An axiomatic approach to counting the world's poor

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UNITED NATIONS
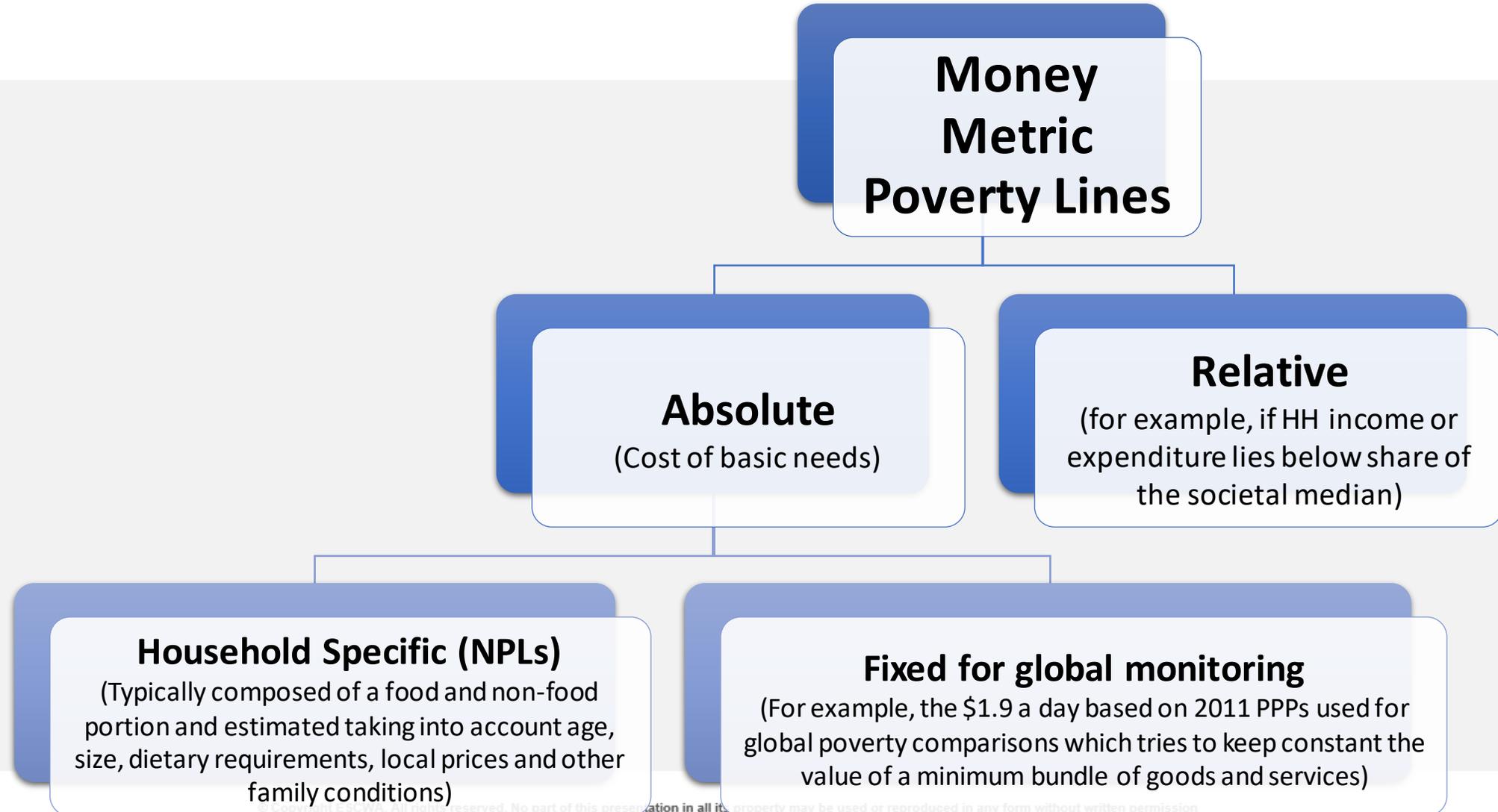
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Shared Prosperity **Dignified Life**

Broad typology of poverty lines

Money Metric Poverty Lines

Absolute
(Cost of basic needs)

Relative
(for example, if HH income or expenditure lies below share of the societal median)

Household Specific (NPLs)
(Typically composed of a food and non-food portion and estimated taking into account age, size, dietary requirements, local prices and other family conditions)

Fixed for global monitoring
(For example, the $1.9 a day based on 2011 PPPs used for global poverty comparisons which tries to keep constant the value of a minimum bundle of goods and services)

Poverty measurement challenges

- Fixed lines have clear problems – do not address country specificity and give potentially misleading results.

