strategy below, that the first term is distribution factor invariant while the second is commodity invariant.

Another technical remark is that testing the distribution factor independence assumption and the proportionality property require no assumptions regarding the assignability or exclusivity of the different goods just as long as the goods are private (Bourguignon *et al.*, 2009: 520). Where goods are assignable (i.e. known to be consumed by a specific member), the collective model can be tested and the sharing rule can be identified up to an additive constant with the use of two demand equations and one distribution factor. Where no assignable or exclusive goods are available, the form of the sharing rule can still be identified (Browning *et al*, 201: 206).

Without better data, we can only recover the sharing rule and individual demands up to an additive constant. We can therefore estimate how the expected level of intra-household inequality changes with the values of the distribution factors, but not the average level of intra-household inequality. Furthermore, Bourguignon et al. (2009) show that identification is generally only possible up to a permutation of members, unless we know which distribution factors favour which household member. This assumption is relatively unproblematic for most distribution factors used in the literature, including the preferred distribution factors in our analysis.

[14] It is clear from this formulation that the sharing rule approach yields the same results as the collective model as $\frac{\partial q_i}{\partial z_k} / \frac{\partial q_i}{\partial z_1} = (\frac{\partial q_i^A}{\partial \rho} - \frac{\partial q_i^B}{\partial \rho})\frac{\partial \rho}{\partial z_k} / (\frac{\partial q_i^A}{\partial \rho} - \frac{\partial q_i^B}{\partial \rho}) = \frac{\partial \rho}{\partial z_k} / \frac{\partial \rho}{\partial z_1} = \kappa_k \forall i$

There is wide empirical support for the collective model of household behaviour. Fortin and Lacroix (1997) test the implications of the collective model for the labour supply decision of Canadian spouses, using the labour and non-labour income of each spouse as distribution factors. Although couples without pre-school age children do not behave in accordance with the unitary model, they cannot reject the collective model for this group. This results is corroborated by Browning and Chiappori (1998), who use relative age and income as distribution factors. Similar results are obtained by Bourguignon, Browning, Chiappori, and Lechene (1993) and Blundell *et al.* (2007) for French and UK data, respectively.

Compared to the numerous tests of the unitary model for developing countries, there are relatively few studies that have attempted to test the collective model for these households. Fuwa *et al.* (2006) use three paternal characteristics (literacy, land holdings and whether still alive) as distribution factors for Indian households and fails to reject proportionality condition. The response of Mexican households to rainfall shocks and changes to female income induced by the PROGRESA program are also found to be consistent with the proportionality condition (Bobonis, 2009). Quisumbing and Maluccio (2003) do not reject the proportionality condition for Bangladesh, Ethiopia, India and South Africa. However, this may reflect the insufficient statistical power of their tests as they employ distribution factors that have small and imprecisely measured effects on household decisions (as discussed in section 2.2) – rather than the behaviour of households. As far as we know, this is the only previous attempt to formally test the collective model for South Africa in a manner explicitly consistent with the cross-equation restriction implied by the model.

One of the contributions of this study is to provide estimates of the relative gender preferences for different commodities. Although many studies report the reduced form estimates of the distribution factors on household decisions, we are only aware of two other studies that have directly estimated such gendered preferences before: Browning and Bonke (2009) and Browning, Chiappori, and Lewbel (2013). The former uses a unique Danish data set that recorded precisely for whom each item was purchased. The latter uses regular consumption data on singles and couples, but adds a strong assumption that individual preferences are no different between married people and singles. Both studies find that wives have a stronger relative preference for clothing, personal services and recreation, whereas husbands have a care more about food, alcohol and tobacco and transportation.

3 Identification and estimation

Our analysis in section 5 starts by testing the validity of different models of household decision making. This requires estimating the demand for good i, $q_i(x, \boldsymbol{a}, \boldsymbol{z})$.[15], with a demand system that nests both the

[15] All income and expenditure values are expressed in logarithmic form.

unitary and collective models. In this regard we follow Bourguignon *et al.* (2009) in assuming that we have two distribution factors, and that demand is linear in $\boldsymbol{a}$ and quadratic in $(x, \boldsymbol{z})$:

$$q_i = \boldsymbol{a\pi}_i + \gamma_{1i}x + \gamma_{2i}x^2 + \psi_{1i}z_1 + \psi_{2i}z_2 + \chi_{1i}z_1^2 + \chi_{2i}z_2^2 + \pi_{1i}z_1x + \pi_{2i}z_2x + \varphi_{12i}z_1z_2 + u_i \quad [13]$$

In this case the unitary hypothesis, which states that household demand is unaffected by the distribution factors, can be expressed as a simple linear hypothesis test:

$$\psi_{ki} = \chi_{ki} = \pi_{ki} = \varphi_{kli} = 0 \ \ \forall\, i, k, l \quad [14]$$

The collective model and its corollary, the proportionality property, imply that the demand equation [13] reduces to *either* of the following forms (Bourguignon *et al*, 2009: 512):

$$q_i = \boldsymbol{a\pi}_i + \gamma_{1i}x + \gamma_{2i}x^2 + \lambda_i(\psi_1 z_1 + \psi_2 z_2 + \chi_1 z_1^2 + \chi_2 z_2^2 + \pi_1 z_1 x + \pi_2 z_2 x + \varphi_{12} z_1 z_2) + u_i \quad [15a]$$

$$q_i = \boldsymbol{a\pi}_i + \gamma_{1i}x + \gamma_{2i}x^2 + \lambda_i(z_1 + \kappa z_2) + \upsilon_i(z_1 + \kappa z_2)^2 + \omega_i x(z_1 + \kappa z_2) + u_i \quad [15b]$$

The two implied restrictions emphasise different aspects of the collective model. The κ parameter in equation [15b] represents the power compensation ratio, which indicates the increase in z_2 required to offset the effect of a marginal increase in z_1 on intra-household bargaining power. Equation [15a], on the other hand, is particularly simple to separate into terms associated with the sharing rule and the difference in individual demands. The effect of an increase in z_k on the demand for commodity i can be expressed as

$$\frac{\partial q_i}{\partial z_k} = \lambda_i(\psi_k + 2\chi_k z_k + \pi_k x + \varphi_{kl} z_l) \quad [16]$$

The second term on the RHS of equation [16] depends on the values of the distribution factors but not on the commodity. It follows from equation [12] that, in a collective setting, this term represents the effect of distribution factors on the sharing rule $\frac{\partial \rho}{\partial z_k} = \psi_k + 2\chi_k z_k + \pi_k x + \varphi_{kl} z_l$. The first term on the RHS of [16], λ_i, is distribution factor invariant and product specific, so that it represents the difference in individual demands $\frac{\partial q_i^A}{\partial \rho} - \frac{\partial q_i^B}{\partial \rho}$.

