Global Absolute Poverty: Behind the Veil of Dollars[*]

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Abstract

The global absolute poverty rates of the World Bank (Chen and Ravallion, 2010) demonstrate a continued decline of poverty in developing countries between 1983 and 2012. However, the methodology applied to derive these results has received extensive criticism by scholars for requiring the application of PPP exchange rates and CPIs that are not constructed to capture the consumption habits of those who live in absolute poverty (Reddy and Pogge, 2010). Those methodological concerns cast reasonable doubts on the poverty rates reported. First, in this paper, I demonstrate the validity of the hypothesis that the World Bank's method inconsistently measures global absolute poverty. Second, I introduce new estimates of global absolute poverty based on a consistent methodology suitable for comparisons in time and between countries.

For this purpose, I follow a well known concept of measuring bare bones subsistence using a consumption basket (Allen, 2001). This absolute poverty yardstick tracks bare bones survival costs and is priced in domestic nominal terms. The minimum caloric requirements used therein are calculated separately for each country and year based on the demographic composition. The exact composition of the baskets is determined separately for each combination of country and year. The non-food component contains, among others, clothing and fuel consumption for basic heating, linked to monthly average temperature data.

The results validate the critique on the World Bank's methodology. They demonstrate large discrepancies in levels, which I find in many cases several times lower of what they report. This difference is far from being a linear change in all countries, which in turn fundamentally changes the geography and development of global absolute poverty. A sharp post 1990 increase together with a thereafter modest but longer decline brings the 2012 estimate only 1% lower than 1990.

Keywords: global absolute poverty, poverty lines, subsistence basket, bare bones basket, food prices

JEL Codes: I32, C43, E21, E31, O15

1 Introduction

Longstanding questions in global economic history and economics relate to the issue of poverty and global poverty. Questions like: "is growth good for all?", "the effect of inequality on the least affluent", and questions related to the effects of globalization, as well as the enigma of the Great Divergence relate with the extent of global and regional poverty or its alleviation thereof. Main point being how to drive absolute poverty to extinction on a global level, and therefore absolute poverty lines irrelevant. Until then, and without a firm and applicable methodological framework, providing answers to these questions, at least to the extent that they relate to global absolute poverty, is largely problematic.

At the same time, great global powers are motivated by concerns about poverty and enable international cooperation in the fight against poverty. In the international arena the World Bank is the authority in both measuring absolute poverty and in providing policy advice to local authorities for designing and executing better policies against various types of poverty. On the individual level the issue of poverty, and to a greater extent the issue of absolute poverty, are of some concern to everyone since empathy is -notable exceptions aside- embedded in all of the people. Measuring poverty is also a fundamental step in an attempt to inform and provide an understanding regarding the extent of poverty mostly to those not afflicted by it. At the same time it consists a -basic and quite indirect- way to pay due respect to those in poverty and provide hope that well informed policies will be implemented to address the underlying cause(s). Therefore, this papers pursues to demonstrate that the international poverty lines which build on the PPP equivalence are inconsistent in international comparison as such, and severely mis-measuring global absolute poverty as well. In turn, new absolute poverty estimates are presented based on a common achievement concept. The results tell an entirely different story in a global, regional and country levels, reshaping the geography and the intensity of global absolute poverty as we know it.

The state of the art in global absolute poverty literature is contained in the estimates of the World Bank's PovcalNet. Those estimates inform us that global absolute poverty has been sky-high around 50% in the developing world during the early eighties, then dropped at about 43% by 1990, and in 2011 was as "low" as almost 17%. These results may well reflect our understanding of global poverty in broad terms. The concerns of many scholars (Reddy and Pogge, 2010; Deaton, 2010a; Srinivasan, 2010; Aten and Heston, 2010) dispute foremost the foundations of the applied methodology, and to a lesser extent the results as such. Those concerns boil down to the issue of consistency in measuring absolute poverty globally. The fundamental concern is the extent that the international poverty line (henceforth iPL), expressed in dollar terms, is capable of measuring absolute poverty with the same standard all over the world and over time[1].

The alternative methodological option, to the one applied by the World Bank and throughout the global absolute poverty literature, is to estimate the objective absolute poverty[2] on a global

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[1]Recently the World Bank has commissioned distinguished scholars to update the global absolute poverty methodology. Holding the global poverty yardstick constant is one of the two commission's main tasks.

[2]Objective poverty estimates are based on measurable dimensions of wellbeing, while subjective ones are

level using well defined consumption baskets. This method, however, has been rather hastily dismissed by the World Bank researchers on the basis that the poor adapt their consumption habits in response to relevant price changes (Ravallion, 2010). As already noted by Allen (2013), there is no reason why this type of behavior would not be possible to be accommodated in the subsistence basket. And indeed this is our approach here.

Hence, the contribution of this paper to global poverty research is the use of a well defined purpose oriented subsistence basket[3] (henceforth bare-bones basket or BBB) to provide estimates of poverty levels and trends throughout the developing world[4]. The BBBs, by the calculation method applied here, adapt to the price fluctuations by selecting the cheapest available nutritional sources that meet the minimum caloric requirements, as required by the methods applied by FAO (2008).

Although this approach has been suggested in principle for some time now (Reddy and Pogge, 2010; Allen, 2013), to the best of our knowledge this has never been applied before to more than a few countries[5]. Here I apply the method for almost the entire developing world[6] in the 30-year period of 1983-2012. The main innovation embedded in the BBB approach is that it completely avoids the use of purchasing power parities, since the calculation takes place in the local currency for each country and year separately. No assumption for the applicability of any currency conversions needs to be made.

As such the definition of absolute poverty, embedded in the BBBs, is exactly that; absolute. This is the reason why it is also by definition confined in one dimension, and measured in simple consumption terms. Bellow the level of consumption, which is incorporated in the BBB poverty lines, survival is threatened. This implies that other important dimensions of poverty are in this case unnecessary. Such a claim holds since the goal here is to categorize people as living in absolute poverty or not. In consequence, those people under the BBB poverty line, are poor in an absolute sense because they have no satisfying alternatives in their consumption choices. If they do not consume this basket, they will face a life threatening condition with considerable probability. Generally, it may well be the case that a group of the people categorized here as living in absolute poverty do not actually consume what is included in BBB, but this is besides the point of absolute poverty. The BBB identifies the absolute poor in the world, by constraining the space of capabilities of those people down to the bare bone essentials. Those

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based on the individual's perception of own poverty. This paper focuses solely on the former concept of poverty.

[3]In mid November 2015 it was brought to my attention that Robert Allen in his keynote speech at the 11th European Historical Economics Society Conference 2015 in Pisa has repeated his suggestions for using the BBB in global absolute poverty research with very similar argumentation as in here. His involvement in the World Bank global poverty commission as an advisory member might be a sign that the Bank is considering this alternative method.

[4]It is assumed that the application of BBB as a poverty line in non-developing countries produces absolute poverty rates practically at 0%. PovcalNet and Chen and Ravallion (2010) make the same assumption for iPL.

[5]To some extent the work of Pogge et al. (2006) for Nicaragua, Tanzania and Vietnam, is in the same direction methodologically, but they track "the preferred patterns of food consumption of the group in the population whose consumption is closest to the nutritional standard", in the BBB method the larger part of the food component tracks the value of the cheapest bundle that meets the minimum dietary energy requirement (MDER) and the protein requirements, and our scope of application is global (see section 3 for more details).

[6]The population coverage throughout the developing world is more than 88% on average during 1983-2012. Lowest coverage is 80.3% in 1983 and highest is 2005 at 92.5%. See figure 15 in the Appendix for more details.

with consumption capacity at BBB levels, in order to make different consumption choices are bound to pay that choice by sacrificing part of the absolute essentials. Adopting consumption patterns that deviate the BBB does not imply that they do not live in absolute poverty. The cost of this bare bones consumption behavior is what the BBB tracks, thus qualifying as an absolute poverty yardstick.

Section 2 contains the motivation and explains in some detail the problems that the traditional methodology of measuring absolute poverty faces. Section 3 provides a thorough explanation of the methodology applied. In section 4 I exhibit the data and sources used in this paper, and in section 5 I present the new global absolute poverty estimates results for a diverse set of countries, as well as for regional and global level, also in comparison to the World Bank's latest results reported in PovcalNet. Section 6 places the results in further perspective, and traces the limitations of the method. Section 7 concludes.

2   Motivation

There are several different methodological choices in the global absolute poverty literature[7]. The common ground, however, is the application of a dollarized iPL, either as suggested by the World Bank (with Ravallion (2008) providing the latest), or a variation of it in terms of its exact value. Thus the entire body of the literature accepts the implicit proposition that a fixed value in dollar PPP terms represents the exact same standard of living (in conditions of absolute poverty) for all the people around the world. However, the PPP exchange rate conversions by construction do not achieve this equivalence for the least affluent groups even for the benchmark year, let alone the other years (Deaton, 2010b; Deaton and Heston, 2010, among others). Furthermore, the main hypothesis in this paper is that the iPL as it is derived by a simple averaging of national poverty lines fails to be representative of absolute poverty in any specific country, let alone the world as a whole. This failure to capture absolute poverty varies in degree depending on the country, thus rendering the iPL an inconsistent yardstick. Before investigating this claim, a review of the current methodology is due.

In their seminal article Ravallion et al. (1991b) (hereafter RDV) have developed a framework for estimating the international absolute poverty line (iPL), which builds on the premise that national poverty lines (hereafter NPL) are composed by an absolute component, that is fixed in all countries, and a relative component connected to the average consumption level independently in each country. For reference, the notation of this relationship in RDV is expressed as follows:

$$ln(z_i) = \beta_0 + \beta_1 c_i + \beta_2 c_i^2 + \epsilon_i, \quad i \in [\text{set of countries}] \tag{1}$$

where z_i is the poverty line of country i, and c_i is the average consumption in that same

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[7]See table 2 in the Appendix for the data used in those publications, as well as table 3 for some basic details about the poverty lines applied, and the results obtained. A detailed discussion of the differences is well beyond the scope here. An appendix to this paper will later become available that discusses these issues greater length.

country. The obvious concern with this formula, already pointed by Srinivasan (2010), is that the absolute minimum poverty line implied obtains for -the rather unrealistic- *zero* mean consumption in a country. In any case, the model predicts a \$0.76-a-day poverty line as a point estimate of absolute poverty line[8]. However, the 1.02\$-a-day[9] was preferred by the method of "eyeballing" (Ravallion, 2010, p.89) a group of poor countries that happened to cluster around the "dollar-a-day" level. The two follow-ups on the methodological framework (Chen and Ravallion, 2001; Ravallion et al., 2009), did not address the *zero* consumption issue either. In all three versions of the methodology, the goal is to isolate the absolute component within a set of NPLs, and identify it as an iPL. Nevertheless, in all three versions, this boils down to a simple averaging of selected NPLs. No convincing argument has been presented about why a simple averaging or eyeballing has the ability to isolate that component. Moreover, a simple averaging of NPLs[10] by itself hardly lends a sufficient theoretical and methodological framework[11].

Despite these issues, the application of an iPL that is based on an averaging method, or even "eyeballing", and is expressed in dollar terms, stands out as the methodological choice that characterizes all available global poverty research articles[12]. To make the averaging possible, one first needs to apply the PPP exchange rates on all values expressed in LCUs, and convert them to international dollars. However, building PPP datasets that "reflect the relative price levels of the goods and services faced by poor consumers" (Aten and Menezes, 2002), as one must do to apply them in poverty research, is a task that the various PPP methodologies cannot deal to a satisfying degree[13]. On the matter, the World Bank warns about the application of PPP rates for poverty estimates, by acknowledging the thesis that PPP estimates "may not reflect the expenditure patterns of the poor" (TheWorldBank, 2007)[14].

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[8]95% Confidence Interval: (0.49, 0.84)

[9]95% Confidence Interval: (0.92, 1.29)

[10]Chen and Ravallion (2010) report that about 80% of the NPLs in Ravallion et al. (2009) use a version of the "cost of basic needs" (CBN) approach, having a country specific food component and some allowance for non-food expenditure; which is also the general framework we apply here as well. This means that in principle a decomposition approach to isolate the absolute component would be feasible, and would avoid the zero consumption issue among others.

[11]It still remains unexplained why the RDV methodology and its variations do not follow the suggestion of Deaton and Dupriez (2009) to use all the NPLs in their dataset and weigh them with population to derive the iPL. This would be more reasonable within their framework of pin pointing the most typical PL for the average poor individual, although still an averaging. Ravallion et al. average instead the NPLs in an unweighted fashion as if they are interested for the average poor country.

[12]Again see table 3 in the Appendix.

[13]In this respect, the assiduous effort of Deaton and Dupriez (2011, 2009) in calculating PPP rates relevant for the poor, although has attenuated all the issues described here, by no means the PPP for the poor (P4s) that they provide are free of important problems. This is so for a number of reasons. On the one hand problems relate with the availability of data below the basic headings, meaning that no per country and commodity price and volume data are available from the ICP. And on the other, consumption patterns differences arise even if one focuses only on the developing world, excluding e.g. OECD countries, or considering only those basic headings that are arguably more relevant to the less poor. The fact that on aggregate PPPs and P4s give very close results according to Chen and Ravallion (2010), does not mean that the differences in a per region per country basis are negligible as found in (Deaton and Dupriez, 2009, Table 16). The coincidence on aggregate offers no guarantees that it would be so in forthcoming or in any previous ICP round. And, yet again the main problem of defining the level of iPL via averaging remains.

[14]Out of the 13 articles that estimate global absolute poverty -see table 2-, only one (Chen and Ravallion, 2010) and only as a side-step uses international rupees, by applying the PPPs for the poor developed by Deaton

The latest estimate for the iPL that is applicable for the entire sample is the \$1.25-a-day[15]. As Pogge (2013) points out, this average obtains from a group of the "fifteen poorest countries, thirteen of which are small states in Africa", along with Nepal and Tajikistan, rendering the iPL substantially oriented towards Sub-Saharan Africa. In this respect, Deaton (2010b, p.4) describes how India has become poorer exactly because it had less poor people. As a product of growth in India, the country is no more within the group of countries of which the NPLs are averaged to obtain the iPL[16]. However the NPL of India is lower than the latest iPL. Excluding India from the group of countries that define the iPL, implies a great and unwarranted discontinuity for the poverty estimates regarding this country.

A thought experiment is quite telling in understanding the fundamental issue with the averaging RDV methodology. Imagine in a year, hopefully, not that far from today, where all countries in the world are at least middle income countries, and no poor developing countries exist any more. If one applies this method then what it will capture would be an average poverty line of a group of the least affluent countries. This poverty line would be dictated by the relative component, which in turn would capture relative poverty at large. Thus this poverty line will be identifying as absolute poor people that are largely much better-off than those captured by current iPL. Therefore as a product of time the RDV methodology, drifts in becoming further and further inappropriate for estimating absolute poverty. Considering that even now NPLs already include a relative component (as a result, e.g. of the varying generosity of the food component and by the different levels of non-food allowance in the various NPLs) directly implies that iPL is an inappropriate tool to identify absolute poverty in the first place.

Ravallion (2010) argues that "[b]y treating absolutely poor people similarly to relatively poor people [...t]he resulting measures would lose meaning as measures of absolute poverty". However, this also describes the problem with the averaging approach they adopt. In consequence, for some countries the iPL they apply is largely relative, while for others it represents a target beyond the definition of national poverty, such as India. By how much it is absolute or relative for each country its not clear without a detailed decomposition of the NPLs. In any case, having countries with an NPL smaller than the iPL shows that those countries, and the residents in those countries, are not being judged by the same standards relative to others around the world. Problems like this are bound to occur in any averaging method to derive an iPL.

The implication of the PPP-based method is that in measuring poverty beyond the ICP benchmark year, one also needs to apply an available CPI index. The undisputed point is that available CPI indexes are not built to follow price changes that the absolute poor actually face, since they track the average consumer. Thus the identified trends are bound to be biased by the price changes that different, and more affluent, groups face[17]. Without an alternative that

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and Dupriez (2011, 2009), as an addition to the official PPP rates. But again, this does not eliminate the problems that relate to the definition of the iPL.

[15]It is based on the 2005 ICP PPP round, and the related confidence interval is not reported. In October 2015 PovcalNet has updated to the 2011 ICP PPP round, but has not done so for some developing countries. Thus for the moment, I keep the 2005 PPP round as the reference point in the comparison with the World Bank.

[16]Originally "[t]he ten countries [whose NPLs are averaged] are Bangladesh, China, India, Indonesia, Nepal, Pakistan, Tanzania, Thailand, Tunisia, and Zambia" (Chen and Ravallion, 2001, p.285 fn.6). In later versions India was dropped from the sample.

[17]Note the resemblance with the investigation of real inequality in post 16th century Europe by Hoffman et al.

focuses on the price changes that are more relevant to the poor, one cannot be certain about the extent or even the direction of those biases.

In their seminal article Ravallion et al. (1991b, p.5) also warn that "[i]deally one would like to construct new PPP rates for the prices most relevant to the absolute poor, in which the prices of food-staples would clearly carry a high weight". Before them Ahluwalia et al. (1979, p.305) already acknowledged that the application of the Kravis ratio[18], in global poverty research, is more appropriate than market exchange rates, but other problems arise that come in place of the problems addressed. His thoughts related to issues such as the likelihood that PPPs vary among various income groups within a country. Another element that concerned him was that the switch from market rates to PPP rates is based among others in the undervaluation of services in developing countries, in turn this may well mean that "official exchange rates understate incomes of the rich more than of the poor", since services are consumed more by the higher income groups within those countries. Averaging out this into a single PPP rate simply turns a blind eye to the problem. Moreover, when the goal is to investigate how specific groups in each country compare with their corresponding groups in other countries, then again PPP calculations should include representative consumption elements of those groups under comparison.

