



IARIW 2021

# IARIW 2021

Monday 23 – Friday 27 August

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## **Systematic Global Poverty Conceptualizations: Bare Bones Baskets, Super Baskets and Relative Poverty**

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Paper prepared for the 36th IARIW Virtual General Conference  
August 23-27, 2021

Session 18: Recent Experiences in Both Official and Academic Approaches to Measuring Poverty  
Time: Thursday, August 26, 2021 [14:00-16:00 CEST]

# Systematic Global Poverty Conceptualizations: Bare Bones Baskets, Super Baskets and Relative Poverty\*

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February 1, 2019

## Abstract

Global poverty measurement has come a long way in the last 40 years, both in terms of data availability as well as methodologically. An outstanding methodological problem addressed here resides, on the one hand, with the inflexibility of the cost of basic needs approach to explicitly account for the need for social participation, while on the other hand, the relative poverty approach cannot strictly account for basic needs at all times. At the same time current resolutions to this dual problem give rise to different issues related to the lack of global monotonicity in own income, strong reliance in the so called PPP assumption, or in the counter-intuitive property where equally shared growth is not decreasing poverty. To resolve this conundrum three proposals are made here: (a) separate the absolutely and the relatively deprived population by applying the relative poverty concept only upon the non-absolutely deprived population; (b) introduce an economic development multiplier upon a basic needs basket that attempts to broadly account for the impact of economic development upon the absolute poverty line; (c) adopt the global perspective in how both absolute and relative poverty concepts are applied, namely utilize global average consumption to estimate the relevant development multiplier and the global income distribution to estimate relative deprivation. These proposals are empirically applied in a long run stylized historical framework, and upon the two recent benchmarks of global poverty measurement (1990 and 2015). A purely global perspective demonstrates the considerably higher poverty rates and population counts in past and present tense, and the economic development multiplier demonstrates its usefulness in constantly updating the relevant costs of basic needs.

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\*I wish to thank Bram van Besouw for his valuable suggestions. This research further benefited from discussions with Auke Rijpma and Jan Luiten van Zanden. I would further like to thank the participants at the 2018 FRESH meeting at Groningen University. All analysis has been conducted with R open source statistical computing software ([R Core Team, 2018](#)). All remaining errors are my own.

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*“Today’s comfort or convenience  
is yesterday’s luxury and  
tomorrow’s necessity”,  
Fuchs (1967)<sup>1</sup>*

## 1. Introduction

A relative poverty measure considers poverty from the perspective of relative deprivation, often linked to the share of the population living below a proportion of the mean or median income. An absolute poverty measure tries to keep the poverty line fixed in real terms, thus accounting for price changes, and it is often linked with tracking living standards that are close to rather extreme deprivation.

Along these lines, there exists an annoying bifurcation in how poverty is measured in developed and developing countries. Developed countries typically prefer a relative poverty concept, while developing ones usually construct an absolute concept—often linked with a cost of basic needs poverty line—to act as the governmental minimum acceptable standard, with possible implications to some social welfare provision. The fact that different standards are applied in countries at different stages of development is not objectionable per se. The problem here resides, on the one hand, with the inflexibility of the cost of basic needs approach to explicitly account for the fundamental need of social participation, while on the other hand, the relative approach cannot strictly account for basic needs, such as food and shelter, at all times. If one of the two did not occur then one could provide a unified measurement method of poverty applicable at all levels of development.

In addition, in more affluent societies when de-growth takes place the relative and absolute poverty considerations may well disagree not only on the level of poverty, but also on the trend in terms of magnitude and possibly sign.

This paper takes the step in separating the two—absolute and relative—poverty concepts in how they are applied on a population suggesting that a sequential application of the two is acceptable in order to resolve unify global poverty measurement. The premise that the two concepts trichotomize the population provides the foundation of the approach assembled here. No person deemed as living in conditions of absolute poverty should also be assessed with a relative poverty criterion. Therefore, the application of the absolute poverty concept first dichotomizes the population, and the subsequent application of the relative poverty line upon the remaining part of the population trichotomizes the whole.

This approach resolves the aforementioned conundrum between the two concepts in a clear cut manner that can be linked with and expands upon the existing literature.

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<sup>1</sup>in “Redefining poverty and redistributing income”.

The concept of the Super Basket (hereafter also refer to simply as SB) is introduced to capture absolute poverty which is building upon the bare bones consumption basket (Allen, 2001, 2017), but updates its value using the prevailing level of economic development in a given country or region. The concept of relative poverty is expressed using the complementary of what Sen (1976) defined as real national income.

In addition to the local application of both poverty concepts, their application from a global perspective is suggested in theoretical grounds and investigated empirically. In such an application the global economic development and the global income distribution are considered in the estimation of the poverty lines applied. This approach sees the world methodologically as one entity, in contrast to the standard practice of applying relative–or global weakly relative<sup>2</sup>–poverty definitions strictly within national borders which are then aggregated globally. Such a global and forward looking approach is warranted, to a considerable extent, within a highly globalized world.

The remaining of this article is organized as follows: section 2 provides a lightly commentated snapshot of the relevant literature, section 3 codifies the various global poverty concepts, while section 4 introduces the methodology in detail. Section 5 discusses the data used, and section 6 gives the empirical application of the proposed global poverty methodology. Section 7 concludes.

## 2. Reflections on the Literature

The link between necessities, deprivation, social participation and poverty is at least as old as the writings of Adam Smith. He separated consumables in two categories: either necessities or luxuries. The interesting element here is the way he implies that the threshold between these two categories should be drawn, as is evident in his famous linen shirt passage, that suggest a open-ended re-drawing of the threshold:

“By necessities I understand not only the commodities which are indispensably necessary for the support of life, but whatever the custom of the country renders it indecent for creditable people, even of the lowest order, to be without. A linen shirt, for example, is, strictly speaking, not a necessary of life. The Greeks and Romans lived, I suppose, very comfortably though they had no linen. But in the present times, through the greater part of Europe, a creditable day-labourer would be ashamed to appear in public without a linen shirt, the want of which would be supposed to denote that disgraceful degree of poverty which, it is presumed, nobody can well fall into without extreme bad conduct.” (Smith, 1776, p.870-871, Glasgow Edition)

This rationale masterfully states that poverty is not only the ability to provide for the very basic of life in a state of bare bones existence, but also to be able to at least not feel ashamed by the living

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<sup>2</sup>As for example in Ravallion and Chen (2017).

standard one is achieving for her/his-self and dependents, with respect to some commonly known and observed custom. Three key contributions since do not entirely shed light on the being ashamed component in Smith's rationale for necessity. Charles Booth (1904) and Seebohm Rowntree (1901) in England and Mollie Orshansky (1963) for USA, have all used poverty definitions that would generally fall within the domain of subsistence living standards.

Some 200 years after Smith though, Fuchs (1967) attempts to—a large extend successfully—“redefine” poverty suggesting that it should from now on be basically measured in terms of inequality. This idea partially echoes the rationale of Smith, albeit with quite big strokes. Fuchs' definition of poverty as a fixed percentage of the median income, has been considerably successful in redefining poverty, and has later been adopted by international organizations such as Eurostat and the OECD.<sup>3</sup> He supported his revolutionary proposal on two arguments: (a) that the “minimum” or “subsistence” budgets will be eventually outdated, since “[t]oday's comfort or convenience is yesterday's luxury and tomorrow's necessity”, and (b) that the main issue at hand is the distribution of income which his proposal—by its very nature—brings to the fore.

This methodological approach is quite simple in its application, but as both Fuchs, and later Sen (1979, p.289) recognize, the definition of the proper “reference group” is the main issue. The use of a 50% or 60% of median or mean income plays certainly a considerable role in the levels and trends of poverty, and the absence of a generic justification for either is not satisfactory.<sup>4</sup> In addition, Sen (1979, p.288) also recons that “[t]here is very little alternative to accepting the element of arbitrariness in the description of poverty, and making that element as explicit as possible”. One can note here that at the same time, acknowledging the ever-present arbitrariness in poverty definition doesn't clear us from the necessity to offer a justification for the choices, in the way one defines relative poverty, that are linked with the problem at hand: the identification of a specific living standard.

In global poverty considerations, although one can argue to some extent that drawing a line at a fixed point of the income distribution would measure the social participation element with some sense of similarity between countries, it is the case that the more the countries in comparison differ, it is all the more probable that the actual living standards—the so drawn poverty lines are capturing in different countries—are distant from one another.<sup>5</sup> However, with Fuchs' approach, one cannot demonstrate that the living standards of those living right on these poverty line levels command

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<sup>3</sup>He proposed 50% of the median, but he also explicitly recognized that this number is not set in stone and deliberations must be made to reach a commonly agreeable figure.

<sup>4</sup>Usually it is said that 50% of the mean is, or was during the 70s, about 60% of the median, and since the median is less sensitive to extreme values in the income distribution, the 60% of median was promoted. But no justification in terms of implied living standards is offered in either of the two cases.

<sup>5</sup>Beyond the reference group consideration, Sen touches upon the role of time in poverty definition. He argues that although for example a fast growing oil-rich country could be more capable to support its citizens, however “the notion of what is poverty may not go up immediately to the corresponding level” (Sen, 1979, p.287). This is an element of living standards that is usually neglected in poverty measurement, and here will only be indirectly addressed in section 4.

the same or equivalent sense of social participation across different countries. And in the domain of relative deprivation, proper accounting of the cost of the social participation component is the central element.

In comparisons across different social setups, Sen (1979, p.288) argues that the following statements are not mutually exclusive:

- (i) “there is less deprivation in community A than in community B in terms of some common standard, e.g., the notions of minimum needs prevailing in community A (or in B)”;
- (ii) “there is more deprivation in community A than in community B in terms of their respective standards of minimum needs, which are a good deal higher in A than in B”.

This distinction, within global poverty considerations, draws a line that dichotomizes among possible approaches. We can either use locally defensible standards, apply them locally, and then compare countries according to their levels of deprivation, or we can use a common standard and evaluate all countries with it. In the later case there will be a mismatch between the local perception of the living standard that a poverty line ought to represent, and what the poverty line applied in this case does—unless the countries are identical. Sen refrains himself from choosing between the two approaches, arguing that such a dispute would be “pointless”, and that the important issue here is that we “note that the two questions are quite distinct from each other”.

Logically, the same applies from a global point of view, where welfare consistency of the applied poverty lines is the prime concern (Ravallion, 2016, p.232), but in the context of Sen’s statements, the perspective under which global poverty is evaluated is key. From the standpoint of a global arbitrator bestowed with the responsibility to disperse poverty alleviation funds, one can argue that option (i) would be more defensible in informing its decisions than option (ii) would. The point here is that the discrepancy between (i) and (ii) lies from the mostly economic differences between communities A and B, which can be reconciled in a more decisive manner using definition (i), that suggests shifting the common livings standards of destitute individuals from all countries, rather than (ii), that considers the differential among respective living standards, which is in its nature endogenous to the overall prosperity of each country.

The two statements by Amartya Sen presented above, can almost directly be applied to the problem of the reference group definition in relative poverty considerations as follows:

- (i) there is less relative deprivation in community A than in community B in terms of some common standard, e.g., the monetary value at the  $p\%$  of a central tendency measure of the income distribution in community A (or in B);
- (ii) there is more relative deprivation in community A than in community B in terms of the  $p\%$  of a central tendency measure of their respective income distributions, which in monetary terms are a good deal higher in A than in B.

These statements bring the issue of the reference group in global poverty to the fore. However, there is a third fundamental option they do not contain. This option refers to the consideration of a reference group as a result of the joint distribution of both communities (or any number of communities for that matter). From the perspective of seeing the world as one whole, the option of using the global income distribution to define the global relative poverty reference group, would not strike one as odd. Such an application of a relative poverty concept can come in addition to that of Fuchs' as applied in rich countries, in order to mark the distinction between a locally applied relative poverty concept aggregated globally, and a global relative poverty concept directly measured from a global perspective.

In this age of globalization it is ever more frequent that matters get compared globally. At the same time, present disparities among countries on a global scale make such a proposal seem unreasonable. However, following Fuchs' rationale that contemporary standards will soon be outdated, and, it is generally expected that in due course extreme poverty would be an issue of the past.<sup>6</sup> Furthermore, in a highly globalized world concerned mostly with relative deprivation, a global supra-national common reference group makes a reasonable candidate for consideration and further investigation. In any case, measuring this global poverty concept in this context prepares the stage for what poverty considerations may look like in a highly integrated global community at some point in the future. It can be thought of as a forward looking global relative poverty concept, using the now standard concept of interpersonal global inequality of Branko Milanovic (2006) in the calculation of relative deprivation.

Even with this broader consideration of a reference group—and in fact even more so in this case—the possible inadequacy of the average or a median level of the income distribution cannot be wished away. Considering this together with the issues of ambiguity in a poverty definition, the arbitrariness of an attempt to eliminate this ambiguity (Sen, 1979, p.286), and the requirement to make the element of arbitrariness “as explicit as possible” (Sen, 1979, p.288), then numerically one is left with one and obvious option: account for this type of uncertainty due to arbitrariness in the definition within the measurement of poverty, and make that explicit by arriving to estimates with proper numerical accounting for this uncertainty: *the error term*. Of course, this is nothing more than proper error propagation that includes the uncertainty encapsulated in the definition of the concept one tries to measure.<sup>7</sup>

Two kinds of relativity can be distinguished in poverty measurement. One is relativity of poverty with respect to a reference group within a community or country (typically referred to simply as relative poverty), while the other type of relativity (should be) encapsulated in concepts

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<sup>6</sup>See for example United Nation's Sustainable Development Goal 1.1 setting the target of extreme poverty elimination by 2030.