Equation [15a] is under-identified in that we cannot separately identify each of the commodity parameters λ_i as well as the sharing rule parameters. We choose to normalise $\lambda_i = 1$ for clothing expenditure, a commodity that international studies have commonly found to increase with female bargaining power. The remaining λ_j values therefore shows the impact of the sharing rule, and thus the distribution factor, on the relevant commodity demands. Values higher than 1 indicate that the commodity is more affected by factors in the sharing rule relative to clothing, while values between 0 and 1 indicate that it is less affected. For all $\lambda_j < 0$ the impact of the distribution factors is reversed. Furthermore, the sharing rule parameters are now anchored to a commodity with a stronger female preference, which means $\frac{\partial \rho}{\partial z_k} > 0$

implies an increase in female bargaining power.[16] Of course, we have relatively strong priors regarding the effect of most candidate distribution factors on bargaining power that can be used to gauge the validity of this normalisation.

In order to simplify the interpretation of the estimated coefficients we use demeaned values of (x, z_1, z_2) in our estimable model. This implies that the coefficients on the linear distribution factor variables can be interpreted as average partial effects. For example, the coefficient estimate on z_1 is represents the effect of a marginal increase in z_1, evaluated at the sample means for (x, z_1, z_2). The coefficients on the quadratic and interaction effects are unaffected by this transformation, whereas the constant coefficient – which is of little interest – is affected.

Naturally, the most important identifying assumption of our empirical analysis regards the choice of distribution factors, which must fulfil similar requirements as instrumental variables. Firstly, a valid distribution factor must be relevant, by significantly altering the bargaining power of household members. Secondly, valid distribution factors must be exogenous with respect to unobservable preferences. Although neither condition can be directly tested in the context of a commodity demand system for couples, we can think of refutability tests that can help us investigate the validity of the distribution factors. If a distribution factor affects expenditure patterns by increasing female bargaining power, then we would expect it to also lead to a higher incidence of self-reported female participation in household decision making. Furthermore, if distribution factors are exogenous with respect to unobservable preferences, then we would expect it to have no explanatory power in the expenditure patterns of single member households.

The first round of empirical studies of household decision making uses relative incomes as a distribution factor. However, there are other plausible reasons why relative earnings would be correlated to the preference for clothing or food. Unobserved tastes for work may be correlated with the unobserved preference for clothing (Browning et al 2011: 226), or working longer hours may increase nutritional requirements. The relative age or education levels of household members are similarly problematic, as age and education are both often considered to determine individual preferences. The most convincing distribution factors are arguably presented by natural experiments in divorce laws or the gender of welfare recipients, which change the opportunities to the wife outside marriage.

In the absence of such variation for South Africa, our two preferred distribution factors are the local gender ratio and the relative level of educational attainment of the spouse's mothers. The local gender ratio represents the quantity of unmarried men relative to unmarried women in the local marriage market. Chiappori *et al.* (2002) argue that a relative scarcity of women improves the bargaining power of the wife, and find empirical evidence that this is reflected in a more favourable distribution of leisure time. Posel and Casale (2009) also find that this ratio is a significant predictor of marriage in South Africa. Browning

[16] Note that in the present case this is due to the signs of the coefficients in estimation.

and Bonke (2009) use a novel Danish data set in which each expenditure item is allocated to a household member and find that the family background of the spouses have a strongly significant effect on sharing. Specifically, if the husband's mother was in full-time employment when he was 14 then he commands a larger share of the household budget. It is argued that such men have less conservative views of gender roles (and are perhaps more likely to contribute more in housework), and hence make more desirable husbands (Browning *et al*, 2011:231). In a high unemployment and poor country such as South Africa a mother's employment status is perhaps more likely to reflect employment opportunities, or economic hardship, than an enlightened perspective on gender roles. Such perspectives are likely to be more accurately capture by the maternal schooling level of the spouses. Although these are our two preferred distribution factors, we also estimate the model with other candidate factors including age differences, the number of young children in the household, the log wage difference, the member receiving the child support grant, spousal wealth before marriage, maternal employment status, differences in education and differences in hours worked.

The model parameters are estimated using Zellner's (1962) seemingly unrelated regression (SUR) model. This estimator will provide consistent estimates of the model parameters as long as the unobservable determinants of product demand are mean-independent of the preference factors, household income and the distribution factors: $E(u_i|\boldsymbol{a}, x, \boldsymbol{z}) = 0$ for all i. The SUR estimator also exploits the cross-commodity correlation structure in the error terms in order to produce more efficient estimates than a system OLS estimator. Testing the collective model requires re-estimating the SUR model subject to the non-linear restrictions represented in [15a] and [15b]. The validity of this model can then be evaluated with a likelihood ratio test. In our empirical analysis these estimates are obtained using the *nlsur* command in Stata 12. All estimates take the survey design characteristics into considerations.

4 Data

The 2008 National Income Dynamic Study (NIDS) was the first wave of a panel that collected data from South African households on a wide range of socio-economic factors (Leibbrandt *et al.*, 2009: 4). The original sample consisted of 7305 households, but we restrict our sample to households that consisted of two adult household members that reside in the household, are of different genders, and are either married or cohabitating. We also drop households in which either of the members are older than 65 or younger than 25. Given that household headship is likely to reflect bargaining power within the household, we also omit the 10% of female-headed households. This gives us a potential sample of 641 households that are relatively homogeneous in terms of household structure and age composition.