Pogge (2013) argues that PPPs are influenced too much by the prices of commodities that are irrelevant to absolute poverty avoidance, such as luxury goods and services. Aten and Heston (2010) conclude that available consumption PPPs are an improvement compared to the GDP PPPs, as they exclude investments and government expenditure. However, the average consumption patterns still differ with the patterns of those that try to survive in conditions of poverty, let alone absolute poverty. They suggest that one could focus on consumption patterns of the poor, and the respective prices they face, but, as we will see below, the problem is hard to solve at best, and not only because of the unavailability of such data.

Even when comparing similarly poor countries, products that are absolutely essential for survival, such as main staples, may well be country specific. Deaton's frequent related example (e.g. in 2010, and 2013) is teff in Ethiopia, that is rarely used anywhere else, and tofu in Indonesia. Both are basic foods consumed by the poor in those countries. But when one wants to compare the two countries poor groups, pricing appropriately those products is simply impossible, as there is no teff in Indonesia and no tofu in Ethiopia. There are methods to estimate a "reasonable" price by regression, but those estimates cannot correct for the fact that any estimated price does not represent anything real in this case. Those prices are simply statistically convenient structures that make the calculation of the PPP rates possible. Bias can work either way in those estimates. The conclusion of Deaton and Heston (2010) is that this estimation "is certainly arbitrary in the sense that the parity between two countries depends entirely on information from third countries"[19]. Thus, an implication of the PPP exchange

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(2002), where they account for the differences in the prices that the various income groups face. They show that in 19th century England, the effect of a change in inequality is amplified by the change in the relevant prices for each group.

[18]Kravis ration is the term that the PPP concept was referred to at the time

[19]A related and rather unexpected issue is that of political balance in the last step of PPP calculation that involves imposing transitivity of the exchange rates. As Deaton and Heston (2010, p.18) discusses the

rates is that when one is estimating global absolute poverty figures then it may well be the case that the number of poor in country A will fluctuate based on the change in prices in country B, even if nothing changed in country A and the reference country (Reddy and Pogge, 2010).

Besides tentative differences in staple food consumption patterns, other GDP components that are "comparison-resistant" include government provided services, health care, education, construction, and house rental. For Ghana, Chad, and Malawi, Deaton and Heston (2010) estimate that the divergence in PPP rates when including or excluding the rental category can be close to 10 percent. And Deaton (2010b, p.14) estimates that, depending on the treatment of the rental component, the poverty count for 2005 changes "by more than 100 million people".

As mentioned above, beyond the benchmark year the value of the iPL is converted according to the domestic CPI. And it is widely accepted that the purchasing power equivalence of the iPL does not necessarily hold with this treatment (Chen and Ravallion, 2010). In principle then the iPL, moves into different trajectories as we move through time for each country separately. The further we move from the benchmark year, the wider the influence of domestic CPI, that track average consumption, on the global poverty estimates. This is especially important since the trends identified in the literature are the result of this inappropriate treatment. As Klasen (2009) notes, the transition to PPP rates from different rounds affects the estimated level of poverty, while the trends are mostly dictated by the application of CPIs in domestic terms[20].

Finally, using an estimation method bound to the use of a single iPL, and due to the iPL's derivation process, we are sentenced to cope with large variation of additional uncertainty. This uncertainty stems from four issues. First, from the inconsistent representation of the absolute poverty component in the iPL of each country. Second, from the uncertainty implied by the confidence intervals of the iPL estimate. In this case, given the steep gradient of consumption distributions around the iPL this implies larger deviations in poverty rate estimates for relatively smaller changes in the iPL, and for the poverty estimates at the boundaries of the iPL confidence interval. Third, both of the above types of uncertainty are amplified if one considers the errors in the estimation procedure of PPP rates (e.g. Deaton argues that 2005 PPPs for China contain a 25% error rate). Lastly, the fourth issue is the chain of uncertainty created by the multiplicative application of yearly CPIs, which capture price volatility relative to the poor with increased error, the further one moves away from the PPP benchmark year.

3 Methodology

The concept of measuring absolute poverty internationally, using a common goal, instead of a common international -dollarized- poverty line, has been proposed by Reddy and Pogge (2010) and implicitly by Allen (2013). This methodology is followed here, and this section

participation of Eurostat in the ICP rounds since 1980 is made conditional on ICP respecting the regional PPPs as estimated by Eurostat. This calls for additional fixity concerns that are political and not statistical in nature. Deaton and Heston (ibid) estimates that without imposing this type of fixity constrains one gets a 6.6 percent higher real GDP for China.

[20]This interestingly translates to that, given the domestic real growth level in consumption, the MDG goal remains linked to the CPI application, and PPPs play an indirect role.

explains the exact specification of the common achievement used and its advantages over the iPL methodology.

To this end, Reddy and Pogge (2010) argue that any two currency amounts are equivalent in time and space only if they both just suffice to meet a common achievement. The implication of this point is that those currency amounts are equivalent in a very specific sense related with the specific common achievement used to equate those currency amounts. In the case of BBBs, the common achievement is bare bones survival that is calculated based on choices mainly made by nature in terms of absolutely necessary nutrients, and largely beyond the human normative influence. Furthermore, BBBs by construction observe the principle of consistency as defined in Ravallion and Bidani (1993, p.2)[21]. According to that definition, consistent poverty lines must be comparable between different regions and subgroups, thus "representing the same level of welfare".

The cost of bare bones baskets is estimated, in this paper, for 137 developing countries[22] starting from 1983 until 2012[23]. The BBBs are constructed so that the achievement remains the same in all countries and for all the years. The common achievement is the possibility of commanding enough resources that just suffice for the absolutely essential in conditions of subsistence survival. The BBBs are then used as domestic poverty lines that identify the group of people that can just afford it at best. This is done with the help of information regarding the distribution of consumption -or income if consumption is not available[24]- for that country-year. In consequence, those people in the distribution below the level of a BBB are the ones living in conditions of absolute poverty in the country for a specific year. The BBBs are expressed in nominal terms, and in the currency denomination relevant in each country-year separately.

Allen (2013) is quite specific in his definition of the BBBs, and de Zwart et al. (2014) apply them globally for estimating real wages. Table 1 contains the overview, and compares with the BBB definition followed here. The main component of the basket is the consumption of staple food, and on a secondary role the consumption of beans/peas. The estimation of these two components is one of the three ways that BBBs estimated here diverge from the original subsistence basket. As it is further explained below, this is done in order to keep the achievement equivalence in space and time. More concretely, the first way I diverge is the caloric intake. In both Allen and de Zwart et al., it is fixed to 1940 kcal, from which the amounts of main staple and beans/peas in kg per year basically derive from. In the revision suggested by Allen (2013) this figure expands to 2100 kcal[25]. Thus, in Bob Allen's methodology the same caloric target

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[21]The other principle that Ravallion and Bidani (1993) defines is that of "specificity", which relates to poverty lines that are representative of "existing norms or values in a society"(Marivoet and De Herdt, 2013, p.2). BBBs obviously do not observe that principle.

[22]For comparability issues we keep the same definition of developing countries as the World Bank does. That is if the country was categorized by the World Bank as developing in 2005 then it remains in the sample for all the years.

[23]In some occasions the data allow the estimation of BBB up to 2014.

[24]Following in this the World Bank's PovcalNet methodology (Ravallion, 2013). Please note that one of the advantages in using consumption distributions is that self production is accounted for.

[25]Which is the line followed in Allen (2015). The actual difference on the overall population between the two lines Allen applies is greater than the simple difference among the two lines. This is so because the 1940 figure was used in combination with a multiplier of 0.75, resulting to 1455 kcal on average for the entire population, while the 2100 is used with a multiplier of 1.

is set for all countries and for all years. In the context of absolute poverty, this extrapolation of a single standard globally is problematic. This treatment would ignore the changes in the anthropometric characteristics and the evolution of the population's age/gender composition. For example, an increase in height and body mass would imply an increase in the number of kcal needed in subsistence. In other words, if one chooses not to adapt what is called by FAO the minimum dietary energy requirement (MDER) target for each country-year, according to the prevailing anthropometric parameters, there is a considerable risk of measuring absolute poverty in each country-year with essentially a different standard[26]. If the actual MDER for a country is lower (higher) than the MDER incorporated in the calculation of the BBB value, then we will be overestimating (underestimating) absolute poverty.

Table 1: Bare Bones Baskets composition for a male adult as defined and applied for different parts of the world; adapted from de Zwart et al. (2014)

Commodity	Unit/Year	N.Europe	China	India	Africa	L.America	BBB
Main staple	kg	155-178	171-179	164-209	185-413	132-165	MDER*
Beans/peas	kg	20	20	20		45	MDER*
Meat/fish	kg	3	3	3	3	3	3
Butter/oil/ghee	kg	3	3	3	3	3	3
Sugar	kg	-	-	2	2	2	2
Soap	kg	1.3	1.3	-	1.3	1.3	-
Linen (defined)	m	3	3	3	3	3	3
Linen (applied)	share	8%	8%	8%	8%	8%	5% ± 1%
Candles	kg	1.3	1.3		1.3	1.3	-
Lamp oil	liter	1.3	1.3		1.3	1.3	1.3
Fuel	mbtu	3	3	-	3	3	temperature*
Cooking	mbtu	-	-	-	-	-	MDER*
Housing	mark-up	5%	5%	5%	5%	5%	5% ± 2%

Note: variation in the weight of the main staple represents the different staple used for different sub-regions, see de Zwart et al. (2014); Allen et al. (2011) for more details.
*: calculated as a function of Minimum Dietary Energy Requirements (MDER) or temperature as noted respectively; see text for details concerning the estimation of each component in the BBBs.

Thus, we estimate the caloric value of the BBBs following the FAO (2008) methodology to derive the MDER for each country-year separately. We do that along with the corrections noted by Allen (2013, p.4 fn.2). The anthropometric parameters that are incorporated in the FAO model, consist of the height for each age cohort, the distribution of the population by age and gender, the body mass index (BMI) that describes the relation of height and weight within a population group, and finally the Physical Activity Level (PAL) which in simple terms describes the intensity of the lifestyle in terms of energy consumption. The height and BMI data are combined to get the weight for each gender/age group. Consequently, the weight and the PAL level for each group along with the share of each group in the total population, allow us to estimate the population wide MDER[27]. An important distinction needs to be noted in

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[26]See section 4 for details about its magnitude.
[27]Allen (2015) uses the concept of adult male equivalent for the purpose of identifying the caloric needs. The FAO method is equivalent in that respect.

relation to the selection of BMI in different age groups. Up to the age of 10 the BMI of the median child in each age cohort is used by FAO's model. Above that age the BMI of the 5th percentile is applied instead. This is done in order to capture the absolute minimum in terms of caloric intake for persons older than 10, without at the same time calculating such low calories for children below 11 that would most likely keep that cohort, and all its follow-up cohorts, shorter in the first place. Such a mistreatment would lower the population living in poverty by lowering the MDER due to a fact that simply the population will be growing shorter.

The second deviation from the Allen (2001) methodology is that I restructure the food component of BBBs to move closer to the absolute minimum cost combination of resources that achieves the goal of meeting the MDER caloric intake and at least 40 gr of protein per day[28]. To do so, I group together the main staples and beans/peas, and apply linear programming techniques to find the cheapest combination between all the available food items in both food categories together. This choice can be partially supported by the finding of Regmi (2001). Regmi using income elasticities of demand for staple foods concludes that "the poor cannot substitute away from staple foods to anything else." Nevertheless, and as noted above, the BBBs allow for a limited variety through the meat/fish and sugar allowance. The incorporated variety in consumption is very limited if compared, for example, to the allowance of the quite frugal 1993 NPL in India. According to Chen and Ravallion (2010), "[t]he daily food bundle comprised 400g of coarse rice and wheat and 200g of vegetables, pulses, and fruit, plus modest amounts of milk, eggs, edible oil, spices, and tea". For an overall comparison regarding the food component, Ravallion et al. (2009) report that in NPLs the average food component share is 65% of the total costs. This share in the case of our BBBs increases to 71% signifying the BBBs' frugality [29]. Moreover, the additional percentage spending in the NPLs is being applied on costs of baskets that incorporate more diversified consumption habits than the BBB does, thus more likely to be more expensive. In turn, this means that the small difference in the additional spending is, more often than not, translated in greater difference in additional actual spending amounts.

The third difference with Allen's approach is that the energy and clothing allowances are linked to the year and country specific temperature conditions. The energy allowance is linked, in addition, with the heat required in cooking the specific amount of calories of the BBB food component, as estimated by the MDER. The link with temperature conditions is calculated using a small model room of fixed dimensions[30] and the amount of energy required to bring the temperature to 18℃ for 8 hours per day. The temperature has been chosen from the literature as a temperature above which the risk "to the health of a sedentary person, wearing suitable clothing" (Wookey et al., 2014) is minimized (see also Healy and Clinch (2002) for a further discussion). The World Health Organization also recommends 18℃ as the minimum indoor temperature as noted in Collins (1986). The 8 hours duration rests on the idea that

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[28]An improvement of the method would be to estimate the protein, and other nutritional, needs from anthropometric data as well. I defer this for a future update of the estimates. See Darko et al. (2010) and Darmon et al. (2002) for some applications.

[29]For comparison with more historical data, Clark (2008) reports that in 1800 English farmer workers have a share of 75% of their budget devoted to food consumption.

[30]Exact dimensions are 10x10x8ft.

total daily hours are equally split among work, rest and leisure. An implicit assumption is that leisure takes place indoors when outside temperatures suggest it, thus pin-pointing the 8 hours per day of heating needs. An important parameter in the calculations of the energy required for heating is that of how good the room insulation actually is. Since we are not able to estimate the exact insulation parameters, we use a variety of parameters representing low-cost and accessible materials. Ergo the uncertainty in the energy requirement estimates that propagates in all the estimates thereof. In turn, the clothing allowance is estimated as a share on top of the basket that includes the energy component. This indirectly makes a link between clothing and temperature[31]. The energy required for cooking is estimated independently from heating energy and based on the FAO finding that the amount of energy needed to cook food is typically on a 3-to-1 ratio[32].

Regarding the remaining of the basket as defined by Allen I keep the allowance for 6 kg of fish or 3 kg of meat, and select whichever is cheaper per year. I also keep the allowance for 2 kg of sugar and 3 kg of butter/ghee/oil per year. Since the BBB is designed by Allen (2001) for historical research in real wages, the allowance for some commodities like sugar and beans follow the realities in specific countries depending if those where actually consumed or not. Since here the focus is on the more contemporary period I incorporate all these commodities to the BBBs for all countries. Following both Allen (2001) and de Zwart et al. (2014), I also incorporate an allowance for 1.3 kg of lamp oil per year, along with a 5% allowance for housing[33]. The allowances for soap and candles are in principle included, but as discussed in section 4, they were finally dropped since they were found to be a negligible share of expenses according to the years with available data.

As such, the BBBs, by construction, follow closely the variation of prices that are most relevant to the poor, and as such it allows the closer monitoring of abrupt changes for people living in absolute poverty. This cannot be achieved by the methodology of the World Bank, also because of its averaging nature. It is clear from the previous discussion that this averaging comes in three counts. First, in the way the iPL is estimated. Second, by applying PPPs that track the overall economy or household consumption in each country with respect to the benchmark country. And third, by the use of CPIs that track the average consumption.

Indeed the BBBs avoid this triad of problems and follow closely the common ground in the recommendations of both sides of the "how not to count the poor" argument[34]. On the one hand the recommendations of Ravallion (2010), who argues that the consumption basket cannot be the same across countries due to price differences[35]. According to him the ideal price index

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[31]As the section 4 presents in greater length, there are no available prices for linen in the post-1983 period. Thus the linen component is imputed as a share calculated based on ILO price data from previous periods. See section 4 for more details.

[32]At section 13.5 Do we really need more energy under the pot than in the pot? from "Energy for sustainable rural development projects - Vol.1: A reader" located at http://www.fao.org/docrep/u2246e/u2246e02.htm

[33]In later versions of this paper, the consumption data available from the World Bank will be used in estimating the allowance of the BBB for housing and clothing.

[34]Referring to the polemic article by Reddy and Pogge with the same title, and the publication exchanges thereof (Anand et al., 2010).

[35]"Ideally the underlying price index would only reflect differences in the cost of a reference level of welfare, fixed across all countries. This means that the reference bundle of goods cannot be the same across countries,

should capture the price variation "of a reference level of welfare". And on the other hand, Reddy and Pogge (2010) who conclude that only an achievement based procedure is a consistent method for estimating poverty of comparable type across countries and time[36].

In relation to the broader skepticism for applying a "cost of basic needs" (CBN) approach, like the BBBs, Srinivasan (2010, p.145) rightfully points that any poverty consumption bundle unavoidably contains some arbitrariness one way or another. Another important objection from Srinivasan (2010, p.146), is that a "poverty bundle common to all regions within a geographically and culturally diverse country such as India, let alone for all countries of the world is hard to visualize even conceptually". The BBBs can partially address both of the above concerns, at least in the international level, since BBBs do not take the form of a fixed bundle, but the form of a bundle that enables a specific achievement, all within a cost minimizing setup. In addition, BBBs are not constructed with a particular representative household in mind, but rather the bare essentials for survival. These essentials include keeping a person alive, with enough caloric intake and without protein deprivation, also keeping -in a very frugal manner- a person dressed, housed, as well as warmed and basically capable to cook food. This is a well defined, and constant, global achievement standard for measuring absolute poverty. It is also mostly linked to objective natural necessities for a bare bones subsistence life conservation, thus in a lesser degree prone to arbitrariness compared to consumption baskets constructed to capture non-absolute poverty.

