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# Household variation and inequality: The implications of equivalence scales in South Africa

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## Abstract

South Africa is an example of a developing country where there is substantial variation in household size and composition by income class and by race. However, inequality measures which are typically derived from per capita adjustments are insensitive to these variations. In this study, we estimate equivalence scales for South Africa using Engel's method applied to expenditure micro-data. Our primary objective is to show how the use of the estimated scales has sizeable effects, significantly reducing existing estimates of total inequality as well as both inter- and intra-racial inequality. For example, the Gini coefficient, measuring total inequality, falls by six percentage points from 0.63 to 0.57 in 2008/2009 when we use the estimated equivalence scales. These findings have important implications for the measurement and comparison of inequality measures over time.

**Keywords:** Household structure; Equivalence scales; Inequality; Race; South Africa.

## 1. Introduction

A growing body of literature recognises that living arrangements in households may respond to economic circumstances (e.g. Stack 1974; Ermisch & di Salvo, 1997; Frankenberg *et al*., 2003; Edmonds *et al*., 2005; Fafchamps & Quisumbing, 2007; Klasen & Woolard, 2009). When resources are limited, living together offers significant opportunities to reduce living costs. Many goods consumed within the household are non-rival or public goods, including housing and the fixed costs of services (Deaton & Muellbauer, 1986; Bellù & Liberati, 2005a). Consumption items such as children's clothing, books and toys, can also be passed on from older to younger children in the household; and pooling consumption expenditure increases the possibility of affording bulk purchases of food and other household items. These cost savings, which are likely to be significant especially in poor households, mean that the costs of living do not necessarily increase linearly as household size increases.

The importance of household formation as a livelihood strategy is particularly relevant in South Africa, where unemployment rates have remained stubbornly high in the post-apartheid period and low-wage work forms a sizeable share of total employment (Burger & Jafta, 2006; Statistics South Africa, 2010b; Verick, 2012). To survive unemployment in the absence of state support, for example, the unemployed may attach themselves to income-receiving households (Klasen & Woolard, 2009), while the living arrangements of children may respond to changes in the household's resources (Edmonds *et al*., 2005).

Globally, South Africa is one of the most, if not the most, unequal of societies for which micro-data are available. Given the legacy of apartheid[1], this inequality continues to be racially defined, although intra-racial inequality has also increased in the post-apartheid period (van der Berg & Louw, 2004; Bhorat *et al*., 2009; Leibbrandt *et al.* 2010). Many studies which describe and analyse inequality in South Africa compare resources across households by deflating total household income or expenditure by household size (van der Berg & Louw, 2004; Bhorat *et al*., 2009; Leibbrandt *et al*., 2010). Although these per capita adjustments are simple and convenient to implement, they are also very restrictive: they are not sensitive to differences in the consumption needs of children and adults; and perhaps more importantly, they ignore the possibilities

[1] Apartheid was a system of institutionalised racial discrimination implemented by the National Party in South Africa between 1948 and 1990. It gave preference to the white minority while severely restricting the opportunities available to the African/black, Coloured and Indian race groups.

of economies of scale in household consumption. Yet, as we show, (black) African[2] households are not only less well resourced than other households on average; they are also significantly larger and include more children.

In this paper, we revisit measures of inequality in South Africa in the context of significant racial variation in household size and composition. Our primary objective is to show that adjusting for differences in household size and composition reduces measures of total inequality, as well as measures of inequality within and between race groups, by a non-negligible amount. To achieve this objective, we estimate equivalence scales for South Africa using Engel's method.

There is a large literature which estimates equivalence scales across a range of countries. Many of these empirical studies provide evidence that adjusting for household size and composition can systematically influence inequality measures (e.g. Aaberge & Melby, 1998; Buhmann *et al*., 1988; Lancaster & Valenzuela, 1999; Creedy & Sleeman, 2004). However, scant attention in South Africa has been paid to the estimation and application of equivalence scales, particularly in the study of inequality. An early set of studies used South African expenditure data collected in 1993 and 1995 to estimate equivalence scales using Engel's method; but these estimations were conducted only for African households and not for the total population (Woolard & Leibbrandt, 1999; 2001; Woolard, 2002). A few poverty studies have applied 'parametric' scale adjustments of the form $(A + \alpha C)^{\Theta}$ to measure individual income or expenditure, where A and C represent the number of adults and children respectively, with a child typically costing half an adult, and an economies of scale parameter ($\Theta$) of 0.9[3] (May *et al.*, 1995; May *et al*., 1998; Woolard & Leibbrandt, 2001; Meth & Dias, 2004; Posel & Rogan, 2012). These 'subjective' scales are not estimated. Rather, they are based on discretionary choices or rule-of-thumb adjustments (Bellù & Liberati, 2005a).

