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How Sensitive Is Regional Poverty Measurement in Latin America to the Value of the Poverty Line?

ABSTRACT   This paper contributes to the methodological literature on the estimation of international poverty lines for Latin America based on the official poverty lines chosen by Latin American governments and commonly used in the public debate. The paper exploits a comprehensive data set of 86 up-to-date official extreme and total urban poverty lines across eighteen countries in Latin America, as well as the recently updated values of the national purchasing power parity conversion factors from the 2011 International Comparison Program and a set of harmonized household surveys. Using US$3.00 and US$6.00 per person a day at 2011 PPP as the extreme and total poverty lines, respectively, for Latin America, this paper illustrates the sensitivity of poverty rates to changes of the values of the poverty lines as a result of the recent update of the PPP values, the period of reference, and the relative cost of living across the countries in the region. Total poverty rates in Latin America increase when the 2011 PPP values are used instead of the 2005 PPP values, while the extreme poverty rate is unaffected. In general, country-specific poverty rankings remain fairly stable regardless of the values of the poverty lines selected.

JEL Classification: I3, I32, D6, E31, F01

Keywords: Poverty, poverty lines, purchasing power parity, Latin America

Threlation comparison of poverty measures is a central tool for development research. Comparing the performance of different countries in terms of poverty reduction is informative about the effect of structural characteristics, shocks, and policies on the well-being of the most vulnerable.

Naturally, for international comparisons, poverty should be measured consistently across countries. Unfortunately, there is no global protocol for measuring poverty at the national level, at least for the purpose of research in international development. In practice, poverty measurement differs from country to country in many respects, including the following: (i) the methodology to estimate the poverty line (for example, relative versus absolute lines, the minimum amount of calories, the choice of the reference group, or the procedure to go from extreme to total poverty lines); (ii) the choice of the individual welfare measure (for example, income versus consumption); (iii) the construction of the welfare aggregate (for example, items included in the income or consumption variable or the treatment of implicit rent of own housing); (iv) the design of surveys (for example, differences in questionnaires); and (v) many other adjustments and considerations (for example, adult equivalent scales versus per capita values, economies of scale, and regional prices). Consequently, the comparison of official poverty estimates across countries is generally misleading. Thus, any attempt to generate meaningful poverty comparisons and to aggregate national poverty indicators into regional and global ones requires a standardized measure of household welfare and a common poverty line.

The common poverty line should ideally be constructed by computing the market price of a single bundle of goods in all the countries. This undertaking, however, requires a high degree of international coordination. The United Nations Economic Commission for Latin America and the Caribbean (ECLAC) has made some inroads into that goal, but countries in the region still measure poverty with substantial heterogeneity.

A body of research proposes some alternative methods to obtain standardized measures of monetary poverty that are comparable across countries and independent of the official methodologies applied in each country. The most widely accepted initiative is to define an international poverty line in US dollars and "translate" this value into local currency using consumption purchasing power parity (PPP) exchange rates, computed by the International Comparison Program (ICP), a large project on price comparisons around the world. This proposal requires setting a value in dollars for the international poverty line. To some extent, this should not be an issue, since it is well known in the development literature that poverty lines are arbitrary cultural constructions, given that there are no discontinuities in any well-being indicator.[1] A thorough poverty analysis should not be confined to a single line but instead should consider a set of poverty lines or, better, check stochastic

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1. Deaton (1997).

dominance conditions. However, it has proved useful in the policy debate and in the development literature to define some "focal" values for the poverty lines. These agreed values, although still arbitrary, are helpful to simplify the discussions.

The seminal work by Ravallion, Datt, and van de Walle proposed one of the first global extreme poverty lines at US$1.01 (rounded to $1.00) per person per day at 1990 PPP values, based on 1985 prices surveyed by the ICP.[2] This global extreme poverty line corresponded to the average of the poverty lines of the eight most deprived economies in the world and became the foundation for the United Nations' first Millennium Development Goals of halving the proportion of people with incomes lower than a dollar a day between 1990 and 2015. This line was then revised by Chen and Ravallion to $1.08 per person per day at 1993 PPP values and by Ravallion, Chen, and Sangraula to $1.25 per person per day at 2005 PPP values, the latter of which is known today as the global extreme poverty line and is computed as the average of the poverty lines of the fifteen poorest countries in the world.[3] Jolliffe and Prydz proposed an update of the global extreme poverty line, which resulted in a poverty line of $1.92 per person per day in 2011 PPP values, while Ferreira and others calculated it as $1.88 (rounded to 1.90) per person per day.[4]

The global extreme poverty line frequently used for international poverty comparisons in the developing world was derived from poverty lines set in the poorest sub-Saharan African countries; therefore, they have limited applicability in Latin America, a region composed mostly of urbanized middle-income economies. The share of the population under that line is lower than 5 percent in the region. Even the US$2.00 per person per day poverty line, commonly used for middle-income countries, is too low compared with the lines officially chosen by the Latin American countries and used in the policy debate.[5] Consequently, these international lines are irrelevant for all local discussions.

Given this problem, many researchers and institutions like the World Bank, the Inter-American Development Bank (IDB), and ECLAC use for

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2. Ravallion, Datt, and van de Walle (1991). Ahluwalia, Carter, and Chenery (1979) used India's poverty line to estimate poverty at a global level based on the 1975 PPP values. This was the first attempt to measure global poverty, though it was based on income and consumption data from only twenty-five countries in the world (Ferreira and others 2016).

3. Chen and Ravallion (2001); Ravallion, Chen, and Sangraula (2009).

4. Jolliffe and Prydz (2015); Ferreira and others (2016).

5. Most countries in the region officially use two poverty lines: an extreme (food) and a total (food and nonfood) poverty line. Countries estimate their extreme poverty lines as the lack of per capita income required to access a basic food basket and expand them to nonfood components using the Orshansky coefficient (Orshansky 1963).

Latin America an extreme and total poverty line of $2.50 and $4.00 per person per day in 2005 PPP values, respectively.[6] Although there is not a formal document supporting this choice, Gasparini, Cicowiez, and Escudero report that these lines were close to the unweighted median of the poverty lines for the main urban areas of a sample of countries in 2005 (the sample excludes Brazil, the most populous country in the region).[7]

In this paper, we provide inputs for deriving focal regional poverty lines by considering the U.S. dollar value of the extreme and total poverty lines officially chosen by Latin American countries and used in their own poverty and social policy debates. Besides providing a detailed description of the methodology, we improve the computations on several grounds. In particular, we exploit a unique data set of eighty-six official subnational urban poverty lines across eighteen Latin American countries, as well as the recent 2011 PPP values from the ICP. We compute different weighted and unweighted statistics and carry out a robustness analysis of the results.

As far as we know, this is the first study to explicitly document the calculation of regional extreme and total poverty lines. Our proposal has some strengths compared to lines computed by other studies in the developing world. First, the proposed lines are based on a comprehensive list of all countries for which up-to-date data on official poverty lines are available (eighteen countries representing roughly 85.3 percent of Latin America's population in 2011 and almost all the urban population of the region). As such, any existing bias in the estimation of the value of the regional poverty lines that results from excluding certain countries is likely to be relatively small.[8] Second, using up-to-date information from national statistical offices on poverty lines used to estimate official extreme and total poverty numbers in every country in Latin America is more transparent and easier to communicate to governments in the region. Third, the method proposed in this paper is relatively simple and easy to replicate, which is key to enhancing the credibility of the process.[9] Fourth, this paper uses *subnational* official urban poverty lines when available, which accounts for regional disparities in the

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6. For example, López-Calva and Ortiz-Juarez (2014); Gasparini, Cicowiez, and Escudero (2013); Ferreira and others (2012); World Bank (2011, 2013, 2014, 2015); Stampini and others (2015).

