The Impact of COVID-19 on Global Inequality and Poverty[1]

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Motivation

- Though COVID-19 started as a health crises, it has had catastrophic economic consequences.
- Quantifying the distribution of these consequences can help understand
  - in which countries the economic consequences have been more severe,
  - the degree to which mitigating economic consequences should be prioritized vis-à-vis other consequences,
  - the extent to which equalizing policies should be preferred over broad recovery policies.

Related literature & contribution

- **Global inequality:** Milanovic (2002); Anand & Segal (2008); Lakner & Milanovic (2016); Milanovic (2021).
- **Global poverty:** Ravallion, Datt, van de Walle (1991); Ravallion, Chen & Sangraula (2009); Chen & Ravallion (2010); Ferreira et al. (2016); Ferreira et al. (2021); Decerf et al. (2021).
- **Inequality during COVID-19:**
  - *Global*: Deaton (2021); WIR (2022); Yonzan et al. (2021).
  - *Cross-country*: Lustig et al. (2021); Bundervoet et al. (2021); Clark et al. (2021); Narayan et al. (2022).
- **Poverty during COVID-19**: World Bank (2020); Mahler et al. (2021); Sumner et al. (2021).

Contribution: We attempt to quantify the impacts on global (inter-personal) inequality and poverty in 2020.

Method

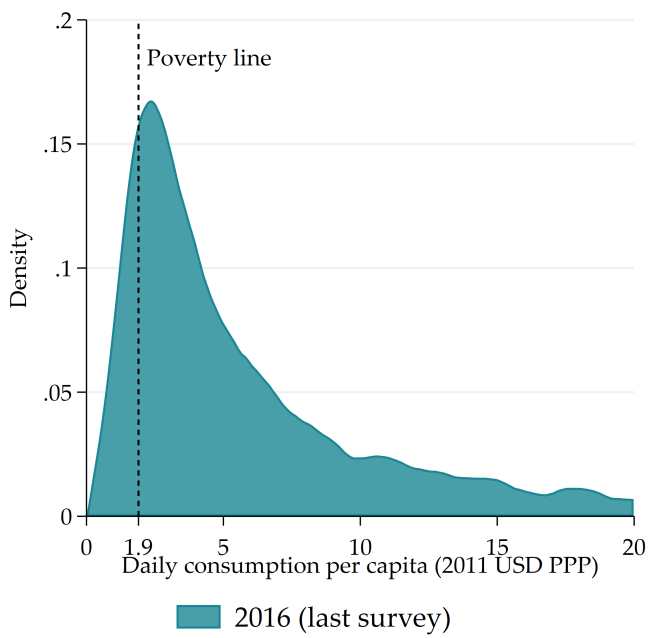
We will generate three welfare distributions for all countries.

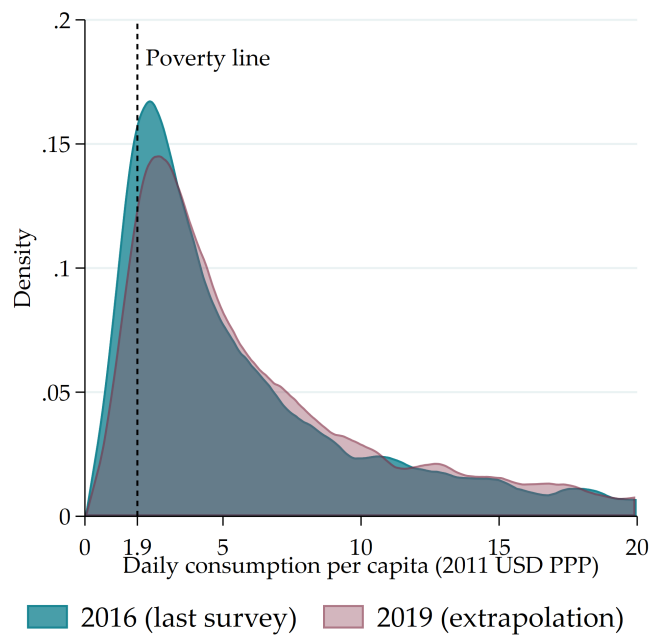
By welfare, we mean consumption for developing countries and disposable income for developed countries and countries in Latin America.

1. A 2019 welfare distribution
2. A counterfactual 2020 welfare distribution (no pandemic scenario)
3. A 2020 welfare distribution (with pandemic scenario)

2019 welfare distribution

- Grow the household income/consumption from latest household survey in line with growth in national accounts.
  - Similar to the procedure the World Bank uses for reporting global poverty.
  - Assumes that inequality has not changed since the time of the survey.





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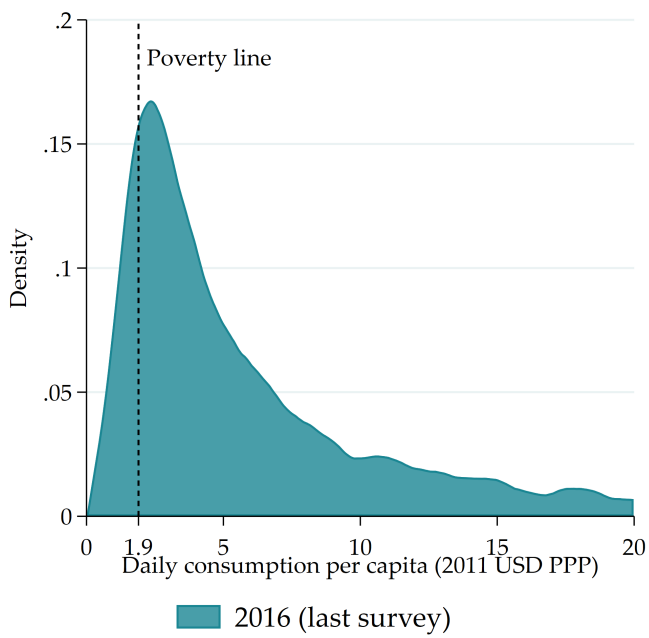

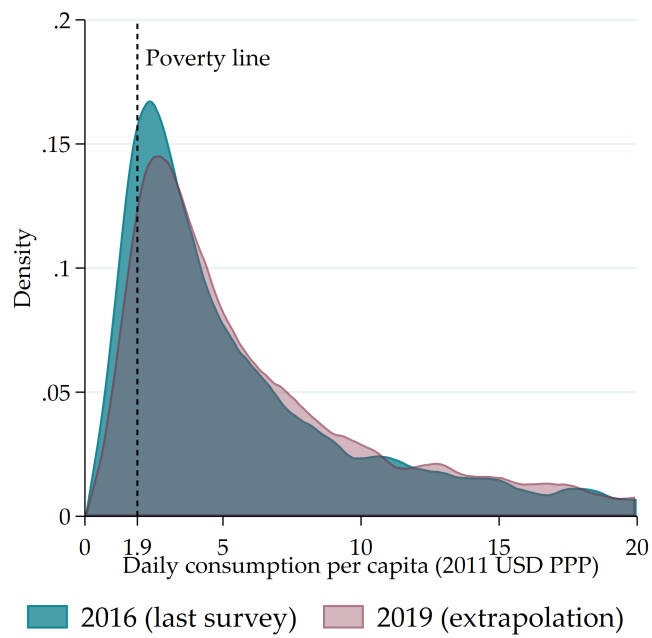

- Countries without any household survey (~3% of the global population) we assign the regional distribution.

Counterfactual 2020 welfare distribution (no pandemic scenario)

- Assume that all households' welfare in 2020 grew by the real per capita GDP growth forecasted in fall 2019 (Macro & Poverty Outlooks).

- To account for the difference in growth rate in the mean welfare in household surveys and the growth in national accounts, the per capita GDP growth rates are adjusted with a pass-through rate of 0.85 (Lakner et al., forthcoming).

2020 welfare distribution (Method 1)

Where available, we will use data from national statistical offices (NSO).

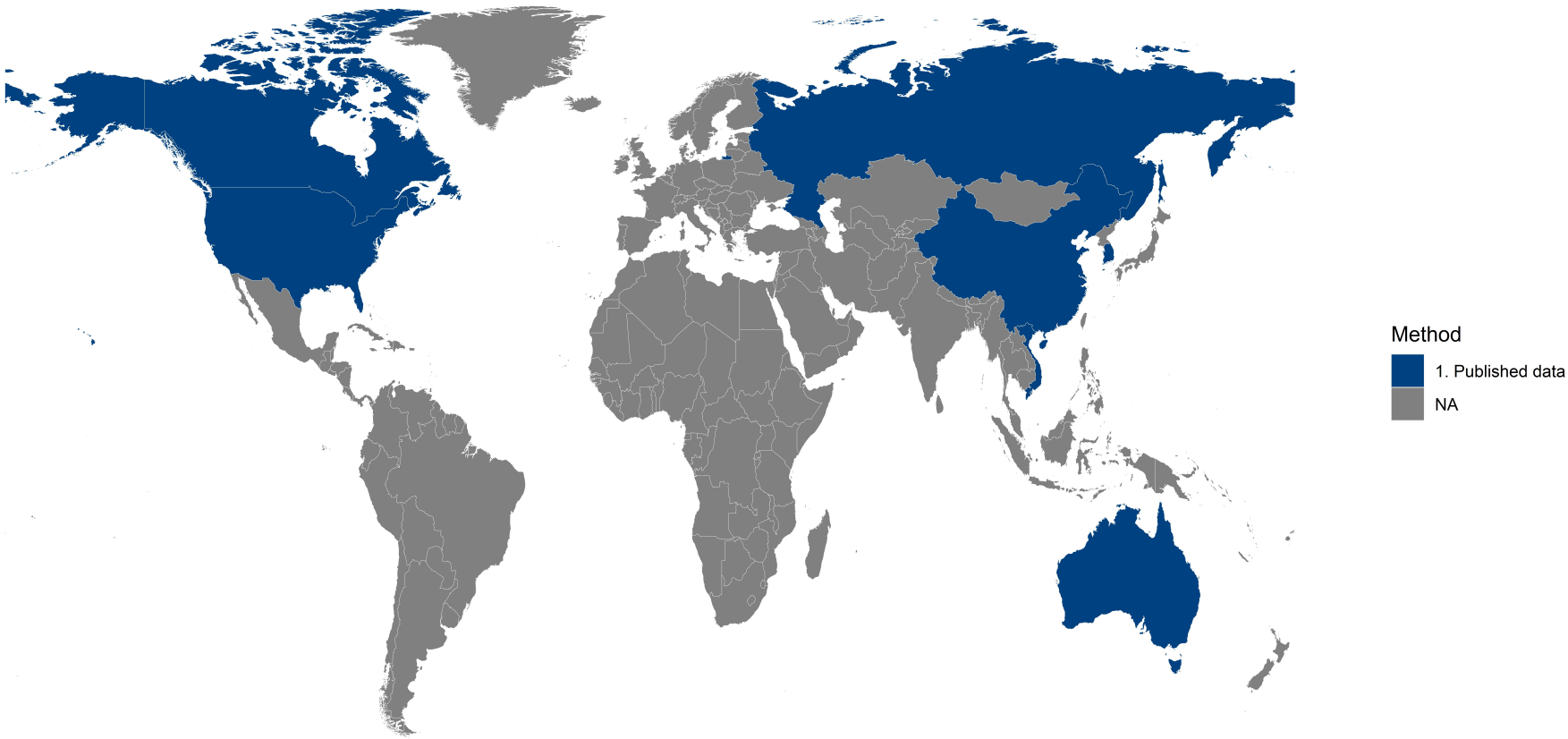

Figure 1: NSO data for the US

Table C-3.

Distribution Measures Using Post-Tax Income and Equivalence-Adjusted Post-Tax Income: 2019 and 2020

(Information on confidentiality protection, sampling error, nonsampling error, and definitions is available at <https://www2.census.gov/programs-surveys/cps/techdocs/cpsmar21.pdf>)

Measure	2019		2020		Percent change (2020 less 2019)*, 2	
	Estimate	Margin of error[1] (±)	Estimate	Margin of error[1] (±)	Estimate	Margin of error[1] (±)
POST-TAX INCOME[3]						
Shares of Aggregate Income by Percentile						
Lowest quintile	3.8	0.06	4.2	0.06	*8.7	2.19
Second quintile	9.5	0.09	9.9	0.09	*3.3	1.26
Third quintile	15.2	0.11	15.5	0.11	*2.1	0.91
Fourth quintile	23.2	0.13	23.4	0.14	0.6	0.75
Highest quintile	48.2	0.30	47.1	0.33	*−2.3	0.83
Top 5 percent	20.3	0.34	19.5	0.36	*−4.0	2.23

Phone surveys + sectoral national accounts (Method 2)

- In collaboration with NSOs, the World Bank has collected and harmonized phone survey data from 70 countries over the course of the pandemic.

- Phone surveys contain information if households experienced an income *gains*, *losses*, or *no change*, however
  1. cannot be linked to prior household surveys (*which?*) and
  2. do not reveal the magnitude of the losses (*how much?*).

Method 2 (first issue, *which?*)

(i) In the phone surveys, we predict the probability that households experienced a change in income based on their education, household and demographic characteristics, and urban/rural residence.

(ii) Based on the probabilities from (i), each household in the 2019 distribution is randomly assigned income *gain*, *no change*, or *loss*.

Example (first issue, *which?*)

Table 1: High Frequency Phone Survey

Household	Area of residence	Education	Income change
A	Rural	<Primary	Increase
B	Rural	<Primary	Decrease
C	Rural	<Primary	No change
D	Rural	<Primary	Decrease

Table 2: Welfare distribution, 2019

Household	Area of residence	Education	Income change
X	Rural	<Primary	?
Y	Rural	<Primary	?
Z	Rural	<Primary	?

Robustness, NGA

Method 2 (second issue, *how much?*)

(i) We have 3 groups within rural and 3 within urban sectors.

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$$g_t^{rur} = g_t^{rur+} \times s_{t-1}^{rur+} + g_t^{rur-} \times s_{t-1}^{rur-} + g_t^{rur0} \times s_{t-1}^{rur0}$$

where s_{t-1}^{rur+} is share of income for those with increased income.

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We know $g_t^{rur0} = 0$: $\Rightarrow g_t^{rur} = g_t^{rur+} \times s_{t-1}^{rur+} + g_t^{rur-} \times s_{t-1}^{rur-}$.