There are, perhaps, two reasons which explain why there has been little subsequent interest in applying equivalence scales to the study of inequality

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[2] In the post-apartheid era, four commonly used 'racial' categories have been included in all household surveys and the population census: African/black (who represent the majority population), Coloured, Indian and white (see, for example, Census 1996, Question 5, or the Living Conditions Survey 2008/9, Question 1.3). From now on, for convenience, we refer to the majority group just as 'Africans' and the remaining three smaller groups as 'non-Africans'.

[3] This parameter means that doubling the household size (for example, from one to two adults) would require an increase in household expenditure of only 87% ($2^{0.9}$=1.87) in order to maintain the same level of welfare.

and why per capita adjustments are routinely applied in South Africa. First, per capita adjustments are easily used and standardised across different datasets and studies. In contrast, scale adjustments require common agreement on what these adjustments should be, and there is no best practice on how to estimate the scales (Woolard, 2002). Second, a few studies which have focused on poverty have shown that the application of equivalence scales in South Africa makes only a small difference to the ordering of children, adults and the elderly in the bottom forty percent of the income distribution (Woolard & Leibbrandt, 1999; 2001; Streak *et al*., 2009).

Although equivalence scale adjustments may have little effect on the profiles of the poor, we show that these adjustments have significant implications for the expenditure (or income) distribution both between and within race groups. The application of equivalence scales increases the measure of individual resources in larger households which include a greater share of children. In South Africa, as is found elsewhere, larger households with a greater share of children are over-represented in the lower tail of the expenditure distribution (Leibbrandt *et al*., 2010; Posel *et al.*, 2016). Because these household types in South Africa are also significantly more common among Africans (as we show below), scale adjustments compress the distribution of expenditure, reducing both inter- and intra-racial measures of inequality.

It is worth noting that although our findings show that the application of equivalence scales in South Africa significantly reduces estimates of inequality, the scale of inequality that remains after the adjustment is still substantial. Inequality therefore continues to be an important policy challenge in South Africa and in other countries where the extent of inequality has risen (Hvistendahl 2014; Ravallion, 2014). What our paper does show, however, is that accounting for household size and composition in the measurement of inequality matters for the estimates, and therefore if applied across countries and over time, could affect findings with respect to inequality rankings.

The rest of the paper is organised as follows. The next section discusses the data used in the study and describes variations in household formation by both race and economic status (measured by per capita expenditure) in South Africa. In section 3, we explain how we estimated equivalence scales, and compare the derived scales with those estimated in the earlier set of studies for South Africa. In section 4, we show how measures of total and racial inequality change with the application of these scales, and in the final section, we review our findings and consider their implications.

## 2. Data and descriptive statistics

To estimate equivalence scales, and measure inequality, we use information collected in the 2008/2009 Living Conditions Survey (LCS), conducted by the official statistical agency, Statistics South Africa.[4] The survey covered a nationally representative sample of 97 486 individuals in 25 075 households and was designed "to provide data that will contribute to a better understanding of living conditions and poverty in South Africa" (Statistics South Africa, 2011:2). It therefore contains information on both income and expenditure, as well as on other aspects of the living conditions of South Africans.

We use the detailed expenditure information in the LCS for our estimations. The data were collected through a combination of the recall and diary methods. Daily purchases were recorded by households in diaries over a period of four weeks, while a series of modules in the household questionnaire covered expenditure over the preceding 11 months. Our measure of total annualised expenditure also includes in-kind consumption, such as gifts, own production of food, subsidised water, electricity and housing, educational bursaries, and other employer subsidies.