7. Gasparini, Cicowiez, and Escudero (2013).

8. Deaton (2010) argues that changes in the composition of the fifteen countries used by Ravallion, Datt, and van de Walle (1991) result in significant changes in the value of the poverty line and the count of the poor worldwide (Jolliffe and Prydz 2015).

9. Ferreira and others (2016).

standard of living within countries and allows for the replication of countries' official poverty estimates. Finally, by using the most up-to-date poverty lines from national statistical offices in Latin America, our approach is less sensitive to changes in consumer price index (CPI) data.[10]

Depending on the specification chosen, the paper estimates the set of extreme and total poverty lines to be approximately $2.50 to $3.20 and $5.30 to $6.80 per person per day at 2011 PPP values, respectively. We then apply these lines to the distribution of per capita household income in all Latin American countries for which microdata are available, using a standardized distribution under the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) project, a joint initiative of the World Bank and the Center for Distributional Labor and Social Studies (CEDLAS) at Universidad Nacional de La Plata (UNLP) in Argentina.[11] Depending on the regional poverty line selected, we find that in 2013, approximately 7 to 11 percent of individuals were extremely poor, while approximately 24 to 35 percent of the population was living on a per capita income lower than the total poverty line.

For the sake of illustration, we use the US$3.00 and US$6.00 per person a day at 2011 PPP as poverty lines for Latin America. We then estimate the sensitivity of the poverty rates to changes in the value of the regional poverty lines when the value of the PPP, the period of reference, and the relative cost of living across the countries in the region are changed.

The rest of the paper is organized as follows. The next section outlines the methodology and brings together the various sources of information used. We then present the results for the poverty lines, followed by the resulting headcount ratios. We also carry out a simulation exercise that quantifies the sources of differences between the poverty estimates under our proposal and those arising from the lines that are currently used by the World Bank and some researchers. The paper ends with some concluding remarks.

Methodology and Data

Given the large heterogeneity across geographical areas, Latin American governments typically measure poverty by setting poverty lines at the subnational level. We propose to derive international aggregate poverty lines for Latin

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10. Chen and Ravallion (2010); Jolliffe and Prydz (2015).

11. CEDLAS and World Bank, "SEDLAC: Socio-Economic Database for Latin America and the Caribbean," August 2015 (www.cedlas.econo.unlp.edu.ar/wp/en/estadisticas/sedlac/).

America from these subnational official poverty lines. Although the proposal is rather straightforward, some notation may clarify it. Define z_{rp} as the official poverty line for the subnational area r in country p expressed in a common currency. As usual in the international studies, we express all lines in U.S. dollars per person per day at purchasing power parity (PPP) values.

There are several ways to define an international line for a region comprising several countries, such as Latin America. One possibility is to take the population-weighted average of all the subnational poverty lines.

$$(1) \qquad z_{AL}^1 = \sum_p \sum_{r \in p} \alpha_r z_{rp} = \sum_p \alpha_p \left[\sum_{r \in p} \alpha_{rp} z_{rp} \right] = \sum_p \alpha_p z_p,$$

where $\alpha_r (\alpha_p)$ is the share of subnational area r (country p) in the population of Latin America, α_{rp} is the share of r in the population of country p, and z_p is a population-weighted average of the subnational poverty lines in country p.

Under this alternative, the international poverty line is strongly affected by the official lines set in highly populated countries (such as Brazil and Mexico, which include more than 55 percent of the Latin American population) and is almost unaffected by the official lines set in other less populated nations (such as Uruguay, with less than 0.6 percent of the regional population). An alternative that avoids this feature and recognizes the special relevance of countries as political entities is to compute an unweighted mean of the country lines:

$$(2) \qquad z_{AL}^2 = \frac{1}{P} \sum_p z_p = \frac{1}{P} \sum_p \left[\sum_{r \in p} \alpha_{rp} z_{rp} \right],$$

where P is the number of countries in Latin America. Finally, a third alternative could be to average out all the subnational lines, ignoring any population weight:

$$(3) \qquad z_{AL}^3 = \frac{1}{R} \sum_p \sum_{r \in p} z_{rp},$$

where R is the number of subnational units for which official poverty lines are computed. Unlike the poverty line in equation 1, the international poverty line in this case is not affected by the size of the population. However, this alternative is strongly affected by countries that consider a relatively large set of subnational official poverty lines (for example, Colombia has more than

twenty-three poverty lines, while Chile, Ecuador, Haiti, and Nicaragua have only one official poverty line).

Equations 1 to 3 illustrate the different alternatives with a measure of central tendency: the mean. In the empirical implementation, we also compute the median for each case, which has the convenient property of being less sensitive to extreme values.

To implement the methodology, we use three different data sets: (i) country-specific official poverty lines from national statistical offices; (ii) the PPP values from the 2011 ICP round; and (iii) the per capita household income distribution from harmonized household surveys.

Country-Specific Official Poverty Lines

We use data on official subnational extreme and total poverty lines that correspond to the closest to the last 2011 PPP round. These lines were obtained from national statistical offices or governmental agencies from eighteen countries in Latin America: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, and Uruguay.[12] We collect more than eighty subnational urban poverty lines.[13] Finally, we account for regional disparities within countries by capturing subnational heterogeneities in the standard of living.[14]

The level of subnational disaggregation varies from country to country. For some countries, poverty lines are determined at the city level (for example, Colombia), while for others, they are determined at the regional level (for

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12. Brazil does not have an official poverty line, so we use subnational poverty lines calculated by the Institute for Applied Economic Research (IPEA), updated yearly based on the CPI (available online at www.ipeadata.gov.br/doc/LinhasPobrezaRegionais.xls). Cuba and Venezuela are not included in this study due to the lack of microdata from the SEDLAC project in both countries and the lack of poverty lines in the case of Cuba. The estimation of the international poverty lines is robust to the inclusion of Venezuela.

13. We discuss the restriction of the analysis to urban poverty lines later in this section.

14. Ravallion, Datt, and van de Walle (1991) compile thirty-three unofficial national poverty lines for the whole world, while Ravallion, Chen, and Sangraula (2009) use data on eighty-eight poverty lines extracted from the World Bank's Poverty Assessments carried out worldwide since 1990. Jolliffe and Prydz (2016) compute implicit national poverty lines by combining official poverty headcounts, as reported in the World Bank's Poverty Assessments, with the corresponding consumption and income distributions from the World Bank's PovcalNet database. One caveat of this exercise is that the combination of official poverty rates with unofficial harmonized microdata sets from PovcalNet may result in poverty lines that deviate from the official ones, which is the case for Latin American countries.

example, Brazil). In a few cases, there is just one line at the national level (for example, Nicaragua). Almost all poverty lines are in per capita terms; the only exceptions are Argentina, where poverty lines also consider household composition, and Uruguay, where the nonfood component of the poverty line accounts for economies of scale.