- Relative lines are also problematic since they are closer to inequality than poverty measures.

- These challenges are well known. Atkinson report recommended maintain the $1.9 till 2030 and introducing MPIs.
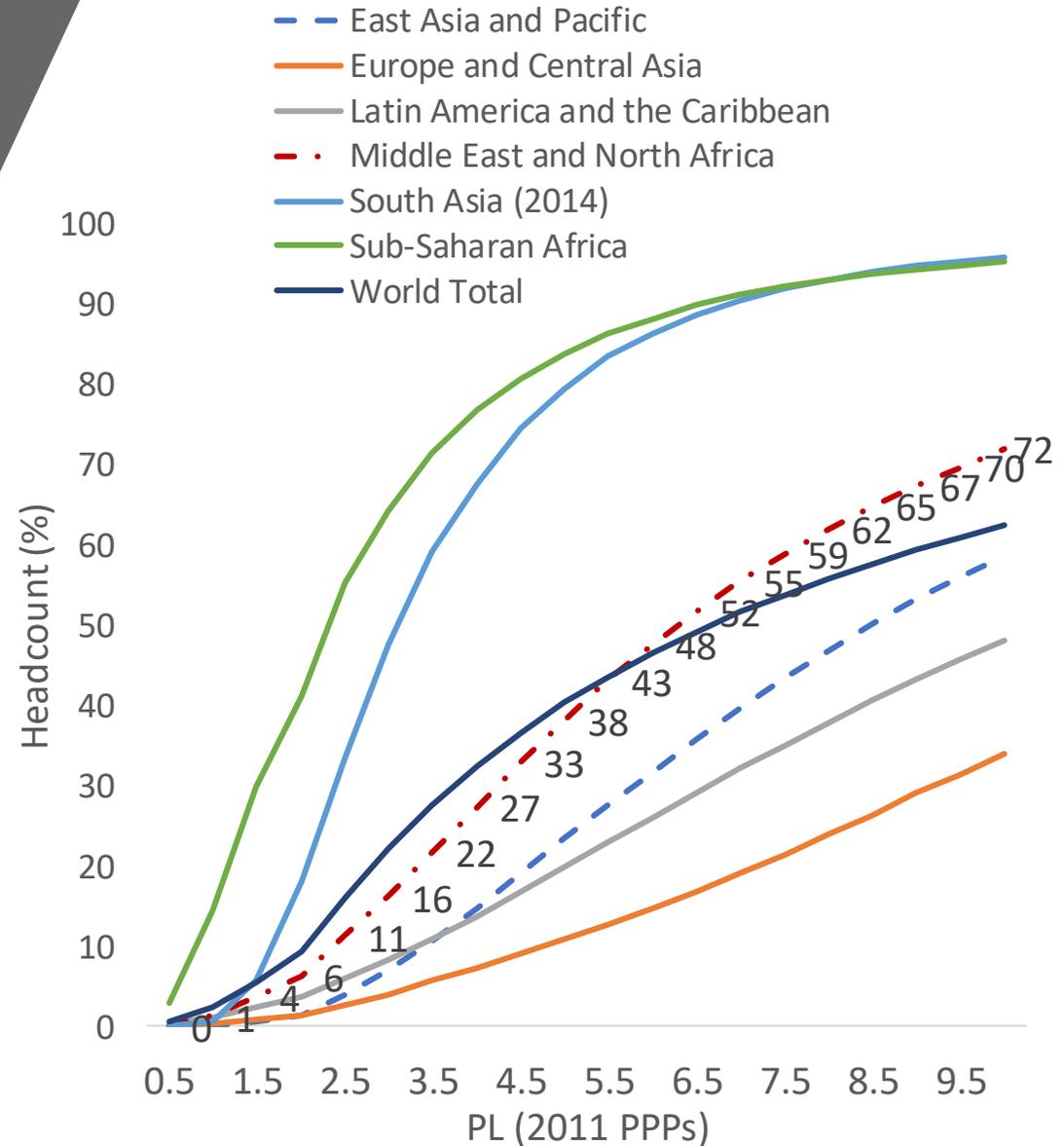
2 Solutions proposed by the WB