All surveyed households were asked to provide information on household and individual income and expenditure during the preceding 30 days. The short time-period reduces the problem of recall bias, but may cause lumpiness in expenditure data on durable goods and infrequent sources of income (Browning and Chiappori, 1998: 1262). This is problematic for two reasons. First, it means that recorded income and expenditure values will deviate more from the underlying propensities that we are interested in. Second, the proportionality test of used to test the collective model assumes that households are at an interior rather than corner solution. The short reporting interval will increase the number of zero expenditure values, which exacerbates concerns of whether this hypothesis test offers an appropriate test of the collective model. Both problems are partly addressed by our choice of seven broadly defined expenditure categories: communication, clothing, entertainment, food, medical expenditure, personal care and tobacco and alcohol. Food contains expenditure on all food items except alcohol while communication only includes cell-phone and telephone expenditure. In order to reduce the proportion of zero clothing expenditure observations, this category is extended to include expenditure on fabric for clothing and washing and cleaning agents. Total entertainment expenditure includes expenditure on reading materials, movies, music and television. Medical expenditure is the sum of expenditure on medical aid, medical supplies, medical professionals and life insurance expenditure. Personal care includes expenditure on "cosmetics, soap, shampoo and haircuts" (NIDS, 2008: 11).

We follow the literature in our choice of preference factors (Browning *et al.*, 2011: 228), which includes the number of children, the age and education level of adult household members, ownership of a home or a car, and the location of the household. Given the historical importance of race, we also control for the race of the household head which may be correlated with a range of unobservable household factors. Furthermore, given the high levels of involuntary unemployment we also explicitly control for the employment status and hours worked of both adult household members.

123 of the households in our restricted sample reported missing values for at least one of the expenditure categories or preference factors. The first of our two preferred distribution factors, the local gender ratio is, is defined as the share of unmarried men between the ages of 25 and 55 in the district council. This share is calculated using data from the 2001 census and contains no missing values. However, 193 of remaining households had missing values for at least one of the adult members' mothers, which is required to construct the second distribution factor. In the 20 cases where individuals reported their father's education levels but not their mother's, predicted value of the latter is obtained using the coefficients from linearly projecting maternal education on own and father's education. This provides us with a sample of 344 households. Table 1 reports the weight adjusted sample statistics of the households included in the subsample.

5 Results

5.1 Tests of unitary and collective model

Table 2 reports the coefficient estimates of the unrestricted demand system. The unitary hypothesis [7] states that distribution factors should be uncorrelated with all commodity expenditures after conditioning on income and preference factors, which is formally evaluated by calculating the joint significance of all of the distribution factor variables. This hypothesis is strongly rejected with a χ^2-statistic of 133.07 and an associated p-value less than 0.0001. As discussed in section 2.2, this result is consistent with the international literature which has overwhelmingly rejected the unitary model.

The unitary model is rejected because of strong evidence that household decisions are affected by our preferred distribution factors: the husband's maternal education share and the local sex ratio. Of course, the validity of the unitary model hinges on the validity of these distribution factors. We observe that households in which the husband's mother is relatively better educated tend to spend less on clothing, communication and personal care, all products for which a stronger female preference have been found in international studies. These households also reveal an inclination to spend more on alcohol and tobacco – found in other studies to be a male-preferred expenditure category – although this effect is imprecisely estimated. Similarly, households that reside in districts with a lower share of unmarried males tend also to spend less on clothing, communication and personal care, and more on alcohol and tobacco. Although these effects the local sex ration are imprecisely estimated the coefficient estimates are large in magnitude, the χ^2-statistic of the joint significance of all the local sex ratio share variables (excluding those interacted with the local sex share) indicates that the unitary model is rejected even when only these distribution factors are used. The same is true when only using the maternal education share variables.

Although the preference factors are mainly included as control variables, their coefficients also presents information regarding the appropriateness of our specification. The household income coefficient estimates indicate that entertainment, communication and medical expenses[17] are all luxury goods for South African households, whereas personal care, food and clothing are necessity commodities. Alcohol and tobacco expenditure is on the brink between a necessity and inferior good. Asset ownership is associated with an increased expenditure on entertainment, medical and personal care. The presence of children tends to increase expenditure on food and clothing, while residing in a rural area decreases expenditure on clothing and personal care. Households with a better educated household head tend to spend more on medical expenses, entertainment (which includes books) and communication.

[17] The high income elasticity of health expenditure is largely driven by the unique South African health services: the department of health offers free medical service at health clinics, but private health care is deemed to be expensive by international standards. See Ataguba and McIntyre (2012) for a discussion on the South African health care system.

Table 3 reports the estimates of the restricted demand system [15a], which is the first of the conditions implied by the proportionality condition. The hypothesis test that this version of the proportionality test is consistent with the data is not rejected (with a p-value of 0.5009), which suggests that the collective model is consistent with the expenditure decisions of two-adult South African households. The estimated coefficients on the preference factors are similar to those obtained in the unrestricted model. The coefficients on the distribution factors are now normalised relative to its effect on clothing expenditure. We observe that expenditure on this presumably female-preferred commodity decreases with the husband's maternal education share and increases with the local sex ratio, which is consistent with our hypothesised bargaining model. Although the average partial effect of the local sex ratio is not statistically significant on its own, its total effect is significant once we consider its quadratic and interaction variables.

Validity of the proportionality condition only requires that either model [15a] or [15b] be consistent with the unrestricted model. However, we also estimated the restricted model [15b] (results not shown) and find that these estimates also offers no evidence that the collective model should be rejected (with a p-value of 0.1771). This model directly estimates of the power compensation ratio as -1.9151, which indicates that a small increase in the husband's maternal education share requires a decrease in local sex ratio that is 92% larger to restore the initial level of intra-household bargaining power.

5.2 Estimates of sharing rule and difference in individual demands

Since the behaviour of South African households is consistent with the collective model, we can use this model to further investigate the nature of the intra-household decision making process. In section 3 we demonstrated that under the additional assumptions of caring preferences and the separability of private consumption, the estimates of equation [15a] can be interpreted as the relative gender preference for the different commodities, as well as the effect of the distribution factors on the sharing rule. Figure 1 plots the effect of the household distribution factors on female bargaining power (normalised on clothing expenditure). As expected, an increase in the local sex ratio shifts bargaining power in favour of the women, whereas an increase in the husband's maternal education share increases the expenditure share allocated to husband. These effects are not significantly non-linear. The effect of the maternal education share is not significantly affected by the household income level, but the effect of the local sex ratio increases significantly as household income decreases. This pattern is consistent with the local marriage market for poorer household being more geographically concentrated due to the more binding effect of transportation costs. Furthermore, the interaction effect of the distribution factors suggests that these factors are not mutually re-enforcing. Women in households with a low husband's maternal education share and a high local sex ratio will therefore have less bargaining power than would be implied by the sum of the two partial effects.