Purchasing Power Parity Exchange Rates

To compare the standard of living of households across countries in Latin America, household welfare needs to be expressed in common units. In May 2014, the ICP launched an update of its PPP data based on information on goods and services for almost every country in the world.[15] The updated PPP data allow for the comparison of household welfare across countries by providing a real exchange rate from local currency to U.S. dollars in a particular year—2011 in this case.[16] The 2011 update of PPP values increased its coverage, collecting prices from 199 countries in the world, up from 146 in the previous update, and included several methodological and operational improvements with respect to 2005.[17]

Why not use exchange rates to express welfare measures in common units across countries? The main difference between the PPP data and the nominal exchange rate is that the former is created as an index of prices of the same basket of goods in the same period, whereas the latter is the price of a local currency in terms of a foreign one (that is, the rate by which both currencies are exchanged). The nominal exchange rate reflects prices of only tradable goods, so a significant proportion of goods and services consumed by the population are not taken into account.[18] Thus, the exchange rate is not appropriate for comparing levels or changes over time of any economic indicator, as it does not express the current cost of living of an economy based on the prices of a fixed basket of commonly purchased goods and services.

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15. The ICP includes nearly 200 countries. As stated in the official report, Afghanistan, Argentina, Lebanon, Libya, South Sudan, and the Syrian Arab Republic are the only large economies that did not take part in the 2011 ICP round.

16. One of the new features of the 2011 ICP round is the availability of global PPP values in addition to U.S. dollar PPP. For this paper, we still consider the U.S. dollar PPP values.

17. See Ferreira and others (2016) for a detailed description of the 2011 PPP data.

18. Ferreira and others (2016).

The Problem of Rural Areas

The methodology outlined so far ignores one relevant limitation: the 2011 ICP round collected prices in Latin America only for urban areas.[19] Given this limitation, the deflation of rural poverty lines using an urban PPP factor would underestimate the value of the regional poverty line, since the cost of living tends to be higher in urban areas than in rural areas. Therefore, the inclusion of rural lines in the calculation of the Latin American aggregate line creates a downward bias; the size of that bias is a function of the differences in prices between rural and urban areas. Given that bias of unknown size, we decided to ignore all rural official poverty lines in our analysis and therefore compute international urban poverty lines. We test the robustness of our estimations to the inclusion of rural poverty lines below.

Income Distribution from Harmonized Household Surveys

To estimate poverty measures that are comparable across countries, we need to increase the cross-country comparability of the welfare measures. We use the SEDLAC database as the primarily source of comparable welfare aggregates across Latin American countries. SEDLAC is a harmonized database of Latin American and Caribbean household surveys compiled by the poverty group at the World Bank in partnership with the Center for Distributive, Labor, and Social Studies (CEDLAS) at the Universidad Nacional de La Plata in Argentina.[20] The main objective of this comprehensive data set of household surveys is to increase cross-country comparability of a range of socioeconomic measures, including total household income, from more than 300 household surveys in eighteen countries in Latin America from the 1970s to the present. Following the practice of most countries in the region, in this paper we measure poverty based on per capita household income at the individual level.[21]

19. World Bank (2014); Ravallion (2018). According to the meta data from ICP, about 29 percent of the 189 countries in the ICP and only one country in Latin America included rural areas in the price surveys (Ravallion, 2018).
20. Bourguignon (2015) presents a detailed evaluation of the SEDLAC data set.
21. National statistics and SEDLAC figures serve different purposes. The former are the best possible representation of individual countries, while the latter represent comparable regional indicators. Therefore, the poverty estimates presented in this paper should not be interpreted as methodologically superior to official poverty estimates.

Regional Poverty Lines

Figure 1 shows the relationship between official per capita extreme and total poverty lines and per capita household income from harmonized household surveys in the SEDLAC database in 2011.[22] The figure reports the nominal value of poverty lines—at 2011 PPP values—for eighteen countries in Latin America at the highest possible level of geographical disaggregation.[23] Figure 1 suggests that in Latin America there is not a significant correlation between the value of the poverty line and the level of per capita income.[24] This result is valid for different regression specifications (see table 1) using poverty lines at both the subnational and national (that is, population-weighted average of subnational lines) levels. Given this result, we decided to consider all available information to compute regional poverty lines, rather than only data from the poorest economies, as done by Ravallion, Chen, and Sangraula.[25]

Table 2 presents population-weighted averages of official extreme and total urban poverty lines for all countries in Latin America in 2011, and figure 2 shows the density function of all official subnational poverty lines. Extreme poverty lines fall within a limited range between $2.00 and $4.40 per person per day, while total poverty lines are more dispersed, ranging from $4.00 to $12.20 per person per day. This implies that the total poverty lines of some countries are lower in PPP terms than the extreme poverty line of other countries. For instance, the population-weighted average extreme poverty line of Paraguay ($4.40 a day) is slightly higher than the population-weighted average total poverty lines of Nicaragua, Ecuador, and Brazil.

The relatively large dispersion of the total poverty lines is also evident in figure 3, which presents the cumulative distribution function (CDF) of the total number of official extreme and total urban poverty lines at the subnational level. The figure shows that the rank of the subnational regions
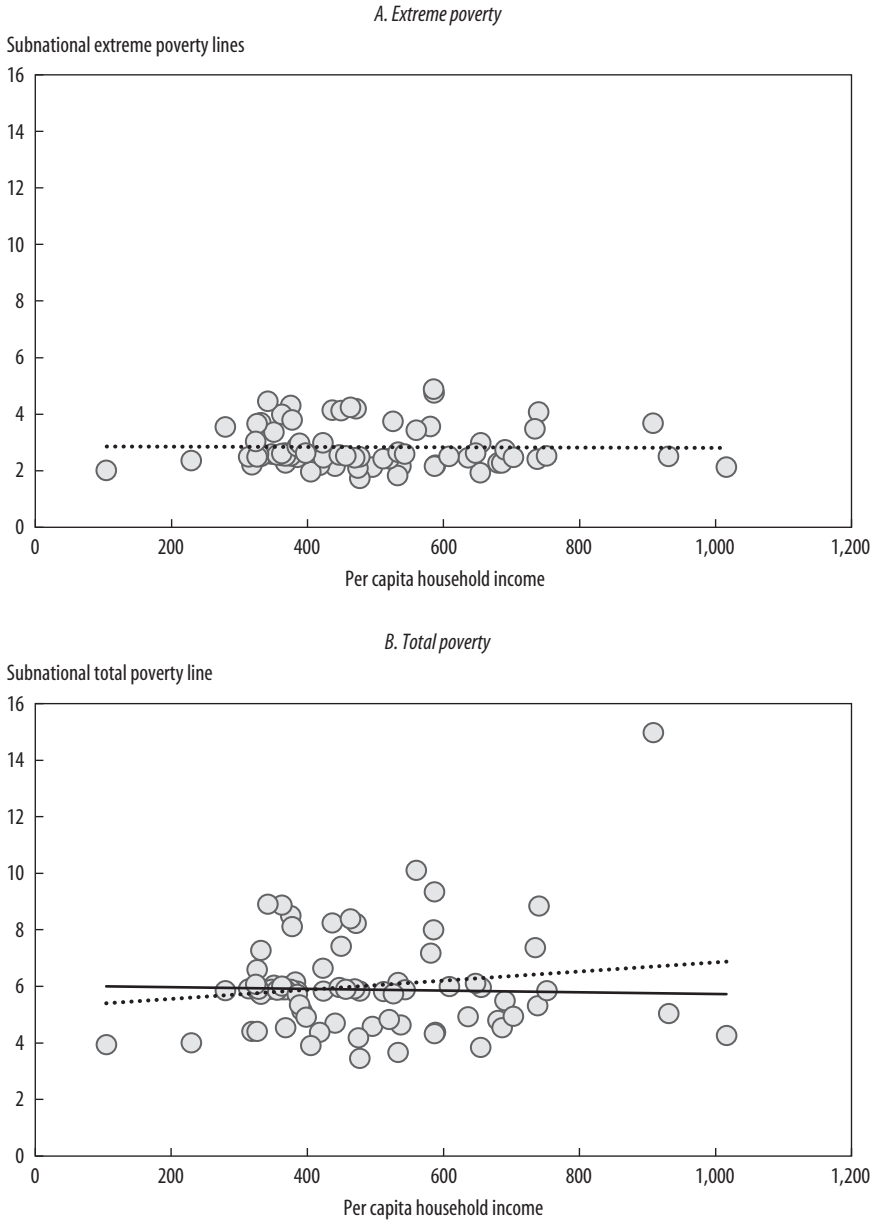
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22. The existing relationship in the graph could be considered spurious if poverty lines were calculated based on the same household surveys used in the graph. This is not the case for the countries covered in this paper; all poverty lines have been computed in different household surveys from the ones used in the figure.