As our objective is to explore inter- and intra-racial inequality, we consider households where all members are of the same race. With very low levels of racial mixing in household living arrangements in South Africa, we lose only 263 of 25 075 (1.05%) households with this restriction. We lose a further 185 households because of missing or incomplete information on expenditure, yielding a total sample of 24 627 households for the analysis.[5]

Ideally, we would like to estimate separate equivalence scales for each race group in the country, but small sample sizes for Coloureds, whites and Indians would compromise the reliability of the estimated scale parameters. In the LCS data, Coloureds comprised 11.1 percent of the total sample, whites 4.9 percent and Indians 1.5 percent. Rather, we distinguish between Africans and 'non-Africans' (representing Coloureds, Indians and whites), partly because of the distinctive features of family formation among Africans in South Africa (Russell 2003), and also so that we can compare our estimates for African

[4] This was the most current LCS available at the time that the empirical work for this project was conducted. Subsequently (in 2017), the LCS 2014/15 was released by Statistics South Africa. Future work could consider using both datasets to analyse how applying equivalence scales affects the change in inequality over time.

[5] We use the population weights provided with the LCS data, which adjust for non-response and survey design, to generate population measures.

households to those generated by Woolard and Leibbrandt using data from the mid-1990s (Woolard & Leibbrandt, 1999; 2001; Woolard, 2002). Although we find significant differences in household size and composition between African and non-African households, we recognise also that there will be considerable variation among non-Africans households which is not reflected in our analysis.

Differences in household size and composition in South Africa are described in Table 1, which shows that, compared to non-Africans, Africans live in significantly larger households, which include more (young and older) children. In 2008, average household size was approximately 4.01 for Africans and 3.47 for non-Africans, while the average share of all household members who are children was 27 percent in African households compared with 18 percent in non-African households. The presence of relatively more children in African households derives, at least in part, from higher fertility rates among Africans and the negative correlation between fertility rates and socio-economic status (Udjo, 2003; Dorrington *et al*., 2004; Statistics South Africa, 2010a).

Table 1: Household Size and Composition in African and Non-African Households, 2008/9

| | **African** | **Non-African** |
|---|---|---|
| **Average** | | |
| Household size | 4.01 (0.02)* | 3.47(0.04) |
| Number of adults (> 15 years) | 2.55 (0.01) | 2.61 (0.03) |
| Number of young children (0-5 years) | 0.54 (0.01)* | 0.32 (0.01) |
| Number of older children (6-15 years) | 0.93 (0.01)* | 0.54 (0.02) |
| **Share of children in household** | | |
| (Number of children/household size) | 0.27 (0.00)* | 0.18 (0.00) |
| N households (underweighted) | 20 073 | 4554 |

*Source:* Own calculations from the LCS 2008/9.

*Notes:* Standard errors are in parentheses. Estimates are produced using population weights. * t-tests of differences in means between African and non-African households are significant at the 95 percent confidence level.

Table 2 shows that Africans live in households where average per capita household expenditure is substantially lower than expenditure in non-African households. Racial differences in access to resources have persisted in post-apartheid South Africa, and large expenditure gaps partly reflect higher rates of unemployment among Africans and lower earnings among those with employment (Burger & Jafta, 2006; Statistics South Africa, 2010; Verick, 2012; Gradin, 2013). However, among both Africans and non-Africans, average per

capita household expenditure falls steeply as household size and the share of children in the household increase. Consequently, the difference in average per capita expenditure by household size and the share of children is typically larger within the two groups, than between the two groups.

Adjustments for the lower consumption needs of children, and for economies of scale in household consumption, will have a larger effect on expenditure in bigger households which include relatively more children. Because these household types are more common among Africans (Table 1), and among people in the bottom expenditure deciles (Table 2), per capita expenditure comparisons will overstate differences both between, and among, African and non-African households. This indicates that the application of equivalence scale adjustments in the calculation of (racial) inequality is a potentially valuable exercise in the South African context.

Table 2: Average per capita Monthly Expenditure by Household Size and Composition (Rands), 2008/9

| | Per capita expenditure | |
|---|---|---|
| | **African** | **Non-African** |
| **Household size** | | |
| 1 | 2526.5 | 10126.8 |
| 2 | 1563.4 | 7097 |
| 3 | 1189 | 5057.7 |
| 4 | 1119.8 | 3970.1 |
| 5 | 893.9 | 2957.4 |
| 6 | 737.6 | 1975.3 |
| 7 or more | 475.8 | 1213.9 |
| **Child share** | | |
| 0 | 1677.2 | 6060.6 |
| $> 0$ & $\leq 0.25$ | 938.1 | 2789 |
| $> 0.25$ & $\leq 0.5$ | 806.7 | 3060.8 |
| $> 0.5$ & $\leq 0.75$ | 569.5 | 2621 |
| $> 0.75$ | 346.2 | 797.7 |

*Source:* Own calculations from the LCS 2008/9.
*Notes:* Estimates are produced using population weights.