Estimates of the relative gender preferences for different commodities are obtained from the commodity-specific estimates of λ_i in Table 3 and plotted in Figure 2. These results need to be interpreted with the relative signs of the distribution factors. For all $\lambda_i > 0$, the distribution factors have a positive effect while they have a negative effect where $\lambda_i < 0$. The distribution factors have the largest impact on the demands for the base category, communications, medical and personal care expenditures. These results, along with the inability to reject the collective model of household behaviour as well as the sign of the preference factors, imply that spouses do use changes in their bargaining power to purchase more of their preferred goods. λ_{food} and $\lambda_{entertainment}$ are sufficiently low to warrant an interpretation that changes in distribution factors only change expenditure on these categories by very small amounts, while the negative sign on $\lambda_{Alcohol\ and\ Tobacco}$ indicates that the distribution factors have a reversed effect on purchases of this item.

Taken together, men are estimated to have the strongest relative preference for alcohol and tobacco, followed by food and entertainment, whereas women have the strongest preference for communication, followed by clothing, personal care and medical expenses. This pattern suggest that any increase in female bargaining power will lead to decreased expenditure on alcohol and tobacco, very small changes in expenditure on food and entertainment, and increased expenditure on communication, clothing, medical categories and personal care.

Our model does not allow us to explicitly test whether greater female bargaining power is associated with an increased consumption of public goods and an improved welfare for children. However, this hypothesis is clearly consistent with the evidence – presented here and in other studies – that households in which husbands have more bargaining power tend to spend a greater share on "vices" like alcohol and tobacco, and less on goods with a greater public good component, like clothing and medical.

5.3 Refutability and robustness tests

Perhaps the main concern with any test of the collective model is the validity of the distribution factors. The estimates in Table 3 confirm that these distribution factors are relevant and operating in the hypothesised direction. However, the validity of these distribution factors also requires that they must operate only through their effect on bargaining power. Such concerns are partly addressed by our choice of distribution factors which, unlike relative wages, education or age, are not obvious candidates for preference factors. Since it is still possible to think of reasons why these factors may affect household decisions through alternative channels, we run a battery of refutability tests to explore their validity.

First, we investigate whether these factors have any impact on bargaining power. NIDS asked household members a series of questions regarding participation in household decisions, including the person who each member perceived to be the main decision maker for day-to-day expenditures. We test whether the predicted level of bargaining power (as estimated by the coefficients in Table 3) are associated with the probability that both household members agreed that the female rather than the male was the main decision maker.[18] The estimates of this regression are presented in Table 4. Higher female bargaining power is found to be associated with a substantial and statistically significant increase in the likelihood that the female will be the main maker of day-to-day expenditure decisions. This confirms that our distribution factors are indeed operating – at least partly – through participation in household decisions.

Next, we investigate the effect of the distribution factors on the expenditure decisions of single adult households. If the distribution factors are truly uncorrelated to individual preferences, then we would expect them to have no effect on these household where decisions are unaffected by bargaining considerations. Since we cannot calculate the husband's maternal education share for single adult households, we test instead the effect of the person's mother's level of education (scaled down to the unit interval for comparability). Table 5 reports the linear coefficients of the distribution factors for couples (taken from Table 3), single male adult, and single female adult households, as well as the p-values for the significance tests on both the linear coefficient on its own, and the linear, quadratic and income interaction coefficients jointly.

As observed earlier, the husband's maternal education share has a highly significant effect on the household expenditure decisions of couples, both when considering the average partial effect or the larger group of variables that include interaction and quadratic terms. In contrast, maternal education does not significantly affect the expenditure decisions of single adult households of either gender. As discussed in section 5.1, the effect of the local sex ratio on the bargaining power of couples varies by income level which is why the full set of related distribution variables are jointly significant even though the average partial effect is not. Comparing this to the effect of the local sex ratio for single adult household of both genders, we see that this effect is insignificant for both the average partial effect and the larger set of variables. The full set of variables associated with either distribution factor is also found to be highly significant as an explanation of the behaviour of couples, but highly insignificant for singles.

5.4 Alternative distribution factors

Finally, we also investigate the effect of using alternative variables as a third distribution factor, z_3, in our analysis. Specifically, all of the variables in Table 6 are included, along with our two preferred distribution factors, in a non-linear SUR model of equation [15a]. If the gender preferences in Figure 2 accurately identify the effect of more bargaining power on the composition of household expenditure, then such a regression model will find the partial effect of z_3 on the bargaining power of females. As before, this effect is allowed to be quadratic and to interact with household income and the values of the other

[18] We also estimated a model in which we included cases where the household members gave contradictory answers regarding the main decision maker as two separate outcomes. Household bargaining power was not found to have any power in predicting these outcomes, but the main results are robust to this more general specification.

distribution factors. The results in Table 6 report the coefficient on the linear term (the average partial effect) and the significance of this linear effect as well as of all the variables associated with this distribution factor. We also report the p-values of the relevant proportionality tests; values above 0.05 are interpreted as evidence that this variable is a third valid distribution factor, in as far as we cannot reject the hypothesis that its effect on all commodities can be represented as if working through a scalar (the same scalar that applies for the other two factors). In the case of the age difference, education difference, the difference in number of hours worked, and residing in a rural area, we are considering distribution factors that were previously included as preference factor. In these cases we have simply omitted the relevant variable from our set of preference factors.

Our analysis suggests that female bargaining power tends to be higher amongst women who earn relatively more, who come from richer parental households, and who have a larger number of young children in the household. The signs of these estimates are all consistent with the international literature, although it is interesting to note that the proportionality test rejects both the number of young children and household income when young as valid distribution factors. International studies have also used relative age, years of education, marital status and whether the husband's mother worked. We find that the being married and age difference have an insignificant effect on consumption patterns, and that the effect of education difference and husband's maternal employment were both of the opposite sign as in the literature. Neither of the significant variables are valid according to the proportionality test statistic.

Table 6 also includes variables not usually considered as distribution factors. Households that reside in rural areas or that receive the child support grant tend to consume more male-preferred commodities. Furthermore, both of these variables pass the proportionality test. It is not difficult to think of reasons why women are less empowered in rural areas, but is less clear why the receiving the child support grant should increase the bargaining power of men. We also observe that households in which women work more hours tend to behave like households in which the female has less bargaining power. This is perhaps most plausible explained by the fact that the hours worked difference variable is itself endogenous and tends to be higher in household where men have more say over women's labour supply decisions.

