The Distribution of Consumption Expenditure in Sub-Saharan Africa

The Inequality among All Africans

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Abstract

This paper uses a set of national household surveys to study the regional Sub-Saharan Africa distribution of consumption expenditure among individuals during 1993 to 2008. The analysis puts the disparities in living standards that exist among persons in Africa into context with the disparities that exist within and between African countries. Regional interpersonal inequality has increased (from a Gini index of 52 percent in 1993 to 56 percent in 2008), driven by increasing disparities in living standards across countries, while there has been no systematic increase in within-country inequality. For the African distribution as a whole, growth of consumption expenditure (from household surveys) has been low (around 1 percent per year). This growth has been uneven and as a result the richest 5 percent of Africans received around 40 percent of the total gains, while the bottom third stagnated.

THE DISTRIBUTION OF CONSUMPTION EXPENDITURE IN SUB-SAHARAN AFRICA: THE INEQUALITY AMONG ALL AFRICANS

La-Bhus Fah Jirasavetakul and Christoph Lakner[1]

I. Introduction

This paper ignores national boundaries and studies the Sub-Saharan-Africa-wide distribution of consumption expenditure among individuals. By combining household survey data from as many African countries as possible (accounting for around three-quarters of the regional population), we can put all Africans on the same scale of consumption expenditure, regardless of their country of residence.[2] Inequality and other distributional characteristics are typically measured at the country-level (e.g. for a recent review of the evidence on Sub-Saharan Africa, see Beegle et al., 2016). This paper offers a complementary view and puts the disparities that exist within African countries into context with the disparities that exist within the region as a whole.

Our analysis is similar to studies of the global income distribution (Milanovic, 2005, Anand and Segal, 2015; Ravallion, 2014a) and we draw heavily on the analysis by Lakner and Milanovic (2015). Our analysis is perhaps best seen as referring to a sub-region of the global distribution. According to Milanovic (2005), there are three concepts of global inequality: (1) the inequality in per capita incomes between countries in the world, which is relevant to studies of income convergence across countries; (2) population-weighted international inequality, which assigns everyone the per capita income of their country of residence; and (3) interpersonal inequality, where everyone is assigned their own income. In this paper, we study the third concept as applied to Sub-Saharan Africa, i.e. the inequality in consumption expenditure among all people living in Sub-Saharan Africa. Implicit in our analysis is an African-wide social welfare function which treats persons irrespective of their country of residence. In the global context, this is referred to as a cosmopolitan social welfare function (Atkinson and Brandolini, 2010).[3] One might also have an instrumental concern for regional interpersonal inequality if extreme regional inequality contributes to conflict or migration.

The analysis in this paper is based on a database of national household surveys from Sub-Saharan Africa maintained by the World Bank, over the period 1993 to 2008. Our welfare measure is consumption expenditure per capita as measured in household surveys, expressed in 2011 PPP USD, although the results are robust to using 2005 purchasing power parity (PPP) exchange rates. While our database of household surveys has a good coverage of Africa as a whole (representing three-quarters of the regional population), the coverage of fragile countries remains low. Hence our results are probably a lower bound on African inequality. Another reason for why our estimates are likely to be a lower bound is that we use consumption expenditure surveys which most likely underestimate consumption at the top of the distribution.[4]

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[2] Throughout this paper, we use "Africa" and "Sub-Saharan Africa" interchangeably, as in Beegle et al. (2016).

[3] A large literature in philosophy discusses the cosmopolitan view of the world and issues of global justice more broadly (e.g. Pogge, 2002; Singer, 2002; Nagel, 2005).

[4] Furthermore, inequality in consumption expenditure tends to be lower than inequality in income, e.g. Li et al. (1998) find a difference of 6.6pp for the Gini index. Considering the regional distribution of *wealth* (as opposed to consumption expenditure), it can be shown that the ten wealthiest individuals have as much wealth as the bottom half of the African continent (in this case including both Sub-Saharan and North Africa) (Lakner, 2015). However, the imputations used in the wealth data might underestimate wealth holdings at the bottom (see footnote 5 of Lakner, 2015), thus suffering from the opposite problem than the African consumption distribution in the present paper.

Between 1993 and 2008, interpersonal inequality for Sub-Saharan Africa as a whole increased. For example, the Africa-wide Gini increased from 52% in 1993 to 56% in 2008. By contrast, Beegle et al. (2016) find no systematic increase of *within*-country inequality in the region. Taken together, the country-decomposition of regional inequality shows that the rise in regional inequality was driven by increasing inequality between countries, i.e. an increasing dispersion in average consumption across countries. However, within-country differences continue to dominate the level of African inequality. The African growth incidence curve is upward-sloping, consistent with the increasing inequality. While mean African consumption grew at around 1% per year, living standards for the bottom third of the distribution stagnated, while the top 5% received some 40% of the total gains between 1993 and 2008 (with a growth rate of around 2% per year).

The paper is structured as follows. First, we explain the construction of our database, and then show summary statistics. Section IV presents results for the cross-sectional distribution and its inequality. Overall African inequality is decomposed into between- and within-country components in Section V. In Section VI, we study growth incidence curves, looking at both relative and absolute gains along the distribution. Section VII compares these results with what can be learnt from GDP per capita alone. We analyze relative movements over time of specific country groups in the regional distribution in Section VIII, and the final section concludes. The Appendix presents a number of robustness checks, especially the results with the 2005 PPPs. Throughout, we draw comparisons with regional results for East Asia and Pacific from a companion paper (Jirasavetakul and Lakner, forthcoming). In the early 1990s, average consumption per capita was comparable in the two regions or even slightly lower in East Asia. However, since then growth in East Asia has been much faster and, while regional inequality also increased, its growth appears less concentrated than in Africa.

II. Data Construction and Methodology

The regional distribution analyzed in this paper is built from nationally representative household surveys from as many countries as possible. PovcalNet is the starting point of this data set. PovcalNet is the global database of national household surveys compiled by the research department of the World Bank, and it is the source of the World Bank's global poverty estimates.[5] Where possible we supplement PovcalNet with additional data directly from household surveys. In total, we use 106 surveys, with three surveys directly from household survey data and the remainder from PovcalNet.[6]

Because most countries do not conduct annual surveys, we have defined a number of benchmark years – 1993, 1998, 2003 and 2008 – to which we match household surveys. We begin our analysis

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[5] http://iresearch.worldbank.org/PovcalNet/. Data downloaded 07 January 2015, which refers to data last updated on 08 October 2014. While PovcalNet attempts to make the consumption measures as comparable as possible, it is important to recognize that changes in the survey methodology can have important effects (Beegle et al., 2012). However, the coverage of regional GDP and population is too low when using the set of surveys that satisfy a higher standard of comparability. For example, these surveys cover less than half of regional GDP in 2008.

[6] We excluded one income survey from Namibia to ensure that welfare is measured as consumption expenditure throughout.

in 1993, because the availability of household surveys in Africa is more limited before this date.[7] Given the lags in data preparation, we were also unable to add another more recent benchmark year beyond 2008.[8] We have established two rules for allocating surveys to benchmark years (similar to Lakner and Milanovic 2015): (1) surveys need to be within two years of a benchmark year, and (2) surveys in consecutive benchmark years should be at least three and no more than seven years apart from each other. However, we had to make a few exceptions to ensure that the household surveys included in our database achieve a sufficient coverage of the African population.[9]

PovcalNet provides the average incomes of the 10 decile groups within a country, but it does not provide more detailed information on the distribution in its main output.[10] We have constructed two versions of the database. First, we only use the raw data available in PovcalNet and construct a data set consisting of country decile groups. Second, we fit a parametric Lorenz curve to the decile groups and build a data set of percentile groups (for each country-year).[11] The second data set has the advantage of providing more detail on the country-level distributions, but this comes at the cost of requiring an additional parametric assumption. Our main set of results uses the data set of percentile groups but we present robustness checks using the more aggregated data. For the three surveys where we use survey data directly, we can of course construct percentile (or decile) groups directly. In the analysis, each quantile group is population-weighted, so every person is assigned the average per capita consumption expenditure of her quantile group in the country-year distribution.

Throughout, welfare is measured using per capita consumption expenditure, measured at the household level and expressed in 2011 PPP-adjusted USD.[12] This new set of PPP exchange rates was recently adopted by the World Bank in its global poverty measurement (Ferreira et al., 2015).[13]

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[7] Using a somewhat broader data set, Lakner and Milanovic (2015) covered only 29% of the population in Sub-Saharan Africa in 1988.

[8] Chotikapanich et al. (2015) present annual estimates of the Gini and poverty headcounts for a number of African countries up to 2010. Similarly, Pinkovskiy and Sala-i-Martin (2014) calculate estimates for regional poverty and inequality up to 2011. However, their methods rely on using GDP per capita for the country mean (which is available for recent years), and extrapolating and interpolating distributional information (for which there is a longer time lag).

[9] Violating the first rule, we use the 2005-2006 survey in South Africa for benchmark year 2003. This survey was largely conducted in 2006, so should be allocated to benchmark year 2008. We use four surveys (from Guinea-Bissau, Kenya, Nigeria and Tanzania) which are eight years apart from the survey in the previous benchmark year. We annualize growth rates when we estimate changes between benchmark years to account for growth spells of varying lengths.

[10] To be precise, PovcalNet provides the overall mean and the consumption share of each decile group from which it is straightforward to construct the average income of the decile group.

[11] We fit a lognormal Lorenz curve to the ten decile groups and use it to generate a distribution of 10,000 points. We use the 'ungroup' Stata routine (Abdelkrim and Duclos, 2007) which implements the Shorrocks and Wan (2008) method. As described in more detail in Lakner et al. (2014), this is very similar to the approach used by PovcalNet in the measurement of global poverty. Our approach differs from other papers in this field which assume parametric within-country distribution functions (e.g. Chotikapanich et al. 2012). According to Minoiu and Reddy (2012), it is preferable to fit a parametric Lorenz curve instead of a kernel density.

[12] PovcalNet reports per capita household consumption which ignores any economies of scale in household consumption. It could be argued that poor people have little scope for economies of scale (Chen and Ravallion, 2010).

[13] At the time of extracting the data used in this paper, PovcalNet used the 2005 PPP exchange rates. Our conversion into 2011 PPP-adjusted USD is consistent with PovcalNet and is given by Lakner and Milanovic (2015) and Jolliffe and Prydz (2015) as

For the additional data we obtain directly from household surveys, we replicate the approach followed by PovcalNet: First, we use the local CPI (from PovcalNet and World Development Indicators (WDI)) to deflate consumption to 2011 domestic prices, and (2) apply the 2011 PPP conversion factors for private consumption (also from WDI) to convert into 2011 PPP-adjusted USD. In the Appendix, we perform a robustness check of our main results using the 2005 PPP exchange rates.[14]

It is appropriate to use consumption expenditure as the welfare indicator, as it can be measured more easily than income in low-income countries (Deaton and Zaidi, 2002), such as Sub-Saharan Africa. However, it is important to recognize that relative to income surveys, consumption surveys tend to show lower levels and slower increases in inequality. For example, this can be explained by a declining marginal propensity to consume, and difficulties in capturing expenditures on the types of items consumed at the top end of the distribution.[15] Therefore, if incomes at the top increase faster than in the rest of the distribution, consumption surveys would register this increase in inequality only to a limited extent.

III.   Summary Statistics

Table 1 shows the main summary statistics of our database of national household surveys. Our database includes around 25 surveys per benchmark year out of a total of 48 African countries. Most surveys lie within one year of their respective benchmark year. Given our interest in estimating the African distribution of consumption expenditure, it is important that the surveys included in our database cover as much of the region as possible. On average, we cover 80% of regional GDP, and at 72% a somewhat lower share of the regional population.[16] Given that richer countries are more likely to have a survey that can be included in our database, it is not surprising that the GDP coverage exceeds the population coverage. This can also be seen very clearly when we break down the GDP and population coverage by country income status.[17] For example, in 2008 our database covers 97% of the population of the upper middle and high income countries in Africa, compared with 61% for low income countries.

$$PPP11inc_t = PPP05inc_t \times \frac{CPI_{2011}}{CPI_{2005}} \times \frac{PPP05}{PPP11}$$

, where CPI_{2011} is the CPI in 2011, $PPP11$ is the PPP conversion factor in 2011, and the 2005 terms are defined accordingly.

[14] For South Sudan we add a 2009 survey directly from household surveys. While the conversion into 2011 PPPs is straightforward, expressing the welfare aggregate in 2005 PPPs is more difficult because national accounts aggregates do not exist separately for Sudan and South Sudan before 2008. Therefore, for the period between 2005 and 2008 we use Sudan's inflation rate, as well as its 2005 PPP exchange rate.

[15] This problem is not unique to developing countries. Recently Aguiar and Bils (2015) use the relative expenditure by high- and low-income households on luxuries to show that US consumption inequality is underestimated in the Consumer Expenditure Survey.