<sup>7</sup>See subsections 4.1-4.3 for the details; do note however that the error term for the relative deprivation component is only indirectly estimated, by the error term of poverty defined with the use of the Super Basket. It remains an error term nonetheless.

of absolute poverty and deals with the issue that:

“[a]ny rigorous conceptualisation of the social determination of need dissolves the idea of ‘absolute’ need. And *a thorough-going relativity applies to time as well as place. The necessities of life are not fixed. They are continuously being adapted and augmented as changes take place in a society and in its products.* Increasing stratification and a developing division of labour, as well as the growth of powerful new organisations, create, as well as reconstitute, ‘need’. Certainly no standard of sufficiency could be revised only to take account of changes in prices, for that would ignore changes in the goods and services consumed as well as new obligations and expectations placed on members of the community. Lacking an alternate criterion, the best assumption would be to relate sufficiency to the average rise (or fall) in real incomes.” (Townsend (1979b), pp. 17-8 as cited in Sen (1983, p.155), emphasis added.)

Linking to the issue of arbitrariness discussed above, it is important to note that on this quotation Sen adds: “[t]he last remark—that the best assumption would be to relate sufficiency to ‘the average rise (or fall) in real incomes’—is obviously *ad hoc*” (emphasis in the original). Sen continues to remark on the distinction between the “absoluteness of needs” and their “fixity over time”. Most importantly, this distinction is separate from that between relativist and absolutist views on poverty, as in the former it is the achievement relative to others that counts, and not the change of needs over time (which should be captured in the absolute approach).

Unsatisfied with the prevailing definition of relative poverty, and the failure of such concept in period of a “general decline” in prosperity, Sen argues that an “essential” characteristic of poverty is lost in the attempt to refine the “**crudities** of Charles Booth’s or Seebohm Rowntree’s old-fashioned criteria” by using relative concepts such as the one proposed by Fuchs (Sen, 1983, p.156, emphasis in the original).

What Sen finds hard to accept is that despite the plausibility of relative poverty measures in the context a growing economy, those measures still ignore the effect and the possibility of economic contraction. This according to Sen “betrays the timing of the birth of these measures in the balmy sixties, when the only possible direction seemed forward” (Sen, 1983, p.157). He also points out the lack of clear empirical evidence regarding the apparent general acceptance at the time that poverty, of the type that involves malnutrition or hunger, had been eliminated in the richer countries. At the core of this disagreement lies Sen’s argument that there is “an irreducible absolutist core in the idea of poverty”, with starvation and hunger being the prime examples of this absolute core (Sen, 1983, p.159). Complementary to this statement, comes his observation that higher and lower living standards are “certainly proof of inequality”, however, this is not enough to identify poverty in that society “unless we know something more about the standard of living that these people do in fact enjoy” (ibid). When those lower living standards are indeed linked with malnu-



trition or hunger, then relative poverty approaches have “to take a back seat behind the possibly dominating absolutist consideration”.

This last remark of taking the back seat, opens the possibility for a different approach in contemplating absolute and relative poverty concepts. Indeed we cannot deny priority of absolute deprivation over relative deprivation, certainly not when absolute deprivation is linked with malnutrition or hunger. We can therefore consider the two concepts in sequence and upon separate groups, which should be clearly categorized as deprived in different ways.

The group that falls below some absolute notion of poverty cannot be denied priority status, whether or not this group is also relative deprived is not a prime concern in this setup.<sup>8</sup> At the same time, the group that is only relatively deprived cannot be denied a relative poverty status, since the existence of absolutely poor in the society does not mean that those who are relatively deprived are not suffering from a distinct, yet very real form of deprivation. To reconcile the competing poverty notions one can apply the relative poverty concept upon the society once the group of those in absolute destitution have been counted out, instigating complete separation of the two poverty concepts and population groups. This would mean that the concept of relative poverty would be applied only to the group of the society that does not suffer in terms of absolute deprivations.

Sen shapes the idea that the things we wish to accomplish in some periods may roughly stay the same, but the means and the resources to achieve them differ and alter in time and space. For example, in the avoidance of shame one might be required to acquire a set of commodities relative to others, but thinking in terms of capabilities,<sup>9</sup> that person tries to avoid shame as a situation and an “absolute requirement”: “[n]ot so much having equal shame as others, but just not being ashamed, absolutely.” (Sen, 1983, p161) For Sen, Townsend’s estimation of the required resources to “participate in the activities of the community” is an exercise to pinpoint the “varying resource requirements of fulfilling the same *absolute need*.” (ibid, emphasis added)

He also concludes that a comparison in the space of living standards is not a comparison of utilities, in the sense that a “grumbling rich man may well be less happy than a contented peasant, but he does have a higher standard of living than that peasant” (Sen, 1983, p.160). Instead he uses the example of a bicycle to argue that the space of capabilities is what “comes closest to the notion of standard of living” (Sen, 1983, p160). In that example, the commodity is the bicycle, its characteristic is its use in transportation, its capability to function is the ability to move one’s self around, and its utility is the pleasure from moving. Seen this way capabilities considerably resemble the concept of Z-commodities found in the works of Becker, as discussed in de Vries (2008). Those are commodities combined with work within the household—not excluding the use of other resources—resulting in Z-commodities that go directly to the household’s utility function. The way capabilities resemble Z-commodities is the fact that both directly enter the utility function.

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<sup>8</sup>Similar arguments are made in Atkinson and Bourguignon (2001, p.17).

<sup>9</sup>See Sen (1985) for a discussion of this concept that Sen introduced.

However, absolute poverty in the space of capabilities, would not need to be absolute in the space of Z-commodities. But, “an absolute approach in the space of capabilities translates into a relative approach in the space of commodities, resources and incomes in dealing with some important capabilities” (Sen, 1983, p167-8).<sup>10</sup> Along other capabilities however, the deprivation could be absolute both in terms of capabilities and in terms of (Z-)commodities, such as the capability of being adequately fed in terms of nutrition.

Concluding on the aforementioned key contributions of Amartya Sen, there are a couple of key statements that a reasonably complete concept of poverty should fulfill:

- “[A]bsolute deprivation in terms of a person’s capabilities relates to relative deprivation in terms of commodities, incomes and resources” (Sen, 1983, p.153)
- “A sharp fall in general prosperity causing widespread starvation and hardship must be seen by any acceptable criterion of poverty as an intensification of poverty”<sup>11</sup> (Sen, 1983, p.157)

The first point on the list is certainly the most demanding one, and it is the one that Fuchs’ relative poverty concept seems to address, albeit very crudely.<sup>12</sup> The second point can be strictly addressed by applying the poverty concepts in sequence, first the absolute concept, and to what non-poor population remains the relative concept is to be applied. This sequential method allows (global or local) poverty measurement to be able to account for conditions of rapid change in economic environment and economic downturn, such as in the recent global financial crisis of 2007/8. Such an approach underlines the distinct nature of the two poverty concepts, while at the same time allows for the appreciation of both.<sup>13</sup>

Antithetically, whenever the aim is to implement both concepts, the literature reviewed next tries to capture both concepts with one formula. This particular research field is still under development so naturally, each of the propositions has its own pros and cons.

Kakwani (1986) follow’s up on the distinction between the nutritional poverty line and the cultural poverty line, made by Sen (1979), and proposes a formula to capture the two at once:

$$z = z_0 + \beta(m - z_0) \quad (1)$$

where  $z_0$  is the nutritional (or absolute) poverty line,  $m$  is the mean or median income in the community under study, and  $\beta$  is a parameter in  $0 < \beta < 1$ . This implies that the overall poverty

<sup>10</sup>In this sense capabilities are a more generic concept of Z-commodities.

<sup>11</sup>Sen’s favourite example in this regard is the Dutch hunger winter of 1944-45: “When the Dutch in the hunger winter of 1944-45 found themselves suddenly in much reduced circumstances, their commodity requirements of capability fulfillments did not go down immediately to reduce the bite of poverty, as under the rigidly relativist account” (Sen, 1983, p163). Sen also generalizes upon this point: “Basic adequacy of a conceptualisation of poverty which should be able to deal with a wide variety of counter-factual circumstances.” (Sen, 1983, p.157)

<sup>12</sup>This requirement is considered in the definition of the Super Basket; see section 4.1 below.

<sup>13</sup>This proposition is defined in more details in section 3.

line cannot be lower than the absolute line  $z_0$ , nor can  $z_0$  be higher than the median or the mean. The problem with this suggestion is that as Kakwani acknowledges that the value of  $\beta$  cannot be yet determined.

Along the lines discussed above, [Ravallion et al.](#), in their 1991 seminal article on global poverty, build a global poverty measurement methodology around the central assumption that every national poverty line (NPL) has an absolute and a relative component. The method they introduce gives birth to what later will be remembered as the dollar-a-day approach. However, the resulting one dollar a day poverty line leaves a number of the least affluent countries without any relative component at all, and rather falsifying the theoretical cornerstone of the methodology they propose, thus making the method seem rather inconsistent. The latest version of this approach, from [Ravallion et al. \(2009\)](#), is shown in figure 1, which contains more data-points and comes with a piece-wise fit.<sup>14</sup> Below the point 4 in log scale in per capita consumption per month the fit is a line parallel to x-axis. All NPLs below the horizontal line of \$1.25 are in practice without a relative component.

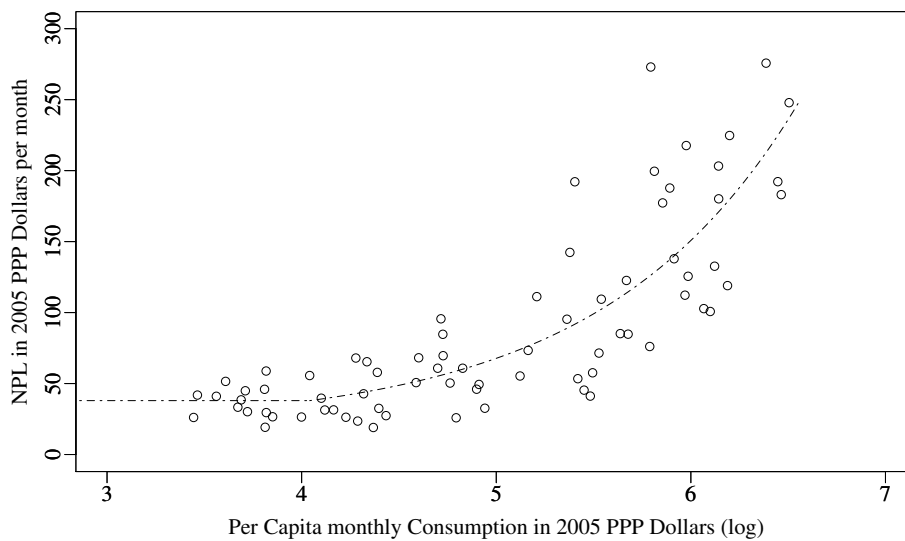


Figure 1: The elbow fitting of the National Poverty Lines as a function of log consumption per capita for the 74 countries in the [Ravallion et al. \(2009\)](#) data set, using the PovcalNet PPP exchange rates.

[Atkinson and Bourguignon \(2001\)](#) try to expand on the method of [Ravallion et al. \(1991a\)](#), taking for granted the absolute poverty line produced by the dollar-a-day approach, and attempting to estimate the relative component on a global level. They do that on the same data as [Ravallion et al. \(1991a\)](#), and ball-park the value of  $\beta$  for the second fitted line to be  $1/3$ . They are the first

<sup>14</sup>In this case this translates to fitting the data with two lines, one horizontal and one with a ramp; do note that the x-axis is in log form.

to use the piece-wise fit approach, and perhaps this gave the idea to [Ravallion et al. \(2009\)](#) to do the same piece-wise fit a few years later.<sup>15</sup> The formula for country  $i$  proposed by [Atkinson and Bourguignon](#) can be written as:

$$z_i^{AB} = \max(z_0, \beta m) \quad (2)$$

where  $z_i^{AB}$  is the proposed (absolute and relative) poverty line. The absolute component is captured by  $z_0$  which is the one dollar a day estimated by [Ravallion et al. \(1991a\)](#). For the relative component,  $\beta$  is the parameter they estimate to 1/3, and  $m$  is the local average income or consumption.

[Ravallion and Chen \(2011\)](#) identify a methodological concern with the results and the approach of [Atkinson and Bourguignon](#). Their point is that equation 2 violates what they call the weak relativity axiom (WRA), which they define as: “if all incomes increase (decrease) by the same proportion, then an aggregate poverty measure must fall (rise)”. For any country where  $z_0 < \beta m$ , then from equation 2 is clear that in an economy where all incomes (or consumption) are growing by the same rate, there will be no reduction in poverty. This fact indeed strikes as an awkward and counter-intuitive property for a poverty definition.

[Ravallion and Chen \(2011\)](#) propose a small modification of the [Atkinson and Bourguignon](#) equation to:

$$z_i^{RC} = \max(z_0, \alpha + \beta m) \quad (3)$$

where  $\alpha$  and  $\beta$  are the parameters to be estimated by the data. Indeed, using the same data as in [Ravallion et al. \(2009\)](#) they estimate the above equation at time  $t$  as:

$$z_{it}^{RC} = \max(\$1.25, \$0.60 + m_{it}/3) = \$0.60 + \max(\$0.65, m_{it}/3) \quad (4)$$

this equation also fits the data better than the formula by [Atkinson and Bourguignon](#), while at the same time satisfying the WRA axiom. The poverty lines that satisfy the WRA are characterized by [Ravallion and Chen \(2011\)](#) as “weakly relative poverty lines”, while those that don’t are “strongly relative poverty lines”.