23. For poverty lines that were not reported at 2011 PPP values, we deflated the closest value using national CPIs. Although countries have published lines for more recent years, we prefer to use the figures closest to the last 2011 PPP round. With regard to geographical disaggregation, Chile, Ecuador, Haiti, and Nicaragua publish the official poverty lines at the national level and make no distinction between urban and rural areas or subnational regions.

24. This contrasts with studies for the developing world (see Ravallion, Chen, and Sangraula 2009; Ferreira and others 2016; Jolliffe and Prydz 2016).

25. Ravallion, Chen, and Sangraula (2009).

F I G U R E 1 .   Official Poverty Lines and per Capita Household Income in Latin America, 2011[a]

A. Extreme poverty

Subnational extreme poverty lines

Per capita household income

B. Total poverty

Subnational total poverty line

Per capita household income

Source: Authors' calculation, based on official extreme and total poverty lines from national statistics offices in the region and SEDLAC data.

a. Subnational poverty lines are in U.S. dollars per day in 2011 PPP values; per capita household income is U.S. dollars per month in 2011 PPP values. The dashed lines correspond to the unweighted ordinary least squares (OLS) regression including all observations, while the solid line in panel B excludes outliers (namely, Montevideo, Uruguay).

T A B L E   1 . Parametric Estimation of Regional Poverty Lines in Latin America and the Caribbean, 2011[a]

	Extreme poverty lines			Total poverty lines		
	OLS		Q-reg p(50)	OLS		Q-reg p(50)
	Subnational	National	Subnational	Subnational	National	Subnational
Coefficient	(1)	(2)	(3)	(4)	(5)	(6)
Log per capita income	0.002	0.534	−0.070	0.155	0.957	−0.160
	(0.235)	(0.541)	(0.126)	(0.493)	(1.278)	(0.220)
Constant	2.810*	−0.077	2.972***	4.980	0.741	6.821***
	(1.444)	(3.335)	(0.772)	(3.023)	(7.818)	(1.348)
No. observations	74	16	74	74	16	74
R squared	0.000	0.065	—	0.001	0.039	—
Forecast for lowest income (Haiti)	2.82	2.41	2.49	5.70	5.19	5.71

Source: Authors' calculations, based on official poverty lines from national statistics offices in the region.

* Statistically significant at the 10 percent level.

*** Statistically significant at the 1 percent level.

a. Standard errors between brackets. The table shows ordinary least squares (OLS) and quantile regressions (QR) (50th percentile), with poverty lines as the dependent variable and the log of per capita household income as the regressor. Columns 1 and 4 show the OLS regression of all subnational extreme and total poverty lines shown in figure 3; columns 2 and 5 are based on national averages of subnational poverty lines shown in table 2; columns 3 and 6 show QRs of all subnational poverty lines. The last row shows the estimated value of the regression for Haiti, the poorest country in Latin America and the Caribbean, in U.S dollars per person per day. All regressions exclude outliers—that is, the highest and lowest value of each poverty line. For instance, the regressions for extreme poverty lines in columns 1 through 3 exclude the Leste urban area in Brazil and the metropolitan area in Paraguay, which are the lowest and highest values, respectively (see figure 3).

T A B L E   2 . Population-Weighted Average of Official Urban Poverty Lines in Latin America and the Caribbean, 2011[a]

U.S. dollars per person per day

	Poverty line in 2011 PPP values	
	Extreme	Total
Country	(1)	(2)
Argentina	2.33	5.04
Bolivia	4.02	7.62
Brazil	2.19	4.39
Chile	2.98	5.96
Colombia	2.52	5.91
Costa Rica	4.07	8.85
Dominican Republic	2.99	6.64
Ecuador	2.48	4.40
El Salvador	3.04	6.08
Guatemala	4.00	8.88
Haiti	2.01	3.95
Honduras	4.45	8.90
Mexico	3.78	8.11
Nicaragua	2.35	4.00
Panama	3.48	7.37
Paraguay	4.45	7.14
Peru	3.11	6.11
Uruguay	3.54	12.23

Source: Authors' calculations, based on official urban poverty lines from national statistics offices in the region.