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(ii) We want to aggregate gains/losses such that they are consistent with aggregate growth in national accounts (which we have).

$$g_t^{nat} = g_t^{rur} \times s_{t-1}^{rur} + g_t^{urb} \times s_{t-1}^{urb}.$$

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Further concerns:

a. We do not know rural/urban growth rates (g_t^{rur}/g_t^{urb}).

b. The above equation is not identified.

$$g_t^{rur} = g_t^{rur+} \times s_{t-1}^{rur+} + g_t^{rur-} \times s_{t-1}^{rur-}.$$

Further assumptions

1. We distribute sectoral growth to urban/rural households as follows:
   - Growth from agriculture $\rightarrow$ rural households
   - Growth from industry $\rightarrow$ urban households
   - Growth from services $\rightarrow$ split by urban/rural income shares

For instance the rural sector:

$$g_t^{rur} \times s_{t-1}^{rur} = (g_t^{agr} \times s_{t-1}^{agr}) + \theta(g_t^{ser} \times s_{t-1}^{ser})$$

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In terms of growth contribution and replace θ by income share:

$$g_t^{c,rur} = g_t^{c,agr} + s_{t-1}^{rur} \times g_t^{c,ser} \tag{1}$$

Further assumptions ..

$$g_t^{rur} = g_t^{rur+} \times s_{t-1}^{rur+} + g_t^{rur-} \times s_{t-1}^{rur-}.$$

2. Household with income *increases* grew according to pre-pandemic expectation.

- For example, if we expected the rural economy of a country to grow by 5% in 2020 before COVID spread, we assign all rural households whose income increased in 2020 a 5% increase.

Further assumptions ..

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2. Household with income *increases* grew according to pre-pandemic expectation.

- For example, if we expected the rural economy of a country to grow by 5% in 2020 before COVID spread, we assign all rural households whose income increased in 2020 a 5% increase.

Replace households with income increases with pre-COVID growth ($g_t^{rur+} = g_{t,preCOVID}$):

$$g_t^{rur} = g_{t,preCOVID}^{rur} \times s_{t-1}^{rur+} + g_t^{rur-} \times s_{t-1}^{rur-}.$$

Rewrite above in terms of growth contribution:

$$g_t^{c,rur} = (g_{t,preCOVID}^{rur} \times s_{t-1}^{rur+} + g_t^{rur-} \times s_{t-1}^{rur-}) \times s_{t-1}^{rur} \qquad (2)$$

Further assumptions ...

Equating (1) & (2), we can backout g_t^{rur-}:

$$g_t^{rur-} = \frac{\left(g_t^{c,agr}/s_{t-1}^{rur} + g_t^{c,ser}\right) - \left(g_{t,preCOVID}^{c,agr} + s_{t-1}^{rur} \times g_{t,preCOVID}^{c,ser}\right) \times s_{t-1}^{rur+}}{s_{t-1}^{rur-}}$$

where $g_t^{rur+} = g_{t,preCOVID}^{rur} = g_{t,preCOVID}^{c,agr} + s_{t-1}^{rur} \times g_{t,preCOVID}^{c,ser}$.

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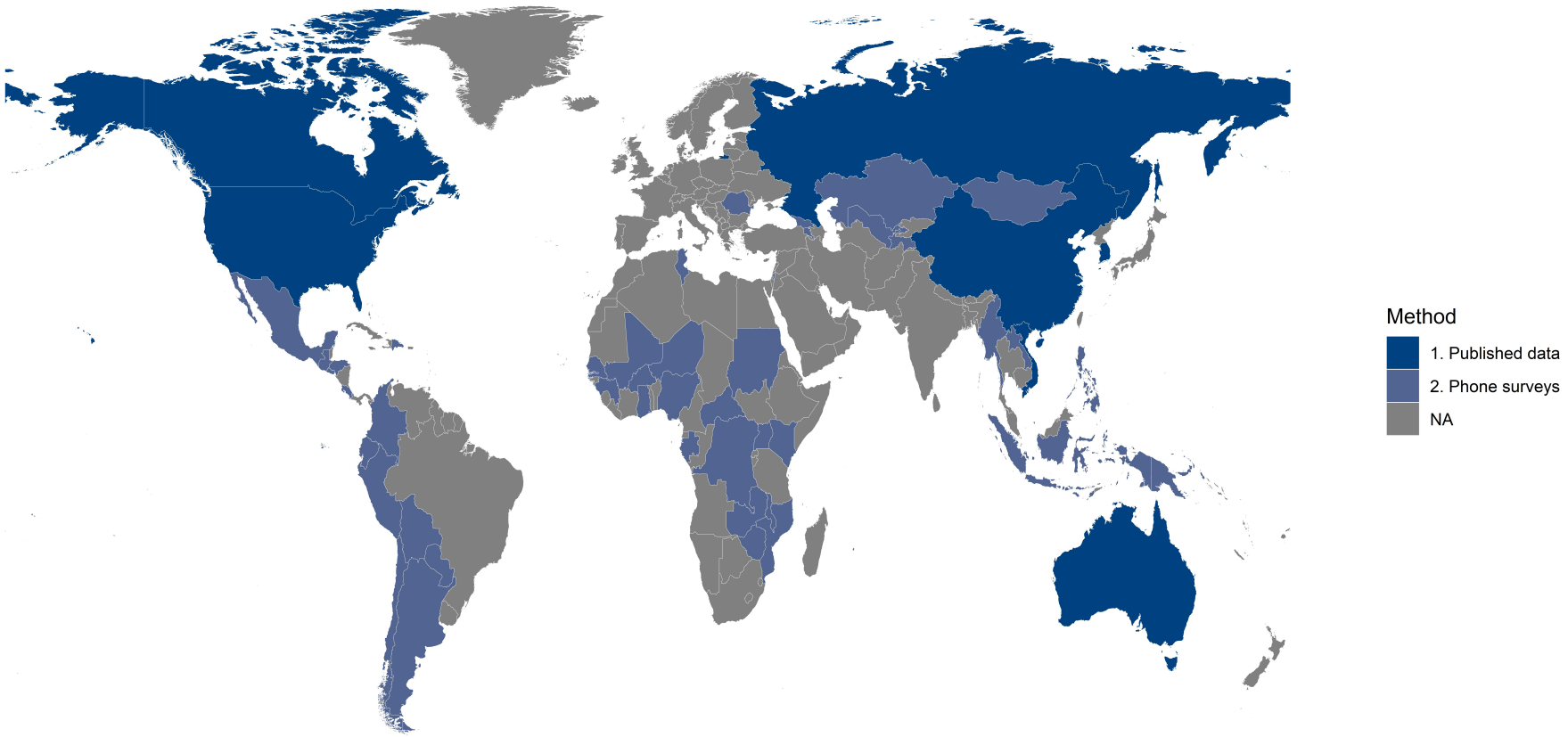
where $g_t^{rur+} = g_{t,preCOVID}^{rur} = g_{t,preCOVID}^{c,agr} + s_{t-1}^{rur} \times g_{t,preCOVID}^{c,ser}$.

3. We assume that all rural households that experienced an income loss, lost the same share of their income (and similarly for gains and for urban households).

Robustness, randomized growth

Figure 2: Method to recover 2020 welfare distributions



Remaining methods (Methods 3-6)

3. Simulations published in the literature:
   - India: Gupta et al. (2021)
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4. Sectoral growth rates: Assume all agricultural growth accrues to rural households, industry growth to urban households, and services to both based on their income shares.

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4. Sectoral growth rates: Assume all agricultural growth accrues to rural households, industry growth to urban households, and services to both based on their income shares.

5. National growth rates: Assume all households grow by the growth rate of real GDP per capita.
6. Regional average: Find the regional distribution for 2020 for the countries with methods 1-5. Apply this to the countries without any household survey data.

Coverage by region

Table 3: Population coverage (%)

Region	NSO	Phone survey	Literature	Rural/urban	National growth	Regional avg
East Asia & Pacific	67	19	0	3	8	3
Europe & Central Asia	16	10	48	26	1	0
Latin America & Caribbean	0	56	33	4	0	7
Middle East & North Africa	0	4	0	69	15	12
North America	100	0	0	0	0	0
South Asia	0	0	74	24	0	2
Sub-Saharan Africa	0	58	0	40	1	0
World	27	20	26	20	4	3

Table 4: Country coverage (number of countries)

Region	NSO	Phone survey	Literature	Rural/urban	National growth	Regional avg
East Asia & Pacific	4	6	0	6	8	14
Europe & Central Asia	1	6	24	16	2	9
Latin America & Caribbean	0	13	1	6	4	18
Middle East & North Africa	0	2	0	8	5	6
North America	2	0	0	0	0	1
South Asia	0	0	1	6	0	1
Sub-Saharan Africa	0	19	0	25	2	2
World	7	46	26	67	21	51

