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New global estimates of child poverty and their sensitivity to alternative equivalence scales☆

David Newhouse [a], Pablo Suárez Becerra [a], Martin Evans [b,*]

[a] World Bank, United States
[b] UNICEF HQ, New York, United States

HIGHLIGHTS

- This paper presents new estimates for child, adult and elderly extreme poverty for 2013 using survey data from 89 countries.
- The poverty rate for children is more than double that of adults.
- Poverty rates are higher for children than adults under all reasonable two parameter equivalence scales.

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ABSTRACT

This paper uses micro-data from household surveys from 89 countries to estimate the rate of extreme poverty among children in the developing world. 19.5% of children are estimated to live on less than $1.90 per day, as opposed to 9.2% of adults. Poverty rates for children remain above 17%, and are greater than adult poverty rates, for all reasonable two-parameter equivalence scales.

This paper presents new estimates of child poverty, as of 2013, and tests the robustness of differences between child and adult poverty headcount rates using different equivalence scales. It updates and improves upon estimates of poor children across the developing world, such as: Batana et al. (2013), Olinto et al. (2013) and Evans and Palacios (2016), by using more comprehensive and newer data and by appropriately adjusting the poverty line when considering alternative equivalence scales.

We use micro-data from 104 surveys collected between 2009 and 2014 in 89 developing countries included in the World Bank's Global Micro Database (GMD). This database adds a set of harmonized household characteristics to the same surveys and welfare measures used to produce the poverty estimates published by the World Bank (Castañeda et al., 2016). Our sample represents 84.2% of the developing world's population and 82.1% of its child population. Children are defined as those below the age of 18 (as defined by UN's Convention on the Rights of the Child).

Children are defined as poor if they live in poor households. Our estimates are based on a per capita welfare measure: extreme poor households are those with per capita income or consumption lower than $1.9 per day, the international poverty line measured in purchase power parity (PPP) of 2011. Our estimates ignore potential disparities in resource allocation within households. Although Dunbar et al. (2013) and Bargain et al. (2014) show that incorporating within-household inequalities can affect child poverty estimates, addressing the problem of intra-household distribution lies outside the scope of the present study due to data limitations.

Table 1 shows the headline results. Poverty rates for children are higher than for adults. Child poverty is 19.5% for 0–17 year olds compared to 9.2% for adults.[1] Across the whole life cycle,

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* Corresponding author.
E-mail addresses: dnewhouse@worldbank.org (D. Newhouse), psuarezbecerra@worldbank.org (P. Suárez Becerra), mcevans@unicef.org (M. Evans).

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[1] Tests of significant differences are available from the authors.

Table 1
Developing world population by age groups and extreme poverty.
Source: GMD, UNDESA, PovcalNet.

	Headcount poverty rate (%)	Poverty gap index (%)	Share of extreme poor (%)	Share of population(%)
Children (aged 0–17)	19.5	6.0	50.2	32.1
Aged 0–4	*21.0*	*6.6*	*15.9*	*9.4*
Aged 5–9	*21.5*	*6.6*	*15.4*	*9.0*
Aged 10–14	*18.7*	*5.7*	*12.9*	*8.6*
Aged 15–17	*14.6*	*4.4*	*6.0*	*5.1*
Adults (aged 18 or more)	9.2	2.6	49.8	67.9
Total	12.5	3.7	*100.0*	*100.0*

Note: The estimates only refer to countries included in the GMD sample, the numbers in the table are not expanded to represent global populations.

prevalence is highest for younger children, those aged less than 10, who have poverty rates of around 21%. Children represent 32.1% of the population but 50.2% of the poor in GMD sample. We apply this proportion to the estimated population of global poor in 2013, 767 million (Castañeda et al., 2016) to obtain an estimated global count of poor children of 385 million.

Per capita estimates also give children the same weight as adults when assessing household needs, and do not allow for larger households to benefit from economies of scale. These problems can be addressed by choosing a different equivalence scale measure. Studies by Buhmann et al. (1988), Lanjouw and Ravallion (1995), Citro and Michael (1995), Duclos and Mercader-Prats (1999), Coulter et al. (1992) and de Ree et al. (2013) address the appropriate choice of equivalence scale and the resulting sensitivity of poverty estimates. Are our estimates sensitive to assumptions of scale and are the differences between adult and child poverty robust?