## 3. Estimating equivalence scales

In studies of poverty and inequality in South Africa, a common practice has been to use per capita measures of welfare, and only a few studies have measured

individual resources by applying a 'parametric form' of equivalence scales (Bellù & Liberati, 2005a). These scales rely on what are essentially rule-of-thumb adjustments for economies of scale in the household and the consumption needs of a child relative to an adult. They also assume that the cost of children relative to adults is the same for each child in the household, and that any cost savings from living together remain unchanged as household size increases. In this study, we attempt to identify plausible values for equivalence scales for South Africa by estimating a more objective form of scale adjustments, which can vary as household size and the number of children increase and which are based on the observed demand behaviour of households (Bellù & Liberati, 2005b).

There are a variety of methods to estimate objective equivalence scales based on observed behaviour. We use Engel's method, which estimates scales using the share of the household budget spent on food (Engel, 1895). The method identifies the cost of an additional household member by estimating the compensation required for the household to retain the same level of economic well-being, where the additional household member can also be distinguished (e.g. into another child or adult). Engel's method assumes that the share of the budget spent on food is an indicator of economic well-being, and specifically that the food share declines as economic status increases. The compensation needed for an additional household member, therefore, is that which would keep the food share unchanged.

To estimate equivalence scales through the Engel curve for food, we adopt the Working (1943)-Leser (1963) form of the equation, extended to incorporate demographic and other factors as in Deaton and Muellbauer (1986):

$$w_f = a + \beta \ln\left(\frac{X}{n}\right) + \gamma_1 n_a + \gamma_2 n_{c0-5} + \gamma_3 n_{c6-15} + \delta Z + \varepsilon \qquad (1)$$

where $w_f$ is the food share, X is the total monthly household expenditure, n is household size, $n_\alpha$ is the number of adults (16 years and older), $n_{c0\text{-}5}$ and $n_{c6\text{-}15}$ are the number of young and older children (0-5 and 6-15 years old), and Z represents other covariates (the age and gender of the head of the household, the proportion of employed individuals in the household, and the geography type and province of location of the household).

The Engel equivalence scales are derived from the ratios of the expenditure of the reference household ($X^0$) to the expenditure of different composition households ($X^*$), which are obtained by equating their food shares (Deaton & Muellbauer, 1986):

$$a + \beta ln\left(\frac{X^0}{n^0}\right) + \gamma_1 n_a^0 + \gamma_2 n_{c0-5}^0 + \gamma_3 n_{c6-15}^0 = a + \beta ln\left(\frac{X^*}{n^*}\right) + \gamma_1 n_a^* + \gamma_2 n_{c0-5}^* + \gamma_3 n_{c6-15}^* \qquad (2)$$

The equivalence scale $E^{\star} = \frac{X^{\star}}{X^{0}}$ is then calculated as[6]:

$$E^{\star} = \frac{n^{\star}}{n^{0}} \exp\left(\frac{\gamma_1 (n_a^{\star} - n_a^0) + \gamma_2 (n_{c0-5}^{\star} - n_{c0-5}^0) + \gamma_3 (n_{c6-15}^{\star} - n_{c6-15}^0)}{\beta}\right) \quad (3)$$

We recognise that there are problems with Engel's method and in particular, that the costs of children are likely to be over-estimated (Nicholson, 1976; Deaton & Muellbauer, 1986).[7] The reason for this overestimation is that if children are mainly food-consuming, the marginal consumption of food will be higher than the average consumption of food with the arrival of a child, resulting in the food share of the household increasing. Engel's method equalises food shares to identify similar levels of household welfare, but restoring the household's food share to its initial level before the addition of a child would require overcompensating total household expenditure.[8]

