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by

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Non-monetary dimensions of well-being: A comment[1]

Martin Wittenberg

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Abstract

Bhorat and van der Westhuizen (2013) use asset indices to explore inequality in post-Apartheid South Africa. We show that the way in which the asset indices were transformed to calculate the Gini coefficients does not preserve the relative ranking of inequality measures on subgroups. This means that the reported trends are not robust. Even if they were, it is difficult to interpret the coefficients.

Keywords: inequality, asset index
JEL codes: D63, I32

[1] I would like to thank Haroon Bhorat for constructive discussions around this article, which led to the correction of a number of errors. He is, of course, not responsible for any remaining mistakes.

In a recent paper, Bhorat and van der Westhuizen (2013) have explored the evolution of well-being in post-Apartheid South Africa using information from assets instead of incomes. The idea of checking the trends from another perspective is excellent. Indeed the descriptive statistics that they produce (in Table 1) show that there has been significant progress on the asset front.

Unfortunately the work that they produce in relation to inequality is deeply flawed, to the point where little of that section of the paper is reliable for analysing post-Apartheid trends. The main issues are: a) the authors right shifted their asset indices, since untransformed indices cannot be used to construct a Gini coefficient or a Lorenz curve; b) measured inequality is not invariant to linear shifts, so any reports of the underlying trends are unreliable; c) even if the trends were unaffected, the interpretation of the results is unclear.

1. Asset indices cannot be used to construct Gini coefficients or Lorenz curves

One of the ways of calculating a Gini coefficient is as

$$\gamma = \frac{1}{\mu N(N-1)} \sum_{i<j} \sum_{j} |x_j - x_i| \tag{1}$$

(Deaton 1997, p.139). It is clear that this is not defined if μ is zero. However, standard approaches to creating asset indices norm the index to have zero mean. Although the formula would allow for negative values, Bhorat and van der Westhuizen transformed their asset indices to ensure that all values are positive, by adding a constant of two to all values (footnote 6, p.299). Otherwise the Lorenz curve shown in Figure 3 would have to have started with negative shares.

Indeed, contemplating the definition of the Lorenz curve indicates another issue with use of asset indices in this context. The Lorenz curve plots the cumulative share of the aggregate (income or expenditure). However, if the mean is zero then the aggregate will be zero also. If a constant of δ has been added to all values then the aggregate against which the shares are computed is

$$\begin{aligned} \sum_{i=1}^{N} (x_i + \delta) &= \sum_{i=1}^{N} x_i + \delta N \\ &= \delta N \end{aligned}$$

So the “aggregate” asset index is actually only the aggregate shift!

2. Inequality measures are not invariant to linear translation

Unfortunately adding a constant to all values is not an innocent transformation. It maintains the relative ranking of observations, but it does not preserve inequality measures.

Consider, in particular, the formula for the Gini coefficient (equation 1). If we add the same constant δ to all observations then the difference between observations, i.e. $\left|(x_j + \delta) - (x_i + \delta)\right|$ is not affected. The mean, however, has increased to μ+δ. In short, the Gini coefficient will **decrease** if we add a positive constant; the larger the constant, the bigger the decrease.

Unfortunately inequality comparisons by sub-group are also affected. Table 1 shows a hypothetical distribution of measures ("incomes") where we have indicated which subgroup each observation belongs to. We have also indicated how this measure changes once we add 5 to all observations.

Table 1: A hypothetical "income" distribution

Measure 1	Subgroup	Measure 2	Subgroup
0	A	5	A
1	A	6	A
3	B	8	B
4	A	9	A
5	B	10	B
12	B	17	B

If we graph the Lorenz curves for each of the subgroups, we get the unambiguous result that group A is more unequal than group B on the original measure (see Figure 1). However the shifted distribution gives precisely the opposite result: group B is now more unequal than group A (see Figure 2)! And given that all standard inequality measures (the Gini coefficient, Theil entropy coefficient, Atkinson indices) respect Lorenz dominance, the inequality measures would also flip.

The fundamental point is that adding a constant to all the asset indices doesn't only change the aggregate measure of inequality – it has unpredictable consequences on how much inequality measures on subgroups will be affected. That means that neither the "trend" analysis (i.e. changes of inequality over time) nor the decompositions by subpopulations (the decompositions of the Theil index by race groups) are robust.