Another relevant point of criticism can be found in Ravallion (2008, p.6), according to which "it is quite possible to find that the 'richer' sector (by the agreed metric of utility) tends to spend so much more on each calorie that it is deemed to be the 'poorer' sector". This concern, although relevant to the CBN method in principle, does not apply to BBBs specifically, since by construction the cheapest calories are assigned to the absolute poor. Also, Ravallion (2008, p.7) referring to the work of Wodon (1997) argues that a general increase in prices may also imply a drop in the "food energy intake" poverty line. In the case of BBBs this is embedded in the BBBs' cost calculation process of the food component, which in nutritional terms follows the evolution of local anthropometric characteristics and is independent of actual consumption behavior, otherwise it would not be tracing absolute poverty. With respect to the relevance of a cost minimizing approach, Lanjouw (2001) argues that "the least cost criteria rarely reflect actual consumption patterns". Consequently also the BBBs have less to do with actual consumption patterns, and more with identifying a specific bare bones consumption capacity threshold. The BBB effectively identifies the absolute poor in the world by constraining the space of consumption alternatives of any person down to the bare bone essentials[37].

Finally, there are two additional benefits brought along with the use of BBBs in absolute poverty identification. First, as a result of the BBB method, any errors in the required data, brought as a result of indirect estimation or measurement, relate only to the particular country-

given that relative prices vary and hence that consumers can substitute among goods to achieve the same level of welfaremoving along their indifference curves." (Ravallion, 2010)

[36] "Such a[n achievement based] procedure, and such a procedure alone, can produce consistent estimates of poverty that are comparable across space and time" (Reddy and Pogge, 2010)

[37] On more abstract terms, the BBBs can be described as the survival-specific point of gravity behind all the indifference curves in the consumption space.

year it represents, and do not influence the entire time-series of global absolute poverty estimation, as the chained errors in PPPs and CPIs do. In other words, any errors in poverty estimates are in principle not contagious to other country-year estimates. The second point relates to the underreporting of consumption -or income- in household surveys that is reported in the literature (Ravallion et al., 2007; Bhalla, 2002; Anand and Segal, 2008). As it has been found also by Bhalla (2002), the foodgrains, are the least understated consumption group in the 1993/4 national household survey for India. And its understatement is about 10 percent, compared to more highly valued food products, such as dairy products, fruits, and vegetables, which show an underestimation of 53 percent. This observation translates in BBBs being more likely a safer choice in terms of household survey underreporting, since they heavily rely on food items that appear less prone to this problem.

4 Data

The estimation of poverty rates consists of two main ingredients: a poverty line and a distribution of a welfare measure. Here the poverty line is the cost of the BBB, and the welfare measure is the consumption or, when consumption estimates are not available, income based distribution from PovcalNet.

For estimating the nominal value of the BBBs, the first step is to identify the average amount of calories (kcal) per person in a country-year, as this is captured by the FAO (2008) MDER methodology. The FAO methodology requires us to obtain data on the age and gender composition of the population; the average height target for adults; make an assumption for the height of newborns; and an assumption about the Physical Activity Level (PAL) of adults. We obtain the age and gender demographic data from the United Nations World Population Prospects (UnitedNations, 2013). This dataset covers 201 countries, annually from 1950 until 2010[38]. The population is classified in five-year age groups (0-4, 5-9, 10-14,.., 95-99, 100+), while the MDER model requires annual information until the 20th year, and every five years thereafter. To overcome this mismatch, we use a non-parametric kernel density estimator to obtain the yearly approximate information on the age/gender distributions.

Regarding the two assumptions needed, we take the height of the newborn to be 40% of the height of a one year old[39]. Regarding the PAL, FAO (2008) offers three versions of PAL according to lifestyle: light, moderate and vigorous; depending on the level of the required physical intensity. For working men[40], we take the average of moderate and vigorous lifestyles, as a middle-ground between two arguments: The first is in favor of vigorous lifestyle, and assumes intense manual labor to be typical among people in poverty conditions. And the second argument in favor of a less vigorous lifestyle, calls for a constraint in very intense physical

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[38]In July 2015 the 2015 revision became available with yearly data up to 2015. It will be incorporated in a later version of this work.

[39]This is arguably a very strong assumption, since it implies that one-year-olds have 2.5 times the height of newborns. However the over-shooting in kcal here compensates for the fact that we do not consider the extra kcal needed by pregnant and breastfeeding women.

[40]For both genders we assume working age to be the years 18-75.

activity from available nutritional conditions. Thus the numeric value of PAL for men that we apply is 2.005, which is the average of 1.76 that corresponds to a lifestyle of average physical intensity, and that of 2.25 which corresponds to a vigorous lifestyle. For working women, we take the FAO average lifestyle of 1.76, as a basis and introduce two minor changes. Namely, we substitute the activity of 1 hour of "commuting with bus" (PAL 1.2) and 1 hour of "low intensity aerobic" (PAL 4.2), with 2 hours of "taking care of children" (PAL 2.5) (FAO, 2001, p.36, table 5.1). This brings daily PAL average to 1.7416 for women, which is almost exactly as the alternative of taking the 1.74 PAL calculated for a spinner, found to be representative of a light work lifestyle in historical real wage literature (Allen, 2013). Finally, for both genders after the 75th year, we assume a light lifestyle with a PAL of 1.55 according to FAO.

For modeling both the growth in height up to the full adult average height, and the difference between male/female we use the underlying growth rates from Table 3 in (FAO, 2008, p.8). The male adult height data are acquired from the ClioInfra (2015) height dataset, that is expanding the work of Baten and Blum (2012). This dataset covers 165 countries, with data starting from the mid-19th century for most. The height ratio in FAO's model between men and women was used to get the women's average height from the men's average height. Typically these height data do not cover all the years we are interested in, and some imputation is necessary to yearly cover the full 100-year span in each required population distribution. This was done by linear interpolation for years between observations, and when extrapolation was needed, I simply use the last observed value[41].

Using FAO height growth rates, I am able to estimate the heights annually from the first year until the 18th for both genders. There is a mismatch on this point with the height source I use. The sources assume that the full height is reached effectively during the 22nd year of age for a male person[42]. Since I am bound to work with the height growth model of FAO, I make the assumption that full height is obtained by the 18th year of age as in the FAO model. In both cases however the same height is finally attained, the only difference is that the height growth takes more years in case of the Baten and Blum (2012) assumption. In turn, and on the aggregate MDER, this mismatch would play a role only if a relatively very large birth cohort is going from 18th up to 22nd year. In order to understand the implied error of this mismatch consider the case of Cambodia in 2000 which contains the relatively biggest birth cohort in the post 1983 UN WPP dataset[43], the contribution of that cohort in the aggregate MDER is about 2.78% of total kcal, and we slightly underestimate a part of that.

From the height data and the body mass index (BMI) in the FAO MDER model, we can get the weight of each age/gender group, and from the weight and the FAO formulas we estimate the kcal per age/gender group. In the final step, I take the population weighted average of MDER of each age/gender group based on the UN WPP information, and this average is the

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[41]Another, perhaps more appropriate solution, would be to follow the regional height evolution patterns. Belated for a next version.

[42]They assume, following Baten and Komlos (1998) that "[t]hose who were 18 years of age were estimated to have 2.4 cm to go; those age 19 1.7 cm, those age 20 0.9 cm, those age 21 0.4, and finally those age 22 only 0.1 cm".

[43]The 15-19 cohort is 2.48 times the 20-24 cohort. The average such ratio in the entire post-1983 dataset is 1.095.

MDER kcal target for a specific country-year combination. It is important to note that the obtaining kcal value corresponds to a minimum requirement because of the body mass indexes used for each age/gender group. Those BMI values are selected by FAO from the WHO reference distributions[44] within the entire population. As already mentioned they correspond to the 50th percentile until 10 years of age, and to the 5th percentile of the distribution thereafter[45].

Figure 1 demonstrates the yearly MDER values within Lao's population for 1981 and 2000, along with the height information for each age cohort. The upper MDER and upper height dots and triangles in the graph refer to male and the lower MDER and height lines refer to female population (MDER is also noted by the gray dots). The male and female MDER points move similarly with small differences for the first 13 years, and thereafter a large gap is shaped and established. This gap relates to the differences in height, BMI and the PAL values. The notable sudden drop in the 10th year relates to the shift in the selection of BMI from the 50th percentile to the 5th percentile in the population according to FAO/WHO. The younger taller generation, as it ages through 1980 to 2000 brings a shift to the MDER value from 1859 kcal to 1894 kcal (noted initially by the dotted horizontal gray line that shifts to the continuous one).
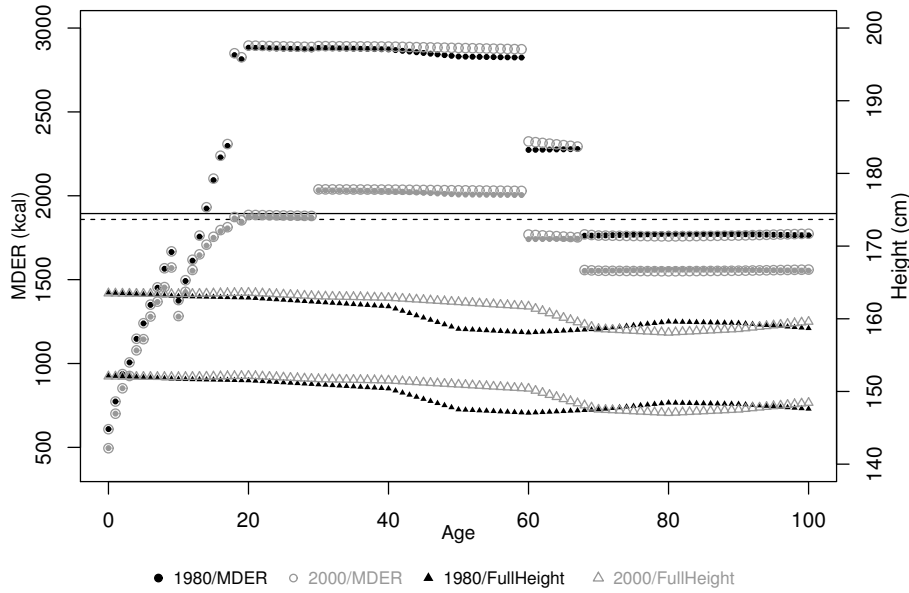

Figure 1: An example of the evolution of MDER and full height with cohort age for Lao People's Democratic Republic in 1980 and 2000

Although the example of Lao may imply that differences in MDER are not important, a close look at the overall picture points to the other direction. Figure 2 shows the evolution of the 3990 total MDER estimates for 133 developing countries, in all the years from 1980 until 2010. We observe that roughly the median of the MDER distribution starts at the initial target of 1940

[44]In 1995, 2006, and 2007.

[45]As noted by Allen (2013) there are some typos in the formulas reported in FAO (2008). Beyond the correction he suggests, we also avoided the multiplier which doubled the energy needed for the gained weight during the first two years after birth. This was done in order to be in accordance with tables 3.1 and 3.2 in FAO (2001)
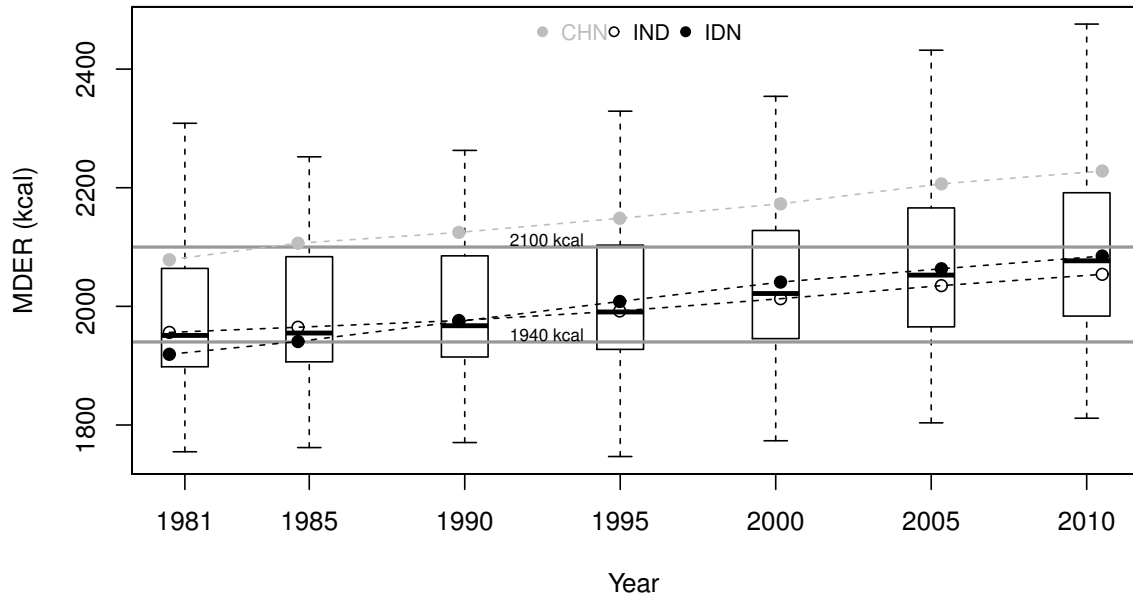
Figure 2: Evolution of MDER, developing countries 1981-2010

kcal set by Bob Allen for the historical subsistence basket, and by 2010 the median is almost at the 2100 kcal which is the updated figure for that basket. This figure implies the importance of accounting in our BBBs for the changes in MDER due to the changing demographic and anthropometric characteristics. It turns out that keeping the caloric intake fixed within the BBBs will typically introduce a 3 to 9% error in the estimation of the BBB value between 1981 and 2010, which can be proven quite important when one is interested in the trends of poverty. The regional and global, as well as most of country, level results in section 5 run until 2012, while a for a few countries poverty estimates may run until 2014. At the same time the last available data driven MDER is from 2010, and this last yearly estimation is also used unchanged for the years after 2010. Based on the discussion above, the implied error from not updating MDER for just two years should be negligible, less than 0.5% of the estimate on average. For the countries with absolute poverty estimates until 2014, the implied error in the estimation of the BBB values should still be quite small, less than 1% of the estimate on average.

In comparison, the MDER values as estimated by FAO are between 1630 and 2000 kcal per person per day[46]. Compared to those food security lines, the MDER values calculated here are typically 13% higher, which is largely attributable to the difference between the 1.55 PAL value FAO applies for both genders and the PAL values applied here. Finally, most developing countries have enough data for calculating the FAO model, but not all. For those few countries, we are using the yearly median MDER value of the countries with sufficient data[47].

With regard to the prices the main source is the online dataset from "The ILO October Inquiry"[48], covering 222 countries and territories with prices in the period 1985-2008. The

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[46]MDER XLS from FAO website, accessed on 27 March 2015.

[47]This happens for approx 2% of the cases.

[48]Detailed description of the items can be found in LABORSTA (2015)

October Inquiry covers 93 items of food and drink. The data contain price information in local currency units and at the currency denomination available in each sampling year. This means that for Lithuania, the prices for 1994 are not given in Euro terms, but in terms of the "Lithuania Lita" that was the currency in 1994. The ILO dataset covers items that allow the pricing for most of the BBB components, including the main staple, beans/peas, meat/fish, butter/ghee/oil, and sugar. For the remaining components I have to use an indirect method to assign them a price. The cost of lamp oil is assumed equal to that of butter/ghee/oil per unit as in de Zwart et al. (2014). To determine the unit costs for soap, candle, and fuel, I used the share of each in the BBBs estimated by de Zwart et al. (2014) using pre-1983 ILO data. For soap and candle this share was less than 0.2% each, and therefore I have ignored it in the BBB calculations. For fuel, when constraining to the non-extreme cases[49], the cost of 1 mbtu of fuel is 4% with a standard deviation of 2%, expressed as a markup on the pre-fuel BBB calculated cost. Moreover, for the cost of cotton/linen a markup of 5% with a standard deviation of 1% is assumed according to trends in the budget share of clothing in the India household surveys 1993-2012[50]. Finally, for the rent allowance we follow Allen (2013); de Zwart et al. (2014) and use a 5% markup on the BBB value on which a standard deviation of 2% is added by assumption[51]. Additional information on prices has been used from FAO that covers the years 1990-2015, and WFP that covers the period 1994-2015. All three price sources may contain price information in a per market, per city or on a country level. In the first two cases I take the arithmetic average of the available prices per product. The two additional sources price the data in nominal terms, but redenominate all prices in the most recent denomination. So, in order to have a homogeneous dataset, I redenominated all prices from FAO and WFP back to the original denomination for each specific country-year. This was done using the dataset on history of currencies curated by the Global Financial Dataset[52]. Nevertheless, for very recent (typically post-2010) changes this dataset was not up-to-date so additional sources had to be used, mostly information available on national central banks. Despite having most of the available information for currency denomination coming from one source, these data are hardly directly usable. Chains of redenominations were constructed from the available data, to make them applicable in the currency redenominations required.

Information regarding the nutritional content of the food items is drawn from USDA[53]. For a handful of food items other sources[54] were used instead, since USDA had no relevant information.

In total, 2904 BBBs have been priced directly from data in the period 1985-2008, with the

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[49]Effectively considering only cases where fuel was more than 2% or less than 20% of the total BBB.

[50]See Appendix III in Key Indicators of Household Consumer Expenditure in India, 2011-12

[51]In a later version of this work, the use on consumption budget shares of lowest income groups at the World Bank Global Consumption Database will constitute an important refinement.

[52]Global Financial Data, Global History of Currencies dataset downloaded from here, accessed on 16, July 2014.

[53]Source for Nutrients Data: National Nutrient Database for Standard Reference, Release 27; accessed May 24, 2015.

