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Societal Poverty

A Relative and Relevant Measure

Dean Jolliffe
Espen Beer Prydz

WORLD BANK GROUP
Development Data Group
&
Development Research Group
Poverty and Inequality Team
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Abstract

Poverty lines are typically higher in richer countries, and lower in poorer ones, reflecting the relative nature of national assessments of who is considered poor. In many high-income countries, poverty lines are explicitly relative, set as a share of mean or median income. Despite systematic variation in how countries define poverty, global poverty counts are based on fixed-value lines. To reflect national assessments of poverty in a global headcount of poverty, this paper proposes a societal poverty line. The proposed societal poverty line is derived from 699 harmonized national poverty lines, and has an intercept of $1 per day and a relative gradient of 50 percent of median national income or consumption. The societal poverty line is more closely aligned with national definitions of poverty than other proposed relative lines. By this relative measure, societal poverty has fallen steadily since 1990, but at a much slower pace than absolute extreme poverty.

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Societal Poverty: A Relative and Relevant Measure

Dean Jolliffe & Espen Beer Prydz*

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* Jolliffe (djolliffe@worldbank.org) and Prydz (eprydz@worldbank.org) are with the World Bank Group, Development Economics Vice Presidency (DEC), in the research and data groups. Authors listed alphabetically. Jolliffe is also a Research Fellow with the Institute for the Study of Labor (IZA) in Bonn and a Research Affiliate with the National Poverty Center at the Ford School of Public Policy, University of Michigan.

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I. Introduction

Most low- and middle-income countries define poverty as an inability to meet basic needs, typically defined by nutritional norms with an allowance for nonfood basic needs (Ravallion, 2010). National poverty lines based on basic needs are meant to be sufficient to attain some fixed level of material wellbeing in society, but this need not be defined as a bare minimum threshold of survival.[1] What defines basic needs varies across countries, but when the value of these basic needs is fixed, it is considered an absolute poverty line. This is in contrast to relative poverty lines, used in many high-income countries, which are explicitly linked to the overall level of income in the country, and increase with economic growth.

Viewing absolute lines as reflecting a fixed level of material wellbeing, while relative lines increase in value as a country grows is a useful conceptual distinction. But, as Ravallion (2010) shows, when considering absolute national poverty lines across countries, the distinction blurs. He finds that these absolute, basic-needs poverty lines range in value from $0.63 per day to more than $9 per day (in 2005 PPP terms), with higher poverty lines corresponding to relatively better off nations. As he suggests, the absolute national lines behave like relative poverty lines in that they are increasingly higher for richer countries.

What is also observed is that even for a specific country, as the country gets richer, its evaluation of what defines poverty as measured by basic needs occasionally increases. Ravallion (1998) asserts "[i]t can be agreed that a sustained increase in average living standards is likely to lead eventually to more generous perceptions of what 'poverty' means in a given society." (p. 29). For example, Niño-Zarazúa and Addison (2012) document that in 2011, the Government of

[1] Ravallion (1994, p. 30) "…doubt[s] if any poverty line found in practice, even in the poorest countries, is no more than needed for survival."

India increased the real value of their urban poverty lines by more than 40 percent, while China increased the real value of the rural poverty line by more than 75 percent.[2] Over time, many countries have increased the real value of their national poverty lines, in recognition that their economies had grown so significantly that the concept of basic needs in their societies had fundamentally changed.[3] In these cases, the national absolute lines again behave like relative lines in that (over longer periods of time) they increase with economic growth.

Townsend (1979) recognized well this point that basic-needs lines are not necessarily fixed over time, because "…the necessities of life are not fixed. They are continuously being adapted and augmented as changes take place in society and its products" (p. 915). Sen (1983) expressed this differently by arguing that a concept of poverty fixed in terms of functioning at some minimum level in a society may not be fixed in terms of the expenditures required to perform this function. For example, participating in the labor market may be viewed as a minimal social functioning; the cost of this functioning though may require only clothing and food in a poor society, while in a richer society it may require internet access, vehicle, cellphone in addition to clothing and food. Paraphrasing Sen, Atkinson states that "…a standard that is *constant* in the space of functionings … would imply a standard in terms of consumption that varies over time and across countries" (World Bank, 2017, p. 139). To reflect this concern, Atkinson recommends that the "World Bank should introduce a *societal* headcount ratio measure

[2] In India, the 2011 value of the poverty line in urban areas increased from 33 rupees per person per day to 47 rupees. The change in rural poverty lines was significantly less, about 19 percent, increasing from 27 to 32 rupees. China also increased the real value of its poverty line several times in the late 1970s.
[3] After 15 years of keeping the real value of its national poverty line constant, the Government of Nepal increased the line in 2011 (Government of Nepal, 2012). Similarly, the Government of Jordan increased the real value of the poverty line by about 10 percent in 2011 (World Bank, 2009, Jolliffe and Serajuddin, 2017). For more examples of countries that changed the value of their national poverty lines, see the appendix in Jolliffe and Prydz (2016).

of global consumption poverty" (World Bank, 2017, p. 144). The purpose of this paper is to propose such a measure. Borrowing language from Atkinson, we offer a "societal poverty line" (SPL) that builds on the work of Atkinson and Bourguignon (2001) and Ravallion and Chen (2011, 2013), but one that we argue is better aligned with national assessments of poverty in low-, middle-, and high-income countries. Our approach is informed, but not completely determined, by countries' assessments of basic needs as exhibited in their national poverty lines.

We offer two parameterizations of the SPL. Our preferred parameterization is one that has an intercept of $1 (in 2011 PPPs) and a gradient of 50 percent of median consumption or income. We also consider a variant of this line that includes a lower bound set at the international poverty line of $1.90. The intercept, or the $1.90 lower bound in the variant case, provides a fixed, absolute element to the SPL. The slope of 50 percent adds a relative element to the SPL, rising in value as median consumption levels increase. This economic gradient of the SPL corresponds with a view of relative poverty that is well accepted in much of the rich world and coincides with SDG indicator 10.2.1 on inequality, which tracks the proportion of people living on less than 50 percent of median income.[4]

The remainder of the paper is laid out as follows. In the next section, we describe existing conceptualizations of global relative poverty and then describe the data used in support of our proposed our SPLs. Section III assesses the fit of the data and our proposed SPLs, and section IV discusses the geographic and temporal profiles of societal poverty.

[4] For details, including metadata and indicators, on each of the 17 SDGs, see http://unstats.un.org/sdgs/iaeg-sdgs/metadata-compilation/ .

II. Global Poverty, Concepts and Data

Conceptual Framework

When counting the total number of poor people in the world, the World Bank uses an international poverty line that is constructed to reflect a constant real value across countries (World Bank, 1990, Chen and Ravallion, 2001, Ravallion, Chen and Sangraula, 2009, Ferreira et al., 2016). Many other institutions, including the United Nations as expressed in the Millennium Development Goals (MDGs) and now the Sustainable Development Goals (SDGs), have also adopted the use of this absolute international poverty line.[5] In addition to maintaining the real value across countries, Ferreira et al. (2016) further make the case that the latest value of the international poverty line of $1.90 (in 2011 PPP terms) maintains, on average, the real value of the previously defined international poverty line of $1.25 (in 2005 PPP terms) among the world's poorest countries.

The Final Report of the Atkinson Commission on Global Poverty (World Bank, 2017) recommends that for the purposes of assessing the goal of eradicating extreme poverty by 2030, the value of the international poverty line should remain fixed in real terms up to that point in time.[6] Using the $1.90 measuring stick, 767 million people in 2013 are estimated to be in extreme poverty (World Bank, 2016). Despite this large count of people who live in extreme poverty, the proportion of the population that is living in extreme poverty has fallen from more

[5]Millennium Development Goal 1.A was stated as cutting poverty in half as defined by the proportion of people living on less than the World Bank international poverty line of $1.25 (in 2005 PPP values). Similarly, target 1.1 of the SDGs is to eradicate extreme poverty, again as defined by the international poverty line. For more details on the SDGs, see: https://sustainabledevelopment.un.org/?menu=1300.
[6] More specifically, Atkinson (2016) recommends updating the value of the international poverty line in each and every country only by their national measure of inflation (in most all cases, as measured by the consumer price index).

than 34 percent in 1990, to less than 11 percent in 2013. The estimated poverty rates in 2013 are less than 5 percent in one-fourth of the 131 countries for which the World Bank monitors extreme poverty. As the global proportion of people in extreme poverty declines further, this assessment of global poverty may become increasingly less socially relevant as societies across the world define the cost of basic needs at levels much greater than the international poverty line.

A global poverty line that allows for the poverty threshold to vary across countries, essentially allowing for the cost of meeting basic needs or functionings to be increasing with the economic development of societies, would result in a definition of poverty that is more closely aligned with each country's own assessment of needs. A few important proposals for such lines are detailed in Atkinson and Bourguignon (2001), Ravallion and Chen (2011), Chen and Ravallion (2013) and Garroway and de Laiglesia (2012), and summarized in Figure 1 and Table 1.

Borrowing notation from Ravallion and Chen (2011), all of these proposed global relative poverty lines, ($Z_{i,t}^{rel}$), follow a similar form that can be summarized as $max(Z^*, \alpha+kM_{i,t})$. Z^* defines a floor, α is a fixed intercept, $kM_{i,t}$ defines for country i in year t the relativist portion of the schedule which is upward sloping ($k>0$) in the level of economic development, typically measured by the national average (or median) value of per capita expenditure, consumption or income (M). The Atkinson-Bourguignon and Ravallion-Chen proposals define Z^* to be equal to the international poverty line (set at \$1 in 1985 PPPs or \$1.25 in 2005 PPPs). More specifically, Atkinson and Bourguignon (2001) propose a global relative poverty line that sets Z^* at a dollar a day (in 1985 PPP terms), $\alpha=0$, k=0.37 and M = mean per capita private consumption expenditure from national accounts. The resulting global relative poverty line, ($Z_{i,t}^{rel}$), takes the value of \$1 for all countries with average per capita expenditure of less than \$2.70 per day and then increases

at a rate of 37 percent of mean expenditure as the country grows richer.[7] Atkinson and Bourguignon suggest that this line has greater relevance for poorer countries than a relative line like 50 percent of median income or consumption (as used in much of the European Union and proposed for global poverty measurement by Garroway and de Laiglesia, 2012) because the floor set at $1 prevents the poverty line from taking values that are much lower than observed for poor countries of the world. And, it is also the case that their line has greater relevance than the absolute international poverty line for richer countries.

