Inequality and Poverty.

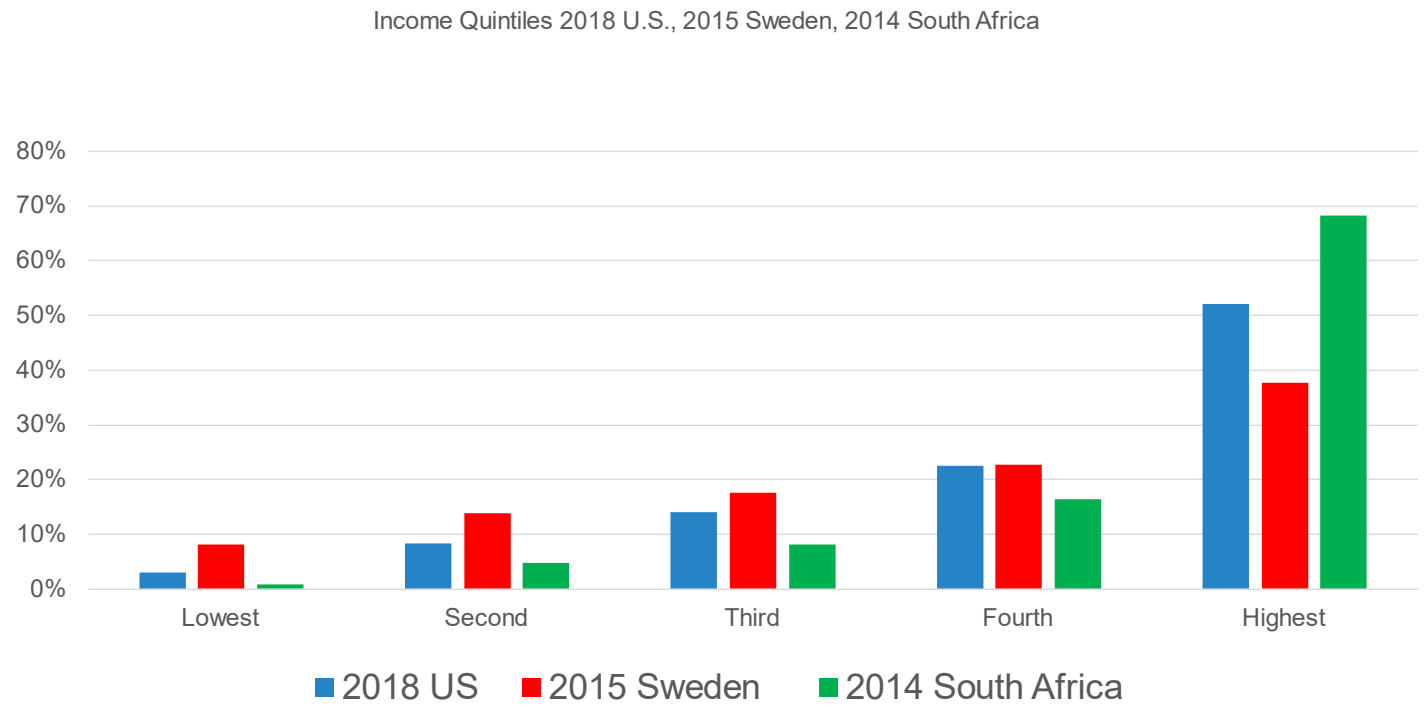
We are going to begin by considering static measures, discuss why we should worry about poverty and inequality, and then investigate dynamic issues of poverty.

One approach to measuring inequality: divide the population into groups corresponding to the personal distribution of income.

Examples are:
Quartiles -4- (25% groups),
Quintiles -5- (20% groups),
or deciles -10- (10% groups).

The basic idea is to divide the population into equal sized shares, and determine what percentage of total income is in the hands of each share.

Comparative Distributions



Gabra herders, 1993 Income per person per day in US cents, First Rainy Season.

HH #	*income per person per day*	HH #	*income per person per day*	HH #	income per person per day	HH #	*Income per person per day*
1	*3*	23	*15*	45	*21*	67	*31*
2	*5*	24	*15*	46	*22*	68	*31*
3	*6*	25	*15*	47	*23*	69	*33*
4	*6*	26	*16*	48	*23*	70	*33*
5	*6*	27	*16*	49	*23*	71	*35*
6	*7*	28	*16*	50	*24*	72	*36*
7	*9*	29	*17*	51	*24*	73	*38*
8	*10*	30	*17*	52	*24*	74	*40*
9	*11*	31	*17*	53	*24*	75	*40*
10	*11*	32	*17*	54	*25*	76	*41*
11	*11*	33	*18*	55	*25*	77	*43*
12	*12*	34	*19*	56	*26*	78	*46*
13	*12*	35	*19*	57	*26*	79	*46*
14	*13*	36	*19*	58	*26*	80	*49*
15	*13*	37	*19*	59	*26*	81	*49*
16	*13*	38	*19*	60	*27*	82	*50*
17	*13*	39	*19*	61	*27*	83	*51*
18	*13*	40	*20*	62	*28*	84	*52*
19	*14*	41	*20*	63	*28*	85	*66*
20	*14*	42	*20*	64	*29*	86	*70*
21	*15*	43	*20*	65	*30*	87	*80*
22	*15*	44	*21*	66	*31*	88	*97*
	$2.32		$3.94		$5.62		$10.57

Use Quartiles for demonstration.

Lower 25% of households (1-22) have $2.32 total
25% to 50% of households (23-44) have $3.94 total
51% to 75% of households (45-67) have $5.62 total
76% to 100% of households (68-88) have $10.57 total

Income total is $22.45 (note that is $22.45 for 88 households)
Lowest quartile have 10% of total ($2.32/$22.45)
Second quartile have 18% of total (3.94/$22.45)
Third quartile has 25% of total ($5.62/$22.45)
Fourth quartile has 47% of total ($10.57/$22.45)

Another approach is a “Kuznets ratio”, the ratio of the top 20% to the lower 40%.

Percent of the Population	Percent of the Income
10%	3%
20%	8%
30%	13%
40%	20%
50%	28%
60%	37%
70%	48%
80%	59%
90%	75%
100%	100%

If we use level of income, the lower 40% of the households (1-35) have a total of $4.49 / 20% and the upper 20% (70-88) have a total of $9.62 / 41%. This is a ratio of 2.1.

The book describes an inequality ratio of (51/14), or 3.6 based on shares.

An alternative approach you may see to looking at the degree of variation is to look at the coefficient of variation in income.

The standard deviation divided by the mean.

In this case mean income is 25, the standard deviation is 17, so the coefficient of variation is 0.65 (or sometimes stated as 65).

An alternative use of the coefficient of variation is to look at household level income variability over time. More on that later, but don't get them confused. One is to measure inequality across households, the other is to measure vulnerability for a given household.

Table 5.3: Mean total income per person per day in US dollars and coefficient of variation by category

	Cash Lower	Cash Higher
Livestock Lower	$0.20 (1.32)	$0.27 (0.90)
Livestock Higher	$0.34 (0.82)	$0.46 (0.63)

Yet another approach is a Lorenz curve. The cumulative percentage of income held by a given share of the population.