[16] The coverage of Sub-Saharan Africa is very similar in Lakner and Milanovic (2015) who use a somewhat broader set of surveys. On average, they cover 80% of regional GDP and 74% of regional population between 1993 and 2008.

[17] Income status as defined by the World Bank Analytical Classification in 2014 (last updated on 1 July 2014). This 2014 classification is based on estimates of gross national income (GNI) per capita for 2013.

Table 1: Africa Sample summary statistics					
	Benchmark year				**Total**
	1993	**1998**	**2003**	**2008**	
Number of surveys	22	20	30	34	106
<u>**Years between survey year and benchmark year (%, by benchmark year)**</u>					
-2	0.00	20.00	6.67	26.47	
-1	27.27	5.00	13.33	14.71	
0	27.27	35.00	36.67	14.71	
1	31.82	5.00	16.67	20.59	
2	13.64	35.00	23.33	23.53	
3	0.00	0.00	3.33	0.00	
Within +/- 1 of benchmark	86.36	45.00	66.67	50.01	
<u>**Income vs. Consumption surveys (%, by benchmark year)**</u>					
Consumption	100	100	100	100	100
Income	0	0	0	0	0
<u>**GDP (in 2011 PPP-adjusted USD) (% of regional GDP represented in the database)**</u>					
AFR	77.51	78.18	78.95	86.80	80.36
Resource rich	66.46	66.07	73.34	92.32	74.54
Non-resource rich	85.65	86.89	83.33	81.22	84.27
Fragile	35.84	29.65	38.74	87.25	47.87
Non-fragile	86.27	88.61	86.73	86.72	87.08
Low income	63.49	61.64	69.28	55.68	62.52
Lower middle income	80.54	80.52	78.94	96.05	84.01
Upper middle and high income	83.55	86.74	85.32	93.78	87.35
<u>**Population (% of regional population represented in the database)**</u>					
AFR	68.32	71.20	70.23	76.25	71.50
Resource rich	57.46	54.52	63.91	93.41	67.33
Non-resource rich	77.49	84.55	76.16	65.17	75.84
Fragile	29.82	21.47	33.52	79.93	41.19
Non-fragile	82.74	89.70	83.84	74.88	82.79
Low income	61.57	62.99	65.05	61.07	62.67
Lower middle income	77.58	78.61	76.96	94.46	81.90
Upper middle and high income	71.50	89.72	74.87	97.16	83.31
Notes: The last column is the (unweighted) average over the benchmark years 1993 to 2008.					

In Table 1, we also look at the representativeness for countries rich in natural resources and those affected by conflict.[18] Given the difficulties in conducting surveys in fragile countries, it is perhaps not surprising that the population coverage of fragile countries is low. For example, in the first three benchmark years our surveys cover only 28% on average of the population living in fragile countries. This improves markedly in 2008, which is largely explained by the inclusion of the Democratic Republic of Congo (DRC) and Sudan.[19] These countries are also responsible for the improvement in the population coverage of resource-rich countries. The lack of information on fragile countries means that our results should be interpreted with caution, and are probably a lower bound on African inequality.[20]

Table A3 shows a simple comparison of the population that is included and excluded along macroeconomic aggregates (i.e. every individual is assigned the country average). As was already shown by Table 1, the excluded population lives in countries that (1) have lower GDP per capita; (2) are less likely to be middle or high-income; (3) on average are more likely to be fragile and resource rich; and (4) receive more official development assistance per capita.[21]

Table 2 summarizes the panel dimension of our database. Out of 48 African countries, 44 appear in our database in various benchmark years. Hence there are only four African countries that never have a survey that could be included in our database.[22] Out of these 44 countries, 13 appear only for one benchmark year, while 15 countries appear for three benchmark years. We also include a robustness check for a balanced sample of countries. Specifically, we analyze changes between 1993 and 2008 for which we observe 19 countries (second to last column). On average, these countries represent 68% of regional GDP and 52% of regional population. For low income countries, this sample covers only 35% of the population, compared with 70% for the non-low income countries. For natural resource rich country it is nearly 60%. At 30% population coverage, the coverage of fragile states is low but comparable to that observed in the entire sample.

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[18] A country is defined to be resource-rich if the average natural resource rents from 2006 to 2011 are at least 10% of its GDP. The fragile state status is defined by the World Bank's Harmonized List of Fragile Situation FY15. That is, a country is a fragile state, if the harmonized average CPIA country rating is less than or equal to 3.2, or if there is a presence of a UN and/or regional peace-keeping or peace-building mission during the past three years.

[19] These two countries account for 26% and 15% of the total population of all fragile states respectively.

[20] Of course, the lack of data on fragile countries also affects estimates of global poverty. In the estimates of global poverty by the World Bank, countries with missing surveys, many of which would be fragile, are assigned the regional headcount (Chen and Ravallion, 2010; World Bank 2014). It is probably reasonable to expect that poverty would be systematically higher in these countries.

[21] Fragile, natural resource rich and income status are held constant at the end-year. Net aid received (in current USD) is obtained from OECD.Stat, accessed January 5 2016.

[22] These four countries are Eritrea, Equatorial Guinea, Somalia, and Zimbabwe.

Table 2: Panel summary statistics: Number of countries by panel duration							
		# benchmark years				# countries observed in	
Regions	Total	1	2	3	4	1993 & 2008	1998 & 2008
Africa	44	13	8	15	8	19	17
Income level							
Lower	23	7	2	11	3	10	8
Lower middle	14	4	3	3	4	7	6
Upper middle & high income	7	2	3	1	1	2	3
Conflict							
Non-fragile	30	5	8	11	6	13	14
Fragile	14	8	0	4	2	6	3
Natural resources							
Non-resource rich	28	5	6	12	5	13	13
Resource rich	16	8	2	3	3	6	4
Notes: The last two columns allow for gaps in the panel. Excluding benchmark year 2012.							

IV.   The African Distribution of Consumption Expenditure and Its Inequality

Figure 1 shows the African distribution of consumption expenditure and how it evolved over time.[23] It is a unimodal distribution which looks approximately lognormal although it has a long right-hand tail. As shown by the rightward movement of the distribution, there was moderate growth between 1998 and 2003 (mean consumption per capita grew at 4% per annum), which was also illustrated by a positive growth incidence curve over this period (see Figure 4 below). Between 2003 and 2008 incomes declined (by 1.2% per annum) with the possible exception of the top. In the early 1990s, mean consumption per capita was around 20% higher in Africa than East Asia (2011 PPP US$ 876 per year in 1992). But between 1992 and 2007, mean consumption grew at an annual rate of 6% in East Asia, so that the African mean was only 60% of the East Asian mean in 2007 (2011 PPP US$ 2,102 per year).

Table 3 shows the main set of results on the African-wide inequality of consumption expenditure. Compared with within-country inequality in the region, the Gini index of the Africa-wide distribution of consumption expenditure is high at between 52% and 56% across the benchmark years (Table 3, Panel A).[24] For example, in benchmark year 2008 the average within-country Gini is 45% (Table 3, Panel D), and there are only four countries that have a Gini in excess of the African

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[23] Using the Kolmogorov-Smirnov test, we can reject the equality of distributions at the 0.5% significance level for all combinations of benchmark years. However, this needs to be interpreted carefully as the data are derived from combining various surveys instead of a single sample (see the discussion on standard errors below).

[24] Pinkovskiy and Sala-i-Martin (2014) estimate a substantially higher Gini index which *decreases* over time. For example, they report a Gini of around 66% in 1993 (64% in 2008) [values are read off from their Figure 21], compared with 52% in 1993 (56% in 2008) for our estimates. Furthermore, their paper reports 34% in 1990 (21% in 2011) of the regional population living below $1.25 (2005 PPPs), compared with 57% in 1990 (47% in 2011) for PovcalNet (accessed November 16 2015), which uses methods similar to our paper. While there are a number of methodological differences, the most important seem to be the use of GDP per capita and imputation of income inequality (from consumption surveys) by Pinkovskiy and Sala-i-Martin. See footnotes 8 and 44 for a discussion of why we do not use GDP per capita.

Gini.[25] The average within-country Gini is slightly lower when countries are weighted by their population, at 44% in 2008, suggesting that the large African countries tend to have higher levels of within-country inequality.

Compared with other regions in the world, Africa has the highest regional inequality.[26] For example in 2008, the regional Gini indices for the mature economies is 41.1%, for Russia, Central Asia and South-East Europe 42.7%, and Latin America and Caribbean 52.2% (Lakner and Milanovic, 2015). For East Asia and Pacific the regional Gini index is 45.9% in 2007 and 44.4% in 2012, so the African Gini is about 10pp higher across the benchmark years.[27] At 67.0% in 2008, the global Gini index is higher than all these regional figures. This is not surprising given that between-country differences tend to be smaller at the regional than the global level.

The African Gini index increased by 9% between 1993 and 2008. By contrast, the average within-country Gini has fallen by 5%, although this effect nearly disappears when population weights are used suggesting a slightly increasing Gini in larger countries. In other words, average within-country inequality for an African hardly changed, while average inequality among this set of countries fell. The global Gini index has fallen somewhat from 69.1% in 1993 to 67.0% in 2008 (Lakner and Milanovic, 2015). For the EAP region, the Gini index increased by 8.6% between 1988 and 2012, and by 5.8% between 1992 and 2007, so slightly slower than Africa over a comparable time period. The regional Gini indices increased in most other regions, with the major exception of LAC where it fell from 56.4% in 1998 to 52.2% in 2008. Therefore, in terms of the regional Gini index Africa has overtaken LAC.

The finding of increasing African inequality is robust to choosing alternative measures of inequality. Figure 2 shows the Lorenz curve for the African distribution of consumption expenditure. The Lorenz curve for 2008 is uniformly to the right of the 1993 curve without crossing.[28] Hence, inequality has increased between 1993 and 2008 irrespective of the choice of inequality measure (Atkinson, 1970).[29] Consistent with this, all the alternative GE inequality measures increase over this period (Table 1, Panel A). The GE(2) measure is most sensitive at the very top of the distribution (Cowell, 2009), so it appears that inequality increased most strongly in this part of the distribution. As Anand and Segal (2015) point out, the estimation of standard errors for the regional Gini index (and other inequality measures) is not straightforward. This is because the Gini index is estimated from combining a set of country-distributions, not from a single regional household survey. However, while changes between some of the intermediate benchmark years are small, the change between 1993 and 2008 of four Gini points appears substantive.

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[25] These countries are Botswana, Central African Republic, Namibia and South Africa.

[26] All global and regional inequality estimates in this paragraph use the 2011 PPPs, although Lakner and Milanovic (2015, Table A.3) use decile groups, and a slightly different spatial price adjustment for Indonesia and China (compared with Jirasavetakul and Lakner, forthcoming).

[27] Furthermore and in contrast to the results for Africa, the EAP Gini exceeds all of the within-country Gini indices in the region.

[28] The right-hand panel zooms in at the very bottom of the Lorenz curve. From this graph it appears that there might be some crossing at the very bottom which we ignore here.

[29] To be precise, the Lorenz dominance result applies to inequality measures that satisfy the Pigou-Dalton transfer axiom. An inequality measure satisfying this axiom would increase after a transfer from a poor to a rich person.

For the benchmark years in between 1993 and 2008, there exists no unambiguous ranking of Lorenz curves. Hence the direction of change in inequality depends on the chosen inequality measure. For example, Figure 2 shows clearly that the Lorenz curves in 2003 and 2008 cross. This is also shown by the fact that the various GE measures move in opposite directions (with the exception of the change between 1998 and 2003).

Our results are unaffected by a number of robustness checks, such as using the original decile data, applying the 2005 PPP US$, and confining the analysis to the balanced sample (i.e. countries that are observed in both 1993 and 2008).[30] The results of these robustness checks are presented in the Appendix. First, using the original data set of decile groups without fitting a parametric distribution reduces the African Gini by about 0.5pp, while the time trend remains unchanged (Table A1, Panel ii). Of course, the fall in the African Gini is to be expected because every within-country distribution is now represented by ten instead of 100 points.[31] The changes in GE(0) over time and its within contribution are also robust to using the decile data. Second, the results from applying the 2005 PPP US$ remain comparable to the main results using the 2011 PPP US$, with the Gini index being 0.8pp lower on average, and increasing by about 9% over the 15-year period (Table A1, Panel iii). Third, we check whether the results are driven by changes in the sample of countries over time. The balanced sample raises the Gini increases by about 1.8pp in 1993 and 0.6pp in 2008 (Table A1, Panel iv). As a result, the Gini index increased by 6% between 1993 and 2008. This increase is slightly smaller than that observed in the main results but remains substantial.

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[30] These robustness checks are important. For example, Lakner and Milanovic (2015) who use a slightly different (and larger) sample of countries find a much smaller increase in the African Gini between 1993 and 2008 when they use the 2011 PPPs. Specifically, they tend to find a higher African Gini index than our estimates, while this gap diminishes over time. While it is difficult to determine the precise reasons for these differences, one difference is that Lakner and Milanovic use some income surveys, while we use consumption surveys throughout. Furthermore with the 2005 PPPs, the African Gini increases by 9% in Lakner and Milanovic, which is very similar to our findings.