[Ravallion and Chen \(2017, p.5\)](#) go further in their dissection of the methodology used in [Atkinson and Bourguignon \(2001\)](#) pointing to a “deep identification problem in using national lines to identify international relative lines”. Their argument is that it would be too strong an assumption to interpret national poverty lines as revealing “the local costs of a globally common level of welfare” (ibid).<sup>16</sup> [Ravallion and Chen](#) offer an alternative interpretation according to which na-

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<sup>15</sup>Although perhaps counter-intuitively [Ravallion et al.](#) do not cite the article by [Atkinson and Bourguignon](#) in theirs.

<sup>16</sup>Although they do not discuss how [Atkinson and Bourguignon \(2001\)](#) are actually committing this fallacy.

tional poverty lines in richer countries are higher in order to reflect the prevailing “more generous reference welfare levels for defining poverty”.

Discussing a number of relative poverty lines, including the aforementioned ones, they identify the problem that neither of them is “globally monotonic in own income”.<sup>17</sup> Global monotonicity in own income means that when two individuals are compared, regardless of where they live, “the one with the higher income cannot have higher measured poverty”. Monotonicity in own income naturally holds within countries, but along the poverty lines presented above it does not need to hold between them. The additional implication of this is that a person who is deemed as being absolute poor in one country, cannot be less poor than another person who is found poor only in relative sense.<sup>18</sup>

Tracing the arguments to locate the proper reference group, the authors reach a conundrum: although they agree that the rich are less relevant as a reference group for relative poverty, they dispute that the rich can be thought of as entirely irrelevant group. To the contrary, if one sees relativist comparisons as more “upward looking”, then higher inequality implies a higher poverty line (which obtains from the relative affluence of the richer groups). They devise a way out of this by considering that a person along the income distribution can be making a selection of a pair of incomes in his country at random, and this pair will constitute the reference group she will be considering in valuating her welfare. Repeating this a large number of times provides an unbiased estimate of the comparison mean. To capture this they derive the following formula:

$$m_j^* \approx [1 - (1 - 2\delta)G]m_j \quad (5)$$

They econometrically test the following functional form for the upper bound (the lower bound is simply the dollar a day of \$1.9 in 2011 PPP exchange rates):

$$z_j = \alpha + \beta[1 - (1 - 2\delta)G]m_j + \epsilon_j, \quad j = (1, \dots, n) \quad (6)$$

to pin-point the value of  $\delta$  from the data, and they reject the null hypothesis that  $\delta$  is 0.5 or 1. However, they cannot reject  $\delta$  being equal to 0 at a 5% confidence level. Using  $\delta$  equal to zero<sup>19</sup> and calibrating this functional form to the data they derive the following poverty line schedule

<sup>17</sup>With respect to the exclusion of Kakwani’s formulation they further mention that it does not work for the 1.9 dollar a day, as the second component of the formula turns to negative on a number of least affluent countries. This, however, is not a very convincing argument as the dollar-a-day method is a simple average of the national poverty lines of some of the least affluent countries. Therefore it is only naturally there are NPLs below the DAD. Therefore, it seems that the empirical problem lies with the derivation method of the DAD iPL, and not with the formula proposed by Kakwani.

<sup>18</sup>As discussed in Ravallion and Chen (2017, p.16) acknowledging the contribution made by Decerf (2017). This is an issue when using poverty indexes that are sensitive to the intensity of poverty. When more crude indexes are used, such as headcount ratio or poverty rates, then this important point is of no direct concern. However, the problem with global monotonicity in own income remains an issue even for the crude poverty rate indicator.

<sup>19</sup>In any case though, one needs to point out here than not rejecting the null hypothesis is not the same as accepting it (Field et al., 2012).

(encompassing both the lower and the upper bounds):

$$z_j^U = \$1.90 + \max(0.7m_j^* - \$1.00, 0) \quad (7)$$

The basic concern of the authors for the justification of this approach is that they are using national poverty lines for the calibration of equation 6 to derive 7 and construct, what they call, welfare-consistent international poverty lines. In doing so they clearly acknowledge that they use a strong assumption “namely that the national lines represent the local costs of a common global level of welfare needed to not be considered poor” (Ravallion and Chen, 2017, p.22). Their approach of using a lower and upper bounds to engulf the “true value” of the welfare-consistent global poverty line attempts to resolve this concern. Moreover, they observe that since the gradient in the national poverty lines (see figure 1) reflects at least partially the welfare relevance of relative income, a fixed poverty line in real terms “will not be welfare consistent” (Ravallion and Chen, 2017, p.22-3).

An additional concern with their finding that relative deprivation is “downward looking” (since  $\delta$  is taking a value of less than 0.5) is that it seems to contradict the conceptual framework of Davis which they use as a starting point. In Davis’ formal approach to the theory of relative deprivation he proposes that “[w]hen a deprived person compares himself with a non-deprived, the resulting state will be called ‘relative deprivation.’” This assumption seems to be in a direct contradiction the result of the empirical identification by Ravallion and Chen (2017), as it implies that one cannot feel relative deprivation when comparing other than upward.

### 3. Codification of Global Poverty Conceptualizations

To some extent the message of Ravallion and Chen (2017) is that it is elusive to attempt an accurate appreciation of global relative poverty. It is a re-formulation of the concern by Fuchs (1967) and Sen (1979) with respect to the selection of the reference group, albeit from a different perspective. This however, does not mean that any of the aforementioned approaches, and possible others, do not have merit for estimation, as otherwise we would be left with rather more inconsistent approaches, most likely leading by implication to more inconsistent conclusions.

Generally speaking, in the realm of poverty there are two workhorses used for country level poverty. Namely the cost of basic needs approach (typically applied in developing countries) and the relative poverty measured as a certain distance to the mean or median income (typically used in developed countries). There is also one dominant methodology for global poverty measurement, namely the dollar a day approach developed by World Bank researchers (Ahluwalia et al., 1979; Ravallion et al., 1991b, 2009; Ferreira et al., 2016).<sup>20</sup> In the domain of global poverty measure-

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<sup>20</sup>A recent attempt to apply the cost of basic needs approach on a global level offers an alternative approach in global poverty measurement (Moatsos, 2017). This research is an effort that the World Bank’s Commission on Global

ment the need for global poverty lines that are relevant for countries which are located at varying levels of economic development has been addressed in the relatively recent work of [Ravallion and Chen \(2011, 2017\)](#)<sup>21</sup>, presented above, on the concept of the “weakly relative poverty lines”. At the same time these otherwise very appealing approaches, build heavily on the purchasing power parity (henceforth PPP) equivalence, which also appears to be an additional strong assumption ([Deaton, 2010](#); [Reddy and Pogge, 2010](#); [Srinivasan, 2009](#); [Subramanian, 2015](#), among others) to the aforementioned one discussed by the authors.<sup>22</sup>

In the realm of relative poverty, one can in principle think of social participation as a good, and as a good it is generally (and relatively) priced differently in different countries. We can consider this pricing mechanism either locally or globally, which corresponds as looking to a world which consists of countries (international approach) or looking at the world as a whole (global approach).<sup>23</sup> If locally, then the issue becomes that the social participation good is not necessarily a good that is comparable across countries. If globally, then the problem transforms to the uninvestigated relevance of a global reference point in terms of mean—or another function—of income to the individual relative deprivation level across the globe.

Therefore, the question revolves around the issue of a (*g*)*local* perspective or a global one. Each has its own merits and issues, but explicitly picking among the two is most likely not advisable: perhaps a better approach would be to link these competing concepts with the questions asked or, simply, the overall perspective one wishes to explicitly take.

For example, [Ravallion and Chen \(2017\)](#) work on a glocal exercise, not a global one. As far as they utilize local  $m^*$  (as defined in equation 5) they are constructing a glocal methodology, in the sense that although they apply a globally fixed formula, the relationships they construct between individuals—who feel either deprivation or gratification—are strictly local and within national boundaries. Which means that the reference group is locally identified. I propose here that it is only the consideration of a global  $m^*$ , or a similar income or consumption concept<sup>24</sup>, that can be seen as a (genuinely) global weakly relative poverty line.<sup>25</sup>

The discussion about the reference group inescapably links to the question about the knowledge of existence of worse- or better-off people than ones’ own is required within the concept of relative deprivation for that deprivation to be a valid one. The effective distance (e.g. geographical) between ones’ own and the ones who are better- or worse-off can be thought that it can play a role in

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Poverty Report has welcomed and recommended as well ([Atkinson, 2016](#)).

<sup>21</sup>The approach in [Ravallion and Chen \(2011, 2017\)](#) refers strictly to the economic domain. Ideally one would like the method to operate within both the social and the economic domains. This point reflects the recognition that poverty is a multidimensional and socially contextualized condition.

<sup>22</sup>Namely the use of national poverty lines to calibrate equation 6.

<sup>23</sup>For the later case, ([Atkinson and Bourguignon, 2001](#), p.2&16) have argued that “[n]ational boundaries have no intrinsic status”, to which they add that “the country in which one lives has no intrinsic claim”.

<sup>24</sup>Preferably consumption, see [Atkinson \(2016\)](#).

<sup>25</sup>A systematic investigation of the implications of such a choice for  $m^*$  in their methodological approach is well out of the scope of the present treatment.

the appreciation of the impact they have on ones' self-perceived relative deprivation/gratification.<sup>26</sup> But what if they are not aware of these conditions, e.g as in the perceived levels of inequality in USA (Hauser and Norton, 2017). How can individuals actually feel this relative deprivation without knowing it, or by overestimating it? This complication can tentatively be avoided by accepting the premise that when one investigates a problem on a global stage this can be done either assuming perfect knowledge of individual conditions among individuals, or identify this knowledge on an individual level (or within some well defined groups).

However, since the present exercise operates in the framework of living standards, and not utility, then the external characterization of a comparison among individuals has a stronger standing than the actual, subjective, and utility-linked, appreciation of relative deprivation or gratification. Similarly, the question of knowledge of better and worse off situations by a person in order to feel relative deprived, can be also seen from the perspective of an evaluator. Is one such external evaluator permitted to isolate relative deprivation only among communicating groups, despite the explicit knowledge the evaluator has about the existence of all possibly isolated groups? In my view, in characterizing the world as a whole, slicing up the population into isolated subgroups simply adds insult to injury, as it can be argued the the lack of knowledge can be endogenous to the relative deprivation we strive to evaluate in the first place.<sup>27</sup>

In turn, comes the question whether or not relative deprivation and relative gratification should be considered together with some additive function connecting the two turning them to some form of joint valuation.<sup>28</sup> In principle though, feeling gratification towards one group does not compensate for the fact that someone is deprived relative to another group. In fact the whole point of identifying those in relative deprivation in living standards seems to be the isolation of the deprivation component and not the co-investigation with other forms of relative comparison. Antithetically, a joint valuation would again be a question to be answered in the utility domain and not in a capabilities or living standards domain. In his formal treatment Davis (1959, p.283) also considers the matters of relative gratification and deprivation separately, using the element of desirability.<sup>29</sup> I therefore strictly focus on the deprivation side of the issue, treating gratification as its residual concept following Davis, (ibid).

The conceptual basis that all NPLs can be dissected to an absolute and a relative component in Ravallion et al. (1991a), mentioned above, can also be traced in the 1990 World Development Report. According to the report:

“[A] poverty line can be thought of as comprising two elements: the expenditure

<sup>26</sup>Relative deprivation being the opposite of relative gratification, see Davis (1959) for a formal discussion.

<sup>27</sup>This point is in agreement with the aforementioned points by (Atkinson and Bourguignon, 2001, p.2&16) who have argued that “[n]ational boundaries have no intrinsic status” and that “the country in which one lives has no intrinsic claim”, as per a previous footnote.

<sup>28</sup>This effectively means whether or not it should be allowed to subtract relative gratification from an index of total deprivation or not, and vice-versa.

<sup>29</sup>Similarly, Ravallion and Chen (2017, p.17) accept the dichotomy between the two groups, in their utility function.



necessary to buy a minimum standard of nutrition and other basic necessities and a further amount that varies from country to country, reflecting the cost of participating in the everyday life of society” (The World Bank (1990, p.26) as cited in Atkinson and Bourguignon (2001, p.14))

However, the Bank applies the first for global poverty, and the second for poverty within a country, but as noted by Atkinson and Bourguignon, this procedure avoids the “crucial question” of how one can combine the two into one framework.<sup>30</sup>

Giving some additional structure to the concepts discussed so far there are two dimensions, or perspectives, along which those concepts can be differentiated:

- (a) their poverty concept perspective, i.e. relative or absolute, and
- (b) their geographical application domain perspective, i.e. local or global (and anything in between).

Along the lines of dimension (b), two other groups can be further identified:

- (i) those that are applied in a *hybrid* domain, i.e. concepts of poverty that apply a global concept locally or a local concept globally, e.g. local poverty standards of country A applied globally, and
- (ii) those that are applied in a *pure* domain, i.e. concepts of poverty that apply local concepts locally or global concepts globally, e.g. national poverty lines for the former, and the dollar-a-day for the latter.