HH 1 has $0.03/$22.44. HH 2 has $0.05/$22.44. HH 3 has $0.06/$22.44…

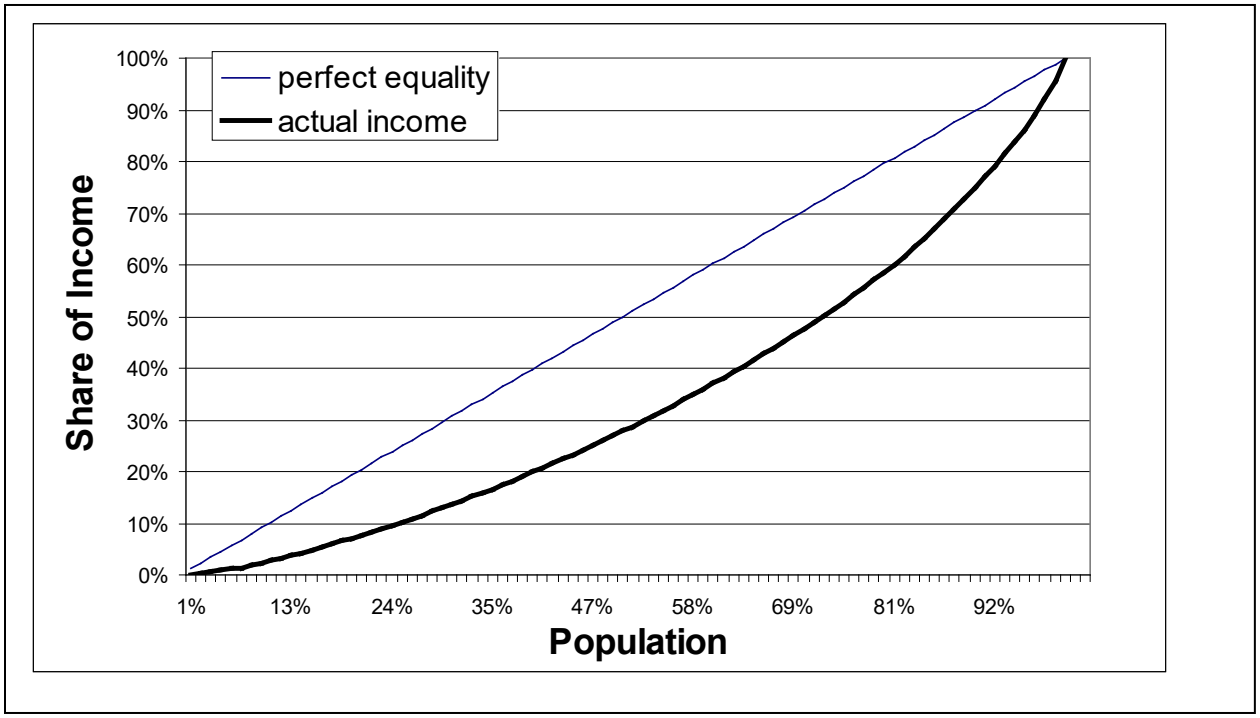
1% of the population (hh1) has .001 (.1%) of the income
2% of the population (hh1 and 2) have .001 plus .002, .003 of the income (.3%)
3% of the population (hh1, 2, 3) have (3+5+6) of the $22.42, or .006 of the income (.6%)

Percent of Population	Percent of Income	Percent of Population	Percent of Income
1%	0%	51%	29%
2%	0%	52%	30%
3%	1%	53%	31%
5%	1%	55%	32%
6%	1%	56%	33%
7%	2%	57%	34%
8%	2%	58%	35%
9%	2%	59%	36%
10%	3%	60%	37%
11%	3%	61%	38%
13%	4%	63%	39%
14%	4%	64%	41%
15%	5%	65%	42%
16%	6%	66%	43%
17%	6%	67%	44%
18%	7%	68%	45%
19%	7%	69%	47%
20%	8%	70%	48%
22%	8%	72%	49%
23%	9%	73%	50%
24%	10%	74%	52%
25%	10%	75%	53%
26%	11%	76%	54%
27%	12%	77%	56%
28%	12%	78%	57%
30%	13%	80%	59%
31%	14%	81%	60%
32%	15%	82%	62%
33%	15%	83%	64%
34%	16%	84%	65%
35%	17%	85%	67%
36%	18%	86%	69%
38%	18%	87%	71%
39%	19%	89%	73%
40%	20%	90%	75%
41%	21%	91%	77%
42%	22%	92%	79%
43%	23%	93%	82%
44%	23%	94%	84%
45%	24%	95%	86%
47%	25%	97%	89%
48%	26%	98%	92%
49%	27%	99%	96%
50%	28%	100%	100%

If income was exactly equal, 1% would have 1%, 10% would have 10%.....

This is a 45-degree line on a graph with a Lorenz curve.

The more the Lorenz curve moves to the South-East corner (away from the 45 degree line), the higher the inequality in the distribution of income.



5.2: Lorenz curves of the distribution of total income, cash income, and livestock