Solution 1: Use different lines for different country groups *Jolliffe, Dean; Prydz, Espen Beer (2016)*

Solution 2: *"Jolliffe, Dean; Prydz, Espen Beer. 2017. Societal Poverty: A Relative and Relevant Measure. Defined as $1.00 plus half the median level of consumption in a country ($1.15 in 2017PPPs) or the international poverty line of $1.9 if $1.00 plus half the median level of consumption is lower than $1.9.*

Shortcoming of the SPL

- A shortcoming of the linearity assumption of the SPL is that it allows the predicted lines to keep rising without limit in highest-income countries. To the extent that poverty lines rely on consistent bundles of essentials, whose real costs are constrained by market forces, they are unlikely to reach $40 or more a day (in 2011 PPP) even in the highest-income countries.

- This also has implications on poverty reduction efforts since it would raise the targeted benchmark in upper middle and high income countries to unreasonable levels.

Motivation

- To propose a new method that maintains **comparability across countries and over time** in counting the poor and is consistent with **behavioral tendencies** of households as informed by classical economic theory.

- To this end we propose an **Axiomatic Poverty Line (APL)** that is grounded in theory and backed by empirical evidence on the **relation between absolute national poverty lines and income**.

First re-examine the relationship between mean or median income/consumption and NPLs.

- Elasticity of the poverty line to the mean/median income is thus positive across a wide group of countries and contexts but it is clear that the relationship is non- linear.

- For countries with higher levels of mean income, elasticity of the poverty line is lower.

National poverty lines vs. mean income As reported by POVCAL and statistical agencies


Source: Authors' calculations.
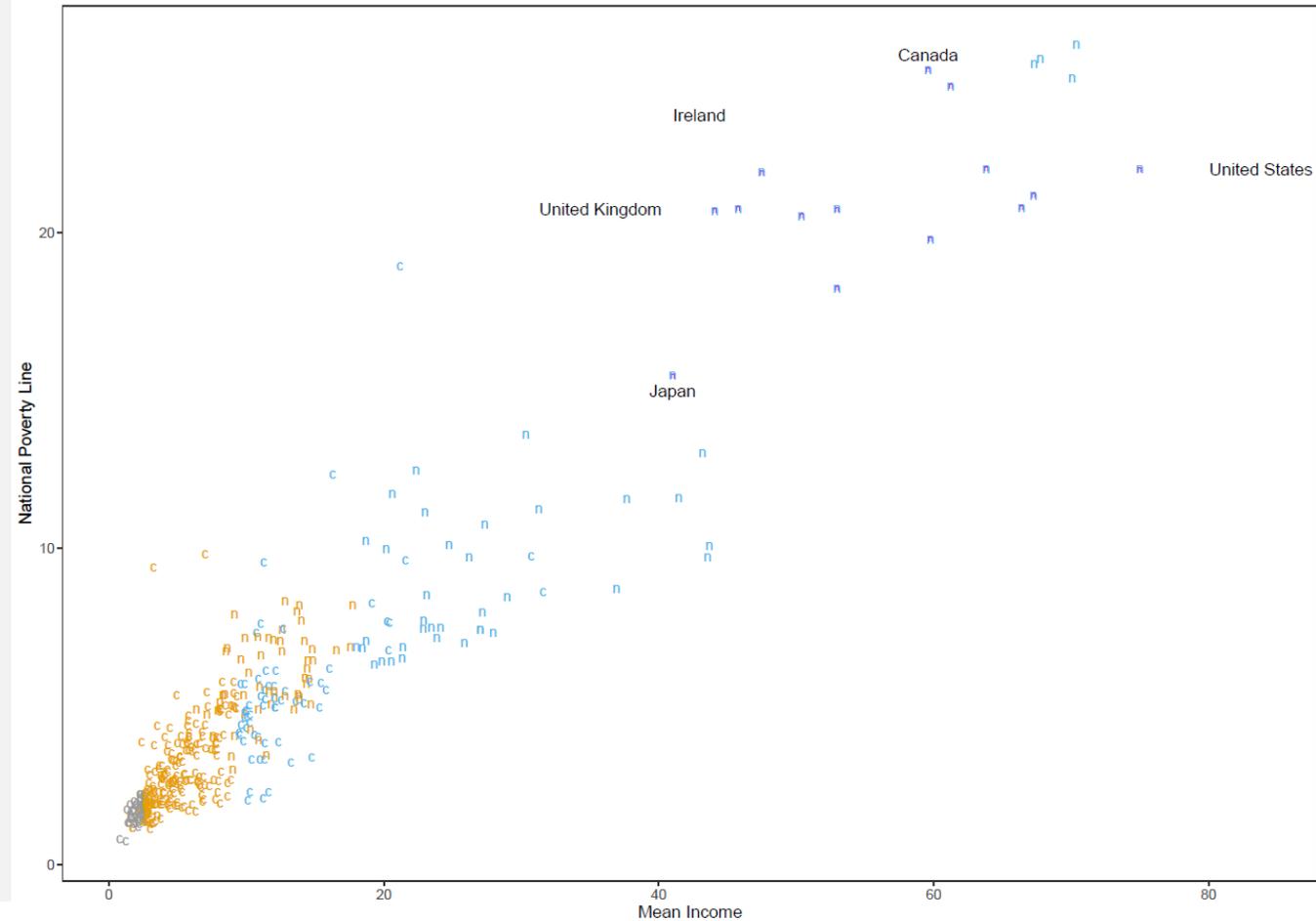
Another way of saying this is that