Ravallion and Chen (2011) offer a relative poverty line, similar to Atkinson and Bourguignon, that sets Z^* =$1.25 in 2005 PPP terms, α=*$0.60,* k=0.33 and M = mean per capita expenditure from national accounts. Chen and Ravallion (2013) propose a variant of this defining M in terms of mean consumption (or income) from household survey data, and setting α=*$0.625* and k=0.5. The key distinction of both of these proposals from the Atkinson and Bourguignon line (and the relative line used by EU/OECD and Garroway and de Laiglesia) is that the elasticity of the poverty line to growth in mean expenditure or consumption is less than one. The importance of this distinction is that it implies that if everyone gets better off by some fixed proportion, then the aggregate measure of poverty must fall. Ravallion and Chen (2011) refer to global poverty lines that respect this property as being *weakly-relative* poverty lines. This attribute is in contrast to a *strongly-relative* poverty line such as that used by the European Union where α=0 and k is frequently equal to a half.[8]

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[7] They base this parameterization on examining the 33 national poverty lines reported in Ravallion, Datt and van de Walle (1991).

[8] Ravallion and Chen (2011) note that the Atkinson and Bourguignon relative poverty line will also not satisfy their weakly relative axiom.

A common motivation of the proposals discussed above is that the decisions made by countries in setting their national poverty lines should be viewed as the guiding social assessments of how needs change as countries become richer.[9] To this end, parameterizations of the global relative poverty line are often informed by assessing the relationship between national poverty lines and mean expenditure or consumption levels for a sample of countries. The Atkinson and Bourguignon line is informed by a bivariate fit based on 33 estimated national poverty lines (described in Ravallion, Datt and van de Walle, 1991), while the Ravallion and Chen line is supported by a sample of 74 national poverty lines (described in Ravallion, Chen and Sangraula, hereafter referred to as RCS, 2009).

Gentilini and Sumner (2012) take the idea of viewing national poverty lines as a guide for assessing global poverty a step further and propose a global measure of poverty that is simply the sum of all poor people in the world as identified by their national poverty line. There is an elegance to the simplicity of this proposal and since the global count of the poor is completely determined by national poverty lines, it fully respects each country's social assessment of poverty. But, implicit in this approach is an underlying international poverty line (or schedule) that is neither fixed in value across countries, as in the international poverty line of $1.90, nor is the implicit line strictly increasing in economic development. In fact, there are many countries at the same level of economic development that have vastly different assessments of basic needs, and similarly there are many cases where richer countries have lower poverty lines relative to poorer countries.[10] An awkward implication of this approach is that the global aggregation of

[9] This idea of viewing national poverty lines as reflecting social assessments of minimum needs has been a motivating argument for international poverty lines for many years. World Bank (1990) and RDV (1991) interpreted national poverty lines from some of the poorest countries in the world as reflecting absolute minimum needs and used them to establish the "dollar-a-day" international poverty line.
[10] Figures 2 and 3 both provide evidence of this.

national headcounts makes the counter-intuitive social judgement that someone who is poor in a poor country may not be poor if their wellbeing were assessed in a richer country.

Database of National Poverty Lines

The most recent expressions of global relative poverty lines (Ravallion and Chen, 2011; Chen and Ravallion, 2013), and similarly the $1.90 international poverty line (Ferreira et al. 2016), are estimated from a set of national poverty lines compiled by RCS (2009). The compilation of these national poverty lines by RCS, and previously by Ravallion, Datt and van de Walle (1991), has been foundational to the work on measuring global absolute and relative poverty. More recently, Jolliffe and Prydz (2016) offer a compilation of national poverty lines with significantly better temporal and geographic coverage and improved harmonization (and thus improved comparability), compared with previous data sets.

In this paper, we draw from the Jolliffe-Prydz data and use a sample of 699 national poverty lines covering 107 countries.[11] The sample of national poverty lines is compiled by taking officially reported poverty headcount (HC) rates at national poverty lines and identifying the unique value on the harmonized wellbeing vector in PovcalNet for the same year that corresponds to the reported national poverty headcount.[12] In other words, if $F(\cdot)$ is the

[11] The sample of 699 poverty lines is the same as the non-OECD country sample in Jolliffe and Prydz (2016). The 104 countries in our sub-sample of lines close to 2011 drops three countries for which the closest line is prior to 2000.

[12] The national poverty headcount rates come from the World Development Indicators (WDI, http://data.worldbank.org/data-catalog/world-development-indicators) database. The WDI is the primary World Bank collection of development indicators, compiled from officially-recognized international sources. PovcalNet is a research tool for poverty measurement that allows analysts to specify parameter values such as the global poverty line, and then estimate the number of poor people in the world based on their assumptions. For more details, see: http://iresearch.worldbank.org/PovcalNet/index.htm.

cumulative density function of the wellbeing vector in PovcalNet, we identify the poverty line (z) for each country *i* in year *t*, such that $z_{it} = F^{-1}(HC_{it})$.[13] We argue that this approach offers several advantages over other available data sets of national poverty thresholds, such as the one documented in RCS (2009), which are particularly relevant for analysis meant to compare values of national poverty lines across countries.

One advantage of the lines used in this paper is that they are all expressed in terms of per capita income or consumption. This is in contrast to RCS, which includes a mix of poverty lines, some expressed in terms of minimum-needs per capita, and others, per adult equivalent.[14] Typically in low-income countries, the same level of minimum needs is greater in value when expressed in terms of adult-equivalents than when expressed in per capita terms. This is largely a function of the age composition of the country – in poorer countries where the average person is an adolescent, per capita needs will be substantially lower than per adult needs.[15] In itself, the mix of per capita and per adult-equivalent lines creates an inherent issue of non-comparability, and this concern is exacerbated by the empirical tendency for average age to be correlated with level of economic development. By harmonizing all national poverty lines in per capita units, our analysis of the relationship between overall national wellbeing and the value of national poverty lines is not contaminated from the usage of differing units of analysis.[16]

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[13] The online appendix to Jolliffe and Prydz (2016) discusses the precision of this methodology and contrasts the estimation error from this approach with the error associated with approaches that build up a database of national poverty lines from national poverty assessment reports. Appendix available at: https://static-content.springer.com/esm/art%3A10.1007%2Fs10888-016-9327-5/MediaObjects/10888_2016_9327_MOESM1_ESM.pdf.

[14] For a description of adult-equivalence adjustments, see James and Schofield (1990).

[15] Van de Boom, Halsema, and Molini (2015) note that per-capita based food poverty lines are on average seven-tenths the value of the corresponding adult-equivalent version of this line.

[16] Another advantage of the Jolliffe-Prydz lines for this analysis is due to the construction of these lines. Since they are derived from national poverty headcount rates, they correspond directly to the level of poverty as assessed nationally. This is a relevant issue for countries that do not have a national poverty

The set of national poverty lines used in this paper also have both greater temporal and spatial coverage. They cover approximately 25 percent more countries than those used by Ravallion and Chen and three-fold more than Atkinson and Bourguignon. Similarly, the temporal coverage of the Jolliffe-Prydz poverty lines is much greater. Previous analysis has been based on data that cover only one point in time for each country represented. But as already noted in this paper, over time, countries adjust their evaluation of basic needs. For our analysis, we draw on an average of more than six observations of national lines for each of the 107 countries we consider. We refer to this sample of 699 national poverty lines as our full sample.

In order to support our claim that the analysis in this paper continues to be relevant to more recent assessments of basic needs in different countries, we also examine a subsample of recent poverty lines. We select the poverty line from each of 104 countries that is closest in time to 2011 (and later than year 2000),[17] and refer to this as our circa-2011 sample. We focus on 2011 primarily because this is the year for which the most recent PPP conversion factors exist. In order to examine national poverty lines expressed in local currency units across countries, we use PPP conversion factors to convert all local currency units into a common currency – as with others in this literature, we use US dollars. In addition to being more recent than the RCS sample, the 2011 subsample also allows us to check whether the findings from the full sample are sensitive to the quality of inflation data.[18] The poverty lines in the 2011 subsample require on

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line, but rather have sub-national lines (e.g. rural and urban lines). For countries with subnational lines, RCS for example, estimate a national poverty line by using a weighted average, but in most cases, they do not use population weights and therefore their estimated national line will generally not correspond with poverty headcounts.

[17] Three countries have no poverty line after 2000, and we drop these countries from the circa-2011 sample.

[18] For discussion of the importance of inflation data in aligning national poverty lines to a common comparison year, see Jolliffe and Prydz (2016) and Ferreira et al. (2016). For a general discussion on data quality in low-income countries, see Jerven (2013).

average one year of CPI data to align them with 2011. This is in contrast to the RCS lines, which required on average 12 years of inflation data to create comparable 2011 currency values.