This brings us to four concepts for poverty which can be aggregated on a global level, all of which can be operationalized either in a pure or hybrid sense:

1. Absolute poverty in real locally defined terms.
2. Absolute poverty in real globally defined terms.
3. Relative poverty in locally defined relative terms.
4. Relative poverty in globally defined relative terms.

Of the above concepts (2) and (4) are of particular interest in global poverty estimation, in both of their–hybrid or pure–forms, and are those that should take priority in global poverty measurements, from a global perspective. Typical example of concept 2 in pure form is the dollar-a-day

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<sup>30</sup>“It assumes that the two kinds of analysis can proceed in parallel without being brought into conjunction.” (Atkinson and Bourguignon, 2001, p.14).

approach as in [Ravallion et al. \(2009\)](#) and in [Ferreira et al. \(2015\)](#); while a hybrid version would be a cost of basic needs approach defined globally as in [Allen \(2017\)](#) or in [Moatsos \(2017\)](#).<sup>31</sup> For concept (4), the approach of [Ravallion and Chen](#) “weakly relative poverty lines” can be a hybrid one when  $m^*$  is calculated using the local distribution of income or consumption, or pure when it is calculated using the global distribution.<sup>32</sup>

In terms of the “crucial question” raised by [Atkinson and Bourguignon](#), that is to combine absolute and relative poverty concepts into one framework, there is one approach that has not been explored yet in the literature. As noted also above, a sequential application of the two concepts is also possible, in the sense that the population groups falling in the domain of absolute and relative poverty are mutually exclusive. For example, when [Ravallion et al. \(1991a\)](#) argue that all national poverty lines are composed of an absolute and a relative component, it is rather obvious that each of the two NPL components could be applied serially; the first absolute one on the whole population and the second on the remaining group. Not necessarily though with the particular formulations presently available, since—for example—Fuchs’ proposal has been conceptualized to be applied upon the entire population. The next section introduces such methods.

## 4. Methodology

The approach I propose in this section evolves around the mutual exclusivity of the two—relative and absolute—concepts in the sense that what is absolute poverty cannot be relative poverty as well. This method, separates the population into those who are living in conditions of absolute poverty only, and those who are living in conditions of relative poverty only. This way all people in absolute poverty will be strictly and normatively more poor than any person living in conditions of relative deprivation only<sup>33</sup>, and that on a global scale.

With respect to the absolute poverty component, the super basket framework is introduced. The key element that separates such a consumption basket from the literature is the economic development multiplier that generally traces the impact of economic development upon the absolute poverty line, which is applied upon the core bare-bones-like consumption basket. In this manner the cost of the super basket is both anchored at the core with plain subsistence, while at the same time its value is augmented based on the current level of economic development.

With respect to the relative poverty component, the concept of welfare loss due to the inequality of the consumption (or income) distribution by [Sen \(1976\)](#) is used for its definition. The formu-

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<sup>31</sup>The fact that those poverty rates are calculated locally is driven by necessity due to differentiating price structures between countries, and it does not change the nature of the concept which implements a globally set goal oriented approach.

<sup>32</sup>The same categorization can be done using strong relative lines as well. Section 4 discusses pure global relative poverty lines in more detail.

<sup>33</sup>Thus this approach resolves the aforementioned concern raised in a recent paper by [Decerf \(2017\)](#), and reiterated by [Ravallion and Chen \(2017\)](#).

lation introduced here is the simplest form of linking income and inequality indexes in capturing relative poverty. Moreover, the loss of welfare emanating from the inequality of the distribution can be thought of as the cause of relative deprivation in the first place.

The detailed definitions and introduction of these concepts follows.

## 4.1 Super Baskets

Competing concepts for absolute poverty are that of subsistence and that of basic needs or necessities.<sup>34</sup> Subsistence is the absolute minimum for scraping a living very close—but slightly above—to the edge of survival possibility of the human organism. Subsistence absolute poverty contains virtually no relative component, in the sense of relativity to the prevailing necessities of living in a given society, while a basic needs poverty line should update its composition to account for a changing set of prevailing necessities, following the dictum by [Smith \(1776\)](#) and [Townsend \(1962\)](#) as discussed above.

There is no principle against designing a consumption basket construction function to connect the two concepts deriving at an adaptive basket that would produce both subsistence and adaptive basic needs recipes. In addition, [Sen \(1983, p.155\)](#) argues about the dual nature of the problems that the relativity concept is facing: one deals with the relative dimension for updating the content of the basket which should be in relation to the overall development (and implicitly of time), while the other is relative to the society in terms of social participation (thus implicitly linked with space or location). Therefore the construction function of the absolute component—the one of interest in this subsection—must trace the overall development, as the relativity dimension linked to social non-deprived participation can also be picked up by a strict relative poverty concept.<sup>35</sup>

The definition of such a construction function could be done both in the direction of (nutritionally) richer food consumables, as well as continuous updating with the gradual introduction of additional consumption components as a function of each country's individual economic development.<sup>36</sup>

Regardless of how these elements are introduced to augment a core bare bones consumption basket recipe, the fundamental issue is the speed with which those items will be introduced, and therefore the speed of which its costs will be updated. For example, if one assumes that on a very low income country the core bare bones basket is actually the relevant absolute poverty line, how would that absolute poverty line change for a high income country with an average income say 40 times higher than that of the low income country? Unless one wants to decompose the identified

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<sup>34</sup>Statistical methodologies, such as the World Bank's dollar-a-day approach, are not considered here due to the methodological reservations raised in the literature by a number of scholars independent from the World Bank (see for example: [Deaton 2010](#), [Reddy and Pogge 2010](#), [Srinivasan 2009](#), [Subramanian 2015](#), [Allen 2017](#)).

<sup>35</sup>See subsection 4.2 for the explicit definition implemented here.

<sup>36</sup>Which, more or less would resemble the expansion of the bare bones basket introduced in [Allen \(2001\)](#) to the more nuanced versions presented in [Allen \(2017\)](#).

incidence of poverty to its causal parts (e.g. excessive rents in the domestic price structure), accounting for a strictly or loosely defined fraction of overall economic development taking place in the society, would broadly suffice for the costs updating.<sup>37</sup>

Therefore there are two elements to be specified. First, the fundamental reference concept of basic absolute poverty (hereafter also referred to as the core). And second, the fraction of economic growth with which the reference living standards costs will be updated, so that the resulting basket can be applied as a poverty line at all levels of economic development.

As already noted elements of arbitrariness cannot be avoided. Table 1 makes this arbitrariness and vagueness explicit in ball-parking the description of a bare bones poverty line. It contains a multitude of nutritional considerations, it accounts for uncertainty to a considerable extent, and it is derived in a linear programming (LP) setup to account for changes in the price structure and product availability. The use of linear programming is required here for an additional reason. According to Townsend (1979) someone should be considered as being destitute only when a deprivation in a certain aspect of life comes as a consequence of economic constraints. Using LP to find the cheapest way to meet a set of needs is the appropriate way to identify if indeed the destitution is a result of strictly economic constraints or not.

This description draws heavily from previous work by Allen (2001, 2013, 2017), de Zwart et al. (2014), and Moatsos (2015, 2017). It attempts to specify the “irreducible absolutist core in the idea of poverty” (Sen, 1983, p.159). At the core one can still identify the bare bones basket introduced by Allen. Here the attention is drawn on adapting various costs, such as the requirement for heating energy or the caloric requirement, to local environmental and demographic conditions following Moatsos (2017). In addition this recipe makes uncertainty in the target values explicit at every component.

On the upper half of the table (first six rows), the nutrient targets for the basket are defined. For the energy target measured in kcal the FAO (2001, 2008) method for estimating the minimum dietary energy requirement (MDER) is used. In calculating MDER a number of anthropometric and demographic data are required (FAO, 2008).<sup>38</sup> These include the distribution of the population in age-groups and per gender, the average height of the population and the mean difference between genders, the body mass index (BMI), and the physical activity level (PAL) for each age group. The level of the MDER changes along with the evolution of these characteristics. The reason for including MDER as a dynamic element is that the poverty level of a current population should be evaluated based on the characteristics of that same current population. The alternative of keeping the MDER constant implies a systematic poverty overestimation (when the evolution of anthropometric characteristics demonstrate degrading) or underestimation (when improving).

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<sup>37</sup>A time-lag may also be expected to be in operation here, as implied by Sen (1979, p.287), but I will not consider with this issue here.

<sup>38</sup>Do note that the required corrections in the formulas that are mentioned in both Moatsos (2015) and Allen (2013) are applied here as well.

Table 1: Super Baskets Composition

Item	Unit/Year	Super Baskets Poverty Line
Energy Target	kcal	Dietary Energy Requirement at 15 ~ 30% of the BMI distribution
PAL	index	1.7 ~ 2.3
Protein Target	gr	0.75 gr per Kg of persons weight
Fat Target*	gr	gr equivalent of 20 ~ 35% of Energy in MDER
Other Nutrients	varies	50 ~ 75% RDA
Cost Minimization Method	LP	mean of 3 cheapest bundles
Main staple	kg	linear programming based on nutritional target
Beans or peas	kg	20 ~ 30 at minimum
Meat or fish	kg	4 ~ 6 or 8 ~ 12
Butter or oil or ghee	kg	4 ~ 6
Sugar	kg	2 ~ 4
Linen (applied)	share	6 ~ 10%
Lamp oil	liter	the energy equivalent of 1 ~ 2 liter added as fuel
Soap	kg	1 ~ 2
Candles	kg	1 ~ 2
Heating Fuel	mbtu	calculated on country daily temperature data
Cooking Fuel	mbtu	additional when necessary heating fuel does not suffice
Housing (rent costs)	share	5 ~ 10%
Economic Development Multiplier	function	$max\{0.5 + \alpha \cdot \sqrt{C} \cdot \log_{10}(C), 1\}$ , $\alpha = .5 \sim .75^{**}$

\* : As per [World Health Organization \(2008, Tables 2.1 & 2.2\)](#).

\*\* :  $C$  is consumption (or income) per capita. EDM traces the non-food component as well as the increasing affluence of the food component as economy develops. Similar to Fuchs' proposal it is open to deliberations about its exact form, however it occupies well the middle ground between the fixed proportional increase and a strict absolute PL such as the core SB.

The scope of the so constructed poverty line is to allow the underlying population in a country on a specific year to be nourished at a well defined minimum level. The “minimum” in MDER represents the selection of the body mass index (BMI) found at the 5<sup>th</sup>-percentile of the BMI distributions by the World Health Organization (for those above 10 years of age in the population). Here, this very low percentile is substituted by the use of 15<sup>th</sup> ~ 30<sup>th</sup> percentile of the same distribution, as a way to de-link the poverty concept from a rather extreme body mass layout, and from a possible vicious cycle induced by chronic under-nourishment. It is also closer to the “median of the range of weight-for-height given by the BMI reference tables” used for the population under 10 years of age in the estimation of the MDER ([FAO, 2008, p.7](#)), in order to avoid that the MDER induce stunning. Finally, the Physical Activity Level (PAL) reflects the intensity of body energy consumption, and the values considered here for this index span from the lifestyles that FAO characterizes as “active or moderately active lifestyle” (1.70-1.99) and “vigorous or vigorously active

lifestyle” (2.00-2.40) (FAO, 2001, p.38, table 5.3).<sup>39</sup>

As stipulated by Kakwani (2003) there are six basic nutrients to be considered in a cost of basic needs consumption basket: calories, proteins, carbohydrates, fats, vitamins, and minerals. In addressing this conclusion the Super Basket includes, on top of energy, proteins, and fat, those nutrients selected by Allen (2017): Iron, Vitamin B12, Folate, Vitamin B1 (thiamin), Niacin, and Vitamin C.<sup>40</sup> Finally, the basket design here uses fractions of the suggested RDA levels similar to the “basic diet” used in Allen (2017), with the expansion here that it is not the “half the Indian recommended daily allowances (RDA)” that is used, but a range from 50 to 75% of RDA to account for uncertainty, and preserving Allen’s choice as the minimum in the considered range.

On the central part of the table, the various consumption components are spelled out. The cheapest main staple is identified as a residual once the nutritional value of all other food components are calculated. The explicit target values are taken from Allen’s bare bones basket, with a considerable grain of salt in terms of uncertainty for all expenses.

The heat energy requirements are included so that the PLs are consistent in evaluating poverty between countries with different prevailing temperatures as well as between years with such differences for the same country. The aforementioned requirements are calculated following the concept of degree-days (Day, 2006). Degree-days give the number of total days equivalents in a year where indoor heating is required.<sup>41</sup> The base (threshold) outside temperature used is the 15.5°C, which corresponds to an indoor temperature of about 18°C. This indoor temperature is recommended by World Health Organization to avoid chronic health deterioration (Collins, 1986). The energy required for cooking is included as a function of the caloric content of the food that requires cooking. This is done in accordance to the FAO finding that the food to fuel energy ratio is approximately 3 to 1.<sup>42</sup>

The decisive point of departure from previous contributions in the literature can be found on the last line of table 1. This introduces the Economic Development Multiplier (EDM), and its value

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<sup>39</sup>Therefore, a uniform distribution within 1.7 and 2.4 is considered. This in turn assumes that the PAL distribution and its uncertainty is the same across the world for all that live in conditions of absolute poverty. It is expected that this PAL will become lower with the transition of the economy from agriculture to services. And further influenced by the agriculture technology applied, unless we assume, the improbable scenario, that poor would be present only in the agricultural, more PAL demanding, sector and not in services. In the present treatment the implementation does not account for this effect.