1. Lower-income countries tend to have very high ratios of absolute national poverty lines to income while the opposite is true for the highest-income countries.

2. Beyond a certain level of income the national poverty lines for richest countries level off.

National poverty lines as share of median income and median income
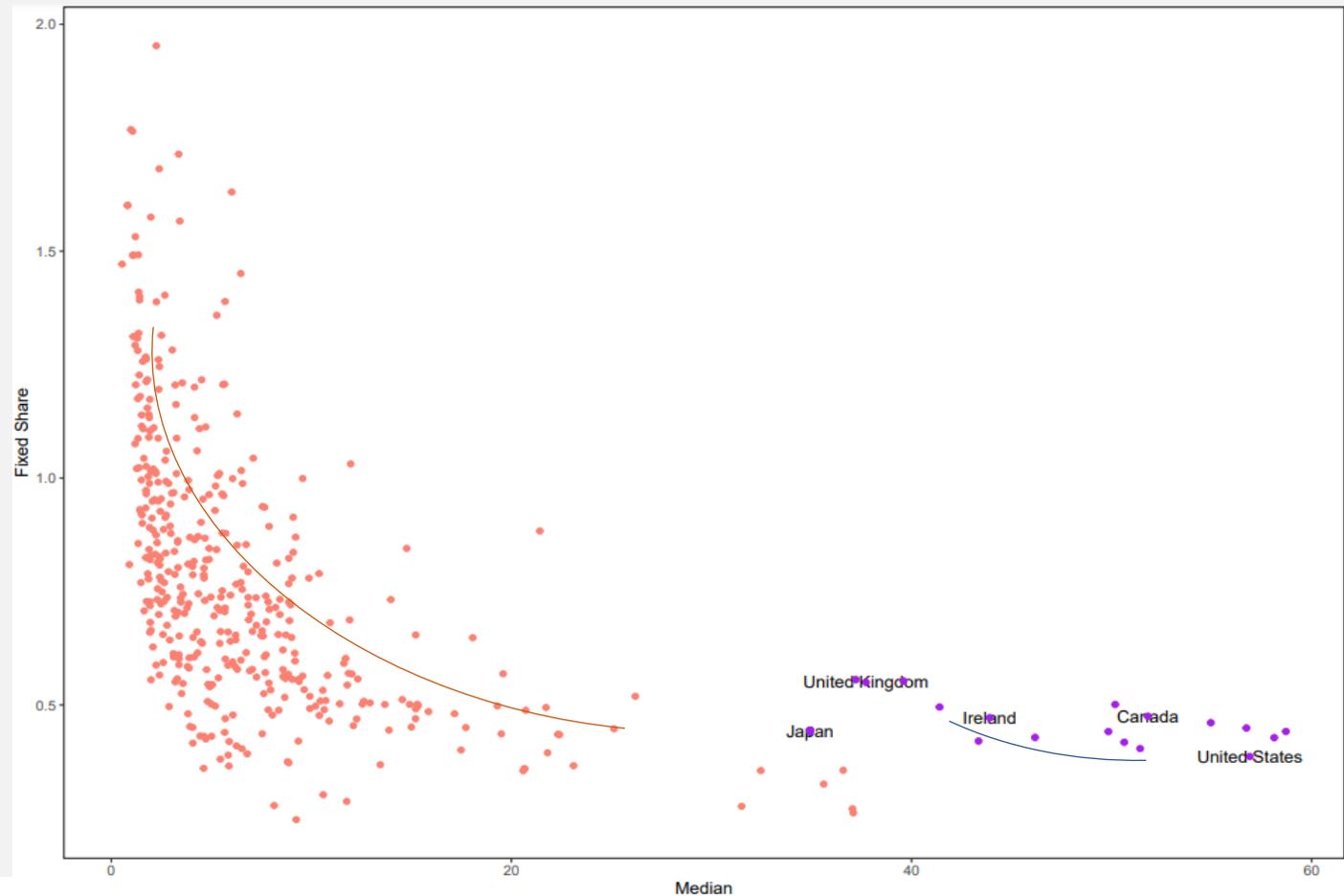
Hence key feature of Axiomatic poverty lines