However, even more sophisticated methods of estimating equivalence scales from demand data have considerable shortcomings (see Blundell and Lewbel (1991) for further discussion on the limitations of demand system equations). We choose Engel's method because it has relatively low data requirements, we can derive the costs of both adults and children (in contrast to Rothbarth's method[9] which estimates the costs only of children), and we can compare our results to the earlier work for South Africa which used this method. In addition, because of the likely overestimation of child costs, Engel's method produces estimates of equivalence scales that are relatively modest and, therefore, we err on the side of caution in stating our main findings. As we show later, equivalence scale adjustments significantly reduce both inter- and intra-race inequality in South Africa. Because African households, and poorer households in general, include significantly larger shares of children, an overestimation of child costs means that we will be understating the reduction in inequality following scale adjustments.

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[6] Assuming all other covariates are equal.

[7] In addition, Ravallion (1992) points out that the food share can be a noisy indicator of well-being if the relationship between food consumption and expenditure differs across household types due to different preferences for example, or if the income elasticity of the demand for food is close to one, as it may be in poorer households.

[8] Bellù and Liberati (2005b) provide a useful practical example of this point. Assume that the true compensation for the addition of a child is 100 in a family with expenditure of 1000, and that with the child being largely food-consuming, expenditure on food is 70 out of the 100. If the household food share was, for instance, 30 percent before the arrival of the child, it will increase to 33.6 percent (370/1100). To restore the household's food share to 30 percent will require a compensation of 200.

[9] In this method, the costs of children are estimated by comparing the expenditure on adult goods in a household according to the presence of children (Rothbarth 1943).

Unlike the earlier work in South Africa (Woolard & Leibbrandt, 1999; 2001; Woolard 2002), which estimated equivalence scales for Africans only, we estimate scales for the pooled sample, and for separate African and non-African sub-samples. In line with the assumptions of Engel's method, in the LCS data we find a clear negative relationship between total household expenditure and relative expenditure on food for both groups. This inverse relationship is shown in Table 3, which describes the food share by expenditure quintile, with the quintiles drawn from the respective expenditure distributions for Africans and non-Africans. Among both groups, the food share declines as total monthly expenditure increases.

Table 3: Food Share by Total Monthly Household Expenditure, African and Non-African Households, 2008/9

| Expenditure quintile (Rands) | Africans | Expenditure quintile (Rands) | Non-Africans |
|---|---|---|---|
| 1 (142, 1237) | 0.44 | 1 (247, 4066) | 0.39 |
| 2 (1238, 1862) | 0.43 | 2 (4067, 8134) | 0.24 |
| 3 (1863, 2738) | 0.40 | 3 (8135, 12904) | 0.16 |
| 4 (2739, 4662) | 0.34 | 4 (12905, 20958) | 0.12 |
| 5 (4663, 98733) | 0.19 | 5 (20959, 98269) | 0.08 |

*Source:* Own calculations from the LCS 2008/9.

*Notes:* Estimates are produced using population weights. The quintiles are constructed for the African and non-African expenditure distributions respectively.

Table 4 shows the equivalence scales obtained from the Engel estimations on the pooled sample (i.e. Africans and non-Africans) and on the African and non-African samples separately. We also present the scales with and without distinguishing children by age group in the regressions. Using the results from the separate regressions in columns 2 and 3 for illustration, the addition of one adult to a single-person household would require a 70 percent increase in expenditure among African households and an 80 percent increase in expenditure among non-African households to maintain the same level of welfare. The addition of one child to a two-adult household would require a 39.4 percent increase in expenditure among African households (0.67/1.70) and a 38.9 percent increase in expenditure among non-African households (0.7/1.80). Or put differently, the incremental cost of a child relative to an adult in a two-person household would be 78.8 percent in African households (39.4*2) and 77.8 percent in non-African households (38.9*2) (Deaton & Muellbauer, 1986).