Figure 1: Lorenz dominance before adding a constant

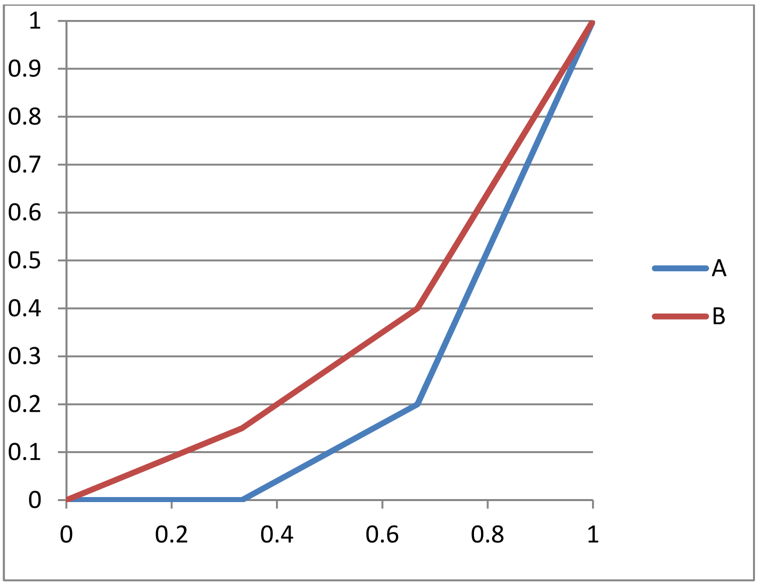
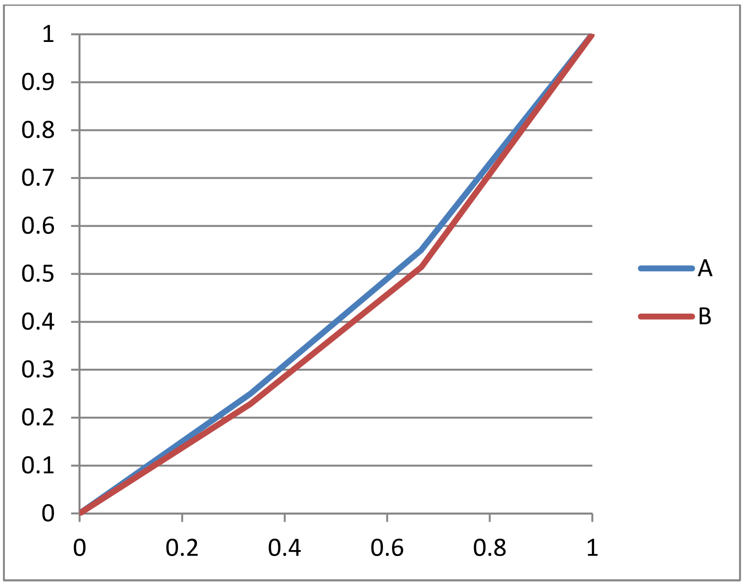


Figure 2: Lorenz dominance after adding the constant



3. How do we interpret the results?

One of the dangers of the exercise undertaken by Bhorat and van der Westhuizen is that the output can easily be misinterpreted. Many analysts (by now) have an intuitive understanding that an **income** Gini coefficient of .64 is “high”. It is high by comparison to other countries and it is high when we bear in mind that the maximum value of the Gini (achieved when one person has all the income) is one.

There is no equivalent way to interpret the Gini coefficients reported for the (shifted) asset index. Firstly there are no comparators (nobody else has tried to calculate Gini coefficients using asset indices). Secondly, the maximum attainable Gini in this case is not clear. If the index is not shifted, there is no reason to suppose that the coefficient is bounded above by one[2]; if the index is shifted so that all numbers are positive, it may have an effective bound that is considerably less than one. Thirdly, it is not even theoretically feasible for one person to have “all the asset index” with everybody else at zero due to the way in which the asset indices are calculated.

The danger is that the “asset index Gini coefficients” will be interpreted against the background of income Gini coefficients. Bhorat and van der Westhuizen are, on the whole, careful not to talk about the absolute magnitudes of the coefficients, but they do lapse at one stage and state “The Gini coefficients for coloureds, Asians and whites were very low in all three years” (p.309). Other readers of their article are likely to be less cautious and draw the inference that inequality, when measured by assets, is much lower than inequality when measured by income.

There is a further problem with interpreting the asset inequality work. The Lorenz curve depicted in Figure 3 invites the interpretation that the bottom 40% of households own around 20% of aggregate assets in 1999. But of course this is completely fictional. What is graphed is the cumulative share of an asset index that has been shifted. It has no meaning at all. The fundamental problem is that inequality in a shifted index is not the same as inequality in assets. It is, however, the latter interpretation that people will put on the results.

[2] Assuming that due to sampling issues the mean is not precisely zero, just very close to it.

References

Bhorat, Haroon and Carlene van der Westhuizen, (2013) "Non-monetary dimensions of well-being in South Africa, 1993–2004: A post-apartheid dividend?" ***Development Southern Africa***, 30:3, 295-314, DOI: 10.1080/0376835X.2013.817308

Deaton, Angus (1997) ***The Analysis of Household Surveys***, Baltimore: Johns Hopkins University Press for the World Bank.

About DataFirst

DataFirst is a research unit at the University of Cape Town engaged in promoting the long term preservation and reuse of data from African Socioeconomic surveys.

This includes:

the development and use of appropriate software for data curation to support the use of data for purposes beyond those of initial survey projects,
liaison with data producers - governments and research institutions - for the provision of data for reanalysis,
research to improve the quality of African survey data,
training of African data managers for better data curation on the continent,
training of data users to advance quantitative skills in the region.

The above strategies support a well-resourced research-policy interface in South Africa, where data reuse by policy analysts in academia serves to refine inputs to government planning.

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