[31] To be precise, Yitzhaki (1994) shows that the (regional) Gini can be decomposed into (1) the between-country Gini and (2) a term which consists of the income share, the within-country Gini, and the overlap index between the country and the regional distribution. Replacing 100 points with ten points would reduce the last two components, while it would leave between-country inequality and the income share unchanged.

	1993	change (%, pp)	1998	change (%, pp)	2003	change (%, pp)	2008	1993-2008 change (%, pp)
Table 3: African inequality								
A2. Regional inequality								
Gini index (%)	51.68	0.92	52.16	3.78	54.13	3.69	56.12	8.59
GE(0) (Theil-L)	0.47	0.16	0.47	8.21	0.51	10.74	0.57	20.02
GE(1) (Theil-T)	0.54	3.24	0.56	33.20	0.75	-4.36	0.72	31.52
GE(2)	1.22	3.00	1.26	150.76	3.16	-24.11	2.40	96.02
B2. Country decomposition of GE(0): level of within- and between-country inequality								
GE(0) (Theil-L) (within)	0.35	-2.72	0.34	-2.46	0.33	2.86	0.34	-2.41
GE(0) (Theil-L) (between)	0.13	8.11	0.14	34.73	0.18	24.90	0.23	81.93
C2. Country decomposition of GE(0): within-country contribution in % (change is in percentage points)								
GE(0) within contribution	73.41	-2.11	71.29	-7.03	64.26	-4.57	59.69	-13.72
D2. Absolute measures of inequality								
Absolute Gini index	548	1.03	553	26.63	701	-2.57	683	24.64
E2. Average annual consumption expenditure per capita (in 2011 PPP-adjusted USD), by percentiles								
Bottom 10%	152	8.72	166	29.75	215	-30.22	150	-1.56
P40-P50	569	-1.51	560	18.81	666	-10.86	594	4.31
P50-P60	702	-2.89	682	16.85	797	-6.80	743	5.76
P60-P70	881	-4.09	845	14.13	965	-2.42	941	6.81
P80-P90	1,699	-2.74	1,652	5.65	1,746	4.65	1,827	7.53
P90-P95	2,567	1.79	2,613	4.51	2,731	4.45	2,853	11.11
P95-P99	4,563	6.25	4,848	10.36	5,351	-0.67	5,315	16.47
Top 1%	12,930	2.15	13,208	91.40	25,280	-19.10	20,451	58.16
H2. Average annual consumption expenditure per capita (in 2011 PPP-adjusted USD), by region								
Africa	1,060	0.11	1,061	22.02	1,295	-6.04	1,217	14.77
Resource rich	1,167	-4.46	1,115	36.41	1,521	-1.58	1,497	28.28
Non-resource rich	858	10.14	945	-2.43	922	3.04	950	10.72
Fragile	1,078	-0.37	1,074	25.61	1,349	1.04	1,363	26.44
Non-fragile	923	-0.65	917	1.20	928	-8.73	847	-8.23
Low income	830	-3.86	798	14.79	916	-27.18	667	-19.64
Lower middle income	939	5.32	989	2.02	1,009	14.17	1,152	22.68
Upper middle & high income	2,618	-11.23	2,324	83.82	4,272	-17.23	3,536	35.06
I2. Comparison with within-country inequality: Average within-country Gini index								
Avg. Gini (%)	47.15	-4.76	44.91	1.03	45.37	-1.53	44.68	-5.24
Avg. Gini (%) [pop-weighted]	44.24	-1.17	43.72	-2.00	42.85	2.73	44.02	-0.50

Notes: For the decompositions by country, changes between benchmark years are in percentage points. For all other rows, changes are measured in percent (not annualised). Observations are weighted using population. Using dataset of 100 percentile groups per country-year, based in part on a parametric Lorenz curve.

Figure 1: African Distribution of Consumption Expenditure, 1993-2008

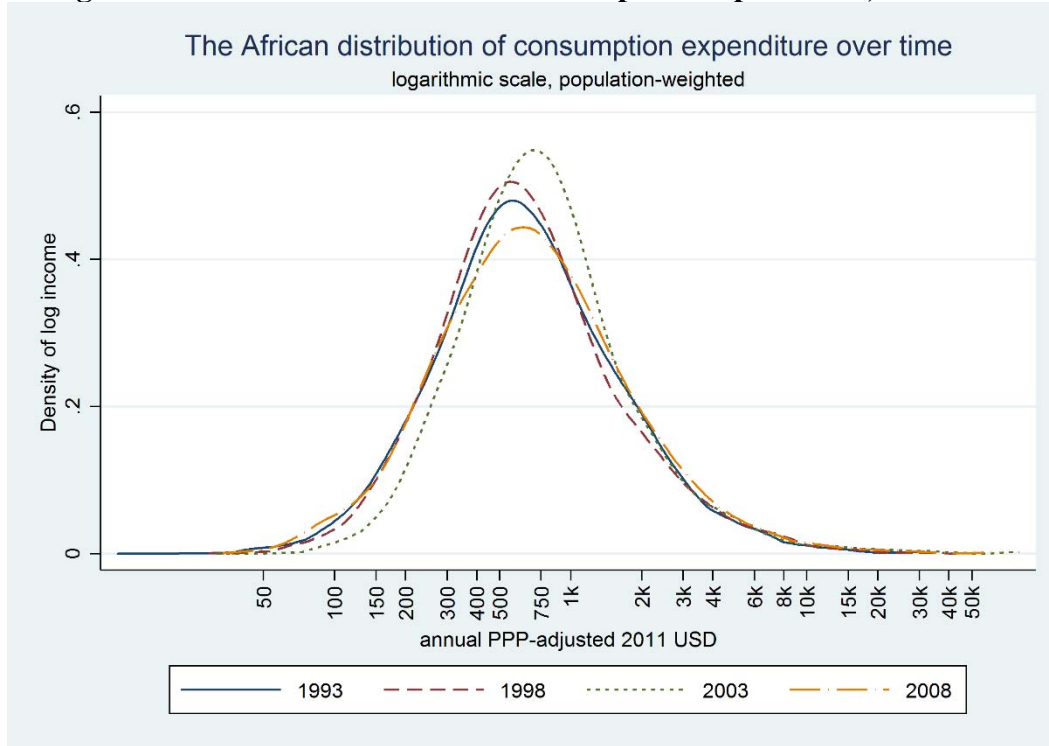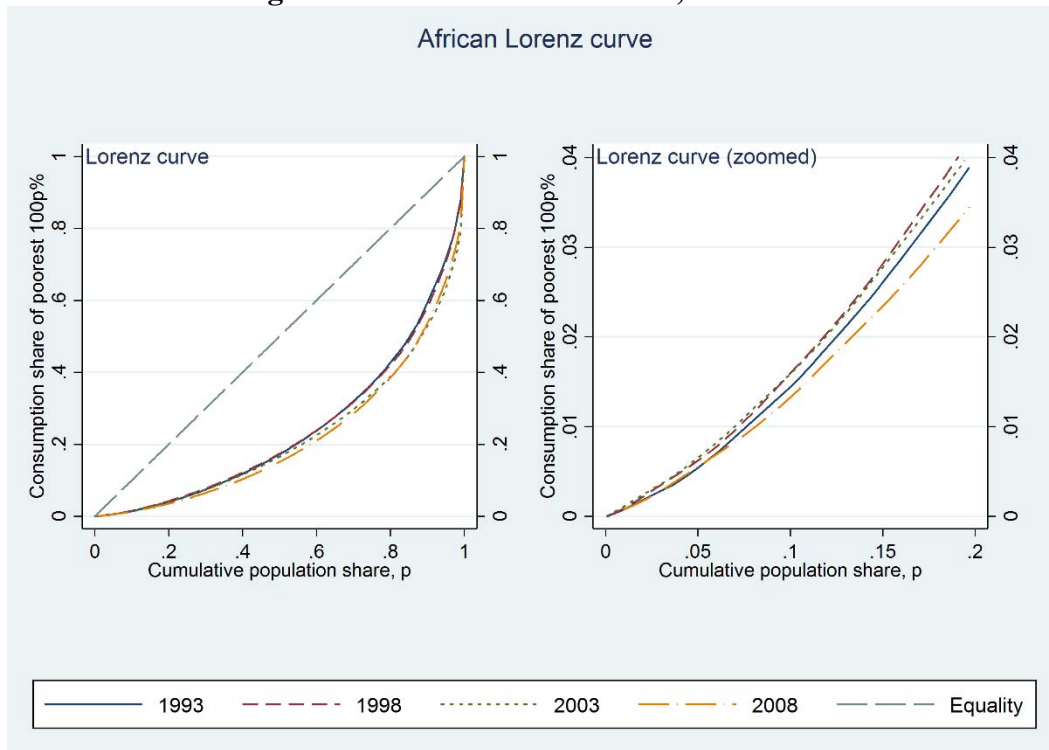The African distribution of consumption expenditure over time
logarithmic scale, population-weighted

Figure 2: African Lorenz Curve, 1993-2008

African Lorenz curve

V. Decomposition of African Inequality into Differences Between and Within Countries

The level of African inequality continues to be explained mostly by differences within countries, which accounts for around 60% of overall inequality. However, the increase observed between 1993 and 2008 was driven by increasing inequality between-country. We decompose overall African inequality (according to GE(0)) into two components, due to differences within and between countries respectively (Table 3, Panel C).[32] The level of within-country inequality declined gradually and continuously, while the inequality between countries increased by 77% between 1993 and 2008.[33] As a result, the contribution of consumption differences within countries to total inequality declined from 73% to 60%. Therefore, an increasing share of African inequality is explained by gaps across countries in terms of average consumption expenditure.

These results stand in sharp contrast to the results at the global level (Lakner and Milanovic, 2015), where (1) within-country inequality increased both in levels and as a share of total inequality, and (2) between-country differences remain the dominant source of inequality. It is perhaps not surprising that between-country differences matter more at the global level compared with within Africa, as one might expect countries' average income or consumption level to be more similar within a region. In addition, given the high levels of within-country inequality, it is not surprising that this is an important component of total inequality. According to Beegle et al. (2016), seven of the ten most unequal countries are in Africa, particularly Southern Africa, although within-country inequality in Africa is comparable to other regions after excluding these countries and controlling for income. However, as Milanovic (2003) argues, high levels of inequality within African countries present a puzzle given the Kuznets hypothesis and widely shared land ownership.

Similar to the results for Sub-Saharan Africa, most of the regional inequality in East Asia and Pacific is explained by differences within countries (Jirasavetakul and Lakner, forthcoming). However, while overall regional inequality increased by a similar amount, this increase was driven by rising within-country inequality in East Asia, in contrast to Africa. For example, the contribution of consumption differences within countries to total GE(0) inequality rose from 69% to 87% between 1992 and 2007.

The GE(0) country-decomposition is additive, so it can be split up into the separate within and between contributions of every country, as done in Figure 3. The total width of the bars is the total level of inequality as measured by GE(0), which has increased over time (also see Table 3, Panel A). We show countries which are larger and have more frequent surveys separately, while combining the contributions for the smaller countries. While within components are always positive, the between component is positive (negative) if the country's mean is less (more) than the overall Africa-wide mean.[34]

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[32] The measures of inequality in the GE-class are additively decomposable by subgroup (Bourguignon, 1979). The decomposition of GE(0) uses population shares, while the decomposition of the GE(1) index is in terms of income shares. Therefore, the within-country component of GE(0) can be interpreted as the residual inequality after equalizing average incomes across Africa, while this does not hold for the GE(1) or GE(2).

[33] The fall in the within-component is consistent with the changes reported for the average Gini index (Table 1, Panel D). Furthermore, a set of African countries with comparable and recent surveys is split about half-half into increasing and decreasing inequality (Beegle et al., 2016).