Figure 2 plots the national poverty lines used in our analysis on national median consumption or income level (as used for poverty analysis). The lighter, hollow dots in both panels reflect the full sample of 699 poverty lines dating from 1984 through 2013. The darker, filled dots are the 104 lines that are the closest to 2011 for each country. Panel A plots the lines and median wellbeing in level-level space, while Panel B is the same plot except the axes have been log-transformed. The plots reveal a few noteworthy points. First, there is a strong positive relationship between a country's assessments of basic needs and their level of wellbeing, similar to that noted by Ravallion and Chen (2011). Also, the sub-sample of 104 from circa 2011, overlaps well with the complete scatter of lines, suggesting some stability in this positive relationship over time.[19]

Panel B also includes predicted lines at the 90^{th} and 10^{th} quantiles from the bi-variate (quantile) regression of the poverty line on median consumption. These predicted lines have similar slopes and the ratio of these lines (in levels) is approximately 2 over the entire range. This suggests that at any given level of national wellbeing, the range in values of national poverty lines is large, with the most generous line consistently being about twice as large as the least generous line. It is this latter result that we view as an argument against a global count of the poor that treats each country's own line as the relevant threshold, such as proposed by Gentilini and Sumner (2012). Allowing for such significant differences in the definition of basic

[19] The circa-2011 lines have shifted up and to the right, simply reflecting that over time, median consumption (or income) and poverty lines have been increasing across the globe.

needs for countries measured to be at the same level of wellbeing strikes us as an undesirable attribute of a societal poverty measure.

Figure 3 compares the national poverty lines used in this paper with the RCS lines used by Ravallion and Chen for their weakly relative poverty line and by Ferreira et al. for the $1.90 international poverty line used to assess progress towards the MDGs and SDGs. Our primary interest in presenting these two samples together is simply to visually show that the national lines that we are using in our analysis align reasonably well with the national lines used in previous analysis. But, the sample of lines used in this analysis will provide greater estimation power due to increased sample size, more scope to support external validity due to improved country coverage, and enhanced relevance due to more recent data. An indication of this is that bivariate regressions of national poverty lines from both samples on a measure of wellbeing show that the intercepts and slopes are similar, but the standard errors associated with the RCS estimates are four-fold larger than the ones based on the poverty lines used in this paper.[20]

III. Setting and Assessing the Societal Poverty Line

This paper continues in the same tradition as Ravallion and Chen (2011) and Atkinson and Bourguignon (2001) of using the relationship between national poverty lines and a measure of overall wellbeing of the country to derive a schedule of relative poverty lines. We examine a set of austere linear regressions of national poverty lines on median and mean consumption (and

[20] The figure illustrates this, but evidence of the similarities can also be observed in a bi-variate regression of the national poverty lines on household final consumption and expenditure (HFCE). Ordinary least squares estimates produce a slope coefficient from RCS of 0.30 (with a standard error of 0.03) which is not significantly different from that estimated from the lines used in this paper of 0.27 (with a standard error of 0.007). The intercepts similarly indicate no significant differences.

income)[21] over both our full sample of 699 national poverty lines and on our sample of 104 poverty lines from circa 2011. Throughout this paper, the regression analysis weights countries equally. For the circa-2011 sample, where there is only one line per country, this means the weight for each observation is one. For the full sample, where countries have varying number of observed poverty lines in our sample, the observation weight is the inverse of the number of poverty lines for each country. This prevents our analysis from assigning greater weight to countries simply because they have more household surveys available.

Our preferred sample is the full sample primarily because this offers greater estimation power. The full sample allows us to observe both variation in poverty lines across countries of differing wealth and changes in poverty lines over time as a country grows richer. Leveraging both sources of variation allows us to improve the precision of our estimates, which is particularly useful to assess whether the relationship varies significantly for low-income countries. The analysis based on the smaller sample of lines from circa 2011 provides evidence of the stability of the relationship over time and also helps address concerns of relevance with more recent data.

Setting the SPL Parameters

Panel A of Table 2 presents the findings from regressing the value of the poverty lines (in levels) on national wellbeing. Columns 1 and 2 (and columns 4 and 5) contrast the fit of the

[21] For most countries in our sample of national poverty lines, consumption is the underlying measure of wellbeing. For about one-third, wellbeing is assessed by income and in these cases, we use median and mean income values. See Ferreira et al (2016) for more discussion on the underlying measures of wellbeing used for global poverty estimation. In all cases, the analysis in this paper matches the national poverty line with the measure of wellbeing that is used to assess poverty status.

model from using median consumption compared to using mean consumption. For both the full sample and the 2011 sample, the fit as assessed by the r-squared statistic is better for the median specification. Or, alternatively, the root mean square error (RMSE) of the observed values from the predictions is about 10 percent less when the median is used rather than the mean.[22] Panel B indicates that the median also provides a better fit than the mean when considering log-log specification of the model.

We also examine log-log specifications of this bivariate model because they minimize proportionate differences (and not level differences) in national poverty lines. While the levels specification equally weights a dollar deviation between the fitted line and the observed national poverty line regardless of the wellbeing level of a country, the log-log specification will weight this deviation more heavily for a poorer country where a dollar deviation is a substantially larger percentage difference from the national poverty line. For this reason, we find the log-log fit as meriting more emphasis in evaluating differences across specifications.

Furthermore, in columns 3 and 6, when we include both the mean and the median in the specification, for both samples the mean is statistically insignificant while the median remains largely unchanged from the value it takes when included alone. We interpret this as suggesting that the median has a stronger signal in explaining national poverty lines relative to mean consumption. Our findings align with the view of Birdsall and Meyer (2015) and Stiglitz et al. (2010) who both argue that median household consumption (or income) is a better measure of material wellbeing in a country than mean household consumption (or income). A candidate explanation for preferring the median is that because consumption and income distributions

[22] The RMSE is 1.1 on the full sample when using the median, and this increases to 1.25 when using the mean on the full sample.

typically exhibit positive skewness, means tend to reflect the wellbeing of those well above the median and are less informative of the cost of basic needs in a society.[23] Moreover, the mean will be more sensitive to surveys missing top incomes, and as such the median is a more robust measure of 'typical' incomes. For these reasons, our preferred specification is based on median and not mean consumption level of the country.

The regression of national poverty lines on the median level of a country's consumption for our full sample has an intercept of 0.98 and for the 2011 sample, this value is 1.01. These values are not statistically significantly different from each other. The slope coefficient for the full sample is 0.53 and that for the 2011 sample is 0.50, and these are similarly not different from each other. That the more recent subsample of lines from circa 2011 results in estimates that are not different from the full sample suggests that the relationship uncovered by the full sample is both relatively stable over time and continues to be reflective of the relationship for some of the most recent poverty lines in our sample.

Attributes of the proposed SPLs

The underlying motivation for using national poverty lines to construct an estimate of an international relative poverty line is based on the notion that this relative line should reflect typical assessments made at the country level on how basic needs change as countries get richer. That the parameter estimates from both samples round to a line that has an intercept of one dollar and increases at a rate of 50 percent of the median, offers the additional attribute of simplicity in

[23] Our preference for the median also corresponds with the theoretical analysis of Aaberge and Atkinson (2013) who use the median as a "watershed" point of reference on the consumption (or income or wealth) distribution for identifying the rich and the poor.

communication. Global poverty lines (both absolute and relative) are statistical products, but their acceptance by policy makers and advocates is affected by how easy they are for non-technicians to understand and communicate. Stating that the SPL is a dollar a day plus 50 percent of median daily consumption is a relatively simple construct.

In addition to simplicity, the intercept and slope also have links to the poverty and inequality literature and to measures used by many countries. The slope coefficient of half the median is widely used by many countries as measures of relative poverty and inclusion. The Organization for Economic Co-operation and Development (OECD) uses 50 percent of median household income as their headline poverty indicator for country poverty rates.[24] Similarly, Vecchi (2015, pp. 4-5) notes that European countries typically set their national poverty thresholds at 50 or 60 percent of median disposable household income. For rich countries, the intercept of $1 proposed by our line will make relatively small difference. And, 50 percent of household median income or consumption is being used as an indicator of SDG 10.2 on inclusion. The intercept of one US dollar (per person, per day in 2011 PPP terms) has a couple of interesting links with existing research on consumption floors and measures of the cost of survival. Ravallion (2016) estimates an empirical lower bound on consumption, a consumption floor as he refers to it, as essentially a measure of the lower bound of support for a distribution of consumption. In one specification from his analysis, he identifies the value of this floor at $0.67 in 2005 PPP terms. This value expressed in 2011 PPP terms is approximately one dollar.[25]

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[24] OECD (2017), Poverty rate (indicator). doi: 10.1787/0fe1315d-en (Accessed on 26 January 2017).
[25] See Ferreira et al. (2016) for discussion on inflating 2005 PPP values into 2011 PPP values. Ferreira et al. assert that, on average, $1.90 in 2011 PPPs maintains the same purchasing power as $1.25 in 2005 PPPs for the set of 15 poor countries that determine the international poverty line. They also demonstrate that this inflation rate of about 52 percent maintains on average purchasing power for essentially all countries in the PovcalNet database for which they estimate poverty (and have measures of PPP in both

Ravallion also notes that the value of this consumption floor is essentially the same as a biological floor estimated by Lindgren (2015), who aims to estimate a "barebones basket" of food items with a minimal allowance for nonfood needs. Using different data and methods, Allen (2016, Table 12) similarly constructs a near-survival line and estimates an average cost in non-OECD countries of $1.02 (in 2011 PPP terms) to consume 1,700 calories per person per day. While the survival lines estimated by Lindgren and Allen are conceptually different from the consumption floor estimated by Ravallion, each suggests a minimum value that corresponds to the intercept of a dollar a day (in 2011 PPP terms).

Our finding that national poverty lines are increasing in economic development over the entire range is in contrast to Ravallion and Chen, and Atkinson and Bourguignon, who proposed relative poverty lines that had floors set at the international poverty line. The motivating reason for a floor, as articulated by Ravallion and Chen and RCS (2009) is that for the poorest of countries, there was no correlation between national poverty lines and measures of national wellbeing (mean consumption or income). They asserted that the relationship between poverty lines and national income was non-increasing for the poorest of countries, and therefore the national poverty lines for these countries reflected absolute minimum needs.[26]

Panel B of Figure 3 plots both the RCS and Jolliffe-Prydz national poverty lines on a measure of national income (i.e. household final consumption expenditure). A fitted line from a locally weighted scatterplot smoothing (lowess) estimator reveals that both sets of national poverty lines are upward sloping in national income, indicating that the definition of basic needs

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years). Inflating $0.67 by 52 percent results in $1.01. Further, direct re-estimation of Ravallion's consumption floor using 2011 PPPs gives a value of $1.00 at 2011 PPPs.