[54]The three items not in USDA are: Fonio with data from here, Tortilla with data from here, and Foufou with data from here . In addition, for families of products -e.g. "Chicken meat", "Chicken meat (fresh, local)", "Chicken meat (frozen, imported)", "Chicken meat (frozen, local)", "Chicken (processed)", "Chicken (without offals)", "Chicken, cleaned"- the same nutritional values were used.

aforementioned limitations, distributed as shown in figure 3. In the years 1985 until 2008, an average of about 70 countries have a priced BBB per year directly from original prices. Also on average the linear programming can identify the cheapest product combinations, that would yield the needed MDER caloric target and the specific protein amount, among a bit more than 7 relevant products with available prices. There are, however, two important issues that dictate the use of imputation techniques for missing price data. First, the need to have both priced BBBs and distributions from PovcalNet for the same years for a given country. Second, the bias introduced when only in some years there are missing prices of the otherwise cheapest products. For example assume that in a country we have the price for maize for three consecutive years, and the price for rice for the first and the last year. Assume further that the rice is the cheapest nutritional source, then this artificially inflates the value of BBBs for the year in between. This happens, not because there was actually no rice in that country for that particular year, but simply because the dataset does not contain it.
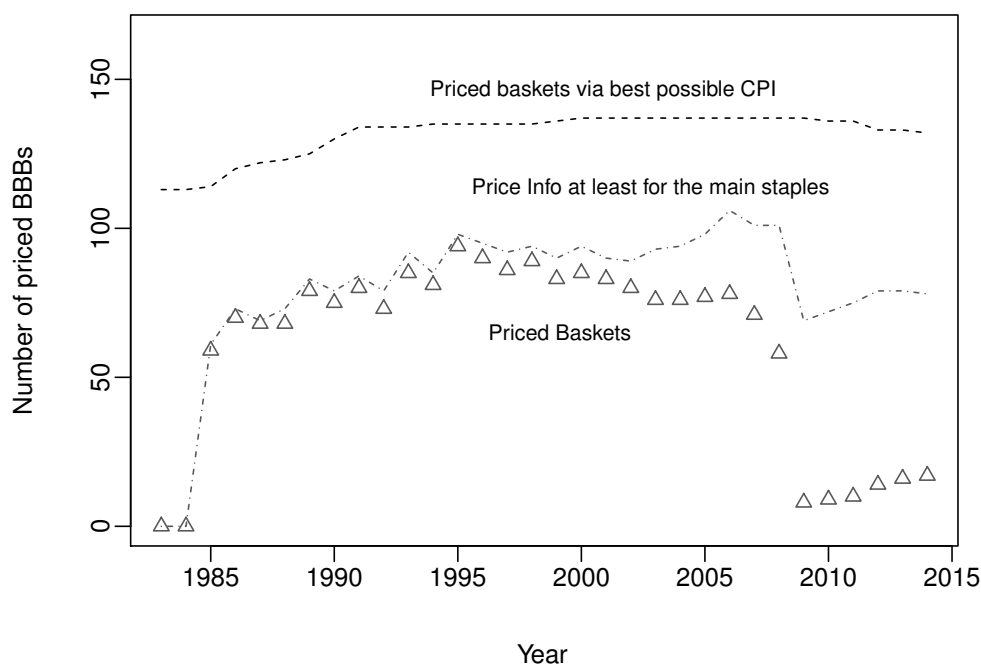

Figure 3: Priced BBB per Year, globally 1983-2014

To overcome these shortcomings food CPIs have been in principle applied to impute the missing prices. In a few cases food CPIs have been complemented by other more generic CPI types, such as average consumption CPIs. All CPI data are drawn from ILO, FAOSTAT, IMF, the World Bank and the Clio Infra dataset. In the process, error introduced by the imputation is ball-parked. For that purpose, an standard deviation of 7.5% is assumed for original prices from ILO, FAO, and WFP. When the imputation is done for a year following a year with available price the assumed uncertainty increases by 1 percentage point by convention. For every additional year of distance between a missing price and the closest year with available price in the original data, an extra percentage point is added to the uncertainty level up to

a maximum of 12.5%. This error is later propagated in the estimation of the poverty rates. In the case of a price imputation between given prices, there are two ways of estimating a value for that year. Either by starting from the later year going back using a CPI rate, or by starting from the lower year and then going forward. Here the average of the two approaches is applied, weighted by the distance of the imputation year and the upper and lower years with available data. The data point of the year closest to the imputation year gets the higher weight proportionally.

Using this technique a total of 4213 BBBs have been priced for the period 1983-2014. Here the linear programming can choose from about 19 priced relevant products on average. The available estimates translate to about 131 per year, out of the 137 countries in the dataset. This is shown in figure 3, alongside the BBBs priced only using the original data. To add some perspective the price availability of the staple food component in the original data is also shown.

With respect to the distributional data, PovcalNet contains data over consumption distribution -or income if consumption is not available- for 165 countries or territories, since 1984. The data are available in PPP 2005 international dollar terms. To make the conversion back to nominal terms, the actual CPIs applied by the World Bank were used, along with the 2005 PPP exchange rates and the aforementioned data for currency denomination[55].

Up until recently, independent researchers without direct access to the underlying household survey data had to use an approximating assumption to impute the actual distribution from partial information[56]. In that case a direct comparison with the results of the World Bank was not really possible. With the inspirational work of Dykstra et al. (2014a,b) an enormous amount of underlying data were "jail-breaked"[57] from the the World Bank's website. There are, however, some differences noted between the two datasets, as for example distributions included in the Dykstra dataset, but not found anymore in the PovcalNet website[58].

Thankfully, Dykstra et al. have also made available the source code they have used to fetch the PovcalNet underlying data. Thus, with only some minor changes in the code I get the current poverty estimates based on the BBB poverty line, expressed in 2005 PPP dollars, directly using the PovcalNet distributional data on the PovcalNet website. [59] This treatment bypasses any discrepancies between the two datasets and allows the direct comparisons of BBB absolute poverty estimates with those of the World Bank[60].

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[55]See Appendix 9.2 for the procedure followed to crosscheck the price index estimation from the PovcalNet available data.

[56]Typically information about the Gini index of inequality in the distribution was made available, and in several cases the share of each decile or quantile.

[57]Referring to the title of their working paper.

[58]The csv files included in the Dykstra dataset, but cannot be found on PovcalNet are: Estonia 2004, Hungary 2007, Kazakhstan 2009, Latvia 2003/7/9 - although 2006/10/11 exist instead, Macedonia FYR 2009, Nigeria 2011, Panama 2001, Poland 1993, Romania 2000, Slovak Republic 2007, and China 2009. Another worrisome aspect is that for some country-years some parameters differ between Dykstra and PovcalNet, e.g. distributional averages for Albania 2008, Argentina 2010, among others.

[59]This is achieved from the updated script by sending the desired poverty line for a particular country-year to PovcalNet website, and capturing the calculated poverty rate that the underlying distribution corresponds at that particular poverty line level. This is all that is needed for the purpose of this paper.

[60]In five cases in total, the use of some poverty lines gave zero or very low poverty rates that were worrisome.

As in the case of the regional and global aggregates presented in PovcalNet and Chen and Ravallion (2010, 2004), one needs to devise a way to align countries' consumption or income distributions to get the yearly estimates with acceptable coverage. I follow their methodology in principle, but also present the results of the method on a per country level to increase transparency. The basic idea of the method consists of using the evolution of a national accounts statistic, typically GDP per capita or household final consumption per capita, to increase or decrease the average of the distribution(s) around the year with a missing distribution. The selection of GDP per capita or household final consumption is based on a per country data availability. When the year of interest lies anywhere between two available distributions, then both distributions are used and two different consumption or income averages are computed. This is done by applying the growth rate from the national account statistic. Consequently, I take the weighted average of the two, with the distribution of the year closest to the year of interest taking the higher proportional weight. If only a distribution for a previous or a later year exist, then only that single value is extrapolated using the national account statistic.

A mismatch between some of the information contained in PovcalNet and the BBBs is that for some major countries (including China, India and Indonesia) PovcalNet offers the distributional information using an urban/rural split. Since I do not have prices separately from urban and rural locations I use the same BBB value for both rural and urban distributions. The population weighted average of rural-only and urban-only poverty rates, becomes then the country wide poverty rate. Comparatively, since PovcalNet does not have separate iPLs for rural and urban areas either, the ratio between national rural poverty line and national urban poverty lines is used to indirectly gauge the iPL towards a "more appropriate" iPL; a far from ideal procedure criticized by Pogge (2013)[61]. Only prices collected from rural areas could solve the actual problem[62].

Lastly, a note regarding the treatment of sources of error and uncertainty in the data and the estimates is warranted. Typically the issue of errors in the global absolute poverty estimates goes by unnoticed and undiscussed. Antithetically, it should be given an important role to the very least because in several populous countries the poverty line is positioned at a point where the consumption distribution has steep gradient. This implies that a small error in the estimation

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The problem with these cases was that those poverty lines were above of some other poverty lines that produced higher poverty rates for the same country-years. More concretely, the actual average poverty line gave poverty rates that were lower than the same poverty line minus one standard deviation in BBB value. This was the case for rural China in 2003, 2004 and 2005 (all with having the poverty line giving zero poverty rates), and for Morocco and Jordan in 1992 (where poverty line gave lower poverty rate than the lower bound poverty line). The workaround this problem is to use the closest poverty line that gave a non-zero poverty rate for the three cases in China. Practically this translates to using a one to six cents of a PPP 2005 dollar higher poverty line than the originally estimated one. For Jordan the poverty rates were so low ($0.01\% \sim 0.02\%$) that low, average and high poverty rates for 1992 were set to 0.02%. For Morocco, the use of a high poverty line increased by one cent produces a poverty rate that resolves the problem (again in very low poverty rates around 0.02%.

[61] "the Bank chose to "use existing differentials in urbanrural poverty lines... to correct the national PPP for the purpose of measuring poverty". Such a "correction" of China's PPP based on existing poverty lines is evidently highly conjectural and moreover ignores that prices in China vary more by province than by rural versus urban (Heston, 2008 , p. 68)." (Pogge, 2013).

[62] For example in China, prices collected in urban locations within relatively rural regions could be used to refine the estimates, and make use of the urban/rural split. This will constitute a considerable improvement in the estimates. This important observation was raised by Dr. Bas van Leeuwen.

of the exact level of the poverty line is enlarged on the level of actual poverty rates. In principle all these data treatments and problems discussed above are sources of uncertainty and errors in the estimates. In this paper not all error sources are accounted for. The error sources considered here are constrained within price uncertainty by following a simple convention, uncertainty in energy required for heating and cooking, uncertainty in the number of persons per household, and the budget shares of housing costs, fuel and linen. Most of these uncertainties have been discussed above. Regarding the remaining: uncertainty in energy required for cooking stems from the exact multiplier used. As estimated by FAO a multiplier of 3 should be used for the average household. Here, more cautiously, I consider a multiplier of 2 ± 0.5. Additionally, in the estimation for heating energy per person also the number of persons per household is needed. For this I use for all countries and average of 4 persons per household ± 1. All the poverty estimates in the results that follow are reported with one standard deviation as this obtains from error propagation.

5 Results

The first part of the results relates to the hypothesis in this paper. It begins by presenting the results of the BBBs as a price index, in contrast to the CPI rates applied by PovcalNet. Then it shows the results that directly compare the iPL with the BBB poverty lines expressed in 2005 PPP dollar terms. The second part relates to the new estimated poverty rates and counts by applying the BBB cost as poverty lines. This is done on a country, regional and global level aggregating all available developing countries per year. The third part shows that new geography in absolute poverty that derives from the new method. Most of the discussion of the results is postponed for the following section.

In figure 4 we see the evolution of the BBBs[63] as a price index that tracks the prices relevant for the absolute poor. On the same graph the evolution of the CPI index applied by PovcalNet is shown as well for comparison. The figure shows a selection of 10 countries from the regions of East & South East Asia, Latin America, Sub-Saharan Africa, and Middle East & North Africa. The patterns vary considerably from country to country. China represents the mosts distinctive case in this comparison. Until 1992 the implied underestimation of price changes relevant to the poor is relatively small. From 1993 onwards, the BBB price index moves with a much larger pace than either the rural or the urban CPIs applied by PovcalNet.

For Argentina, it is clear that certain spikes in price volatility relevant to the absolute poor are captured more vividly by the BBB price index, e.g. the 2001/2003 spike related to the Argentinian financial crisis, and largely missed by the aggregate urban CPI. Antithetically in Colombia and Egypt the prices for the absolute poor evolve fast, but nevertheless clearly on a different trajectory than the national CPI. Also the year to year change is different among the two indexes. A similar picture, but less severe regarding the divergence, is found for Ethiopia.

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[63]As stated above, the results section makes use of the BBBs calculated based on the imputed prices dataset. The picture is overall very similar in the case of the BBBs estimated with the original prices dataset as well. Due to the in between missing prices problem mentioned above, the BBB evolution based upon the original data does show higher volatility than presented in figure 4.

For India the gap and the trend differences are notable from 1992 onwards. This time it is the national CPI that typically trails behind the BBB index.

For Guinea and Nigeria the two indexes move relatively closer together, however, not without some occasional gaps such as in 1995 for Nigeria and 2004/2005 onwards for Guinea. For Niger, the gap among the indexes is less notable in absolute terms, but quite volatile in its sign throughout the period. Finally, the BBB/CPI gap for Indonesia appears throughout the entire period, although not easily visible in the figure due to the scale, and becomes quite distinguishable after 1997. The jump in Indonesia in 1998 comes after the 1997/1998 food crisis episode, caused by a combination of drought, forest fires and massive capital outflows as reported by the World Bank[64], and related food shortages (Soekirman, 2001).
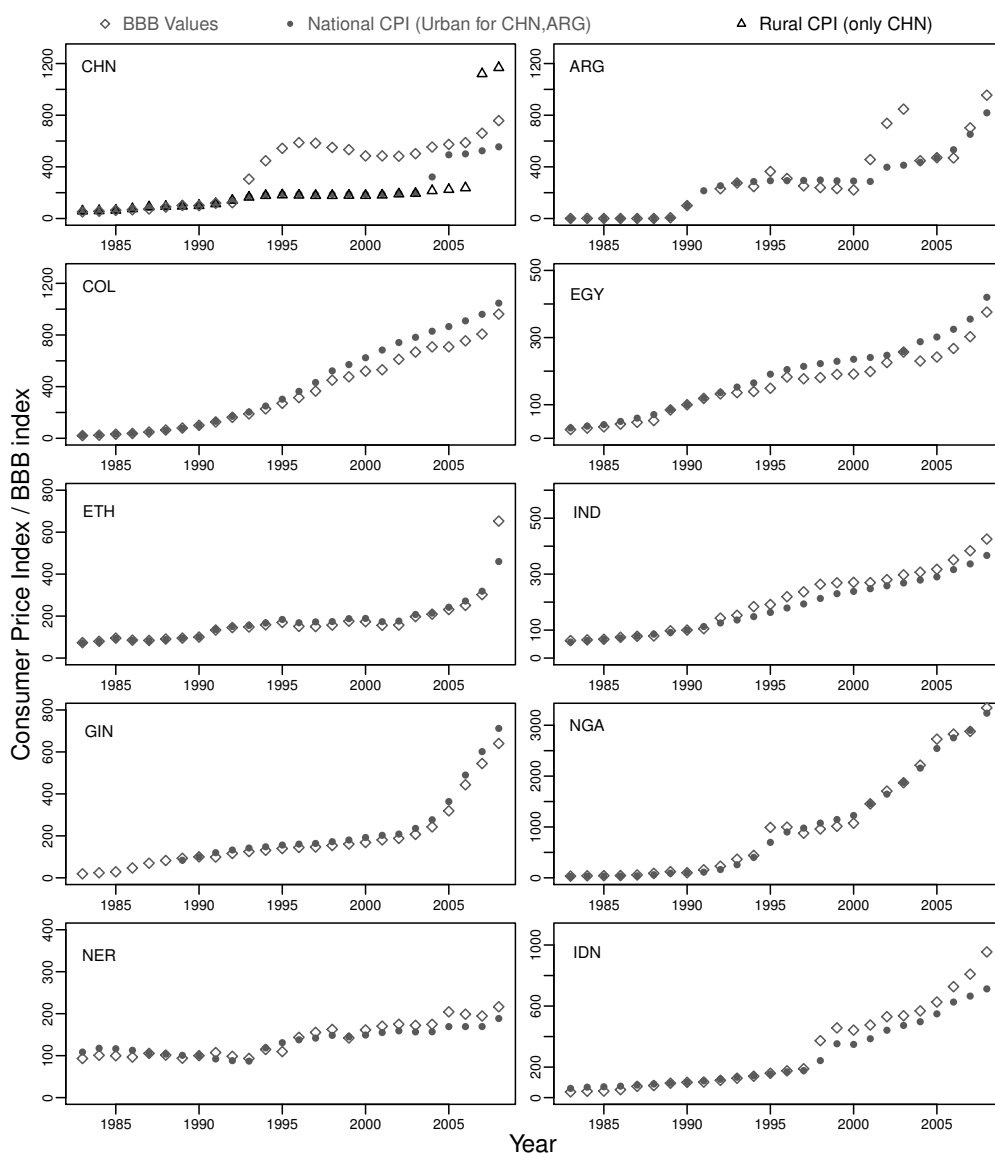

Figure 4: Evolution of CPI and BBB price indexes for selected countries, 1983-2008, (1990=100)

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[64]General Food Price Subsidies in Indonesia: The 1997/1998 Crisis Episode