TABLE 4: EQUIVALENCE SCALES OBTAINED USING ENGEL'S METHOD, 2008/9

| | Pooled | African | Non-African |
|---|---|---|---|
| **Household type** | | | |
| 1 adult | 1 | 1 | 1 |
| 2 adults | 1.73 | 1.70 | 1.80 |
| 2 adults+1 child | 2.41 | 2.37 | 2.50 |
| 2 adults+2 children | 2.99 | 2.93 | 3.09 |
| 2 adults+3 children | 3.49 | 3.40 | 3.57 |
| >2 adults+>3 children | 3.86 | 3.61 | 4.29 |
| Incremental cost of an adult | 0.73 | 0.70 | 0.80 |
| Incremental cost of one child[a] | 0.68 | 0.67 | 0.70 |
| $\Theta$[b] | 0.79 | 0.77 | 0.85 |
| $\alpha$[c] | 0.93 | 0.95 | 0.87 |
| | | **Young/older children** | |
| 2 adults+1 child | 2.39/2.42 | 2.36/2.37 | 2.43/2.55 |
| Incremental cost of one child[a] | 0.66/0.69 | 0.66/0.67 | 0.63/0.75 |
| $\alpha$[c] | 0.9/0.94 | 0.93/0.95 | 0.78/0.93 |

*Source:* Own calculations from the LCS 2008/9.

*Notes:* Estimates are produced using population weights. [a] The incremental cost of one child is relative to a two-person family. [b] $\Theta$ is obtained from $\Theta=\log(ES)/\log(2)$ where ES is the equivalence scale of the two-adult household. [c] $\alpha$ is calculated by adding the incremental cost of one child to one adult and using the equation $(1+\alpha)^{\Theta}=1+$child cost (White & Masset, 2002).

These estimates of incremental child costs incorporate economies of scale. In other words, the proportionate increase in expenditure with the addition of a child is less than one, not only because a child consumes less than an adult, but also because of the benefits from shared public goods in the now larger household. To distinguish between the relative cost of a child and economies of scale, we extract the adult equivalent ($\alpha$) and economies of scale ($\Theta$) parameters using the conversion in White and Masset (2002).[10] The value of $\Theta$ is 0.77 for African households and 0.85 for non-African households, suggesting that African households benefit relatively more from economies of scale. In contrast, the adjustment for a child in non-African households is larger than in African

[10] The economies of scale parameter $\Theta$ is obtained from the following equation $\Theta = \log(ES)/\log(2)$, where ES is the two-adult equivalence scale. The adult equivalence parameter $\alpha$ is calculated by adding the incremental cost of one child to one adult and using the equation $(1+\alpha)^{\Theta}=1+$child cost. It can also be approximated by dividing the incremental cost of a child by the incremental cost of an adult (White and Masset 2002). Note that these parametric estimations are only crude approximations as the system of equations to derive the scales is overdetermined.

households, with the adult equivalence parameter (α) equal to 0.93 for African households and 0.87 for non-African households.[11]

Our estimates of economies of scale in household expenditure are substantially higher than the parameter of 0.9 commonly assumed in the few South African studies which have applied rule-of-thumb adjustments (May *et al*., 1995; Woolard & Leibbrandt, 2001; Meth & Dias, 2004; Posel & Rogan, 2012). This is particularly so for African households, suggesting that there is merit in distinguishing African households from other households in the estimation of equivalence scales. Our estimate for African households based on 2008/2009 data, however, falls within the range of estimates derived by Woolard and Leibbrandt (2001) and Woolard (2002), who also used Engel's method and found a value for Θ ranging from 0.62 to 0.85 based on 1995 micro-data.

However, our estimates of the adult equivalence parameter suggest much higher child costs than those assumed in the studies which have used discretionary scales. The adult equivalence parameters for African and non-African households are 0.95 and 0.87 respectively, whereas the rule-of-thumb adjustment used for South Africa has been 0.5 (May *et al*., 1995; Woolard & Leibbrandt, 2001; Meth & Dias, 2004; Posel & Rogan, 2012). These high costs of children relative to adults are typical of estimates derived using Engel's method for developing countries (Deaton & Muellbauer, 1986; White & Masset, 2002) and are similar to those found in Woolard and Leibbrandt (1999) using the 1995 data for South Africa.

When we distinguish between younger (0 to 5 years) and older children (6-15 years) in the estimation of the equivalence scales, we find that younger children cost less compared to an adult than older children do, in both non-African and African households. However, the difference is very small in African households, while in non-African households the adult equivalence parameter is 0.78 for younger children and 0.93 for older children. This larger difference between younger and older children relative to an adult may be related to the higher expenditure on education among non-African households. Again, this suggests that the disaggregation by race in estimating equivalence scales is a worthwhile exercise.