Coverage Map

(I) FINDINGS ACROSS METHODS 1, 2, & 3

Figure 3: Distributional changes for countries with tabulated data

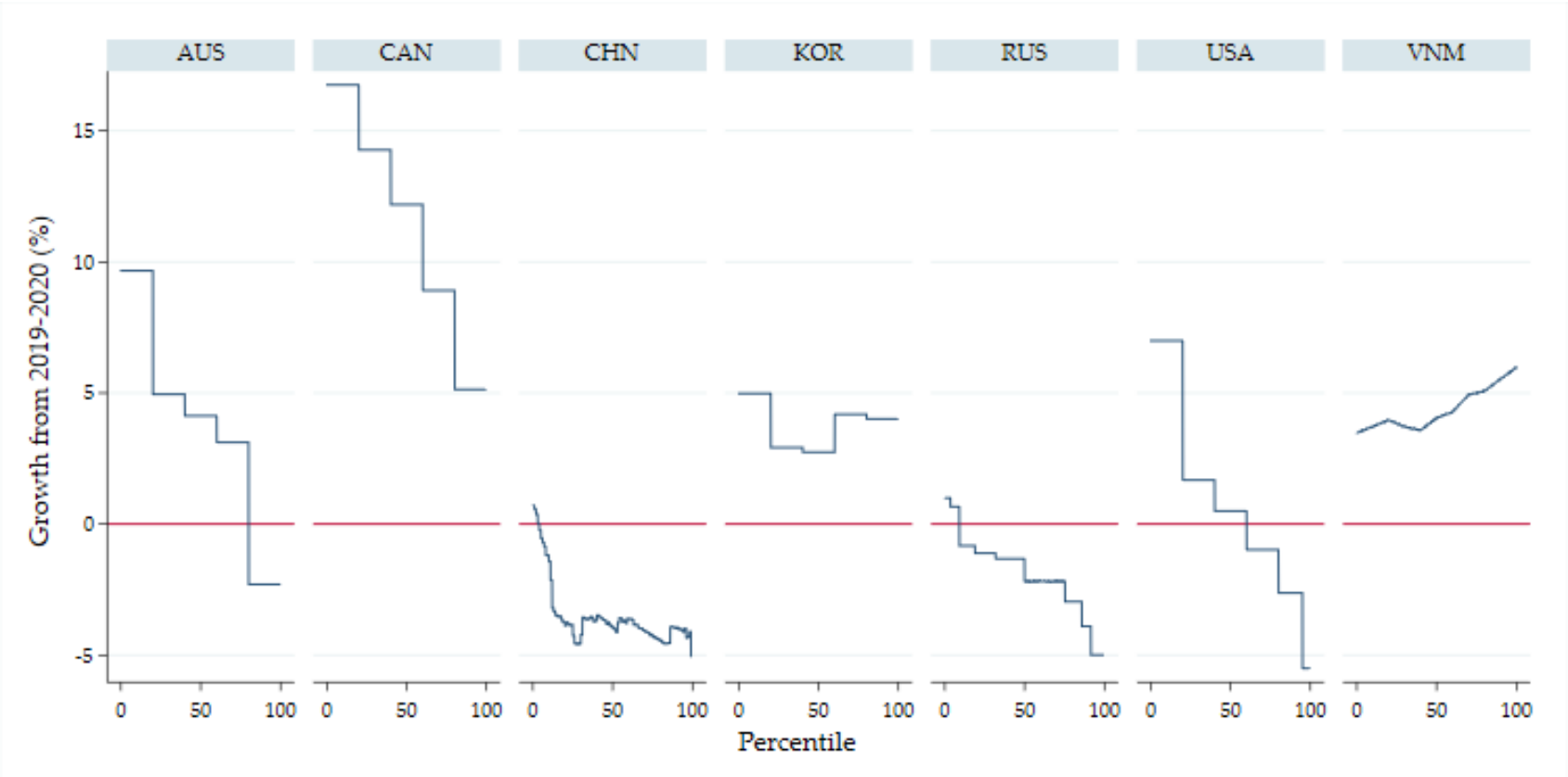


Figure 4: Pct. points change in extreme poverty, phone surveys

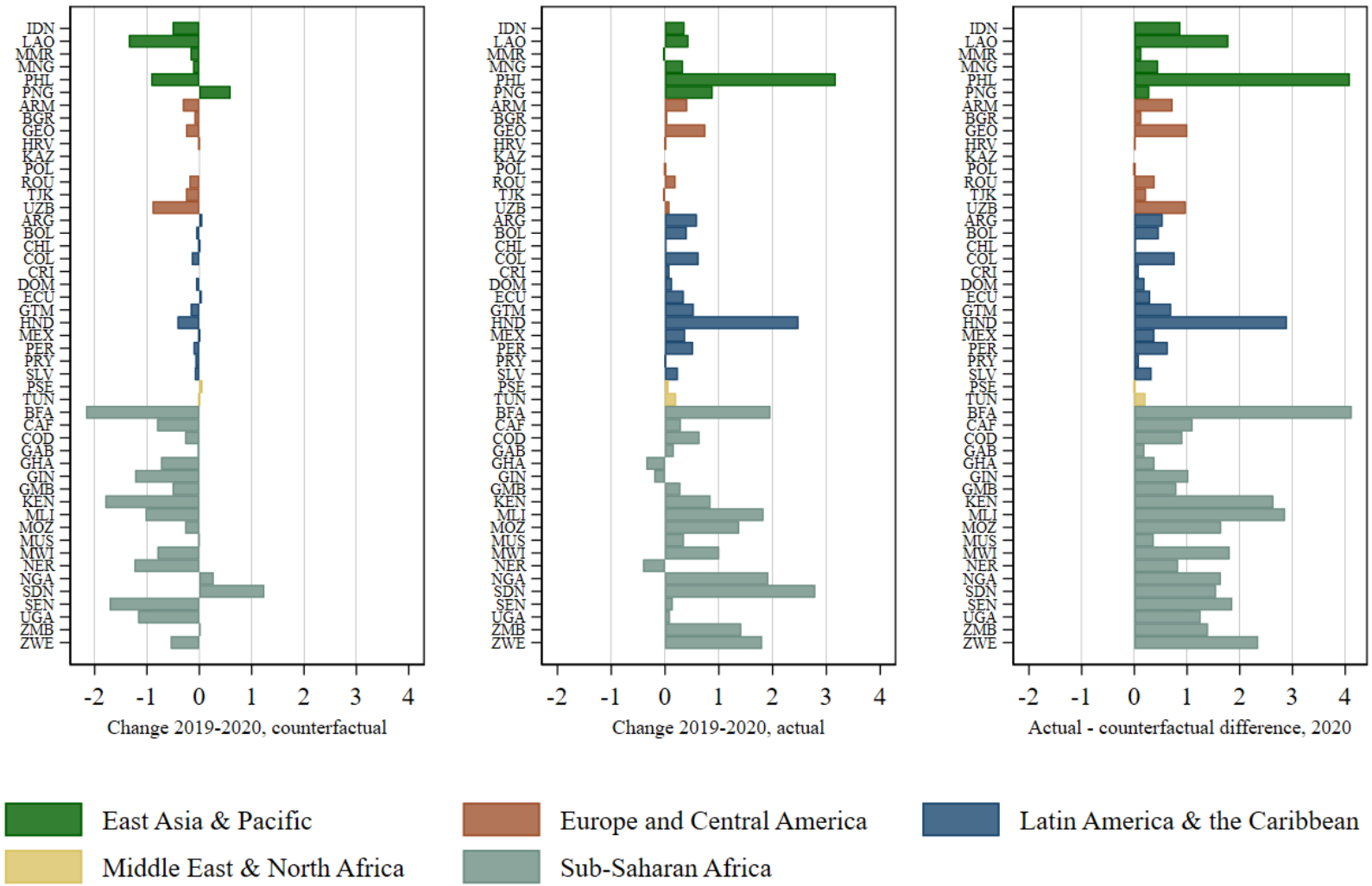


Figure 5: Pct. change in Gini index, phone surveys

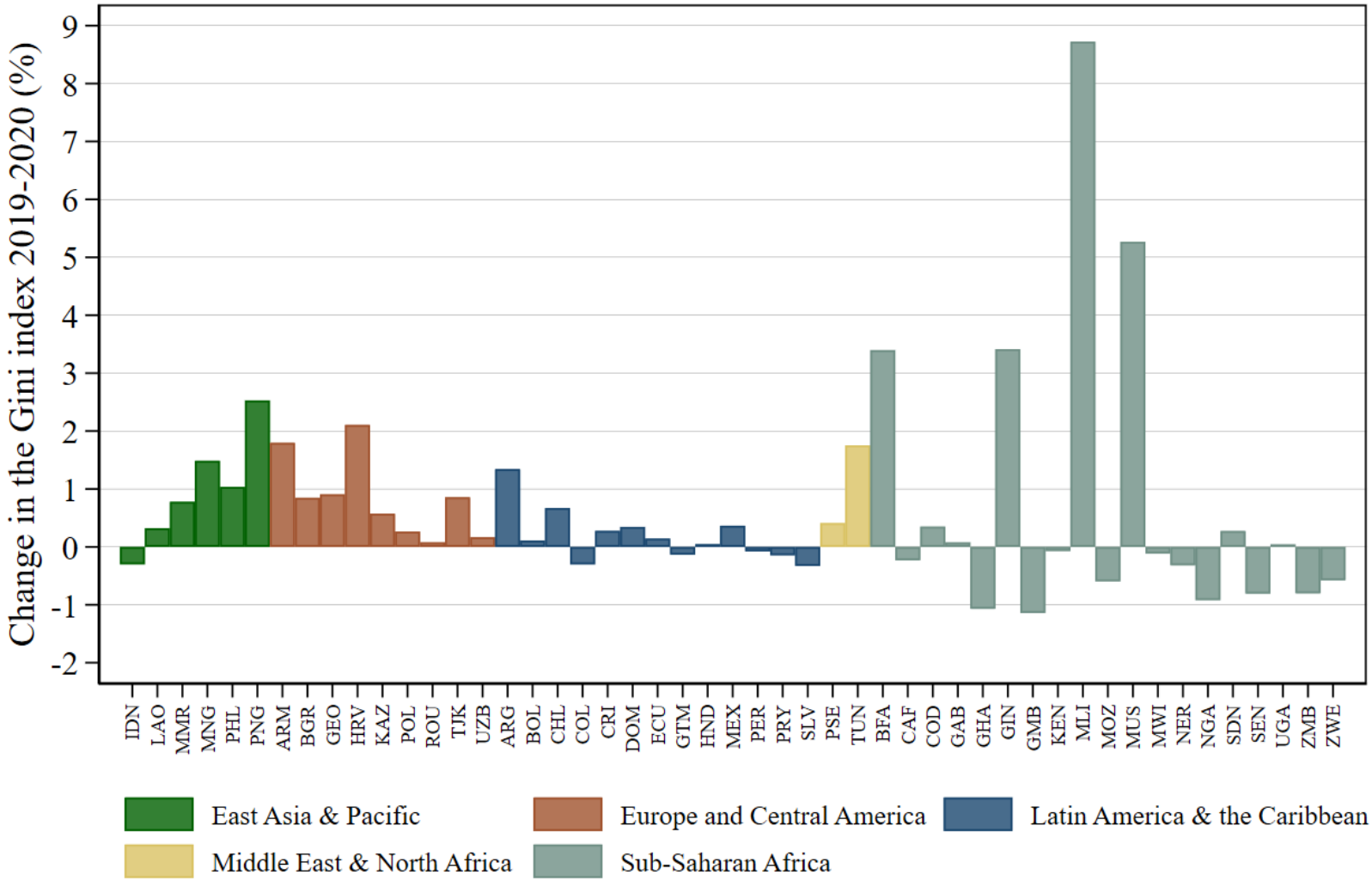


Figure 6: Change in extreme poverty as a function of mean income

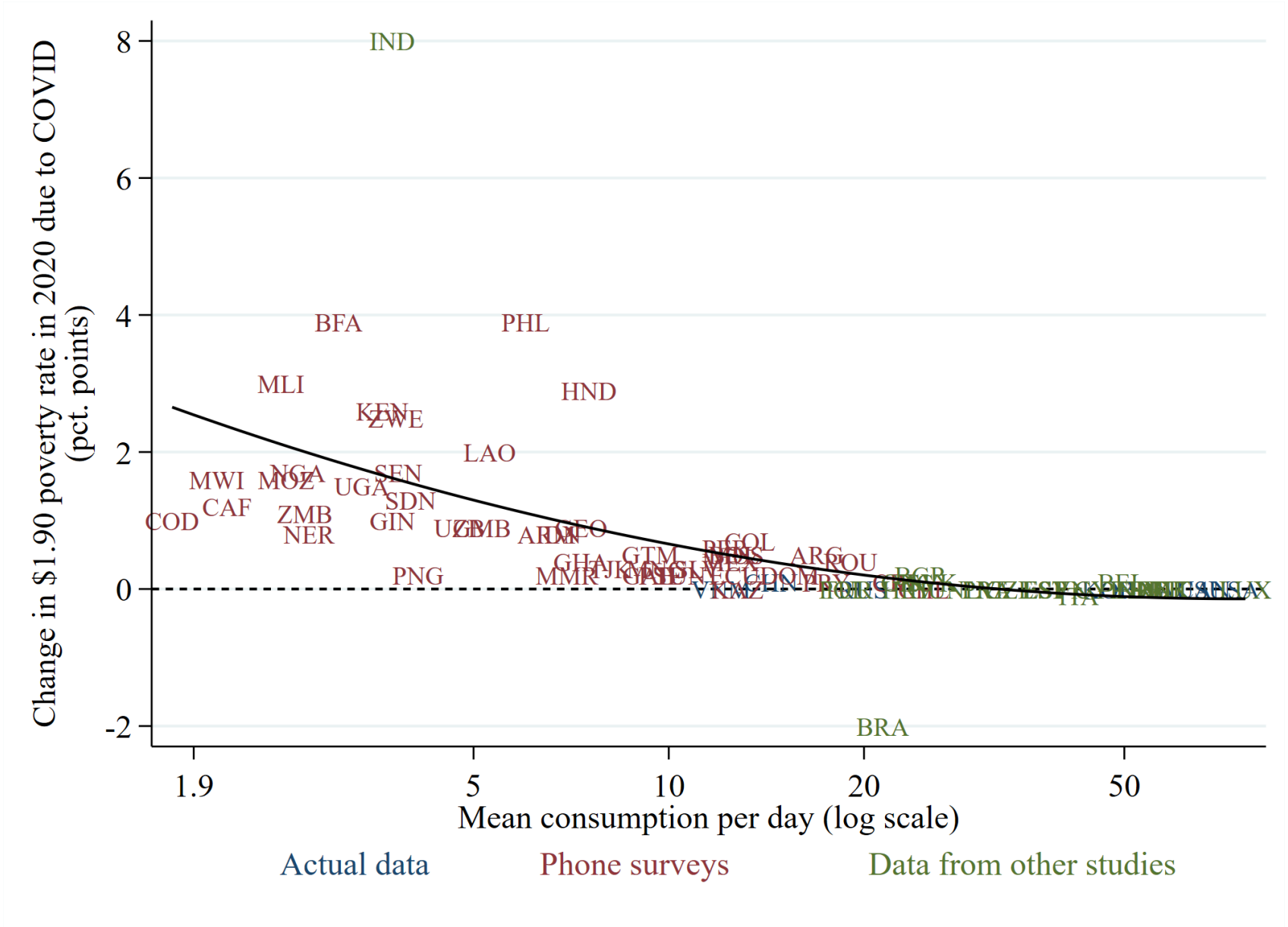
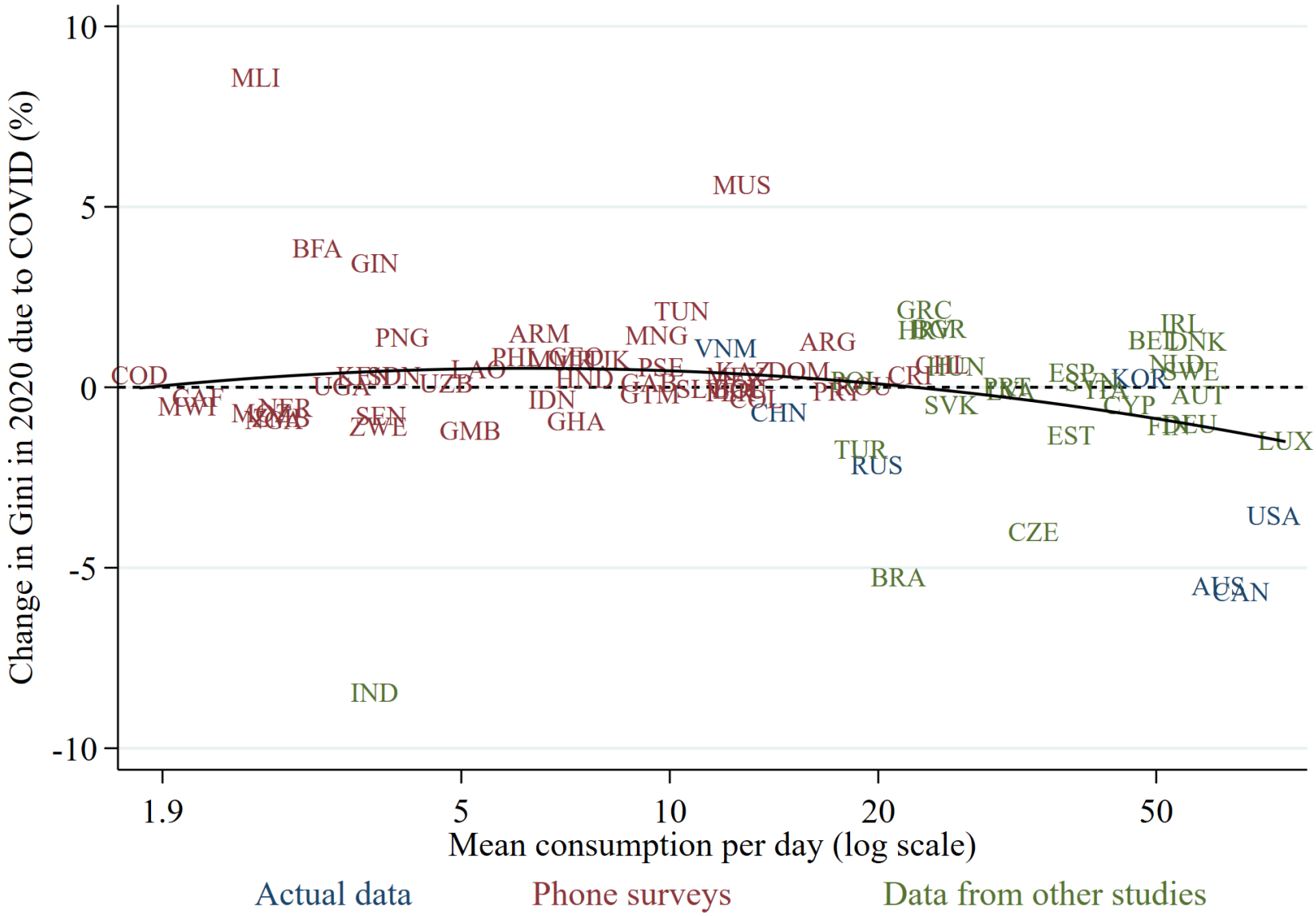