Figure 5 delivers the main point. Here the BBB poverty lines are expressed in 2005 PPP dollar terms. This is done by using the ICP 2005 final household consumption PPPs, and the actual CPIs; both are identical to those reported by PovcalNet. Methodologically, only for 2005 a direct comparison with the 1.25$/day iPL makes sense. For that benchmark year the comparison is clearly pointing to that iPL overestimating global absolute poverty compared to the consistent common achievement approach. In that year the BBB poverty line that comes closer to the iPL is for Peru at $1.08, with the median poverty line being $0.55.
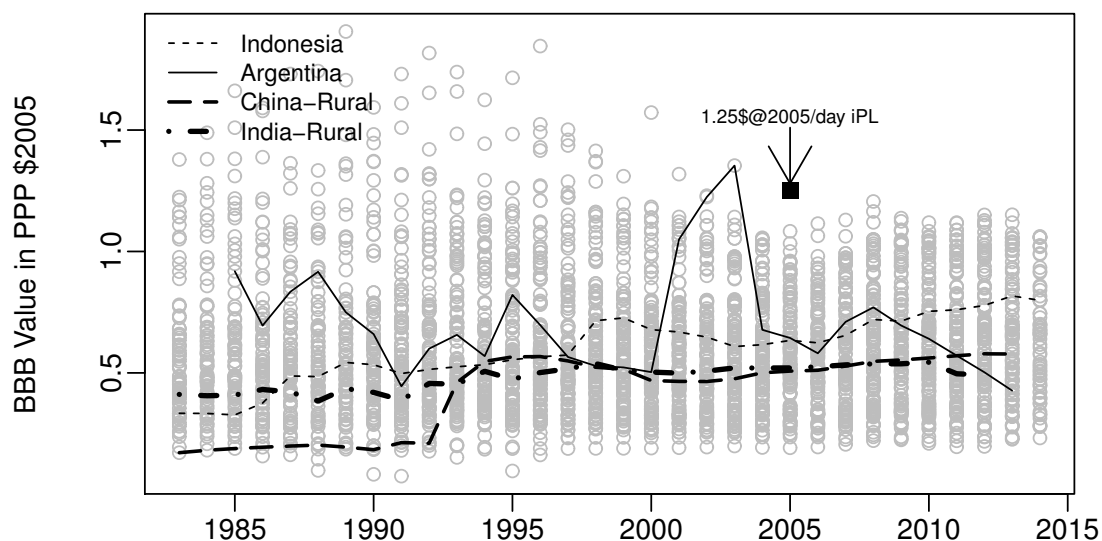

Figure 5: Evolution of BBB poverty lines expressed in 2005 PPP dollars, 1983-2014

If now we move to another year note that we do not have an iPL for that other year to compare to. That is the result of having a benchmark year for the ICP, and then using the domestic CPI to estimate the iPL in local currency. We cannot estimate an iPL for 2004 for example, by simply correcting the 2005 iPL for the CPI in the USA. That is simply wrong as explained by Ravallion (2010). So for those non-benchmark years the BBB values expressed in dollars give us an understanding of the fluctuation of the BBB poverty lines, either in relation to the same country's BBB value in 2005, or in comparison to the other country's BBB poverty line for the same year. However, not in comparison to an iPL for any non-benchmark or benchmark year.

The main point remains evident from the figure. The international Poverty Line applied by the World Bank does not consistently correspond to the same type of poverty in different years and locations. If that were the case then the variation among the BBB poverty lines for the benchmark year should have been quite modest, only to represent some uncertainty in pinpointing the exact iPL level in dollar terms. This cannot be concluded from the figure. The common achievement method, on the other hand, delivers estimates of the same type of absolute poverty that range, in 2005 PPP dollar terms, from less than a fifth of a dollar up to more than 1.5 dollars-a-day within the 1983-2014 period. This is a clear demonstration of the intensity and the severity that the iPL expresses different types of poverty, depending on

the year and on the country. The implications of this inconsistency, as we will see further, are important in identifying the extent and the distribution of absolute poverty throughout the world.

Also in the same figure a number of important countries are tracked by lines that mark the evolution of a few country specific BBBs. In the evolution of the BBB value expressed in PPP dollars, there are some pronounced episodes that introduce volatility to those lines. The 2001-2002 pronounced spike in Argentina for example, relates to the crisis that struck the country in the same period. The hump shown on the graph regarding Indonesia during 1998 relates to the 1997/1998 food crisis episode mentioned above. India is the only country shown here that has a rather smooth upward trending evolution without such large episodes.

Beyond doubt, the most striking case in the evolution of BBB poverty lines is that of China. A big jump in the BBB value takes place within a couple of years, from 1993 to 1994. It is important to note that this is not a result of imputation, but it is driven by available original price data. This finding has important implications for the trends in global poverty both in China and worldwide due to the population size of this country.

The implication on a local level can be seen in figure 6. The figure shows poverty estimates using 3 different types of poverty rates. The first two express the BBB and double the BBB value. As seen in the figure, the point estimates for poverty rates are accompanied with the upper (lower) estimate that occur by increasing (decreasing) the value of BBB by one standard deviation due to error propagation from the various sources discussed in section 4. For comparison the point estimates from PovcalNet are shown as well, which makes the iPL the third poverty rates series represented in the figure. The story of absolute poverty in China changes completely by the application of the common achievement methodology. During the eighties and until 1992 absolute poverty rates were very close to zero, and always less than 1%. Thereafter a price shock in the cheapest staple food (maize in this case) introduced a considerable rise in the absolute poverty rates. Note that the increase of absolute poverty in China comes a few years after the beginning of the second stage of reforms with a focus on privatization. The aforementioned shock greatly shifts the number of people living in poverty in China, from under 4 million in 1992, to almost 80 million in 1994. In BBB this trend is captured from an increase in staple food prices, complemented by a drop of income in rural areas. It is quite telling to observe the variation in the estimates once the BBB values are taken with one standard deviation. There is no way to compare that variation from uncertainty with the PovcalNet methodology, since all steps in the calculations are reported as single values without a standard deviation or a confidence interval.
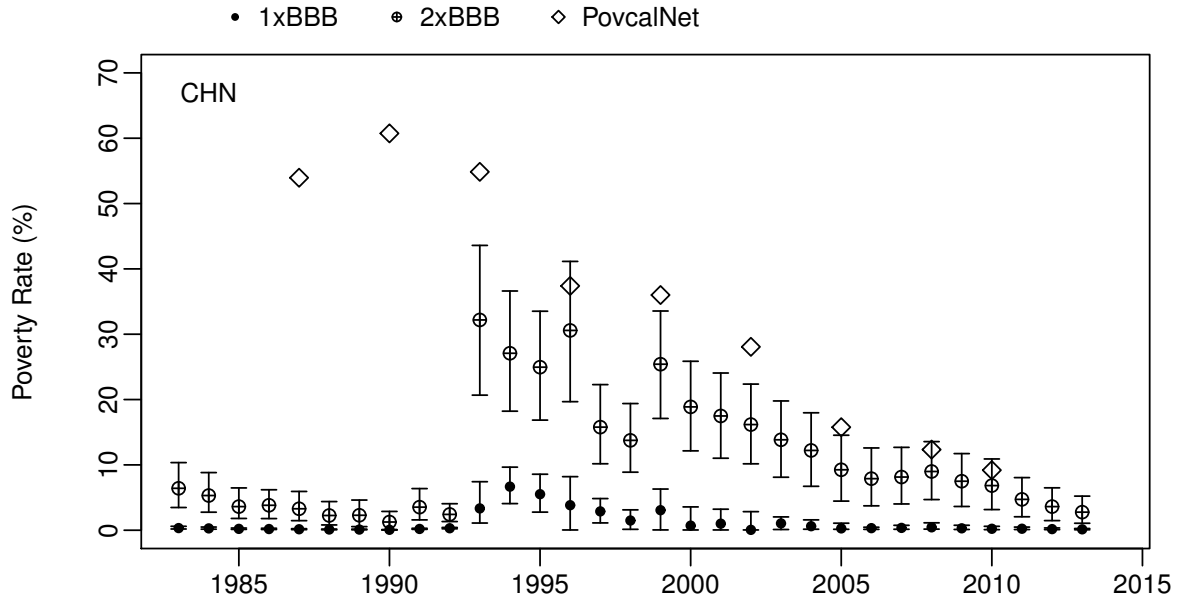
Figure 6: Evolution of BBB based poverty rates alongside the PovcalNet PPP based poverty rates for China, 1983-2013 period.

The poverty rates started to drop right after the peak in 1994 at 6.67% (4.1, 9.7)[65]. While in any case this "peak" is dwarfed in comparison to the PovcalNet estimate, which a bit shy of 55% in 1993 and is at 37.4% in 1996. A small increase occurs in 1999, and the rates phase down to a few percentage points after 2002. Comparing with the two-times BBB poverty line reveals how dense the distribution is around the poverty line. A doubling of the poverty line, results to about 5 to 6 times the poverty rate. Those rates are closer to the poverty rates of PovcalNet after 1993, but stand at very low levels before that year. Comparing 1xBBB and 2xBBB poverty lines between 1993 and 1994, the role of the distribution is quite distinctive. Although one line has simply the double value of the other, the trend they capture in poverty rate terms is strongly in the opposite direction. This relates to the underlying density of the welfare distributions at the specific points where the poverty lines rest upon those distributions. The broader picture that figure 6 paints tells a vastly different story of absolute poverty about China than was thought so throughout the global absolute poverty literature.

India, shown here in figure 7, has often been the largest contributor in global absolute poverty. In terms of BBB measured absolute poverty rates an entirely different story emerges. The incidence of absolute poverty in India is very low, and consistently lower than 3% on average. In comparison with current PovcalNet estimates BBB poverty is found many times lower throughout the board. Even doubling the poverty line would result to much lower poverty rates compared to the World Bank figures. Again note that due to the high density around the poverty line, doubling BBB results into poverty rates 7 or 8 times higher that one identifies with a single BBB per person. In comparison with China, India has higher absolute poverty

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[65]This notation should not be read as a confidence interval. $\pm$ 1 SD of the BBB value gives 9.7% and 4.1% respectively, or in the simpler notation (4.1, 9.7) as reported here.

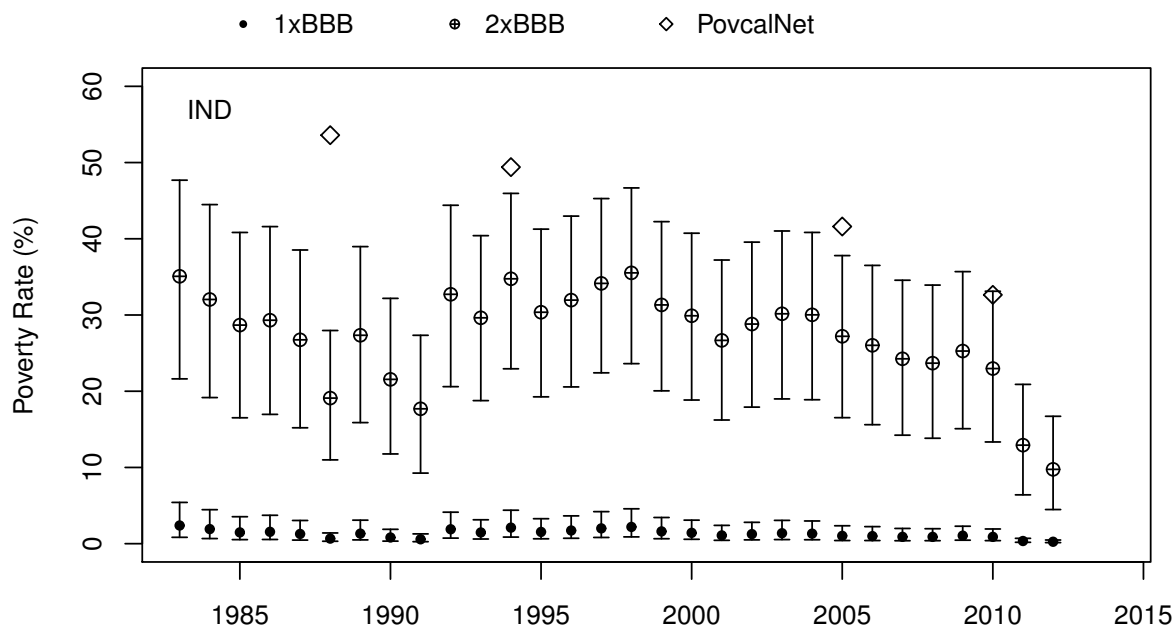rates with the exception of 1993-1995 and 1997.

Figure 7: Evolution of BBB based poverty rates alongside the PovcalNet PPP based poverty rates for India, 1983-2012 period.

In the case of Argentina, both BBB and PovcalNet poverty rates evolve much closer. In the years around the 2001/2002 crisis a spike appears in all estimates, representing the intense forces of destitution operating within a few years of hardship. What becomes evident from a comparison with India and China, is that a relatively wealthier country such as Argentina that belongs to the upper middle income countries is quite possible to surpass a low income or a lower middle income country respectively[66] regarding its absolute poverty rate.

It is worth noting that around the years 2001-2002, during which the crisis for Argentina struck, BBB absolute poverty captures a much stronger increase. It starts at 2% (1.9, 2.4) in 2000, then increases more than threefold in 2001 to 6.8% (6, 8.2), and again almost doubles in 2002 to reach 12.2% (9.3, 14.5). For PovcalNet the yearly rate of increase in the period is about 50%. That means the impact of the crisis in Argentina was more than double in terms of its magnitude on absolute poverty according to the BBB methodology. In terms of headcount, it translates to 2.8 million people entering absolute poverty in terms of PovcalNet during the crisis, while the figure according to BBB is 3.8 million. However, from the BBB point of view, the population in absolute poverty in 2000 was less than 0.8 million to begin with.

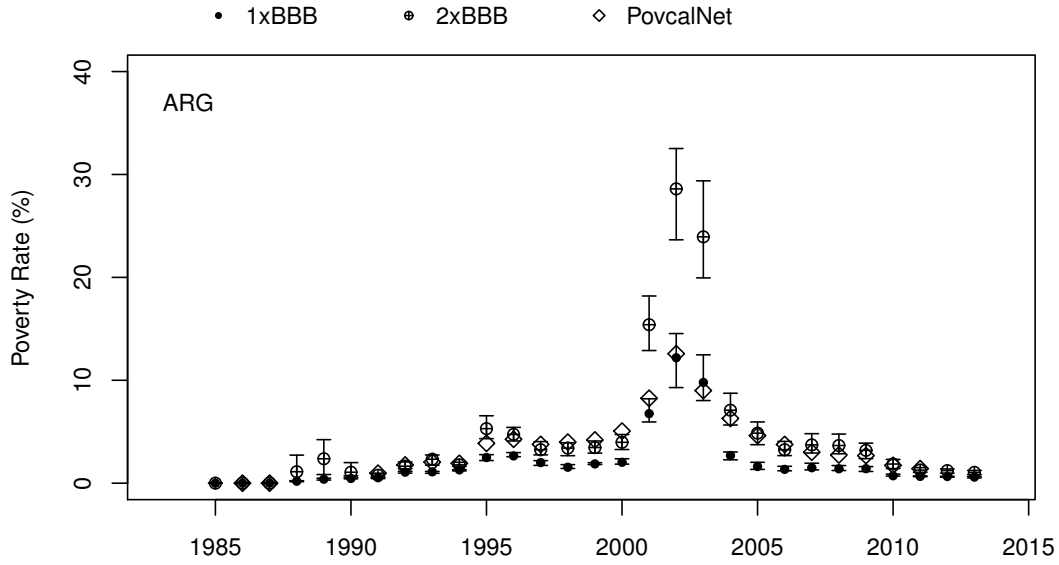[66]According to the World Bank list of economies (July 2005).

Figure 8: Evolution of BBB based poverty rates alongside the PovcalNet PPP based poverty rates for Argentina, 1985-2013 period.
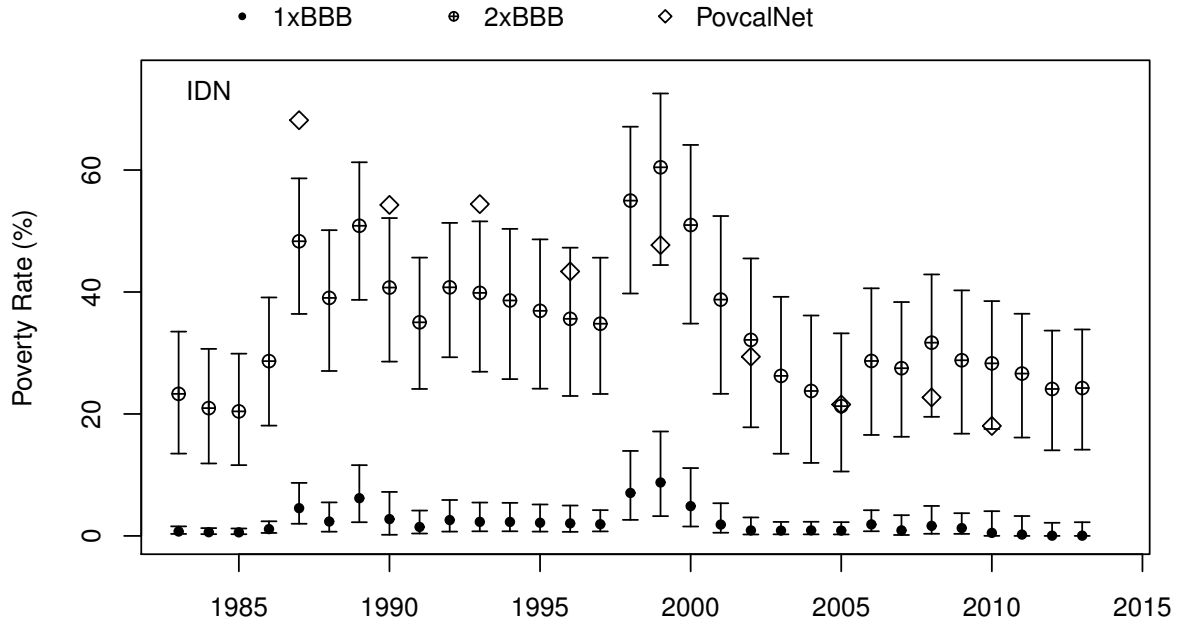

Figure 9: Evolution of BBB based poverty rates alongside the PovcalNet PPP based poverty rates for Indonesia, 1983-2013 period.