- In light of such stylized facts, following Abu-Ismail et al. (2012) we propose an Axiomatic Poverty Line where the ratio of the poverty line to mean income should be the anchor for global poverty measurement (declining as income rises).

- Theoretically this means going back to Engel's Law

Engel's Law

Engel's law postulates that the food share of total expenditure is inversely related to the logarithm of income (Perali, 2008). Taking the cost of basic needs (i.e., absolute poverty line) as a measure of food expenditure, and equating expenditure with income, this can be written as follows, with a scale parameter γ:

$$\frac{z_{i,t}^{u}}{M_{i,t}} = \gamma \left(logM_{i,t}\right)^{-1}$$

Taking a natural logarithmic transformation, $log\left(z_{i,t}^{u}\right)$ is made a function of a constant term $log(\gamma)$ and a complex term $logM_{i,t} - log\left(logM_{i,t}\right)$. The latter polynomial term in logarithms can be first-order approximated by $logM_{i,t}$.

Deriving APL from Engel's Law

- Building on Engel's law as expressed in Equation 8, we posit that the cost of basic needs declines as a share of household income at higher incomes. Reflecting this insight, a simple regression model is applied for countries' poverty lines as a function of their mean incomes, in logarithmic form.

- As a technical innovation to Jollife and Prydz's (2019) specification, a binary indicator is added to distinguish countries using consumption from those using income in their national surveys ($C_i = 1$ for consumption).

- The model takes the following estimable log-log form

$$log\ z_{i,t}^{u} =\ \alpha_0 +\ \beta_1 \log(M_{i,t}) + \beta_2 C_i + \beta_3 D_i + \varepsilon_{i,t}$$

Results (1a)

- Estimating the log-log regression model in equation 9 yields the following results, with all variables significant at the 5% level:

$$log\ z_{i,t}^{u} = \alpha_0 + \beta_1 \log(M_{i,t}) + \beta_2 C_i + \beta_3 D_i + \varepsilon_{i,t}$$

R-Squared: 90.69%. Mean Absolute Error: 55%, Mean Absolute Percentage Error: 33%

Sample size: 428 country-year observations for 144 unique countries with absolute poverty lines