a. Poverty lines are population-weighted averages of official subnational extreme and total poverty lines. Chile, Ecuador, Haiti, and Nicaragua have only one national poverty line.
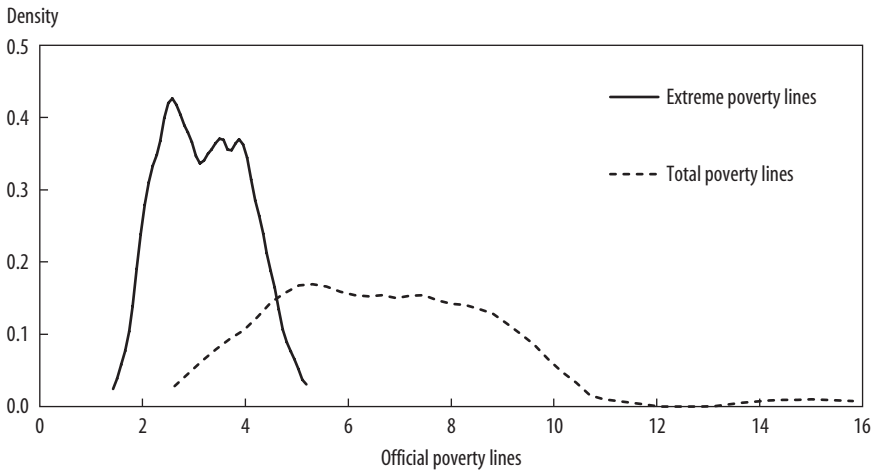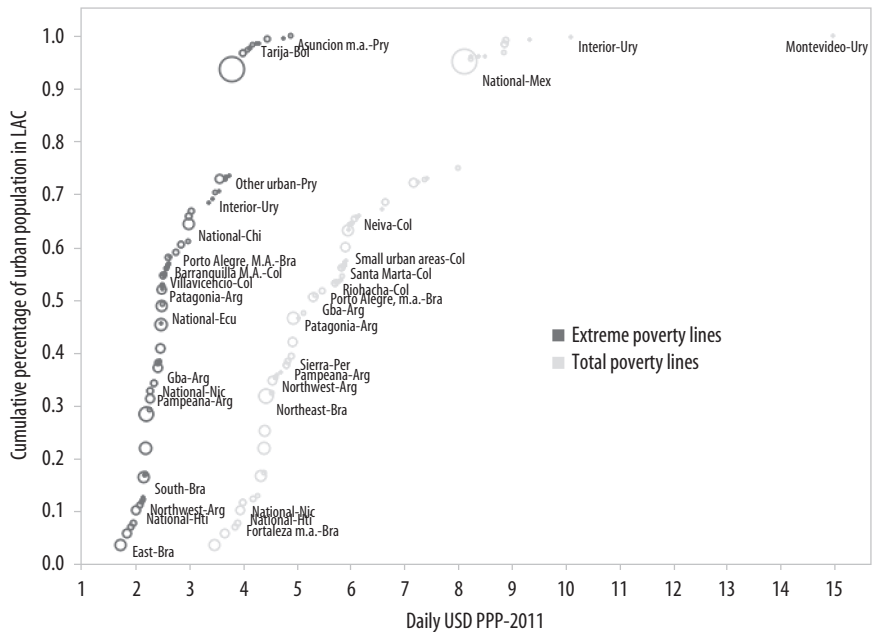
Source: Authors' calculations, based on official poverty lines from national statistics offices in the region.
a. The figure shows the density function of extreme and total official poverty lines (in U.S. dollars per day at 2011 PPP values) using the Epanechnikov kernel.

F I G U R E   3 .   **Cumulative Distribution of Official Extreme and Total Poverty Lines in Latin America and the Caribbean, 2011**[a]

Source: Authors' calculations, based on official poverty lines from national statistics offices in the region.
a. Each circle represents a subnational region, with the diameter proportional to the subnational population.

based on the official extreme poverty lines is different from the rank based on official total poverty lines, suggesting a large variation of the Orshansky coefficients in Latin America. Additionally, the slope of the CDF based on extreme poverty lines is steeper than the one based on total poverty lines, which suggests that there is more heterogeneity in the normative cost of living when nonfood items are added to the overall household consumption bundle.

Additional key messages emerge from figure 3. First, there is a substantial overlap between subnational poverty lines—both extreme and total—across countries in Latin America. For example, the Leste urban area of Brazil has the lowest total poverty line in Latin America ($3.50 per person per day), which is considerably lower than the total poverty line of the Pampeana region in Argentina ($4.80 per person per day). By contrast, the metropolitan area of Porto Alegre in Brazil has a total poverty line of $5.50 per person per day, which is above the median total poverty line in Latin America ($5.30 per person per day) and considerably higher than total poverty lines in subnational areas of Argentina. Second, there is large heterogeneity in terms of the number of subnational poverty lines by countries. For instance, Colombia has twenty-three regional poverty lines, whereas Chile, Ecuador, Haiti, and Nicaragua have only one national poverty line. Finally, there are some extreme values of national poverty lines that could substantially increase the mean value of the regional poverty lines. For instance, the total poverty line in Montevideo, Uruguay, is $14.90 per person per day, which is considerably higher than the rest of the total poverty lines in Latin America.

Table 3 presents the mean and median of the extreme and total urban poverty lines in Latin America in U.S. dollars a day per person at PPP, using different weights according to equations 1 to 3 above. The first row (z_{AL}^1) shows a population-weighted mean (or median) of all the subnational official urban poverty lines in Latin America; the second row (z_{AL}^2) shows the unweighted mean (median) of the country lines, computed as population-weighted means of the subnational lines; and the third row (z_{AL}^3) is an unweighted mean (median) of all the available subnational official lines. Regional extreme poverty lines based on the most up-to-date official data are approximately $3.00 per person per day, on average, while regional total poverty lines are approximately $6.00 per person per day, on average. However, there is variation across different specifications in the table. Extreme and total regional poverty lines based on mean values of the official poverty lines are higher than those based on median values, which demonstrates the impact

T A B L E   3 .   Regional Poverty Lines in Latin America and the Caribbean, 2011[a]
U.S. dollars per day

Poverty line	Mean		Median	
	Extreme (1)	Total (2)	Extreme (3)	Total (4)
Urban poverty lines alone				
z_{AL}^1	2.80	5.90	2.50	5.30
	(0.21)	(0.49)	(0.37)	(0.85)
z_{AL}^2	3.20	6.80	3.10	6.60
	(0.16)	(0.45)	(0.29)	(0.53)
z_{AL}^3	2.90	6.10	2.60	5.90
	(0.08)	(0.17)	(0.10)	(0.05)
Urban and rural poverty lines				
z_{AL}^1	2.80	5.60	2.50	5.10
	(0.19)	(0.44)	(0.29)	(0.68)
z_{AL}^2	3.00	6.20	3.00	6.30
	(0.13)	(0.38)	(0.24)	(0.45)
z_{AL}^3	2.80	5.80	2.60	5.80
	(0.06)	(0.14)	(0.04)	(0.15)

Source: Authors' calculations, based on data from national statistics offices.

a. The first row (z_{AL}^1) shows a population-weighted mean (or median) of all the subnational official urban poverty lines in Latin America; the second row (z_{AL}^2) is an unweighted mean (median) of the country lines (computed as weighted means of the subnational lines); the third row (z_{AL}^3) is an unweighted mean (median) of all the available subnational official lines. Bootstrapped standard errors with 100 repetitions are in parentheses.

of outliers on the regional averages. Similarly, unweighted poverty lines are higher than the population-weighted poverty lines, due to the heterogeneity in the size of the subnational population and the number of poverty lines by country.

Table 3 also tests the robustness of the estimates to the inclusion of rural poverty lines. Since the 2011 ICP round collected prices in Latin America only for urban areas, we deflated the rural poverty lines using an urban PPP factor. The results are fairly stable. However, the deflation of rural poverty lines using an urban PPP factor underestimates the value of the regional poverty line if they are not first adjusted by urban prices. We therefore prefer to avoid the use of rural poverty lines in our estimates.

As discussed above, although poverty lines are social constructions and poverty analysis could be carried out without reference to a given line, in practice it is useful to define a sensitive "focal" value for the poverty line in order to simplify the discussions. Given the results in table 3, we propose the use of US$3.00 and US$6.00 per person per day at 2011 PPP as focal regional lines for poverty comparison in Latin America. Based on these two lines, we

then illustrate the sensitivity of the poverty rates to the value of the poverty lines when the PPP values, the period of reference, and the relative cost of living across countries are changed.