[26] This idea of viewing poverty lines from the poorest of countries as reflecting minimum absolute needs was also proposed in RDV (1991) and World Bank (1990).

is increasing as countries grow richer. But, the lowess line for the RCS poverty lines in Panel B does potentially indicate a very slight flattening of the fitted lowess line at the tail end of the RCS data.[27] This flattening of the line is the underlying motivation for the minimum at $1.25 (in 2005 PPP terms) of the Ravallion-Chen weakly relatively poverty line, but we argue that the lack of a statistically significant positive slope coefficient for the bottom quintile of the RCS sample (the bottom 15 countries) could also simply be an issue of power.

When we regress our more complete set of national poverty lines on household final consumption expenditure (HFCE) from national accounts (following RCS), we find no evidence that the slope of the fitted line goes to zero for poor countries. In our lowess regression (Figure 3, Panel B), the fitted line is everywhere upward sloping with no appearance of a flattening at the end of the distribution. Similarly, when we do a spline regression on the full sample of national poverty lines, both the log-log and the levels specifications indicate that the slopes of the fitted lines are positive and statistically significant over the first quintile. When the sample is restricted to the circa-2011 subsample (with reduction in sample size to approximately $1/7^{th}$ of the full sample), both estimates are still positive, though only the log-log specification is statistically significant.[28]

One reason for the difference in our results and previous analysis suggesting a non-increasing relationship between national lines and income for the bottom quintile may simply be due to differences in country coverage. The sample of national poverty lines used in this paper

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[27] Using a Hansen (2000) threshold estimator, RCS identify a break point for the bottom 15 countries (or about 20 percent of the sample) and flat portion of the schedule to the left of the break point. The lowess line is a more flexible approach and similarly provides some visual evidence that the correlation weakens. Klasen et al. (2016) find that the flat segment observed by RCS does not hold at 2011 PPPs when using the same specification as RCS, but it does hold for a log-log specification.

[28] Spline regression results available from the authors upon request.

cover 40 percent more countries than the sample of poverty lines previously used to assess the relationship between national poverty lines and national wellbeing. The different sample, and the harmonization of the lines, results in a different point estimate of the slope coefficient. Another element of the story is that the slope coefficient for the bottom quintile in our analysis is more precisely estimated (due to a more than nine-fold increase in the number of poverty lines in the bottom quintile of our full samples and harmonization)[29] than the analysis used to suggest a zero-slope coefficient at low levels of income.

The findings from the spline regressions and the observation of the lowess regression lead us to argue that there is no flat portion or lower bound, Z*, in our preferred parameterization of the SPL. The interpretation of the intercept α, estimated at $1, as a floor for bare survival also resonates with existing literature on establishing absolute minimum values for poverty thresholds. But, as argued above, poverty lines reflect social values and an SPL that can take values approaching $1 has two unattractive aspects. The first is simply that a value approaching $1 may simply be too low to be socially acceptable. The near-survival threshold of $1.02 estimated by Allen (noted above) is a candidate example of a socially unacceptable basket because it only provides 1,700 calories per person per day and these calories all come from one food item. While our preferred SPL never assigns the value of $1 to a country (because this is the value of the intercept and it is not possible for a country to have zero median consumption), there might be a social aversion to expressing the SPL as having its minimum value at $1.

A second and related argument against $1 as a floor is that the international development community has largely converged on accepting $1.90 as defining extreme poverty (evidenced by

[29] Without adjusting for weighting and intra-country correlation effects, one expects this difference in sample size to result in a three-fold increase in the precision of the estimated slope coefficient (i.e. ignoring design effects, precision increases in proportion to the square root of the change in sample size).

inclusion in the MDGs and SDGs). A reasonable criterion for a socially acceptable relative poverty line might then be that any person identified as living in extreme poverty must also be identified as poor by the societal poverty line. In accord with this candidate criterion and past proposals, we also consider a variant of our preferred SPL which sets a lower bound for the threshold (Z*) at $1.90. This lower-bound variant of the SPL, expressed as *max*($1.90, $1 + 50% of median consumption), is conceptually analogous to the existing Atkinson-Bourguignon and Ravallion-Chen lines.

Our preferred parameterization of the SPL is $1 + 50% of median consumption, but we also view the lower-bound variant of this line as a reasonable alternative parameterization. Our reason for preferring the SPL of $1 + 50% of median consumption is in part due to its simplicity and in part due to finding no empirical evidence to support a flat portion in the SPL schedule. Given this finding, there is then tension in proposing the lower-bound variant as an alternative, but this tension is more of a conceptual concern than an empirical one. Our analysis indicates that the measured differences between these lines is relatively small and will continue to dissipate.

The RMSE of the lower-bound variant of the SPL (when assessed against the full sample of national poverty lines) is slightly more than 6 percent greater than the RMSE of the SPL without the lower bound. The 6 percent difference is substantial though because by construction, differences in errors will only exist for countries where the lower bound is binding. This means that the lower-bound variant performs significantly less well for the poorest of countries based on analysis of the full sample. This unfavorable finding is tempered considerably when contrasted with findings for the circa-2011 sample. When examining the more recent data, the

RMSE of the lower-bound variant SPL is only about 1 percent greater than the RMSE for our preferred SPL.

This improvement in fit of the bounded SPL is simply due to the fact that countries are richer in the circa-2011 sample (relative to the on average older full sample), and $1.90 is therefore binding for far fewer countries. For the most recent 2013 estimate, the lower bound of $1.90 is only binding for 13 countries, which represent less than 3 percent of the global population in 2013. In contrast, for the 1981 estimate, the lower bound was binding for 37 countries representing 50% of the global population. Moreover, even if binding for some countries, the lower bound of $1.90 is, on average, not much higher than the societal line without the lower bound. In 2013, for the 13 countries where the lower bound is binding, the average societal line (without lower bound) was $1.70, giving an average poverty headcount for those 13 countries of 63%, versus 70% with the lower bound. Because these 13 countries cover only 3 percent of the global population, the 7 percentage-point difference between the SPLs (with and without lower bound) affects the global count of societal poverty by only 0.21 percentage points.

Both the SPL and the lower-bound SPL respect the weakly relative poverty property proposed by Ravallion and Chen, discussed above. Figure 4 plots the point elasticity of the SPL and lower-bound SPL to changes in median consumption (or income) with markers identifying typical median consumption values for low-, middle- and high-income countries. The figure indicates that it is everywhere less than one, satisfying the weakly relative property. The elasticities of the two proposed lines are the same for all values of median income greater than $1.80 (the kink in the lower-bound schedule). For countries with median income less than the value at the kink, the elasticity of the lower-bound SPL drops to zero due to the floor set at the international poverty line of $1.90.

An aspect of the point elasticity is that it is increasing with median income and tends toward one for high-income countries. This relationship is directly linked to the proportion of the relative component of the SPL (50% of median consumption or income) to its total value. For rich countries with very high median consumption, the value of the SPL is largely determined by the relative component and the elasticity approaches one. Among high-income countries in 2013 the average national median income was approximately $40, which corresponds to an SPL with an elasticity of .95 – a 1 percent increase in median national consumption or income leads to a 0.95 percent increase in the SPL. The intercept of $1 constitutes only 5% of the value of the societal poverty line, causing the SPL to behave very similarly to a strongly relative line common in these countries. For poor countries, where the fixed component (either $1 or $1.90 for the lower-bound SPL) is a large proportion of the country's SPL, the elasticity is lower. For a typical low-income country in 2013, with median income of approximately $2.1/day, the elasticity of the SPL is 0.5 and the fixed share of the poverty line is about 50 percent.

The proportion of the value of the SPL that emanates from the relative component not only affects the measured elasticity of the SPL to median consumption, but also hints at an alternative interpretation of the SPL. For countries where the relative component is a relatively large contributor to the value of the SPL, the SPL is primarily determined by estimated median consumption. This attribute can serve to mitigate concerns about the potential non-comparability of the national wellbeing measures. For example, about three-fourths of the wellbeing measures in PovcalNet are estimates of consumption and the remaining ones are income (Ferreira et al., 2016). A fixed-value poverty line, such as the international poverty line, implicitly assumes that the underlying measures are comparable; but income and consumption are, by definition, different concepts. Even when considering the conceptually same measure such as consumption,

no two countries use the same questionnaire to measure it, and this also affects comparability. There is a large literature that documents significant variation in estimated consumption resulting from seemingly innocuous variation in, for example, the number of prompts or questions posed (Beegle et al., 2012, Browning et al., 2014, Jolliffe, 2001, Pradhan, 2009, and Winter, 2003), the recall period (Beegle et al., 2012, Deaton and Kozel, 2005), or the time of year of the fieldwork (Jolliffe and Serajuddin, forthcoming; Khandker, 2012). Because the SPL proposed in this paper is in part defined by the measure of wellbeing used in a particular country, the societal poverty threshold assigned to each country is partially harmonized with the measure of wellbeing.