Predicted vs. observed poverty lines
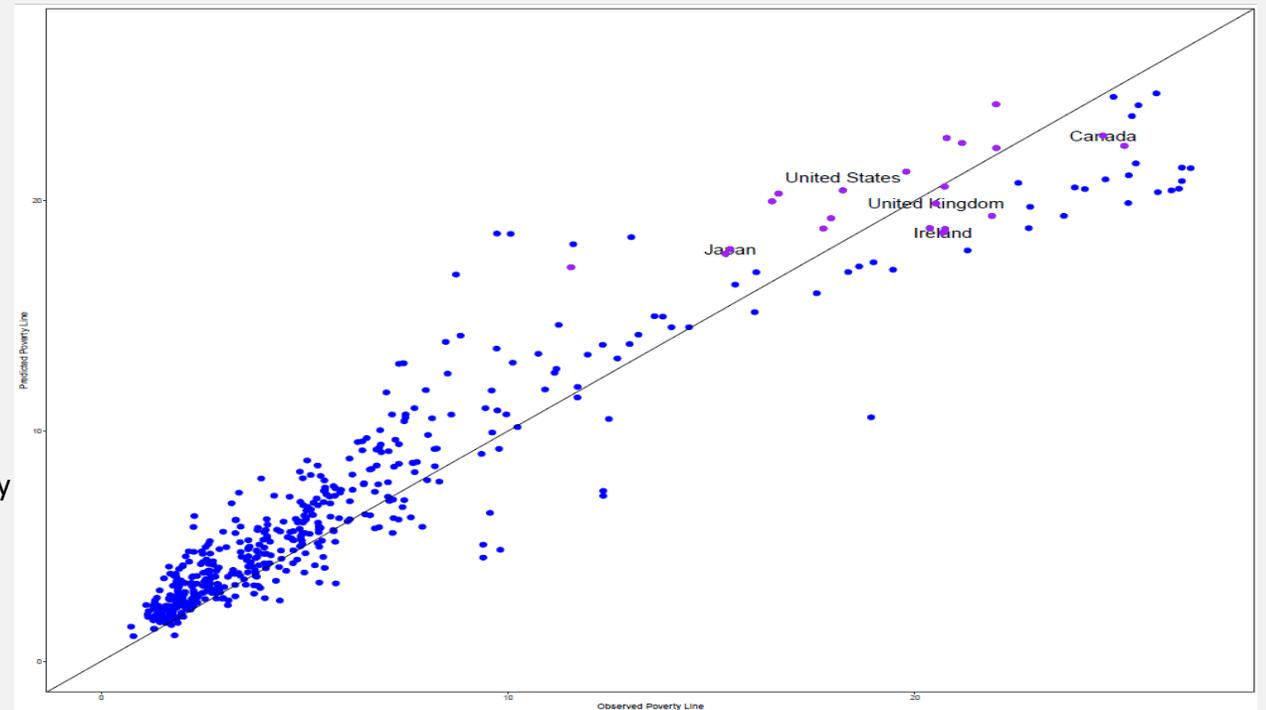
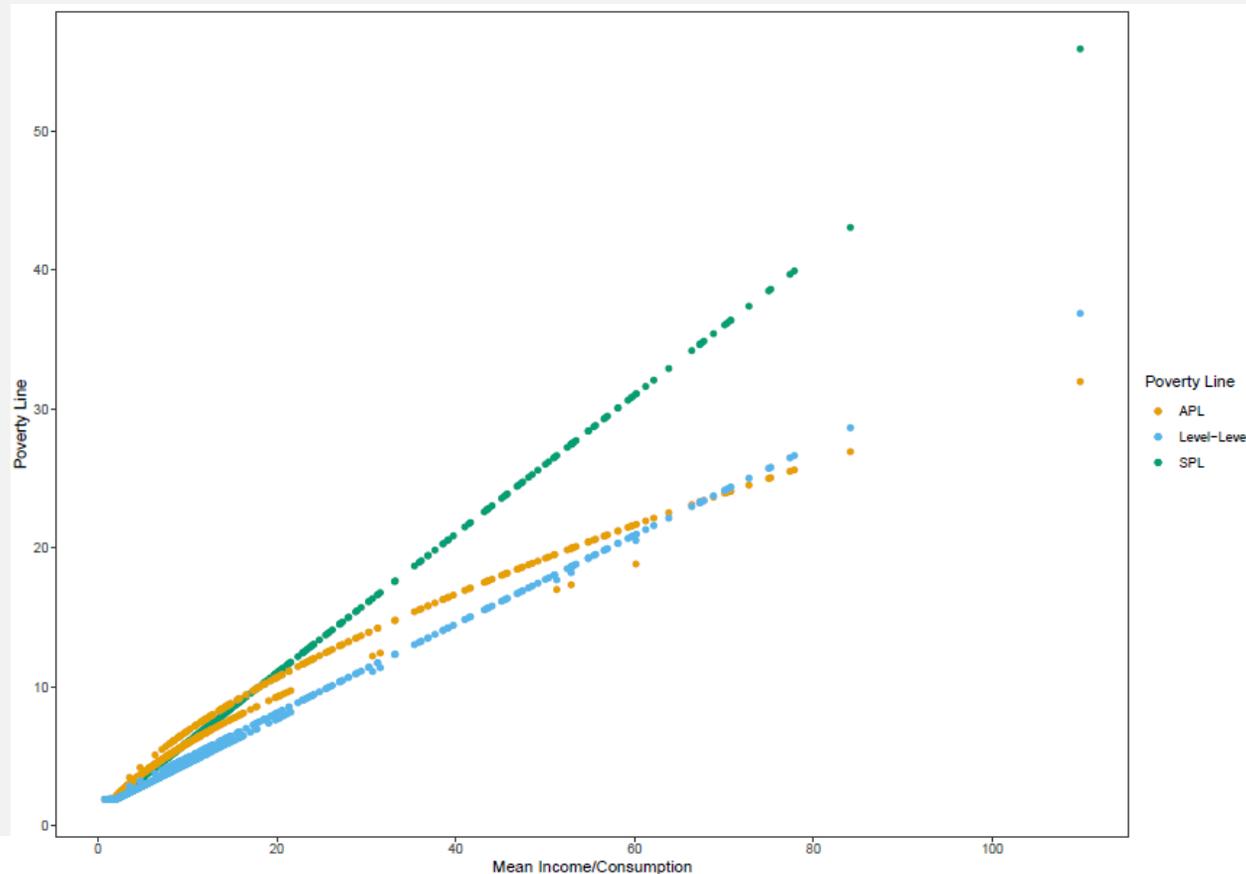# Results (1.b) Empirically this makes sense given national poverty lines (absolute) and mean income (in 2011 PPPs) have a good fit, in log-log form