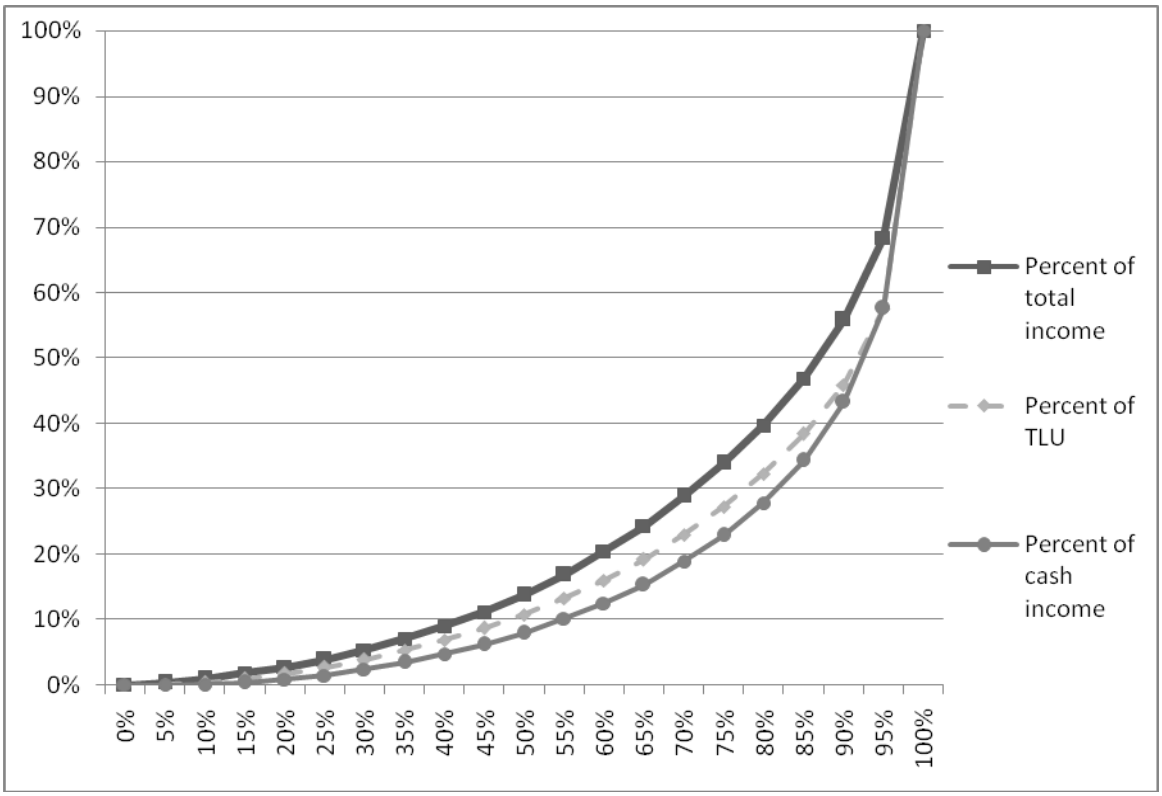
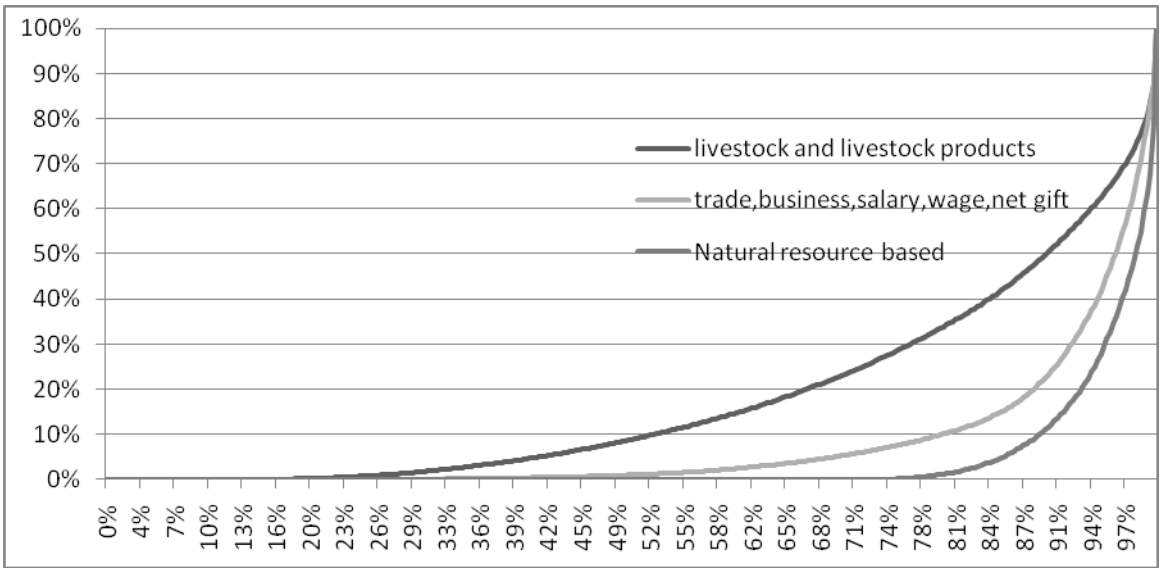


Figure 5.9 : Lorenz curves for distribution of cash income sources across households



We can use this information to compute a Gini Coefficient, the measure of concentration of income.

Perfect equality has a concentration ratio of 0, while perfect inequality has a ratio of 1. What is the total area under the perfect equality line? (remember the trusty old triangle?) 0.5.

What is the area between the perfect equality line and the Lorenz curve? In our case here of the Gabra income data we started with, the area is 0.16. The Gini coefficient is 0.16/0.50, or 0.32. By way of comparison, Kenya overall is 0.58 (from the book).

A/(A+B)
A=.16, A+B=.5

Highly unequal distributions fall in the range 0.5 to 0.7.

Relatively equal is 0.2 to 0.35.

Some examples: Denmark (23), Bulgaria (29), UK (36), Uganda (43), Brazil (58), Namibia (71). CIA estimates, various years.

https://hdr.undp.org/content/human-development-report-2023-24
https://hdr.undp.org/system/files/documents/global-report-document/hdr2023-24reporten.pdf

US census estimates:

1967	.397
1970	.394
1975	.397
1980	.403
1985	. 419
1990	.428
1995	.450
2000	.466
2005	.469
2010	.470
2013	.476

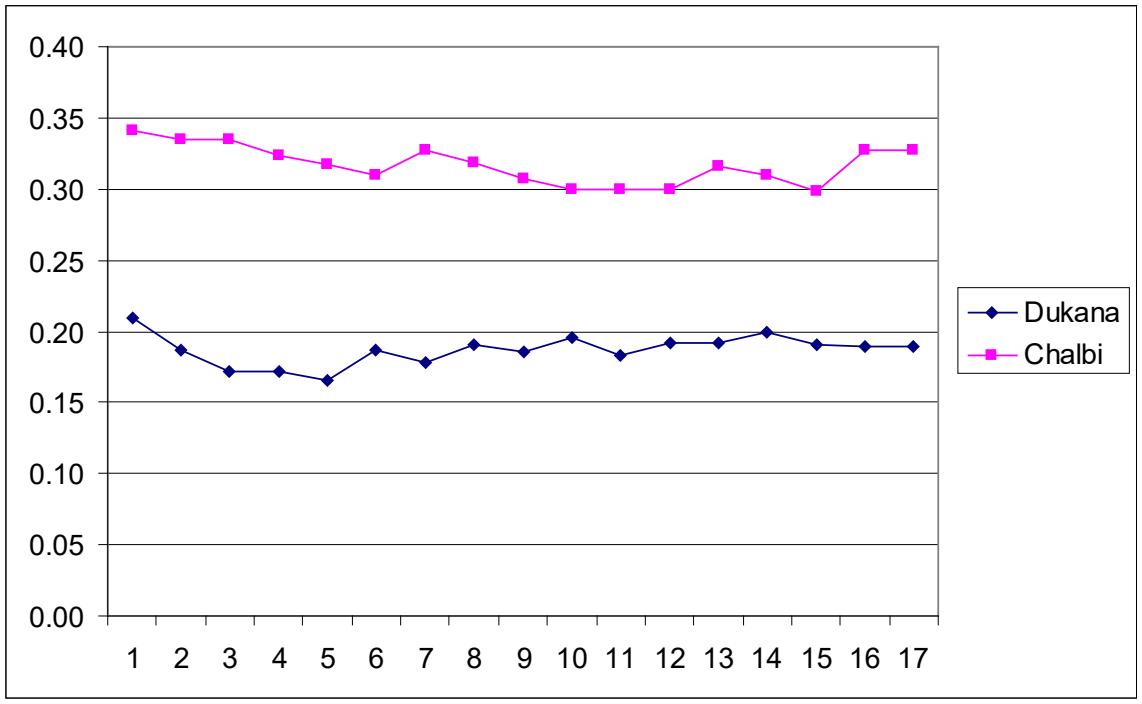
Table 4.
Gini Indexes for the 25 Most Populous Counties