IV. Profile of Societal Poverty

Current global counts of absolute poverty are typically based on data primarily from PovcalNet (e.g. Ferreira et al, 2016), as are the estimates of societal poverty presented in this paper. For the global count of absolute poverty, many high-income countries are assumed (not estimated) to have no extreme poverty, as measured by the international poverty line. While this may be a reasonable approximation for the percent of people living on less than $1.90 per day in some rich countries, it is not an acceptable assumption for societal poverty. To address this concern, we supplement the PovcalNet reference-year distributions for 131 low- and middle-income countries with data from 24 high-income countries not included in the World Bank's extreme poverty counts.[30] These 24 high-income countries represent 928 million people in 2013. To estimate the

[30] We produce estimates from 100 surveys based on data from 24 high-income countries, including: Australia, Austria, Belgium, Canada, Cyprus, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and the United States. These surveys are from PovcalNet, but are not included in the reference-year aggregations. For details on the regional groupings used in PovcalNet and by this paper, see: http://iresearch.worldbank.org/PovcalNet/data.aspx.

relative poverty rate for a specific country, we take the median consumption level for that country, estimate the country-specific SPL for survey and reference years, and pass the value of the SPL back to PovcalNet to extract the estimated poverty rate.[31]

Because the SPL results in a relative poverty line for each country that is directly linked to the overall wellbeing in that country, we suggest that this can be interpreted as defining poverty at a level that has social relevance to the country. (This can also be inferred from the fact that the parameterization of a dollar plus 50% of median consumption or income was selected because it fits national poverty lines well.) Another way of assessing social relevance is to pose the question of whether the SPL results in an estimated poverty rate that corresponds with national poverty headcount rates. The top two graphs in Figure 5 plot the officially reported poverty rates at national poverty lines and the estimated societal poverty rate for each country based on our preferred SPL and the SPL with the $1.90 lower bound. In both figures, the societal poverty rates closely correspond to national poverty rates, as reflected by the relatively tight scatter of poverty rates around the 45-degree line (indicating perfect correspondence between national poverty and relative poverty as measured by the various SPLs). While we note above some differences in the RMSE between the SPL and the lower-bound variant of the SPL, from visual inspection of Figure 5, these differences appear relatively inconsequential for the resulting poverty measures. Indeed, Table 3 provides the mean deviation and mean absolute deviation

[31] Estimates are produced from the version of PovcalNet updated October 1, 2016, available at http://iresearch.worldbank.org/PovcalNet/home.aspx (accessed April, 2017). China, India and Indonesia have separate rural and urban distributions in PovcalNet and no national median is therefore readily available. For these countries, the national median is derived by combining the rural and urban population weighted distributions available in PovcalNet and estimating the median of the joint national distribution. The resulting national median is used in defining the SPL used for these countries. For high-income countries, we replicate the alignment of the closest surveys to the reference years using National Accounts data, as done for countries included in PovcalNet's reference-year aggregation.

between poverty rates based on national poverty lines and the two SPLs, and both perform similarly. The mean deviation over all observations for the unbounded SPL is 1.7 compared to 2.3 for the lower-bound variant. The poverty rates derived from both of these lines correspond closely with the national definitions of poverty and their corresponding headcount rates.

This is in contrast to the poverty rates derived from our application of the Chen-Ravallion weakly relative poverty line and the strongly relative line set at 50 percent of median consumption (or income).[32] While the poverty rates derived from the Chen-Ravallion weakly relative poverty line are positively correlated with the national poverty rates, the vast majority of national poverty rates are far lower than the poverty rates suggested by the Chen-Ravallion weakly relative poverty line (Figure 5). The mean deviation between the national and relative poverty rates is 12.4 (Table 3), more than six times greater than the mean deviation for the SPL proposed in this paper. This misfit with national poverty is even more striking when examining the strongly relative poverty line. In this case, for a large majority of countries, their relative poverty rate is significantly lower than their national poverty rate (Figure 5), and the mean deviation is more than tenfold greater than that for SPL of one dollar plus 50 percent of median (Table 3). In both cases, we view the large, systematic difference between the measure of societal poverty and national poverty rates as an undesirable attribute.

Using the SPL, aggregating and lining up poverty headcounts for selected reference years following the same methods as in PovcalNet (but including high-income countries),[33] we

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[32] Chen and Ravallion parameterize their weakly relative poverty lines in 2005 PPP terms fixing the lower bound at $1.25. In the figure, we present the 2011 PPP equivalent, fixing the lower bound at $1.90. We adjust the intercept to be $1.90/2.

[33] The issue is that household survey data do not exist for every country in every year, but all global poverty estimates are for a specific year. To overcome the data gaps, survey data are projected forward (and sometimes back-casted) to produce country-level poverty for each year. For an overview of the methods used, see Jolliffe et al. (2014) or Ferreira et al. (2016).

estimate a societal poverty headcount of 2.16 billion people in 2013 (2.18 billion when based on the lower-bound variant). This count is almost three times more than the global count of people living on less than $1.90 per day (estimated at 767 million in 2013). Figure 6 displays the change over time in both the count and rate of societal poverty, as measured by our proposed SPL, and the SPL with lower bound; and similarly displays the count and rate of absolute extreme poverty as measured by the international poverty line of $1.90 per day. Our estimates indicate that the societal poverty rate has fallen steadily since 1990, but at a slower rate than the decline of extreme poverty. This divergence in the rate of decline amplifies the distinction between the two measures. In the early 1980s, societal poverty (46.5%) is estimated to be about 10 percent more than the extreme poverty rate (42.1%); by 2013, the rate of societal poverty is almost three times greater than extreme poverty. In a growing global economy, this divergence is an expected outcome, but the magnitude of the change (in first differences of the rates) over the decades highlights the distinction in the informational content in both measures.

Figure 6 also reveals a slight divergence in societal poverty with the $1.90 lower bound in the 1990s, but this essentially disappears by 2010. Figure 6a shows the trajectories for poverty rate as measured by the SPLs and the international poverty line, with aggregate societal poverty falling by about 1/4 from 43 percent in 1990 to 30 percent in 2013, while the absolute extreme poverty rate fell by more than 2/3, from 35 percent in 1990 to 11 percent in 2013. Figure 6b reveals that while the rates have been decreasing, the total headcount of societal poverty is essentially at the same level it was in 1990 due to the increasing global population.

The levels and trends in poverty headcounts and rates based on our proposed SPLs differ substantially from those reported by Ravallion and Chen (2013) based on their weakly relative poverty line. They estimate a weakly relative poverty rate of 49.8 percent in 1990 which drops to

43.6 in 2008.[34] Using the SPL, we estimate a global headcount rate of 42.3 in 1990 which drops to 33.4 in 2008 (or from 43.6 in 1990 to 33.7 in 2008 when using the SPL with a lower bound). Our societal poverty measure is lower overall and declines at a faster rate. The higher aggregates from Ravallion and Chen originates from the fact that their preferred specification results in a higher average poverty line than the SPL. The difference in levels can also be inferred from comparing the SPL panels in Figure 5 with the panel for the weakly relative poverty line.

By design, the SPL used in estimation of societal poverty is increasing with growth, and this is reflected in Figure 7 which shows the values of the line over time. The population-weighted average SPL over all countries increases from about $5.20 in 1990 to $6.70 in 2013. Among upper-middle-income countries, the mean SPL almost doubled over the same time period, increasing from $2.80 in 1990 to $5.50 in 2013. The relative line has increased in all regions, but faster in fast-growing regions (Table 4). In 1981, the mean SPL in South Asia was equal to the international poverty line of $1.90 and the SPLs in East Asia and the Pacific, and Sub-Saharan Africa were just slightly higher. Due to strong economic growth in East Asia and Pacific, the mean line has more than doubled since then to $5.60 per day in 2013. In contrast, Sub-Saharan Africa, which has experienced much weaker overall growth, has an estimated mean societal poverty line of $2.20 per day in 2013, essentially unchanged since 1981.

The profile of societal poverty by region and income groups and over time is given in Table 5.[35] Similar to regional profiles of absolute poverty, Sub-Saharan Africa stands out as a region with substantially higher rates of societal poverty. While societal poverty has declined in

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[34] Implemented with the latest data and at 2011 PPPs with the poverty line as max(1.9, 1.9/2+0.5*mean) we the estimate are 49.9% in 1990 to 44.1% in 2008.

[35] We use the World Bank's classification of countries in regions and income groupings. For details about the World Bank income classification, see Fantom and Serajuddin (2016). For regions used by the World Bank see: http://www.worldbank.org/en/country.

Sub-Saharan Africa over time, it still is almost half the population (48 percent) in 2013. In contrast, the East Asia and Pacific region has halved societal poverty from 55 percent in 1990 to 26 percent in 2013. All developing regions have seen an overall decline in societal poverty rates since 1990, especially during the 2000s, while the high-income countries in aggregate have seen a stable level of societal poverty of about 16 percent, remaining lower than in all the 'developing' regions.

V. Conclusion

In this paper, we propose a measure of societal poverty that is based on counting the number of poor people who live on less than a country-specific poverty line that takes the value of $1 plus 50 percent of median consumption (or income) in that country. This relative measure of societal poverty can be viewed as a complement to the absolute measure of extreme poverty based on the international poverty line of $1.90 per person per day. The absolute measure monitors progress in eliminating extreme poverty as assessed by a material standard fixed over time, while the societal measure monitors progress in reducing poverty in accord with how countries assess changing standards of minimum needs. By fixing the absolute international poverty line at $1.90, it serves the useful purpose of providing a fixed target for eliminating extreme poverty. This advantage of keeping the line fixed also means though that as the world progresses towards eradicating extreme poverty, the $1.90 poverty line will become increasingly irrelevant to large portions of the world. In contrast, because the SPL is explicitly a function of the wellbeing of each country, it is by construction a relevant yardstick for all countries.

The decision to anchor the SPL in a median measure of wellbeing both fits the data well (as assessed by regressions of national poverty lines on consumption level of the country) and corresponds with existing definitions of relative poverty in many countries. Garroway and

Laiglesia (2012) also note that by making the relative poverty line a function of the median and not the mean, poverty lines will differ across countries with the same level of consumption per capita if the overall distribution of consumption differs across the countries. The proposed SPL also has relevance to SDG target 10.2 aimed at "social, economic and political inclusion of all," the indicator for which is the proportion of people living below 50 percent of median income. While the focus of this SDG is on reducing inequality and improving inclusion, and it is useful to recognize that it overlaps well with the idea of monitoring societal poverty. As countries grow, societal poverty provides information on the extent to which the poor share in the growth.

Methodologically, the approach followed in this paper to parameterize a global relative poverty line is similar to how others have approached this problem. The analysis in this paper though is based on a much larger data set of national poverty lines and this has allowed us to more precisely estimate the shape of the fitted relative line. One key finding of our estimates is that national poverty lines increase in value as countries get richer over the entire observed range of countries. We do not observe a flat-line relationship for the poorest of countries, in contrast to much of the limited literature on this point. Our parameterization of the SPL also includes a positive intercept, which results in our SPL being an example of a weakly relative poverty line. Another way of interpreting the positive intercept is that it brings a fixed component to the relative poverty line, ensuring that the elasticity of the poverty line to growth is always less than one but increasing with income.