6 Conclusions

In the above we estimated the determinants and effects of intra-household inequality for two-adult South African households using cross-sectional data. The behaviour of South African households is confirmed to be consistent with the collective, but not the unitary model of household decision making. Additional refutability tests confirm that our two preferred distribution factors – the local sex ratio and the male's maternal education share – affect consumption decisions via participation in household decisions and not through preferences. Increases in the local sex ratio is found to increase the bargaining power of women, whereas an increase in the male spouse's maternal education share increases the expenditure share allocated to him. Additionally we find that female bargaining power tends to be higher amongst women who earn relatively more, who come from richer parental households, and who have a larger number of young children in the household. We find that female household members have a stronger preference for expenditure on communication, clothing, personal care and medical expenses, while male members have a stronger preference for alcohol and tobacco, food and entertainment.

7 Bibliography

Alderman, H., Chiappori, P.-A., Haddad, L., Hoddinott, J., & Kanbur, R. (1995). Unitary versus collective models of the household: is it time to shift the burden of proof? *The World Bank Research Observer, 10*(1), 1-19.

Aromolaran, A. B. (2004). Household income, women's income share and food calorie intake in South Western Nigeria. *Food Policy, 29*(5), 507-530.

Arrow, K. J. (1950). A difficulty in the concept of social welfare. *The Journal of Political Economy*, 328-346.

Ataguba, J. E., & McIntyre, D. (2012). Paying for and receiving benefits from health services in South Africa: is the health system equitable?. *Health policy and planning*, *27*(suppl 1), i35-i45.

Becker, G. S. (1974). A Theory of Social Interactions. *The Journal of Political Economy, 82*(6), 1063-1093.

Becker, G. S. (1991). A Treatise on the Family (Revised and enlarged edition): Cambridge, Massachusetts: Harvard University Press.

Blundell, R., Chiappori, P. A., Magnac, T., & Meghir, C. (2007). Collective labour supply: Heterogeneity and non-participation. *The Review of Economic Studies*,*74*(2), 417-445.

Bobonis, G. J. (2009). Is the Allocation of Resources within the Household Efficient? New Evidence from a Randomized Experiment. *Journal of Political Economy, 117*(3), 453-503.

Bourguignon, F., Browning, M., & Chiappori, P.-A. (2009). Efficient intra-household allocations and distribution factors: implications and identification. *The Review of Economic Studies, 76*(2), 503-528.

Bourguignon, F., Browning, M., Chiappori, P.-A., & Lechene, V. (1993). Intra household allocation of consumption: A model and some evidence from French data. *Annales d'Economie et de Statistique*, 137-156.

Browning, M., & Bonke, J. (2009). Allocation within the household: direct survey evidence. *University of Oxford, Working Paper No. 429*.

Browning, M., Bourguignon, F., Chiappori, P.-A., & Lechene, V. (1994). Income and outcomes: A structural model of intrahousehold allocation. *Journal of Political Economy*, 1067-1096.

Browning, M., & Chiappori, P.-A. (1998). Efficient intra-household allocations: A general characterization and empirical tests. *Econometrica*, 1241-1278.

Browning, M., Chiappori, P.-A., & Lechene, V. (2006). Collective and unitary models: A clarification. *Review of Economics of the Household, 4*(1), 5-14.

Browning, M., Chiappori, P.-A., & Lewbel, A. (2013). Estimating consumption economies of scale, adult equivalence scales, and household bargaining power. *The Review of Economic Studies*, rdt019.

Browning, M., Chiappori, P.-A., & Weiss, Y. (2011). Family economics. *Tel Aviv University, unpublished textbook manuscript*.

Chiappori, P. A. (1988). Rational household labor supply. *Econometrica: Journal of the Econometric Society, 56(1)*, 63-90.

Chiappori, P.-A. (1997). Introducing household production in collective models of labor supply. *Journal of Political Economy, 105*(1), 191-209.

Chiappori, P. A., Fortin, B., & Lacroix, G. (2002). Marriage market, divorce legislation, and household labor supply. *Journal of Political Economy, 110*(1), 37-72.

Duflo, E. (2003). Grandmothers and Granddaughters: Old‐Age Pensions and Intrahousehold Allocation in South Africa. *The World Bank Economic Review, 17*(1), 1-25.

Fortin, B., & Lacroix, G. (1997). A Test of the Unitary and Collective Models of Household Labour Supply. *Economic Journal, 107*(443), 933-955.

Fuwa, N., Ito, S., Kubo, K., Kurosaki, T., & Sawada, Y. (2006). Gender Discrimination, Intrahousehold Resource Allocation, and Importance of Spouses' Fathers: Evidence on Expenditure from Rural India. *The Developing Economies, 44*(4), 398-439.

Gummerson, E., & Schneider, D. (2013). Eat, drink, man, woman: gender, income share and household expenditure in South Africa. *Social forces, 91*(3), 813-836.

Haddad, L. J., Hoddinott, J., & Alderman, H. (1997). Introduction: The Scope of Intrahousehold Resource Allocation Issues". In L. J. Haddad, J. Hoddinott & H. Alderman (Eds.), *Intrahousehold Resource Allocation in Developing Countries*. Baltimore: The Johns Hopkins University Press.

Lise, J., & Seitz, S. (2011). Consumption Inequality and Intra-household Allocations. *The Review of Economic Studies, 78*(1), 328-355. doi: 10.1093/restud/rdq003

Lundberg, S., & Pollak, R. A. (1993). Separate spheres bargaining and the marriage market. *Journal of Political Economy, 101*(6), 988.

Lundberg, S. J., Pollak, R. A., & Wales, T. J. (1997). Do Husbands and Wives Pool Their Resources? Evidence from the United Kingdom Child Benefit. *Journal of Human Resources, 32*(3).

Maitra, P., & Ray, R. (2003). The effect of transfers on household expenditure patterns and poverty in South Africa. *Journal of Development Economics, 71*(1), 23-49.

Manser, M., & Brown, M. (1980). Marriage and household decision-making: A bargaining analysis. *International Economic Review*, 31-44.