Figure 7: Pct. change in Gini as a function of mean income



(II) IMPACT ON GLOBAL POVERTY

Figure 8: Extreme poverty changes in historical perspective

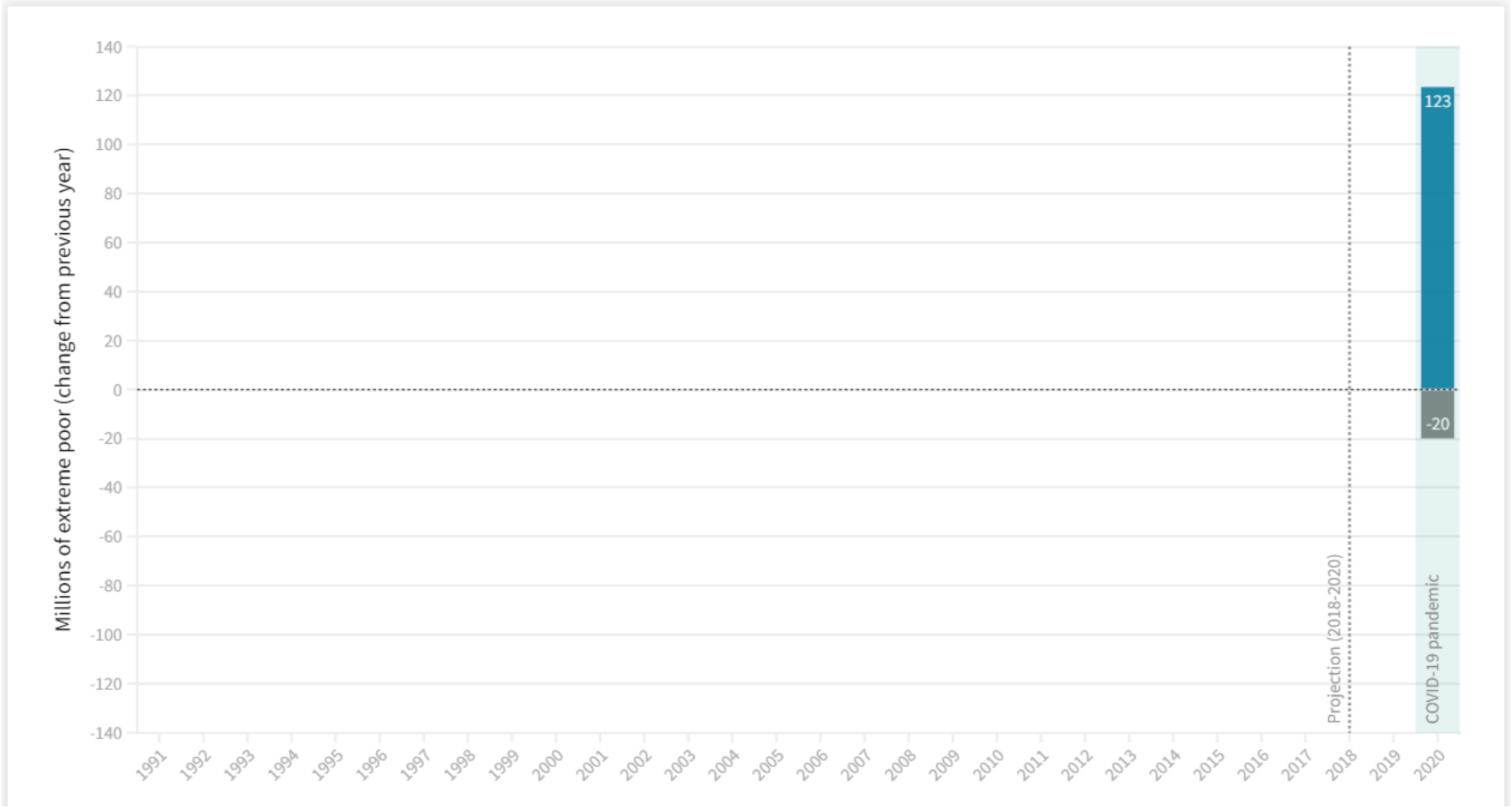


Figure 9: Extreme poverty changes in historical perspective

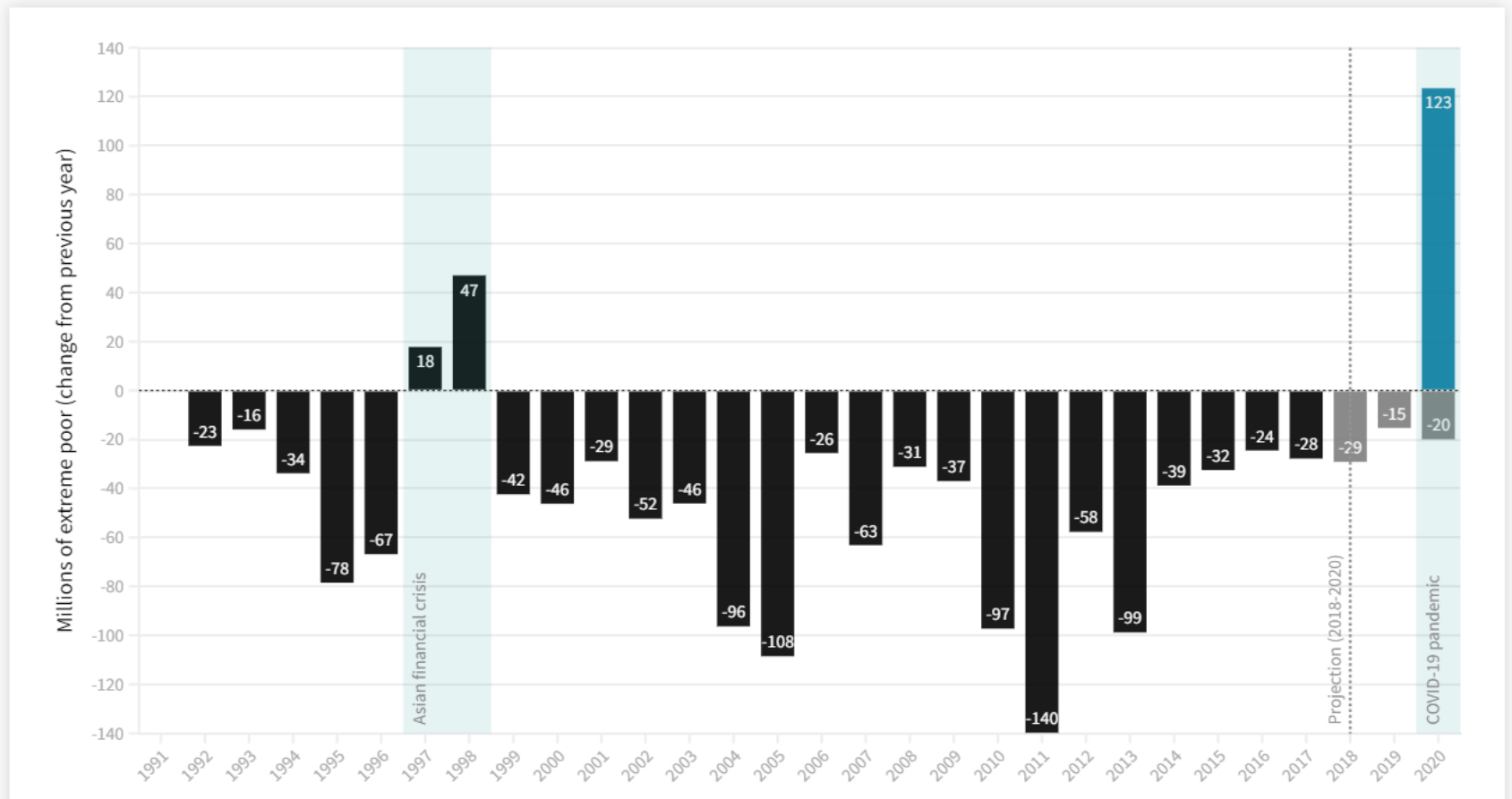


Figure 10: Decomposing changes in global extreme poverty

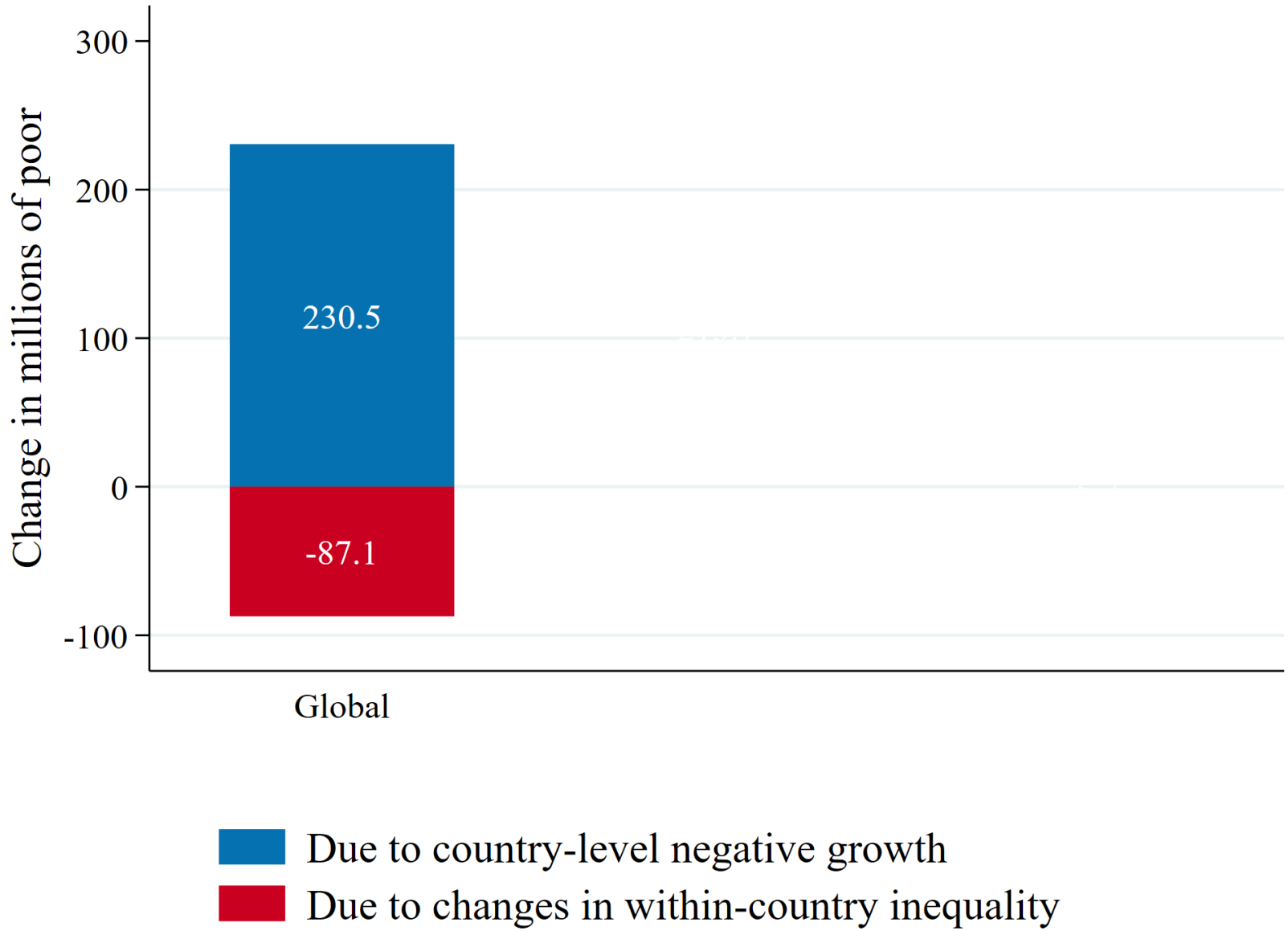


Figure 11: Decomposing changes in global extreme poverty

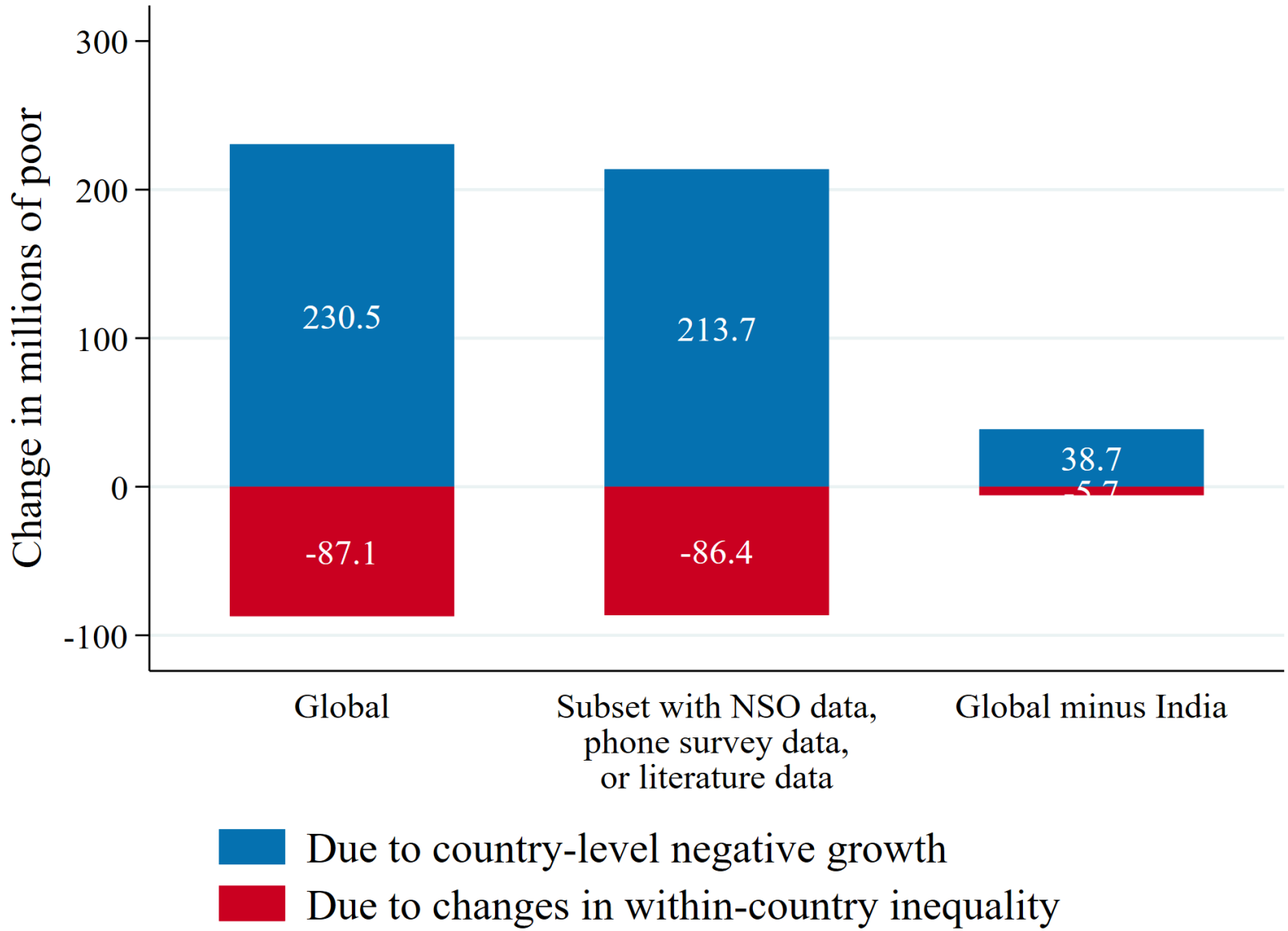


Figure 12: Extreme poverty change in 2020 (pp)