[34] The decomposition of the Theil-L index can be written as

South Africa contributes negatively (labelled "B-ZAF") to between-country inequality because its mean consumption exceeds the regional average. The same is true for Ghana in some years, although the contribution is much smaller due to a smaller population size. Within-country inequality appears to have declined in Nigeria (labelled "W-NGA").[35] However, the main contributor to African inequality is the increasing between-country inequality from the residual countries (labelled "B-Other AFR"). This also shows that because of less unequal population shares, the regional results for Sub-Saharan Africa are much less driven by a single country, in contrast to for example East Asia.[36]

Figure 3: African Inequality Decomposition, 1993-2008
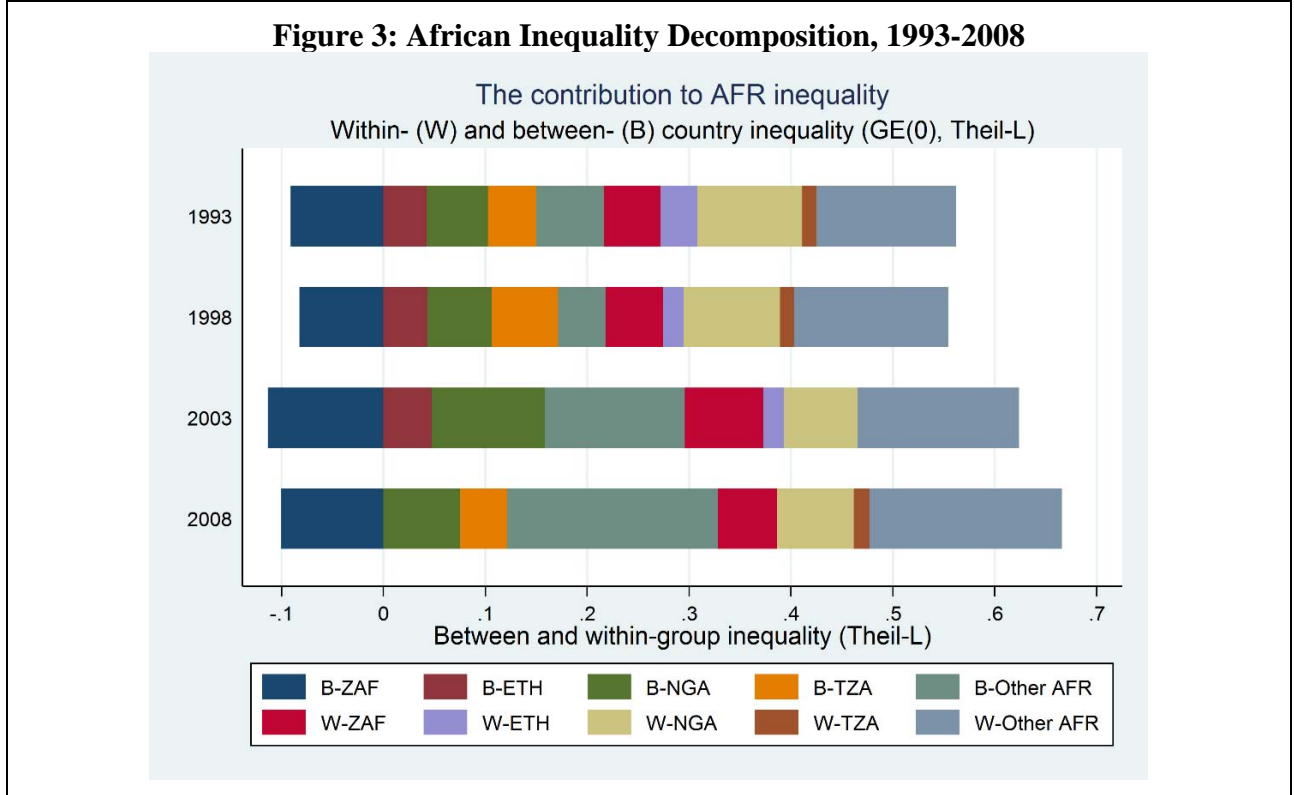
$$T_L = \sum_{i=1}^{N} \frac{1}{N} \ln\left(\frac{\bar{Y}}{y_i}\right) = \sum_{g=1}^{G} \frac{N_g}{N} I_g + I_B$$

where y_i is the consumption of percentile group i, $\bar{Y}$ is average SSA-wide consumption, N is total SSA population, G is the number of countries and N_g is the population of group g. I_g is the inequality in consumption within country g, i.e. the within-country Theil-L index. I_B is the inequality between groups, which is defined as

$$I_B = \sum_{g=1}^{G} \frac{N_g}{N} \ln\left(\frac{\bar{Y}}{\overline{Y_g}}\right) = \sum_{g=1}^{G} \frac{N_g}{N} \left(\ln(\bar{Y}) - \ln(\overline{Y_g})\right)$$

In other words, I_B uses the difference in mean consumption between group g and the overall mean $\bar{Y}$. The between-component of group g will be negative if $\ln(\bar{Y}) < \ln(\overline{Y_g})$.

[35] Furthermore, the within-country Gini index for Nigeria declined from 45% in 1993 to 43% in 2008.

[36] For example, China's population accounts for about 70% of the EAP population in the latest benchmark year 2012. On the other hand, Nigeria – the largest country in terms of population – accounts for about 18% of the African population in 2008.

VI. Growth Incidence Curves

Average consumption in Africa as a whole increased by approximately 15% (or 0.92% per annum) between 1993 and 2008 (Table 3, Panel H), which is a very low growth performance. In terms of average consumption expenditure, resource-rich countries have performed better than the overall African average. Average consumption in upper middle/high income countries grew faster than in lower middle income countries, while there was a decline in low income countries.

The African (anonymous) growth incidence curve (GIC) (Figure 4) shows how the growth in mean consumption expenditure of less than 1% per year was distributed along the distribution.[37] For example, it shows how the average consumption of the bottom 5% in 1993 compares with the average consumption of the bottom 5% in 2008. Growth was particularly high for the top 5% of the distribution, whose average consumption grew at around 2% per year. The GIC is upward sloping throughout, so higher income groups benefited relatively more from growth between 1993 and 2008, and inequality increased. Consumption expenditure declined for the poorest 10% of Africans. The growth rates for all ventiles except the very top ventile were less than the growth of the mean, shown by the dashed red line. Furthermore, the bottom 30% of the distribution had a negative consumption growth and there were nearly no gains between the 30th and 40th percentile groups. The GIC drawn over the original decile groups without imputing the Lorenz curve also exhibits the same upward sloping shape (not shown here). When we use the balanced sample (i.e. the same set of countries in 1993 and 2008), the growth rate for the bottom 5% becomes positive, but it is important to note that the result of stagnation for the bottom 30% remains unchanged (not shown here).

Figure 5 splits up this 15-year period into the five-year growth spells between the intermediate benchmark years. The upward-sloping shape of the 15-year GIC appears to be mostly driven by the period between 2003 and 2008, while the gain at the very top occurred mostly between 1998 and 2003. We also show the ten-year GIC between 1998 and 2008, since the constituent five-year periods show almost completely opposite growth patterns.

By comparison, the growth in mean consumption expenditure was much higher in EAP over this period. Between 1992 and 2007 the EAP mean increased by 6% per annum, with the poorest part of the distribution growing at 4% per annum. While the growth process was also pro-rich in EAP (i.e. the GIC is upward-sloping), the (already modest) consumption growth in Africa appears to be distributed even more unequally, especially at the very top.

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[37] Our definition of the GIC follows Lakner and Milanovic (2015) but is slightly different from the original definition by Ravallion and Chen (2003) who plot the growth rate of consumption of a particular fractile (not the fractile group). In other words, the GIC as defined by Ravallion and Chen is derived by inverting the cdf and taking the growth rate. Hence it offers a straightforward test of first-order stochastic dominance. The two approaches differ mostly in the tails and we would argue that our approach is more informative. In the original GIC drawn over ventiles, the highest income group would be the 95th percentile. This curve would fail to show any income growth that occurs within the top 5%, while our approach would average over this.

Figure 4: African Growth Incidence Curve (GIC), 1993-2008

African Growth Incidence Curve (fractile groups), 1993-2008

Annualised growth rate in average consumption expenditure of the fractile group (not the fractile). Weighted by population. Growth incidence evaluated at ventile groups (e.g. bottom 5%). The horizontal line shows the growth rate in the mean of .92%.
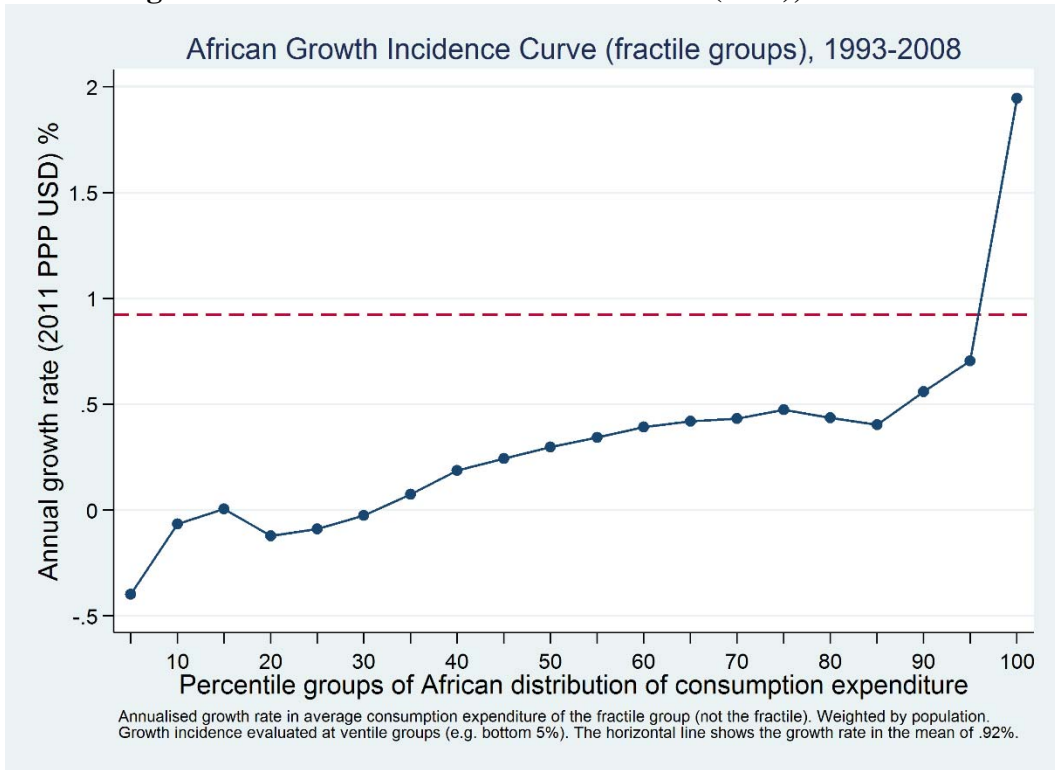
Figure 5: African GICs (between the Four Benchmark Years)

African Growth Incidence Curve (fractile groups), over time

Annualised growth rate in average consumption expenditure of the fractile group (not the fractile). Weighted by population. Growth incidence evaluated at ventile groups (e.g. bottom 5%).

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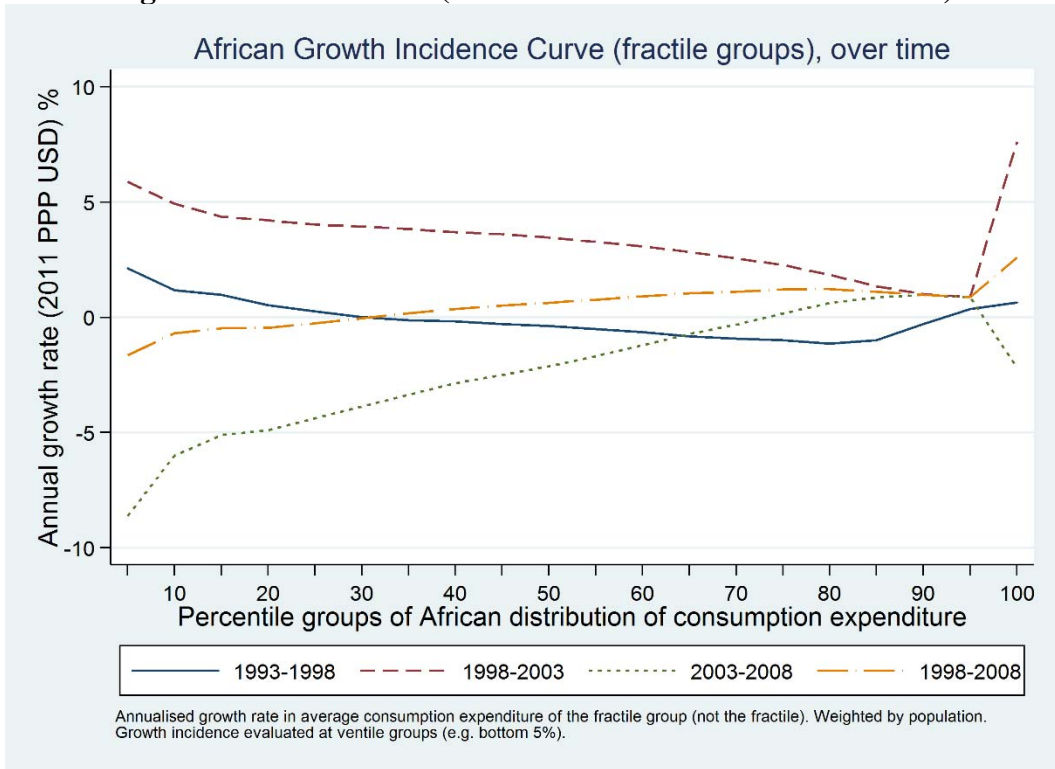
It is important to stress that all the gains we discussed so far are relative gains. Of course, these translate into quite different absolute gains in annual consumption expenditure depending on the money amount in the base year. Figure 6 repeats the African GIC but uses the absolute gain (per annum) in annual consumption expenditure on the y-axis instead of the relative gain. It is thus very similar to taking the difference between the Pen's Parade (or quantile function) in 2008 and 1993.[38] Precisely because the absolute gains are so different, the y-axis uses an inverse hyperbolic sine transformation instead of a linear scale.[39] Between 1993 and 2008, the top 5% of Africans added more than $100 per annum to their consumption expenditure, compared with $1 per annum for the 40th percentile group.