This last point also addresses a recommendation in World Bank (2017, recommendation 16) that the World Bank should monitor a measure of global societal poverty that takes into account a country's standard of living and that combines both fixed and relative elements in one line. The SPL proposed in this paper fills this gap in the effort to monitor global poverty.

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Tables

Table 1: Proposals for International Relative Poverty Lines

	Relative lines				
Name of proposal	**Atkinson & Bourguignon Relative Poverty Line (AB-RPL)**	**Ravallion & Chen Weakly Relative Poverty Line (RC-WRPL)**		**Strongly Relative Poverty Line (SRPL)**	**Societal Poverty Line (SPL)**
Reference(s)	Atkinson and Bourguignon (2001)	Ravallion and Chen (2011)	Chen and Ravallion (2013)	EU, OECD, Garroway and de Laiglesia (2011)	(this paper)
Number of national lines (countries) used in parameterization	33 (33)	74 (74)	74 (74)	n/a	699 (107)
PPPs	1985	2005	2005	n/a	2011
Economic variable (M)	PCE from National Accounts	PCE from National Account	Mean consumption from household survey	Mean consumption from household survey	Median consumption from household survey
Parameters					
Gradient (k)	0.37	1/3	1/2	1/2	1/2
Intercept (α)	0	$0.60	$0.625	0	$1
Lower bound (Z*)	$1 (IPL)	$1.25 (IPL)	$1.25 (IPL)	0	SPL variant, $1.90 (IPL)
Kink M* = (Z*-α)/k)	$2.70	$1.95	$1.25	n/a	SPL variant $1.80

Note: SPL column includes parameters for both the SPL and the SPL variant with lower bound – α and k are the same, but SPL with lower bound defines parameters for the Z* and the kink. IPL refers to the absolute international poverty line.

Table 2: Economic gradient of national poverty lines

Panel A: Level-level models

	(I) Full sample (weighted)			(II) 2011 sample		
	(1)	(2)	(3)	(4)	(5)	(6)
	Z	Z	Z	Z	Z	Z
	b/se	b/se	b/se	b/se	b/se	b/se
Median	0.53***		0.49***	0.50***		0.55***
	(0.02)		(0.10)	(0.02)		(0.12)
Mean		0.42***	0.03		0.40***	-0.04
		(0.03)	(0.08)		(0.03)	(0.10)
Constant	0.98***	0.70***	0.95***	1.01***	0.73***	1.05***
	(0.13)	(0.18)	(0.14)	(0.15)	(0.23)	(0.15)
R-squared	0.861	0.821	0.862	0.863	0.809	0.864
Sample size	699	699	699	104	104	104

Panel B: Log-log models

	(I) Full sample (weighted)			(II) 2011 sample		
	(1)	(2)	(3)	(4)	(5)	(6)
	Log(Z)	Log(Z)	Log(Z)	Log(Z)	Log(Z)	Log(Z)
	b/se	b/se	b/se	b/se	b/se	b/se
Log(Median)	0.72***		0.45**	0.69***		0.60***
	(0.03)		(0.18)	(0.03)		(0.20)
Log(Mean)		0.74***	0.28		0.72***	0.10
		(0.03)	(0.20)		(0.03)	(0.21)
Constant	0.16***	-0.13**	0.04	0.18***	-0.10*	0.14
	(0.05)	(0.07)	(0.11)	(0.04)	(0.06)	(0.10)
R-squared	0.805	0.797	0.810	0.835	0.814	0.836
Sample size	699	699	699	104	104	104

Notes: Z denotes the national poverty line, and *, **, *** indicate p-values less than 0.10, 0.05, and 0.01, respectively. Standard errors in columns 1-3 are adjusted for multiple observations for each country with a sandwich (Huber-White) variance estimator. Standard errors in columns 4-6 are White adjusted to correct for heteroscedasticity of general form.

Table 3: Deviation between national and global relative poverty rates

	Latest observation		All observations	
Relative global line	**Mean absolute deviation**	**Mean deviation**	**Mean absolute deviation**	**Mean deviation**
SPL ($1 + 50% of median)	8.7	1.7	9.5	-1.9
SPL w lower bound at $1.90	9.1	2.3	9.7	-1.3
Chen and Ravallion (WRPL)	14.0	12.4	12.5	9.5
Strongly relative (50% of median)	19.5	-18.1	18.5	-17.4
Number of observations	115	115	631	631

Notes: Table shows the mean and mean absolute difference (in percentage points) between poverty headcount rates at relative lines and national lines. A negative (positive) mean deviation indicates that, on average, the relative line produces a headcount rate lower (higher) than that given by the national line. The Chen and Ravallion weakly relative poverty line approximated at 2011 PPPs using max($1.90, $1.90/2+50% of mean).

Table 4: Societal Poverty Line

A. By region

Region(s)	1981	1990	1999	2008	2013	Change 1981-2013
East Asia & Pacific	2.5	3.1	3.5	4.5	5.6	3.1
Europe & Central Asia	9.5	10.3	11.2	14	14.3	4.7
Latin America & Caribbean	4	3.8	4	5.2	6	1.9
Middle East & North Africa	3.4	3.8	4	4.7	5	1.6
North America	18.9	22.7	23.8	25.6	25.1	6.2
South Asia	1.9	2	2.1	2.2	2.5	0.7
Sub-Saharan Africa	2.1	2	1.9	2.1	2.2	0.1
World	4.8	5.2	5.4	6.3	6.7	1.9
-Excluding 'Other High Income Countries'	2.6	2.6	2.7	3.4	4	1.4

Notes: Table presents (population-weighted) average of the value of country SPLs, evaluated at $1 + 50% * median consumption (or income).

B. By income group

Income group	1981	1990	1999	2008	2013	Change 1981-2013
Low income	1.8	1.7	1.8	1.9	2	0.3
Lower middle income	2.1	2.2	2.2	2.5	2.8	0.7
Upper middle income	2.9	2.8	3	4.4	5.5	2.6
High income	13.7	16.9	18.7	21.2	21	7.3

Table 5: Societal Poverty Headcount Rates

A. By regions

Region(s)	1981	1990	1999	2008	2013	Change (p.p.) 1981-2013
East Asia & Pacific	67	55.1	43.9	33	26.4	-40.6
Europe & Central Asia	15.2	16.3	20.1	16.2	15.9	0.7
Latin America & Caribbean	34.9	34.8	34	29.9	28.1	-6.8
Middle East & North Africa	30.7	28.4	26.7	24	22.2	-8.5
North America	19.1	19.6	18.6	19.5	19.5	0.4
South Asia	54.4	49.2	46.6	41.7	34.7	-19.7
Sub-Saharan Africa	52.5	55	57	51.1	47.8	-4.8
World	46.5	42.3	39.2	33.4	29.3	-17.2
-Excluding 'Other High Income Countries'*	53.6	47.8	43.8	36.7	31.7	-21.9

Notes: SPL is $1 + 50% of median consumption (or income). *). Regional grouping previously referred to as 'Developing World' for which PovcalNet monitors poverty.

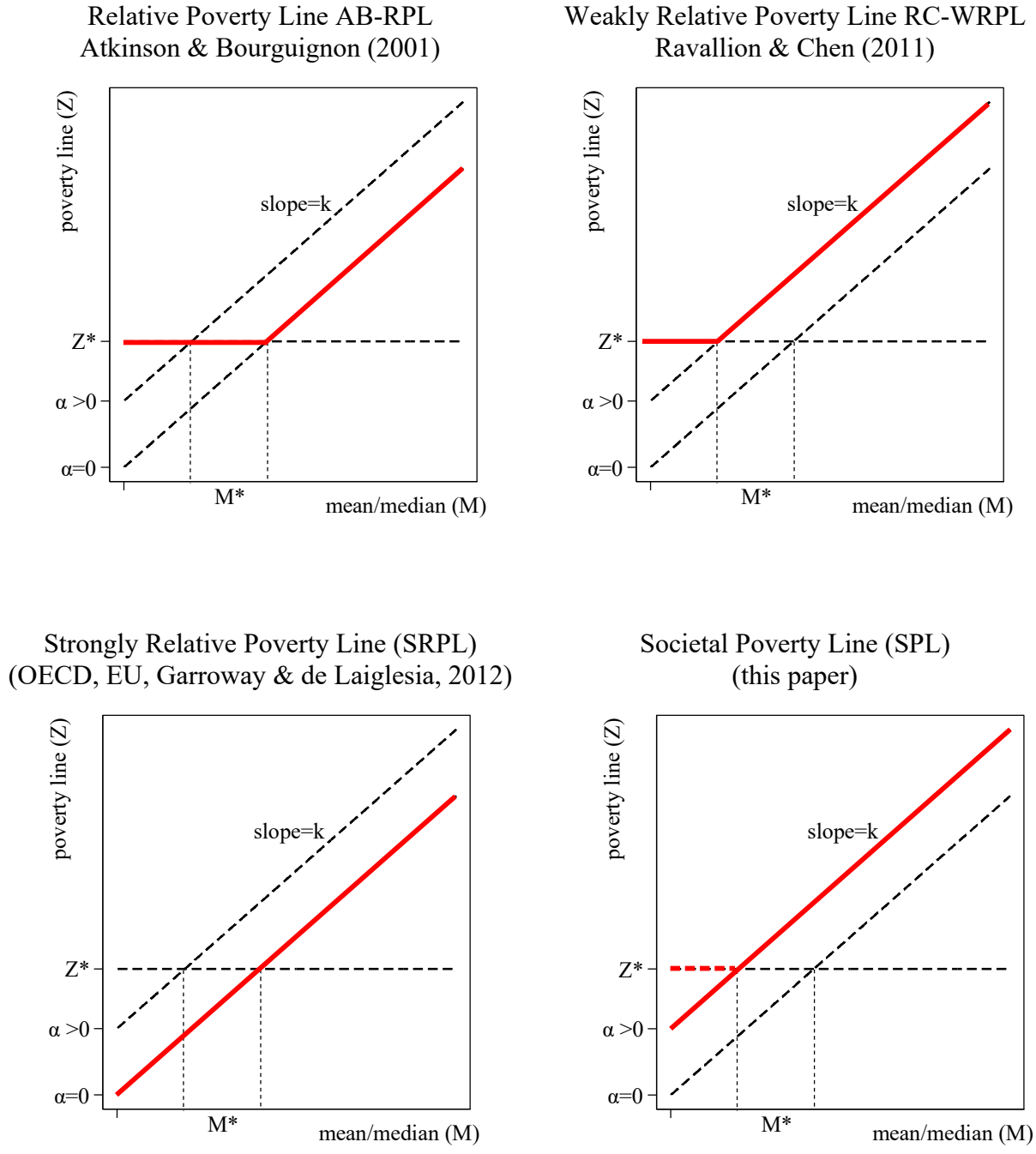
B. By income group

Income group	1981	1990	1999	2008	2013	Change (p.p.) 1981-2013
Low income	61.6	62.3	63	55.5	50.7	-10.9
Lower middle income	51.5	46.9	45	39.7	34.3	-17.3
Upper middle income	56.4	48.2	40.7	30.8	25.5	-30.9
High income	15.5	15.5	15.4	15.6	15.8	0.3