[11] The adult equivalence parameter is lower in non-African compared to African households because the cost of an additional adult is higher (and economies of scale are therefore lower) in non-African households, leading to a smaller relative cost of a child.

## 4. Re-estimating race inequality in South Africa

We now consider the implications of using equivalence scales in the measurement of inequality between and within race groups in South Africa. In the previous section, the values of the parameters α and Θ were derived from the Engel scales based on the two-person household for illustrative purposes. In this section, the full range of scales from the Engel regressions is used to adjust expenditure; in other words, the additional cost of an adult or child varies with household size. This method therefore distinguishes the scales from those (such as the rule-of-thumb) adjustments which assume constant parameters for all households.

Although the costs of children are estimated as being relatively high using Engel's method, and the equivalence scales are therefore modest, the difference in average expenditure between the two broadly-defined race groups drops considerably with scale adjustments. Table 5 shows that whereas the ratio of average expenditure among non-Africans and Africans is 4.4 using per capita measures of individual expenditure, the ratio decreases to 3.9 when equivalence scales are estimated from the pooled sample of Africans and non-Africans (Scale 1), and to 3.5 when scales are estimated separately by race (Scale 2). (Note that for both sets of scales, children are distinguished by age group.)

Table 5: Average Monthly Expenditure (per capita and Adjusted) in African and Non-African Households, 2008/9

| | Non-African expenditure (Rands) | African expenditure (Rands) | Non-African/African expenditure |
|---|---|---|---|
| Per capita | 4016 | 924 | 4.4 |
| Scale 1 (pooled, young/older children) | 5541 | 1420 | 3.9 |
| Scale 2 (African/non-African, young/older children) | 5129 | 1483 | 3.5 |

*Source:* Own calculations from the LCS 2008/9.

*Notes:* Estimates are produced using population weights.

We describe changes in inequality using two measures, the Gini coefficient (which is not decomposable but is commonly used) and the Theil index (which can be decomposed). In Table 6, we compare these inequality measures derived from the per capita household expenditure distribution, to those derived from the distribution that has been adjusted using the separate scales for Africans and non-Africans. Scale adjustments clearly reduce overall expenditure inequality in South Africa – both inequality measures drop significantly when

adjusted expenditure is used. For example, the overall Gini coefficient falls by approximately six percentage points, from 0.63[12] to 0.57. The fall in the Gini coefficient is not only statistically significant, but also significant in economic magnitude, far exceeding the three-percentage-point-change in the Gini, which Atkinson (2003) considers as the threshold for an economically significant change. Anand *et al*. (2015) estimate that to achieve a two percentage point reduction in the Gini coefficient (from 0.665 to 0.645, based on per capita household income data from 2012), would require reducing unemployment in South Africa by ten percentage points or increasing government transfers by forty percent.

As has been recorded elsewhere for South Africa (Leibbrandt *et al*., 2010), we find that inequality among Africans is higher than among the other race groups, and that this intra-racial inequality is the largest driver of inequality overall. Following scale adjustments, within-group inequality declines significantly among both Africans and non-Africans. For example, the Gini coefficient among Africans falls from 0.54 to 0.49, and among non-Africans, from 0.53 to 0.50.

Decomposing the Theil measure shows also that between-group inequality declines with scale adjustments. Using per capita expenditure, the Theil index of total inequality is 0.79, 32 percent (0.25) of which is attributed to inequality between groups. With the scale adjustment, the index falls to 0.62, of which 29 percent (0.18) derives from between-group inequality. While scale adjustments, therefore, result in both the within and between components of inequality falling, the relative fall is slightly larger for the between-component.

We also applied the rule-of-thumb adjustments that have been used in a few South African poverty studies to our data ($\alpha = 0.5$ and $\Theta = 0.9$), and found smaller (although still economically significant) changes in the inequality measures: the Gini falls from 0.63 to 0.6 and the Theil index from 0.79 to 0.71 (with the between component accounting for 32 percent of overall inequality). This suggests that there is value in estimating the scales based on the observed demand behaviour of households and in not assuming that the elasticity of costs, with respect to each additional child or household size, is constant.