Yet another way of capturing the distribution of these gains is to look at the total gain in consumption expenditure between 1993 and 2008, and ask what share of this gain is received by different quantiles of the distribution.[40] Figure 7 shows that 39.4% of the total gain in consumption between 1993 and 2008 went to the top 5% of the African distribution, while the bottom 40% received 8.5%, i.e. around one quarter of the gain by the richest 5%. In EAP, the growth between 1988 and 2012 was more equally. For example, the top 5% received 20.8% of the total gain, compared with 13.2% for the bottom 40%.

In addition, a simple numerical example might help to put these gains into perspective. Between 1993 and 2008, the 13th ventile (between 65th and 70th percentile) grew by around 0.42% per annum, slightly faster than the 17th ventile (between 80 to 85) (0.40% per annum) (Figure 4). However, the 13th ventile started with an annual consumption of PPP-2011 $829 in 1988 compared with PPP-2011 $1,517 for the 17th ventile. At the end of this period, they ended up with PPP-2011 $883 and PPP-2011 $1,611 respectively. Therefore, although both groups experienced comparable growth in their consumption, one group gained PPP-2011 $54 while the other gained PPP-2011 $94, implying of course quite different improvements in living standards.

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[38] The Pen's Parade has incomes on the vertical axis for a number of quantiles along the horizontal axis (Ravallion, 2014b), or in other words, it is the inverse cumulative distribution function. Our chart is defined somewhat differently: Instead of showing quantile incomes (e.g. the income of the 5th percentile), we show average incomes for a quantile *group* (e.g. the average income of the bottom 5%).

[39] The inverse hyperbolic sine transformation (Burbidge et al., 1988) is similar to a logarithmic scale but can also accommodate negative values which occurs for the bottom quantile groups.

[40] Such a comparison does not account for changes in total population. For example, Figure 4 showed that the average income of the bottom 5% fell by around 0.5% per year, while Figure 7 still shows a positive gain in total income for this group. Because population grew faster (at 3.4% per year) than total consumption (at 3% per year), the consumption for the average African in the bottom 5% fell.
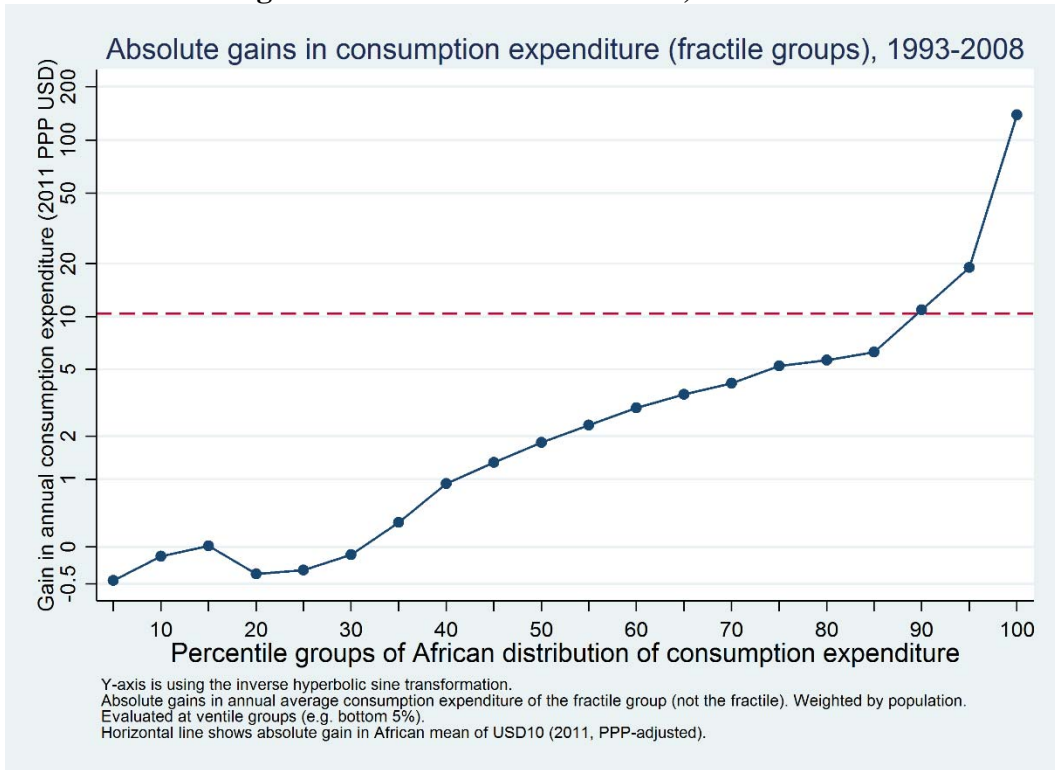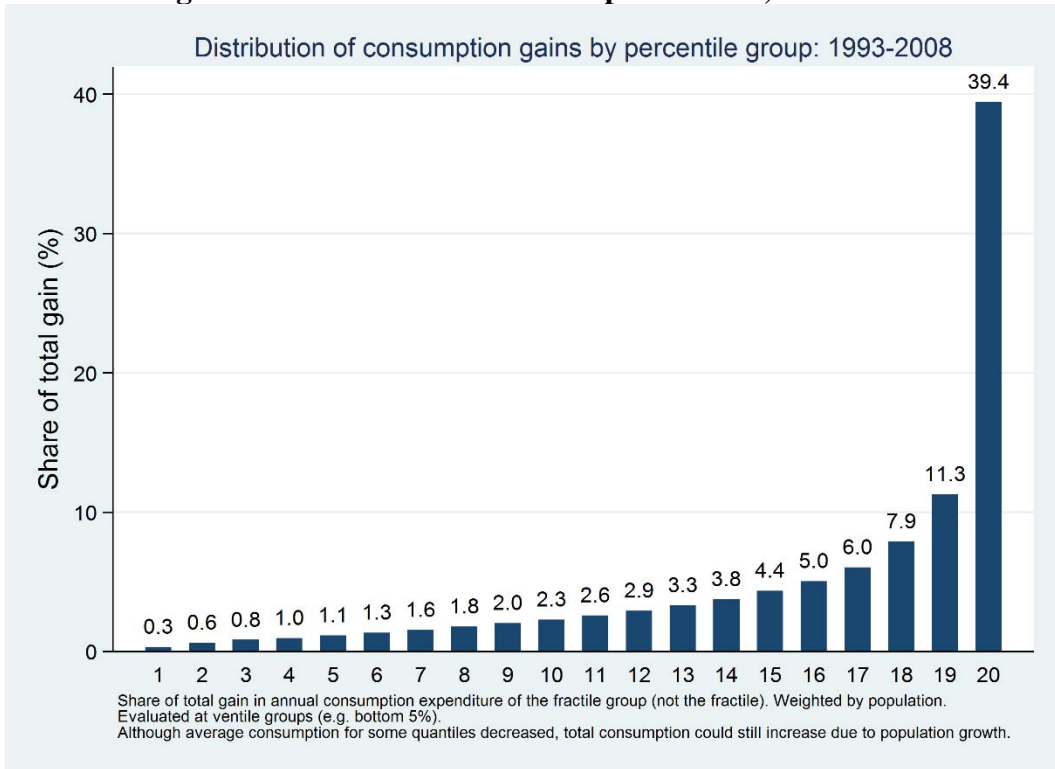
Figure 6: African Absolute Gains, 1993-2008

Absolute gains in consumption expenditure (fractile groups), 1993-2008

Y-axis is using the inverse hyperbolic sine transformation.
Absolute gains in annual average consumption expenditure of the fractile group (not the fractile). Weighted by population.
Evaluated at ventile groups (e.g. bottom 5%).
Horizontal line shows absolute gain in African mean of USD10 (2011, PPP-adjusted).

Figure 7: Distribution of Consumption Gains, 1993-2008

Distribution of consumption gains by percentile group: 1993-2008

Share of total gain in annual consumption expenditure of the fractile group (not the fractile). Weighted by population.
Evaluated at ventile groups (e.g. bottom 5%).
Although average consumption for some quantiles decreased, total consumption could still increase due to population growth.

This discussion of absolute versus relative gains links directly to the choice between absolute and relative measures of inequality (Kolm, 1976).[41] All the standard measures of inequality considered so far are relative measures of inequality (Table 2, Panel A). In Panel D of Table 2, we report the absolute Gini index which increased by almost 25% over this period, consistent with Figure 7.[42] In sum, whether one thinks that inequality increased moderately (e.g. Gini increased by 8.6%) or very strongly (e.g. absolute Gini increased by 25%), depends on whether one cares about relative or absolute gains.[43]

VII.   Using GDP per Capita Instead of Survey Consumption

Splitting countries according to their GDP per capita reflects these patterns in the African distribution only to some extent.[44] There are of course very good reasons for this, such as definitional differences, or the fact that GDP per capita does not reflect distributional characteristics.[45] There exists an extensive literature on the gap between national accounts and household survey consumption or income, which we do not intend to review here.[46] For example, Figure 8 plots the national accounts gap across countries in 2008.[47] It is clear that the gap is larger in upper middle countries compared with low income countries. Furthermore, six of the ten countries with the largest gap are natural resource rich. It is important to recognize that the World Bank's Twin Goals are direct measures of individual welfare (based on household surveys), and constitute a move away from focusing exclusively on low-middle-high income country status or GDP growth.[48]

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[41] Standard inequality measures, such as the Gini index, are relative or scale-invariant. This means that they are unchanged by a proportional transformation, such as a doubling of all incomes. However, such a change would increase the absolute gap between individuals, and thus increase absolute measures of inequality. An absolute measure is translation-invariant, i.e. it is unchanged by an additive change, such as adding $100 to everyone's incomes.

[42] The absolute Gini is defined as $AbsGini(X) = Gini(X) \times \bar{X}$, where $Gini(X)$ is the relative Gini and $\bar{X}$ is the mean.

[43] The empirical evidence as to whether individuals perceive inequality as absolute or relative is mixed (Amiel and Cowell, 1999; Ravallion, 2004).

[44] Below we use GDP and GNI per capita interchangeably, as the main point we make pertains to the use of national accounts based measures more generally.

[45] Because GDP per capita does not reflect within-country inequality, it cannot be used to derive a measure of regional interpersonal inequality. This is an example of a concept 1 type measure, using the Milanovic (2005) classification reviewed in the introduction.

[46] National accounts based measures of per capita household consumption typically exceed those measured in household surveys (Deaton, 2005). Especially relevant for our paper, there exists a substantial strand of the global inequality literature which anchors a country's mean income to GDP per capita (Bourguignon and Morrisson, 2002; Sala-i Martin, 2006; Chotikapanich et al., 2012; Pinkovskiy and Sala-i-Martin, 2014; Chotikapanich et al., 2015). Anand and Segal (2008) argue that GDP per capita is not an appropriate measure of household income. Furthermore, Lakner and Milanovic (2015) suggest that the national accounts gap is unlikely to be distributionally neutral, and could be related to the underestimation of top incomes in household surveys.

[47] The gap is defined as the ratio of mean per capita consumption from household surveys to GDP per capita.

[48] The World Bank's Twin goals are defined respectively as (1) "reducing to no more than 3 percent the fraction of the world's population living on less than $1.25 per day", and (2) "shifting from a focus on average economic growth to promoting income growth among the bottom 40 percent of people [in every country]" (World Bank, 2014). Atkinson (2013) suggests that economic performance should be assessed by a new indicator that is a more direct measure of household living standards and also accounts for distributional characteristics. Such arguments are closely related to

Classifying countries into income groups according to their GNI per capita ignores the substantial overlap that exists in their distributions of consumption expenditure. In Figure 9 we have split the African distribution of consumption expenditure in 2008 into 20 ventiles, each representing 5% of the African distribution. For each ventile, the chart shows the share of the population that comes from low, lower middle, and upper middle/high income countries.[49] In 2008, 54% of the population in the top 5% of the African distribution come from upper middle/high income countries, 36% from lower middle income countries and 10% from low income countries. Not surprisingly, the share of population from upper middle/high income countries increases as one moves up the distribution, while the share of the population from lower income countries declines. In other words, better-off Africans are more likely to live in upper middle/high income countries. However, it is clear that there is a lot of overlap across these country classifications.

