

An Interesting Step Backwards in Measuring Global Poverty

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Abstract: Allen (2017) claims to provide a better method for measuring global poverty than the World Bank's, and to obtain a substantially higher poverty count. This paper assesses and rejects both claims. Allen's use of least-cost diets with fixed non-food bundles is inconsistent with consumption behavior and is no more relevant to developing countries than rich ones. His higher poverty count is not robust, but reflects his use of urban-biased prices and his arbitrary choice of nutrients. The paper shows that another nutrient specification of Allen's gives a lower poverty count than the Bank's, although the decline over time is similar.

¹ In the interests of full disclosure, it should be noted that the author took the lead at the Bank in developing its current approach to global poverty measurement, in research that started in 1989 and made public in the Bank's 1990 *World Development Report* (World Bank, 1990) drawing on a background paper to that report (Ravallion et al., 1991). The author maintained a direct supervisory role in the Bank's global poverty measurement efforts until he left the Bank in December 2012 to join the faculty at Georgetown. The author takes sole responsibility for this paper, which was not commissioned by, or reviewed by, the World Bank.

The World Bank’s longstanding method of measuring global poverty uses Purchasing Power Parity (PPP) rates across countries in trying to assure that the international poverty line has constant purchasing power globally. In his paper, “Absolute Poverty: When Necessity Displaces Desire,” Robert Allen (2017) has proposed and implemented an alternative method. At the core of Allen’s method is the use of Linear Programming (LP) to set a least-cost diet for attaining stipulated nutrients, following Stigler (1945).² Allen estimates country-specific least-cost diets anchored to globally-constant nutritional requirements, which he then values at local prices, and adds an allowance for spending on his stipulated bundle of non-food goods. Allen does not present his method as a complement to the Bank’s, but as superior.

This comment argues that Allen’s proposed method is an interesting step backwards in the methodology of poverty measurement—the resurrection of a method famously rejected long ago because it produces poverty lines of little relevance to consumption behavior. From the point of view of the history of thought on poverty, it is interesting to see what this old method delivers with new data for the developing world. However, as this comment argues, the method Allen proposes should still be rejected, based on the literature and Allen’s own findings. PPP’s remain essential for global poverty measurement. Furthermore, while it is not clear how one should compare poverty counts for the two methods, the paper shows that Allen’s claim that his method gives a higher count than the Bank’s is not robust.

Comparing the two methods

The Bank has long measured global poverty in a way that is broadly consistent with how other international economic comparisons are made, namely using PPP exchange rates, as derived from the country-level prices collected by the International Comparison Program (ICP). Official exchange rates cannot be relied on for this purpose since many goods are not traded internationally. These goods tend to be cheaper in poorer countries where wage rates are lower. So official rates overstate the extent of poverty in such countries by overstating the cost-of-living. The ICP collects prices across countries, to calculate PPP rates.

² Stigler did not actually use LP, as the technology of Dantzig’s simplex algorithm was not yet available, but Allen reports that Stigler still came close to the LP solution.

In the bulk of its global poverty work, the Bank has insisted that the global poverty line should have constant purchasing power across countries.³ For measuring the global poverty rate, this is equivalent to using real household consumption (or income) per person as the welfare metric (or what is sometimes called the “welfare ratio” following Blackorby and Donaldson, 1987). Thus the measure of global poverty is recognizable to economists as a summary statistic of the global distribution of real income.

The research papers produced to underpin the Bank’s more high-profile reports have used multiple lines, and tested the robustness of key qualitative claims (notably whether poverty is falling) to the choice of poverty line. For example, there are many such lines in Chen and Ravallion (2010) (they test and accept first-order dominance over 30 years for all possible lines up to the US official poverty line). Ravallion (2016) also presents results over time for many lines from the consumption floor to the mean line for the developing world.

To help interpret these lines, World Bank (1990) and Ravallion et al. (1991) locate them within the distribution of national poverty lines, when converted to PPP. The Bank has long taken the view that an essential part of the task of fighting poverty globally is that every country should have its own national poverty line (at least one), and do the routine survey data collection and calculations needed to measure and monitor poverty within that country. Thus national lines now exist for almost all countries. These are generally credible national efforts to construct poverty lines appropriate to each country. These do not of course use PPPs, but rather they are set in terms of local prices and local perceptions of what “poverty” means. The national lines are set either by country-governments (the national statistics office, almost always) or by the World Bank in its country-level analytic work, typically in consultation with the government of the country concerned.