Poverty Estimates

In this section, we compute poverty headcount ratios based on the regional poverty lines suggested in table 3. As discussed above, and given the lack of rural data for the PPP adjustments, the regional lines are for urban areas only. However, in this section we decided to report national poverty estimates, since policy debates usually center on those statistics. As a rough approximation to consider lower consumption prices in rural areas, we multiply all rural incomes by the ratio of urban to rural poverty lines.[26]

Using the set of extreme poverty lines shown in table 3 (between $2.50 and $3.20 per person per day), the extreme poverty rate would have ranged from 7 to 11 percent in 2013. Similarly, using the total poverty lines (between $5.30 and $6.80 per person per day), the total poverty rate would have varied from 24 to 35 percent in the same year.

As we showed above, the difference in the number of subnational poverty lines by country, the presence of outliers, and the size of the subnational population affect the value of the poverty line. For the sake of simplicity, the following analysis uses US$3.00 and US$6.00 per person per day as the values for the extreme and total poverty lines, respectively. These values result from averaging each column of table 3.

Table 4 presents the country-specific poverty estimates in 2013 based on these selected extreme and total poverty lines and the 2011 PPP values. Poverty headcounts vary considerably across countries in Latin America. For instance, Uruguay has the lowest extreme and total poverty rate in Latin America, with approximately 1.8 and 9.8 percent of the population living on a per capita income lower than US$3.00 and US$6.00 per person per day in 2013, respectively. Haiti has the highest extreme and total poverty rate: approximately 67.2 and 85.7 percent of the population live on a per capita income lower than US$3.00 and US$6.00 per person per day, respectively.

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26. Here, we follow Deaton and Dupriez (2011) and Chen and Ravallion (2010). We use the average value of all the country-specific urban-to-rural poverty line ratios for countries that have only one poverty line.

T A B L E 4 . Extreme and Total Poverty Rates in Latin America and the Caribbean Determined Using Selected Poverty Lines in 2011 PPPs, 2013[a]
Percent

|	Poverty headcount	
Country	Extreme (1)	Total (2)
Argentina	3.4	12.2
Bolivia	12.0	30.5
Brazil	8.6	24.9
Chile	2.2	11.9
Colombia	12.6	34.9
Costa Rica	3.6	14.6
Dominican Republic	9.2	36.5
Ecuador	9.7	35.3
El Salvador	7.7	34.4
Guatemala	17.2	48.5
Haiti	67.2	85.7
Honduras	31.4	59.7
Mexico	12.2	40.6
Panama	7.2	21.3
Paraguay	5.2	20.8
Peru	8.3	26.4
Uruguay	1.8	9.8
Latin America and the Caribbean	9.8	30.2

Source: Authors' calculations, based on SEDLAC data.
a. Poverty rates are based on extreme and total poverty lines of US$3.00 and US$6.00 per person per day, respectively.

The last row of table 4 shows the extreme and total poverty rates in Latin America as a whole based on the US$3.00 and US$6.00 per person per day poverty lines and the 2011 PPP values. By 2013, approximately 9.8 percent of the population lived on a per capita household income lower than US$3.00 per person per day in 2011 PPP values. Similarly, approximately one in three Latin Americans qualified as poor in 2013, living on a per capita household income lower than US$6.00 per person per day.

Comparison with Other Lines

As mentioned above, researchers and the World Bank have been using poverty lines of $2.50 and $4.00 at 2005 PPP values, due to the lack of a study on regional lines. This section analyzes whether the poverty rates computed with these lines differ substantially from calculations based on our proposal. To explore this issue, figure 4 presents the comparison of country-specific

F I G U R E 4 .   Country-Specific Poverty Rate Rankings Based on 2005 and 2011 PPPs, 2013[a]
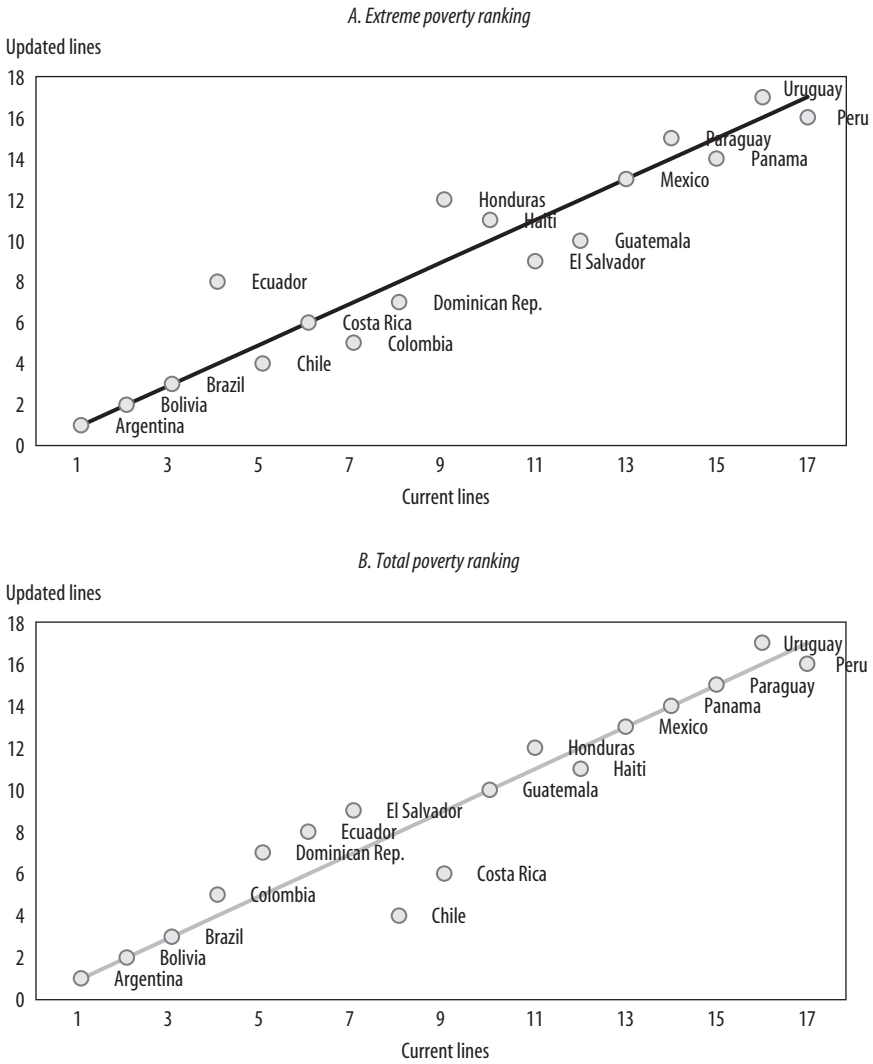
A. Extreme poverty ranking

Updated lines

Current lines

B. Total poverty ranking

Updated lines

Current lines

Source: Authors' calculations, based on official extreme and total poverty lines from national statistics offices in the region and SEDLAC data.

a. The horizontal axis is based on poverty rates using poverty lines of US$2.50 and US$4.00 per person per day at 2005 PPP values, while the vertical axis is based on poverty rates using poverty lines of US$3.00 and US$6.00 per person per day poverty lines at 2011 PPP values (see table 3).

extreme and total poverty rankings based on the $3.00 and $6.00 per person per day poverty lines and the 2011 PPP values with the corresponding estimates based on the $2.50 and $4.00 per person per day poverty lines and the 2005 PPP values. Any deviation from the 45-degree line denotes differences between the poverty rankings. The figure shows that country-specific extreme and total poverty rankings are generally stable to the value of the poverty lines, with a few exceptions such as the Dominican Republican and Mexico.