<sup>40</sup>Thus carbohydrates are not explicitly considered, but it is expected that the daily requirements should be covered to a large extent as residuals.

<sup>41</sup>Moreover, I assume that the house is empty for 8 hours per day, then residents are sleeping for another 8 hours (not requiring heating), and for the remaining 8 hours per day heating is required. For simplicity this is included in the calculations by dividing the total number of degree-days by 3.

<sup>42</sup>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>. Here the ratio used is 2.5±0.5. Also the energy required for cooking may come from heating energy, when burning fire for heating purposes is dictated by the temperature conditions. In this case no additional energy is included for cooking to avoid double counting. This means in turn that heat energy requirements per day are required (which have a strong seasonal behavior), to account properly for the total heating and cooking energy required in a household.

is given by the following formula:

$$\max\{0.5 + \alpha \cdot \sqrt{C} \cdot \log_{10}(C), 1\}, \text{ with } \alpha = .5 \sim .75 \quad (8)$$

There is nothing magic about this particular formula, and infinitely many others can be used in its place.<sup>43</sup> The whole point in using such a function is to broadly map the evolution of overall consumption per capita with the overall increase in the monetary evaluation of a commonly agreed poverty line in the same sense as [Ravallion and Chen \(2017, p.5\)](#) argue that richer countries have “more generous reference welfare levels for defining poverty”. Its trajectory is similar to the formula derived by [Ravallion and Chen \(2017\)](#), although it is not derived based on data. Its added value is the use of parameter  $\alpha$  which takes values within the interval of 0.5 and 0.75 using a uniform distribution.<sup>44</sup> The fact that therefore the values that this function takes are not fixed, but they are substantially broad at every level of consumption per capita, reflects the present inability to sharply pin-point the exact correspondence of a one dollar increase in consumption per capita to say  $x$  dollars in the prevailing national poverty line. This is in agreement to the invitation by [Sen \(1983\)](#) to be explicit about the arbitrariness in the definition of poverty.

Figure 2 compares this formula with those used in [Ravallion and Chen \(2011\)](#) and [Ravallion and Chen \(2017\)](#). The only loose calibration taking place here is that the values of the fixed 0.5 parameter and that of  $\alpha$  parameter are such that the area this function covers broadly corresponds with the mid-range between the strict dollar-a-day assumption and that of a simple linear update proposed by [Atkinson and Bourguignon \(2001\)](#). The fact that this function broadly follows [Ravallion and Chen \(2017\)](#), albeit with a diverging lag, only provides a reference with the present literature, and it should not be considered as a confirmation of the former or the later functional forms. At the same time it produces poverty lines with weakly relative increase of their value as a function of average income or consumption, fulfilling the requirements set by [Ravallion and Chen \(2011\)](#) and [Ravallion and Chen \(2017\)](#) in their critiques against [Fuchs \(1967\)](#) and [Atkinson and Bourguignon \(2001\)](#).

The Super Basket (SB) method instead of pin pointing what exact items are required to properly update the content of a consumption basket to track the ever-changing decomposition of a constant-level-of-welfare living standard, it is making a core definition of such basket expand its value in the process of economic development, starting from a reference position when and where the core absolute poverty basket was actually binding. The main problem that is tackled in this manner

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<sup>43</sup>There are though four guiding principles in constructing this formula. First is that it should broadly cover the center of the area between the strictest and the more generous approaches in the literature (this would exclude for example exponential functions). This also implies a rather conservative approach with respect to the current state in the literature. Second, and by implication of the first requirement, having a parameter defined as a distribution such as  $\alpha$  parameter here. Third, the formula should not have elasticity of one of the poverty line it predicts with respect to consumption, to avoid violating WRA. And fourth, preferably and conservatively it would not be a linear function, as it is too simple a form to possibly capture such an unknown complex mapping.

<sup>44</sup>For details about the Monte Carlo implementation see subsection 4.3 below.

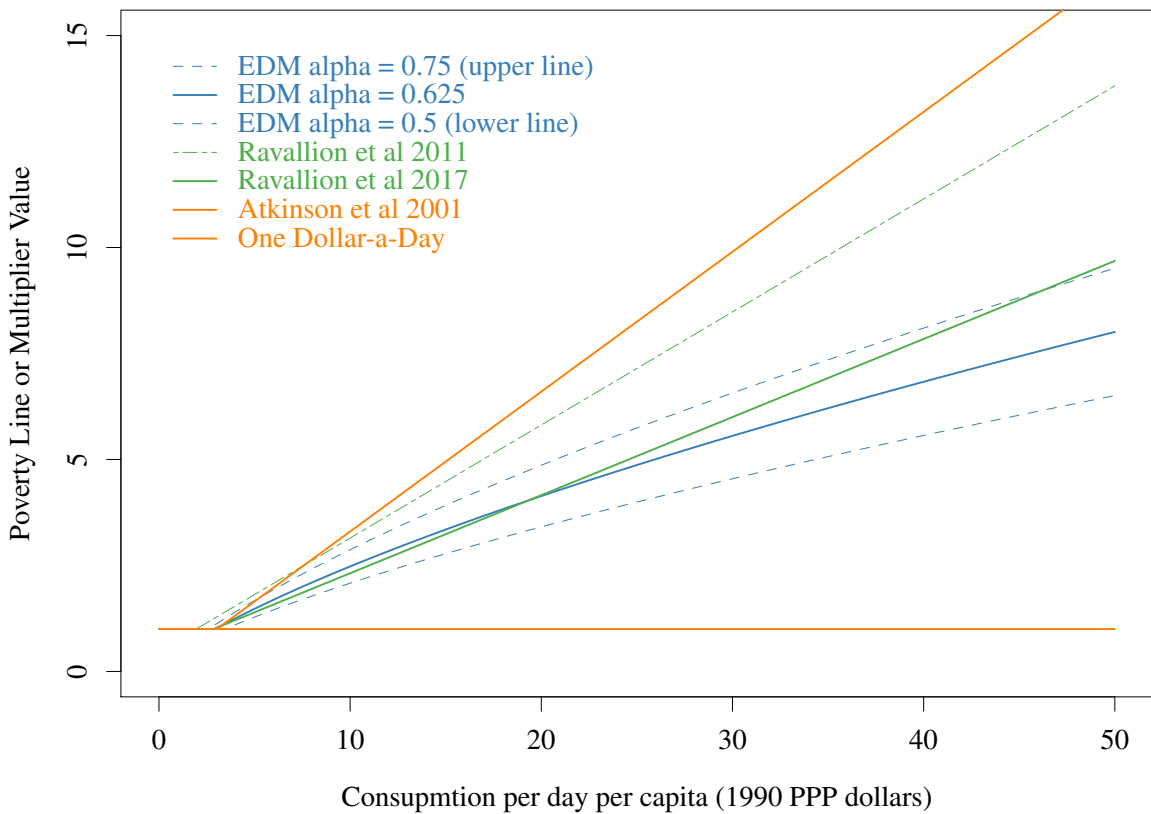


Figure 2: Comparison of the EDM function at three levels of  $\alpha$  parameter, and the functions proposed by [Ravallion and Chen \(2011\)](#) and [Ravallion and Chen \(2017\)](#). The last two functions are divided 1.25 and 1.9 respectively to roughly account for the use of PPP exchange rates from different ICP rounds. Those values are the respective dollar value of the dollar-a-day poverty line in 2005 and 2011 PPP terms.



is that the more one departs from the absolute essential for the support of life,<sup>45</sup> the more the complexity of an appropriate consumption basket explodes to almost intractable levels. In the SB method the impact on the costs of an absolute poverty line that development process is accounted for in a simplified form that can correspond to an almost infinite variety of actual baskets that might actually be preferred locally.<sup>46</sup>

## 4.2 Strictly Relative Component

In the same manner as Sen argues that there is an irreducible absolute component in poverty, it must also be the case that there is an irreducible strictly relative component of relative deprivation, regardless of the average level of economic development. This can be argued in the sense of social subordination (Davis, 1959, p.283), e.g. such as in a situation where the living standards of all are situated well above the SB poverty lines using a form of cash transfers pending approval from those at top income tier.<sup>47</sup> Those people are living in conditions above the expected level of living standards of absolute poverty, but from the perspective of relative poverty, and especially that of social deprivation, those individuals may well experience a constant state of fear and exposure to relative deprivation. These considerations must be, in some sense, accounted for by the relative poverty line.

In addition, the following statement by Reddy and Pogge has been utilized empirically to support absolute poverty lines in global poverty research (Moatsos, 2017):

“One currency amount at a point in time and space can be deemed equivalent to another currency amount at another point in time and space if both quantities are just sufficient to achieve a common end” (Reddy and Pogge, 2010).

Nonetheless, this statement as such can be useful also in the domain of relative poverty. It all relates to what is meant by the “common end”, and if that definition includes considerations for social deprivation or not. In global poverty measurement poverty lines are fundamentally iso-welfare lines as much as possible (Ravallion, 2016, p.232). The “iso” element in this case carries the same meaning as the “common end” in statement by Reddy and Pogge. As long as the common end contains the element of relative deprivation in an appropriately defined manner, then the resulting poverty lines are iso-welfare lines to the extent that the common end is a defensible standard.

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<sup>45</sup>Such as the core SB used here, or the consumption baskets defined in Allen (2017) or in Moatsos (2017) among others.

<sup>46</sup>Naturally this procedure can be reverse engineered, and deduct the implied set of actual consumption baskets relevant in a specific country-year that correspond to the same costs as the SB method.

<sup>47</sup>A similar argument can be made from the perspective of desirability: “At least one of these partitionings [of population into deprived and non-deprived groups] is considered throughout the population to reflect differences in *desirability*. Such a partitioning divides the population into two classes, the deprived and the non-deprived, the latter state being universally preferred to the former.” (Davis, 1959, p.281).

Along the lines of socially induced deprivation, high levels of economic inequality in turn shape decisively the distribution of income and wealth for the years to come, via a political influence channel (Piketty, 2014; Stiglitz, 2012; Sandel, 2012). Such high levels of inequality should be captured by a relative deprivation poverty line, as it is exactly what the problem of inequality is all about<sup>48</sup>, in a manner that coincides with the rationale of Fuchs' proposal. Thus the minimum criterion that such a threshold needs to fulfill would be a direct positive link with prevailing inequality.

An approach in line with the political influence channel departs from the attempt of Ravallion and Chen (2017), which contemplates both upward and downward looking comparisons for relative poverty, and must link relative deprivation strictly to the overall extend of inequality, and if possible in a manner more direct than Fuchs' proposal, i.e. that for as long as economic inequality is high, this relative component should not be possible to be reduced to zero (such as in Fuchs proposal, where it is technically possible to have both zero relative poverty and high levels of inequality).

Thus the minimum criterion of a direct positive link with prevailing inequality needs to further include the clause that it will not allow for relative poverty eradication in presence of inequality. This criterion is in line with Davis definition of relative deprivation, as the condition resulting from a deprived person comparing her/himself with a non-deprived, which in economic terms is by definition strictly higher up in the income or consumption distribution.

This requirement can be met with a very simple formulation following Sen (1976). Sen derived a real income concept that corrects for income "wasted" in terms of welfare in a country due to economic inequality. The formula for real national income according to this correction is given by the mean income  $m_j$  multiplied by  $1 - G_j$ . Therefore the traditionally defined real income is reduced to Sen's real national income concept when multiplied with a parameter of economic equality (since  $G$  is an inequality index,  $1 - G$  is an equality index). Conversely the amount  $W_j$  of traditional real national income in country  $j$  that goes "wasted" (or equivalently, goes un-allocated among individuals due to unequal distribution) is equal to:

$$W_j^* = G_j^* \cdot m_j^* \quad (9)$$

In being consistent with the separability requirement of the relative and absolute concepts of poverty introduced here, the application formula should be applied to the relevant subgroup of the population, and in the case of interest here, those who are not counted as living in conditions of absolute poverty (denoted by the asterisks used in the formula).

I propose that the amount of real consumption or income  $W$  that is wasted due to its unequal distribution, would be the threshold below which relative deprivation starts among those not absolutely deprived in a society. The higher the inequality level the higher the waste and relative deprivation, among those not absolutely deprived, as well. At maximum inequality those below

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<sup>48</sup>See Sandel (2012) for a discussion on this issue.

$m^*$  will be accounted for as relatively deprived against the one at the top, at the average level of inequality those at or below half  $m^*$  will be relatively deprived, while when perfect equality prevails there is no relative deprivation.

This approach essentially assumes that it is exactly because of the existence of this waste of potential welfare that relative deprivation actually takes place. Equation 9 will not necessarily produce poverty lines higher than the minimum income among the population group which is not living in conditions of absolute poverty in SB terms, it can therefore be the case that relative poverty technically zero while inequality and absolute poverty are both above zero, however in the entire population this definition strictly fulfills the requirements described above. It is only because of the normative decision to give priority to the concept of absolute poverty that the strictly relative component can be accounted as zero in conditions of non-zero inequality.

Obviously, this is just one method to define this strictly relatively deprived group within a country (or globally). As such the conclusions drawn for its application are—similarly to the proposal by Fuchs (1967)—by no means definitive, and should be considered as indicative of a new approach. However, in absence of a systematic investigation of alternative formulations to capture relative deprivation more representatively, equation 9 has the advantage of being the most simple form among all such possible formulas. At the same time this formulation puts the spotlight of relative deprivation on inequality which is exactly where Fuchs intended it to be.