Notes: Income classification for FY15, based on GNI per capita in 2013.

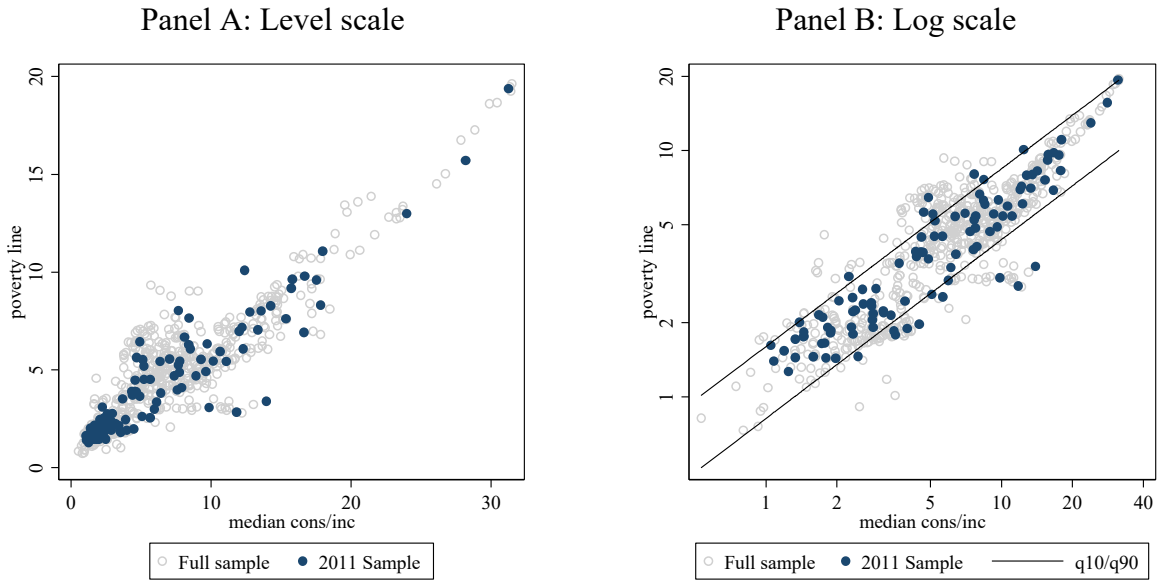
Figures

Figure 1: Global Relative Poverty Lines, Existing Proposals



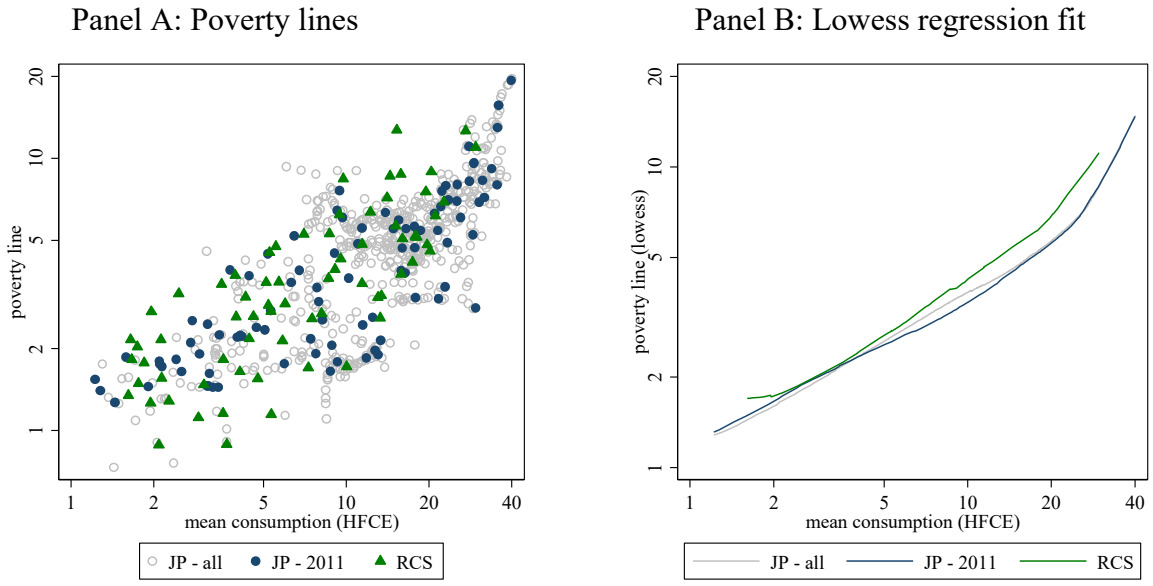
Notes: The horizontal axes reflect the overall wellbeing of the society, as measured by either the mean (M) or median (M') of consumption or income. Z* reflects the lower bound for the relative poverty line that is used by Chen and Ravallion (2013) and Atkinson and Bourguignon (2001).

Figure 2: National Poverty Lines and Economic Development



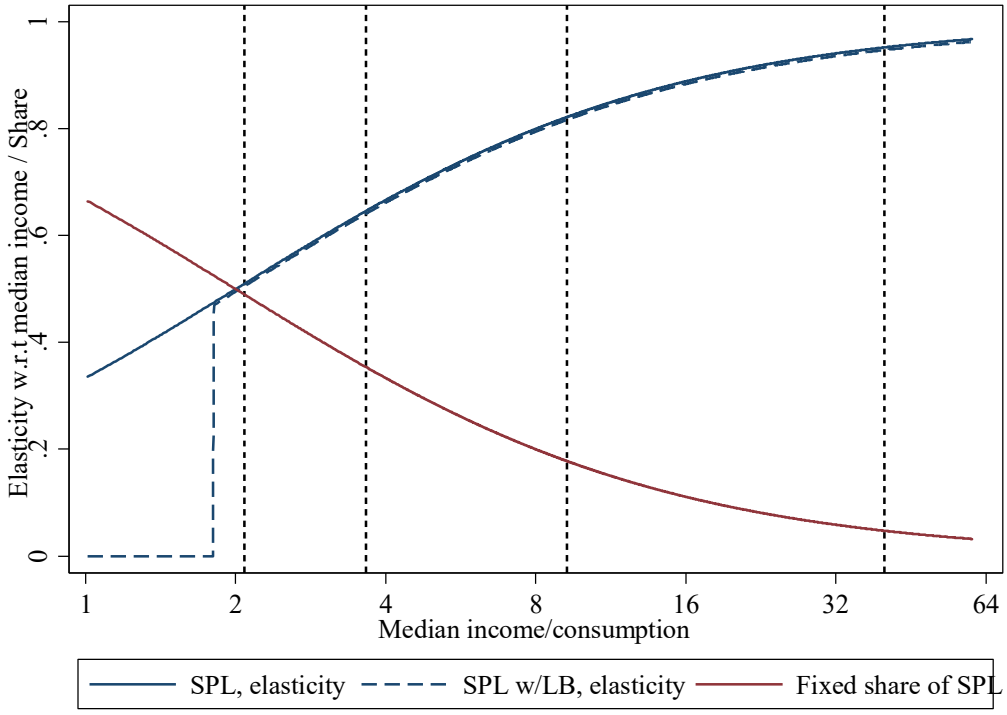
Notes: Both panels plot 699 harmonized national poverty lines compiled by Jolliffe and Prydz (2016). Dark dots indicate the 104 poverty lines that are closest to 2011 (one unique line for each country), excluding lines prior to 2000. Both panels plot the same data – Panel A plots the lines on actual values, Panel B plots these same values but the axis of the plots are log transformations. Lines in Panel B are predicted 90th and 10th quantile lines.