As one would expect, we see higher real poverty lines in richer countries, as was found in Ravallion et al. (1991) and reaffirmed in new data by Ravallion et al. (2009), Jolliffe and Prydz (2017) and Ravallion and Chen (2017). Also, the real values of the national poverty lines tend to rise over time with sustained growth in developing economies, just as we saw in the US and Western Europe over time.⁴ Of course, national lines are not revised (in real terms) continuously,

³ When a common line is used for international comparisons within a given region, but not between regions, it is a line considered reasonable within that region.

⁴ Around the turn of the C20th the most widely used poverty line in the US was little more than \$1 a day in 2005 prices; it is closer to \$15 a day now (Ravallion, 2016b).

if only because of bureaucratic/political inertia. Nonetheless, across the developing world, national poverty lines rise with an elasticity of around 0.5 as national mean income rises.⁵ This inherent relativity is unavoidable and appears to be entirely plausible, though there is a continuing debate about its implications for global poverty measurement when relative deprivation matters (Ravallion and Chen, 2017). Here the focus is on measuring absolute income-poverty assuming that people only care about their own consumption.

Since 1990 the Bank and the United Nations have given greater attention in setting goals for global poverty reduction to a deliberately frugal line that is anchored to the national lines found in the poorest countries, judged by consumption per capita. This gave the original “\$1 a day line” (Ravallion et al., 1991). Based on an expanded and improved data set on national lines, Ravallion et al. (2009) re-set the international line at \$1.25 a day using the 2005 ICP. Using domestic price indices and the 2011 ICP, the \$1.25 line was updated to \$1.90 a day by Ferreira et al. (2016). Let us call this the “benchmark line.” This is understood to be a low line; anything less than this would be hard to defend as one would be using a line that is lower than typically found in the poorest countries. Higher lines can be justified and used. The Bank’s [PovcalNet](#) website also gives \$3.50 and \$5.50 lines, in addition to the benchmark line of \$1.90. (The user of *PovcalNet* can enter her own preferred line at any value she likes.)

Allen abandons both the use of PPP exchange rates and the use of national poverty lines for interpreting the data. There are two key points of departure in Allen’s method. The first is that he uses LP to devise a set of nutrition-based international lines in local prices, anchored to a globally common caloric requirement. Four specifications for the nutrients are considered. I will focus on his “CPF” and “basic” specifications as these appear closer to what is found in national poverty lines for developing countries.⁶ Both use 2100 calories per person, as recommended by the US Department of Agriculture. Both include allowances for protein (50 grams per person per day) and fat (34 grams). The “basic” specification includes extra allowances for minerals and vitamins (notably B12 and C). The prices used for valuation are from the 2011 ICP.⁷ The second

⁵ This is based on a country fixed-effects regression of the log of the national poverty line on the log of the mean, as reported in Ravallion (2016c, online Appendix), using data from Jolliffe and Prydz (2017).

⁶ Allen also provides some results for an exceptionally frugal 1700 calorie specification and an extended version of the “basic” line with a much wider assortment of micronutrients.

⁷ This includes the ICP’s global core list, though augmented with regional ICP prices that are not publically available.

departure is that he uses an explicit non-food bundle, fixed across countries (with extra allowances for clothing, lighting and fuel in cool climates).

Allen use ICP prices for valuation, which can differ from the local prices used (or implicit) in the actual national lines underlying the Bank's international line. LP solutions for this problem can be expected to be sensitive to even small changes in relative prices (as Stigler, 1945, noted), though Allen does not present any tests for stability of his solutions in the presence of measurement errors in prices. The ICP is known to be urban-biased, in that the price surveys for most countries are done in urban areas, often only the capital city.⁸ Food and (especially) housing are more expensive in cities. Yet it is estimated that three-quarters of the poor (using the Bank's method) live in rural areas (Ravallion et al., 2007). There is also indirect evidence consistent with the view that ICP price collection favors goods that are more likely to be internationally traded, as these are more comparable across countries; such goods tend also to be higher quality and so more expensive in local markets.⁹ The discussion will return to this point.