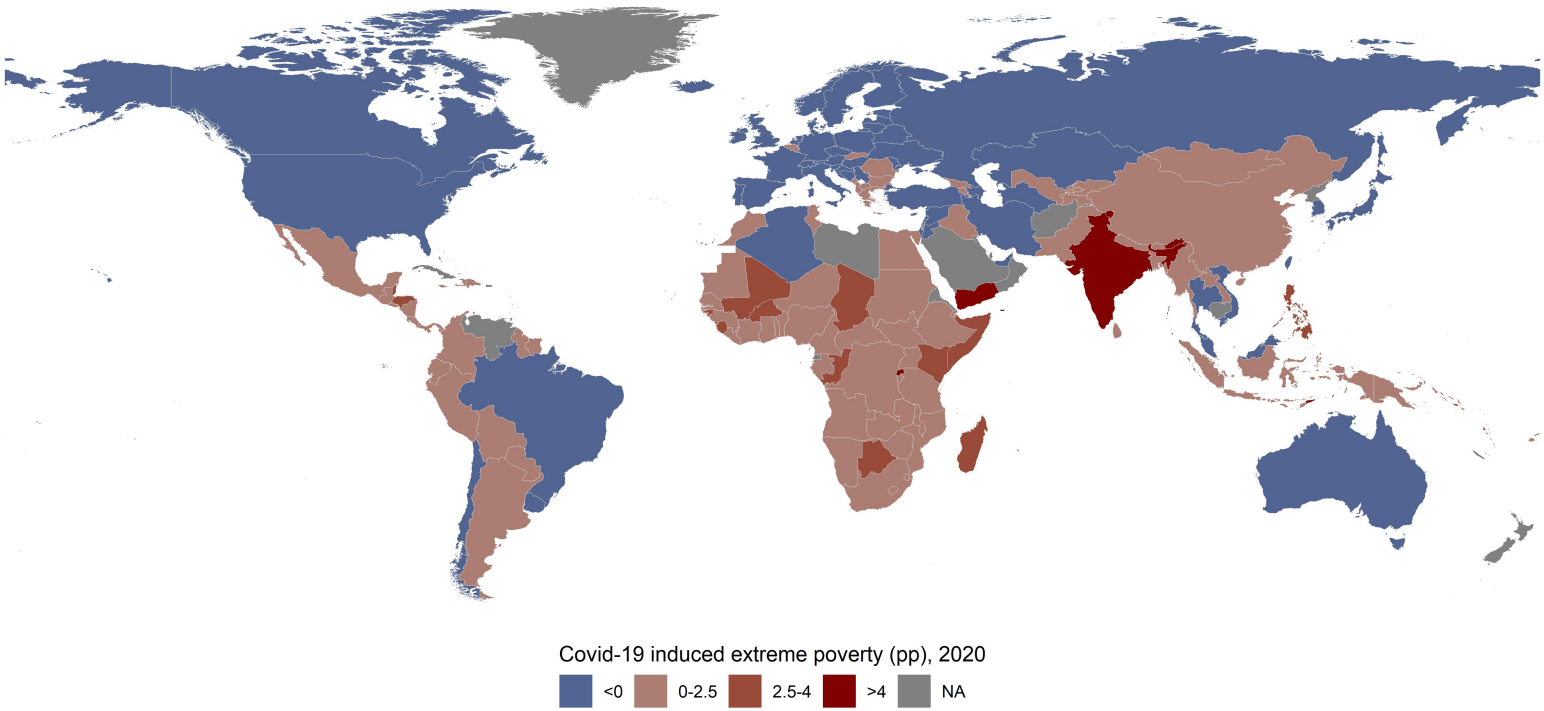
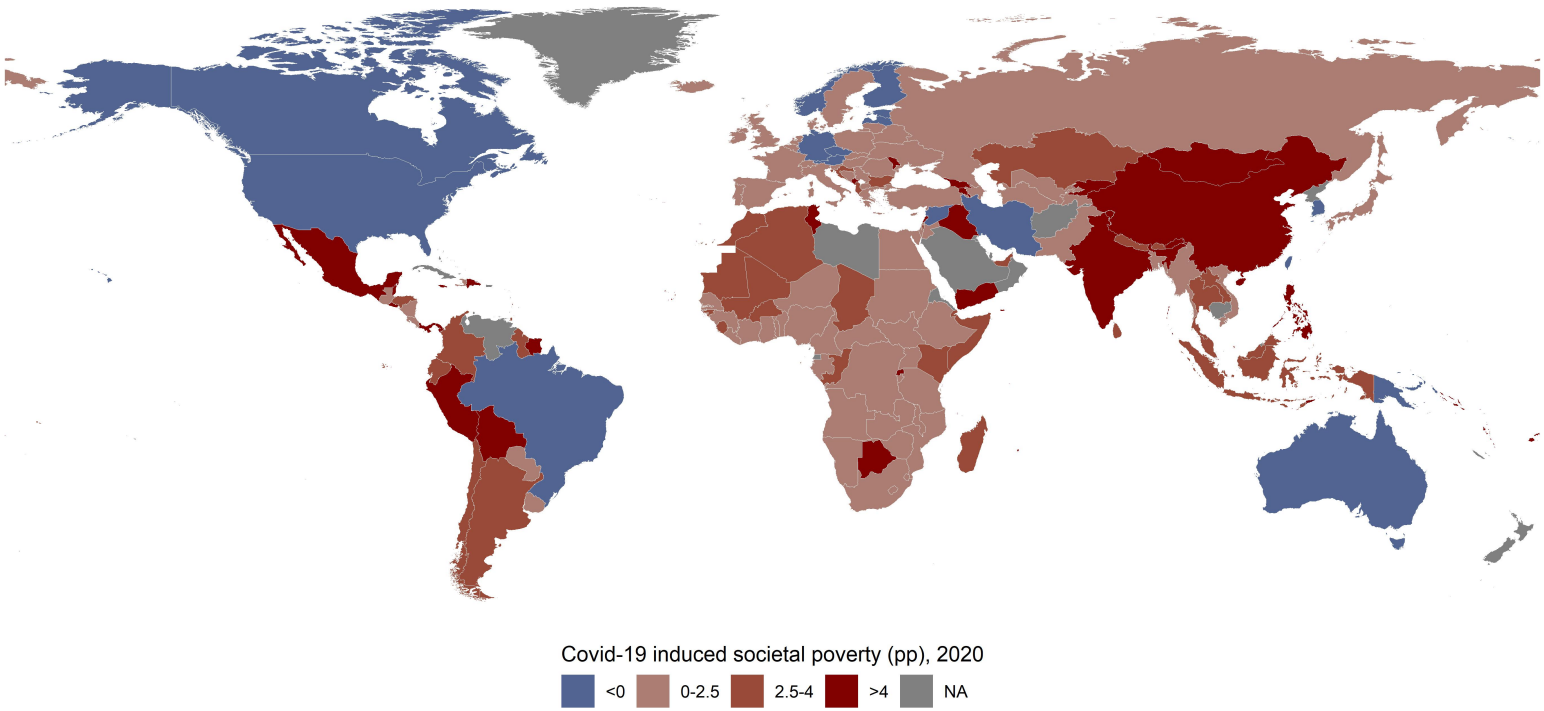


Figure 13: Country-relavant poverty change in 2020 (pp)