Figure 3: Comparing JP and RCS national poverty lines



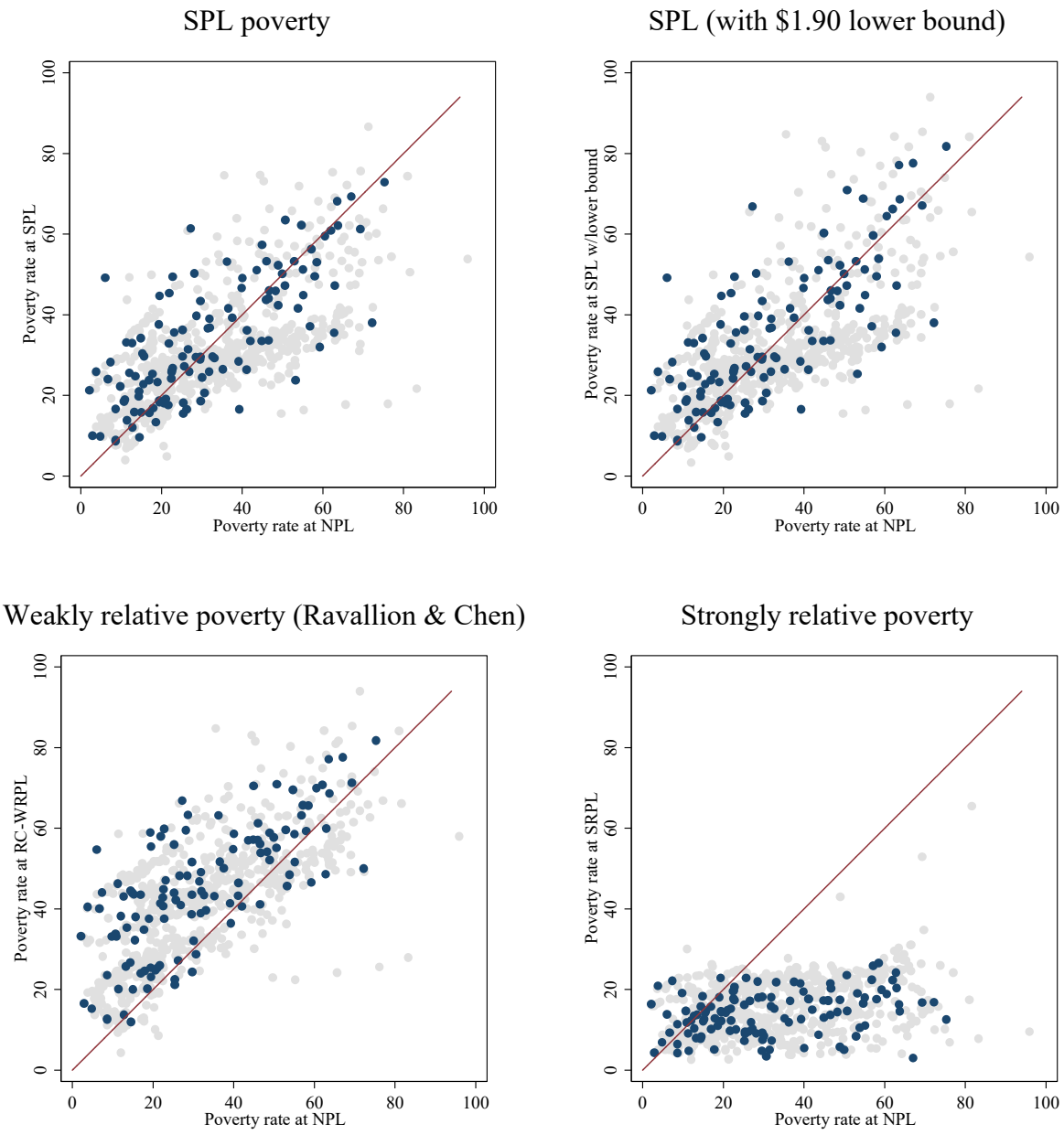
Notes: These panels compare the Jolliffe-Prydz (JP, 2016) and Ravallion, Chen, Sangraula (RCS, 2009) datasets of national poverty lines on household final consumption and expenditure (HFCE) from national accounts. All values are expressed in 2011 PPP US dollars.

Figure 4: Elasticity of SPL



Note: Vertical lines indicate the average national median consumption or income in 2013 for World Bank income classification groupings (from left to right): Low ($2.1/day), Lower Middle ($3.7), Upper Middle ($9.3) and High Income ($40) Countries.

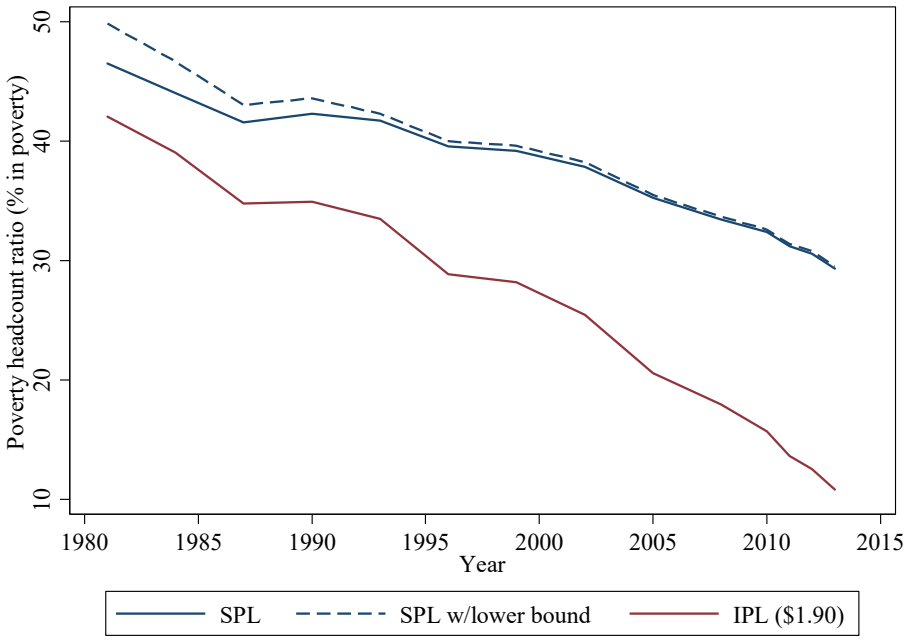
Figure 5: Comparing Relative Poverty and National Poverty Headcount rates



Notes: The four panels plot poverty rates for various proposal for relative global poverty line against poverty rates at national lines. The filled (dark) markers represent the latest observation for each country (115 observations), while the hollow markers represent the full sample (746 observations). The 45-degree line represents the point at which the poverty rate at the relative lines are equal to the rates at national lines. The national poverty rates come from WDI (series SI.POV.NAHC.NC), while the relative rates are estimated for this paper using PovcalNet using the procedure described in Section 3.

Figure 6: Societal Poverty, Global Estimates 1981-2013

(a) Poverty rate



(b) Number of poor

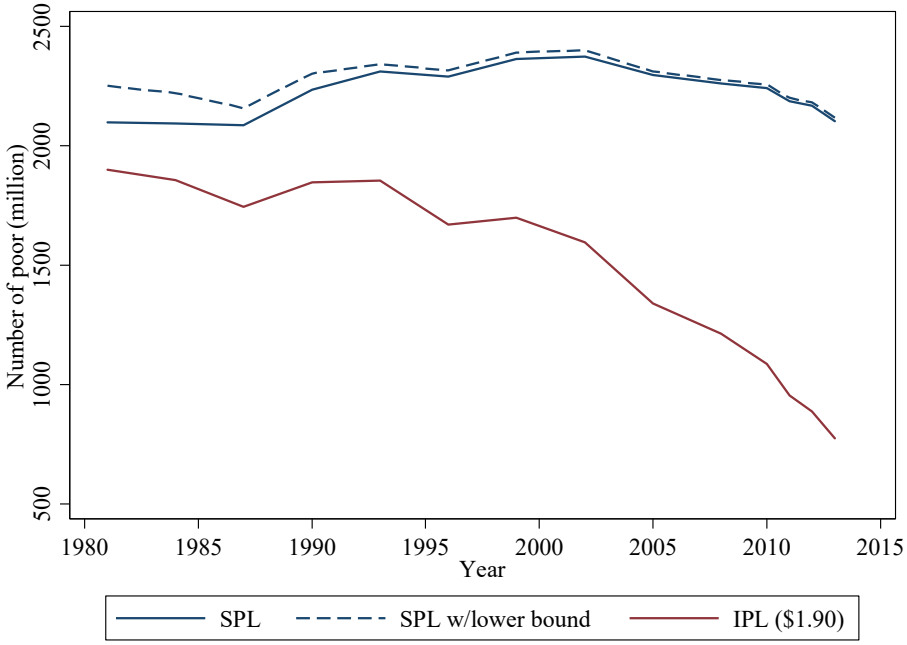
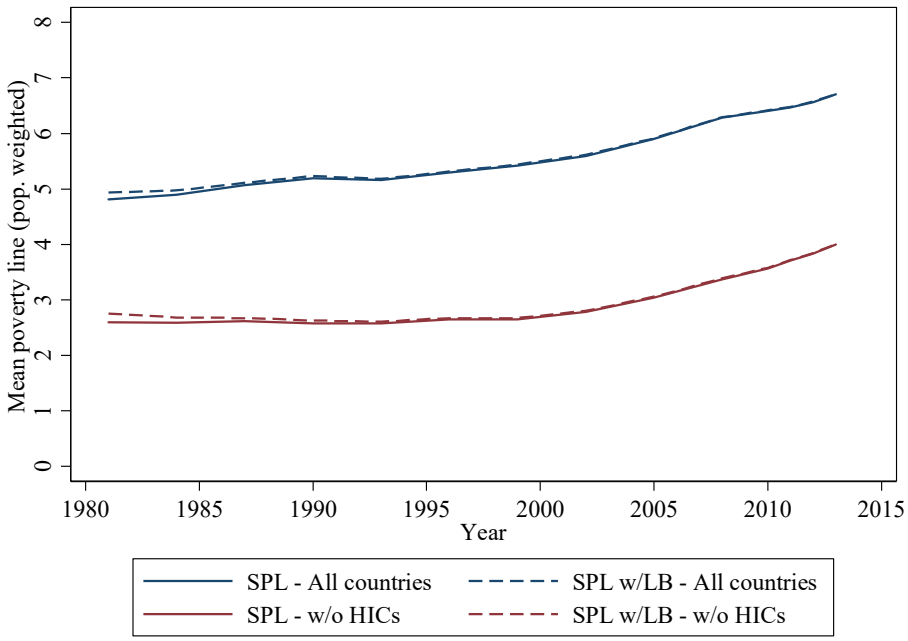


Figure 7: Mean Societal Poverty Line 1981-2013



Note: Dashed line represents international poverty line at $1.90 in 2011 PPP terms.