Allen's claims as to why his method is superior

Allen is keen to establish that his method is better than the Bank's. There is a serious risk that those readers of his paper not very familiar with the Bank's methods will come away agreeing with him when they should not.

Every one of the claims made by Allen in support of his method is questionable. Let me address them in turn, with reference to points (i)-(v) in the abstract to his paper (p. 3690):

- (i) "This approach is superior to the World Bank's \$1-a-day line because it is clearly related to survival and well being." "Survival" is not a criterion for either approach; a great many people survive below both sets of poverty lines. (I return to this point.) The concept of "wellbeing" (welfare, as understood in economics) in the Bank's approach is very clear, namely real income. It is not clear what concept of wellbeing underlies Allen's method, so it is unclear in what sense his poverty lines are welfare-consistent globally. In short, the World Bank's approach is no less clearly related to "survival and wellbeing" than Allen's.

⁸ For about 70% of countries the ICP price surveys are only done in urban areas, mostly major cities, and often the capital city only. For further discussion see Ravallion (2018).

⁹ This is consistent with the excess sensitivity of PPP rates to market exchange rates when comparing ICP rounds; see Ravallion (2018).

- (ii) “This approach is superior to the World Bank's \$1-a-day line because it is ... comparable across time and space since the same nutritional requirements are used everywhere while nonfood spending is tailored to climate.” As noted, the Bank aims to assure that the international poverty line has constant purchasing power across countries. This is a clear concept of comparability, though (as always) there are practical problems in implementation. However, it is not clear in what sense Allen’s lines are “comparable.” Even if one said that nutritional status is the sole parameter of human welfare (which is plainly not the case), using fixed nutrient intakes does not assure the same nutritional status (as indicated by anthropometric data) since nutrient absorption is lower in less healthy environments.¹⁰ And when relative prices differ a constant bundle of non-food goods cannot (in general) be welfare consistent.
- (iii) “This approach is superior to the World Bank's \$1-a-day line because it ... adjusts consumption patterns to local prices.” The LP adjustment of consumption patterns to local prices in Allen’s method is fundamentally non-behavioral; it ignores consumer preferences (except in so far as they are reflected in prices). Allen’s method of setting the non-food component of the line is also vulnerable to this critique. (For example, he includes three square meters of housing per person no matter what the land/housing rental rate.) By contrast, the PPP exchange rates used by the Bank do adjust to local prices; being multilateral versions of Fisher price indices, there is an underlying specification of preferences.¹¹
- (iv) “This approach is superior to the World Bank's \$1-a-day line because it ... presents no index number problems since solutions are always in local prices.” Yes, Allen’s method avoids certain index-number problems (though the usual limitations of using fixed-bundle indices for non-food goods remain, as noted). But in doing so Allen loses any economic basis for claiming that his poverty lines have the same real purchasing power in different countries. (And, of course, the Bank’s global line can be converted to local prices so this is not an issue.)
- (v) “This approach is superior to the World Bank's \$1-a-day line because it ... requires only readily available information.” There does not appear to be any sense in which

¹⁰ See, for example, Duh and Spears (2016) using data for India.

¹¹ For further discussion see Deaton and Heston (2010).

Allen's method uses more readily available data than the Bank's. Allen uses a lot of the same primary data, though he also used some micro price-data from the ICP that users outside the ICP (including myself) have not had access to.

There are other examples in which Allen's case against the Bank's method rests on incomplete and potentially deceptive representations of the latter. In a prominent example in the paper's introduction, drawing on comments by Deaton (2010), Allen claims that the Bank's methods imply "that the number of poor in India...increased markedly despite India's economic growth—a perverse result indeed!" (p.3691). Allen is not referring here to how India's poverty rate has changed over time; the Bank's methods robustly indicate falling poverty measures in India during its recent period of economic growth (Datt et al., 2016). (This is robust to the choice of ICP round as the benchmark.) Rather Allen's comment refers to the comparison of two sets of estimates based on old and new PPPs (different ICP base years) and new data on national poverty lines. As a result of the new data, and India's growth, that country was no longer in the set of low-income countries used to anchor the Bank's benchmark line. This is a perfectly consistent application of the Bank's method using new data. Yes, India's historical poverty line was below the benchmark line, though it should also be noted that India's line was in the process of being revised upwards at this time, and the new line was in fact above the Bank's benchmark line. Of course, readers of Allen's paper will not know all this.