The shift in the poverty headcounts calculated using 2011 versus 2005 PPP values reflects not only the differences in the value of the poverty lines but also the change in the base year (that is, 2005 or 2011) and the relative cost of living between countries (that is, 2011 PPP round or 2005 PPP round). For instance, an extreme poverty line of $2.50 per person per day in 2005 PPP values is different from an extreme poverty line of $2.50 per person per day in 2011 PPP values, because $2.50 at 2011 PPP values is less, in real terms, than $2.50 at 2005 PPP values. Furthermore, the headcounts obtained under the two poverty lines are affected not only by the general price inflation that all the countries experienced, but also by changes in the relative prices between countries from 2005 and 2011 (reflected in the PPP values) and in the set of underlying official poverty lines used to calculate the regional lines. To obtain the same poverty rate as the $2.50 line at 2005 PPP values using 2011 PPP values, it is necessary to set the poverty line at $3.20 per person per day.

Thus, the difference between the poverty headcounts using the poverty lines in 2005 PPP values versus 2011 PPP values can be decomposed into three components. The first component is the change in the level of the nominal value of the poverty line. In our example, the nominal value changed from $2.50 to $3.00 per person per day for the extreme poverty line and from $4.00 to $6.00 per person per day for the total poverty line. The second component is the effect of changing the base year from 2005 to 2011. That is, the welfare aggregate of each country is deflated to either 2005 PPP values or 2011 PPP values using the corresponding CPI. Because the CPIs of the different countries evolve independently over time, the welfare distribution of the Latin American region as a whole will differ depending on whether the base year is 2005 or 2011. Finally, the third component is the effect of changing the spatial deflator (that is, relative prices) from 2005 PPP to 2011 PPP values. Most of the countries in Latin America—except for Guatemala, Panama, and Peru—experienced a currency depreciation, as the 2011 PPP values are higher than the 2005 PPP values.

To understand the effect of these components, we estimate the Shapley value of the marginal effect of each component in the change of the poverty headcount. That is, we change one of the components from its corresponding

F I G U R E 5 . **Shapley Decomposition of Poverty Headcount Differences: 2005 PPP Values versus 2011 PPP Values, 2013**[a]
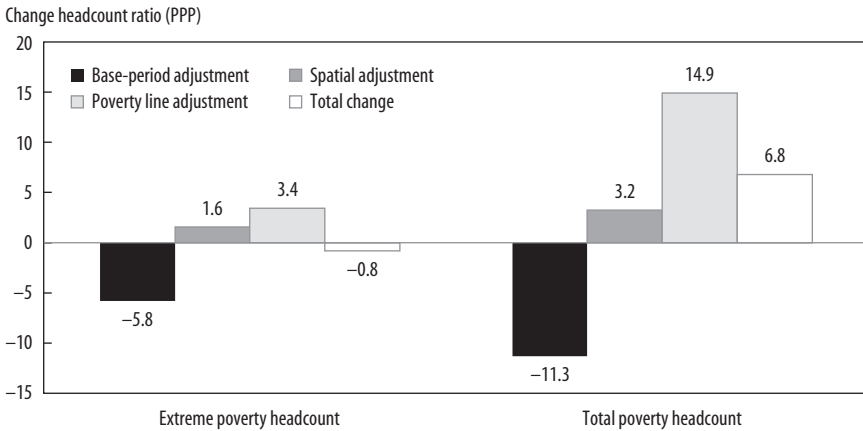
Change headcount ratio (PPP)

Source: Authors' calculations, based on official poverty lines from national statistics offices and SEDLAC data.

a.   The figure shows the decomposition into three components of the difference in poverty rates resulting from the use of 2011 versus 2005 PPP values. The base-period adjustment is the effect of deflating the welfare aggregate from 2005 to 2011 PPP values. The spatial adjustment is the effect of changing the spatial deflator (that is, relative prices) from 2005 PPP to 2011 PPP. The poverty line adjustment is the change in the nominal value of the poverty line. The 2011 PPP poverty lines selected are US\$3.00 and US\$6.00 per person per day (see table 3).

value in 2005 PPP to its value in 2011 PPP, while holding the other two components constant. We then repeat this process five more times until we have calculated all the possible combinations.[27]

Figure 5 shows the results of the Shapley decomposition for the changes in extreme and total poverty using the welfare aggregate of the closest household survey of each country to 2013. In the case of total poverty, the decomposition shows a substantial poverty-increasing effect of 14.9 percentage points from changing the nominal value of the poverty line and leaving unchanged the other two components. However, the \$4.00 per person per day poverty line at 2005 PPP values and the \$6.00 per person per day poverty line at 2011 PPP values are expressed in different spatial and temporal units. With respect to the PPP effect (that is, the spatial adjustment effect), poverty headcounts would increase by 3.2 percentage points, all else constant, reinforcing the effect of changing the nominal value of the poverty line. In contrast, the base-period effect—that is, the temporal adjustment effect—would reduce poverty by 11.3 percentage points, counterbalancing the significant positive effect of

27. The number of possible combinations is equal to the factorial (*n*!) of the number of components. See the appendix for technical details.

the other two components. The net change is approximately 6.8 percentage points in 2013. In the case of extreme poverty, the base period effect fully offsets the positive contribution of the PPP and the nominal value effects, leaving the proportion of extremely poor unchanged in 2013.

In Africa and South Asia, the change in poverty measurement using the 2011 PPP values reinforced the trend of poverty reduction in the majority of countries.[28] In Latin America, in contrast, measuring poverty with 2011 PPP values leads to an increase in total poverty and does not affect extreme poverty.

Concluding Remarks

Most countries monitor their own citizens' welfare and measure their living conditions on a regular basis. However, poverty measurement methodologies vary considerably across countries, which makes cross-country comparison and aggregations into regional and global trends difficult. To assess the world population's welfare, international organizations and researchers have promoted standardized methods to determine comparable cross-country poverty estimates by harmonizing a spatially deflated welfare aggregate and by estimating a single poverty line. At the regional level, poverty lines of $2.50 and $4.00 per person per day at 2005 PPP values are widely used in Latin America. Using these lines, 12 percent of the population in the region qualified as extremely poor in 2013, while 24 percent qualified as poor during the same year.

This paper provides inputs for updating the regional extreme and total poverty lines used for measuring poverty in Latin America as a whole. It is the first attempt to explicitly propose and document these inputs in the region. The recently released 2011 PPP values represent an excellent opportunity to estimate regional extreme and total poverty lines in Latin America. To achieve this objective, we collected the most comprehensive and up-to-date data on official extreme and total urban poverty lines, combined with the standardized microdata from the SEDLAC project. Unlike previous global estimates, we do not find a strong relationship between per capita income and the value of the poverty line. Therefore, we did not exclude any countries from regional estimates in Latin America and the Caribbean.