National Income Dynamics Study (NIDS). (2008). *NiDS Household Questionnaire Wave 1*. [Online] Availabe: http://www.nids.uct.ac.za/documents/wave-1-documents-and-questionnaires/wave-1-questionnaires/35-household-questionnaire [21.07.2014].

Quisumbing, A. R., & Maluccio, J. A. (2003). Resources at Marriage and Intrahousehold Allocation: Evidence from Bangladesh, Ethiopia, Indonesia, and South Africa*. *Oxford Bulletin of Economics and Statistics, 65*(3), 283-327.

Samuelson, P. A. (1956). Social indifference curves. *The Quarterly Journal of Economics, 70*(1), 1-22.

Thomas, D. (1990). Intra-Household Resource Allocation An Inferential Approach. *Journal of Human Resources, 25*(4), 635-664.

Thomas, D. (1993). The distribution of income and expenditure within the household. *Annales d'Economie et de Statistique*, 109-135.

Udry, C. (1996). Gender, agricultural production, and the theory of the household. *Journal of Political Economy*, 1010-1046.

Vermeulen, F. (2005). And the winner is... An empirical evaluation of unitary and collective labour supply models. *Empirical Economics, 30*(3), 711-734.

Wang, S.-Y. (2014). Property rights and intra-household bargaining. *Journal of Development Economics, 107*, 192-201.

A.1 Tables

Table 1: Sample statistics

	Sample average	Standard deviation	Minimum	Maximum
Expenditure category				
Clothing	4.31	2.08	0	8.61
Medical	3.20	3.55	0	9.26
Entertainment	2.24	2.68	0	7.31
Food	6.90	0.95	3.95	8.82
Communication	4.04	2.53	0	8.88
Personal care	3.22	2.37	0	6.91
Alcohol and tobacco	2.40	2.62	0	7.82
Preference factors				
Log household income	8.57	1.34	5.06	11.50
Any children	0.64	0.48	0	1
More than two children	0.36	0.48	0	1
Number of children	1.18	1.21	0	9
Home ownership	0.64	0.48	0	1
Car ownership	0.47	0.50	0	1
Rural	0.26	0.44	0	1
Coloured	0.12	0.33	0	1
Indian	0.03	0.17	0	1
White	0.30	0.46	0	1
Age (male)	41.44	9.36	26	65
Education (male)	10.00	4.83	0	24
Hours worked (male)	33.54	27.09	0	200
Employed (male)	0.77	0.42	0	1
Age (female)	37.14	9.53	25	65
Education (female)	10.04	4.02	0	24
Hours worked (female)	15.17	23.12	0	180
Employed (female)	0.39	0.49	0	1
Distribution factors				
Husband's maternal education share	0.47	0.23	0	1
Local sex ratio	0.79	0.12	0.50	1.23

Table 2: Unrestricted demand system estimates

	Clothing	Medical	Entertain-ment	Food	Commu-nication	Personal care	Alcohol and tobacco
Constant	4.770*** (0.920)	1.845 (1.559)	0.812 (1.153)	6.586*** (0.352)	4.450*** (1.111)	3.013** (1.184)	1.229 (1.565)
Any children	0.198 (0.349)	-0.417 (0.562)	-0.0774 (0.427)	0.0506 (0.118)	-0.401 (0.351)	0.225 (0.398)	-0.707 (0.519)
More than two children	0.423 (0.368)	0.842 (0.543)	-0.773* (0.456)	-0.0433 (0.129)	0.557 (0.481)	0.757* (0.392)	-0.288 (0.572)
Number of children	-0.0655 (0.121)	-0.326 (0.205)	0.00869 (0.194)	0.0489 (0.0388)	-0.270 (0.181)	-0.477*** (0.169)	0.139 (0.220)
Home ownership	0.252 (0.267)	0.566 (0.468)	0.544* (0.312)	-0.0661 (0.0988)	-0.0943 (0.277)	0.347 (0.323)	-0.487 (0.343)
Car ownership	0.236 (0.295)	1.807*** (0.562)	0.879** (0.409)	0.327** (0.135)	0.765** (0.382)	1.029*** (0.378)	0.293 (0.558)
Rural	-0.499* (0.275)	0.259 (0.351)	-0.343 (0.250)	0.0948 (0.106)	0.429 (0.306)	-0.590 (0.372)	-0.0988 (0.388)
Coloured	0.177 (0.389)	0.281 (0.875)	0.228 (0.570)	0.358** (0.151)	0.368 (0.592)	1.065*** (0.406)	-0.602 (0.489)
Indian	1.213*** (0.420)	0.291 (0.864)	-1.960 (1.250)	0.627*** (0.221)	0.0502 (0.564)	0.484 (0.651)	3.314*** (0.958)
White	-0.513 (0.345)	0.672 (0.733)	-1.340** (0.528)	0.180 (0.148)	0.242 (0.414)	0.239 (0.466)	2.037*** (0.589)
Age (male)	-0.0129 (0.0188)	-0.0147 (0.0341)	-0.00528 (0.0232)	0.00109 (0.00700)	0.00443 (0.0221)	-0.0418* (0.0246)	0.0266 (0.0312)
Education (male)	0.135*** (0.0428)	0.0879* (0.0476)	0.121*** (0.0399)	0.0349*** (0.0120)	0.0151 (0.0355)	0.0821** (0.0407)	0.0640 (0.0498)
Hours worked (male)	0.00974* (0.00508)	0.0142* (0.00833)	0.00321 (0.00662)	0.00599** (0.00300)	0.0175*** (0.00523)	0.00783 (0.00608)	0.000264 (0.00711)
Employed (male)	-1.050** (0.408)	-1.570** (0.658)	-0.500 (0.492)	-0.472*** (0.168)	-1.132** (0.486)	-0.331 (0.465)	1.114** (0.543)
Age (female)	0.00509 (0.0188)	0.0123 (0.0377)	0.0151 (0.0256)	-0.00421 (0.00840)	-0.0220 (0.0216)	0.0347 (0.0289)	-0.0291 (0.0295)
Education (female)	-0.103** (0.0468)	0.0392 (0.0548)	-0.00109 (0.0436)	0.00215 (0.0155)	0.0440 (0.0443)	-0.0932* (0.0490)	-0.0887 (0.0577)
Hours worked (female)	-0.00182 (0.00473)	-0.0145* (0.00828)	-0.00883 (0.00675)	-0.00540 (0.00339)	3.93e-05 (0.00643)	0.00167 (0.00863)	-0.000271 (0.00811)
Employed (female)	-0.0952 (0.281)	0.378 (0.437)	0.412 (0.382)	0.143 (0.148)	-0.144 (0.360)	0.398 (0.438)	0.298 (0.476)
Log income	0.781*** (0.160)	1.081*** (0.244)	1.075*** (0.175)	0.351*** (0.0619)	1.080*** (0.150)	0.464** (0.200)	0.0539 (0.255)
Log income^2	-0.0457 (0.0611)	0.0960 (0.0709)	0.153*** (0.0560)	-0.0231 (0.0202)	-0.0231 (0.0548)	0.0496 (0.0715)	0.169* (0.0924)
Husband's maternal education share	-1.516*** (0.437)	-1.072 (0.957)	-0.826 (0.577)	-0.0922 (0.139)	-2.072*** (0.495)	-1.288** (0.641)	0.924 (0.680)
Husband's m. educ. share^2	-0.129 (1.067)	-1.469 (1.707)	-1.278 (1.115)	-0.383 (0.407)	-0.698 (1.191)	-2.154 (1.355)	2.144 (1.352)
Husband's m. educ. share*Log income	-0.0326 (0.405)	-0.222 (0.669)	-0.271 (0.455)	0.121 (0.142)	-0.0326 (0.393)	0.150 (0.476)	-0.346 (0.559)
Local sex ratio	0.575 (0.992)	-1.003 (2.137)	-0.264 (1.437)	-0.0246 (0.410)	1.627 (1.209)	0.461 (1.360)	-1.610 (1.686)
Local sex ratio^2	1.640 (4.891)	-9.415 (7.458)	-0.176 (4.980)	-1.779 (1.678)	-3.832 (5.034)	0.456 (6.100)	0.502 (7.518)
Local sex ratio*Log income	-1.657* (0.965)	-2.477 (1.805)	0.297 (1.066)	0.0547 (0.352)	-1.223 (0.942)	-0.690 (1.095)	-1.101 (1.518)
Husband's m. educ. share*Local sex ratio	-0.857 (2.924)	0.0304 (4.164)	-0.293 (3.079)	0.881 (1.100)	-4.374 (3.680)	-0.412 (4.548)	10.57** (4.181)
Observations	344	344	344	344	344	344	344
R-squared	0.516	0.6399	0.604	0.713	0.6083	0.494	0.339