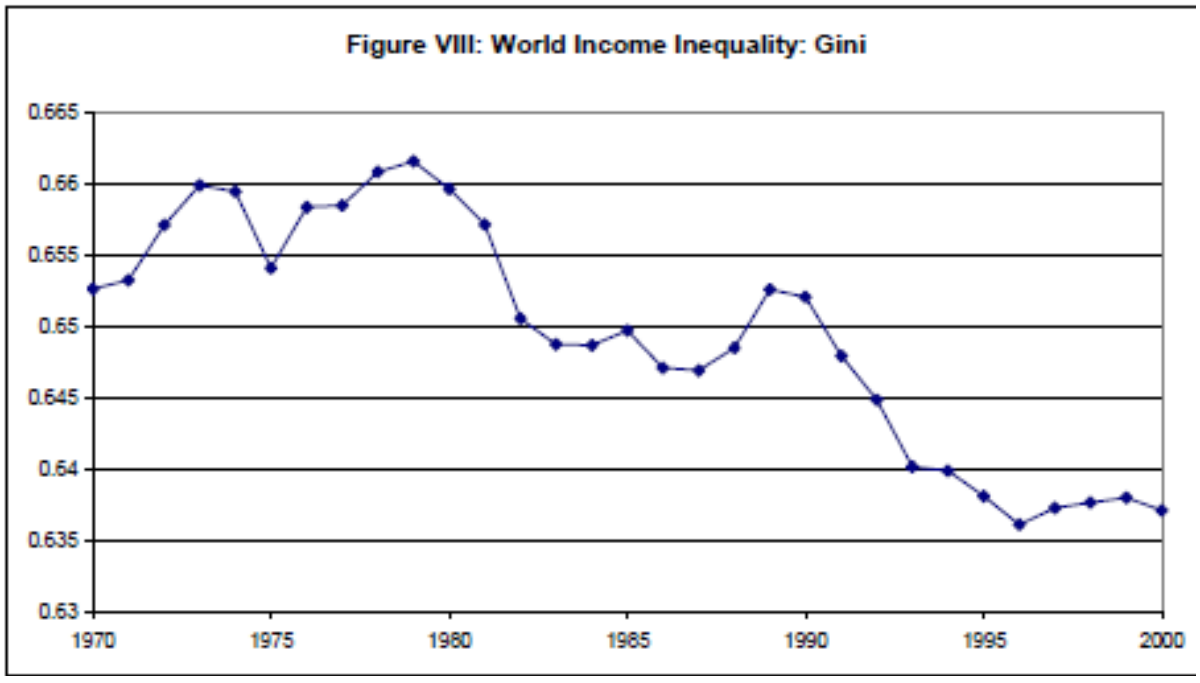
Population rank	County	Population (2010)	Largest city of MSA	Estimated Gini index (2006–2010)
1	Los Angeles County, California	9,818,605	Los Angeles	0.489
2	Cook County, Illinois	5,194,675	Chicago	0.488
3	Harris County, Texas	4,092,459	Houston	0.488
4	Maricopa County, Arizona	3,817,117	Phoenix	0.452
5	San Diego County, California	3,095,313	San Diego	0.452
6	Orange County, California	3,010,232	Los Angeles	0.455
7	Kings County, New York	2,504,700	New York	0.499
8	Miami-Dade County, Florida	2,496,435	Miami	0.503
9	Dallas County, Texas	2,368,139	Dallas	0.492
10	Queens County, New York	2,230,722	New York	0.433
11	Riverside County, California	2,189,641	Riverside	0.439
12	San Bernardino County, California	2,035,210	Riverside	0.422
13	Clark County, Nevada	1,951,269	Las Vegas	0.434
14	King County, Washington	1,931,249	Seattle	0.456
15	Wayne County, Michigan	1,820,584	Detroit	0.469
16	Tarrant County, Texas	1,809,034	Dallas	0.448
17	Santa Clara County, California	1,781,642	San Francisco	0.450
18	Broward County, Florida	1,748,066	Miami	0.469
19	Bexar County, Texas	1,714,773	San Antonio	0.463
20	New York County, New York	1,585,873	New York	0.601
21	Philadelphia County, Pennsylvania	1,526,006	Philadelphia	0.494
22	Alameda County, California	1,510,271	San Francisco	0.456
23	Middlesex County, Massachusetts	1,503,085	Boston	0.461
24	Suffolk County, New York	1,493,350	New York	0.417
25	Sacramento County, California	1,418,788	Sacramento	0.431

Sources: U.S. Census Bureau, 2006–2010 American Community Survey and 2010 Census (Population).

(Bee, 2012)

Gini for the Gabra herders over these seventeen time periods, two sites.



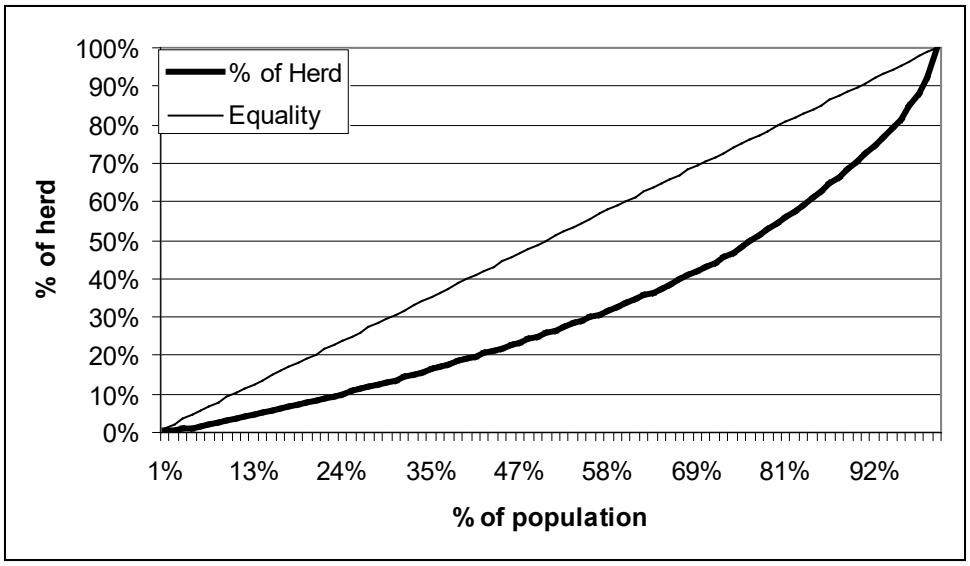


Sala-i-Martin's World Distribution of Income article

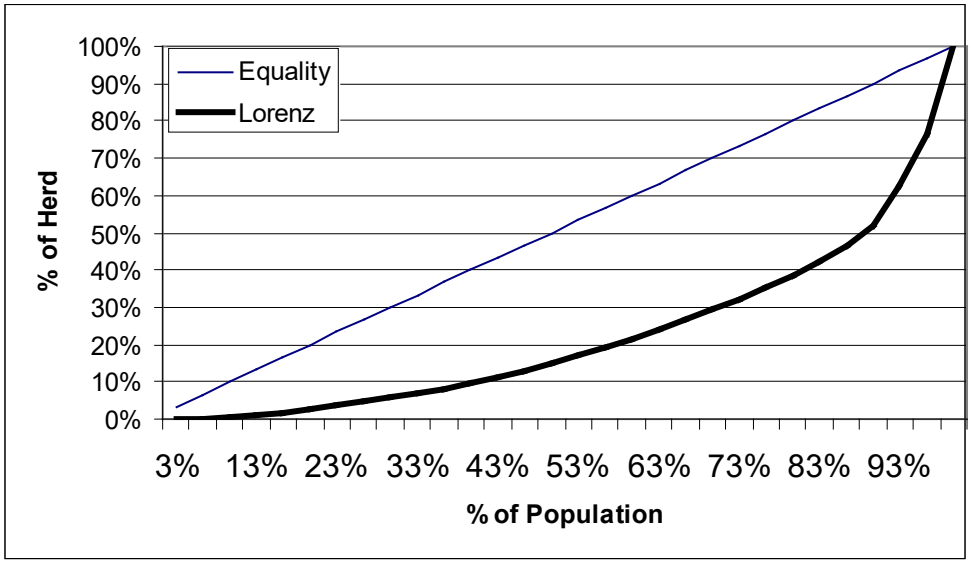
Gini satisfies four principles:

1) Anonymity – it does not matter the personal characteristics of who has the income.
2) Scale independence – it does not matter whether we do this in dollars or yen, percentage or levels.
3) Population independence – it does not matter how big the population is, a Gini for the Bahamas can be compared to a Gini for India without adjustment.
4) Transfer principle – if we transfer money from a richer person to a poorer person, the Gini moves towards greater equality.