The situation is similar in Indonesia, presented in figure 9. Again, large discrepancies among the BBB and PovcalNet estimates are identified in both levels and in the trends of poverty. Absolute poverty is very low, typically less than 3% points, with two brief exceptions. That of 1987 and 1989 in the eighties, were absolute poverty rose respectively to 4.6% (2, 8.7) and 6.2% (2.2, 11.6), occurring after the 1986/87 economic crisis Ananta (2002). And that of 1998/1999 in the nineties, with 7% (2.6, 13.9) and 8.7% (3.2, 17.1) respectively, occurring after the 1997

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crisis in Indonesia.

For Zambia, as seen in figure 10, the situation is much worse than any of the countries presented so far. Observe that PovcalNet poverty rates for Zambia before 1995 are not that different compared to countries like China, India and Indonesia. However, in terms of BBB absolute poverty is multiple times the absolute poverty measured in the other countries. At its peak in 1991 it raised to 32.9% (30.7, 35.1). Consider in this comparison the vastly different absolute poverty intensity that persisted in Zambia those years, compared to the methodologically inconsistent poverty estimates according to PovcalNet. This does not mean that India and the other countries were rich, but they suffered from poverty of a different kind than the absolute poverty strongly persistent in Zambia. In other words, the kind of poverty found in China, India and Indonesia via PovcalNet, as a whole, is of a less severe type than the one found in Zambia. Zambia's poverty rate is undervalued in relative intensity according to the PovcalNet figures. Going back to the evolution of absolute poverty in Zambia, after the 1991 peak, a steady decline in poverty takes place until 2003. Then a sharp rise in poverty brings the 2004 estimate up to 16.3% (13.2, 19.4). For the remainder of the period, until 2014, the poverty rates vary approximately around these boundaries.
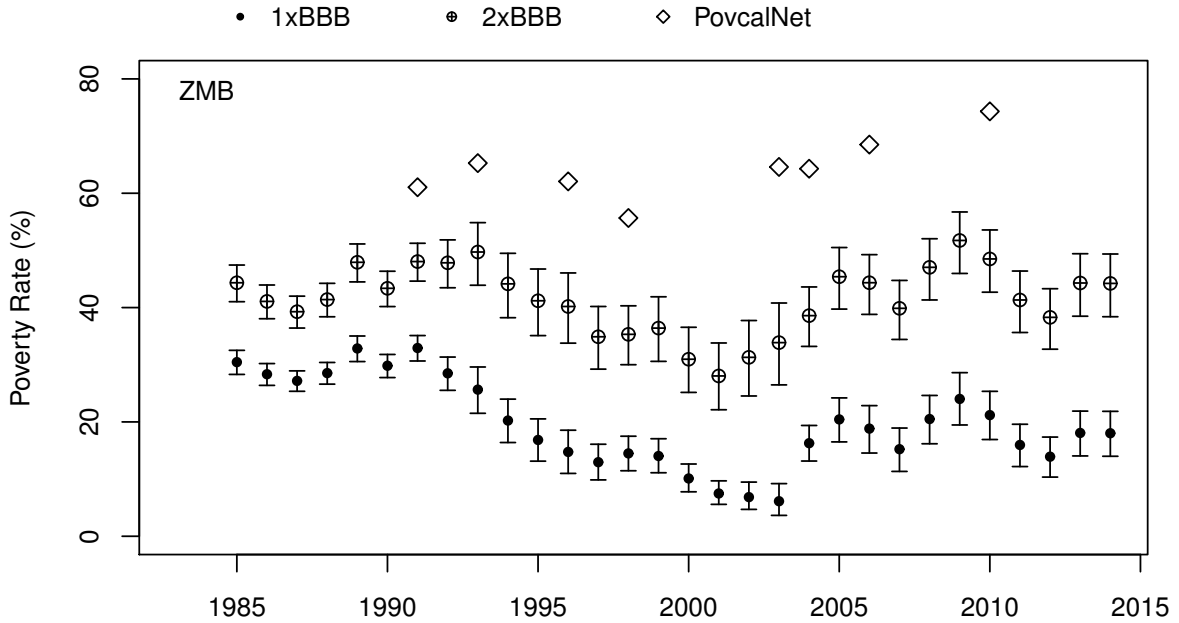

Figure 10: Evolution of BBB based poverty rates alongside the PovcalNet PPP based poverty rates for Zambia, 1985-2014 period.

The case of Zambia is descriptive of the situation in Sub-Saharan Africa as a whole (figure 11). Although the region is considerably less volatile than that specific country, absolute poverty is consistently beyond the typically low values found in other locations and regions[67]. An upward trend peaks in 1995 in Sub-Saharan Africa at the level of 27% (22.5, 31.4), and then follows a downward trend until the shift in 2008/2009. This shift can also be observed in the figure of Zambia. The link of this shift with the Great Financial crisis cannot be ruled out without

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[67]The development of absolute poverty rates for all regions is shown in section 9.4 of the Appendix

further investigation. Moreover, in the region of Sub-Saharan Africa the highest poverty rates on a per country level are also recorded. In Angola in 1993, the BBB measured absolute poverty rate reached 73.2% (68.8, 76.9). In the Democratic Republic of the Congo in 1996 absolute poverty rate peaked at 74.2% (67.8, 79.1). Madagascar in 1999 reached 77% (71, 81.6), and finally Swaziland in 1988 peaked the global absolute poverty rates with the negative record of 82.4% (77.3, 86). These high figures suggest that the BBBs are not bound to produce low poverty rates. They rather mean that some countries throughout the developing world are, and/or were, relatively far more backward in terms of absolute poverty than previously thought of.
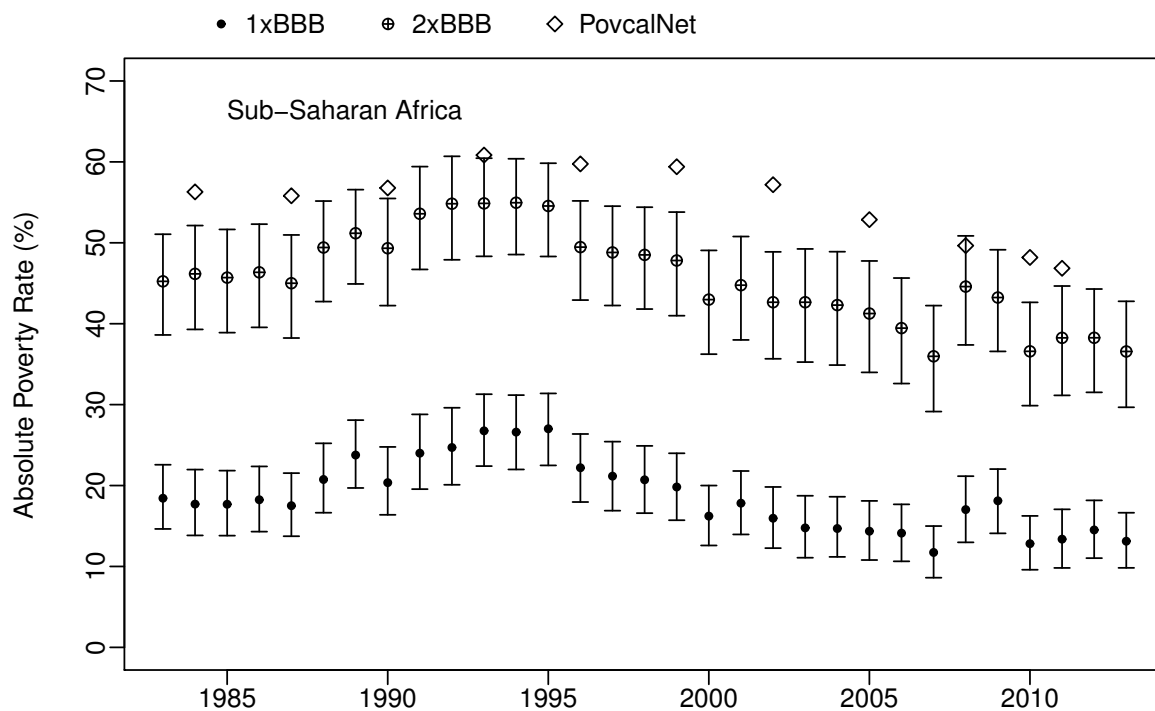

Figure 11: Evolution of BBB based poverty rates alongside the PovcalNet PPP based poverty rates for Sub-Saharan Africa, 1983-2012 period.

On the global aggregate level the absolute poverty rates of the Developing World are shown in figure 12. The divergence from the levels and trends identified by the PovcalNet methodology was somehow expected considering the results presented so far. The BBBs reveal a clear upward trend in the 1983-1994 period, that fades off and reverses in 1995. In 1994 the global absolute poverty rate peaks for the entire period at 6.6% (4.6, 9.1). For the remaining years until 2012 the trend is negative, but very slowly so. It is also interrupted once in 2008/2009 during the years after the onset of the Global Financial Crisis. It therefore appears that there has been a mark left on the population living in absolute poverty in the world that could be linked with that crisis. Do note that this is not picked up by the averaging iPL based estimates from PovcalNet.

For 1990, which is the year of reference for the first Millennium Development Goal, the poverty rate is found to be 3.7% (2.6, 5.1). The Goal itself is to halve absolute poverty rates between

1990 and 2015[68]. The end year of the Goal is 2015 for which there are no data yet, but for 2012 the estimate is 2.7% (2, 3.5). Given the very slow trend during the post 1995 period, it becomes unlikely that the Goal will be achieved. This is in stark contrast to the celebration of this Goal as one of the first that have been achieved, also 5 years before its deadline. Nevertheless, these results show that on the one hand the target of alleviating absolute poverty is not very far as it was thought of, but on the other hand, absolute poverty has shown remarkable persistence throughout the period.

In terms of the number of people living in absolute poverty the results are again far lower than those of PovcalNet, as shown in figure 13, but less optimistic in terms of trends. Again the total population living in poverty peaked in 1994 as did the poverty rates. The estimation for that year is about 286 million (202, 395). In the latest year, 2012, the estimation becomes 149 million (119, 195). Comparing that against the 1990 estimate of 137 million (98, 192), it appears that the developing world could not sustain the additional population without setting some additional people in conditions of absolute poverty. In 1984 the lowest number of people in absolute poverty was achieved. The figure is down to 94 million (64, 141) in that year[69].
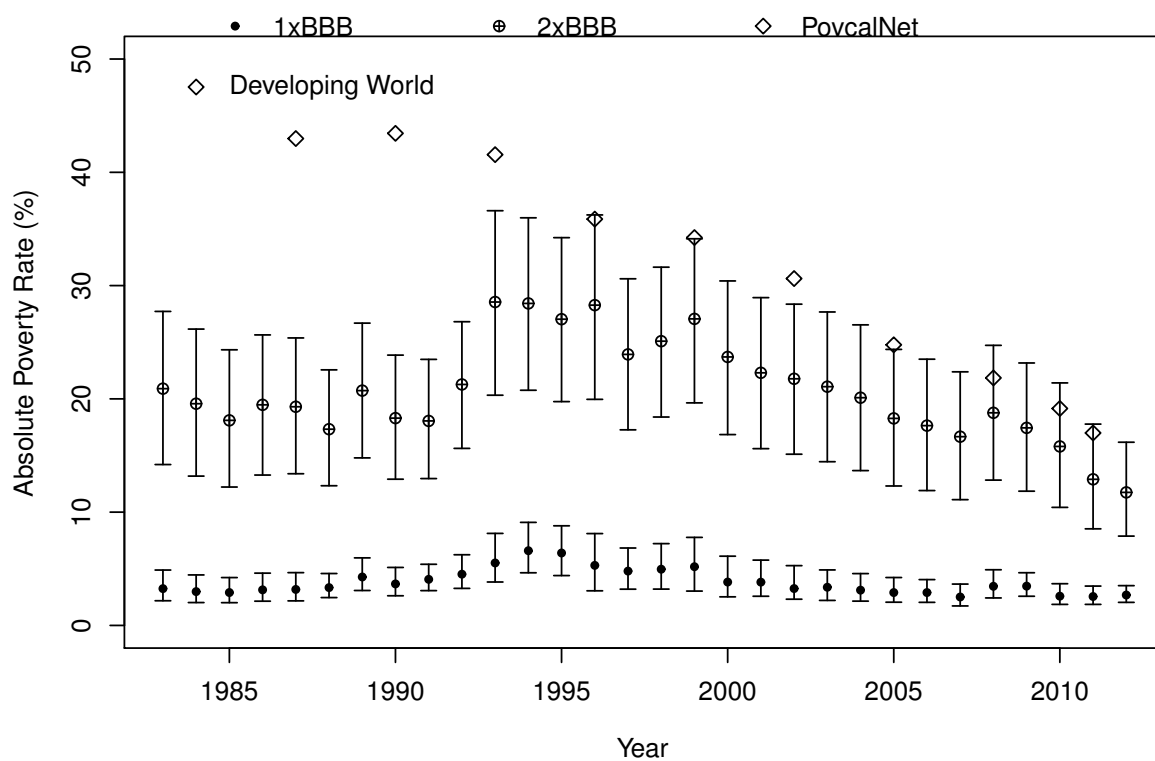

Figure 12: Evolution of BBB based poverty rates alongside the PovcalNet PPP based poverty rates for Developing World, 1983-2012 period.

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[68]"Target 1.A: Halve, between 1990 and 2015, the proportion of people whose income is less than $1.25 a day", taken from http://www.un.org/millenniumgoals/poverty.shtml

[69]The developing countries from Europe & Central Asia are missing from that year, however the region constitutes a small fraction of the people living in absolute poverty. Thus this "record" is most likely to hold even once data from that region is eventually added.
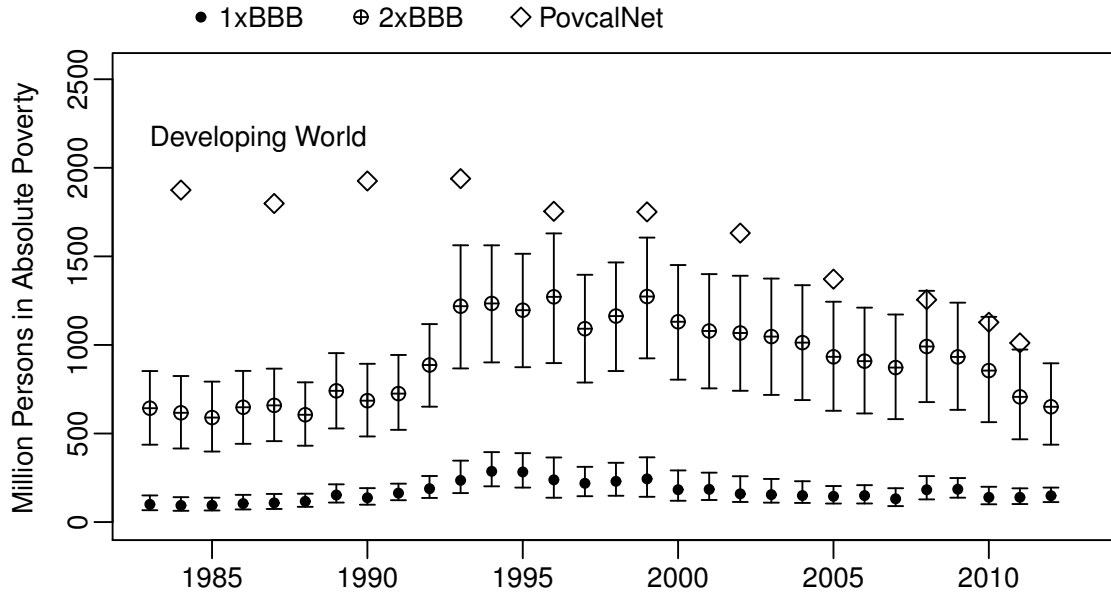
Figure 13: Evolution in the number of people living in absolute poverty Developing World, 1983-2012 period.