A core component of the Bank's methods that Allen rejects is the use of PPPs. The ICP is a huge global statistical effort, involving the statistics offices (in 2011) of 145 national governments, the regional development banks, Eurostat, and led by the World Bank under the auspices of the United Nations Statistical Commission. The construction of the PPPs is overseen by a Technical Advisory Group of distinguished economists and statisticians. It can be granted that there are issues in how PPP rates are calculated, and continuing debates on some aspects.¹² (For example, there is the aforementioned urban bias in ICP prices.) But these are methodological issues about implementation that can be debated and resolved. The idea that the PPPs should be abandoned on the basis of the arguments in Allen's paper is hard to take seriously.

Let me now take a closer look at what Allen proposes to replace the PPPs, and the implications for global poverty measurement.

¹² See the discussions in Ravallion (2016c, 2018).

Is there a case for resurrecting Stigler's method of least-cost diets?

The method proposed by Allen was rejected long ago by the World Bank and by other researchers working on poverty, including in poor countries. None of the 75 national lines for developing countries used by Ravallion et al. (2009) to locate the Bank's \$1.25 line in 2005 prices appear to have used this method.¹³ The main reason for rejecting the method echoed Stigler's (1945) own finding that his least-cost diets tend to differ markedly from prevailing dietary norms in specific contexts. For example (making reference to Stigler's least-cost diets), Sen (1981, p.27) writes that "Such minimum cost diets are typically very inexpensive, but exceedingly dull and very often regarded as quite unacceptable."¹⁴ The method can be made more palatable by adding constraints to the LP problem such that certain popular foods should be consumed in some positive amount. However, even with many such constraints, Smith (1959) found that very few people (in Michigan in the mid-1950s) actually consumed anything like his LP solutions. This can be no surprise, assuming that people (even poor people) maximize utility subject to budget constraints rather minimize the cost of attaining stipulated nutrients.

The irrelevance of Allen's least-cost diets comes from the non-behavioral nature of his method, and this is no less so for poor people in poor countries. Except possibly in extreme situations, such as famines, it is plain that people do not make their consumption choices to minimize the cost of attaining nutrient requirements. That is why existing methods of setting poverty lines in developing countries are (implicitly or explicitly) based on diets that accord with prevailing dietary norms in the specific settings. For example, one common approach to setting absolute lines in developing countries is to find the consumption expenditure or income level at which nutritional requirements are met on average in the specific setting. Of course, there are infinitely many food bundles that will attain any given set of such requirements. Few people would accept that a least cost diet should be used. The social specificity to the notion of "poverty" is surely undeniable.

¹³ I also checked this with three specialists on the national poverty lines at the World Bank and all three confirmed this claim.

¹⁴ Stigler would clearly have agreed. In the context of his discussion of the possible general equilibrium implications of everyone consuming his least-cost diets, Stigler (1945, p.312-3) writes that: "No one recommends these diets for anyone, let alone everyone. It would be the height of absurdity to practice extreme economy at the dinner table in order to have an excess of housing or recreation or leisure."

Food habits are also evident in the fact that the consumption patterns of migrants do not adapt quickly to the new set of relative prices in the destination (as Atkin, 2016, shows for India migrants). Allen notes this at one point but speculates that only a modest upward revision to his least-cost diets would be justified (p. 3708). Maybe, or maybe not. But then the question is left begging: why not directly anchor the diets to prevailing food customs in the specific setting, rather than solving for these non-behavioral least-cost diets?