While we have talked about these for income, they can also be used for assets, consumption measures, education achievement,…



Here in the Gabra rangelands the herd distribution Gini is .18/.5, or 0.37.



Here, across the desert in Kargi in the Rendille rangelands, it is .28/.5, or a Gini of 0.56. [However, not shown but the income Gini is 0.37]

Inequality:
What might be good about having some inequality?

Why might be bad about having some inequality?

1) Possible problems of inefficiency in savings and investment. For a given average income level, higher inequality implies a greater share of the population is collateral poor – unable to get credit to make productive investments. Education. Businesses. Improvements.
2) Middle income segment tends to have more domestic impact than wealthier savings. Savings rates higher as well for middle.
3) Social stability political stability put under strain by inequality.
4) Corruption. Focus on redistribution of existing economic wealth rather than growth.
5) Normative objections. Rawlsian veil of ignorance. What would we accept if we did not know our position?

Growth and inequality.

One perspective is that we don't need to worry about the relationship between growth and inequality since they will take care of each other. Kuznets curves.

Inverted U shaped relationship between Gini coefficient and GNP per capita. Begin at low income, low inequality. Over time, inequality increases as GNP per capita increases. Middle income and high inequality then give way to high equality and high per capita income.

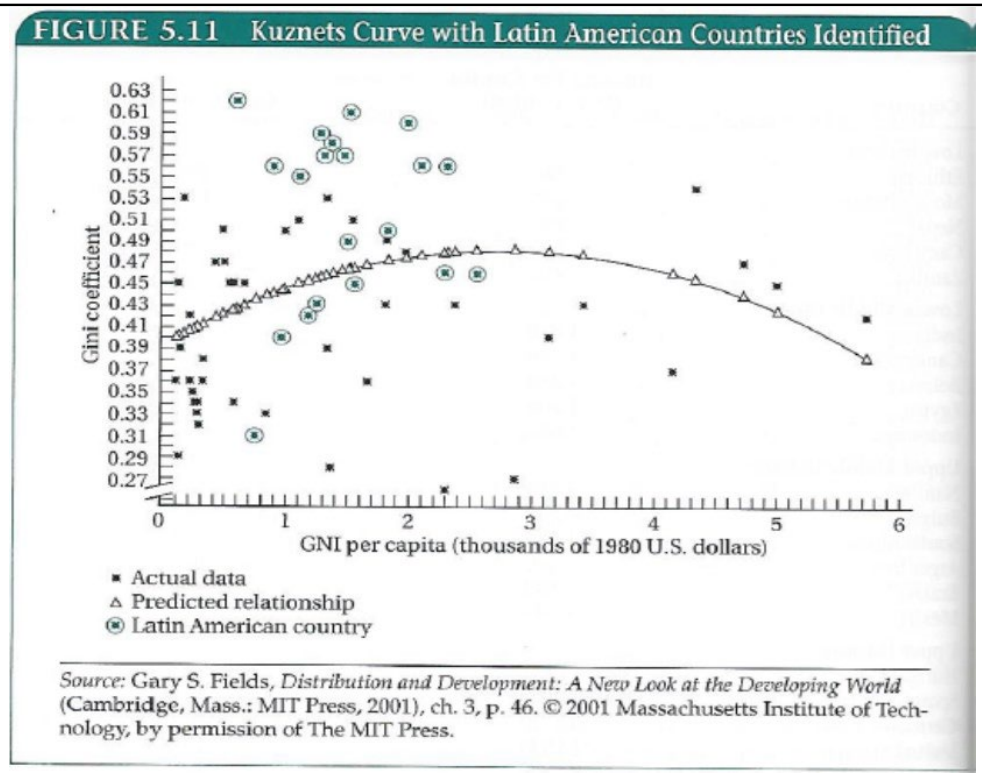
Sequential process of economic development. Note this is for a single country over time.

Difference between cross sectional and longitudinal.

Latin American countries with high inequality and middle income. This is related to history as well as to stage of development. Is this what drives the U-shape?

[draw]

Kuznets Curve



Danger of using cross sectional data to tell and over time story

Todaro and Smith, 2012

Individual Countries over Time

Page 44

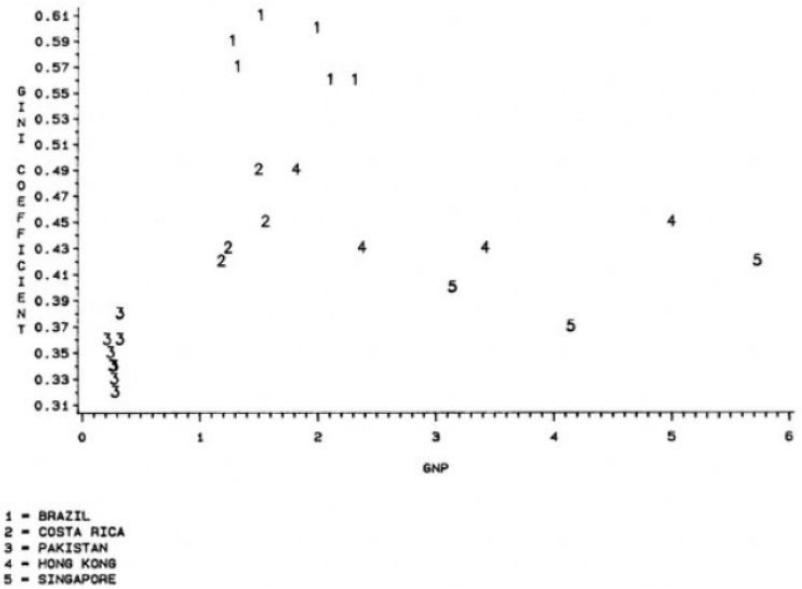


Figure 3.5
Plot of the data for selected countries
Source:Fields and Jakubson 1994.

Fields, Gary (2001)

Larger issue: Cross sectional data to tell temporal story is a problem in a variety of settings.

What is the relationship between income growth and inequality in the distribution of income?

Does high inequality encourage income growth?
Does high income growth increase inequality?

No clear result yet, but some findings worth noting.

Persson and Tabellini (1994) AER. Sample of industrialized countries, and also a broader worldwide sample. Negative relationship between income inequality at the start of the period and growth in subsequent periods.

Partridge (1997) AER. Sample of US states from 1960 to 1990. Gini is positively correlated with growth. Higher inequality at the start of the period is correlated with higher growth in the ensuing period. Mean Gini for the states in their sample is 0.36.