Finally, in figure 14, the geographical distribution of the people living in absolute poverty is presented. As it is evident from the graph, Sub-Saharan Africa is constantly the largest contributor on global scale. The second largest contributing region depends on the specific year. From 1983 until 1992 and from 2000 until 2012 it is South Asia that occupies second place. In the years between 1992 and 2000 the second largest contributing region becomes East Asia & Pacific. That region ranks 4th in most of the other years. The third place is typically occupied by Latin America & Caribbean. Europe & Central Asia only becomes visible from 1991 until 2004. However, before 1991 the region is largely underrepresented and its aggregate is not shown in this figure for that period. Middle East & North Africa have extremely low contribution, therefore as a region it is not visible in the graph at any year. Comparing these findings with the geography of poverty from PovcalNet largely a complete reshuffle takes place. Sub-Saharan Africa is most of the years in 3rd place, only to rank first in 2011 according to that source. In PovcalNet, until 1999 East Asia & Pacific was the largest contributor, followed by South Asia. This order reversed from 2000 onwards. Also Latin America & Caribbean ranks 4th in PovcalNet instead of 3rd place that it takes on the BBB basis.
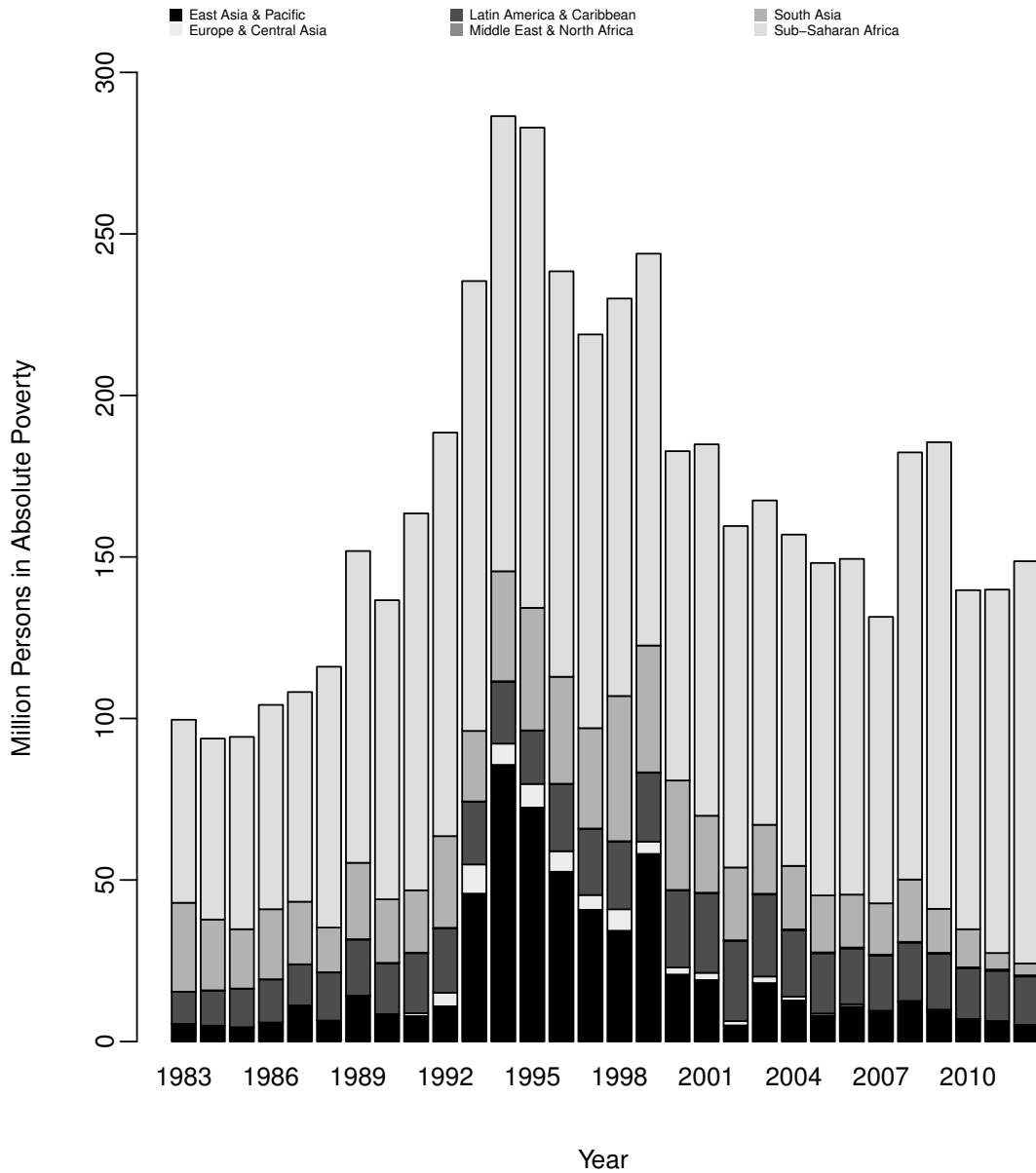
Figure 14: The geography of global absolute poverty on regional level, 1983-2012. *Note* that the region Middle East & North Africa is not visible due to the very low number of people living in absolute poverty in that region.

6   Discussion

One might argue that the first implication of the BBB absolute poverty results is that PovcalNet and the World Bank have largely overestimated the incidence of absolute poverty for the entire period covered here. The results certainly validate this conclusion, however, I will argue that the first implication is a rather methodological one. What has been supported by the results presented, is that the World Bank has not been measuring absolute poverty with a consistent and internationally comparable methodology, thus has not been measuring global *absolute*

poverty almost at any country-year. On the contrary, the World Bank has been measuring a different type of poverty per country, and per year, depending on the interplay of the iPL, the PPP, and the relation of the CPI with the price index appropriate for people living in absolute poverty in a country as shown in figure 5. This is directly implied by that comparison of BBB values in dollar terms. For some countries those ingredients end up measuring poverty with criteria that are relatively more demanding than in others, consequently measuring different types of poverty among countries.

The direct implication of this finding is a matter of comparing "apples to apples". Consider two countries that have almost the same poverty rate according to PovcalNet, e.g. 47.7% for Indonesia in 1999, and 46.9% for Honduras in 1990. However, according to a consistent methodology, such as the BBBs applied here, the poverty rates are 8.7% and 11.3% respectively. The ranking has reversed and the Honduras appear now with about 30% higher incidence of absolute poverty than Indonesia. Thus in terms of the same type of poverty, and in our case absolute poverty, the situation between the two country-years is far from being equal. But this cannot be captured by an averaging methodology like the iPL.

The sense from the "low" absolute poverty rates reported using BBBs as poverty lines, might be discomforting. But again, one needs to keep in mind that, as the first section in the results has shown, compared to the iPL the BBBs are a very strict and frugal definition of absolute poverty. This might be something expected from a methodology that tries to capture the *absolute* component of poverty in an internationally consistent manner. The more one moves away from the absolute necessary for survival, the more relative is the nature of the poverty threshold one applies. As has been shown here, the repeated effort of the World Bank, and its researchers to do so until now, all have important methodological limitations that render the iPL methodology inaccurate for the purpose of measuring absolute poverty. Nevertheless, the undertaking of the PovcalNet to measure poverty does carry some considerable value, to the very least, by bringing the problem of absolute poverty forward.

Very importantly, India and China, the two largest contributors in the accounts of people living in absolute poverty, were not and are not countries with a large part of their population living under absolute poverty conditions. This has implications on how one reasons about the impressive rates of absolute poverty alleviation that have been reported for some time now about these two countries. According to the BBB framework, there has been no such thing as an impressive absolute poverty alleviation there. With the exception of China in 1993/94 the absolute poverty figures are almost too low to be visible on the same graph with the PovcalNet estimates. Methodology matters a great deal here.

On the other hand, BBBs and PPPs share similar limitations when price data are concerned. In principle we have price data from a few urban locations per country. Even in cases when the prices are reported as a national average, again the underlying data originate from a few measurement locations. The ICP faces similar limitations, as the price collection for the 2005 ICP round in China shows. For China the price collection is limited to twelve main cities (Ward, 2009), thus ignoring rural areas, for example. Undoubtedly, more effort is necessary to improve this; and the larger the country, the more important the implication of those price differences

can be.

Related to the above, it is widely accepted that prices in rural areas are lower than urban ones. However, for the poor there is one additional element to consider. As noted by Ward (2009); Reddy and Pogge (2010), low income groups tend to face higher prices for the same goods. On the matter, Rao (2000) finds relevant evidence for rural South India, and Biru (1999) for Zambia, as cited by Reddy and Pogge. This negative effect for the poor is captured neither in our data, nor in the data of the World Bank.

Another important limitation that is shared among our methodology and the PovcalNet is the inability of both to account for any misallocation within households. This is of particular concern, and as shown by Klasen and Wink (2003) there are indications of strong misallocation, especially towards women. However, available data do not have the necessary level of detail that would allow us to address this particularly worrisome effect. With a proper treatment this could, however, be captured by the error term as part of our uncertainty in pinpointing the exact level of absolute poverty.

A final shared limitation mentioned here is the constraint of working with average consumption or income data on a yearly basis. This is entirely due to the nature of both the distributions- and the price data structure. This means that both methodologies capture poverty if on a yearly average someone is below a threshold. It could however well be the case that there is some inequality in the distribution of income or consumption the year. Also the price fluctuation within a year could be creating months that are harder to go by than others. Those individuals that "only" serve a few months a year in absolute poverty conditions, also because of bad savings technology at hers or his disposal, may well go unnoticed by both the data and the methods.

Regarding the selected composition of the BBBs, it is arguably one of many others that can be followed, especially with respect to the part of the basket that does not relate to the nutritional intake. Nevertheless, the principle of judging the world's absolute poor with the same standards would still be reasonably respected for any number of small deviations around the exact definition we apply here. The important element is to keep the rules regarding the composition and calculation of the BBB fixed. In this respect, Ravallion and Bidani (1993) have shown for the case of Indonesia in 1990, that CBN methods are "fairly robust" in variation of the bundle composition, of the functional form of the poverty measure, and spatial price differences adjustments.

Finally, our findings confirm those of Reddy and Pogge (2010) regarding the differences in trends identified by the poverty spells. They have shown that using NPLs and the iPL, a large part of "the trends of poverty identified [...] are different in direction". As shown here, this holds with the BBBs approach as well.

7 Conclusions and final remarks

The application of a bare bones basket in absolute poverty estimates sheds light on global and regional poverty from the perspective of a consistent poverty line in terms of an achievement that is common to all residents in all countries. This paper has shown that this is in direct contrast to the "varying notion of absolute poverty" implied by the use of PPP conversion methods as pointed by Srinivasan (2010). Additional findings have been provided here which show that what is captured by World Bank's PovcalNet definition of absolute poverty, varies across years and countries due to the nature of the underlying methodology. Put differently, the international Poverty Line derived by averaging of PPP converted data does not correspond to any internationally consistent standard. This failure is the result of a sequence of inappropriate methodological choices. The Bare Bones Basket, as precisely applied here, is only one way of producing poverty rates that consistently identify the incident of absolute poverty. However, the general methodological framework of the common achievement approach, where the BBBs belong to, is currently the only available option that measures absolute poverty by the same standard all over the world.

The results presented here demonstrate vividly that our understanding of absolute poverty in global terms is widely biased by inappropriate methodologies. The incidence of absolute poverty is not as extensive a phenomenon as has been thought so far. Neither it is widely distributed globally to large numbers of people living in poverty or as poverty rates. Instead, on average global absolute poverty rates fluctuate rather slowly around the level of a few percentage points throughout the entire period. The occurrence of this type of poverty is also geographically contained largely within Sub-Saharan Africa in the entire period we focus.

Further work is necessary to account for differences in prices between rural and urban regions, and to expand the investigation back in time. Accounting for, among others, errors contained in the distributions; errors introduced by shifting distributions to years were they are unavailable; errors due to the quality of the price sources; and errors due to the estimation process of the PAL and MDER values is required as well. Along these lines, the traditional openness of ILO to avail the price data it gathers is an important component in measuring global poverty research, keeping this policy in place would be highly recommended.

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9 Appendix

9.1 Global poverty articles

Table 2 summarizes the contributions in the global absolute poverty literature. Dhongde and Minoiu (2011) conclude from their review of the poverty literature, that studies of global poverty estimates are simply not comparable. Methodological differences, along with the exact countries included in the sample, result in vastly different estimates that in the very end do not allow those studies to be compared directly or indirectly. Even when the same international poverty line is applied, results change drastically if one uses the welfare indicator of income or consumption, and also depending whether this indicator is measured by the national account statistics (NAS) or found through household surveys (HHS). Those differences strongly imply that one measures entirely different poverty groups with the application of each set of methodological and data choices (Deaton, 2005).

Table 2: Global poverty studies characteristics

Global poverty study	Years Covered	No. of countries & Focus [a]	Database [b]
Ahluwalia et al. (1979)	1975	25, Developing	World Bank Data Bank
Ravallion et al. (1991a)	1985	22, Developing	World Bank
Chen et al. (1994)	1985-1990	44, Developing	World Bank / WDR
Ravallion and Chen (1997)	1987-1993	67, Developing	World Bank / WDR
Chen and Ravallion (2001)	1987-1998	88, Developing	World Bank
Bourguignon and Morrisson (2002)	1820-1992	See footnote[c], Global	
Bhalla (2002)	1950-2000	149, Developing	World Bank, PWT
Chen and Ravallion (2004)	1981-2001	97, Developing	World Bank
Sala-i Martin (2006)	1970-2000	81 (138[d]), World	WIID, PWT
Pinkovskiy and Sala-i Martin (2009)	1970-2006	191, World	WIID, PovcalNet
Chen and Ravallion (2010)	1981-2005	115, Developing	WIID, PWT
van Zanden et al. (2011)	1820-2000	39-99[e], World	WIID, Maddison, Historical
Pinkovskiy and Sala-i Martin (2014)	1992-2010	39-99[f], World & Developing	PovcalNet, WDI

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[a] Countries for which distributional data is imputed are not included. It also refers to the maximum number of countries in the sample, which does not mean that for each year a study covers there are surveys available for all the countries in their sample. Focus refers to whether the paper focuses on global poverty, or on a mix of developing and developed countries, or more explicitly on poverty in the developing world

[b] PWT: Penn World Tables; WDR: World Development Report; WIID: UNU-WIDER World Income Inequality Database.

[c] Varies with the observation year

[d] For 81 countries the author has data for more than 1 observation year, and the remaining country-years are imputed. An additional 29 countries have at least one distribution available for the entire period, and the remaining country-years are imputed. To reach the total 138, an additional group of 28 countries is included with pure imputation techniques.

[e] Varies with the observation year

[f] Imputation is used extensively

Table 3: Comparison of Poverty Rate of Aggregate Estimates (in percentage points)

Study	1950	1960	1970	1975	1981	1984	1987	1990	1993	1996	1999	2002	2005
$200/year or $0.55/day@1970PPP, Consumption/Survey Based													
Ahluwalia et al. (1979)					38								
$1.02/day@1985PPP, Consumption/Survey Based													
Ravallion et al. (1991a)					-	33[1]	-	-	-	-	-	-	-
95% CI					-	27.9~39.2[1]	-	-	-	-	-	-	-
# of Surveys					-		-	-	-	-	-	-	-
Chen et al. (1994)					-	33.88[1]	-	33.52	-	-	-	-	-
Ravallion and Chen (1997)					-	-	30.7	-	29.4	-	-	-	-
(ibid)[4]					-	-	33.9	32.9	31.9	-	-	-	-
$1.08/day@1993PPP, Consumption/Survey Based													
Chen and Ravallion (2001)					-	-	28.31	28.95	28.15	24.53	25.56[2]	-	-
Chen and Ravallion (2004)					40.4	32.8	28.4	27.9	26.3	22.8	21.8	21.1[3]	-
$1.25/day@2005PPP, Consumption/Survey Based													
Chen and Ravallion (2010)					51.8	46.6	41.8	41.6	39.1	34.4	33.7	30.6	25.2
$1.52&$3.04/day@2000PPP, Income/NAS Based													
Pinkovskiy and Sala-i Martin (2009)	-	-	26.8	23.3	15.7	11.2	8.9	8.2	8.0	7.2	6.5	6.2	5.6
(ibid)	-	-	45.2	43.1	37.8	33.2	27.5	24.9	23.6	19.9	16.8	15.5	13.7

	1950	1960	1970	1975	1980	1985	1990	1995	2000	2005
$1.08&$1.30/day@1993PPP, Consumption/Survey Based										
Bhalla (2002)	58.2	46.4	40.2	-	38.0	-	20.0	-	11.4	-
(ibid)	65.8	55.4	49.3	-	46.5	-	29.0	-	18.2	-
$1.25&$1.50/day@1993PPP, Consumption/NAS Based										
(ibid)	55.8	43.9	37.9	-	35.0	-	17.7	-	9.1	-
(ibid)	63.2	52.5	46.4	-	43.5	-	25.4	-	13.1	-
$1.50/day@1996PPP, Income/NAS Based										
Sala-i Martin (2006)			20.2	18.5	15.9	12.1	10.0	8.0	7	
(ibid) developing world only			25.3	22.7	19.7	14.8	11.9	9.5	8.3	
$1.52&$3.04/day@2000PPP, Income/NAS Based										
Pinkovskiy and Sala-i Martin (2009)	-	-	26.8	23.3	17.5	10.	8.2	7.7	6.4	5.6
(ibid)	-	-	45.2	43.1	38.7	31.3	24.9	21.4	16.2	13.7

1. Estimate for 1985 instead of 1984; 2. Estimate for 1998 instead of 1999; 3. Estimate for 2001 instead of 2002; 4. Excluding EECA; 5.SAP: Simple Accountant Procedure, see the text for details.

9.2 Price index estimation test

As a point of control, I have used the actual price index applied by PovcalNet reported in the "output details" of the distributional data. I thus can verify if the CPI information allows, along with the PPP exchange rates, to replicate each country-year price index. Based on the disclosed CPI values by PovcalNet and the official 2005 consumption-based PPP also reported by PovcalNet, from the 445 cases, the price indexes of 337 were reproduced with an accuracy of more than 3 decimal points, 39 price indexes were reproduced with more than 1% error margin, 19 with more than 3% and 13 with more than 10%. Those 13 cases are: BRA1981-1988, COL2000, HRV1998, HRV2008, HTI2001, THA2010. For the case of Brazil 1981-1985, if a rate of depreciation equal to 5 trillion (instead of the correct 2.75 trillion) one gets the price index reported by PovcalNet with 3 decimal points of accuracy. For Brazil 1986-1988, the same issue exists but this time instead of the appropriate 2.75 billion, PovcalNet seems to be using 5 billion. It is worth noting that for 7 out of the 445 PovcalNet detail outputs have yearly consumption/income reported instead of monthly. Also IRQ2007 contains an obvious error in the LCU mean value by 3 decimal points. Regarding this particular case, in an on-going personal email correspondence with PovcalNet they acknowledge that a 1000x multiplier on the expenditures reported in LCU was indeed applied, because of the differences observed between the currency level in the reported expenditures and the PPP2005 values. Apparently, other multipliers have been applied to other cases, however they are not reported anywhere in PovcalNet's website. Note that from the countries that I have calculated the price indexes with some error, ALB2005 is a particular strange case since a price index of 55.9 is reported by PovcalNet, although the ICP PPP 2005 exchange rate is 60.41. In these calculations I have only used data made available by PovcalNet, and the discrepancy with their official results is worrisome, but only for a handful of cases. However, it may be entirely due to redenomination/revaluation issues, as the case of Brazil indicates. Despite the above discrepancies, for the large majority of country-years for which I can directly observe and verify the price indexes used by PovcalNet, it is possible to reproduce the same price index.