The added value within the sequential application of absolute and relative poverty lines components is that a defensible definition of relative poverty in terms of being iso-welfare between countries is constructed. Once all the absolutely deprived individuals are accounted for and separated, those that remain are being evaluated according to the prevailing inequality within that population group. Thus on a global scale the population group upon which the relative deprivation criterion is applied is all above the absolute poverty level, therefore all those individuals are standing above a global living standard which constitutes an iso-welfare level. At the same time, since the criterion for relative deprivation is applied strictly beyond a common living standard on a global scale, and it is defined identically among countries, then it defines an iso-welfare level in the sense that those located exactly at the so defined relative poverty lines will be exposed to equivalent relative deprivation against those within their countries that are non-deprived. This is—at least partially—addressing the concern with Fuchs' proposal that in terms of social participation it is not clear that it is comparable across countries, as there is a stronger sense of comparability when those compared share some similar characteristics—here all persons above the SB absolute poverty level—than when not, as in Fuchs' application.

### 4.3 The Global Perspective

Typically the new, or rather nuanced, poverty lines introduced above would be applied in a hybrid instead of a pure manner. This means that those lines as global concepts would be applied locally,

using for example the local income or consumption distributions—thus in a hybrid manner—instead of a global distribution, that would make the application a pure one.

If that is the case then one would like to know if they are globally monotonic in own income, per the requirement set by [Ravallion and Chen \(2017\)](#). The SB absolute poverty concept becomes globally monotonic in own income, either when all countries are at the same level of development, thus having equal EDM ratios, or when the EDM ratio considered for all countries is that of the global economy as a whole. The former is in all likelihood an impossibility, while the latter represents an investigation of global absolute poverty from the perspective of the world as a whole.<sup>49</sup>

The situation with respect to the strictly relative poverty line, introduced in subsection 4.2 above, is similar to SB. When the relative poverty lines are applied locally, then they are not globally monotonic in terms of own income. When the global income or consumption distribution is used along with the global average income or consumption then this concept becomes also a pure one and globally monotonic in own income. Like in the case of the SB application, here as well it is a matter of the perspective one chooses to adhere to. Nonetheless, it is good to know that both poverty concepts introduced above are in line with the requirement of global monotonicity when applied in their pure form on a global perspective.

From the standpoint of relative deprivation, regarded by a global perspective, the problem identified in the theoretical discussion above concerns the uninvestigated relevance of a global reference point in terms of the overall global distribution as well as the mean income or consumption of the global economy to the individual relative deprivation level across the globe. Without proper empirical grounding this concern is not possible to be addressed. However, one can indicate that—as discussed above—the world from a purely global perspective will eventually become relevant as global integration gains speed. That said, it is also the case that from a global perspective the welfare levels of individuals to some extent are related to the general position of their country within the global distribution of income.

It is trivial to show that both poverty concepts introduced above, when applied globally, are consistent with the WRA axiom. Reconsidering that axiom from a world or global perspective (therefore a pure application), the following theoretical questions are of interest:

- (i) if a country's income is held fixed and global income is increasing must then poverty increase in that country?
- (ii) if country's income is increasing and global is increasing at a higher rate then poverty should be decreasing or increasing?

For both questions absolute poverty will increase in that country, because of the increase of the multiplier from a global standpoint, while the country stagnates in terms of growth. What

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<sup>49</sup>This application would also consist a pure application in the sense introduced in section 3.

happens to relative poverty depends on the specifics; primarily where this country is located along the global distribution.

#### 4.4 A minimalistic example

Consider two countries or communities A and B, with five inhabitants each. The respective consumption per day of each person in some international PPP currency is shown on table 2. Lets further assume that the core basket in both countries is priced at 1 in the same international PPP currency, and therefore both countries have 0 absolute poverty in terms of the core SB basket. From the consumption data shown in the table, country A has a Gini index of 0.32 and B of 0.36, while the Gini of their joint interpersonal income distribution is about 0.39. Also, country A is twice as rich in terms of consumption per day than B, with an average of 30. Based on equation 8, the SB absolute poverty line for A is 5.5 and for B 3.3, which means that SB poverty rate is in both countries 20% in hybrid context. In a globalized pure context the SB poverty line is 4.5, and now absolute poverty in country A is 0% while in country B is still 20%. Since, B is poorer than A the pure SB poverty line will be higher than its hybrid one, therefore the resulting pure poverty rate will be equal or higher than in the hybrid case—and vice-versa for country A.

Table 2: Consumption per day and inhabitant, countries A and B.

Country List		
Person	Country A	Country B
1	5	2.5
2	20	7.5
3	30	15
4	40	20
5	55	30

With respect to the relative poverty, and from a hybrid perspective, the poverty lines based on equation 9 are 7.2 for A and 4.5 for B. This translates to zero hybrid relative poverty in both countries. From a global perspective though, due to the consumption disparities among the two countries the relative poverty line increased to 7.7, and relative poverty in country B becomes 20% from a global or pure perspective. It is therefore the case that when inequality between countries is high, relative deprivation will tend to increase, especially in the least well-off countries, as one would intuitively expect.

## 5. Data

The anthropometric data used are the age and gender population distributions from the United Nations World Population Prospects dataset [United Nations \(2015\)](#). Height data are those available by [Baten and Blum \(2015\)](#).<sup>50</sup> The price data are a combination of sources mainly based on the ILO's October Inquiry data, complemented with prices quotations from the World Food Program (WFP) and FAO (both are United Nations agencies). For the years with partial or full missing price quotations the most appropriate available price index is used. In order of preference those price indexes are: the food CPI for the poor available from ILO for a group of developing countries; the average CPI; or finally the price index of similar products for which the sources used here provide data for in the same country.<sup>51</sup>

Data on the nutrients of food items is taken from the USDA database<sup>52</sup>, while the retention rates applied for caloric values are taken from [Appleton et al. \(1999\)](#). The consumption or income distributions are those of PovcalNet.<sup>53</sup>

For the stylized historical application that follows consumption is taken proportional to that of the GDP per capita estimates from [Bolt et al. \(2018b\)](#) and [Bolt et al. \(2018a\)](#). To account for the average difference between GDP and consumption the average final consumption expenditure as a share of GDP from the World Bank data is used.<sup>54</sup> For the recent benchmark application (for 1990 and 2015) the consumption data are taken from the household surveys in PovcalNet, similar to [Ravallion et al. \(2009\)](#) and [Ferreira et al. \(2015\)](#).

Total global population data for the period 1800-1959 are taken from "Our world in data", and are based on UN and HYDE estimates (with interpolated unavailable years), and for the period 1960-2016 the aggregates are from the World Bank.<sup>55</sup> Finally, the temperature data come from the Global Historical Climatology Network.<sup>56</sup>

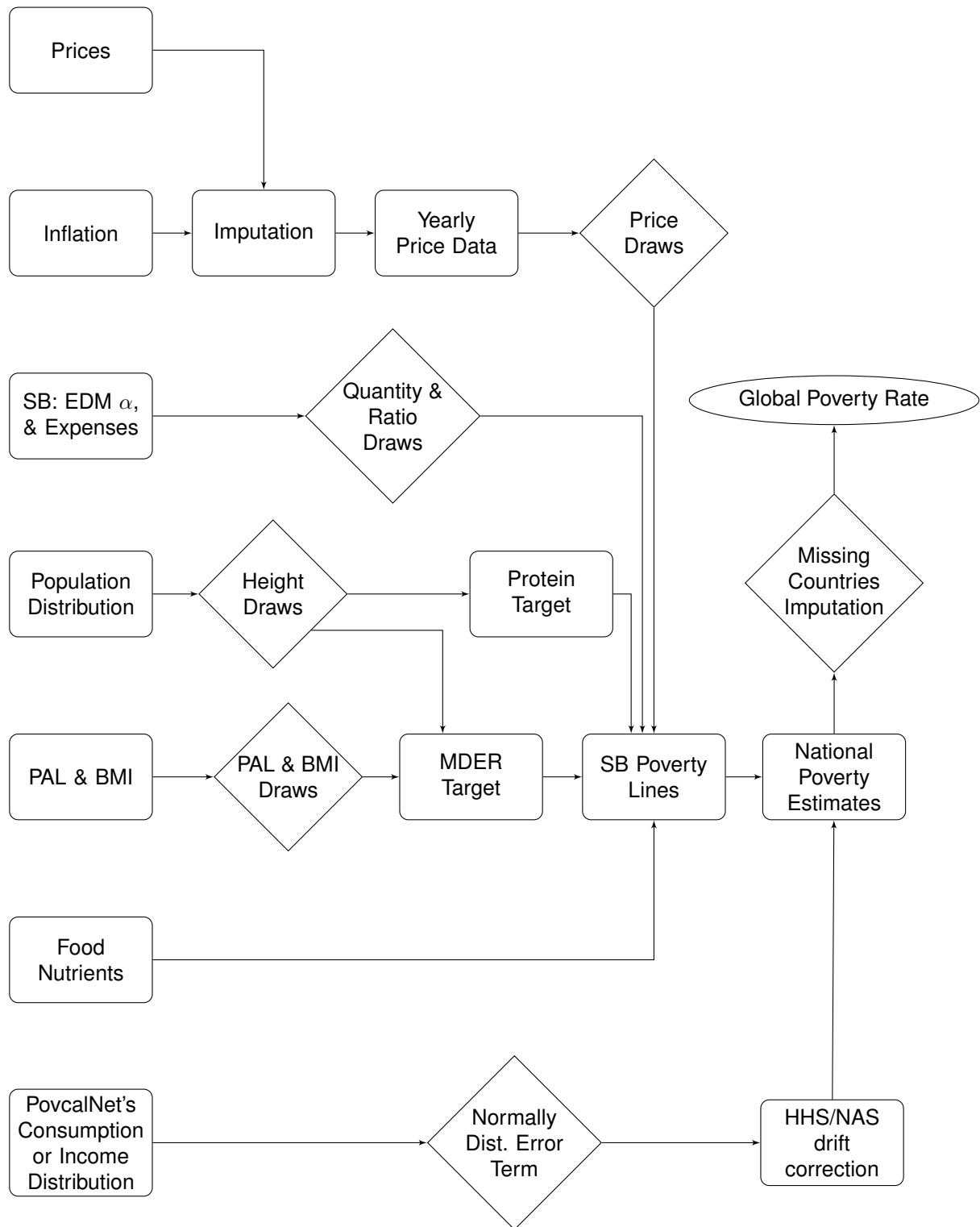


Figure 3: Architecture of Data and Monte Carlo method for the SB method. Diamond shaped objects mark a draw from a distribution in the Monte Carlo simulation, with the value range specified in table 1. This flow chart is an updated version based on [Moatsos and Lazopoulos \(2019\)](#).

## 6. Empirical applications

Given that the values for most of the items of the SB recipe are given in intervals, the Monte Carlo approach is the appropriate computation method. Here I draw on the model used in [Moatsos and Lazopoulos \(2019\)](#), which I expand in a number of ways as required by the specifications spelled out in table 1. Figure 3 shows the flow chart of the method. The calculation flow up to the formation of the SB poverty lines generally follows the tabulation from table 1. It also contains the part relating to the price imputation method described in data section above. In addition, it denotes the section dealing with the income or consumption distributions, and shows the need for imputation on missing countries in order to reach a global poverty rate at the end of the entire process.

With respect to the income distributions a normally distributed error term of 5% is used to simply account for the fact that the true value of the income or consumption at any point on the distribution may be in exact. This is by all means a crude method, but it is beyond the purpose of this empirical application to properly estimate the error term of each individual distribution contained at PovcalNet.

Regarding the imputation of missing countries there are two approaches to follow. One is the approach used by the World Bank, which assumes that the population weighted poverty rate of a geographical region based on the countries with available data is the same also for countries without data. The alternative approach is to devise a form of error accounting for each country without data, and assume precautionary that on average the poverty rate among the countries without available data must be higher than those with data. The plausibility of this assumption rests on the observation that countries with the capacity to produce data for monitoring poverty levels, or countries able to fetch outside assistance for the same matter, may well be more likely to be in a development trajectory that is less prone to the incidence of poverty compared to the countries that do not. To simply account for this observation two steps are taken: first, a normally distributed 10% standard error is added on the regional average when the poverty rate for a missing country is imputed, and second, the regional average is also increased by an arbitrary 10% as well.

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<sup>50</sup>Dataset downloaded from the Clio Infra website, at <https://www.clio-infra.eu/>, last accessed April 15, 2018.

<sup>51</sup>For detailed discussion of price data sources and imputation method see [Moatsos \(2017\)](#).

<sup>52</sup><https://ndb.nal.usda.gov/ndb/>

<sup>53</sup>The World Bank's Povcalnet online service was last accessed on October 3rd, 2018 to retrieve the distributions. The distributional data are directly available from the [Data Publication platform of Utrecht University](#).

<sup>54</sup>Rounded to the closest integer, this is equal to 82% for the 1960-2017 period, with a high between countries variation that I ignore here. For example China has around 62% on average.

<sup>55</sup>World Bank data page <https://data.worldbank.org/indicator/SP.POP.TOTL>. Our World in Data page is <https://ourworldindata.org/world-population-growth>. Both accessed on January 23rd, 2019.

<sup>56</sup>Menne, M.J., I. Durre, B. Korzeniewski, S. McNeal, K. Thomas, X. Yin, S. Anthony, R. Ray, R.S. Vose, B.E.Gleason, and T.G. Houston, 2012: Global Historical Climatology Network - Daily (GHCN-Daily), Version 3.22.