Economic Origins of Dictatorship and Democracy

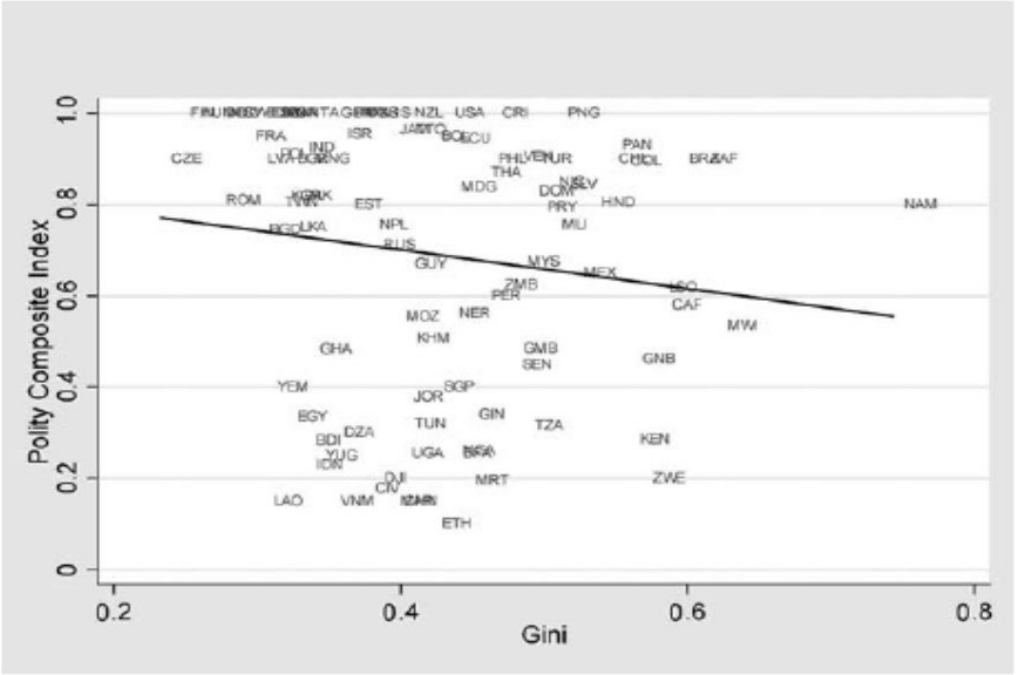


Figure 3.16. Democracy and Inequality 1990s.

Acemoglu and Robinson (2006)

Gini and Political Rights

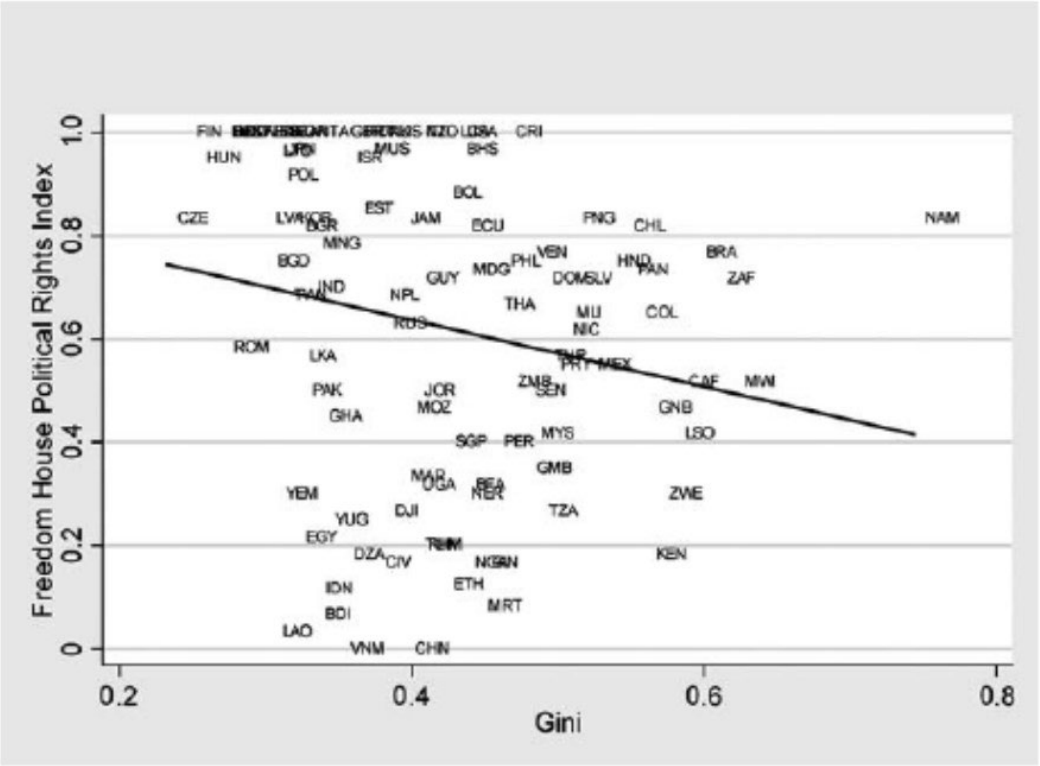


Figure 3.15. Democracy and Inequality 1990s.

Poverty measures.

Absolute poverty. One standard is $1 per person per day (this was commonly used, then moved to $1.25 to $1.50 PPP per person per day.

World Bank uses multiple options now.

https://pip.worldbank.org/home

First measure is a headcount. How many of our herders were absolutely poor by the standard of $1 per person per day in early 1993? All of them. Headcount = 88. H=88.

What if we define a $.50 per person per day standard (close to the Kenyan poverty line)? 81 are below this cutoff. Headcount =81. $H_{\$0.50}$=81.

We can also express this as a Headcount Index. The headcount (H) divided by the total population (N). We have a 100% headcount index for a $1/person/day standard, a 92% headcount index for a $0.50/person/day standard. $HI_{\$1.00}$=100%, $HI_{\$0.50}$=92%.

A limit to the headcount index is that we can't tell between 100% earning $0.10 per person per day and 100% earning $0.99 per person per day. Clearly the former is a more severe form of poverty, but both come out the same on a headcount index for a $1 per person per day line.

Poverty Gap measures address this.

Summation of the distance in dollars between the poverty line and the household incomes. The total amount of money it would take to bring every household up to the absolute poverty line.

Household 1 has an income of $0.03, the gap is $0.97.
Household 2 has an income of $0.05, a gap of $0.95.

Sum up the amount of money it would take to move all households / individuals up to the poverty line.

It would take $65.55 per day to move each household in poverty up to the poverty line (if there is only one person per household).

[Since the average household has 4.5 people, not one, we can multiple the total poverty gap times 4.5 to approximate the total poverty gap for the sample of $295 dollars per day. But for now, don't worry about this]

The average poverty gap is this sum divided by the total number of households (N), or 75 cents if there is one person per household ($65.55/88) = $0.75.

Can also calculate a normalized average poverty gap by dividing this figure by the poverty line: $0.75/$1=0.75: the average household poverty gap is 75% of the poverty line.

For the 50 cent poverty line, the APG is ($22.71/88), or $0.26. The N(A)PG is ($.26/$.50), or 52%.

There is also an idea of the average income shortfall. We can use the 50 cent line to make the contrast. H=81, N=88.

For the 50 cent poverty line, the AIS is ($22.71/81), or $0.28 and the APG is ($22.71/88), or $0.26.