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[12] Our Gini coefficient estimate is similar in magnitude to that calculated in Statistics South Africa (2014) using the same data from the LCS 2008/9, but it is lower than that reported by Leibbrandt *et al.* (2010) based on the National Income Dynamics Study of 2008. However, their value of 0.70 is based on income per capita (without imputed rent and income from subsistence agriculture). It appears that Gini coefficient estimates for South Africa vary quite substantially depending on the data source and methodology used and on whether the estimates are based on income or expenditure information. For example, Leibbrandt *et al*. (2010) obtain a Gini coefficient of 0.68 based on income data from the Income and Expenditure Survey of 2000 and 0.59 using expenditure data from the General Household Survey of 2004.

Table 6: Inequality Measures using Per Capita and Adjusted Expenditure, 2008/9

| Inequality measure | Per capita | Equivalence scale (2) (African/ non-African + young/older children) |
|---|---|---|
| | **Pooled sample** | |
| Gini | 0.63 (0.002) | 0.57 (0.002) |
| Theil | 0.79 (0.009) | 0.62 (0.006) |
| | **African** | |
| Gini | 0.54 (0.004) | 0.49 (0.003) |
| Theil | 0.59 (0.009) | 0.47 (0.006) |
| | **Non-African** | |
| Gini | 0.53 (0.003) | 0.50 (0.003) |
| Theil | 0.48 (0.013) | 0.42 (0.008) |
| | **Theil decomposed** | |
| Theil within groups | 0.54 (0.008) | 0.44 (0.006) |
| Theil between groups | 0.25 (0.006) | 0.18 (0.004) |

*Notes:* Estimates are produced using population weights. Bootstrap standard errors are in parentheses.

## 5. Conclusion

In this study, we described considerable variation in household size and composition by race and economic status in South Africa. Compared to other South Africans, Africans live in households that are significantly larger and include more children, and these household types are typically far poorer than smaller households with fewer children. The relationship between economic status and household size and composition arises not only because in larger households resources are shared among more people, but also because when people are poorer, living together offers a means to reduce living costs. In the South African context of very high rates of unemployment, household formation therefore may be an important component of the livelihood strategies of the poor (Klasen & Woolard, 2009).

Per capita measures of household resources, however, make no adjustments for differences in the size and composition of households. Rather, these measures assume that the costs of living together are the same as the costs of living apart, and that children have the same consumption requirements as adults. However, equivalence scales estimated using Engel's method clearly point to economies of scale in household consumption in South Africa, which appear to be larger in African households compared to non-African households. The estimations

also confirm that children consume less than adults, although Engel's method is likely to overestimate child costs relative to adults. Because of this likely overestimation of child costs, Engel's method produces measures of equivalence scales that are relatively modest, and therefore we err on the side of caution in stating our main findings below.

The application of the estimated equivalence scales significantly reduces total inequality in South Africa. The overall Gini coefficient, for example, falls by approximately six percentage points from 0.63 to 0.57, a fall which is both statistically and economically significant. Because household size and composition are strongly correlated with economic status and race in South Africa, measures of both inter- and intra-racial inequality are also significantly reduced.

Although estimates of inequality decline when equivalence scales are applied, we reiterate that inequality remains worryingly high, and even at the reduced Gini coefficient of 0.57, South Africa remains one of the most unequal countries in the world. And, as has occurred in other African countries, inequality has risen in South Africa in recent decades, despite GDP growth (Obeng-Odoom, 2015). High and rising levels of inequality therefore remain difficult national and global policy challenges (Hvistendahl, 2014; Stilwell, 2016).[13] The more accurate measurement of inequality is important both to better map the extent of inequality and to assess how effective policy interventions are in reducing inequality.

Per capita adjustments are appealing to implement because they are easily standardised across different datasets and studies. In contrast, in the absence of commonly agreed-upon scales, equivalence adjustments will vary across studies, compromising comparability. However, given systematic variation in household size and composition in South Africa, more attention should be paid to developing credible scales and, at the least, there should be more recognition of the likely overestimation of inequality based on per capita measures. Similar household characteristics may be evident particularly in other developing countries, with implications more generally for the measurement of inequality over time and for rankings across countries.

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[13] We also recognise that economic indicators, such as the Gini coefficient (and GDP), do not capture all elements of the reality on the ground (Obeng-Odoom, 2017). However, they remain widely used in academic and public discourses, and therefore their measurement and implementation should be interrogated.

## Biographical notes

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