(III) IMPACT ON GLOBAL INEQUALITY

Figure 14: Global welfare loss due to COVID-19 in 2020

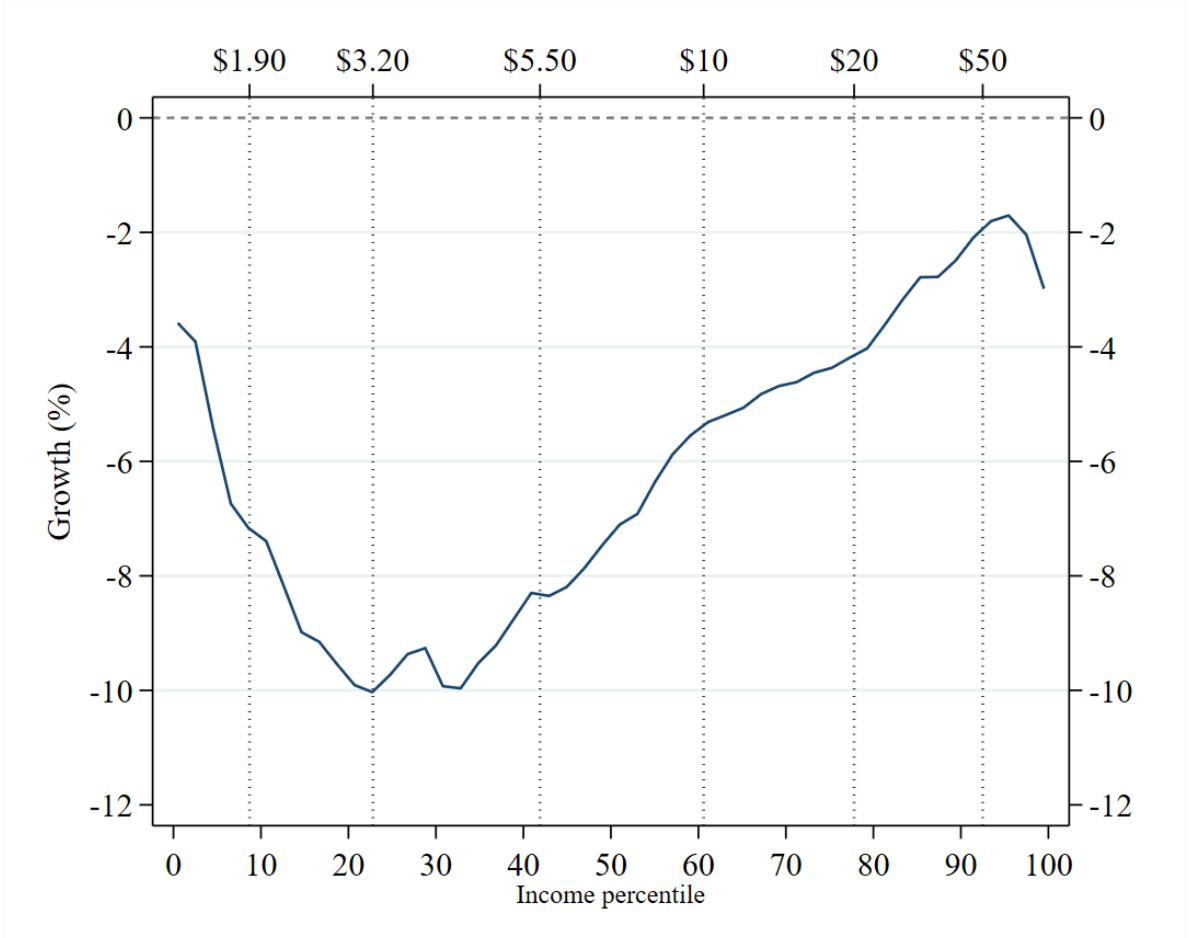


Figure 15: Global inequality changes in historical perspective

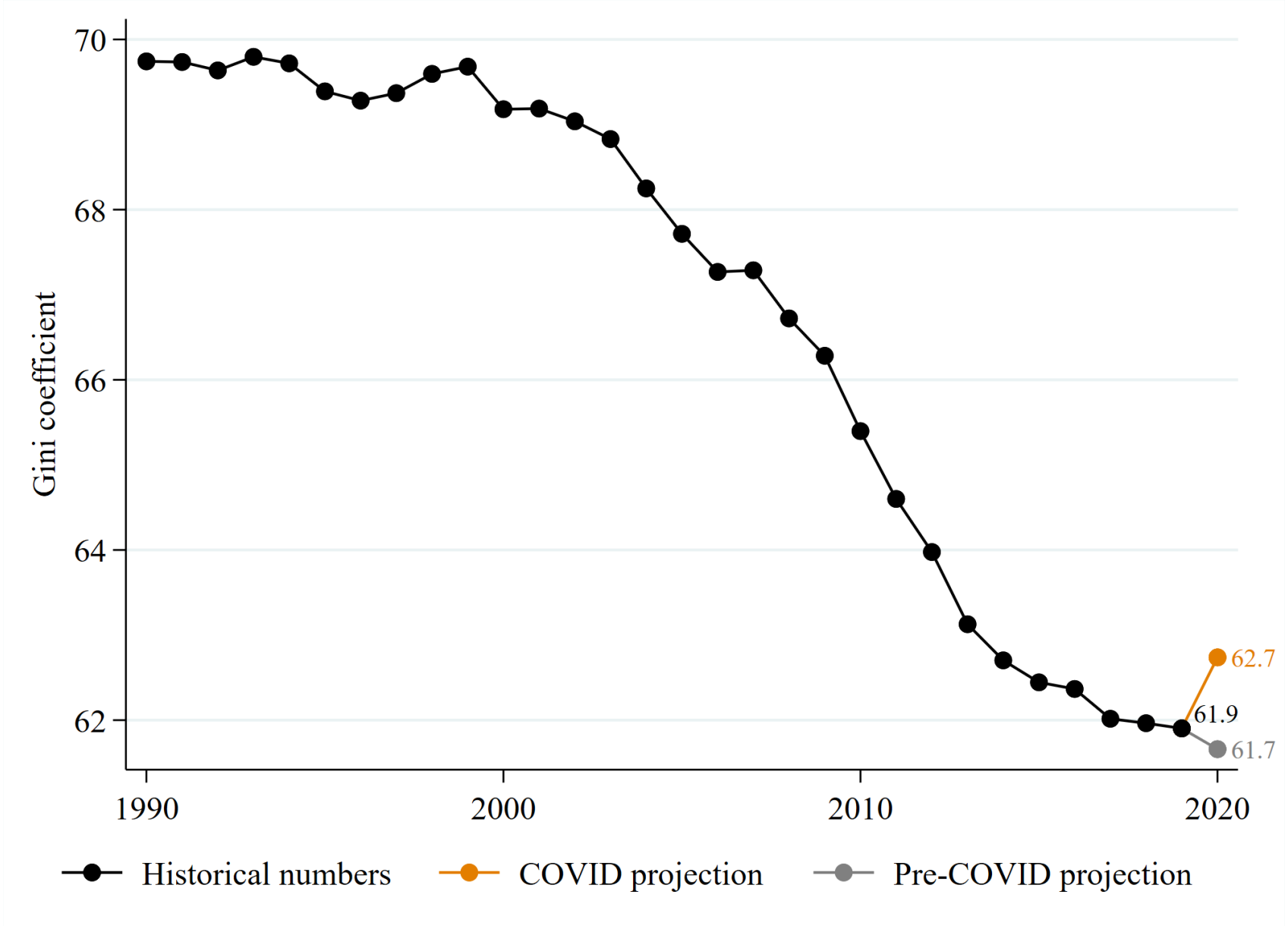


Figure 16: Decomposing changes in global inequality

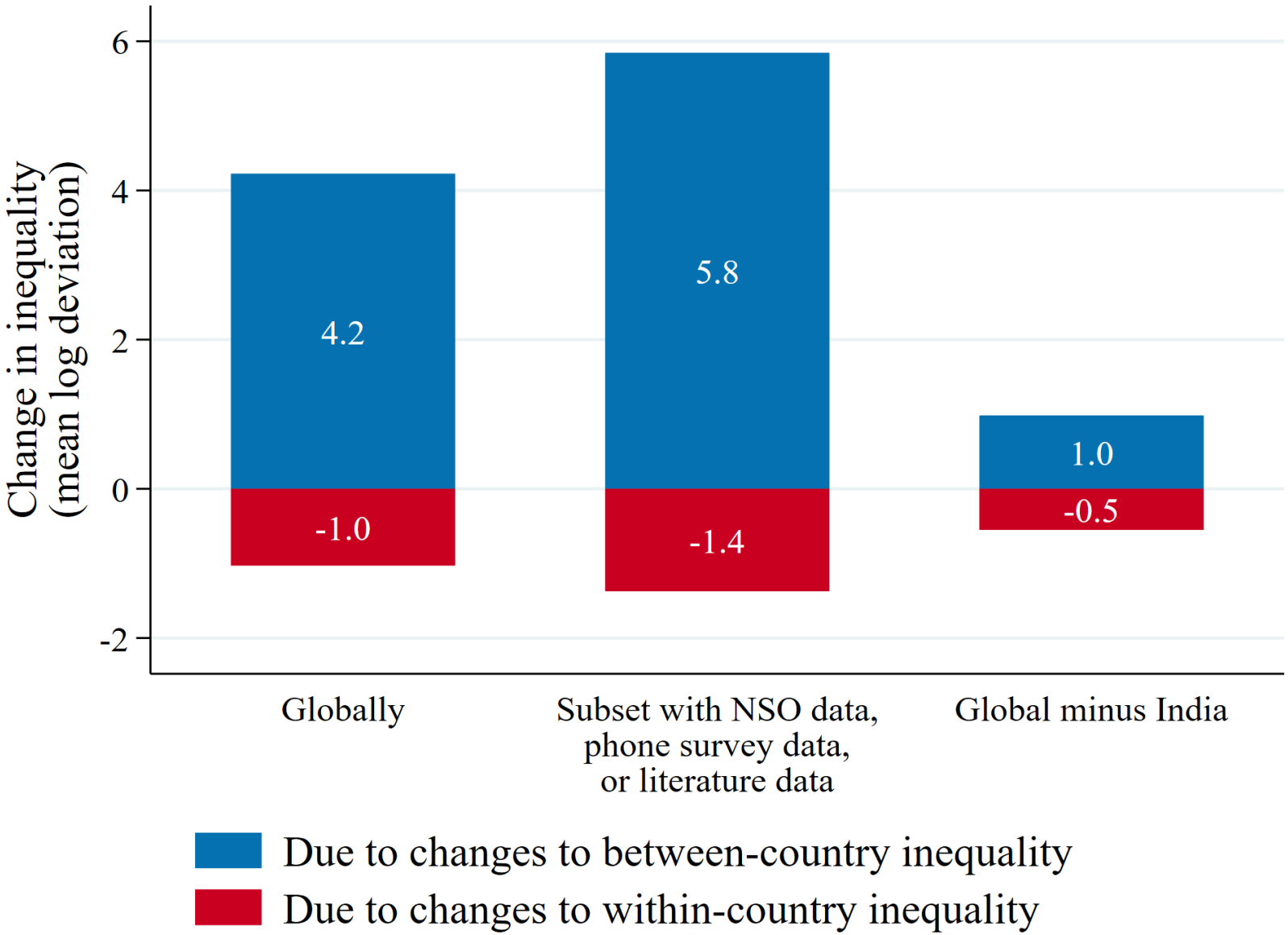


Figure 17: Between-country inequality

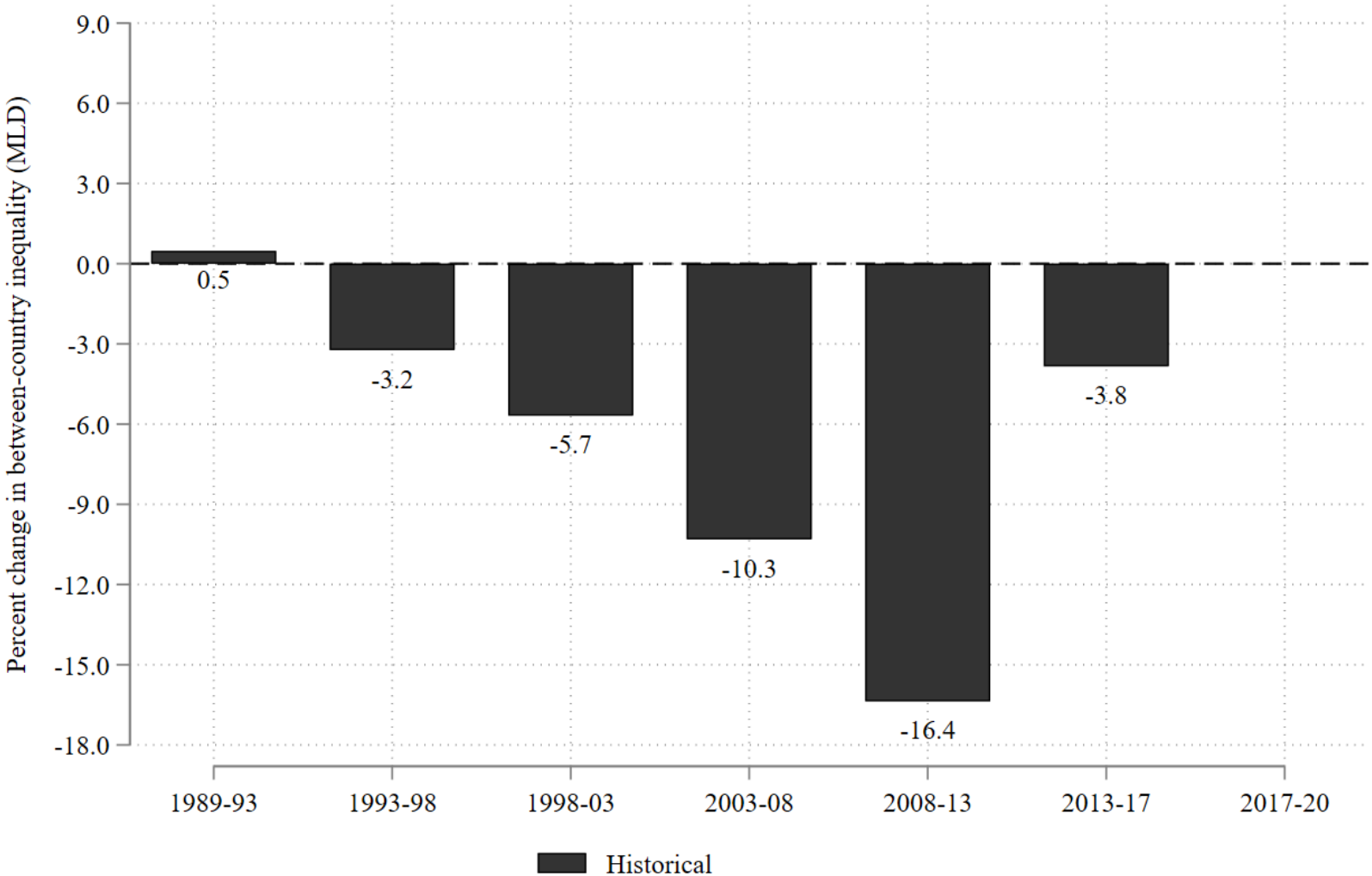
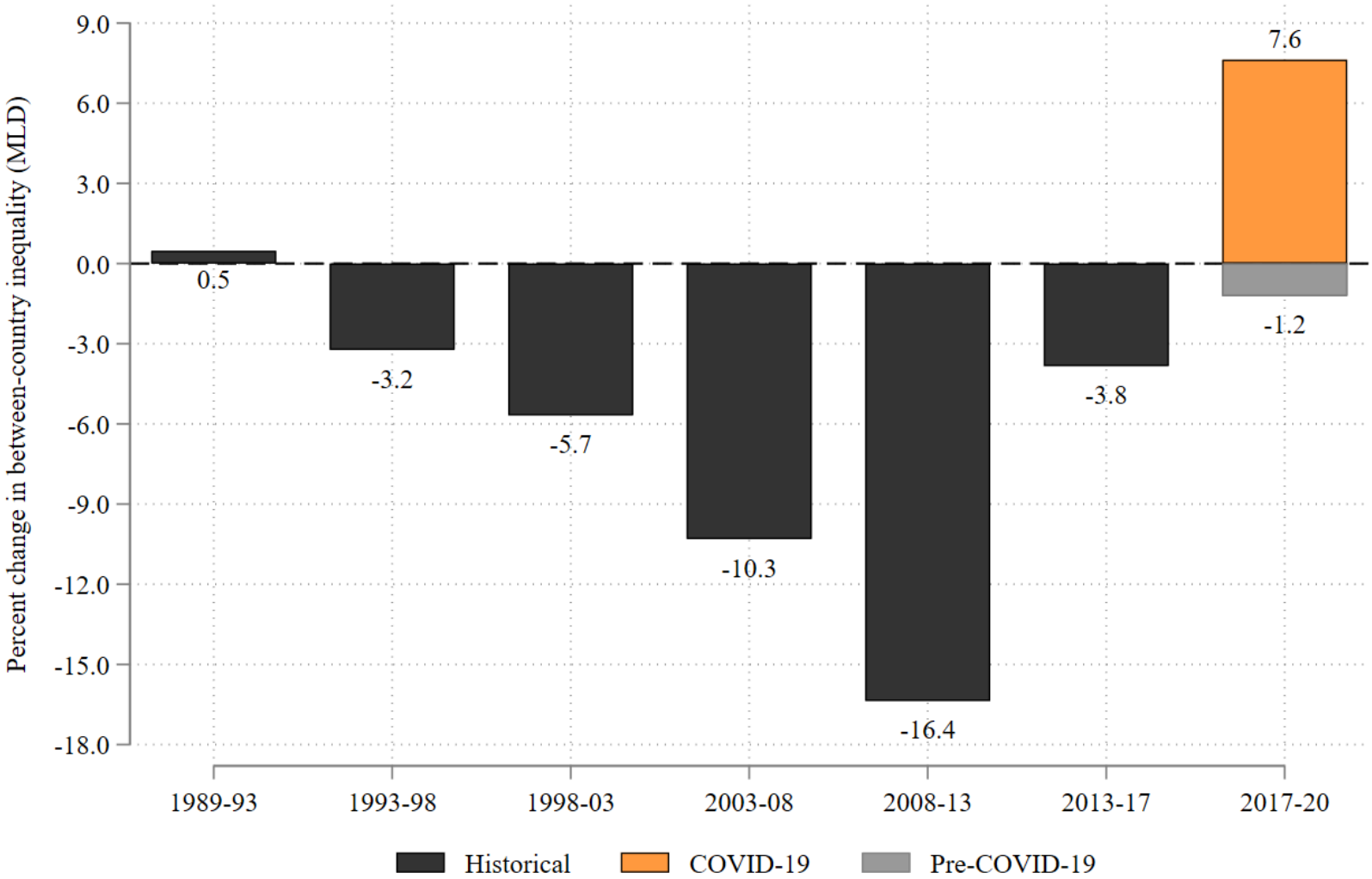


Figure 18: Between-country inequality



Conclusion

- The pandemic has caused the first marked increase in global inequality and global poverty in a generation.
- We find that 143 million people were pushed into extreme poverty in 2020 due to the COVID-19 pandemic, mostly driven by shocks to average incomes in countries.
- We find that the global Gini index increased by 1.3% in 2020 from 2019 compared to an average of -0.4% annual change in the last 30 years.
- The increase in global inequality was primarily driven by the widening of income gap between countries. We find a 7.6% increase in inequality between countries in 2020 compared to 2017.
- Changes in within-country inequality were mixed. Although, we find that poorer countries were more likely to experiance increase in inequality relative to richer countries in 2020.

What about 2021 and beyond?

1. Between-country impacts:
   - Further COVID-19 disruptions?
   - Inequality in vaccine access might exacerbate inequality.
2. Within-country impacts:
   - If social protection measures in high-income countries stop, within-country inequality is likely to increase.
   - Slow and uneven jobs recovery could raise inequality in labor markets.
   - Change in jobs format could be disproportionate. Estimates from the UK suggest that some 60 percent of tasks can be accomplished remotely by those with gross labor income above GBP 70,000, compared to 20 percent of tasks among workers with gross labor income below GBP 10,000 (Adams-Prassl et al., 2020).
   - Loss in schooling for children especially to those in the low-income households could exacerbate long-term inequality.

APPENDIX

Some mechanisms

- **Poverty:**
  - Shocks to labor incomes pushed some households below the poverty line.
  - Social protection partially mitigated these shocks.
- **Within-country inequality:**
  - Urban low-skilled professions were generally hardest hit, with large shocks across the distribution.
  - High-income countries were partially able to mitigate this through transfers.
- **Between-country inequality**:
  - The pandemic hit different countries and regions with different magnitude.
  - Government spending to mitigate the impacts has been uneven.

Figure 19: Market distribution in 2020, US

Table A-3.

Income Distribution Measures Using Money Income and Equivalence-Adjusted Income: 2019 and 2020

(Information on confidentiality protection, sampling error, nonsampling error, and definitions is available at <https://www2.census.gov/programs-surveys/cps/techdocs/cpsmar21.pdf>)

Measure	2019		2020		Percent change (2020 less 2019)*,2	
	Estimate	Margin of error[1] (±)	Estimate	Margin of error[1] (±)	Estimate	Margin of error[1] (±)
MONEY INCOME[3]						
Shares of Aggregate Income by Percentile						
Lowest quintile	3.1	0.05	3.0	0.06	*-3.4	2.24
Second quintile	8.3	0.09	8.1	0.10	*-1.8	1.49
Third quintile	14.1	0.12	14.0	0.14	-0.5	1.14
Fourth quintile	22.7	0.16	22.6	0.18	-0.2	0.93
Highest quintile	51.9	0.35	52.2	0.39	0.7	0.90
Top 5 percent	23.0	0.44	23.0	0.46	-0.1	2.53
Summary Measures						
Gini index of income inequality	0.484	0.0036	0.489	0.0040	0.9	1.01
Mean logarithmic deviation of income	0.590	0.0112	0.618	0.0124	*4.7	2.82
Theil	0.432	0.0098	0.438	0.0103	1.3	3.05
Atkinson:						

Cross-checking our first assumption (*which?*)

- The phone survey sample for Nigeria is drawn from the 2018/19 survey General Household Survey.
- So, we are able to exactly match the households with change in income in the phone survey.