Joint significance of distribution factors:			
	Both factors	Husband's maternal education share	Local sex ratio
χ^2 test statistic	133.07	59.36	35.37
p-value	0.000	0.000	0.026

Table 3: Restricted demand system estimates

	Clothing	Medical	Entertain-ment	Food	Communi-cation	Personal care	Alcohol and tobacco
Constant	4.819***	1.807	0.745	6.546***	4.430***	2.914**	1.341
	(0.916)	(1.602)	(1.164)	(0.356)	(1.100)	(1.192)	(1.621)
Any children	0.152	-0.404	-0.0486	0.0723	0.551	0.256	-0.822
	(0.358)	(0.599)	(0.426)	(0.120)	(0.486)	(0.390)	(0.536)
More than two children	0.424	0.851	-0.794*	-0.0506	-0.274	0.735*	-0.289
	(0.371)	(0.571)	(0.461)	(0.132)	(0.178)	(0.395)	(0.569)
Number of children	-0.0521	-0.356*	0.00321	0.0429	-0.274	-0.481***	0.160
	(0.121)	(0.205)	(0.192)	(0.0393)	(0.178)	(0.168)	(0.205)
Home ownership	0.255	0.492	0.562*	-0.0525	-0.101	0.421	-0.532
	(0.280)	(0.467)	(0.305)	(0.0993)	(0.282)	(0.330)	(0.351)
Car ownership	0.208	1.763***	0.961**	0.327**	0.761**	1.103***	0.196
	(0.276)	(0.565)	(0.398)	(0.130)	(0.374)	(0.379)	(0.548)
Rural	-0.434	0.170	-0.232	0.0954	0.388	-0.496	-0.0692
	(0.285)	(0.390)	(0.254)	(0.0947)	(0.306)	(0.349)	(0.376)
Coloured	0.174	0.249	0.297	0.381**	0.378	1.141***	-0.635
	(0.389)	(0.969)	(0.579)	(0.153)	(0.587)	(0.406)	(0.533)
Indian	1.276***	0.435	-1.816	0.595***	0.0483	0.435	3.604***
	(0.421)	(0.828)	(1.237)	(0.216)	(0.558)	(0.623)	(1.005)
White	-0.512	0.503	-1.270**	0.209	0.238	0.382	1.913***
	(0.339)	(0.743)	(0.537)	(0.147)	(0.406)	(0.483)	(0.615)
Age (male)	-0.0123	-0.0214	-0.00397	0.00108	0.00620	-0.0438*	0.0254
	(0.0198)	(0.0347)	(0.0226)	(0.00694)	(0.0225)	(0.0246)	(0.0317)
Education (male)	0.139***	0.0865*	0.121***	0.0343***	0.0163	0.0761*	0.0735
	(0.0439)	(0.0470)	(0.0400)	(0.0130)	(0.0359)	(0.0407)	(0.0485)
Hours worked (male)	0.0102**	0.0150*	0.00312	0.00582**	0.0179***	0.00658	0.00273
	(0.00493)	(0.00783)	(0.00682)	(0.00286)	(0.00523)	(0.00608)	(0.00752)
Employed (male)	-1.064**	-1.639**	-0.549	-0.476***	-1.135**	-0.316	1.061*
	(0.422)	(0.700)	(0.503)	(0.174)	(0.486)	(0.470)	(0.555)
Age (female)	0.00393	0.0223	0.0109	-0.00460	-0.0234	0.0339	-0.0259
	(0.0187)	(0.0383)	(0.0248)	(0.00818)	(0.0215)	(0.0287)	(0.0298)
Education (female)	-0.103**	0.0303	0.00145	0.00155	0.0419	-0.0886*	-0.0984*
	(0.0468)	(0.0553)	(0.0446)	(0.0160)	(0.0445)	(0.0483)	(0.0570)
Hours worked (female)	-0.00289	-0.0156*	-0.00839	-0.00509	0.000813	0.00200	-0.00293
	(0.00469)	(0.00835)	(0.00702)	(0.00323)	(0.00647)	(0.00804)	(0.00854)
Employed (female)	-0.0586	0.434	0.415	0.148	-0.173	0.423	0.380
	(0.276)	(0.445)	(0.380)	(0.143)	(0.357)	(0.427)	(0.476)
Log income	0.776***	1.166***	1.033***	0.352***	1.077***	0.434**	0.0898
	(0.158)	(0.247)	(0.180)	(0.0626)	(0.150)	(0.204)	(0.248)
Log income^2	-0.0518	0.101	0.163***	-0.0154	-0.0209	0.0637	0.147
	(0.0616)	(0.0657)	(0.0567)	(0.0198)	(0.0533)	(0.0682)	(0.0898)
Commodity-specific factor	1	0.798*	0.284	0.0581	1.335***	0.807***	-0.591
	.	(0.452)	(0.258)	(0.0808)	(0.368)	(0.298)	(0.374)
Husband's maternal education share	-1.506***						
	(0.382)						
Husband's m. education share^2	-0.703						
	(0.601)						
Husband's m. education share*Log income	-0.0144						
	(0.224)						
Local sex ratio	0.926						
	(0.674)						
Local sex ratio^2	-1.050						
	(2.670)						
Local sex ratio*Log income	-1.218**						
	(0.558)						
Husband's m. education share*Local sex ratio	-3.237*						
	(1.730)						
Observations	344	344	344	344	344	344	344
R-squared	0.514	0.629	0.6001	0.7081	0.6078	0.4888	0.3218
Joint significance of distribution factors:							
	Husband's maternal education share			Local sex ratio		Both factors	
LR test statistic	16.83			8.14		19.46	
p-value	0.001			0.043		0.007	
Test of proportionality hypothesis							
LR test statistic	35.32						
p-value	0.5009						

Table 4: Probit regression: main decision maker is female

Constant	-1.175 (2.797)
Any children	-0.0947 (0.251)
More than two children	0.373 (0.267)
Number of children	-0.0311 (0.118)
Home ownership	0.356* (0.186)
Car ownership	0.105 (0.235)
Rural	-0.132 (0.182)
Coloured	0.270 (0.234)
Indian	0.386 (0.504)
White	0.387 (0.289)
Age (male)	-0.00774 (0.0149)
Education (male)	0.0373 (0.0277)
Hours worked (male)	-0.00611 (0.00423)
Employed (male)	0.280 (0.282)
Age (female)	0.0176 (0.0156)
Education (female)	-0.00614 (0.0284)
Hours worked (female)	0.00286 (0.00454)
Employed (female)	-0.0367 (0.237)
Log income	-0.180 (0.676)
Log income^2	0.0189 (0.0409)
Predicted female bargaining power	0.196*** (0.0676)
Observations	338
Pseudo R-squared	0.0794

Table 5: Significance of distribution factors: couples, single men & single women

	Couples	**Single men**	**Single women**
Husband's maternal education share			
Linear coefficient estimate (average partial effect)	-1.506	0.013	1.017
p-value	0.000	0.836	0.150
χ^2 test statistic for linear, quadratic and income interaction terms	16.830	0.680	2.870
p-value	0.001	0.878	0.413
Local sex ratio			
Linear coefficient estimate (average partial effect)	0.926	-0.116	-0.813
p-value	0.170	0.555	0.205
χ^2 test statistic for linear, quadratic and income interaction terms	8.140	0.600	2.210
p-value	0.043	0.897	0.531
All distribution factors			
χ^2 test statistic for all distribution factor terms	19.460	0.710	3.940
p-value	0.007	0.998	0.787

Table 6: Test statistics for various candidate distribution factors

	Average partial effect		Total effect		Proportionality test
Distribution factor	Estimate	p-value	$\chi 2$ test statistic	p-value	p-value
Age difference	0.016	0.160	3.88	0.275	0.126
Number of young children	0.336	0.059	7.48	0.058	0.061
Rural	-0.402	0.060	3.54	0.170	0.317
Log wage difference	0.066	0.021	15.11	0.002	0.177
Child support grant	-0.372	0.038	4.31	0.116	0.329
Household income step difference	0.231	0.001	11.09	0.011	0.020
Husband's mother worked	0.264	0.040	13.25	0.001	0.002
Married	-0.106	0.660	0.20	0.907	0.001
Education difference	-0.075	0.012	7.44	0.059	0.023
Hours worked difference	-0.005	0.040	9.25	0.026	0.033

Figure 1: Female bargaining power and distribution factors

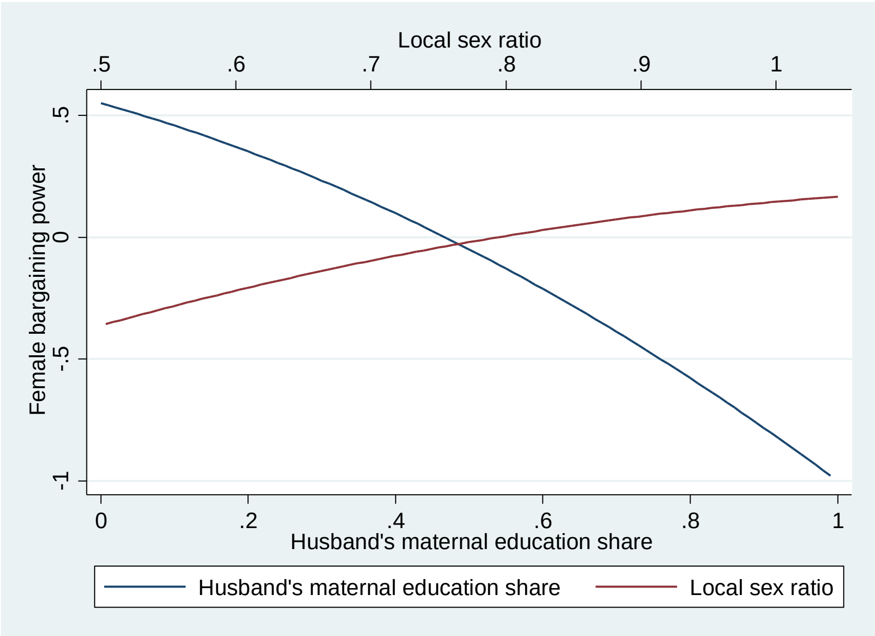

Figure 2: The relative gender preference for consumption expenditure