There is something troubling about Allen's defense of least-cost diets. He accepts that LP is not reasonable for people living in rich countries (quoting Stigler) but argues that it is fine for poor people in poor countries, for whom "necessity displaces desire" (in the paper's title). This is asserted without any serious justification. Yet there is ample evidence in the literature in development economics on the importance of social effects on behavior even in very poor settings; examples can be found in Banerjee and Duflo (2008) on spending patterns, Rao (2008) on celebrations in India, Milanovic (2008) on quail in Yemen, and there are many others (including the literature in anthropology). All this is ignored with Allen's assertion that poor people have no preferences over commodities or social connectivity but care only about the necessities needed for survival, and so that "linear programming is much more germane to poor people." (p. 3695). The fact that LP produces diets that are socially unacceptable in rich countries does not then matter in Allen's eyes when discussing poor people in poor countries. Yet a frugal nutritionally adequate diet comprising foods that are rarely consumed may well be just as socially unacceptable in the poorest country as the richest.

Allen provides little justification for his claim that "necessity displaces desire," such that LP is relevant for developing countries, even if not in rich countries. As I have noted, there are many reasons to reject that claim from what we know. As evidence claiming to support his claim, Allen provides his Table 8, which compares his mean LP predictions for 11 developing countries with average consumptions of food items from food-balance sheets in 1961, assuming that the "average" person in the developing world was poor in 1961. (It is not clear why this assumption should be accepted, but I leave that concern aside.¹⁵) Table 1 below reproduces the numbers for developing countries from his Table 8. Allen concludes they match well, but we see large differences. The LP predictions are high on foodgrains and fats, and low on meat, fish,

¹⁵ On this point Allen refers to Ahluwalia et al. (1979), which set their line at the consumption of the forty-fifth percentile in India in the 1970s. Allen argues that this is "not far off average consumption in 1961" though this claim is puzzling, and possibly reflects a confusion between the median and the mean.

vegetables and fruits. There is clearly less variety in the LP solutions, consistent with Stigler's conclusions for America around 1940.

Allen claims that there is no data to compare his LP lines with consumption patterns today (p. 3706). That is not correct. There is a huge amount of micro data on food and non-food spending in developing countries (including, but not confined to, the World Bank's LSMS surveys now spanning over 70 countries, including many of the poorest). If Allen wanted to test his claim "necessity displaces desire" using current data he could. The extremely frugal ideas of what "poverty" means have clearly evolved since 1961. (As already, noted the real value of national poverty lines has tended to rise in growing developing countries.) Over the last 50 years, consumers in the developing world have diversified their diets, with more nutrients from meat, fish, eggs, milk, and less from starchy staples (see, for example, Delgado, 2003).

Household expenditure data are widely used in setting national poverty lines in developing countries.¹⁶ As noted, one method finds the consumption expenditure at which stipulated nutrient requirements are met on average in each setting. Another common method identifies a specific bundle of goods (often only for food, but using the corresponding food share to inflate to a total consumption line) based on the consumption behavior of people in a neighborhood of the poverty line. One can readily check if the implied poverty lines are internally consistent, in that the assumed neighborhood includes the poverty line so derived.

As noted in the previous section, neither Allen's nor the World Bank's lines are "survival lines." This is not to deny that there is an interest in establishing a bare-bones survival line, though not claiming it is a poverty line. Estimates of a "survival line" already exist in the literature, and they are lower than Allen's lines. Lindgren (2015) estimates that the subsistence minimum for survival is \$0.67 a day (2005 PPP), which is about \$1.00 a day in 2011 PPP. Ravallion (2016) independently came to almost exactly the same figure by a very different method in estimating the consumption floor in the world. The motivation here is to assess whether the poorest have been "left behind" despite overall progress in reducing numbers of poor (Ravallion, 2016). However, neither Lindgren nor Ravallion claim that what they are measuring is a "poverty line," which is a different concept.

¹⁶ The methods summarized here are discussed in more detail in Ravallion (1994, 2012).

Is Allen getting a higher poverty count than the Bank?

A headline of Allen (2017) is that he gets a higher poverty count than the World Bank. For example, in the abstract he reports that “the new approach implies much more poverty than the World Bank’s” (p.3690). If (as I have argued) least-cost diets are inconsistent with the behavior of poor people then surely Allen’s lines would not be higher than the Bank’s? This puzzle is resolved by considering: (i) Allen’s selective choice of nutritional requirements for comparing his lines to the Bank’s, and (ii) the likely biases in the prices used by Allen to value his least-cost bundles. I examine these two issues in turn.