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Table 5: Nigeria case study

	Households	2019	2020		Covid - precovid difference	Change 2019-2020
			precovid	covid		
(A) Poverty rate (%)						
Actual matching	1,866	37.6	37.7	39.47	1.76	1.89
Predicted matching	1,866		37.7	39.39	1.69	1.82
(B) Gini index						
Actual matching	1,866	34.2	34.2	34.05	-0.14	-0.17
Predicted matching	1,866		34.2	33.99	-0.21	-0.23

Method 2a Method 2b

Cross-checking our second assumption (*how much?*)

- Recall we assume that *all* rural households with income loss (and same for income gain and no change in income) grow at the same rate, $g_{t,i}^{rur-} = g_t^{rur-}$. (Same for urban households.)
- This was necessary so that the aggregated household growth rates equal per capita GDP.
- However, there are infinite combination of growth rates that yield a particular average growth, such as g_t^{rur-}. So, we will relax the above assumption and use a distribution of growth rates for each household such that the average is g_t^{rur-}.

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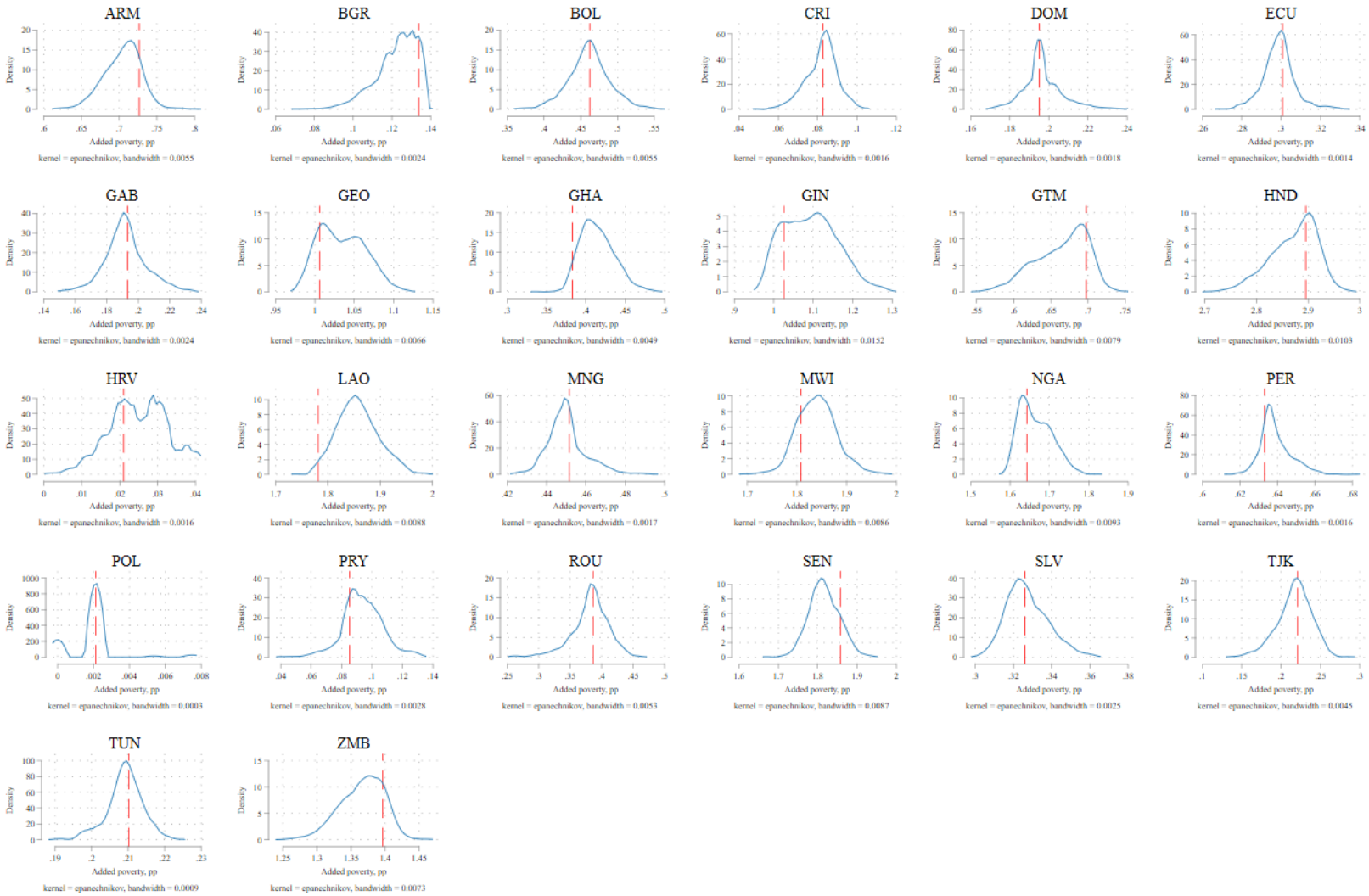
- This was necessary so that the aggregated household growth rates equal per capita GDP.
- However, there are infinite combination of growth rates that yield a particular average growth, such as g_t^{rur-}. So, we will relax the above assumption and use a distribution of growth rates for each household such that the average is g_t^{rur-}.

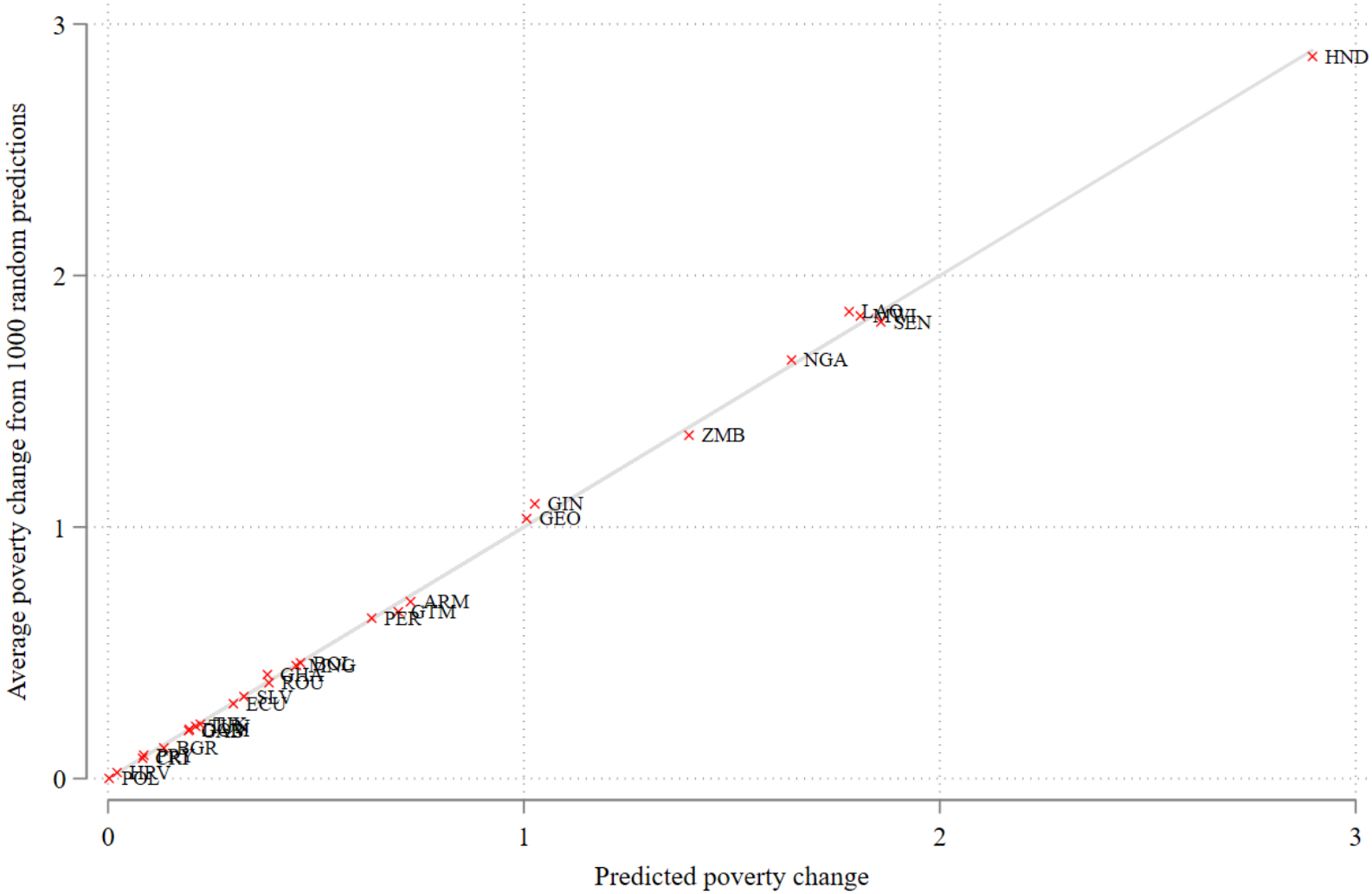
- For instance, instead of assigning every rural household with income loss g_t^{rur-}, we set growth for the i^{th} household as $g_{t,i}^{rur-} = g_t^{rur-} \pm k_i$, where $k_i \sim U(0, b)$. Note that $\frac{1}{N}\sum_i^N g_{t,i}^{rur-} = g_t^{rur-}$.
- For example, if $b = 2$ and $g_t^{rur-} = -3.5$, then the households would get uniformly distributed random growth rates between -5.5 and -1.5.
- We run 1000 iterations by randomly drawing b each time.

Figure 20: Distribution of poverty impact of COVID-19, in pp



Note: This figure shows the distribution of COVID-19-induced poverty for 1000 random distributions. The red line identifies this estimate for the preferred method.