Batana et al. (2013) state that global extreme poverty rates for children in 2000 would fall drastically, from 38.5% to between 3% and 6% if different equivalence scales were used in place of the per-capita assumption. Ravallion (2015), echoing Deaton and Zaidi (2002), disputes their findings by pointing out that such tests of sensitivity should simultaneously adjust the poverty line. Failing to do so ignores the fact that the $1.90 poverty line is a threshold derived from the national poverty lines of 15 poor countries, expressed in terms of per capita consumption (Ferreira et al., 2015; Ravallion et al., 2009).

Our sensitivity test is based on what Deaton and Zaidi (2002) call an "arbitrary" approach to equivalence of scale. We choose a commonly used expression with two key parameters following the formula:

$$m_h = \left(n_{a,h} + \alpha n_{c,h}\right)^{\theta} \tag{1}$$

where, for household h, $n_{a,h}$ is the number of adults, $n_{c,h}$ is the number of children and m_h is the household's size measured in equivalent adults. The parameters α and θ can take values between zero and one; lower values of α are used to reflect children's lower expenditure needs relative to adults; lower values of θ express higher economies of scale in households' expenditure. When α and θ are set equal to one the number of equivalent adults is equal to the household size, giving the per capita welfare measure. As part of the "arbitrary" approach we test how sensitive our results are to assumptions on equivalence of scale by considering a series of reasonable values of α and θ.

We follow the suggestions of Ravallion (2015) and Deaton and Zaidi (2002) and adjust the per capita international poverty line (z_1) to changes in the equivalence of scale parameters. We use the following formula:

$$Z^e(\alpha, \theta) = Z_1 \cdot \frac{n_{a,r} + n_{c,r}}{\left(n_{r,h} + \alpha n_{r,h}\right)^{\theta}} \tag{2}$$

where Z^e, the adjusted poverty line, depends on the scale parameters α and θ, given $n_{a,r}$ and $n_{c,r}$, the number of adults and children in a pivot or reference household. Members of a household are considered poor when their consumption (or income) per equivalent adult (EA) is lower than Z^e. By construction, a pivot household will remain considered either poor or non-poor for any set of parameters.

In Batana et al. (2013), the *de facto* pivot household was formed by a single adult. Ravallion (2015) proposes that "poverty comparisons should be anchored to the typical circumstances of households near the poverty line". We concur and choose a pivot household based on the demographic characteristics of a typical household in the neighborhood of the $1.90 poverty line. Then, using Eq. (2), we adjust the international poverty line from per capita to adult-equivalent terms for each set of parameters. This methodology overcomes a key limitation of Batana et al.'s (2013) approach. It allows us both to compare households of different sizes and compositions under alternative equivalence scales, and allows the poverty line to adjust in line with the demographic composition of a typical poor household rather than a household formed by one adult.

Table 2 shows the results of the sensitivity test of our estimates to both children's relative cost (α) and household economies of scale (θ). Robustness in adult to child poverty differences is tested using three values of α and θ: 1, 0.6, and 0.2. Additionally, we test the case where $\theta = 0.5$ and $\alpha = 1$, which corresponds to the "square root scale" used by the OECD (OECD, 2009).[2]

The pivot household contains six people, three adults and three children. This is the median number of adults and children in households with welfare per capita between $1.70 and $2.10 per day in the sample, which is an approximate ten percent window in each direction around the poverty line of $1.90. We follow Eq. (2) to estimate the adjusted poverty line for each scenario: the poverty line of $1.90 is multiplied by the ratio of household size to the number of equivalent adults for the pivot household. Thus, when $\alpha = 0.8$ and $\theta = 1$ (row 2 of Table 2), multiplying $1.90 by 6 and dividing by 5.4 gives an adjusted poverty line of $2.1 per EA for that equivalence scale, which is used to re-estimate poverty rates.

The results confirm higher children poverty rates under every reasonable two-parameter assumption. Our alternative poverty rates are always higher than the very low headcount rates of between 6% and 3% reported by Batana et al. (2013), varying in range between 17.2% and 20.9% across all values of α and θ of 0.2 or more, a lower bound beyond that commonly used in the literature.