A key question is left begging by Allen’s paper: Which of his various nutrition bundles and corresponding sets of lines should be used when making a comparison to the Bank’s poverty measures? It is not clear how one might make this comparison with any rigor. Though not conclusive, all we can really do is see whether the Bank’s estimates of the poverty measures are within the range of those implied by Allen’s various poverty lines corresponding to different specifications for the nutrients in his LP program.

It seems to be a reasonable assumption that the nutritional requirements underlying the national poverty lines used to anchor the Bank’s \$1.35/\$1.90 line are somewhere between those for Allen’s “CPF” and “basic” lines. Their nutrient specifications will look reasonably familiar to those setting national poverty lines in low-income countries; the 2100 calories Allen uses is common though certainly not universal.¹⁷ Roughly similar allowances to Allen’s for protein and fats appear to be common in low-income countries though explicit allowances for the extra micronutrients in Allen’s basic specification are not so common.

However, Allen (2017) only gives poverty counts for his basic lines. As noted by Ferreira (2017), in an earlier working paper Allen had focused instead on his CPF lines, with a slight upward adjustment for vitamins and minerals anchored to India’s poverty line. This gave him exactly \$1.90 a day on average (Allen, 2016). Indeed, Allen identifies this as a key finding of the WP, arguing that his approach “...provides a clear rationale for why \$1.90 per day is a good standard” (Allen, 2016, p.1). If one focuses on Allen’s CPF lines for his sample of developing countries, one finds that they have a mean of \$1.88—slightly below the Bank’s line. The story

¹⁷ For example, the longstanding official poverty lines for India, set by the Planning Commission (1979), corresponded to the levels of per capita total expenditure at which the caloric norms of 2,400 calories per person per day were typically attained in rural areas and 2,100 calories for urban areas. However, the 2,400 number would probably be considered high today.

changed with the final published version where he focuses instead on the basic lines, which give a higher poverty count than for a uniform \$1.90 a day. No justification is given for this choice. The published version heralds the higher poverty count, and provides no poverty measures for any of his other lines.

Allen's Table 11 provides his lines in \$PPP. There are only 14 developing countries in Allen's calculations, and he says nothing about why he chose these countries. In identifying "developing countries" I will also include Allen's two middle-income OECD countries (Turkey and Mexico), which the Bank classifies as developing countries. Allen gives poverty lines for various specifications of the nutritional requirements but only gives poverty measures for his basic lines.

Let us look more closely at the CPF lines. On converting these to \$PPP, their mean across Allen's 14 developing countries is \$1.88, as noted. If one also includes Allen's two middle-income OECD countries then the mean is \$1.85 (with a standard error of \$0.14; $n=16$), falling to \$1.79 when population-weighted. So the CPF lines come out well below the Bank's \$1.90 line on average.

However, there are large differences in the PPP-based purchasing power of Allen's lines, as can be seen from Table 2 (Column 1). The lines vary from to \$0.98 (Zimbabwe) to \$2.83 per day (Thailand). I would not like the job of explaining to Zimbabweans that (by Allen's reckoning) they can escape absolute poverty with only 35% of the real income needed by a Thai (and recall that this is an attempt to measure absolute poverty not relative poverty).

I have calculated the poverty counts for each of these 16 countries using Allen's CPF lines as well as the Bank's \$1.90 line. I used *PovcalNet*, using the closest survey year to 2011 (and using consumption rather than income when there is a choice). Table 2 (columns 2-4) gives the results. The poverty rates are positively correlated ($r=0.55$), but we see a number of notable differences. For example, the \$1.90 line implies that 18.5% of the population of Bangladesh is poor in 2010, whereas Allen's method brings this down to a (remarkably) low value, less than 4%. His method halves India's poverty rate (from 31% to 16%). For The Gambia, Allen's method cuts 20% points off the Bank's poverty rate. The population-weighted poverty rate using Allen's lines is 11.3%, representing 399 million people. Using instead \$1.90 for all countries, the corresponding poverty rate is 16.3%, representing 579 million people. Allen's CPF lines give a

substantially lower poverty count than the World Bank's. Allen's use of least-cost diets is clear a plausible candidate for explaining this difference.