In Figure 10 we focus on the top 10% of the African distribution in 2008, which of course could be repeated for other deciles or other benchmark years. A positive (negative) value implies that the share of a particular country in the African top 10% exceeds (is less than) the share of that country in the African population, i.e. it is over-(under-)represented in the top 10% relative to its population size.[50] Countries are ranked according to their GDP per capita, so one would expect the bars to become more positive as one moves to the right. But the extent to which countries with a similar rank of GDP per capita are represented at the very top shows some interesting variation. For example, Swaziland has a higher GDP per capita than Cabo Verde, but its population share at the top is lower. Similarly, Nigeria is richer than Côte d'Ivoire, but it is underrepresented in the regional top 10%, controlling for its population. While the three African countries with highest GDP per capita are very small in terms of population (0.5% of the regional population), their citizens represented almost 3% of the top African decile.[51]

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the conclusions from the Stiglitz-Sen-Fitoussi commission, and the emerging work on Distributional National Accounts (DINA).

[49] We use the World Bank's income groups from Fiscal Year 2014. Countries are classified according to their GNI per capita in 2012 using exchange rates based on the Atlas method.

[50] In this comparison, population shares are defined relative to the total population covered by the surveys included in the database.

[51] By comparison, the population from the top three East Asian countries accounted for about 88% of the regional population, and their citizens made up about 77% of the top East Asian decile.
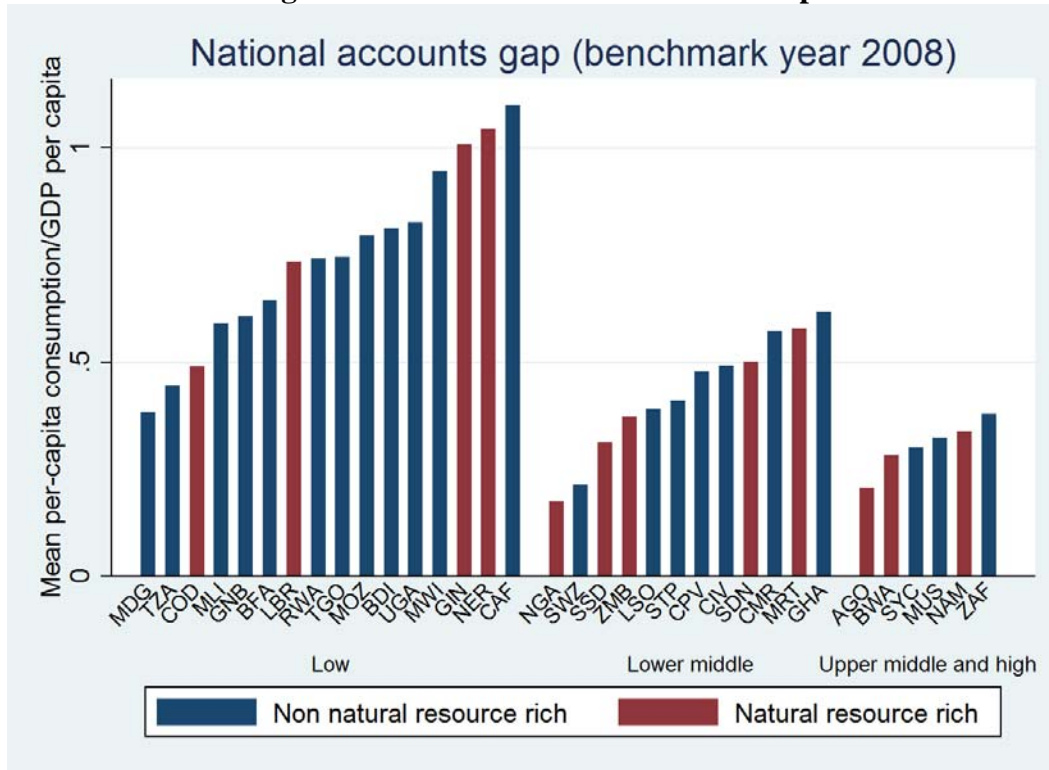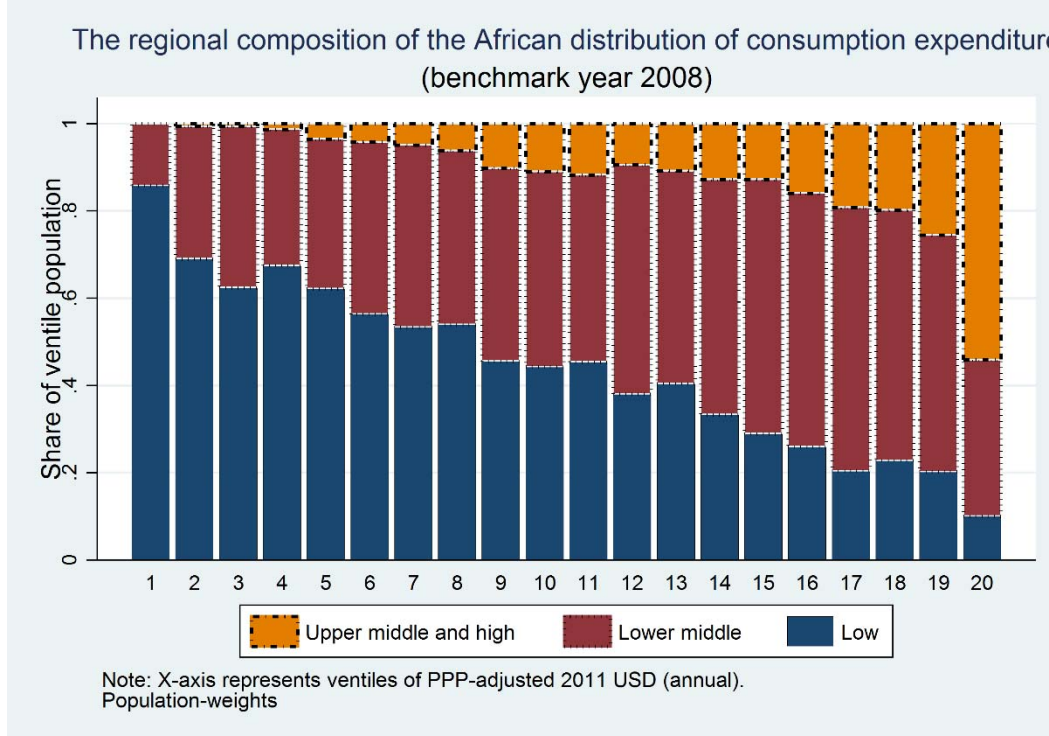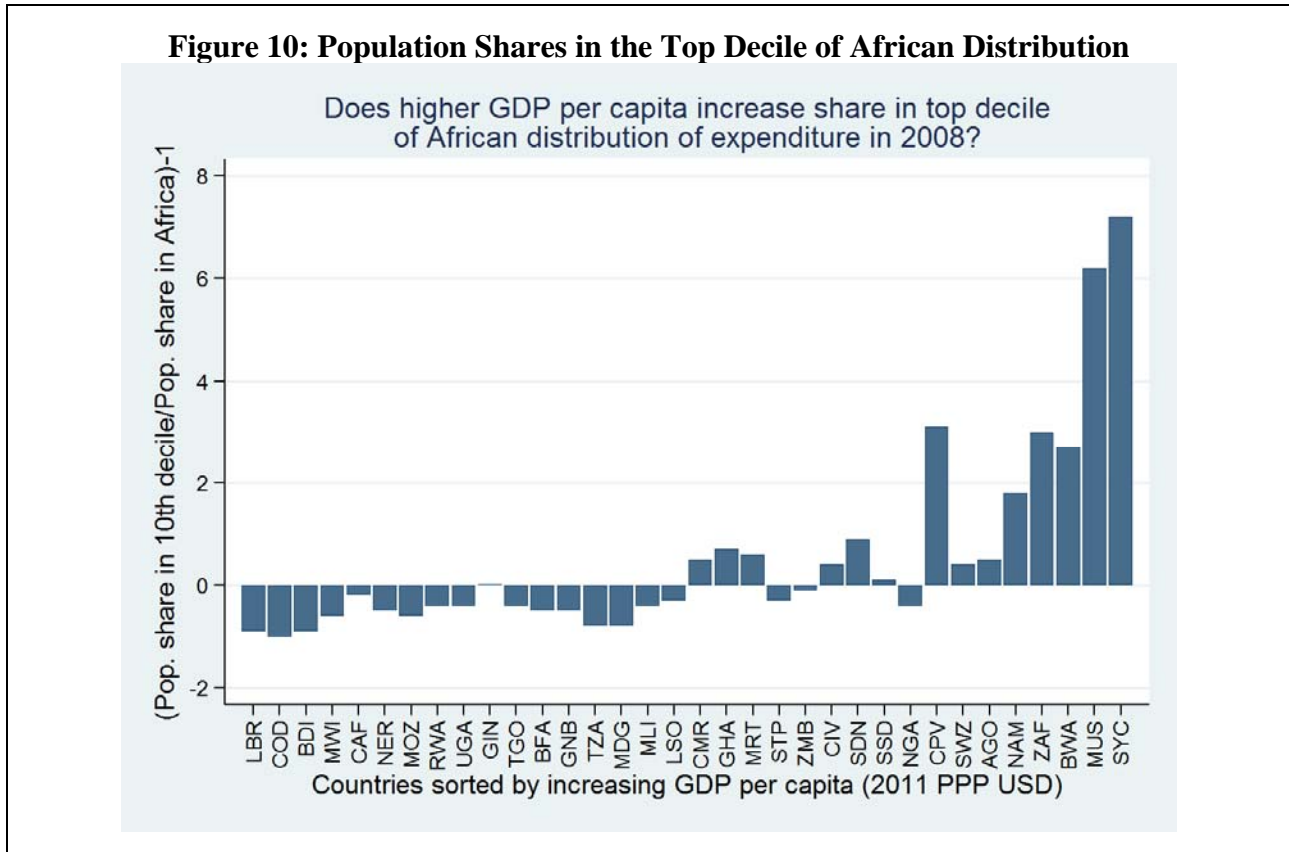
Figure 8: African National Accounts Gap

Figure 9: Regional Composition of African Distribution of Consumption Expenditure

Figure 10: Population Shares in the Top Decile of African Distribution

VIII. Relative Movements over Time: Winners and Losers

The analysis up to this point only considered the cross-sectional distribution without asking which countries and which groups within these countries might explain these overall regional patterns. For example, the African GIC showed that the consumption expenditure of the bottom third of the respective regional distributions hardly grew or even declined slightly (Figure 4). However, the bottom third in 1993 and 2008 could be quite different individuals.

To evaluate the relative success of different country-percentiles we compare their position in the Africa-wide distribution and how it changed over time.[52] In Figure 11 the within-country position is shown on the horizontal axis, while the vertical axis plots the position in the regional distribution. For example, in 2008 the 20th percentile group in Ghana is around the regional median, while the same within-country group in Rwanda only reaches the bottom 10% regionally. We have shown this for a number of countries and years, while this can obviously be repeated for every country-year. For Nigeria, the figure is almost straight line, i.e. the national percentiles are very close to the

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[52] We compare the movement of a particular country-decile over time in the regional distribution. It is important to recognize that these deciles might consist of quite different people, as long as there is mobility within the national distribution. See the discussion in Lakner and Milanovic (2015) on the non-anonymous growth incidence curves.

regional percentiles. This is because of both Nigeria's population size and the fact that its growth has been broadly in line with that of the regional distribution as a whole.

In 1993, the percentile groups from both South Africa and Côte d'Ivoire had their position at the top of the regional distribution. In addition, comparing to other countries in the region, their bottom percentile groups were ranked relatively better. South Africa's percentile groups have maintained their relatively high regional ranks over the 15-year period. Côte d'Ivoire has lost out while Ghana's and Uganda's percentile groups have improved their regional positions. Among the countries with relatively lower ranks in the regional distribution, citizens in the bottom half of Rwanda attained rather similar regional positions across the years.

Figure 11: Position of National Deciles in the African Distribution
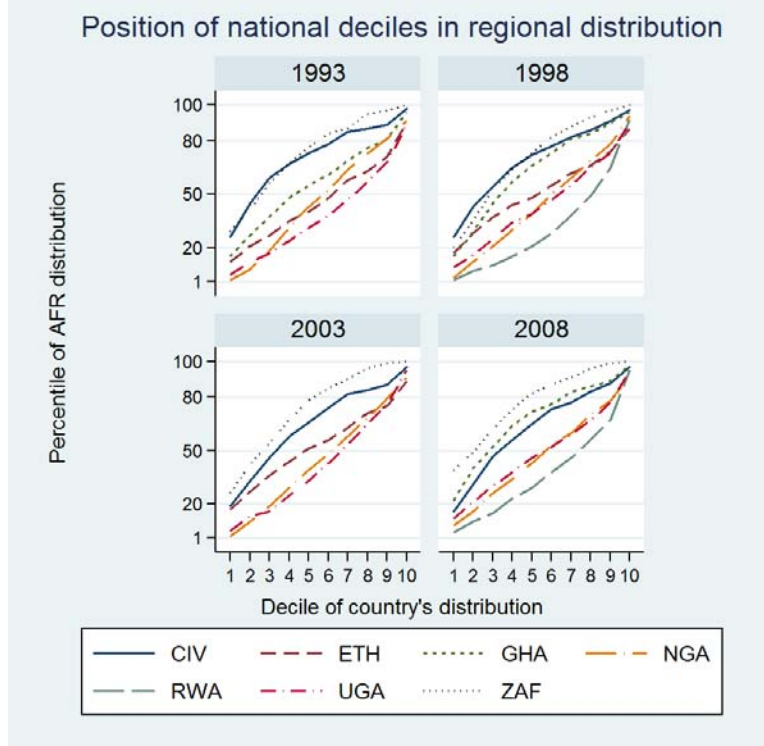
IX.   Conclusion

In this paper, we have ignored national boundaries and provided a regional perspective on interpersonal inequality for Sub-Saharan Africa as a whole. Our analysis implicitly relies on an African-wide social welfare function which treats persons irrespective of their country of residence. This approach puts levels of within-country inequality into context with differences that exist within Africans taken together. Furthermore, such a perspective might be relevant for the study of migration flows within the region.

