Day 3: Inequality

New Climate Economy Training Course

World Resources Institute

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Motivation

So far, we have covered the core concepts on income distribution and an in-depth discussion on poverty and poverty measures. This new set of slides aims to offer the principal insights on inequality – and inequalities –, with focus on different inequality measures: income percentiles, Gini coefficient, Atkinson index and Theil index.

Motivation

This presentation is organized as follows.

1. Motivation

2. Inequality and inequalities

3. The inequalities of climate change

4. Inequality measures

5. Problem Set

Inequality and inequalities

"Inequality is the state of not being equal, especially in status, rights, and opportunities."[1]

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[1]UNDP, 2013

Inequality and inequalities

⇒ Different **types** of inequality:
- Money-metric measures
  - Income
  - Asset ownership
  - Wages
- Access to basic needs/capabilities:
  - Nutrition
  - Health services
  - Education
  - Decent work
  - Exposure risk

Inequality and inequalities

$\Rightarrow$ Different **measurement** of inequality:

- Between, cross or inter-country inequality.
- Within or intra-country inequality.
- Global inequality (both within and between country inequalities).

Income inequality *between* countries has improved in the last 25 years, meaning average incomes in developing countries are increasing at a faster rate. However, income inequality *within* countries has become worse. This is especially important because inequalities within countries are the inequalities people feel day to day.

Inequality and inequalities
Global inequality

Global inequality refers to inequality between 'world citizens'. It compares the incomes of people across the globe by analyzing within country inequality based on data collected from household surveys. Branko Milanovic – former World Bank's economist who has specialized in global inequality – stresses the importance of studying global inequality in an era of an increasing globalization.

Inequality and inequalities
Global inequality

"As the world becomes more integrated the global dimension of inequality is likely to become increasingly relevant. This is for at least two reasons: because of much greater movement of factors of production across borders, and because of greater influence of other people's (foreigners') standard of living and way of life on one's perceived income position and aspirations."[2]

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[2]Milanovic, 2012

Inequality and inequalities

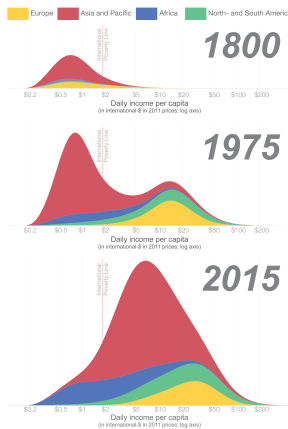## