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WIDER Working Paper 2017/71

Gender bias and the intrahousehold distribution of resources

Evidence from African nuclear households in South Africa

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March 2017

United Nations University World Institute for Development Economics Research
wider.unu.edu

Abstract: This paper applies recent developments in collective model estimation to elicit the household resource sharing rule, i.e. the amount of household resources accruing to fathers, mothers, and their children among African families in South Africa. We use the 2010/11 South African Income and Expenditure Survey as it contains exclusive goods, i.e. goods consumed by specific household members, to be used for identification. We rely on a collective model of household consumption that accounts for (potentially unequal) resource sharing and jointness in consumption (generating economies of scale). Results indicate that men tend to receive more than women (even if imprecise estimates make the difference statistically insignificant) and there is a sharp gender differential in terms of poverty. Ignoring economies of scale leads to an overestimation of poverty among adult men and women living with others. Children's resource shares are in line with international standards but household resources are relatively low among African families so that ignoring intrahousehold allocation leads to an underestimation of child poverty.

Keywords: collective model, sharing rule, economies of scale, individual poverty, South Africa
JEL classification: D11, D12, D3, I31, J12

Acknowledgements: We are grateful to Zaki Wahhaj, Michèle Tertilt and participants of the 2015/16 Gender and Development workshops at UNU-WIDER and University of Namur; and 2015 MASA conference for useful advice. This research was originally commissioned by UNU-WIDER in Helsinki, within the Gender and Development research project.

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This study has been prepared within the UNU-WIDER project on 'Gender and development".

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ISSN 1798-7237 ISBN 978-92-9256-295-3

Typescript prepared by Lesley Ellen.

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The Institute is funded through income from an endowment fund with additional contributions to its work programme from Denmark, Finland, Sweden, and the United Kingdom.

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1 Introduction

Empowering women for economic development has always been high on the post-apartheid South African government's transformative agenda. This has been actioned through a myriad of nationwide measures, e.g. integrating women into the education system and into economic activities, and instituting pro-gender equity legislation. Regardless, women still fare worse than men in attributes of welfare enhancement (Hoogeveen and Ozler 2005; Leite et al. 2006; Leibbrandt et al. 2012). This begs the question whether the low sensitivity of gender equity to state interventions is partly sparked by household members' perspectives on gender equity in general and, precisely, on the effective allocation of resources within households. For South Africa, the gender equity dimension in resource allocation at household level has received limited attention so far (among exceptions are Duflo 2000; Case 2002; Wittenberg 2009; Kreuser 2013). The present paper suggests new evidence based on structural estimations.

Traditionally, it has been assumed that resources are allocated equitably, or according to needs, among household members, notably in the unitary model of Becker (1981). The development of collective models has allowed putting a formal structure on the potentially unequal allocation of resources within the household (Chiappori 1988, 1992). At the same time, the theory underlying the unitary model, notably the absence of individualism, has been criticized while empirical evidence has led to a clear rejection of this model when applied to couple data (Browning and Chiappori 1998), as well as the rejection of necessary conditions like the income pooling hypothesis (Lundberg et al. 1997). It has been suggested that the distribution of resources in the household depends on the control over external streams of income (Bourguignon et al. 2009), factors affecting outside options (Manser and Brown 1980; Chiappori et al. 2002) and more generally the 'distribution factors' that influence the sharing rule.

Strikingly, the collective model has become operational only recently. Indeed, most of the early literature following Chiappori (1988, 1992) has consisted in testing the efficiency assumption at the core of this theory or in identifying the marginal sharing rule. The complete resource allocation between spouses has been identified only recently under some assumptions about preference stability across family status (Browning et al. 2013). This approach, at the core of the present study, represents a valuable extension of the Rothbarth (1943) approach, notably as it additionally accounts for economies of scale and parental bargaining while being firmly grounded in the collective model's theory and identification strategy. Several extensions have followed including a useful simplification of this method allowing estimations on cross-sectional data (Lewbel and Pendakur 2008), the extension of the latter to account explicitly for children (Bargain and Donni 2012) or applications to specific groups like elderly couples (Cherchye et al. 2012). These analyses focus on rich countries. Very few applications have been carried out for developing countries, where it is suspected that intrahousehold inequality is the highest (using anthropometric evidence for the Philippines, Haddad and Kanbur (1990), show for instance that a third of inter-individual inequality is explained by intrahousehold inequality). To the best of our knowledge, there are two exceptions. One is the extension of Bargain and Donni (2012) to multi-children households in Côte d'Ivoire (Bargain et al. 2014). The other is an estimation on data from Malawi that suggests a slightly different identification approach (Dunbar et al. 2013).

Against this background, it seems there is a need to apply more widely this type of estimations for developing countries in order to embrace a broad range of possible results, assess potential regularities or explain differences across cultural and institutional settings. Such applications should also go beyond

the mere calculation of sharing rules and be used to re-estimate poverty rates at the individual level in regions where within-household inequality may be present. Indeed, unequal allocations of resources can lead to the disadvantage of vulnerable household members, for instance women and children, while poverty is almost always assessed at the household level. Collective models also provide a solid ground to test gender inequality within families. In particular in an African context, aforementioned studies provide some evidence of pro-boy discrimination in Malawi but no boy–girl difference in Côte d'Ivoire.[1]

The contribution of the present paper is as follows: we provide evidence on resource shares in nuclear African families of South Africa, examine potential gender imbalances, and characterize the degree of individual poverty for specific household members. Specifically, we address the following questions: What factors determine the balance of power in African households? How are resources distributed in the household? Is there evidence of gender imbalance in the allocation of household resources among adults and among children? What are the implications of household resource allocation decisions on individual poverty? How do economies of scale from living with others affect poverty among adults? While the present study does not make technical innovations, its contribution is at least twofold. First, as motivated above, it consolidates the literature by adding novel estimates to the very scarce literature on collective model estimations for relatively poor regions of the world. Notably, it questions the degree of intrahousehold and gender inequality in a different African context compared to existing evidence. Indeed, results for Malawi and Côte d'Ivoire, as cited above, cannot be generalized as they show somewhat relatively contrasting results, perhaps owing to peculiarities in the socio-economic/political and cultural environments of these countries. It is therefore interesting to provide a comparison with the poor population of South Africa (Africans). Second, general empirical studies on intrahousehold relations in Africa are still limited. Previous studies on South Africa have typically focused on testing the unitary model. Kreuser (2013), Duflo (2000), Case (2002), and Wittenberg (2009) notably reject necessary conditions of the model. The proposed research goes beyond these studies by providing explicit information on the resource shares of household members. Recovering the sharing rule sheds light on whether household resource allocation decisions are laced with gender inequality due to power imbalances and whether conventional poverty measures based on household resources mask higher deprivation among certain populations.

The rest of the paper is organized as follows. In section 2 we present a brief background to the study, section 3 presents the theoretical framework, the empirical model, and the data. Section 4 discusses the estimation results and section 5 provides a detailed poverty analysis and additional results. Section 6 concludes.

[1] For Côte d'Ivoire, this result is shared with Deaton (1989) who uses adult equivalence outlay ratios and data for the year 1985. For other parts of the world, Bhalotra and Attfield (1998) consider food allocation among children in Pakistan and reach the same conclusion as the two latter studies, while evidence of gender discrimination is supported by data on India in Rose (1999).

2 Background

The Republic of South Africa is classified by the World Bank as an upper middle-income country—its GDP per capita was US$6,600 in 2013 (ranked 89th)—but its Human Development Index lags behind (ranked 116th—see UNDP 2015). The nation has about 52 million inhabitants classified as Whites (8.9 per cent), Indians (2.5 per cent), Coloureds (8.9 per cent), and Africans (79.2 per cent) (Statistics South Africa 2012). These populations incur vast inequalities in wellbeing as sparked by separationist policies of the Apartheid era (1948–93). Twenty-three years post-Apartheid, and despite a decrease in inter-racial inequality, access to quality education, economic opportunities, basic services, income, and wealth is still skewed in favour of Whites followed by Indians, Coloureds and Africans. Hence, focusing on the latter group means we concentrate on the poorest segment of the South African population. Two aspects are of particular importance to demonstrate this point. First, inequality still persists in the country—the Gini coefficient increased from 0.57 in 1995 to 0.69 in 2011 (Hoogeveen and Ozler 2005; Statistics South Africa 2014)—but this trend seems to be exacerbated by an increase in *within* rather than between group inequalities, especially *among* Africans (Leibbrandt et al. 2012). Second, since the country's distribution of household income still follows the inherited pattern, Africans predominate in low percentiles of the country's income distribution. Poverty is evaluated at 45.5 per cent of the South African population in 2011 (Leibbrandt et al. 2010; Statistics South Africa 2014) mainly due to Africans. This figure is relatively comparable to that of Côte d'Ivoire or Malawi (see Bargain et al. 2014 and Dunbar et al. 2013), which makes the comparison with these countries interesting.

While the distribution of South African resources between households is well-known, the same does not apply to that within households and, consequently, to poverty at individual levels. Currently, few research efforts have been made towards highlighting that African households do not operate as per the unitary model (Wittenberg 2009). The small but growing consensus in the literature is that the allocation of expenditure in African households is sensitive to the income recipient's identity, which refutes the altruism that is inherent in the unitary model (Duflo 2003; Wittenberg 2009). Although this hints at a certain degree of conflict in the household allocation process, the latter cannot be read from present studies.

Regardless of the literature gap, factors that translate into individual bargaining power in two-adult African households seem to be somewhat tilted in favour of men. For instance, in 2014, 72.7 per cent of women and 75.7 per cent of men in South Africa had attained at least some secondary education (UNDP 2015). However, that many women are educated, suggests that they are more likely to bargain for more resources towards their children's upkeep (Duflo 2003). Moreover, relatively fewer women than men participate in the labour market—44.5 per cent vs. 60.5 per cent in 2013. Women are also more prone to unemployment than men, e.g. in 2013, the official unemployment rates were 26.7 per cent and 23.1 per cent respectively (Statistics South Africa 2014). They also tend to work more often in the household or in survivalist occupations in the informal sector. Their median wages are less than men's (Casale and Posel 2002; Bhorat and Goga 2013). It also seems as if married African women's bargaining power is further compromised by the cultural practice of having their husbands pay *lobola* (bride-wealth) to their families, so as to legitimize the union (Mwamwenda and Monyooe 1997). However, some individuals argue the opposite, hence evidence to this effect is inconclusive (see Ambrus et al. 2010). On the one hand, some individuals uphold this culture and opine that being *lobola*d is a sign of respect and commitment that the husband will indeed take care of the wife. On the other, some equate being *lobola*d to women being 'bought by their husbands' which reduces gender equity and women's bargaining power within the households (Mwamwenda and Monyooe 1997; Shope 2006).

This view somewhat dilutes women's power to bargain for more resources for themselves and their children, which renders them more likely to be in poverty than men. Evidence pertaining to resource allocation among children, i.e. boys and girls in African households, is currently scant. For instance, Duflo (2000) shows that girls' nutrition responds more than boys' to pension income received by grandmothers. This study is, however, restricted to a single measure of needs.

3 Model and data

Empirical evidence on intrahousehold allocation of resources has been mainly hampered by two well-known problems. First, surveys often report expenditure and consumption data aggregated at the household level. As a result, individual shares of household resources are rarely observed. Second, there is joint consumption of some household goods and services (e.g. dwelling costs), making it difficult to allocate such consumption to a given individual. To resolve these problems, this study estimates the household sharing rule (i.e. family resources accruing to each household member) using a multi-person collective model with parental bargaining and economies of scale. We follow the approach developed by Bargain and Donni (2012) and recently applied by Bargain et al. (2014) to multi-children households in an African context. The identification of the model is inspired by the method designed by Rothbarth (1943) and Gronau (1988, 1991), namely the existence of exclusive goods (consumed only by certain types of individuals in the household, e.g. adult goods) under the assumption of preference stability. That is, individual preferences of adults in couples, regarding their consumption of exclusive goods, can be inferred from the observation of expenditure on the same goods for similar adults living alone (this assumption was first used in Couprie (2007), and Browning et al. 2013). The following section presents an abridged version of the collective model used in Bargain et al. (2014).

3.1 Collective model of household consumption

The model assumes three types of households i.e. $n \in \{1, 2, 3\}$ where ($n=1$) for single adults, ($n=2$) for childless couples, and ($n=3$) for couples with children. Let superscript $k=1,..,K$ index goods over which households make consumption decisions. Individuals are denoted by subscript i: $i=1$ for men, $i=2$ for women, and $i=3$ for children. The log household expenditure is denoted by x. Every household is characterized by a set of utility functions—one for each individual; a set of scaling functions that capture adult economies of scale or jointness in consumption; and a sharing function that defines which resources accrue to each member. As previously discussed, the model also presumes that an individual's utility function is independent of household type, i.e. after controlling for joint consumption and resource sharing. This notion allows combining data on singles and couples in order to retrieve the resource sharing rule and a term for scale economies.

The decision-making process inherent in the model occurs in two stages. In the first stage, household resources $exp(x)$ are distributed to members according to some sharing rule. Thus, an individual i living in household $n>1$ receives resource share $\eta_{i,n}(\boldsymbol{p},\boldsymbol{z})$ of total expenditure $exp(x)$; where $\boldsymbol{p}$ and $\boldsymbol{z}$ are vectors of prices and socio-demographic characteristics (e.g. age, education, region of residence, house ownership, and employment status). For identification, it is assumed that the sharing function does not depend on household total expenditure (see Lewbel and Pendakur 2008; Bargain and Donni 2012; Dunbar et al. 2013). This assumption is possibly allayed by including measures of household wealth other than total expenditure in individual shares.

In the second stage, each individual solves his/her own utility maximization problem subject to an individual budget constraint. In multi-person households ($n > 1$), the budget share equations will reflect economies of scale (due to joint consumption) and sharing of resources. Therefore, it is assumed that for each person i living in a household of type $n > 1$ there exists a scalar-valued function $s_{i,n}(\mathbf{p}, \mathbf{z})$ which measures cost savings experienced from economies of scale. Accordingly, the budget share equation of individual *i* for good *k* in household n is:[2]

$$\omega_{i,n}^{k}(x, \boldsymbol{p}, \boldsymbol{z}) = \lambda_{i,n}^{k}(\boldsymbol{p}, \boldsymbol{z}) + w_{i}^{k}\left(\boldsymbol{p}, x + \log \eta_{i,n}(\boldsymbol{p}, \boldsymbol{z}) - \log s_{i,n}(\boldsymbol{p}, \boldsymbol{z}), \boldsymbol{z}_{i}\right)$$

where $\lambda_{i,n}^{k}(\boldsymbol{p}, \boldsymbol{z}) = \partial \log s_{i,n}(\boldsymbol{p}, \boldsymbol{z}) / \partial p_{k}$ is a price elasticity of the scaling function. The budget shares for all household members are positive and sum to one. The household expenditure on each good k is the sum of individual expenditures on good *k* and is given by:

$$W_{n}^{k}(\boldsymbol{p}, x, \boldsymbol{z}) = \sum_{i=1}^{n} \eta_{i,n}(\boldsymbol{p}, \boldsymbol{z}) \cdot \left[\lambda_{i,n}^{k}(\boldsymbol{p}, \boldsymbol{z}) + w_{i}^{k}\left(\boldsymbol{p}, x + \log \eta_{i,n}(\boldsymbol{p}, \boldsymbol{z}) - \log s_{i,n}(\boldsymbol{p}, \boldsymbol{z}), \boldsymbol{z}_{i}\right)\right]$$

The measure of economies of scale $s_{i,n}(\mathbf{p}, \mathbf{z})$ ranges between $\eta_{i,n}(\boldsymbol{p}, z)$ for purely public consumption and 1 for purely private consumption. It should be noted that the economies of scale are not directly interpretable, they must be compared to $\eta_{i,n}(\boldsymbol{p}, z)$. A normalized indicator of the individual economies of scale can be defined as:

$$\sigma_{i,n}(\boldsymbol{p}, \mathbf{z}) = \frac{\eta_{i,n}(\boldsymbol{p}, \mathbf{z})\left(1 - s_{i,n}(\boldsymbol{p}, \mathbf{z})\right)}{s_{i,n}(\boldsymbol{p}, \mathbf{z})\left(1 - \eta_{i,n}(\boldsymbol{p}, \mathbf{z})\right)},$$

In multi-person households $\sigma_{i,n}(\boldsymbol{p}, \mathbf{z})$ is equal to 0 for purely private and 1 for purely public consumption. The scaling factors must be individual specific, since economies of scale may differ between individuals within the same household, depending on how they value the good which is jointly consumed. Specifically, since any given good may have some public/private elements, it is possible that some consumption is joint from one spouse's perspective but not the other's: assume a spouse has all the power and decides about the level of consumption for a certain good (e.g. the house), it will be private to him but joint for her if she is associated with its consumption (e.g. live in this house). Hence our specification allows for identifying individual specific economies of scale. Alternatively, a strict sense of economies of scale can be adopted so the same scaling factors are used for both spouses. This constraint will be imposed in a variant of the baseline model.

Indifference scales $I_{i,n}(\boldsymbol{p}, \mathbf{z})$ that are pertinent for welfare comparisons are identified follows:

[2] See Bargain and Donni (2012) for derivation.

$I_{i,n}(\boldsymbol{p},\mathrm{z}) = \eta_{i,n}(\boldsymbol{p},\mathrm{z}) / s_{i,n}(\boldsymbol{p},\mathrm{z}).$

They represent the income adjustment applied to a person living in a multi-person household for him/her to reach the same indifference curve as when living alone. Notably, the indifference scales are independent of the level of utility (Lewbel and Pendakur 2008; Bargain and Donni 2012). For children, scaling functions are pointless as they always live within the same family structure; these are normalized, i.e. $\lambda^k_{i,n}(p,\boldsymbol{z}) = 0$ and $s_{i,n}(p,\boldsymbol{z}) = 1$ for $i = c$, $n = 3$ and $k = 1,\ldots,K$. Consistent with cross-section data, the price vector $\boldsymbol{p}$ is assumed to be constant. For detailed discussions on identification of the main structural components of the model and corresponding proofs, see Bargain and Donni (2012); Bargain et al. (2014).

3.2 Specification

The empirical model specification consists of two main equations: basic budget share equations for the different demographic groups under consideration and household budget share equations (Bargain and Donni 2012; Bargain et al. 2015). The basic budget share equations assume the following quadratic specification:

$$w^k_{i,j,n} = a^k_i + b^k_i \mathbf{z}_{i,j} + c^k_i \left(x_{i,n,j} - e_i \mathbf{z}_{i,j}\right) + d^k_i \left(x_{i,n,j} - e_i \mathbf{z}_{i,j}\right)^2 \quad \text{for i = 1, 2, 3 and k = 1,..., K,}$$

where j represents sampled households, a^k_i, b^k_i, c^k_i, d^k_i *and* e_i are parameters to be estimated, $\mathbf{z}_{i,j}$ is a vector of demographic characteristics, $x_{i,n,j} = \log \eta_{i,n},_j - \log s_{i,n},_j$ denotes log resources for individual *i* in household *j* of type *n*.

For adult men and women ($i = 1,2$) the parameters are gender-specific but independent of household type *n* and number of children. This follows as the adult budget share equations are similar for single women (men) and for women (men) living in a couple. The demographic variables enter the specification both as a translation of budget share equations and as a translation of log scaled expenditure (coefficient vectors b^k_i *and* e_i respectively). For adults, age and education enter into $e_i \mathbf{z}_{i,j}$, while the same variables and proxies for wealth i.e. women's employment status, dummies for house ownership and urban residency enter into $b^k_i \mathbf{z}_{i,j}$. In the case of children, the characteristics entering $b^k_i \mathbf{z}_{i,j}$ include their average age, their number, and the proportion of male children in the household. As for the household budget share equations, they are specified as follows. For single men and women, these coincide with the budget share equations w^k_i plus an additive error term:

$$W^k_1(x,\mathbf{z}) = w^k_i(x,\mathbf{z}_i) + \varepsilon^k_1.$$

For multi-person households $n \geq 2,$ and for non-adult-specific goods, the household budget share equations $W^k_{n,j}$ encompass individual functions $w^k_i(\cdot,\mathbf{z}_i)$ and three other components as specified and defined below, i.e.:

$$W_{n,j}^{k} = \sum_{i=1}^{n} \eta_{i,n,j} \left[\lambda_{i,n,j}^{k} + w_{i}^{k} \left(x_{j} + \log \eta_{i,n,,j} - \log s_{i,n,,j} , \mathbf{z}_{i,j} \right) \right] + \varepsilon_{n,h}^{k}$$

First, the *sharing functions* $\eta_{i,n,j}$ are defined by the logistic form below:

$$\eta_{i,n,j} = \frac{\exp(\alpha_{i}^{\eta} + \beta_{i}^{\eta} \mathbf{z}_{i,j}^{\eta})}{\sum_{\tau \in \varphi_{n,j}} \exp(\alpha_{\tau}^{\eta} + \beta_{\tau}^{\eta} \mathbf{z}_{\tau,j}^{\eta})}, \qquad \text{for } i = 1,2,3.$$

where α_{i}^{η} and β_{i}^{η} are parameters and $\mathbf{z}_{i,j}^{\eta}$ are characteristics for adults these include age education, urban residency, house ownership, and women's employment status. For children they include mother's education and employment status, urban residence, average age of children, proportion of male children, and number of children in the household. Second, the *log scaling functions* that translate expenditure within the basic budget shares can be written as:

$$s_{i,n,j} = \frac{\eta_{i,n,j}}{\sigma_{i,n,j} + \eta_{i,n,j} - \sigma_{i,n,j} \eta_{i,n,j}}, \quad \text{with} \quad \sigma_{i,n,j} = \alpha_{i}^{\sigma} + \beta_{i}^{\sigma} \mathbf{z}_{i,h}^{\sigma} \qquad \text{for } i = 1,2$$

where α_{i}^{σ} and β_{i}^{σ} are parameters, $\mathbf{z}_{i,h}^{\sigma}$ only includes the number of children, with the restriction that $\sigma_{i,n,j} \in [0,1]$. Third, the function that translates the basic budget shares $\lambda_{i,n}^{k}(\mathbf{z})$ is a price *elasticity*. Measuring price effects is generally challenging. Therefore these terms are restricted to be constant and normalized to zero for children.

$$\lambda_{i,n}^{k}(z) = \overline{\lambda}_{i,n}^{k}, \qquad \text{for } i = 1,2,3, n = 2,3, \text{ and } k = 1,\ldots,K.$$

The model is estimated by the iterated seemingly unrelated regression models. To account for potential correlation between the error terms ε_{n}^{k} in each budget share function and the log total expenditure, each budget share equation is augmented with the 'Wu-Hausman' residuals (see Blundell and Robin 1999).

3.3 Data

This study uses data drawn from the 2010/11 South African Income and Expenditure Survey (IES) conducted by Statistics South Africa. This is a nationally representative cross-sectional dataset with detailed information on household consumption, demographics and economic activities. The initial sample consists of 25,328 households. For the purposes of this study, the sample is restricted to African households thereby eliminating about 21 per cent of the initial sample. African households represent the country's majority and were the most disadvantaged group in Apartheid South Africa. This restriction allows us to focus on a more homogeneous group with a reasonable sample size. In addition, it facilitates comparison of our results with those from Côte d'Ivoire and Malawi. The sample is further restricted to monogamous, nuclear households which drops a further 38 per cent. The extension beyond nuclear households, i.e. to other members or the extended family, is a daunting challenge (see Donni and Badaoui 2014, for a three-generation model of labour supply with application to South

Africa). We also drop couples with children aged above 14 and those with more than three children[3] (i.e. 5 per cent). Single mothers and single fathers (8 per cent) are also dropped. An additional 4 per cent was dropped—this comprises of households with missing information on education or had heads aged below 20 or above 65 years. Finally, we dropped households with 'inconsistent'[4] reports on clothing, zero food expenditures, and outliers (7 per cent). This sample delimitation process leaves a final sample of 4,212 households (21 per cent of African households) composed of single men and women, childless couples, couples with 1–3 children. Tables 1 and 2 present descriptive statistics (i.e. household characteristics and expenditure) for our selected households.

The statistics in Table 1 show that children in larger families are on average older than those in smaller ones. The mean age for children in households with one child is 4.9 years while that for households with three children is 9 years. The distribution of children's sex is balanced across households. For house ownership, relatively more single men (46.7 per cent) own houses than their female counterparts (39.7 per cent). The proportion tends to increase with family size; from 49.5 per cent for couples with one child to 71.5 per cent for those with three. The average house size ranges from 1.5 rooms, for single people, to 3.3 rooms for couples with three children. This suggests that the observed households are relatively poorer than other households in the country (average of 5 rooms). The figures also show that urban residents range from 53.6 per cent to 67.7 per cent across households. Also, larger families are less likely to be urban dwellers than their smaller counterparts.

Table 1 also shows that single women (40 years) are, on average, older than single men (37 years). However, among couples men are consistently older than women, and both sexes become older as they have more children. Furthermore, the proportion of single women with low levels of education (i.e. no schooling and primary) is of the same magnitude as that for single men. The sex differential is reversed among couples as a marginally higher proportion of married men have low education than their female counterparts.

[3] Households with more than three children are primarily composed of older children; this might pose problems in distinguishing children from adult clothing expenditure. This distinction is central to the identification of the model.

[4] This consists of single men who report expenditure on women's and children's clothing; single women who report expenditure on men's and children's clothing; and couples with no children who report expenditure on children's clothing.

Table 1: Descriptive statistics on household characteristics

	Single men		Single women		Childless couple		Couple + 1 child		Couple + 2 children		Couple + 3 children	
Average child age	–	–	–	–	–	–	4.9	(0.21)	7.6	(0.17)	9.0	(0.19)
Prop. of male children	–	–	–	–	–	–	0.498	(0.024)	0.500	(0.016)	0.492	(0.018)
House ownership	0.467	(0.012)	0.397	(0.020)	0.486	(0.019)	0.495	(0.024)	0.623	(0.021)	0.715	(0.026)
Number of rooms	1.490	(0.047)	1.493	(0.089)	1.989	(0.091)	2.053	(0.113)	2.641	(0.105)	3.331	(0.146)
Urban	0.571	(0.012)	0.605	(0.020)	0.610	(0.018)	0.677	(0.022)	0.616	(0.021)	0.536	(0.029)
Men:												
Age	37.4	(0.28)	–	–	40.6	(0.43)	37.2	(0.43)	39.7	(0.35)	41.4	(0.41)
Low education	0.275	(0.011)	–	–	0.317	(0.018)	0.173	(0.018)	0.252	(0.019)	0.275	(0.026)
Employed	0.821	(0.009)			0.786	(0.015)	0.868	(0.016)	0.834	(0.016)	0.847	(0.021)
Women												
Age	–	–	40.1	(0.54)	36.5	(0.42)	31.7	(0.38)	34.6	(0.31)	36.1	(0.35)
Low education	–	–	0.276	(0.019)	0.296	(0.017)	0.157	(0.017)	0.215	(0.018)	0.224	(0.024)
Employed	–	–	0.724	(0.019)	0.499	(0.019)	0.343	(0.023)	0.435	(0.021)	0.390	(0.028)
Number of households	1,663		572		706		440		536		295	

Notes: Standard errors in parentheses. Low education is composed of people with no schooling or primary education.

Source: Authors' compilation.

Table 2: Descriptive statistics on household expenditure

	Single men		Single women		Childless couple		Couple + 1 child		Couples + 2 children		Couples + 3 children	
Budget shares												
Food	0.291	(0.004)	0.291	(0.006)	0.293	(0.006)	0.305	(0.006)	0.315	(0.006)	0.331	(0.008)
Alcohol	0.054	(0.002)	0.009	(0.001)	0.040	(0.003)	0.017	(0.002)	0.019	(0.002)	0.016	(0.002)
Women's clothing	–		0.060	(0.002)	0.041	(0.002)	0.035	(0.002)	0.026	(0.001)	0.022	(0.002)
Men's clothing	0.073	(0.002)	–	–	0.046	(0.002)	0.037	(0.002)	0.030	(0.001)	0.027	(0.002)
Children's clothing	–	–	–	–	–	–	0.029	(0.001)	0.041	(0.002)	0.045	(0.002)
Housing	0.228	(0.003)	0.257	(0.006)	0.223	(0.005)	0.219	(0.006)	0.209	(0.006)	0.199	(0.007)
Transport & comm	0.175	(0.003)	0.183	(0.005)	0.176	(0.004)	0.163	(0.005)	0.162	(0.004)	0.158	(0.006)
Household utilities	0.080	(0.002)	0.093	(0.004)	0.096	(0.004)	0.095	(0.004)	0.106	(0.004)	0.111	(0.005)
Leisure goods & services	0.075	(0.002)	0.066	(0.004)	0.052	(0.002)	0.056	(0.003)	0.051	(0.003)	0.053	(0.004)
Pers. goods & services	0.024	(0.001)	0.042	(0.002)	0.031	(0.001)	0.045	(0.002)	0.041	(0.002)	0.038	(0.002)
Prop. of zero purchases on:												
Women's clothing	–	–	0.086	(0.012)	0.147	(0.013)	0.095	(0.014)	0.166	(0.016)	0.180	(0.022)
Men's clothing	0.127	(0.008)	–	–	0.197	(0.015)	0.175	(0.018)	0.239	(0.018)	0.231	(0.025)
Children's clothing	–	–	–	–	–		0.082	(0.013)	0.090	(0.012)	0.051	(0.013)
Household expenditure†												
In Rand/month	1951.50	(41.349)	2035.71	(66.225)	2838.68	(100.678)	3284.15	(134.304)	3670.51	(141.957)	3990.07	(221.662)
In USD/month	266.96	(5.657)	278.48	(9.060)	388.33	(13.773)	449.27	(18.373)	502.12	(19.420)	545.84	(30.323)
Prop. of hh exp used	0.722		0.705		0.670		0.683		0.648		0.677	

Notes: Standard errors in parentheses. † We indicate the level of household expenditure considered in the structural model (in Rand and in USD, using the 2010 exchange rate of $1=R7.31). Some expenditures are not included (education, health), so we indicate the proportion that it represents in percentage of total household expenditure.

Source: Authors' compilation.

According to Table 2, total monthly household expenditure is lowest for single men (R2,703), and logically increases with family size. For instance, a childless couple spends R4,235 per month which increases to R4,809 for a couple with one child and R5,893 for couples with three children. Nonetheless, goods used in this study account for 65–72 per cent of total household expenditure. This comprises food, alcohol, women's clothing, men's clothing, children's clothing, transport and communication, housing, household utilities, leisure, and personal goods and services.[5] Strictly, the model only requires the existence of an adult-specific good (e.g. clothing) and a residual good in order to identify children's resource shares. However, to improve identification we separate men and women's clothing and also include children's clothing in the model. The other goods are included to improve efficiency of the estimates.

We find that households allocate about a third of their resources to food, which indicates that these households are relatively poor. Couples with children spend less than 2 per cent of their resources on alcohol, while single men and childless couples spend 4–5 per cent. As for clothing, single men allocate 7.3 per cent of their resources to clothing which is 1.3 per cent points higher than single women. These budget shares, for both sexes, are lower for couples and they decline with family size—it appears parents sacrifice their specific expenditures to accommodate their children. For instance, clothing shares are 4.6 per cent for men and 4.1 per cent for women. In childless couples these change to 2.7 per cent for men and 2.2 per cent for women in households with three children. Also as expected, the allocations on children's clothing increase with family size: 2.9 per cent for couples with one child increasing to 4.5 per cent for those with three children. Nonetheless, that clothing makes up only a very small fraction of total expenditures could be a possible threat to our model's identification strategy. The cross-sectional data at use precludes us from investigating why men have a larger budget share on clothing than women, and whether this gender differential leaves room for such reshuffling of resources across goods categories. For instance, it is possible that women (in an equal-sharing household) are compensated by being allowed to consume more in other categories, e.g. more leisure goods.

Statistics for housing show that, apart from single women who spend 26 per cent on accommodation, other households devote 20–23 per cent. Household expenditure on transport and communication is relatively lower than on housing, that is, 16–18 per cent. Also, expenditure on household utilities ranges from 8 per cent for single men to 11.1 per cent for couples with three children. The allocation for leisure goods and personal goods and services is in the range 2.4–7.5 per cent. These budget shares decline with family size suggesting the presence of economies of scale. Table A1 in the Appendix shows descriptive statistics for our estimation sample along with those of the full sample. To some extent our sample is selected, hence the analysis herein should be generalized with caution.

[5] Expenditure on services such as education, health care, insurance and durable goods (e.g. cars and furniture) were excluded as they might represent a set of very selected, possibly, occasional expenditures.

4 Estimation results

Our baseline model consists of a K-1 = 7 good system with expenditure on household utilities as the residual good.[6] We estimate 15 individual Engel curves as our system comprises four non-exclusive goods, with three individual budget shares (two for the adults and one for children), and three assignable goods (adult male, adult female, and child clothing). In this system we estimate 180 parameters, of which 47 per cent are statistically different from zero at 5 and 10 per cent levels. Table 3 presents estimates of resource shares $(\eta_{i,n})$, scaling factors $(s_{i,n})$ and indifference scales $(I_{i,n})$ for three variants of our model: (i) baseline—excludes housing expenditure,[7] (ii) restricts parameters in the scaling function to be identical for men and women; and (iii) includes housing expenditure in the budget share system—for sensitivity tests on estimated economies of scale. Standard errors of these models presented in parentheses are heteroscedasticity consistent. In our discussion, we first consider resource shares, followed by economies of scale and indifference scales, respectively.

4.1 Resource shares

Panel A of Table 3 reports the share of resources per household member. Model I is our baseline while the scaling function is restricted to be gender invariant in model II, and housing is counted in total expenditure in model III. We observe that the share of total household resources accruing to the wife is lower than that of the husband in all models and all demographic groups. For instance, our baseline estimates show that in childless couples, 44.7 per cent of household resources are allocated to women and 55.3 per cent to the husband. In couples with one child, women receive 36 per cent of household resources and men obtain 8.6 percentage points more. Across model types, men's shares are between a fifth and a third higher than women's. The difference is not statistically significant but this is obviously due to the imprecise estimates derived from estimations on small samples. The intra-household gender gap seems to be attenuated with family size but is in fact constant in percentage of the adult share.

For children, the model can only identify their total resource share, not individual shares. The estimated resource shares for children are quite modest with a single child receiving about 19.5 per cent of the total household resources. Naturally, children's resource share increases with family size—three children receive 36.7 per cent of the total household resources. Again we find that the estimates for children's shares are fairly stable across models. Overall, results from our three models suggest that shares of one child are in the range 18.4—21.2 per cent. Using the baseline model for couples with one child, we note that the average child share is 54 per cent of mother's share.

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[6] In estimations, expenditure on alcohol is combined with that on leisure goods and services.

[7] Conventionally, expenditures on housing are not modelled as they may be difficult to measure for owners and those living in rural areas. Nonetheless, we believe that expenditures on housing cannot be ignored as they may be an important contributor to household economies of scale.

Table 3: Household resource shares, scaling factors and indifference scales

	Model I		Model II		Model III	
	Baseline model		Model with identical $\sigma_{i,n}$		Model with housing	
	Coef.	Std.err	Coef.	Std.err	Coef.	Std.err
Panel A: Resource shares						
Couple with no children						
Women	0.447	(0.067)	0.425	(0.066)	0.454	(0.045)
Men	0.553	(0.067)	0.575	(0.066)	0.546	(0.045)
Couple with 1 child						
Women	0.360	(0.064)	0.347	(0.062)	0.358	(0.048)
Men	0.446	(0.072)	0.469	(0.072)	0.430	(0.044)
Children	0.195	(0.083)	0.184	(0.079)	0.212	(0.060)
Couple with 2 children						
Women	0.325	(0.068)	0.316	(0.066)	0.342	(0.048)
Men	0.403	(0.080)	0.427	(0.079)	0.410	(0.047)
Children	0.272	(0.111)	0.257	(0.106)	0.248	(0.067)
Couple with 3 children						
Women	0.283	(0.075)	0.278	(0.071)	0.323	(0.050)
Men	0.350	(0.090)	0.375	(0.090)	0.388	(0.053)
Children	0.367	(0.141)	0.347	(0.136)	0.289	(0.081)
Panel B: Economies scales						
Couple with no children						
Women	0.876	(0.232)	0.766	(0.252)	0.821	(0.162)
Men	0.759	(0.185)	0.857	(0.147)	0.706	(0.106)
Couple with 1 child						
Women	0.817	(0.275)	0.689	(0.267)	0.704	(0.183)
Men	0.664	(0.215)	0.786	(0.181)	0.577	(0.114)
Couple with 2 children						
Women	0.777	(0.287)	0.645	(0.261)	0.642	(0.172)
Men	0.617	(0.218)	0.746	(0.187)	0.534	(0.106)
Couple with 3 children						
Women	0.725	(0.317)	0.589	(0.264)	0.582	(0.164)
Men	0.556	(0.225)	0.692	(0.206)	0.490	(0.100)
Panel C: Indifference scale						
Couple with no children						
Women	0.510	(0.130)	0.555	(0.153)	0.553	(0.106)
Men	0.729	(0.204)	0.671	(0.150)	0.773	(0.141)
Couple with 1 child						
Women	0.440	(0.137)	0.503	(0.157)	0.509	(0.129)
Men	0.671	(0.228)	0.596	(0.160)	0.746	(0.166)
Couple with 2 children						
Women	0.418	(0.145)	0.489	(0.156)	0.532	(0.140)
Men	0.652	(0.230)	0.572	(0.161)	0.769	(0.169)
Couple with 3 children						
Women	0.390	(0.163)	0.471	(0.165)	0.555	(0.156)
Men	0.630	(0.236)	0.543	(0.170)	0.793	(0.176)

Note: Standard errors are heteroscedasticity consistent.

Source: Authors' compilation.

4.2 Economies of scale and indifference scales

Panel B of Table 3 presents estimates for economies of scale.[8] For a couple without children, these must lie between 1 and the share received by a given person, i.e. $\eta_{i,n} \leq s_{i,n} \leq 1$. When $s_{i,n} = \eta_{i,n}$, consumption is viewed as purely public, while it is purely private when $s_{i,n} = 1$. Reassuringly, our estimates satisfy this condition. Results based on the baseline model show that economies of scale, although present, are moderate and increase with family size. Thus, in a couple without children, a woman (man) faces 88 per cent (76 per cent) of the cost incurred by a single woman (man). For households with three children women (men) incur 73 per cent (56 per cent) of the costs for a single woman (man). Also as expected, our results provide evidence of significant economies of scale from housing. When considered across all households, these results dispel the notion of the presence of few economies of scale in South Africa—Woolard and Leibbrandt's (1999) estimates suggest average economies of scale of 0.85 while previous researchers (e.g. May et al. 1995) have used a value of 0.90.[9]

Panel C of Table 3 presents results for indifference scales. This is the fraction of household expenditure which puts a person living alone on the indifference curve(s) he/she would attain when living in a multi-person household (Lewbel and Pendakur 2008). As discussed earlier, this is given by $\eta_{i,n}/s_{i,n}$. Our baseline estimates show that, if a childless married woman were to live alone, she would require about 51 per cent of a couple's income to maintain her welfare (indifference curve) than when living with a partner. For a married man without children, the corresponding requirement is about 73 per cent. When housing is incorporated into the analysis, we find that the amount of compensation increases across all households for both men and women—possibly this captures the increased benefit (economies of scale) of living in a household. Overall, the indifference scales are in the range 0.39–0.55 for women and 0.54–0.79 for men.

4.3 Estimates of the main parameters

To gain a better understanding of the household resource allocation process, we briefly discuss the parameters in the sharing and scaling functions, as presented in Table 4. With reference to the baseline model, results for the sharing function show that the share of expenditure allocated to a spouse increases with own age.

As expected, the fraction of resources allocated to spouses significantly increases with education and this result is consistent across all models. In addition, women's employment and house ownership are significantly and positively related to shares of resources allocated to them. To some extent, these findings suggest that proxies for wealth play a non-trivial role in resource allocation among couples. Urban residency serves to increase (decrease) the shares allocated to women (men)—this result is only significant in the model which incorporates housing costs.

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[8] Economies of scale factors are normalized to one for children.

[9] This value was suggested by Angus Deaton in a lecture given in South Africa in 1993, but was suggested as a plausible value for the purposes of explaining the principle of the equivalence scales (Woolard and Leibbrandt (1999:14).

Table 4: Parameters of sharing and scaling functions

	Model I		Model II		Model III	
	Baseline model		Model with identical $\sigma_{i,n}$		Model with housing	
	Coef.	Std.err.	Coef.	Std.err.	Coef.	Std.err.
Women's index						
Constant	–	–	–	–	–	–
Women's age	0.015	(0.009)	0.017	(0.008)	0.015	(0.007)
Women low education	-0.315	(0.170)	-0.343	(0.156)	-0.236	(0.140)
Urban	–	–	–	–	–	–
Woman's employment	0.246	(0.129)	0.261	(0.102)	0.300	(0.104)
House owner	–	–	–	–	–	–
Men's index						
Constant	-0.849	(0.446)	-0.873	(0.469)	-0.529	(0.297)
Men's age	0.018	(0.009)	0.019	(0.008)	0.014	(0.007)
Men low education	-0.310	(0.169)	-0.321	(0.149)	-0.596	(0.127)
House owner	-0.237	(0.125)	-0.242	(0.118)	-0.201	(0.100)
Urban	-0.060	(0.161)	-0.050	(0.140)	-0.343	(0.117)
Children's index						
Constant	-2.011	(0.632)	-2.062	(0.629)	-1.558	(0.445)
Number of children	0.437	(0.101)	0.428	(0.100)	0.206	(0.109)
Prop. of male children	0.188	(0.133)	0.190	(0.132)	0.245	(0.180)
Ave. age of children	0.099	(0.041)	0.103	(0.041)	0.065	(0.020)
Urban	0.207	(0.133)	0.225	(0.129)	0.255	(0.175)
Mother low education	-0.208	(0.122)	-0.221	(0.107)	-0.190	(0.114)
Mother employed	0.205	(0.099)	0.215	(0.085)	0.293	(0.097)
Women's scaling function						
Constant	0.114	(0.235)	0.226	(0.288)	0.181	(0.192)
Number of children	0.012	(0.051)	0.014	(0.054)	0.054	(0.036)
Men's scaling function						
Constant	0.394	(0.419)	0.226	(0.288)	0.500	(0.285)
Number of children	0.012	(0.051)	0.014	(0.054)	0.054	(0.036)

Notes: Standard errors are heteroscedasticity consistent. Women, men, and children's indexes are the exponential functions entering the logistic function. Estimated parameters and standard errors indicated by a dash are set to zero for identification purposes.

Source: Authors' compilation.

The share of household expenditure allocated to children is positively related to their number and their age, as well as mother's education and employment. Further, the results do not present evidence of gender and rural/urban bias in the allocation of household resources towards children. It is notable that all these results are qualitatively similar across our different model specifications. As for the scaling functions, the results present evidence of modest (slight) economies of scale for men (women). Joint consumption for men (women) represents around 39 per cent (11 per cent) of the consumption of the other persons in the household and is insignificantly related to number of children. For model II, the level of joint consumption is 23 per cent of the consumption of other persons in the household.

In the model with housing, the level of joint consumption increases to 18 per cent for women and 50 per cent for men from the baseline values of 11 per cent and 39 per cent, respectively. This is in line with the notion that expenditure on housing significantly contributes to economies of scale in the household. Other results for the budget share equations for adults and children are presented in Tables

A2 and A3 in the Appendix, respectively. The effects of socio-demographic characteristics are generally mixed across men, women, and children's budget shares[10].

5. Poverty analysis and additional results

5.1 Implications on poverty measurement

In the preceding sections, we have found gender differences in household resource allocation, albeit statistically insignificant. Given that equity in resource share is not synonymous to equity in individual wellbeing, we examine whether resources allocated to each individual are sufficient to meet their minimum requirements for a decent standard of living. We use the 2010 monthly upper-bound[11] national poverty line of R594 (US$81.2)[12] per person reported by Statistics South Africa (2014) as a benchmark. Taking cognisance that children require a fraction of adult requirements to meet their minimum requirements, we set their poverty line at R356 (US$48.7) per child. This is obtained by applying a conservative ratio of 0.6 to an adult's requirements which is in line with our earlier finding on a child's share relative to the mother's. Our results are complemented by identification of a poverty line which makes the level of child poverty to be more or less in the same order as that of parents—i.e. child poverty line set at 0.4 of adult requirements. We use the estimated resource shares to calculate the actual amount of the total household expenditure accruing to each adult, unadjusted and scale weighted.[13]

For children, we divide their amount of total household resources by their number.[14] To examine the implications of ignoring the sharing rules when measuring poverty, we also use the per capita measure of total household expenditure. Table 5 presents the distribution of the resource shares along with poverty head count measures based on the different proxies of welfare. Regarding the distribution of total expenditure shares, we note that shares for men (women) in a childless couple range between 40 per cent and 80 per cent (20 per cent and 60 per cent) depending on their characteristics (z). Overall,

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[10] For adults, we find that age generally has a negative effect on budget shares. The effect of low levels of education on budget shares is mostly insignificant; a negative significant effect is only observed for women's clothing. Women's employment has a significant negative (positive) relationship with their food (clothing and transport and communication) budget shares. House ownership has a consistently negative effect on budget shares for all goods; however, this is statistically insignificant for women's (men's) transport and communication (food and leisure goods and services) budget shares. We find a negative relationship between urban residence and food budget shares for both men and women; the negative correlation extends to men's clothing and transport and communication. Urban residence is positively related with men's leisure budget shares. The slopes of adult budget shares in relation to log total expenditure indicate that goods in our system are mostly necessary goods. However, for children it is difficult to determine the type of goods in the system.

[11] The upper bound poverty line is the level of consumption below which individuals are unable to meet their minimum monthly food and non-food requirements (Statistics South Africa 2014).

[12] This poverty line corresponds to US$2.7 per day, which is only slightly higher than the World Bank threshold.

[13] Unadjusted: $y_{i,n} = \exp[x + \log \eta_{i,n}(\mathbf{z})]$ where $i = 1, 2$. scale-weighted: $\ddot{y}_{i,n} = \exp[x + \log I_{i,n}(\mathbf{z})]$.

[14] $y_{c,n} = \dfrac{\exp[x + \log \eta_{i,n}(\mathbf{z})]}{number \text{ of children}}$.

the range is quite wide and is always lower for women's resource shares relative to men's across all types of households. For children, the distribution of total expenditure shares also shows significant variation.

Turning to poverty, the per capita measure shows that poverty for single men and women is very low at 4 per cent and 2 per cent, respectively—about 72 per cent (82 per cent) of single women (men) are employed, hence likely to be a highly selected group. The poverty rate is 21 per cent for couples without children. In line with previous studies, we find that poverty rates increase with household size to about 41 per cent for families with three children. Using the resource shares that are unadjusted for economies of scale and 0.6 adult equivalence scale, we find that poverty is higher among women than men. For instance, 28 per cent of married women without children are poor compared to 15 per cent of men. When considered across household types we find that, barring women in childless couples, the per capita measure overestimates poverty rates for both sexes. When resource shares are adjusted for economies of scale, as expected, poverty rates decrease for both men and women. Thus, the poverty rates of married women fall in the range of 16–22 per cent instead of 22–29 per cent while those of married men are 4–8 per cent instead of 15–22 per cent. The decrease in poverty after adjusting for economies of scale suggests that individuals, especially women, are not fully compensated but do benefit from resource sharing.

Table 5: Poverty measurement

	Resource shares (baseline model)			Poverty head count							
	Min.	Med.	Max.	Per capita expenditure		I (high child need)		II (low child need)		III (`adjusted' adult shares)	
Single men	1.000	1.000	1.000	0.036	(0.005)	0.036	(0.005)	0.036	(0.005)	0.036	(0.005)
Single women	1.000	1.000	1.000	0.024	(0.006)	0.024	(0.006)	0.024	(0.006)	0.024	(0.006)
Couples with no children											
Women	0.198	0.413	0.599	0.205	(0.015)	0.285	(0.017)	0.285	(0.017)	0.221	(0.016)
Men	0.401	0.587	0.802	0.205	(0.015)	0.152	(0.014)	0.152	(0.014)	0.081	(0.010)
Couples with 1 child											
Women	0.169	0.344	0.582	0.222	(0.021)	0.224	(0.021)	0.224	(0.021)	0.137	(0.017)
Men	0.244	0.418	0.624	0.222	(0.021)	0.156	(0.018)	0.156	(0.018)	0.051	(0.011)
Children	0.109	0.218	0.446	0.222	(0.021)	0.254	(0.022)	0.107	(0.015)		
Couples with 2 children											
Women	0.165	0.301	0.467	0.350	(0.021)	0.259	(0.019)	0.259	(0.019)	0.160	(0.016)
Men	0.241	0.408	0.609	0.350	(0.021)	0.169	(0.016)	0.169	(0.016)	0.039	(0.008)
Children	0.125	0.279	0.507	0.350	(0.021)	0.417	(0.021)	0.241	(0.019)		
Couples with 3 children											
Women	0.143	0.247	0.405	0.412	(0.030)	0.290	(0.028)	0.290	(0.028)	0.162	(0.022)
Men	0.233	0.342	0.631	0.412	(0.030)	0.217	(0.025)	0.217	(0.025)	0.037	(0.011)
Children	0.212	0.399	0.609	0.412	(0.030)	0.430	(0.030)	0.265	(0.027)		

Notes: Standard errors in parentheses. Compared to poverty rate based on per capita expenditure, columns I–III show rates of individual poverty under three scenarios. In column I, the child poverty line is set at 60 per cent of adult requirements, in II it is set at 40 per cent of adult requirements, in III adult resource shares are adjusted for economies of scale.

Source: Authors' compilation.

Ominously, we observe very high poverty rates among children. For instance, the poverty rate is 41 per cent for children with two other siblings. We also find that poverty rates among children are underestimated by 2–7 percentage points when intrahousehold allocation of resources is ignored. This result is, however, comparably smaller than the findings for Côte d'Ivoire where child poverty is underestimated by approximately 14–23 percentage points (Bargain et al. 2014). Thus, the per capita measure paints a more optimistic picture of poverty than is the reality. Although our results are quite informative, a few caveats need to be borne in mind. First, we set the poverty line for children at 60 per cent. The child poverty rates could be much lower if this measure is an overestimation of children's needs. We note that for children to have better or similar welfare as adults, the poverty line for children should be reduced to around 0.4 of the adult poverty line. Second, our model does not explicitly account for economies of scale among children (these are normalized to 1). This is difficult to identify as we do not observe children in two states that are pertinent for assessing economies of scale: living alone and living with parents. Nonetheless, if there are substantial economies of scale among children, then poverty rates reported here might be an overestimate. In view of this, our poverty measures can be viewed as an upper-bound estimate of children's poverty rates. Below we provide additional results for estimated resource shares and draw some cross-country comparisons.

5.2 Additional results

Sensitivity of results to choice of child gender variable

In the previous models, we used the proportion of male children to examine if parents exhibit gender preference in the allocation of resources to children. Here, we check sensitivity of our results to the choice of variable used by estimating a series of models which use a dummy capturing the gender of children by birth order, i.e. gender of the first, second, and third child. The dummy is equal to 1 if gender of a child is male and 0 otherwise. Results from this exercise are presented in Appendix Tables A4 (resource shares and scaling factors) and A5 (parameters of the sharing and scaling functions).

When using gender of first, second, or third child, we find that shares allocated to women, men, and children are not significantly different to the shares obtained in the baseline model. This stability of results extends to economies of scale and corresponding indifference scales which are of the same order. Parameter estimates for children's index presented in Table A5 show that gender of the first child is significantly and positively related to the share allocated to children. Thus, if the first child is male, the resource shares allocated to children will increase by 20 per cent. This finding is at odds with the result from the baseline model suggesting that the proportion of male children is positively but insignificantly related to children's shares. Similar to our baseline results, we find that gender of the second and third child does not have a significant effect on children's resource shares. Thus, parents' resource allocation appears to be sensitive to the gender of the first child only. Given the mixed results from the different specifications, we opine that the evidence of child gender preference in resource allocation is not compelling.

Sensitivity of results to reference point

In all models presented thus far, single men and women were used as the reference point. It is important to note that married women or men could potentially have systematic different preferences from single women or men even after controlling for observed characteristics. In this case, our estimates which rely on using single men and women as the reference group might be biased. To assess the sensitivity of the results to the choice of reference group, Table A6 in the Appendix presents results from a model which is closer in spirit to Dunbar et al. (2013). This model, termed the 'unitary model', restricts the sample to couples only and

uses couples without children as the reference point. This is in line with Rothbarth's (1943) approach which relies on adult clothing to identify children's shares. Thus, the sharing function is cast in such a way that enables the identification of parents' shares (without distinguishing husband's and wife's) and children's share. Reassuringly, resource shares obtained from this model are quite similar to those obtained from our baseline model.

We also estimate the Gronau-Rothbarth model which does not account for economies of scale. The estimated children's shares are smaller compared to those obtained from the unitary model. For instance in the unitary model a child (three children) receives 21 per cent (32 per cent) of total household resources compared to 17 per cent (24 per cent) obtained from the Gronau-Rothbarth model. The underestimation (overestimation) of children's (parents') shares may be attributed to the fact that parents are not compensated from economies of scale. A similar pattern, i.e. underestimation of children's shares in the Rothbarth (1943) model, is obtained for Côte d'Ivoire. Overall, based on the robustness checks, our findings are fairly stable across models. To position our study in extant literature, we compare our findings with those from precedent studies from two African countries: Malawi and Côte d'Ivoire.

Cross-country comparisons

Côte d'Ivoire and Malawi are among the poorest countries in the world (OECD 2008; UNDP 2015), while South Africa is a middle-income country characterized by one of the highest rates of inequality worldwide. These contrasted situations provide an opportunity to identify any regularities in the intrahousehold allocation of resources in these different countries. Table 6 presents resource shares for South Africa (baseline model) and those obtained for Côte d'Ivoire and Malawi.

Table 6: Estimated resource shares for South Africa and other developing countries

	South Africa‡		Côte d'Ivoire*		Malawi#	
Childless couple						
Women	0.447	(0.067)	0.517	(0.071)	-	-
Men	0.553	(0.067)	0.483	(0.071)	-	-
Couple with one child						
Women	0.360	(0.064)	0.420	(0.075)	0.363	(0.042)
Men	0.446	(0.072)	0.392	(0.086)	0.400	(0.045)
Children	0.195	(0.083)	0.188	(0.114)	0.227	(0.036)
Couple with two children						
Women	0.325	(0.068)	0.401	(0.081)	0.221	(0.043)
Men	0.403	(0.080)	0.375	(0.091)	0.462	(0.051)
Children	0.272	(0.111)	0.224	(0.134)	0.317	(0.045)
Couple with three children						
Women	0.283	(0.075)	0.380	(0.088)	0.176	(0.044)
Men	0.350	(0.090)	0.355	(0.098)	0.466	(0.053)
Children	0.367	(0.141)	0.265	(0.156)	0.358	(0.050)

Notes: Standard errors in parentheses.

Source: ‡ Authors' compilation, *Bargain et al. (2014), and #Dunbar et al. (2013).

Results show that resource shares for South African women in childless couples are 7 percentage points lower than those for women in Côte d'Ivoire—this difference is, however, statistically insignificant.[15] In the presence of one child, married women in South Africa receive 36 per cent of total household expenditure which is similar to that in Malawi but 6 percentage points lower than women's share in Côte d'Ivoire.[16] When considering couples with two and three children, we find that Ivorian households allocate a relatively larger share to women while Malawian women receive the least share. Thus, South African women's shares lie in between Malawian and Ivorian resource shares. Ivorian men and women have statistically similar resource shares; the gender differential, in favour of women, hovers around 3 per cent across household types. For South Africa, the estimates attest, at face value, that men receive 7–11 per cent more resources than women. However, this gender differential is not statistically significant possibly due to data-related imprecise estimation of the underlying models. Results for Malawi show more inequality between men and women than this study; men's resource share is significantly larger than women's by 4–29 per cent, across household types.

Pertaining to children's shares, it is estimated that a child living with both parents receives 19–23 per cent of total household resources across the three countries.[17] Clearly, the share of total household resources received by South African children is in line with findings from other African countries.

6. Conclusion

Using a collective model of household behaviour which accounts for parental bargaining and jointness in consumption, this paper estimates the household resource sharing process, economies of scale (in the form of indifference scales) and, subsequently, the degree of individual inequality and the incidence of individual poverty. We find that a spouse's age, education, and employment status significantly affect the share of household resources that accrues to them. Also, mother's employment status and the number and ages of children translate into a higher share of resources allocated to children. Further, we find moderate economies of scale, especially among households with children. We provide evidence for lower women's resource shares relative to men's, but the gender differential is not statistically significant in all households and models. Cross-country comparisons of within-household resource shares situate South African married women's shares between those of Ivorian and Malawian women. Pertaining to children, we find that they receive a reasonable share, around 19–21 per cent of total household resources for the first child, and declining shares for the next ones. This is in harmony with findings in precedent studies. More generally, we find no compelling evidence of gender preference in the allocation of household resources to children, i.e. no pro-boy discrimination.

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[15] When considered on a wider scale, resource shares for South African women in childless couples lag by about 6–11 percentage points. Studies in developed countries show that for Ireland the share of women in childless couples is 51 per cent (Bargain et al. 2010). For France, Bargain and Donni (2012) report an estimate of 55 per cent for women in childless couples. Browning et al. (2013) find that women's share in childless couples is on average 63 per cent while Lewbel and Pendakur (2008) obtain smaller shares in the range 36–46 per cent for Canada.

[16] In Ireland and France, women's estimated shares in couples with one child were 40 per cent and 36 per cent, respectively (Bargain et al. 2010; Bargain and Donni 2012).

[17] In Ireland and France, children's shares are estimated to be 21 per cent and 25 per cent, respectively (see Bargain et al. 2010; Bargain and Donni 2012).

Furthermore, we find that poverty measures based on per capita rather than individual resources overestimate men and women's poverty and underestimate children's. Adjustments for economies of scale reduce poverty rates among adults by 7–18 percentage points. These results suggest that ignoring intrahousehold distribution of resources may lead to an inaccurate poverty profiling in South Africa. Overall, our poverty incidence results display gender sensitivity to resource allocation; women are more likely to be poor than men. Arguably, broader gender inequality trends reported in the country are somewhat traceable to households. We also note that a considerable proportion of families lack resources to meet the basic standard of living—mainly to the disadvantage of children who appear to be more vulnerable than adults.

Although this study provides some important insights into the intrahousehold allocation of resources in South Africa, it is not without limitations. The model estimated herein places some stringent requirements on the data, i.e. the use of nuclear households and single men and women. Given the notion of *ubuntu* among African households, we lose a substantial portion of our sample to extended families. Thus, our analysis is focused on a more tightly knit set of families which is a selected sample. Future studies should endeavour to extend the model to a wider range of family types prevalent in African societies. In addition, the model does not explicitly model economies of scale among children due to identification issues. Again future considerations on this matter are essential for a more complete assessment of household behaviour and individual welfare.

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Appendix

Table A1: Characteristics of selected sample compared to the whole sample

	Whole sample		Selected sample		ttest on the equality of means	
	Mean	Std.err.	Mean	Std.err.	Difference	Pvalue
Total household expenditure (Rand/month)	5474.302	(43.655)	3805.136	(79.695)	1669.166	0.000
Total household expenditure (USD/month)	748.254	(5.967)	520.104	(10.893)	228.150	0.000
Prop. men with low education	0.250	(0.005)	0.268	(0.007)	-0.018	0.040
Prop. women with low education	0.227	(0.005)	0.242	(0.008)	-0.015	0.134
Prop. employed women	0.424	(0.004)	0.496	(0.010)	-0.072	0.000
Urban	0.575	(0.003)	0.597	(0.008)	-0.022	0.009
House ownership	0.692	(0.003)	0.501	(0.008)	0.191	0.000
Prop. of male children	0.503	(0.003)	0.497	(0.011)	0.006	0.630
Average age of children	17.865	(0.099)	6.987	(0.121)	10.878	0.000
Household size	3.734	(0.015)	2.038	(0.021)	1.696	0.000
Number of households	24,133		4,212			

Note: Original data has 25,328 observations; we dropped those with outlying consumption values and missing information on key variables.

Source: Authors' compilation.

Table A2: Estimated coefficients of the baseline model—budget share equations of adults

	Food		Clothing		Trans. & comm.		Personal goods & services		Leisure goods & services	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Constant	0.7100	0.2085	-0.4426	-0.0553	-1.5590	-0.9346	-0.0368	-0.0424	-0.0731	0.6394
	(0.2233)	(0.2917)	(0.1244)	(0.0808)	(0.3106)	(0.2395)	(0.0527)	(0.0699)	(0.1765)	(0.1914)
Age	0.0004	-0.0004	-0.0012	-0.0010	-0.0002	-0.0006	-0.0003	-0.0005	-0.0001	-0.0011
	(0.0003)	(0.0005)	(0.0001)	(0.0002)	(0.0003)	(0.0004)	(0.0001)	(0.0002)	(0.0003)	(0.0003)
Low education	0.0113	0.0050	-0.0027	-0.0086	0.0018	-0.0090	-0.0013	-0.0011	-0.0061	0.0115
	(0.0091)	(0.0138)	(0.0037)	(0.0044)	(0.0074)	(0.0126)	(0.0021)	(0.0048)	(0.0072)	(0.0099)
Women's empl.	—	-0.0366	—	0.0115	—	0.0490	—	0.0025	—	0.0107
	—	(0.0104)	—	(0.0040)	—	(0.0096)	—	(0.0037)	—	(0.0070)
House owner	-0.0082	-0.0273	-0.0060	-0.0064	-0.0520	-0.0144	-0.0036	-0.0080	-0.0045	-0.0132
	(0.0068)	(0.0109)	(0.0030)	(0.0036)	(0.0057)	(0.0103)	(0.0018)	(0.0038)	(0.0057)	(0.0082)
Urban	-0.0154	-0.0335	-0.0066	-0.0015	-0.0390	-0.0138	0.0010	0.0008	0.0115	0.0088
	(0.0077)	(0.0110)	(0.0034)	(0.0035)	(0.0065)	(0.0097)	(0.0019)	(0.0039)	(0.0064)	(0.0080)
Log scaled exp.	-0.0336	0.1454	0.1439	0.0427	0.4496	0.3003	0.0224	0.0300	0.0566	-0.1964
	(0.0615)	(0.0852)	(0.0309)	(0.0241)	(0.0730)	(0.0683)	(0.0142)	(0.0215)	(0.0471)	(0.0551)
Log scaled exp. sq.	-0.0047	-0.0184	-0.0087	-0.0030	-0.0265	-0.0195	-0.0017	-0.0021	-0.0039	0.0175
	(0.0041)	(0.0065)	(0.0020)	(0.0019)	(0.0046)	(0.0052)	(0.0010)	(0.0018)	(0.0031)	(0.0041)
Demographic translation										
Men's age		-0.0091				Women's age		0.0352		
		(0.0066)						(0.0098)		
Men's low education		-0.0104				Women's low education		0.1979		
		(0.1879)						(0.1656)		

Note: Food includes alcohol. Standard errors in parentheses are heteroscedasticity consistent.

Source: Authors' compilation.

Table A3: Estimates coefficients of the baseline model—budget share equations of children

	Food	Clothing	Transport & communication	Personal goods & services	Leisure goods & services
Constant	0.8451 (0.3610)	0.3729 (0.1890)	-0.3601 (0.3183)	0.1179 (0.1938)	-0.0097 (0.2166)
Prop. of male children	0.2355 (1.1586)	0.0377 (0.2200)	-0.0962 (0.5828)	0.0379 (0.2740)	-0.0819 (0.4603)
Average age of children	0.3697 (1.7278)	0.0560 (0.3249)	-0.1744 (0.8614)	0.0831 (0.3997)	-0.1497 (0.6822)
Number of children	0.0810 (0.6624)	0.0000 (0.0000)	-0.0287 (0.3290)	0.0507 (0.1559)	-0.0316 (0.2655)
House owner	-0.0186 (0.0299)	0.0018 (0.0084)	0.0729 (0.0465)	-0.0089 (0.0126)	-0.0317 (0.0238)
Urban	-0.0282 (0.0387)	0.0023 (0.0115)	-0.0048 (0.0307)	0.0022 (0.0156)	-0.0211 (0.0233)
Log scaled expenditure	-0.0894 (0.0308)	0.0033 (0.1245)	0.0475 (0.0229)	-0.0254 (0.0241)	0.0348 (0.0206)
Log scaled expenditure squared	0.0000 (0.0002)	-0.0173 (0.0091)	0.0000 (0.0001)	0.0000 (0.0003)	0.0000 (0.0002)
Demographic translation					
Proportion of male children	-2.0708			Number of children	-0.2352
	(12.5220)				(7.1148)
Average age of children	-4.0688				
	(18.5523)				

Note: Standard errors in parentheses are heteroscedasticity consistent.

Source: Authors' compilation.

Table A4: Shares by different child gender specification based on birth order

	Gender of 1st child		Gender of 2nd child		Gender of 3rd child	
Resource shares						
Women with no children	0.449	(0.067)	0.443	(0.074)	0.459	(0.082)
Men with no children	0.551	(0.067)	0.557	(0.074)	0.541	(0.082)
Women with 1 child	0.362	(0.064)	–	–	–	–
Men with 1 child	0.444	(0.072)	–	–	–	–
1 child	0.193	(0.082)	–	–	–	–
Women with 2 children	0.328	(0.068)	0.316	(0.074)	–	–
Men with 2 children	0.402	(0.079)	0.398	(0.094)	–	–
2 children	0.270	(0.110)	0.286	(0.131)	–	–
Women with 3 children	0.286	(0.075)	0.276	(0.082)	0.291	(0.102)
Men with 3 children	0.351	(0.089)	0.347	(0.106)	0.342	(0.118)
3 children	0.363	(0.140)	0.377	(0.164)	0.367	(0.194)
Economies of scale						
Women with no children	0.889	(0.222)	0.849	(0.297)	0.911	(0.148)
Men with no children	0.770	(0.182)	0.762	(0.220)	0.689	(0.164)
Women with 1 child	0.833	(0.265)	–	–	–	–
Men with 1 child	0.679	(0.212)	–	–	–	–
Women with 2 children	0.794	(0.278)	0.765	(0.369)	–	–
Men with 2 children	0.632	(0.214)	0.626	(0.262)	–	–
Women with 3 children	0.742	(0.309)	0.727	(0.418)	0.832	(0.251)
Men with 3 children	0.573	(0.223)	0.574	(0.272)	0.495	(0.207)
Indifference scales						
Women with no children	0.505	(0.122)	0.522	(0.180)	0.504	(0.098)
Men with no children	0.716	(0.195)	0.731	(0.235)	0.784	(0.204)
Women with 1 child	0.435	(0.128)	–	–	–	–
Men with 1child	0.655	(0.217)	–	–	–	–
Women with 2 children	0.413	(0.135)	0.414	(0.190)	–	–
Men with 2 children	0.636	(0.218)	0.635	(0.260)	–	–
Women with 3 children	0.386	(0.153)	0.380	(0.212)	0.349	(0.140)
Men with 3 children	0.613	(0.224)	0.605	(0.266)	0.691	(0.292)

Notes: Gender of first, second, and third child is captured by a dummy variable equal to 1 if child is male and 0 otherwise

Source: Authors' compilation.

Table A5: Estimates of parameters as a function of children's gender by birth order

	Gender of 1st child		Gender of 2nd child		Gender of 3rd child	
Women's index						
Constant	–	–	–	–	–	–
Women's age	0.015	(0.009)	0.015	(0.009)	0.015	(0.013)
Women's low education	-0.338	(0.171)	-0.321	(0.182)	-0.579	(0.222)
Woman employed	0.255	(0.130)	0.239	(0.144)	0.484	(0.200)
Urban	–	–	–	–	–	–
House owner	–	–	–	–	–	–
Men's index						
Constant	-0.862	(0.446)	-0.826	(0.512)	-0.753	(0.569)
Men's age	0.018	(0.009)	0.018	(0.010)	0.016	(0.014)
Men's low education	-0.320	(0.169)	-0.292	(0.196)	-0.663	(0.269)
Urban	-0.053	(0.161)	-0.072	(0.187)	-0.072	(0.257)
House owner	-0.241	(0.126)	-0.237	(0.136)	-0.327	(0.176)
Children's index						
Constant	-2.053	(0.630)	-2.014	(0.763)	-1.623	(1.137)
Number of children	0.432	(0.101)	0.409	(0.161)	–	–
Gender of $1^{st}/2^{nd}/3^{rd}$ child	0.198	(0.111)	0.165	(0.131)	0.209	(0.401)
Average age of children	0.102	(0.040)	0.105	(0.048)	0.163	(0.077)
Urban	0.220	(0.131)	0.187	(0.157)	0.151	(0.328)
Mother low education	-0.219	(0.123)	-0.199	(0.138)	-0.358	(0.202)
Mother employed	0.211	(0.098)	0.197	(0.115)	0.534	(0.215)
Women's scaling function						
Constant	0.102	(0.221)	0.141	(0.319)	0.083	(0.144)
Number of children	0.013	(0.049)	0.001	(0.076)	–	–
Men's scaling function						
Constant	0.366	(0.395)	0.393	(0.494)	0.531	(0.416)
Number of children	0.013	(0.049)	0.001	(0.076)	–	–

Notes: Standard errors are heteroscedasticity consistent. Women, men, and children's indexes are the exponential functions entering the logistic function. Estimated parameters and standard errors indicated by a dash are set to zero for identification purposes.

Source: Authors' compilation.

Table A6: Estimated resource shares for additional models

	Unitary model		Gronau-Rothbarth model	
	Share	Std.err.	Share	Std.err.
Couple with 1 child				
Adult share	0.787	(0.053)	0.826	(0.027)
Women	-	-	0.413	(0.014)
Men	-	-	0.413	(0.014)
Children	0.213	(0.053)	0.174	(0.027)
Couple with 2 children				
Adult share	0.739	(0.062)	0.797	(0.025)
Women	-	-	0.399	(0.013)
Men	-	-	0.399	(0.013)
Children	0.261	(0.062)	0.203	(0.025)
Couple with 3 children				
Adult share	0.685	(0.075)	0.765	(0.030)
Women	-	-	0.382	(0.015)
Men	-	-	0.382	(0.015)
Children	0.315	(0.075)	0.235	(0.030)

Note: Shares are estimated at the average point of the sample. Standard errors are heteroscedasticity consistent.

Source: Authors' compilation.