The region's mean consumption expenditure per capita has grown slowly between 1993 and 2008, at around 1% per year. However, this modest growth was distributed unequally, and the bottom

third of the distribution did not grow at all. As a result, regional inequality increased, which is robust to the choice of inequality measure. This rise in regional inequality was driven by increasing inequality between countries, i.e. increasing dispersion in average living standards across countries. This contrasts with results at the global and East Asia level where within-country inequality increased.

The share of the regional population that is covered by a household survey that can be included in our database increased from 68% to 76% over this period. However, around a quarter of the population remains uncovered, and they are likely to live in some of the poorest countries in the region. Therefore, it is plausible that the estimates of inequality presented here are a lower bound on the true inequality. In addition, the latest available benchmark year is 2008, while GDP per capita has grown strongly since then. Thus it would be interesting to understand whether this growth at the macro level translated into gains in household consumption and what its distributional incidence was.[53] In order to move forward with this research agenda, we thus need more recent data and better coverage of the poorest countries, for which there is an emerging consensus among a number of actors (e.g. World Bank, 2015).

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[53] Between 2009 and 2014, regional real GDP in Sub-Saharan Africa grew at 5% on average (IMF, *World Economic Outlook* 2015), compared with the average real growth of 4.8% during 1993 and 2008 (the period analyzed in this paper). In fact, during the latter period, Africa grew faster than other regions except Asia for which average real growth was about 6%. Furthermore, Sub-Saharan Africa avoided the slowdown experienced globally and in all regions except Asia. Nonetheless, it is important to note that population growth in Africa has been stronger than in other regions (about 2.4% per annum during 1993 and 2008, and 3% per annum during 2009 and 2014).

Appendix: Robustness Checks

We include three robustness checks on our main estimates of African inequality. First, we restrict the sample to those countries that are present in both 1993 and 2008. Second, we use the raw data set of decile groups without the imputation of a parametric Lorenz curve. Third, we check for the robustness to using the older set of PPP exchange rates for 2005. Table A1 summarizes the robustness checks on the inequality results which were already discussed in the main text. Below, we will discuss the results with the 2005 PPPs in more detail.

Table A1: African inequality								
	1993	**change (%, pp)**	**1998**	**change (%, pp)**	**2003**	**change (%, pp)**	**2008**	**1993-2008 change (%, pp)**
i. Regional inequality (from Table 3)								
Gini index (%)	51.68	0.92	52.16	3.78	54.13	3.69	56.12	8.59
GE(0) (Theil-L)	0.47	0.16	0.47	8.21	0.51	10.74	0.57	20.02
GE(0) within contribution (%)	73.41	-2.11	71.29	-7.03	64.26	-4.57	59.69	-13.72
ii. Regional inequality - Deciles								
Gini index (%)	51.08	1.04	51.62	3.91	53.63	3.66	55.59	8.83
GE(0) (Theil-L)	0.46	0.17	0.46	8.60	0.50	10.98	0.55	20.73
GE(0) within contribution (%)	72.65	-2.17	70.48	-7.10	63.38	-4.59	58.79	-13.86
iii. Regional inequality - 2005 PPP-adjusted USD								
Gini index (%)	52.25	0.15	52.33	6.66	55.82	1.79	56.82	8.74
GE(0) (Theil-L)	0.48	-1.45	0.48	14.77	0.55	5.05	0.57	18.81
GE(0) within contribution (%)	71.58	-0.92	70.66	-10.61	60.05	-1.25	58.80	-12.78
iv. Regional inequality - Balanced sample								
Gini index (%)	53.46	1.00	53.99	9.43	59.08	-4.04	56.69	6.05
GE(0) (Theil-L)	0.51	-0.92	0.51	22.02	0.62	-9.02	0.56	10.00
GE(0) within contribution (%)	72.30	-1.90	70.40	-9.91	60.49	1.68	62.17	-10.14

Notes: For the decompositions by country, changes between benchmark years are in percentage points. For all other rows, changes are measured in percent (not annualised). Observations are weighted using population. Using dataset of 100 percentile groups per country-year, based in part on a parametric Lorenz curve.

New PPP exchange rates become available periodically, reflecting new collections of international price data. Recently, the World Bank adopted the 2011 PPP exchange rates for its measurement of global poverty. Ferreira et al. (2015) provide a detailed explanation of how the World Bank adopted these new PPP exchange rates, and in particular how the international poverty line was updated. The changes for the global extreme poverty headcount have been small. For example, in 2011, the global poverty rate falls from 14.5% to 14.1% when moving from the 2005 PPPs (with a poverty line of $1.25) to the 2011 PPPs (with a poverty line of $1.90).

According to Table A1, the revision of the PPP exchange rates only had a small effect on the level of regional inequality. But it could potentially lead to a re-ranking of countries, even though these effects cancel out in the aggregate. With the GE(0) inequality measure, African inequality consists of three components (see the formula in footnote 32): (1) a country's population size; (2) its level of inequality; and (3) its position in the African distribution captured by the country mean. Because of a substantial change in relative price levels (Ferreira et al., 2015), the change to 2011 PPPs

would affect African inequality through the third component of the decomposition. In other words, if relative price levels remained the same, i.e. all incomes are multiplied by the same factor, African inequality would not change for a scale-invariant measure such as GE(0). Of course, the overall effect of a change in relative prices will depend also on the country's population size.

The ranking of countries by their mean consumption changed quite substantially as a result of the new PPPs in the middle group of countries, while the tails remained largely similar. Figure A1 plots the rank of a country in the distribution of 2011 PPP means against its rank according to the 2005 PPP means (all for benchmark year 2008). Relative to other African countries, Nigeria and Zambia improved their ranking as a result of the 2011 PPPs. This means that its price level declined between the 2005 and 2011 ICPs, leading to an improvement in consumption expenditure in real terms. While this re-ranking analysis is useful as a first step, it misses a number of elements which are important for assessing the effect on African inequality, such as differences in population sizes and the absolute size of the movement.[54]

Figure A2 offers a more direct look at the effect of the PPP change on between-group inequality. We plot the contribution of differences between countries to overall inequality for all countries for which we have data in the 2008 benchmark year. The chart is very similar to Figure 3 in the main text. The two bars show the contribution under 2005 and 2011 PPPs respectively. As the previous chart showed, the new PPP data led to a downward revision of the price level in Nigeria and Zambia relative to countries with similar means. Because the between-group inequality component includes population weights, the contribution to overall GE(0) inequality has been much smaller for Zambia than Nigeria. Among the largest changes, DRC, Mozambique and Tanzania increased their contribution to total inequality, while Madagascar, Nigeria and Zambia moved in the opposite direction. Angola changed from a positive to a negative contribution, its mean thus moving across the regional mean. Given that the revision of the PPP exchange rate hardly affected the overall level of inequality, the negative and positive effects on the between component largely cancelled out.

Instead of considering a specific measure of inequality, Table A2 looks at the entire African distribution. Each decile of the 2008 African distribution was split according to the population contribution from each country (similar to Figure 9). The table shows the change in these population contributions as a result of the change in PPP exchange rates. As a result of the new PPP exchange rates, DRC increased its population share in the bottom decile by 12.1 percentage points (from 37% to 49% of the African population in the poorest decile). In contrast, the share of Mozambique in the eighth African decile decreased by 1.8 percentage points (from 3.3% to 1.5%). Given its population size, Nigeria had the largest upward movement, while Angola, Madagascar, Sudan and Zambia moved in the same direction. On the other hand, DRC, Mozambique, Tanzania and South Africa have reduced their shares in higher percentiles.

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[54] In other words, the between-component in the GE(0) decomposition relies on log-differences in mean consumption, not differences in ranks. Furthermore, we use population weights throughout, so the size of the country obviously matters.

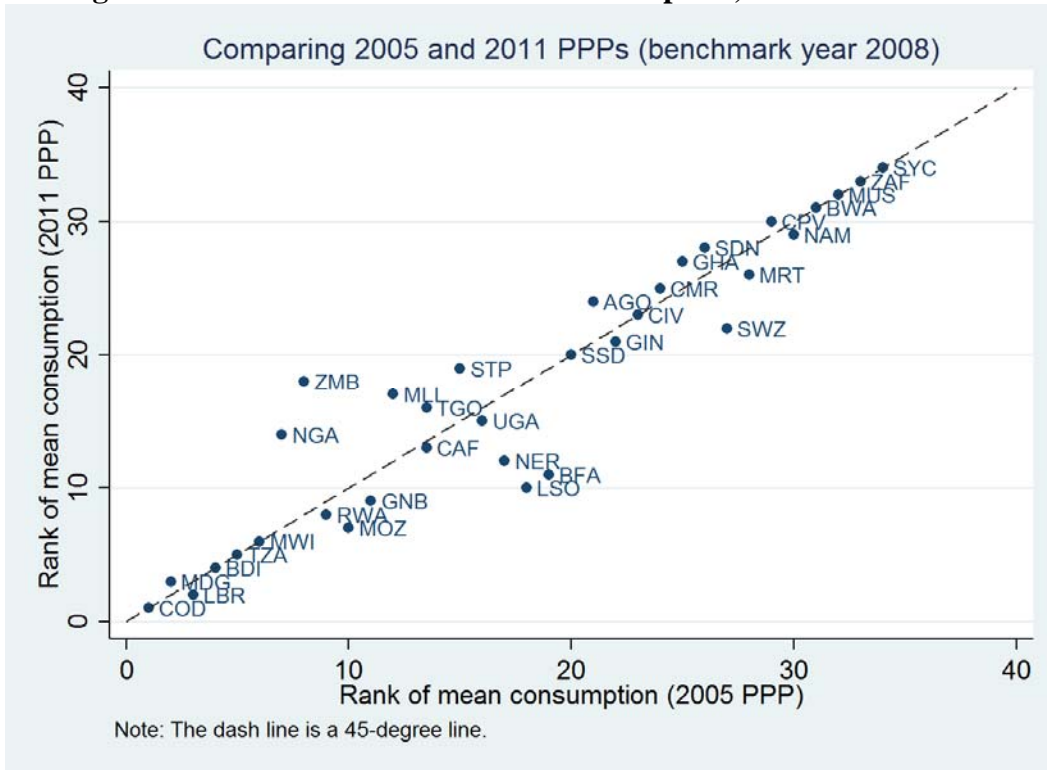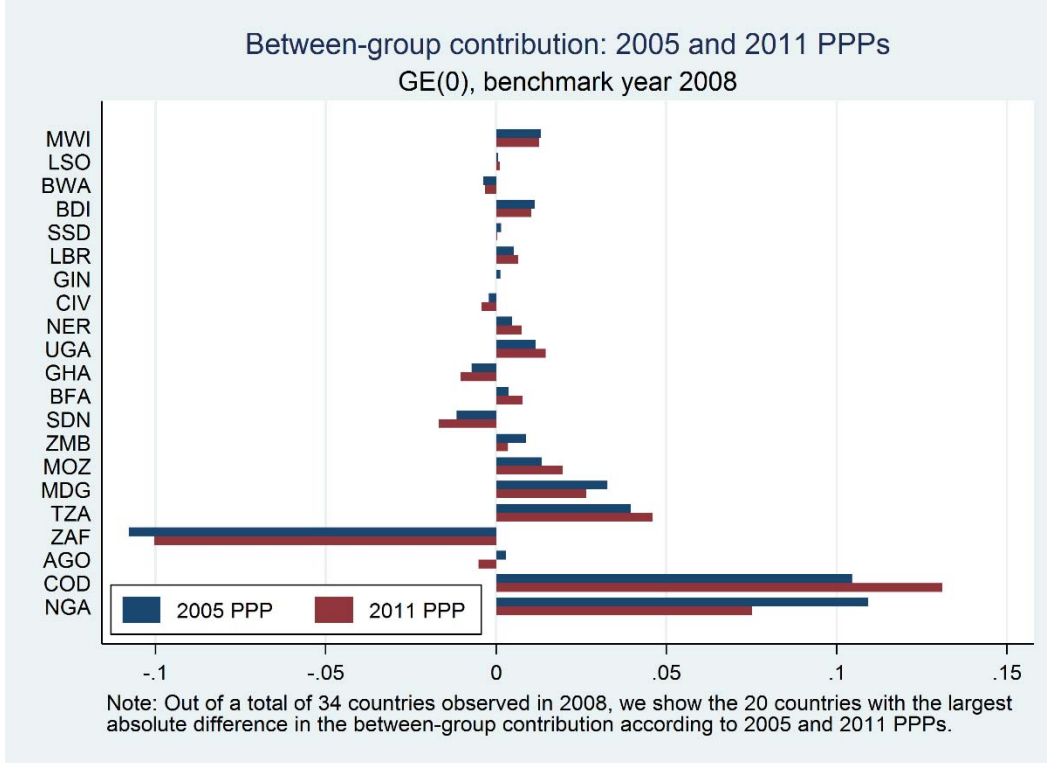**Figure A1: African Ranks of Mean Consumption, 2005 vs 2011 PPPs**

Note: The dash line is a 45-degree line.