Before a national poverty rate can be calculated an additional correction is required again for reasons of sparse distributional data and this is depicted in the flow chart an “HHS/NAS drift correction”. The practice followed by the World Bank in order to achieve higher population coverage in any given year, is to re-use the available distributions from a year close to the one investigated when there is no available from that particular year.<sup>57</sup> This is the approach I follow here as well. In order to shift the distribution from its year of origin to the year of interest, growth rates from national account statistics (NAS) are used to estimate the mean.<sup>58</sup> The real growth in household final consumption expenditure from the NAS is generally preferred. In cases where this is not available, the real GDP per capita growth is used instead. The major concern with this type of imputation of the mean is that there is a considerable divergence between the “organic” HHS-based growth rates and the growth rates found in NAS (Deaton, 2005, p.2). A simple correction for this discrepancy is suggested by Ferreira et al. (2015), and I follow it here as well. Ferreira et al. use an 87% multiplier as an adjustment factor for all, but two, countries: India gets a 51% correction factor is 51% and China 72%. Finally, if the year of interest falls between two available distributions then their (time) weighted average is used.<sup>59</sup>

## 6.1 Stylized Historical Benchmark

In this subsection a stylized demonstration of the methodology introduced above is performed to estimate poverty levels since 1820. In order to produce this stylized version, and extract the baseline behavior of the SB and strictly relative methodology, a couple of simplifying assumptions are in order. First, it is assumed that all countries for all years have a consumption distribution of 0.5 Gini. And second, it is assumed that one dollar in 1990 PPP terms<sup>60</sup> represents the costs for the core of one SB for all countries and all years.<sup>61</sup>

In order to have some perspective the results are compared with the absolute poverty line of a dollar a day by the World Bank (assuming it was one dollar also in 1990 PPP terms, in this analysis this is called core poverty, since the core SB is assumed to be a dollar a day). Finally, for the historical context where many more countries are missing from the data than in the contemporary period, the error accounting for missing countries would be more representative if it was a more conservative one. Thus when imputing missing poverty rates for countries with missing data, we use a value 20% higher than the regional average of those countries with available data, instead of the 10% specified above. When the total population in the Maddison data is less than the estimates for the global population, for those that are unaccounted for in the Maddison data the

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<sup>57</sup>See Chen and Ravallion (2010, 2004) and Ferreira et al. (2015) for details.

<sup>58</sup>The shape of the distribution remains the same.

<sup>59</sup>If a distribution is more than 4 years away from the year of interest then it is excluded.

<sup>60</sup>Which are the PPP exchange rates used in the version of the Maddison data I use here as well (Bolt et al., 2018a).

<sup>61</sup>This represents the core assumption of the dollar-a-day approach as well.

same method is applied as for the countries with missing data.<sup>62</sup> When entire regions are missing from the data, then simple linear interpolation is used to avoid sudden drops or increases in global aggregates.<sup>63</sup> Here the use of a similar version to the country level imputation is avoided because it is usually the less poor Western Europe that would be used to impute poverty rates for typically much poorer regions.<sup>64</sup> Finally, for the Pure implementation the GDP per capita estimates are interpolated and extrapolated on a country level due to the nature of the exercise, and the data it requires, assuming that entry and exit of a country from the estimates due to missing observations is a greater concern compared to a few years of interpolation or extrapolation for a relatively small subset of the countries included.

### 6.1.1 Hybrid implementation

Figure 4 shows the estimates of the hybrid stylized implementation for the SB baskets and for the concepts of core, absolute and relative poverty, as well as total poverty being the aggregate of last two. Back in 1820, core poverty at 53% accounts for the bulk of poverty around the world. Its trajectory follows a smooth s curve until 1855 where a slow and persistent downward trend begins that is interrupted only by WWI, where core poverty increases from 36% to 40%. Right after a U-shaped trajectory leads to WWII, with its low point at 34% in 1928 and peak at 42% in 1945. Within 17 years about half of the progress made in more than 100 years since 1820 evaporates. Beyond the WWII peak a strong downward trend persists until 2016, where core poverty reaches slightly more than 5%.

SB absolute poverty is strictly higher than core poverty in all years by definition. It closely follows the trajectory of core poverty and their peak difference of about 10% is reached at the end of the period where SB poverty stands at less than 16%. In the meantime the bulk of overall poverty reduction in terms of core or SB poverty is converted to relative poverty. This effect is most likely exaggerated here because of the high fixed Gini used in this stylized benchmark, especially with respect to contemporary relative inequality levels. Relative poverty on a global scale starts at 2% on average in 1820, thereafter reaching 6% by 1896. By 1958 it reaches 10%, and 20% in 2005. In 2016 it reaches its highest value of slightly more than 23% on average.

Total poverty on a global scale stands at almost 56% in 1820, only a few points higher than core poverty at the time. The downward trend of total poverty is considerably less prominent than core and SB concepts, and the substantial reduction pace reached by those poverty concepts after WWII, is difficult to spot on the total aggregate due to the opposing trend of the relative poverty concept.

<sup>62</sup>Linear interpolation is used also for country level missing data on population.

<sup>63</sup>For 1820 and 2016 all regions are represented, therefore there is no need for extrapolation. Due to their population size, the same approach is applied for China and India with the addition of one year extrapolation from 1821 back to 1820.

<sup>64</sup>When this is applied with error accounting, then the linear interpolation should include an additional error term. But this stylized application does not investigate this aspect.

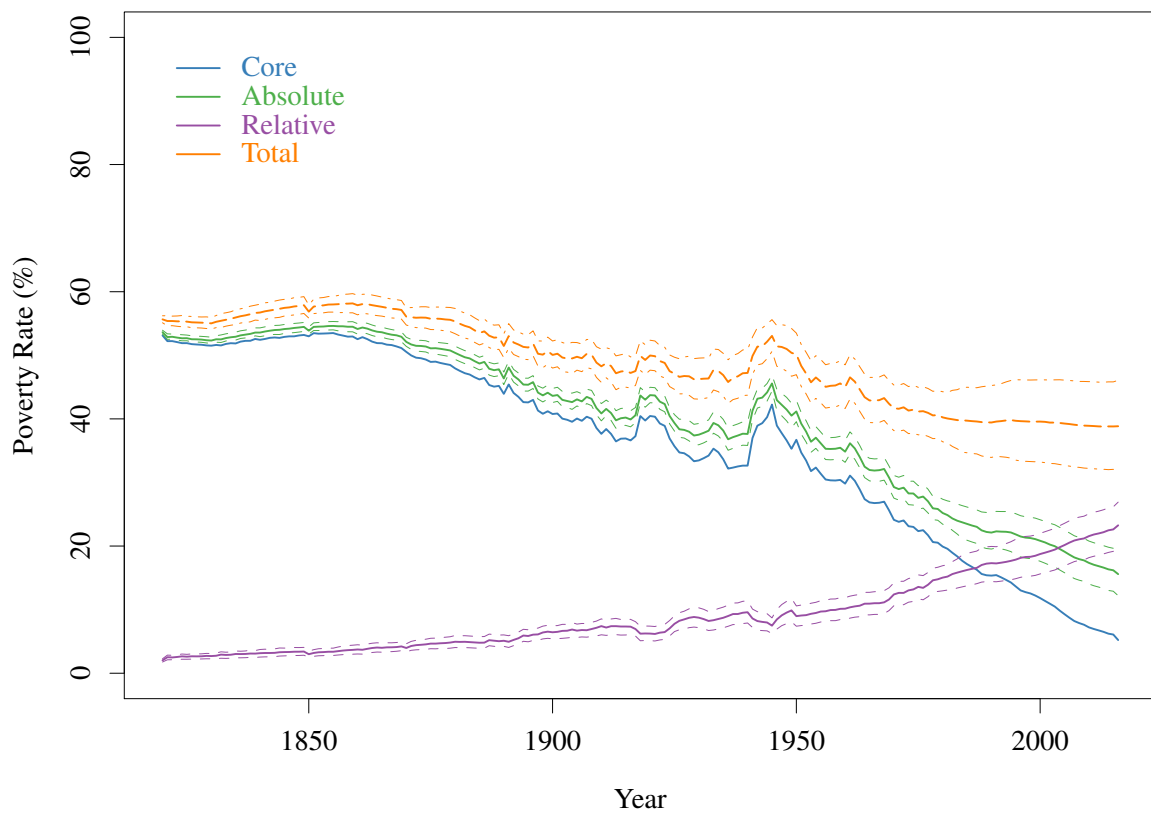


Figure 4: Poverty rates on global scale as defined by the hybrid poverty concept using the stylized version of the SB baskets.

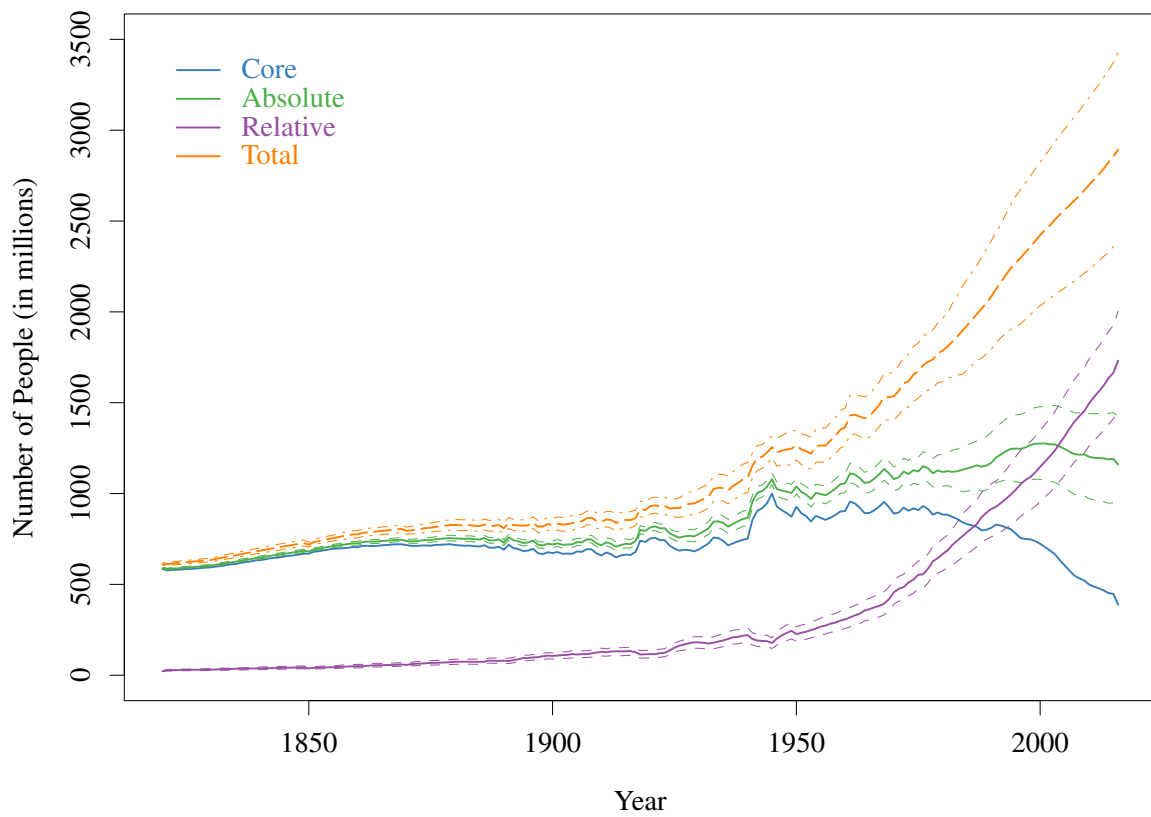


Figure 5: Counts of people living in conditions of poverty on global scale as defined by the hybrid poverty concept using the stylized version of the SB baskets.

At the end of the period total poverty still stands at almost 39%, although its decomposition is very different than that in 1820, with relative concept filling most of the room since the early 00s.

In terms of population count the evolution is substantially different, given the enormous population growth during this period. As figure 5 shows, with the exception of core poverty after the end of the 1970s and SB poverty after 2000, all poverty concepts are showing a general increase throughout. Total poverty on average starts at 611 million people in 1820, 583 of which are living in conditions of core poverty, 6 strictly in SB poverty and 11 in strictly relative poverty. Total poverty reaches 1 bn people between 1932 and 1933. The 2bn mark is reached between 1987 and 1988, and by 2016 the total count is 2.89 bn people on average.

Core poverty during the 19th century reaches a maximum of 711 million in 1879, and in the 20th century reaches a maximum of a few thousand less than 1 bn people in 1945 when total population was a bit less than 2.4 bn. The relatively strong downward trajectory starts around 1991, and by 2016 the overall minimum of 388 million is reached. In terms of SB poverty the trajectory does not show the signs of improvement that core poverty does. After a slowly increasing trajectory during most of the 19th century, where it accounted for 760 million people by 1891, a weak downward trend lasting up to 1913 brings the account to 707 million. By the end of WWII SB absolute poverty accounted for 1078 million people, and the overall maximum is reached in 2001 at 1276 million people. By 2016 the count shows 1160 million people living in conditions of absolute poverty on average, with some 800 million of them living strictly under those conditions (those not accounted in core poverty). Relative poverty reaches 100 million by 1897/8, and 200 million by 1936/7. After 1950s the upward trend is picking up speed, and by the end of the period it accounts for 1732 million people, making this poverty concept the most populous on the globe at the present.