Figure 3. National poverty lines (absolute) and mean income (in 2011 PPPs), in log form
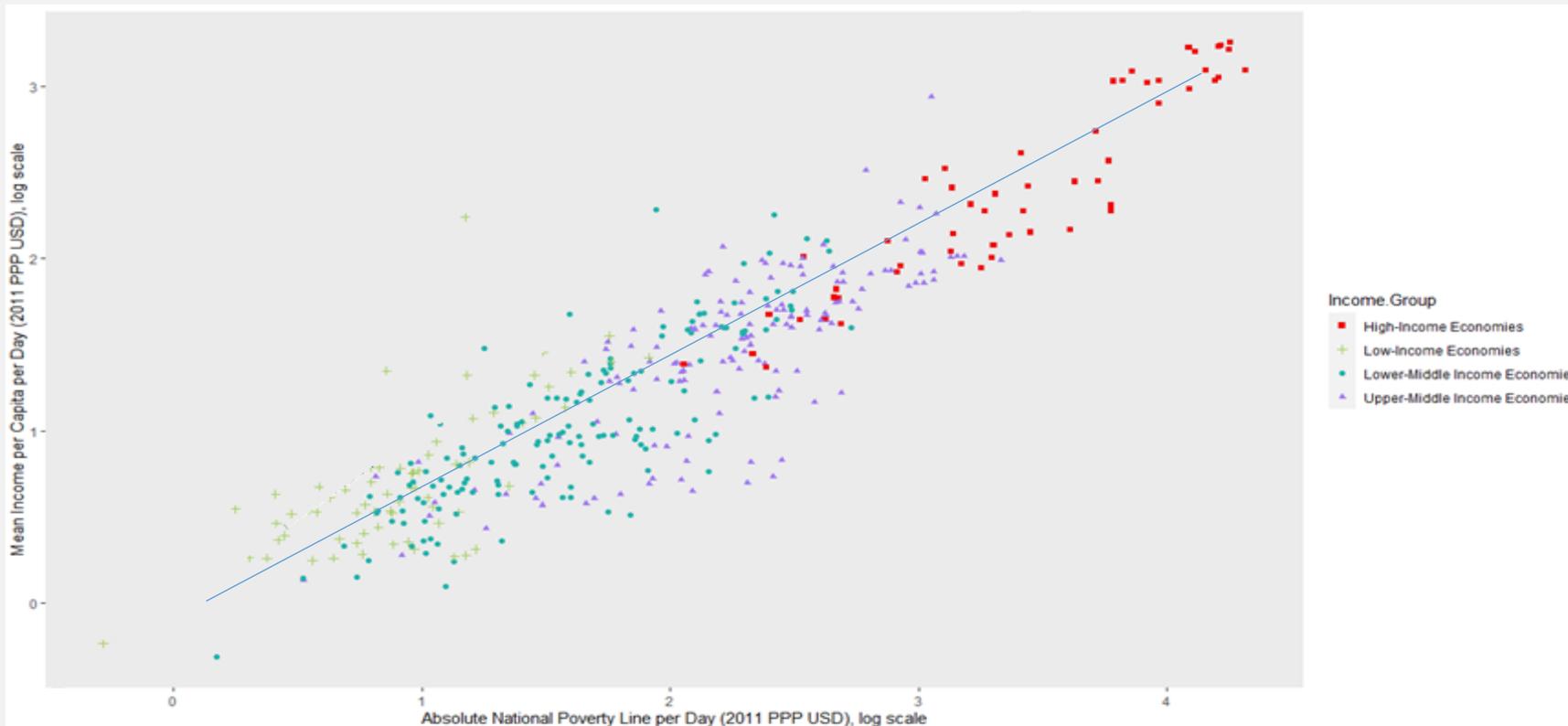
Results (2): as expected we have constrained PLs for higher income countries