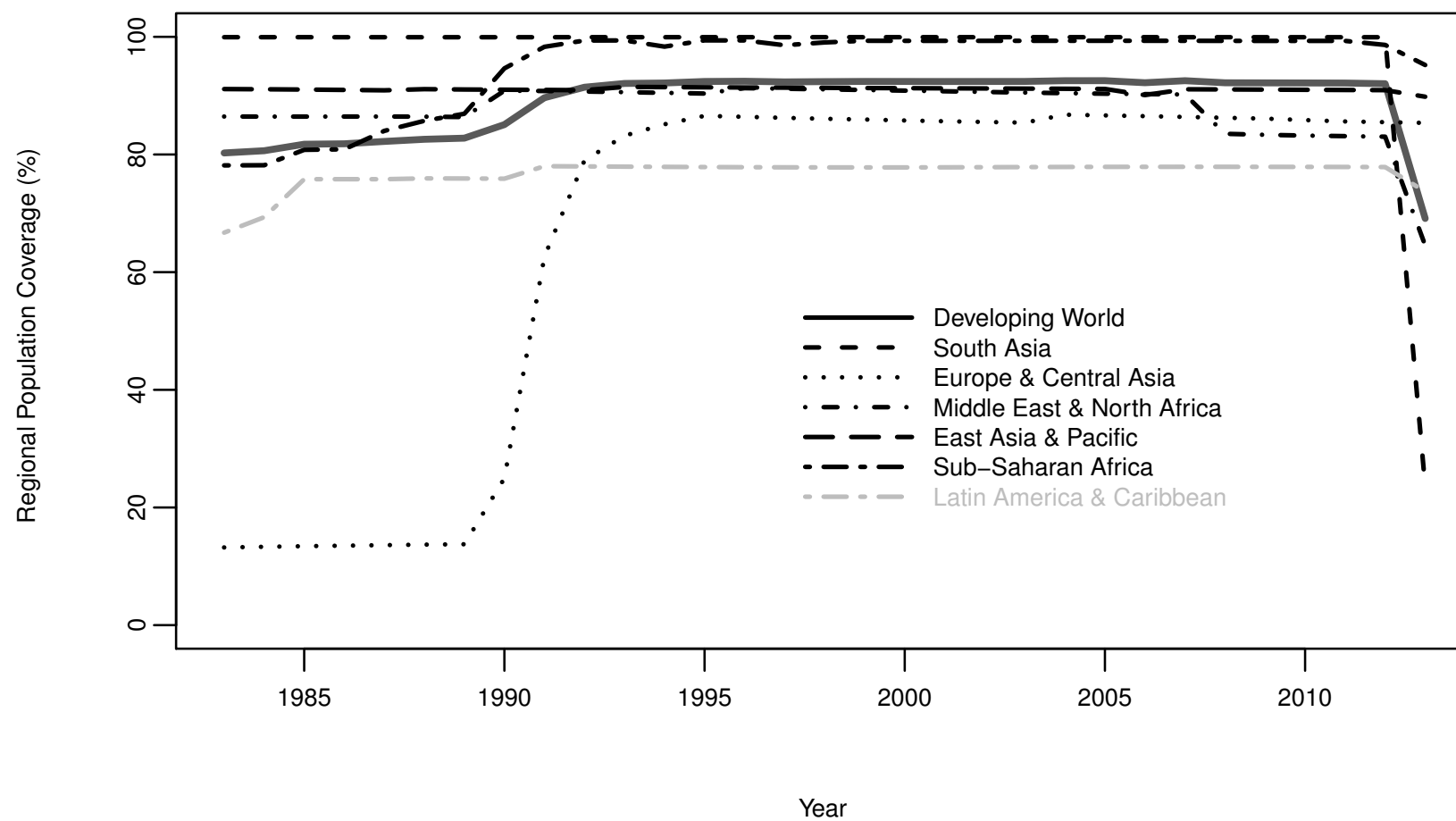## 9.3 Population coverage of BBB regional estimates

Figure 15: Population coverage of developing countries in the various world regions (in percentages), 1983-2013.

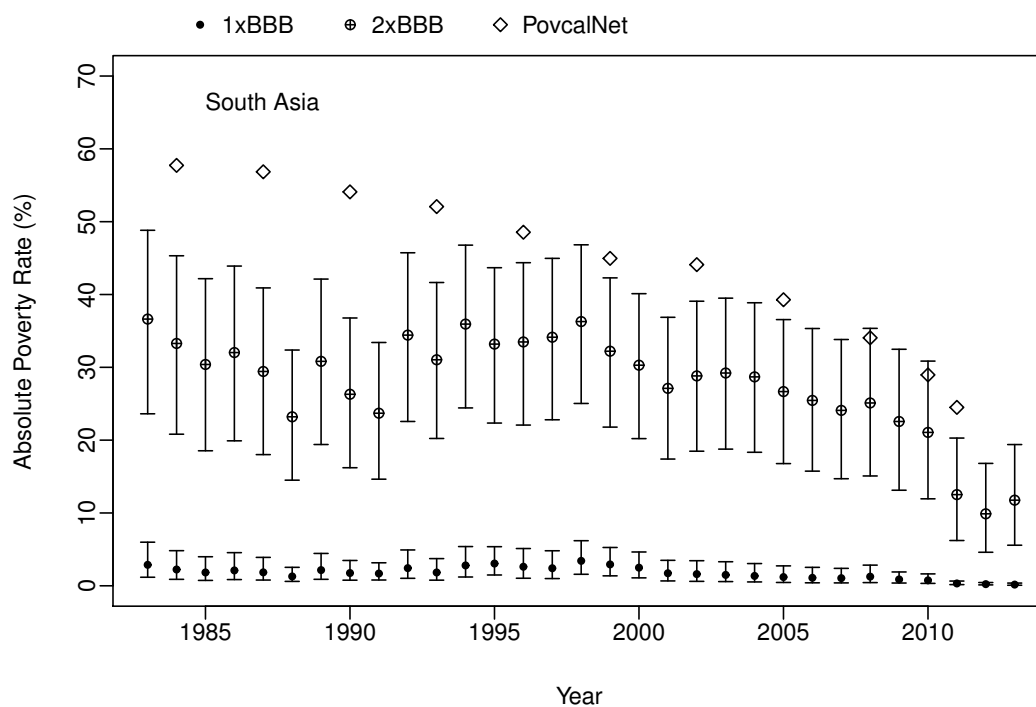## 9.4 Regional absolute poverty rates evolution

Figure 16: Evolution of BBB based poverty rates in South Asia, 1983-2013 period. Note: India is missing in 2013.
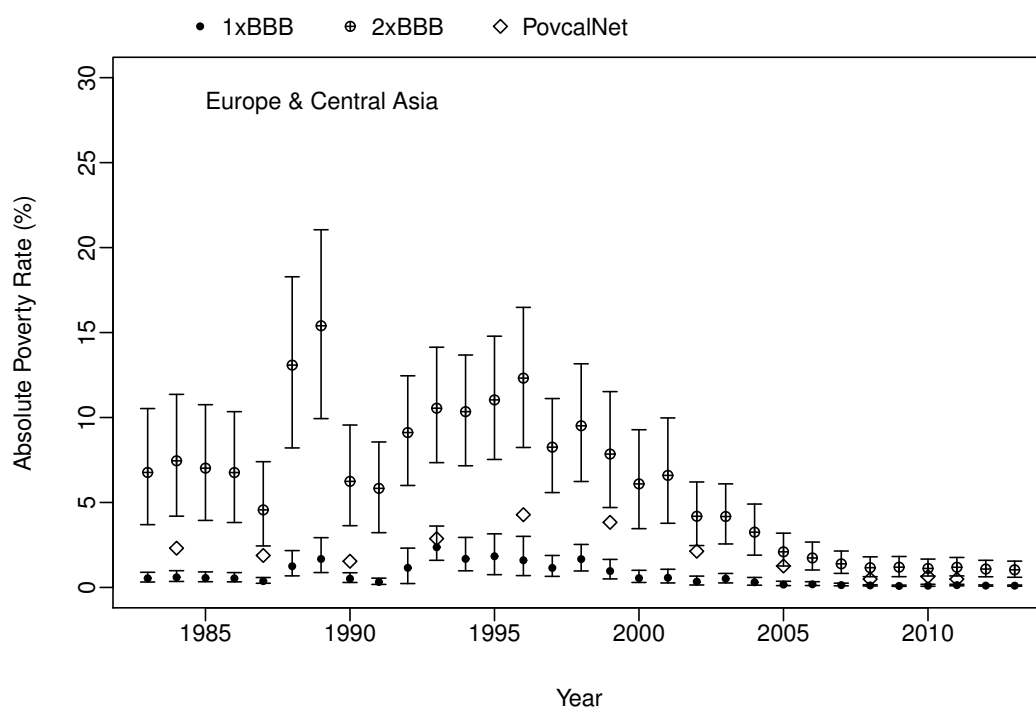

Figure 17: Evolution of BBB based poverty rates in Europe & Central Asia, 1983-2013 period. Note: Before 1991 population coverage is low.
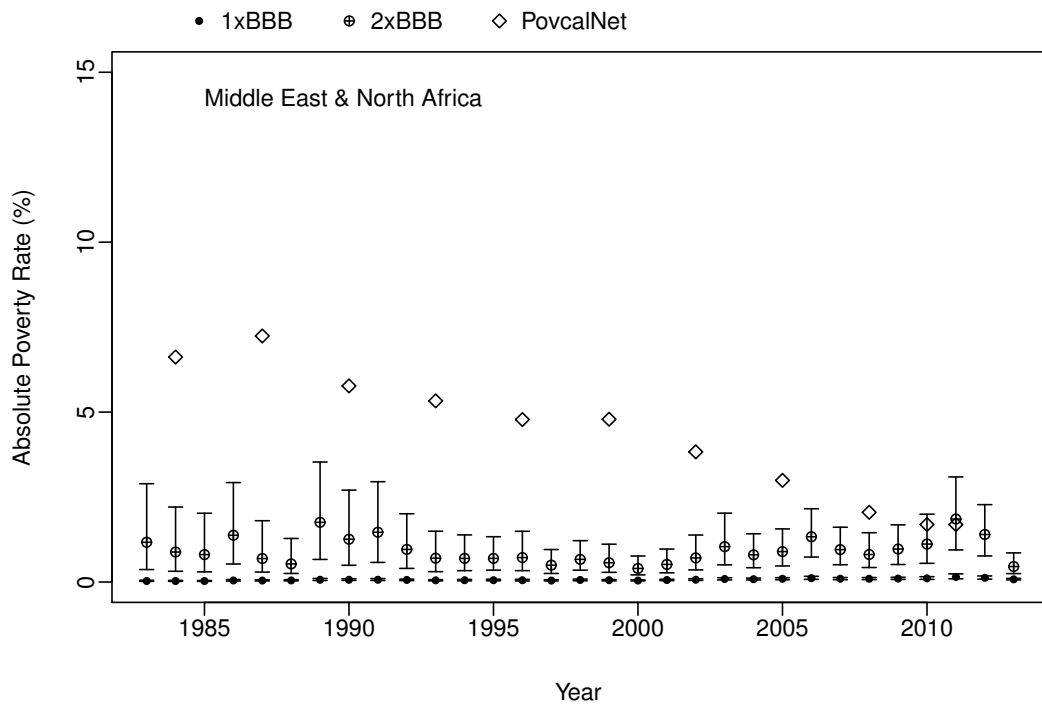
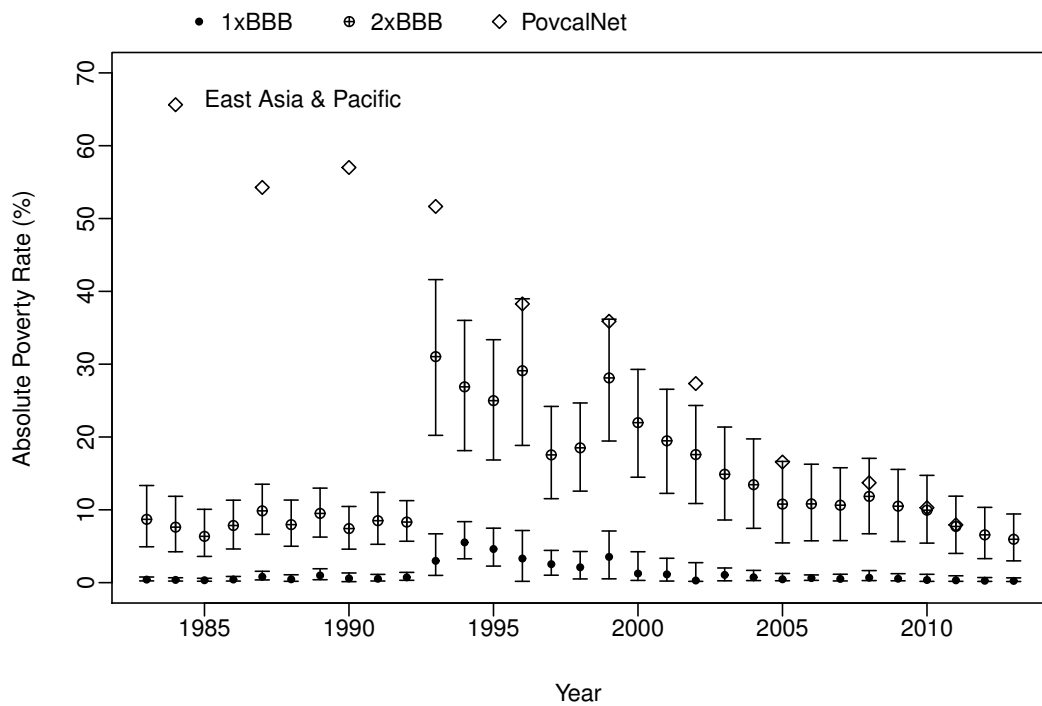Figure 18: Evolution of BBB based poverty rates in Middle East & North Africa, 1983-2013 period.

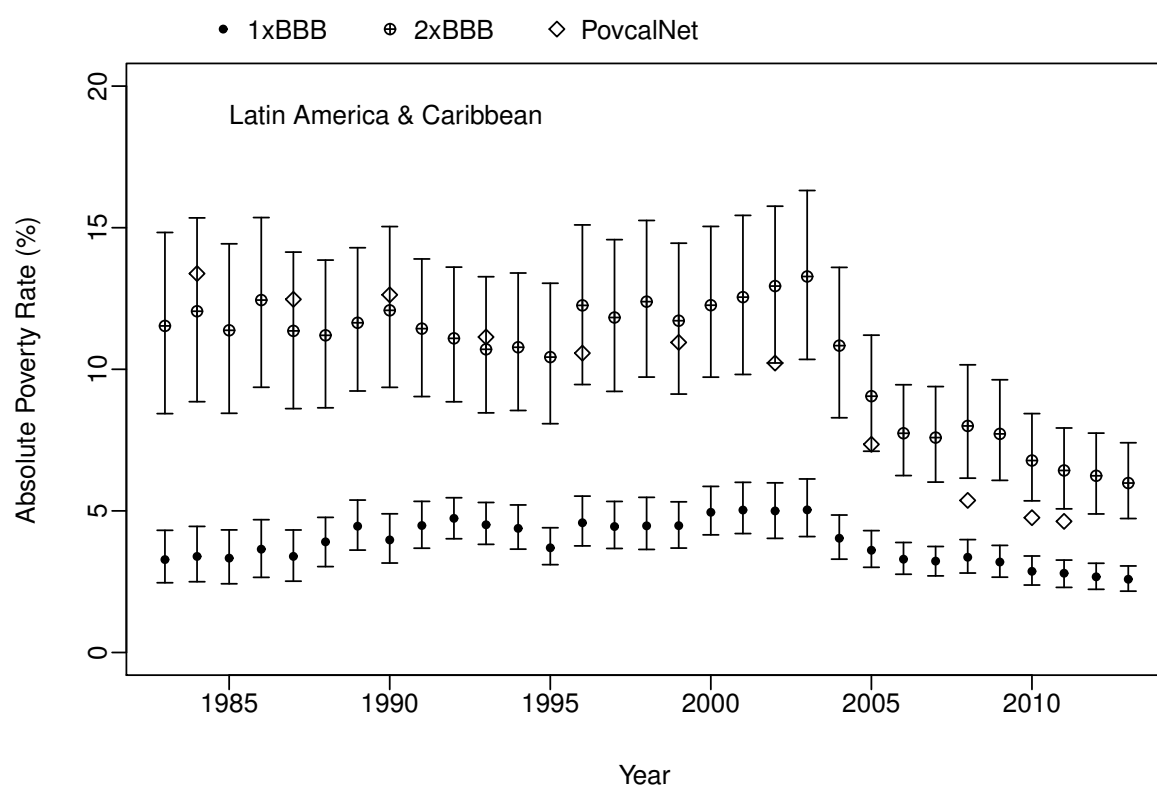Figure 19: Evolution of BBB based poverty rates in East Asia & Pacific, 1983-2013 period.

Figure 20: Evolution of BBB based poverty rates in Latin America & Caribbean, 1983-2013 period.