This paper sets regional poverty lines ranging from $2.50 to $3.20 per person per day for extreme poverty and from $5.00 to $6.80 per person per

28. Dykstra, Kenny, and Sandefur (2014).

day for total poverty. Depending on the regional poverty line selected, we find that approximately 7 to 11 percent of Latin America's population qualified as extremely poor in 2013, while approximately 24 to 35 percent of the population qualified as poor. To illustrate the sensitivity of the poverty rate to the value of the poverty line, we compare the results of using US$3.00 and $6.00 per person per day at 2011 PPP with US$2.50 and $4.00 per person per day at 2005 PPP. The poverty lines with the 2011 PPP values lead to an increase in total poverty rates in Latin America with respect to the 2005 PPP values, while the extreme poverty rate is unaffected. We believe that the approach described in this paper, together with the results and underlying data, could serve as valuable inputs for guiding the regional debate on poverty measurement in Latin America.

Appendix: Shapley Decomposition of Change in Regional Poverty Methodology from PPP 2005 to PPP 2011

A poverty rate P_s can be defined as a nonlinear function φ with components s—poverty line, CPI, and PPP. There are two possible values for s: $\{a, r\}$, where a and r refer to the proper set of components used to estimate the poverty headcount using either alternative (a) or currently used (r) poverty lines. Thus, the poverty rate is defined as $P_s = \varphi\,(\mathbf{y}_s, z_s)$; where z_s represents the poverty line of the set of components s, and $\mathbf{y}_s^t = \pi(y, cpi_s, ppp_s)$ is a vector of household incomes in time t that has been deflated using the set of components s.

Under this framework, equation A1 shows that the difference between P_a and P_r is not wholly due to changes in the poverty line, but also to spatial and temporal deflation using PPP and CPI, respectively.

(A1) $$P_a - P_r = \varphi\left(\mathbf{y}_a, z_a\right) - \varphi\left(\mathbf{y}_r, z_r\right).$$

Given that the differences between the two welfare distributions $\mathbf{y}_a$ and $\mathbf{y}_r$ are fully characterized by the use of different country-specific CPI and PPP, equation A1 could be expressed as follows:

(A2) $$P_a - P_r = \varphi\left(\pi\left(\mathbf{y}, cpi_a, ppp_a\right), z_a\right) - \varphi\left(\pi\left(\mathbf{y}, cpi_r, ppp_r\right), z_r\right).$$

The poverty headcount function φ is not additively separable among its components, which means that the sum of the marginal effects of all the components is not equal to the total change. Therefore, to shed light on the contribution of each of the components, we apply a decomposition procedure for distributional analysis based on the Shapley value suggested

by Shorrocks to estimate the relative weight of each component of the difference in equation A2.[29]

The Shapley-Shorrocks procedure consists of constructing a counterfactual headcount based on different combinations of components by substituting one component at a time. The poverty headcount thus obtained by modifying only one component at a time—say, the PPP component

$$(\varphi(\pi(\mathbf{y}, cpi_a, ppp_b), z_a))$$

represents a counterfactual headcount of the PPP component, which can be interpreted as the poverty headcount that would result if the PPP changed while the other components remained constant. Thus, the marginal contribution of the PPP would be the differences between the counterfactual headcount and the observed headcount, $\varphi(\pi(\mathbf{y}, cpi_a, ppp_a), z_a)$. Given that the poverty headcount is a function of three components, the procedure is done six times to account for all possible combinations.[30]

Because the marginal effects of each component do not sum to the total change between the headcounts obtained with the current and alternative poverty lines, the decomposition suffers from path dependency. Additionally, the order in which each component is changed affects the marginal effects of each component. To solve that issue, the Shapley-Shorrocks value of a component is the average of all possible marginal effects from changing that particular component. Figure A1 shows all the paths for computing the marginal effects for the three components.

For instance, in the case of the poverty line component, the Shapley value $(\partial P_{ra}/\partial z_{ra})$ is the average of poverty headcount differences when just the poverty line switches from z_r to z_a for all the possible paths. The sum of each marginal effect is equal to the total change in poverty headcounts. Algebraically,

$$(A3) \quad \frac{\partial P_{ra}}{\partial z_{ra}} = \frac{2}{6}\Big[\varphi\big(\pi\big(y, cpi_r, ppp_r\big), z_a\big) - \varphi\big(\pi\big(y, cpi_r, ppp_r\big), z_r\big)\Big]$$

$$+ \frac{1}{6}\Big[\varphi\big(\pi\big(y, cpi_a, ppp_r\big), z_a\big) - \varphi\big(\pi\big(y, cpi_a, ppp_r\big), z_r\big)\Big]$$

$$+ \frac{1}{6}\Big[\varphi\big(\pi\big(y, cpi_r, ppp_a\big), z_a\big) - \varphi\big(\pi\big(y, cpi_r, ppp_a\big), z_r\big)\Big]$$

$$+ \frac{2}{6}\Big[\varphi\big(\pi\big(y, cpi_a, ppp_a\big), z_a\big) - \varphi\big(\pi\big(y, cpi_a, ppp_a\big), z_r\big)\Big].$$

29. Shorrocks (2012).
30. The number of changes is equal to $n!$, where n is the numbers of components.

F I G U R E   A 1 .   Shapley Decomposition Paths

$$\varphi\left(\pi\left(\mathbf{y}, cpi_r, ppp_r\right), z_r\right)$$

$$\varphi\left(\pi\left(\mathbf{y}, cpi_a, ppp_r\right), z_r\right) \qquad \varphi\left(\pi\left(\mathbf{y}, cpi_r, ppp_a\right), z_r\right) \qquad \varphi\left(\pi\left(\mathbf{y}, cpi_r, ppp_r\right), z_a\right)$$

$$\varphi\left(\pi\left(\mathbf{y}, cpi_a, ppp_a\right), z_r\right) \qquad \varphi\left(\pi\left(\mathbf{y}, cpi_r, ppp_a\right), z_a\right) \qquad \varphi\left(\pi\left(\mathbf{y}, cpi_a, ppp_r\right), z_a\right)$$

$$\varphi\left(\pi\left(\mathbf{y}, cpi_a, ppp_a\right), z_a\right)$$
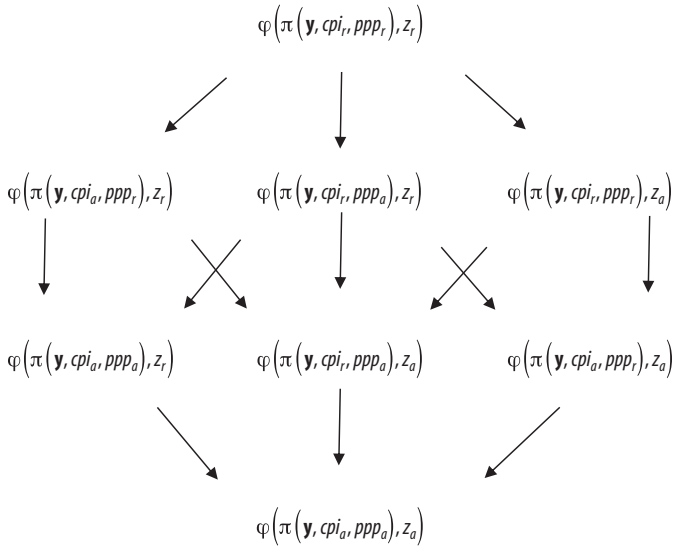
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