Allen does not say anything about changes in poverty measures over time using his method. Table 2 (columns 5-7) also gives the corresponding calculations for 1990, or the closest available survey year. (For two countries, Myanmar and Zimbabwe, there is only one survey in *PovcalNet*.) The population-weighted poverty rate using Allen's lines for the earlier year is again lower than for \$1.90 a day (45% versus 50%). The decline in the poverty rate over this (approximately) 20 years period is almost identical, namely 33.6% for Allen's lines against 33.8% for the Bank's.

As noted, Allen's "basic" lines are higher, as they correspond to a more generous set of nutrients. Their mean over Allen's 14 developing countries is \$2.63 a day, with a range from \$1.46 to \$3.55.¹⁸ There can be no surprise that a higher poverty line gives a higher poverty count. (Allen is using the same data on the distributions of income or consumption for developing countries, namely *PovcalNet*. Trivially then, when he gets a higher poverty count he must be using higher real poverty lines.)

Since Allen chose to draw his readers' attention to his basic lines we should look more closely at them. As we have seen, Allen's CPF lines give an appreciably lower poverty count than the Bank's \$1.90 line, while his basic lines give a higher count. Thus, the aggregate poverty count using the Bank's method is within the range of Allen's.

Let us turn now to the second comparison issue flagged above, the ICP prices. Another, less obvious, difference with the Bank's methods is relevant to both Allen's CPF and basic lines. The ICP prices Allen has used for valuation are clearly higher than the bulk of the (implicit or explicit) prices underlying the national lines. A simple but suggestive calculation indicates that the urban bias in ICP prices can explain about two-thirds of the gap between Allen's mean basic line of \$2.63 and \$1.90, and leave a difference that is not statistically significant. Assume that Allen's lines valued at ICP prices are essentially urban prices while the national lines are averages of urban and rural lines, using the numbers of poor in urban and rural areas as the weights. Ravallion et al. (2007) find that 75% of the poor live in rural areas and that urban poverty lines are on average 30% higher than rural lines (a ratio of rural to urban prices of 0.77). Then one would need to scale down Allen's lines by a factor of 0.83 ($=0.75 \times 0.77 + 0.25$), giving a

¹⁸ On including Allen's two middle-income OECD countries the mean is \$2.61 (with a standard error of \$0.19).

line of \$2.18. Allowing for the sample variability in both lines the t-test for the difference in the means is 1.1.¹⁹

The same logic would also suggest that if the urban-bias in Allen's CPF lines could be removed then we would expect to get lines below \$1.85 on average (\$1.79 population weighted), and an even lower poverty count in my Table 2. The impact of his non-behavioral least-cost diets would then be even greater than the above calculations suggest.

So there is no puzzle. As expected, Allen's method of least-cost diets yields lower poverty lines and poverty measures than the Bank's method of anchoring the (common) international line to average national lines found in low-income countries.

In conclusion

There is an important methodological choice raised by Allen's paper, which matters to the credibility of global poverty measures. I have argued that his proposal, anchored to least-cost diets for reaching nutritional requirements, is a step backwards methodologically, in that it entails a break from the emphasis on respect for consumer behavior that has been a foundation of modern poverty measurement. While normative judgements will be essential in setting any poverty line, it is a compelling guiding principle that the composition of the goods consumed at the poverty line should accord reasonably well with observed behavior at that line. In other words, when the poverty rate changes due to changes in relative prices, consumers living at the poverty line should agree on the direction of the implied welfare change. Allen's least-cost diets based on linear programming do not respect the behavior of poor people, as Stigler had already acknowledged for his own least-cost diets for Americans around 1940. This concern is no more relevant to people in poor countries than rich ones; for the most part, necessity does not displace desire for poor people.

If one follows Allen's approach then one can no longer interpret global poverty measures in terms of the distribution of real income, consistently with global inequality measures and measures of mean income. This economic foundation is removed, with implications for public understanding and endorsement of poverty measures. There are good reasons why the World Bank's global poverty lines have been expressed in \$US, fixed at PPP. The \$US is the most well-

¹⁹ The standard deviations are \$0.73 (n=14) and \$0.59 (n=15) for Allen's and the \$1.25 line Ravallion et al. (2009) (scaling up the latter by 1.9/1.25).

known currency; almost everyone can imagine what \$1 or \$2 a day (say) could buy. This gives the international poverty line a transparency that is desirable in public knowledge and discourse about poverty. This depends in no small measure on the claim that (to the best of our knowledge and subject to a set of measurement assumptions) the line has the same purchasing power in different countries at the benchmark year. If we make a break from this there will be a justifiable critique that the poverty lines are uneven in purchasing power across countries, as is evident in Allen's case. There is of course scope for debate on specifics, and scope for improving PPPs. However, global poverty measures should continue to be (important) summary statistics of the distribution of real income in the world. PPPs are crucial for correctly measuring that distribution.