How susceptible are our results to the choice of the pivot household? Fig. 1 looks at the distribution of welfare per EA for a combination of α and θ set at 1 and 0.5, and shows first order dominance of children over adults for each set of parameters. This suggests that, the choice of pivot, which would affect the adjusted poverty lines, do not affect our conclusion that the child poverty rate is higher than the adult poverty rate.[3]

[2] A fuller set is available from the authors.

[3] As found in Atkinson (1987) the first order dominance also implies an unambiguous ranking in terms of other poverty measurements like the poverty deficit or poverty gap.

Table 2
Children and adults headcount poverty rates considering equivalence of scale.
Source: Source: GMD, UNDESA, PovcalNet.

Parameters		Adjusted poverty line per equivalent adult (PPP$)	Headcount poverty rates (%)	
θ	α		Adults	Children
1.0	**1.0**	1.9	9.2	19.5
	0.6	2.4	10.8	18.5
	0.2	3.2	14.5	17.2
0.6	**1.0**	3.9	11.0	19.5
	0.6	4.4	12.4	19.0
	0.2	5.3	14.7	18.0
0.5	**1.0**	4.7	11.9	19.7
0.2	**1.0**	8.0	15.0	20.9
	0.6	8.3	15.5	20.8
	0.2	8.8	16.3	20.3

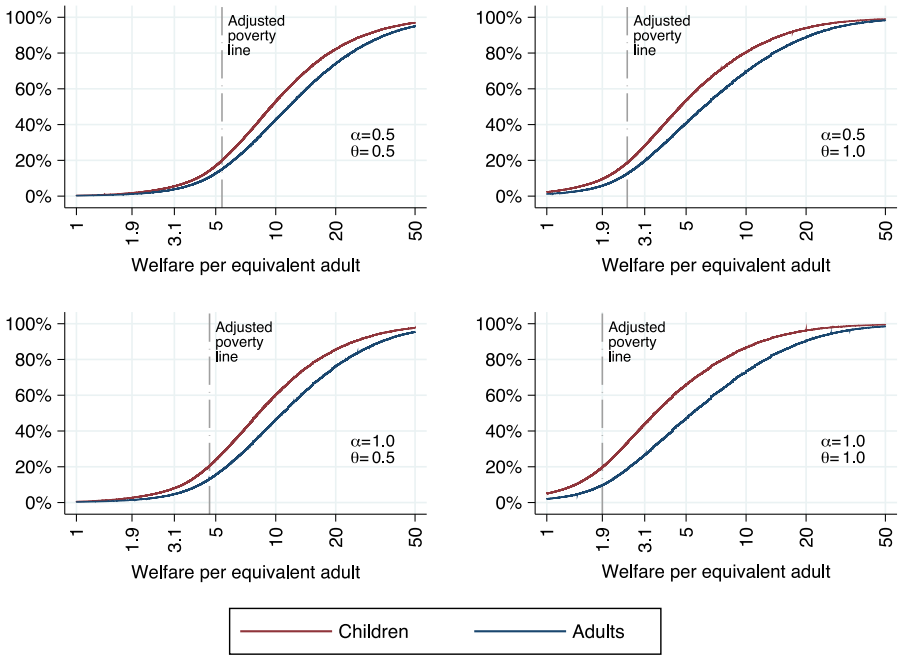

Fig. 1. Cumulative density functions using different parameters of equivalence of scale.
Source: GMD, UNDESA, PovcalNet.

Conclusions

Children in developing countries are more likely to be poor than adults using a large sample of survey data from the World Bank's Global Micro Database (GMD): 19.5% of children are extremely poor, compared with 9.2% of adults. We examine the sensitivity of this headline result to different assumptions on both the relative cost of children's needs and economies of scale, using an approach that recalibrates the poverty line accordingly. Changing values for these parameters within a reasonable range maintains higher global extreme poverty rates for children vis-à-vis adults. Additionally, we find first order dominance of children over adults across distributions of welfare using a range of the two equivalence parameters, providing further evidence that our conclusion that children are more likely to be poor than adults is also robust to adjustment of the poverty line.

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