The normalized (average) income shortfall is ($0.28/$.50), or 0.56 or 56%. The N(A)PG is ($.26/$.50), 0.52 or 52%.

N=88	H	HI	PG	APG	N(A)PG	AIS	N(A)IS
$0.50 line	81	92%	$22.71	$0.26	52%	$0.28	56%
$1.00 line	88	100%	$65.55	$0.75	75%	$0.75	75%

These measures are not sensitive to distribution of poverty among the poor.

Say we have a poverty line of $1 per person per day, and there are four people in the economy and three people are under this line.

You ($0.50), me ($0.50), and my sister ($0.50) are under the line.
Total gap is $1.50.
Average income shortfall is $0.50.
N(A)PG=0.375 (37.5%)

Now, say my sister beats me up and takes almost all my money.

We have you ($0.50), me ($0.01), and my sister ($0.99).
Total poverty gap is $1.50.
Average income shortfall is $0.50.
N(A)PG=0.375 (37.5%)

These are different situations, and the poverty situation is more dire (at least from my perspective) in the latter situation, but our measures are not picking this up.

Foster-Greer-Thorbecke index.

$$P_\alpha = \frac{1}{N} \cdot \sum_{i=1}^{H} \left(\frac{Y_p - Y_i}{Y_p} \right)^\alpha$$

P is the measure of poverty with alpha as a parameter to be chosen to define the measure.
Y sub p is the absolute poverty line chosen.
Y sub i is the income of household i, and households are indexed from 1 to N (the total number of households) or 1 to H (the total number below Y sub p).

Say alpha equals zero.
Then, just the sum of 1 to H divided by N: Headcount index.
Extent of poverty.

Say alpha equals one.
It is the normalized average poverty gap. Depth of poverty.

If alpha equals two, we get a severity of poverty measure.

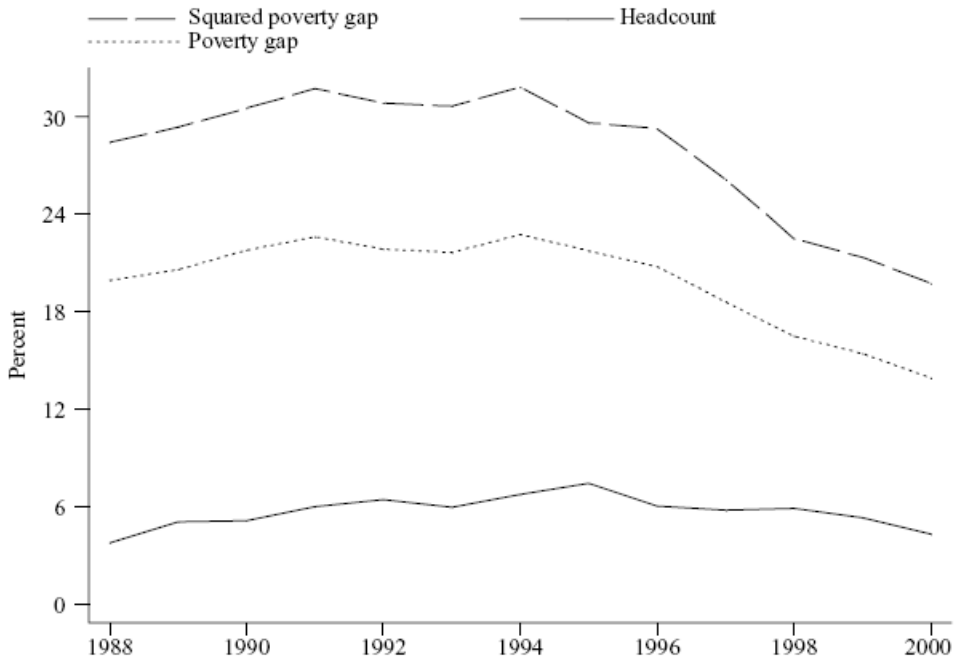
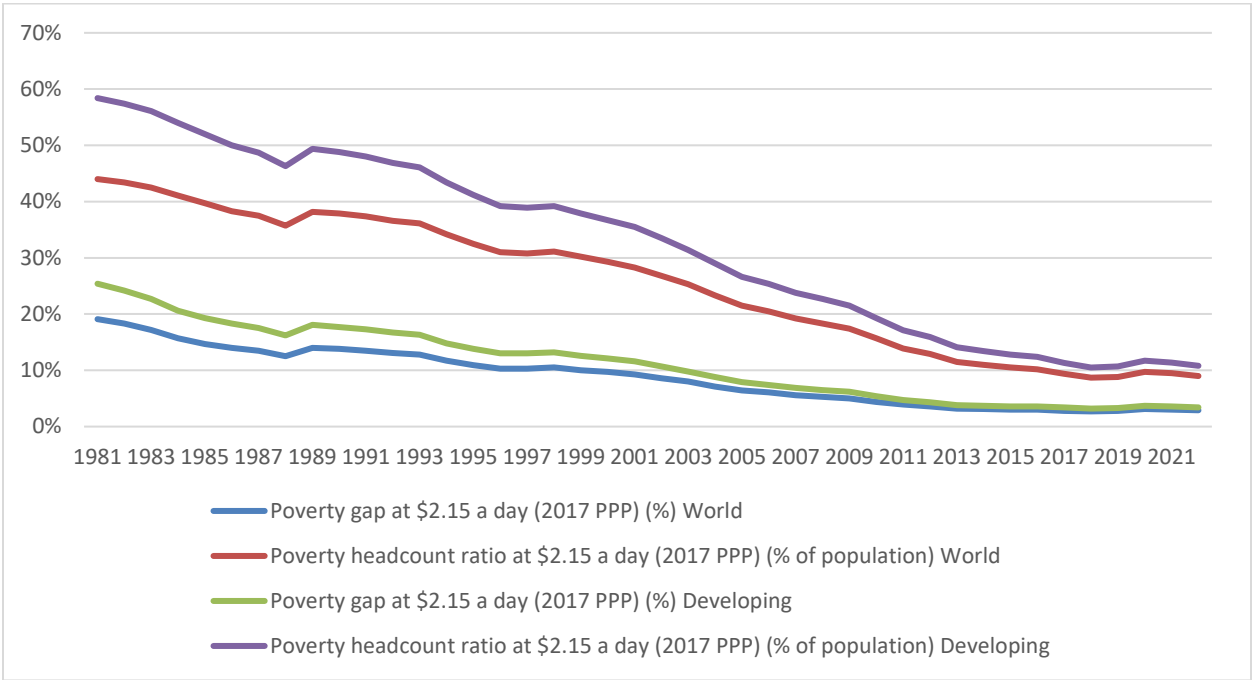


Figure 1. Percentage reduction in child poverty from food stamps

From Jolliffe et al. AJAE, 87(3). 2005. Page 575 This is for the United States.



From WDI online. Headcount Index, Normalized Average Poverty Gap.

We want two other characteristics for our poverty measures (in addition to the anonymity and population independence discussed above).

1) Monotonicity. If you add income to a person below the poverty line all else held equal, the poverty measure should not increase.
2) Distributional Sensitivity. If you move money from a poorer person to a richer person all else equal, the poverty measure should increase.

Which of our measures meets these characteristics?

	Anonymity	Population Independence	Monotonicity	Distributional Sensitivity
H	Y	N	Y	N
HI	Y	Y	Y	N
TPG	Y	N	Y	N
NPG	Y	Y	Y	N

Say the fourth person (my brother) in the economy has an income of $1.25.