Figure 21: Correlation of poverty impact, in pp



Method 2b

Figure 22: Correlation of inequality impacts of COVID-19

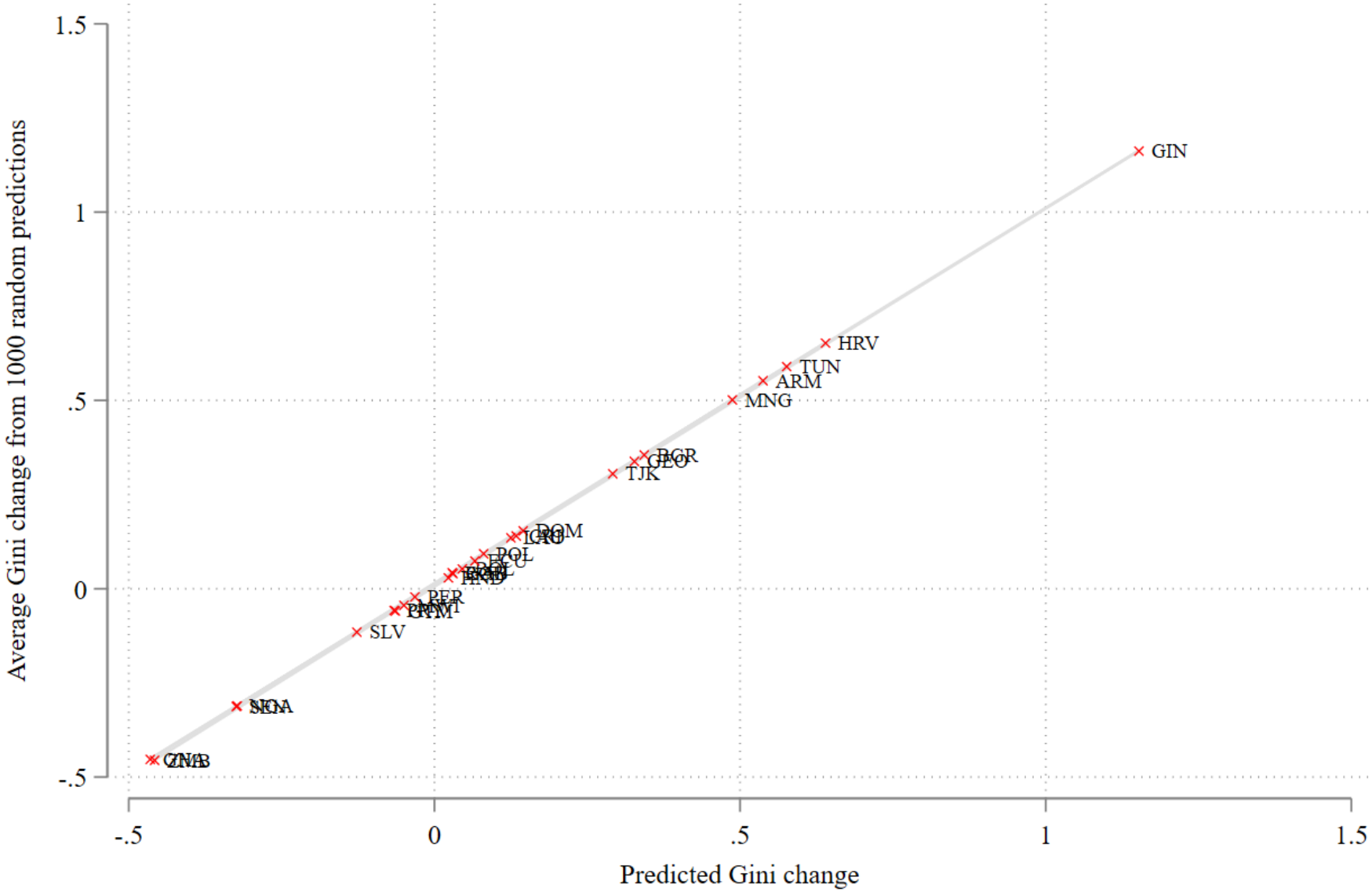
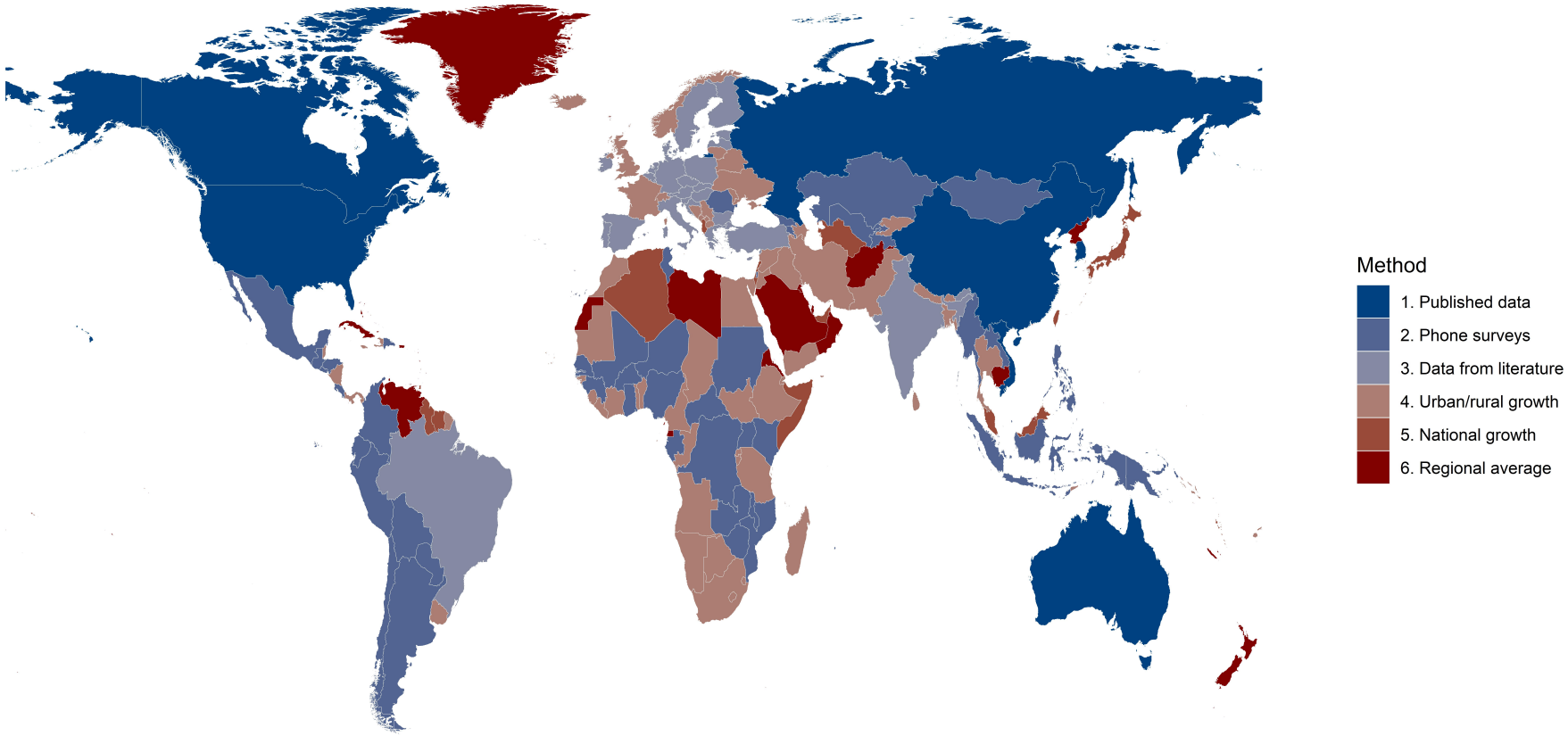
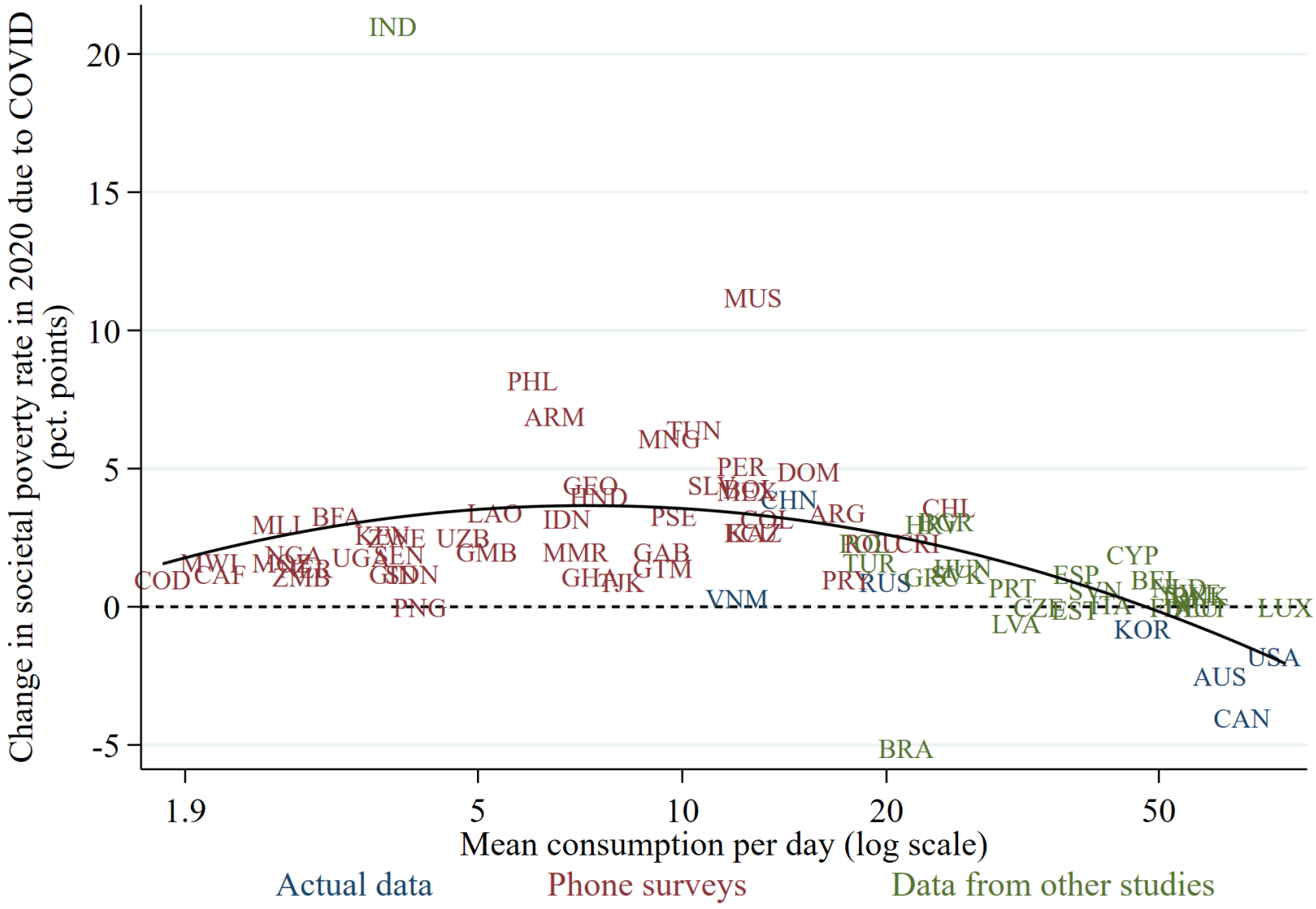


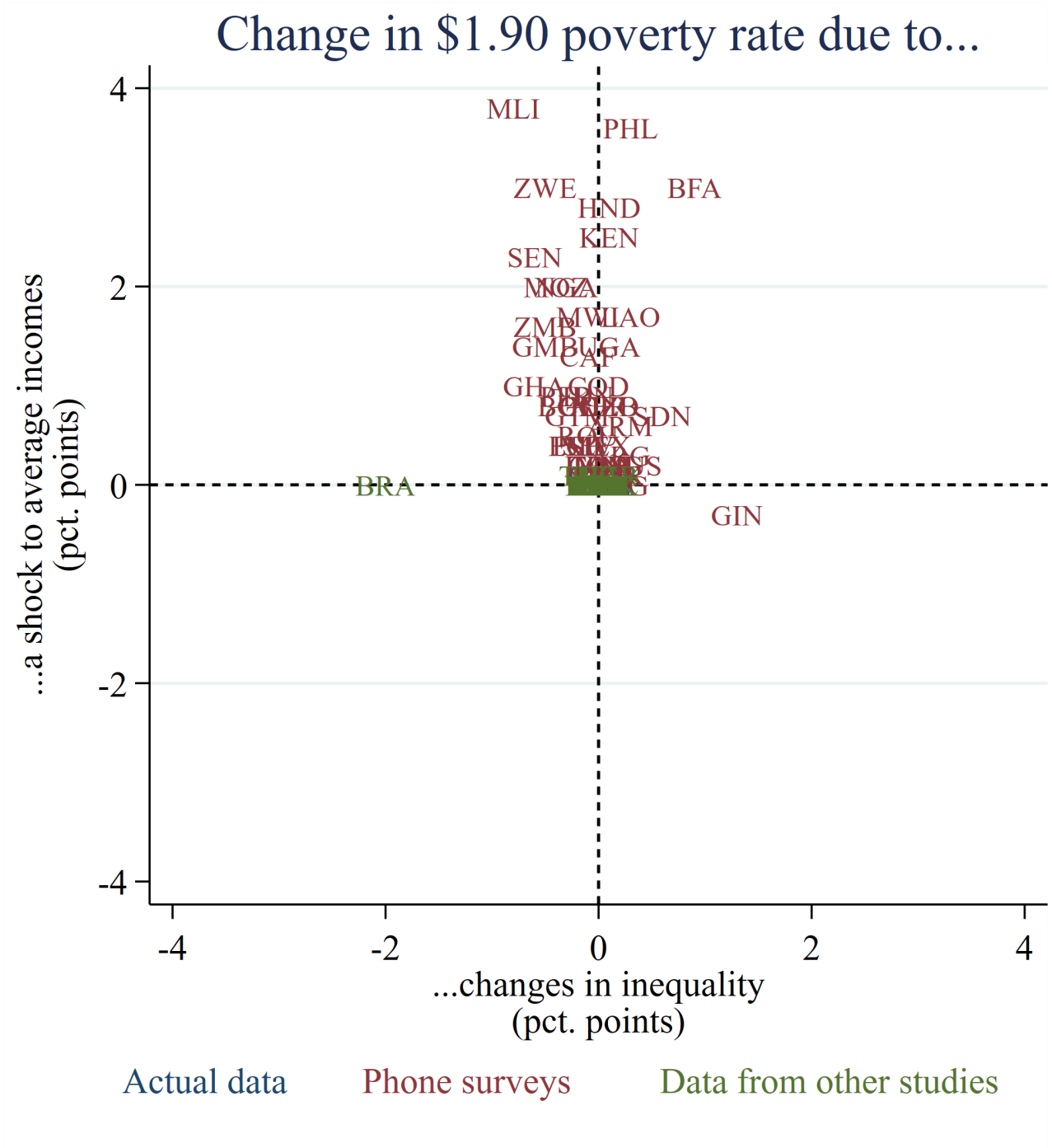
Figure 23: Method to recover 2020 welfare distributions



Coverage Table

Figure 24: Country-relevant poverty and mean income




Change in $1.90 poverty rate due to...
...a shock to average incomes (pct. points)
...changes in inequality (pct. points)
4
2
0
-2
-4
MLI
PHL
ZWE
BFA
HND
KEN
SEN
ZMB
GIN
BRA
Actual data
Phone surveys
Data from other studies

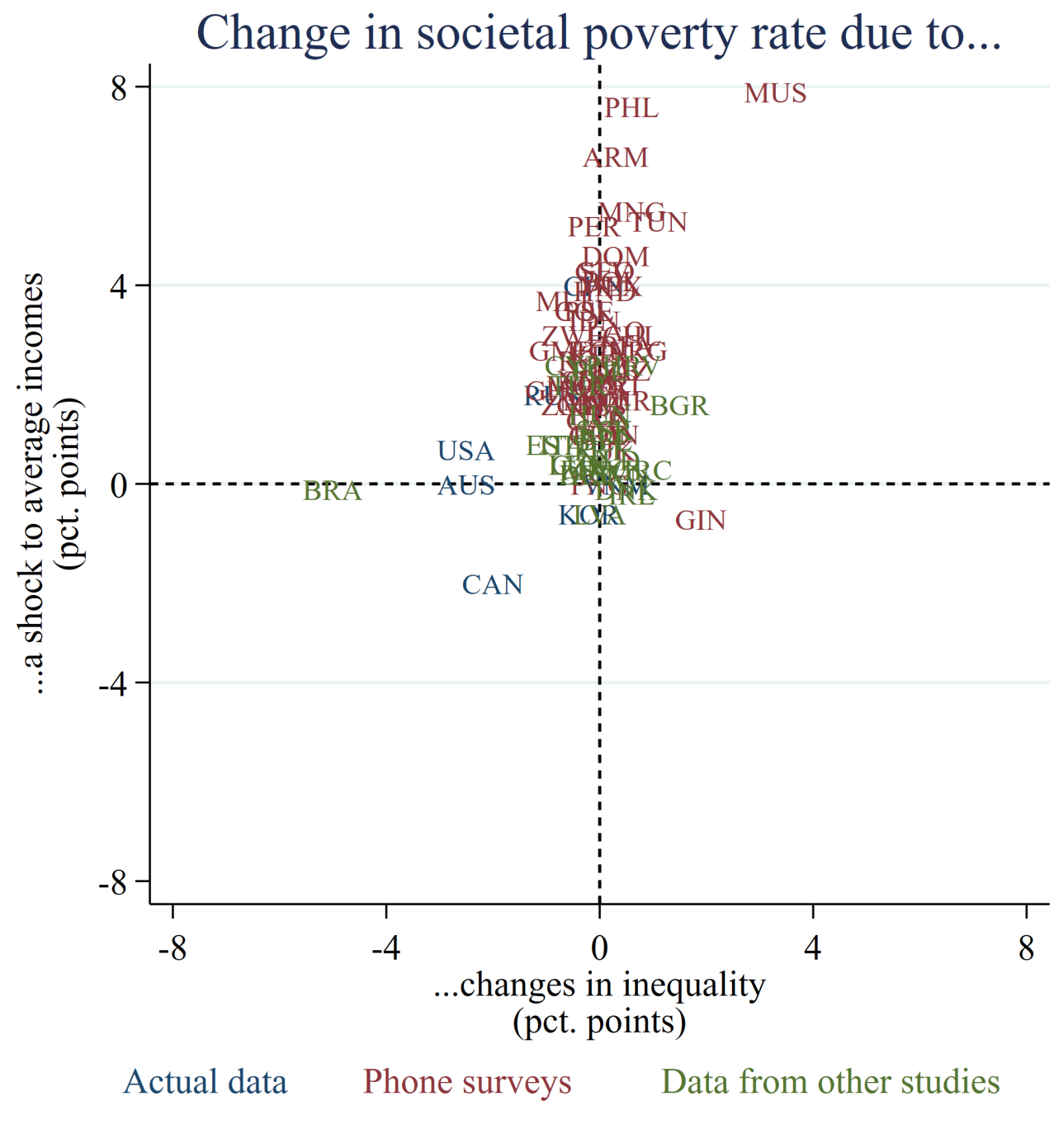

Change in societal poverty rate due to...
...a shock to average incomes (pct. points)
...changes in inequality (pct. points)
8
4
0
-4
-8
-8
-4
0
4
8
MUS
PHL
ARM
MNG
PER
TUN
DOM
BGR
USA
AUS
BRA
CAN
GIN
Actual data
Phone surveys
Data from other studies

Figure 25: Within-country inequality changes in 2020 (Gini points)