### 6.1.2 Pure implementation

Lets turn the focus now on the evolution of the various poverty concepts using stylized historical implementation from a pure global perspective. That means on the one hand the average global mean consumption is used to calculate the SB poverty line and rate in every country, and on the other the Gini of the global distribution of those not living in conditions of SB absolute poverty and its mean are used to estimate the relative poverty threshold again for each country.<sup>65</sup>

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<sup>65</sup>For demonstration purposes the evolution of the value of the EDM along with the evolution of global average consumption per capita is shown on figure 8 in the Appendix. It is only by 1898 that the value of the EDM becomes larger than 1 for the first time since 1820, and most likely since forever.

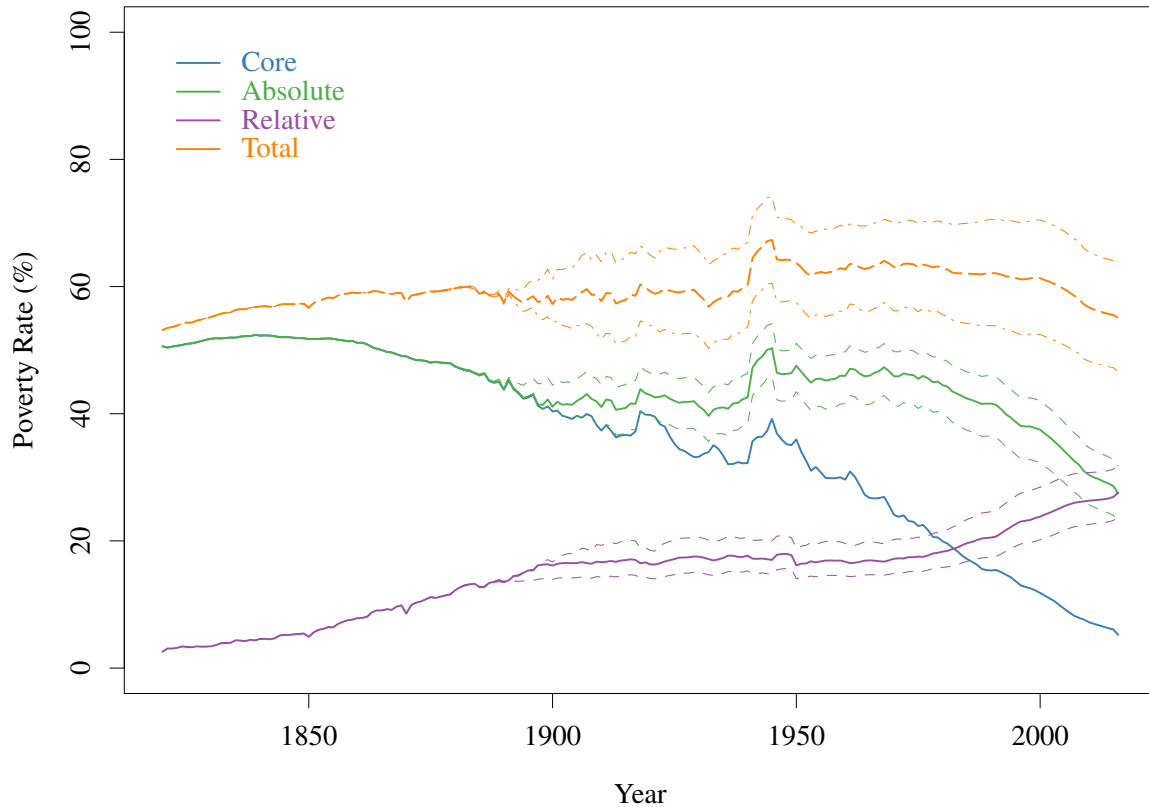


Figure 6: Poverty rates on global scale estimated in a pure poverty implementation using the stylized version of the SB baskets.

Figure 6 traces the evolution of all poverty concepts in their pure global perspective. The initial values in 1820 are all almost identical to the hybrid implementation, with some small differences attributable to the more intense use of interpolation required for the pure implementation. Core and absolute poverty start at slightly less than 51%, relative poverty at 3%, and total poverty at 54% (difference due to reporting rounding). Interestingly this value of total poverty rate is the lowest in the entire period, with its peak at 67% in 1945 and following a recent downward trend it reached 55% by 2016. Core and absolute poverty provide matching estimates since the EDM value is 1 until 1898 (see figure 8 in the Appendix for its evolution). Since then absolute poverty provides considerably higher poverty rates than core poverty does. Until 1945, absolute poverty follows a U-shaped trajectory with its minimum in 1932 at slightly less than 40%, and its 20th century peak in 1945 at 50% (almost identical to its 1820 initial value, without the rounding).

The generally decreasing trend in absolute poverty concept brings it down to slightly above 27% by 2016, a value almost matched by the final estimate for the relative poverty concept as well. Relative poverty concept follows a clear increasing trajectory throughout, indicating both the

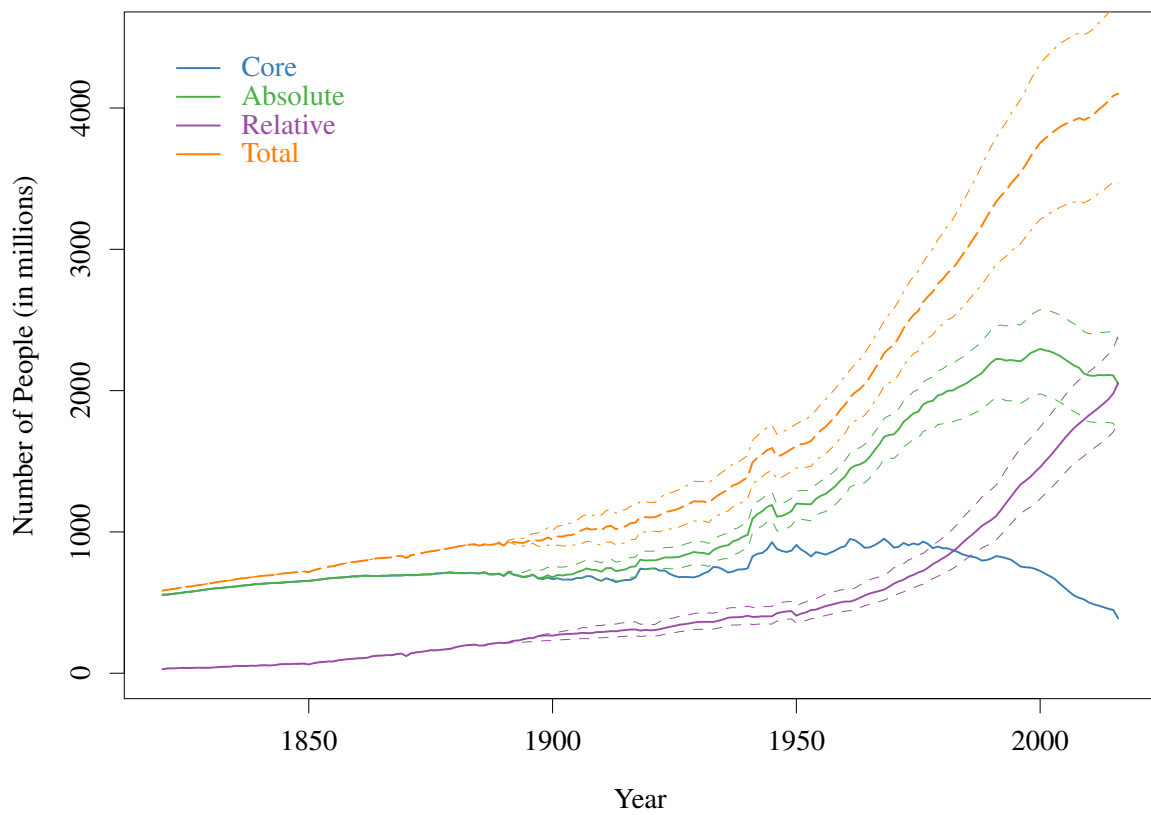


Figure 7: Counts of people living in conditions of poverty on global scale estimated in a pure poverty implementation using the stylized version of the SB baskets.

increase in global inequality among countries<sup>66</sup>, as well as the increase of those not evaluated as absolute poor, but still falling below the global relative poverty line. The effect of between countries inequality in global poverty is missed with the hybrid investigation, and can only be captured from a pure global perspective. However, this stylized application is blind to the development of the within countries inequality which can further accelerate or decelerate the differences between the two implementations.

Figure 7 shows the population counts for all poverty concepts in their pure definitions. During the 19th century, the totals are almost identical to that of the hybrid approach, with some small differences in absolute poverty due to some early developed countries having an EDM higher than 1 earlier than when in 1898 the global EDM multiplier departs from its resting value. Especially after 1950 the discrepancy between the population counts in absolute poverty between the two implementations is marked, and it is only by the late 90s that a downward trend can be identified in the pure case. Total poverty count reaches the 1bn mark by 1906, some 30 years in advance of the hybrid case. The 2bn mark is reached by 1962/3, 25 years prior to when the hybrid implementation. And by the end of the period it stands at an all time high of 4.1bn people, after passing the 3bn mark in 1985 and 4bn in 2012/3.

## 6.2 Recent Benchmarks

**Note: this implementation is pending; it involves the detailed estimation of global poverty using the methodology introduced here, including the detailed SB recipe on table 1, for the years 1990 and 2015 and for developing countries only, and it will in any case be available well before the start of the conference.**

## 7. Conclusions

The increased poverty counts identified in this paper relative to other estimates in the literature especially during the 20th and 21st centuries should not be taken as a sign of global regression. It is clear from the stylized analysis that at least in terms of the irreducible core absolute poverty concept incredible progress has been made. However, new developments create new forms of deprivation and this is to some extent captured by the methodology introduced here. The methods we devise and apply in monitoring global progress against poverty should not be blind to the evolving concepts of poverty around the world as a function of foremost economic development.

Trying to perfectly capture those effects appears to be a daunting task, while vagueness and ball-barking approaches, along with the recognition of the arbitrariness of any method and definition, can provide a useful stepping stone to systematically estimate defensible notions of poverty

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<sup>66</sup>Shown to take place in the period 1820-1950 in (Moatsos et al., 2014, Table 11.4)



that to some extent tackle key issues in the literature as it has developed so far.

The complete separation of the population groups that are perceived as absolutely or relatively deprived provides a good candidate to resolve the dual problem of those competing poverty concepts where absolute definitions fail to account for social participation and relative definitions fail to always account for deprivations in basic needs. In such a setup the two concepts are complementary and not antagonists.

The use of the pure implementations of those concepts in global scale, allow for the developments in global inequality to influence the results, and provide insights of how poverty could look like in a highly integrated world. Arguably such a general approach would become evermore relevant in how poverty is seen from the global perspective.

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## 8. Appendix

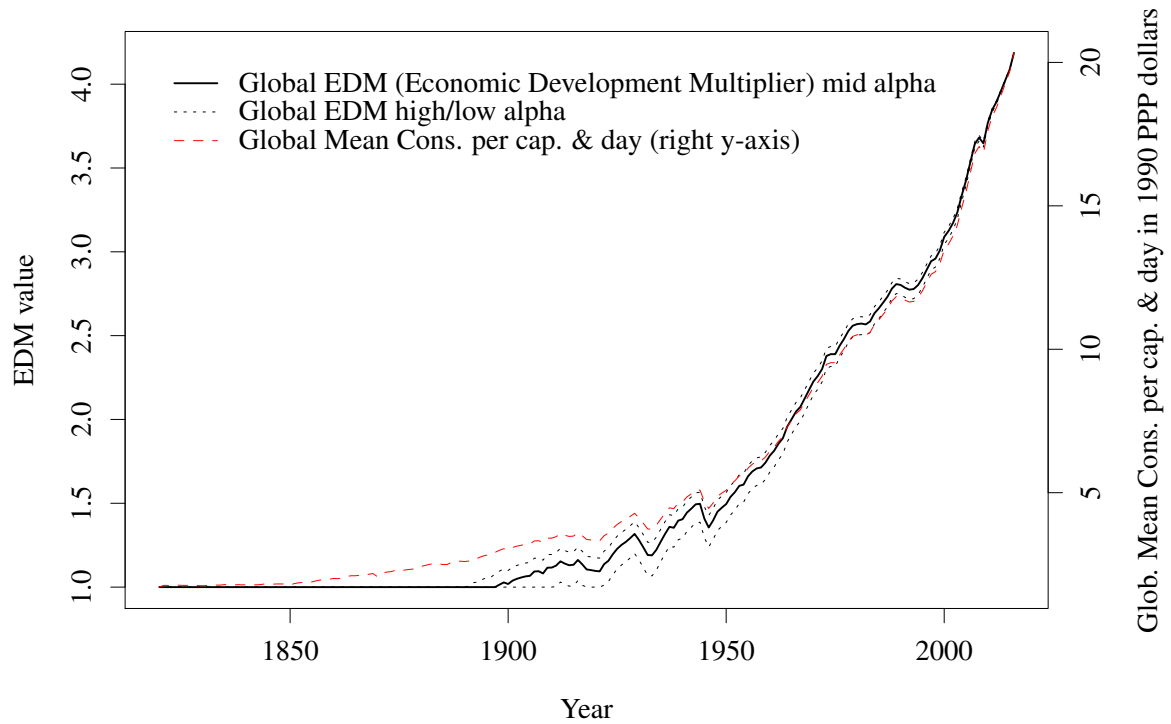


Figure 8: Global EDM value as a function of time. GDP per capita is discounted to 82% of its value to proxy for individual consumption. In 1898 the EDM is larger than 1 for the first time.