Alpha equals zero;

you, me, and my sister are below the line: H=3.

Before she beats me up.

1+1+1=3

After she beats me up

1+1+1=3

If N = 4 (the brother), H/N=0.75.

Alpha equals one in a normalized average poverty gap measure;

you, me, and my sister are below the line: H=3.

Before she beats me up.

(1/4)*[(0.5/1)+(0.5/1)+(0.5/1)] = 0.375 (37.5%)

After she beats me up

(1/4)*[(0.5/1)+(0.99/1)+(0.01/1)] = 0.375 (37.5%)

Neither alpha equals zero or alpha equal one is showing distributional sensitivity.

Alpha equals two;

Before she beats me up.

$(1/4)*[(0.5/1)^2+(0.5/1)^2+(0.5/1)^2] = 0.1875$

After she beats me up

$(1/4)*[(0.5/1)^2+(0.99/1)^2+(0.01/1)^2] = 0.308$

The severity of poverty index reflects that things have gotten worse.

-Alternative take on the alpha equals two version-
The alpha equals two version can be restated:

$$P_2 = (H/N) * \left[NIS^2 + (1 - NIS)^2 * (CV_p)^2 \right]$$

NIS is normalized income shortfall $(TPG/H)/Y_p$, in our cases one and two it is the same: ($1.50/3)/$1= 50%.

CV of the poor in case one is zero (no variation)

CV of the poor in case two is calculated as follows:
Variance = $\left(\frac{1}{H}\right)\sum_{i=1}^{H}(y_i - \bar{y})^2$
In our case: $(1/3)*[(.99-.5)^2 + (.5-.5)^2+(.01-.5)^2] = (.4802/3)=0.16$.

The square root of the variance is the standard deviation, 0.40.

The CV is the standard deviation divided by the mean, the mean is 0.50. So the CV post sister mugging is=0.80.

CASE 1:
$(3/4)*(.5)^2 =.1875$

$(3/4)*[(.5)^2 +(1-.5)^2 *.80^2]= (3/4)*(.25+.16)=0.308$

Same values using the alternate formula.

Human Poverty Index. UNDP. Like the HDI. Income measures alone may not be sufficient to understand well being (as in GNI per capita) or poverty (such as we have been doing here).

Original version focused on three key depravations. Of life, of basic education, and overall economic provisioning.

Probability at birth of not surviving beyond 40 years of age, illiteracy rate, percent without access to health services, clean water, and percent of children under 5 who are underweight.

Here, a low HPI is good and a high one bad.

Note UNDP had a HPI-1 for developing countries and an HPI-2 that adds in social exclusion and is applied to developed countries.

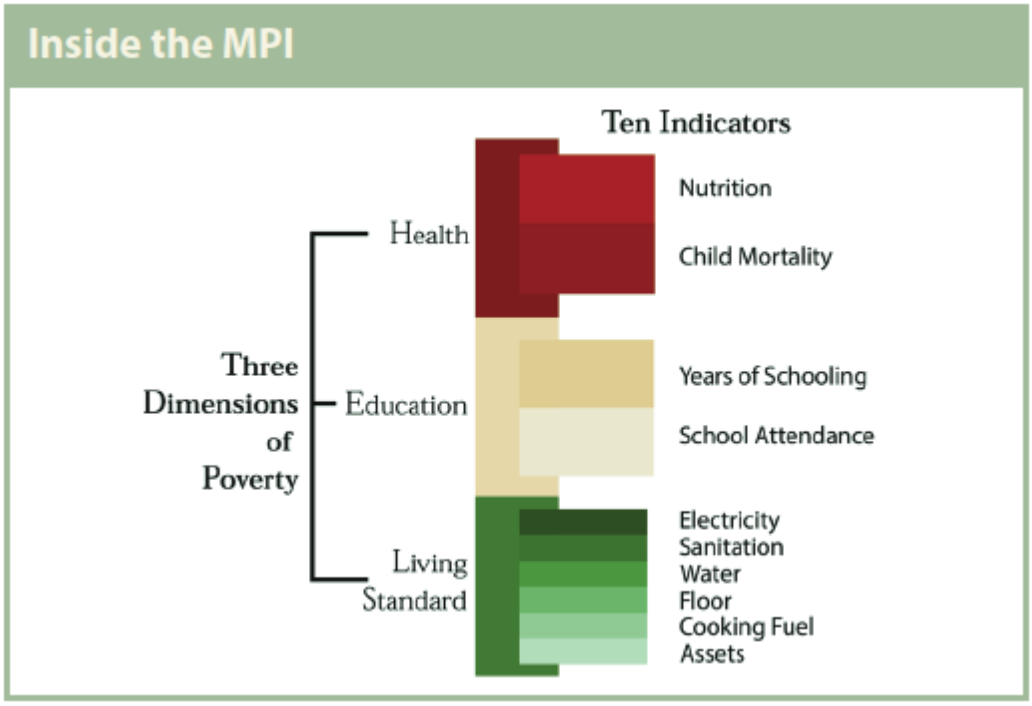
HPI-1 Developing Countries
HPI-2 Developed Countries

These gave way to the Multidimensional Poverty Index

https://hdr.undp.org/content/2024-global-multidimensional-poverty-index-mpi#/indicies/MPI

Multidimensional Poverty Index (MPI)

The Oxford Poverty and Human Development Initiative (OPHI) of Oxford University and the Human Development Report Office of the United Nations Development Programme (UNDP) launched in July 2010 a new poverty measure that gives a "multidimensional" picture of people living in poverty which its creators say could help target development resources more effectively. The MPI has supplanted the Human Poverty Index which had been included in the annual *Human Development Reports* since 1997.



https://ophi.org.uk/global-mpi

What is the relationship between increasing growth and decreasing (eliminating?) poverty?

Is rapid growth bad for the poor, since they are bypassed and marginalized even further?

Is spending money on reducing poverty bad for growth, and hence bad for everyone in the long run, since it reduces the money that can go to investment critical to growth?

Some reasons why reducing poverty and increasing growth may be in harmony.

1) The productive asset argument. Poor credit constrained, and security through children, so increasing alternatives helps growth.
2) Poor, sick, malnourished labor force is not the most productive labor force. Eradicate malaria, labor productivity increases.
3) Rich not good at saving, middle and poor actually make more productive savings decisions for the economy. French wine or another milking goat?
4) Poor and middle class buy things made in the country. Stimulate local demand.
5) Encourage social stability and social cohesion.

Reducing poverty and high growth need not be incompatible. WB in the late 90's. It does appear that growth rates in per capita income and growth rates of income for the poor have some positive correlation.

What can be done to address poverty?

1) Implement policies that alter the returns to different factors (land, labor, capital). Remove barriers that distort factor prices, and let the market determine the returns to various factors.
2) Implement policies that redistribute asset ownership. Move assets from one segment of the population to another. Land Reform.
3) Income and wealth taxes. Progressive taxes, so the rich are taxed at a higher rate than the poor.
4) Direct transfers and provision of public goods targeted at the poor. Health and water projects. Schools. Feeding programs. Food aid.
    a. Targeting
    b. Dependence
    c. Diversion of people from what they are doing to take advantage of public good.
    d. Political resentment of not-included.