Figure A2: Between-group Contribution to African Inequality, 2005 vs 2011 PPPs

Note: Out of a total of 34 countries observed in 2008, we show the 20 countries with the largest absolute difference in the between-group contribution according to 2005 and 2011 PPPs.

Table A2: Effect of 2011 PPPs on Entire African Distribution										
[Population share with 2011 PPP] - [Population share with 2005 PPP]										
for each decile of African distribution (percentage points)										
Country	Poorest	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Richest
Congo, Dem. Rep.	12.1	0.2	-2.8	-1.9	-3.8	-1.0	0.0	-1.9	-0.9	-0.9
Liberia	0.6	0.3	0.0	-0.1	-0.2	-0.2	-0.1	-0.1	-0.1	0.0
Madagascar	-3.3	-0.9	0.7	0.9	0.6	0.9	0.3	0.0	0.3	0.3
Burundi	-0.1	-0.5	0.2	0.1	0.1	0.1	0.0	0.1	0.0	0.0
Tanzania	1.9	1.5	0.7	1.3	-0.8	-0.7	-1.9	-0.7	-1.3	0.0
Malawi	-0.3	0.0	0.0	0.2	0.0	0.0	0.3	0.0	0.0	-0.2
Mozambique	1.4	1.2	1.1	0.3	-0.4	-0.7	-0.3	-1.8	0.0	-0.7
Rwanda	-0.1	0.0	0.2	0.2	0.0	0.0	-0.3	0.0	0.2	-0.2
Ginuea-Bissau	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lesotho	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1
Burkina Faso	0.2	1.4	0.3	0.7	0.2	0.2	-0.7	-0.9	-0.7	-0.7
Niger	0.2	0.2	1.2	0.2	0.4	0.0	-0.2	-1.2	-0.7	-0.2
Central African Republic	0.1	0.1	0.0	0.1	0.0	-0.1	0.0	-0.1	-0.1	-0.1
Nigeria	-10.0	-2.1	-2.2	-2.5	2.2	2.3	2.9	4.9	2.5	2.4
Uganda	0.5	1.1	0.5	0.0	0.5	-0.5	0.1	-0.5	-0.5	-1.0
Togo	0.0	0.1	0.1	0.1	0.0	0.1	-0.1	-0.1	-0.1	-0.1
Mali	-0.2	0.0	0.2	0.0	0.0	0.2	-0.2	0.0	0.0	0.0
Zambia	-1.9	-0.4	0.2	0.2	-0.2	0.4	0.4	0.2	0.6	0.4
São Tomé and Principe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
South Sudan	-0.2	-0.3	0.2	-0.1	0.1	0.0	0.0	0.1	0.0	0.1
Guinea	0.0	-0.2	-0.3	0.2	-0.2	0.2	-0.1	0.2	0.2	0.2
Swaziland	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
Côte d'Ivoire	0.0	-0.3	-0.3	0.0	0.0	0.0	0.1	0.0	0.0	0.6
Angola	-0.6	-1.5	-0.6	0.0	-0.6	-0.6	0.1	0.9	1.2	1.8
Cameroon	0.0	0.0	0.0	0.3	0.0	0.0	0.1	0.3	-0.6	0.0
Mauritania	-0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0	-0.1	0.0
Ghana	-0.4	0.0	-0.4	0.0	0.0	-0.4	-0.3	0.4	0.4	0.7
Sudan	0.0	-0.5	0.0	-1.1	0.0	0.0	-0.4	0.0	0.6	1.6
Namibia	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	-0.1
Cabo Verde	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Botswana	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.0	-0.2
Mauritius	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-0.1
South Africa	0.0	0.0	0.8	0.8	2.3	0.0	0.1	0.0	-0.8	-3.3
Seychelles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: Countries are sorted according to their mean consumption expenditure per capita in 2011 PPPs.

Table A3: Comparison of population in sample and rest of Africa						
		Benchmark year				Total
		1993	1998	2003	2008	
GDP per capita (2011 PPP)	All	2269	2327	2446	3075	2347
	Sample	2542	2527	2720	3456	2596
	Out of sample	1637	1795	1750	1793	1727
Share middle/high income countries (%)	All	10	10	10	9	10
	Sample	10	12	10	12	11
	Out of sample	9	3	8	1	7
Fragile (%)	All	27	27	27	27	27
	Sample	12	8	13	28	11
	Out of sample	60	74	60	23	65
Resource rich (%)	All	42	42	42	42	42
	Sample	35	32	38	51	35
	Out of sample	58	68	52	12	59
Aid per capita (current USD)	All	1849	1302	2233	2632	1795
	Sample	1551	1274	1538	2530	1454
	Out of sample	2514	1372	3932	2953	2606

Notes: Population weighted. The last column is the (unweighted) average over the benchmark years 1993 to 2008.

References

Abdelkrim, A. and J. Y. Duclos: 2007, "DASP: Distributive Analysis Stata Package", PEP, World Bank, UNDP and Université Laval.

Aguiar, M. and M. Bils: 2015, "Has Consumption Inequality Mirrored Income Inequality?", American Economic Review, 105(9), 2725-56.

Amiel, Y. and F. Cowell: 1999, "Thinking about Inequality", Cambridge University Press.

Anand, S. and P. Segal: 2008, "What Do We Know about Global Income Inequality?", Journal of Economic Literature, 46 (1), 57–94.

Anand, S. and P. Segal: 2015, "Chapter 11 – The Global Distribution of Income", In Atkinson A. B. and F. Bourguignon, Eds. "Handbook of Income Distribution", 2, 937-979.

Atkinson, A. B.: 1970, "On the Measurement of Inequality", Journal of Economic Theory, 2(3), 244-263.

Atkinson, A. B.: 2013, "Putting People First and Macro-economic Policy", Working paper, University of Oxford.

Atkinson, A. B. and A. Brandolini: 2010, "On Analyzing the World Distribution of Income", The World Bank Economic Review, 24(1), 1-37.

Beegle, K., L. Christiaensen, A. Dabalen, and I. Gaddis: 2016, "Poverty in a Rising Africa: Africa Poverty Report", The World Bank: Washington DC.

Beegle, K., J. De Weerdt, J. Friedman, and J. Gibson: 2012, "Methods of Household Consumption Measurement through Surveys: Experimental Results from Tanzania", Journal of Development Economics, 98(1), 3-18.

Bourguignon, F., and C. Morrisson: 2002, "Inequality among World Citizens: 1820-1992", American Economic Review, 92(4), 727-744.

Burbidge, J. B., L. Magee, and A. L. Robb: 1988, "Alternative Transformations to Handle Extreme Values of the Dependent Variable", Journal of the American Statistical Association, 83(401), 123-7.

Chen, S. and M. Ravallion: 2010, "The Developing World is Poorer than We Thought, But No Less Successful in the Fight against Poverty", Quarterly Journal of Economics, 125(4), 1577-1625.

Chotikapanich D., W. E. Griffiths, P. Rao, G. Hajargasht, and C. Xia: 2015, "Inequality and Poverty in Africa: Regional Updates and Estimation of a Panel of Income Distributions", ECINEQ Conference 2015.

Chotikapanich, D., W. E. Griffiths, P. Rao, and V. Valencia: 2012, "Global Income Distributions and Inequality, 1993 and 2000: Incorporating Country-Level Inequality Modelled with Beta Distributions", Review of Economics and Statistics, 94(1), 52-73.

Cowell, F. A.: 2009, "Measuring Inequality", Oxford University Press.

Deaton, A.: 2005, "Measuring Poverty in a Growing World (Or Measuring Growth in a Poor World)", Review of Economics and Statistics, 87(1), 1-19.

Deaton A. and S. Zaidi: 2002, "Guidelines for Constructing Consumption Aggregates for Welfare Analysis", The World Bank: Washington DC.

Ferreira, F. H. G., S. Chen, A. Dabalen, Y. Dikhanov, N. Hamadeh, D. Jolliffe, A. Narayan, E. Prydz, A. Revenga, P. Sangraula, U. Serajuddin, and N. Yoshida: 2015, "A Global Count of the Extreme Poor in 2012", World Bank Policy Research Working Paper Series 7432, The World Bank: Washington DC.

International Monetary Fund: 2015, "World Economic Outlook Database", April, Washington DC.

Jirasavetakul, L. F. and C. Lakner: forthcoming, "The East Asia and Pacific Distribution of Consumption Expenditure".

Jolliffe, D. and E. Prydz: 2015, "Global poverty goals and prices: how purchasing power parity matters", World Bank Policy Research Working Paper Series 7256, The World Bank: Washington DC.

Kolm, S. C.: 1976, "Unequal Inequalities I", Journal of Economic Theory, 12(3), 416-42.

Lakner C.: 2015, "The Ten Richest Africans Own as Much as the Poorest Half of the Continent", http://blogs.worldbank.org/developmenttalk/ten-richest-africans-own-much-poorest-half-continent, Let's Talk Development Blog post.

Lakner, C. and B. Milanovic: 2015, "Global Income Distribution: From the Fall of the Berlin Wall to the Great Recession", World Bank Economic Review. Advance Access published September 26, 2015.

Lakner, C., M. Negre and E.B. Prydz: 2014, "Twinning the Goals: How Can Shared Prosperity Help to Reduce Global Poverty?", World Bank Policy Research Working Paper Series 7106, The World Bank: Washington DC.

Li, H., L. Squire, and H.-f. Zou: 1998, "Explaining International and Intertemporal Variations in Income Inequality", The Economic Journal, 108(446), 26-43.

Milanovic, B.: 2003, "Is Inequality in Africa Really Different?", World Bank Policy Research Working Paper Series 3169, The World Bank: Washington DC.

Milanovic, B.: 2005, "Worlds Apart: Measuring International and Global Inequality", Princeton University Press.

Minoiu, C. and S. Reddy: 2014, "Kernel Density Estimation on Grouped Data: The Case of Poverty Assessment", The Journal of Economic Inequality, 12(2), 163-189.

Nagel, T.: 2005, "The Problem of Global Justice", Philosophy and Public Affairs, 33(2), 113-147.

Pinkovskiy M., and X. Sala-i-Martin: 2014, "Africa is on time", Journal of Economic Growth, 19(3), 311-338.

Pogge, T. W.: 2002, "World Poverty and Human Rights: Cosmopolitan Responsibilities and Reforms", Polity Press.

Ravallion, M.: 2004, "Competing Concepts of Inequality in the Globalization Debate", In: S. M. Collins and C. Graham (eds.): Brookings Trade Forum 2004: Globalization, Poverty, and Inequality. Brookings Institution Press.

Ravallion M.: 2014, "Income Inequality in the Developing World", Science, 344 (6186): 851–55.

Ravallion M.: 2014b, "Are the World's Poorest Being Left Behind?", NBER Working Papers 20791, National Bureau of Economic Research, Inc.

Ravallion, M. and S. Chen: 2003, "Measuring pro-poor growth", Economics Letters, 78(1), 93-99.

Sala-i-Martin X.: 2006, "The World Distribution of Income: Falling Poverty and ... Convergence, Period", Quarterly Journal of Economics, 121(2), 351-397.

Shorrocks, A. and G. Wan: 2008, "Ungrouping Income Distributions", Working paper 2008/16, UNU-WIDER.

Singer, P.: 2002, "One World: The Ethics of Globalization", Yale University Press.

World Bank: 2014 "Prosperity for All/Ending Extreme Poverty: A Note for the World Bank Group Spring Meetings 2014", Washington DC.

World Bank: 2015, "World Bank's New End-Poverty Tool: Surveys in Poorest Countries", Press Release, October 15, 2015, http://www.worldbank.org/en/news/press-release/2015/10/15/world-bank-new-end-poverty-tool-surveys-in-poorest-countries, Accessed November 15, 2015.

Yitzhaki, S.: 1994, "Economic Distance and Overlapping of Distributions", Journal of Econometrics, 61, 147-59.