APL and alternative models vs. mean income

Results (3) closer approximation to NPLs for richer countries but higher PL estimates for poorer countries

Weighted poverty lines (NPL, SPL and APL) by region

Region	2020 (Countries with observed NPLs)		
	NPL	**SPL**	**APL**
Arab region	3.83	3.35	4.10
East Asia and the Pacific	4.86	9.06	8.43
Europe and Central Asia	14.37	16.20	13.05
Latin America and the Caribbean	6.94	7.93	8.56
North America	22.27	36.80	28.68
South Asia	1.96	2.67	3.72
Sub-Saharan Africa	1.86	2.07	2.76
World-average	5.95	8.48	7.92

Results 4: As a result poverty headcounts in 2020 significantly higher for poorer countries and lower for richer ones

Poverty headcounts and ranks by region for SPL, APL and $1.9

	Headcount poverty rates (%)			Ranks (1 being lowest poverty)		
	$1.9	SPL	APL	$1.9	SPL	APL
Arab Region	11.91	24.27	38.53	6	4	4
East Asia and the Pacific	0.63	22.22	23.02	3	3	3
Europe and Central Asia	0.47	20.26	15.62	2	2	1
Latin America and the Caribbean	2.85	36.68	41.45	4	6	5
North America	0.00	28.11	19.21	1	5	2
South Asia	5.28	18.91	42.22	5	1	6
Sub-Saharan Africa	41.02	43.41	59.52	7	7	7
Worldwide	8.08	25.86	33.87			

Results (5) Poverty reduction is faster (consistent with $1.9)

Poverty Headcount ratios (%) 2015-2030

Regions	Models	2015	2030
South Asia	SPL	17.13	18.80
	APL	46.04	26.59
	$1.9	11.09	0.05
Sub-Saharan Africa	SPL	43.75	34.36
	APL	60.03	49.28
	$1.9	42.41	25.46
Europe & Central Asia	SPL	20.27	20.26
	APL	16.12	12.46
	$1.9	0.71	0.01
Arab Region	SPL	20.71	21.10
	APL	35.33	24.51
	$1.9	6.29	7.04
Latin America & the Caribbean	SPL	37.72	36.57
	APL	41.43	35.97
	$1.9	1.48	1.21
East Asia & the Pacific	SPL	24.17	22.21
	APL	31.22	15.31
	$1.9	1.77	0.04
North America	SPL	28.39	28.08
	APL	20.44	15.62
	$1.9	0	0
Worldwide	**SPL**	**26.09**	**24.40**
	APL	**36.29**	**25.60**
	$1.9	**8.77**	**4.72**

Limitations

1. Forecasted results are affected by results of few large countries?

2. We don't know much about absolute poverty in rich countries.

2. The APL is not as simple as SPL.

Concluding remarks

Despite limitations, we think this is a more realistic measure for global poverty monitoring.

Given current global crises and dynamics, such an effort is well worth it.

Finally, with more data and improvements in PPPs results are expected to improve.