Does this make a difference to the measures of poverty and how they have evolved over time? This is a difficult question, as it is unclear how one should go about comparing poverty measures from the two methods. Allen puts much emphasis on the fact that he gets a higher poverty count than implied by the Bank's current \$1.90 a day line, anchored to the poverty lines observed in low-income countries using PPPs for currency comparisons. The higher count he reports is based on only one of the four nutrient specifications he considers. Another of his specifications implies a slightly lower line on average than \$1.90. When I take account of the cross-country variability in Allen's lines, and population sizes, I find that this specification yields an overall poverty count that is appreciably lower than the Bank's, although the rate of decline in the poverty rate over 1990-2011 is almost identical. Allen's claim that he gets a higher poverty count than the Bank is thus based on a selective choice of nutritional requirements and is not robust to changing that choice even among his own estimates for alternative nutrients.

It is not, of course, surprising that a more generous specification of the nutritional constraints in Allen's LP program gives a higher count of poor people. However, there is another, less obvious, factor at work here, namely that the ICP prices Allen has used for valuation are urban-biased and so probably higher than those underlying the national poverty lines for low-income countries, as used by the Bank to determine the \$1.90 line. On allowing for this, I find that there is no statistically significant difference between the mean poverty lines used by Allen for his global poverty counts and that used by the World Bank. Allowing for urban bias will bring down even further the poverty count for Allen's less generous nutrient specification.

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Table 1: LP predictions for developing countries compared to 1961 average consumptions

	Grain/bread	Fats/oils	Animal and fish	Vegetables, nuts, fruits	Other	Total weight
LP prediction	170	5	28	90	0	293
1961 average	138	4	41	132	19	334

Note: Kg/person/year

Table 2: Poverty rates for Allen’s developing country sample using his CPF lines compared to the World Bank’s \$1.90 line

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
			Around 2011			Around 1990	
	Allen’s CPF line (\$PPP/day)	Year	Poverty rate for \$1.90 a day (%)	Poverty rate for Allen’s CPF line (%)	Year	Poverty rate for \$1.90 a day (%)	Poverty rate for Allen’s CPF line (%)
Algeria	1.85	2011	0.5	0.4	1988	6.5	5.9
Bangladesh	1.36	2010	18.5	3.9	1989	43.9	18.7
China	1.83	2011	7.9	7.1	1990	66.6	64.2
Egypt	2.42	2010	3.0	9.9	1991	7.4	19.2
Gambia	1.25	2003	45.3	25.4	1998	70.5	52.3
India	1.52	2010	31.1	15.7	1988	44.8	27.5
Indonesia	2.43	2011	13.6	28.2	1990	57.3	74.2
Liberia	2.18	2014	38.6	75.6	2007	68.6	75.6
Mexico	1.74	2010	3.8	2.9	1989	7.1	5.8
Myanmar*	2.74	2015	6.5	20.4	2015	6.5	20.4
Niger	1.15	2011	50.3	12.6	1993	78.2	46.1
Sri Lanka	1.44	2010	2.4	0.6	1991	8.7	2.4
Thailand	2.83	2011	0.0	0.7	1990	9.4	28.5
Turkey	1.64	2011	0.3	0.0	1987	1.6	0.9
Vietnam	2.30	2010	4.2	7.8	1993	49.2	62.3
Zimbabwe*	0.98	2011	21.4	1.3	2011	21.4	1.3
Mean (equally weighted)	1.85		15.5	13.3		34.2	31.6
Mean (pop.-weighted)	1.79		16.3	11.3		50.1	44.9

Note: Mean poverty rates are population-weighted using populations at survey years. For * only one survey is available in this period.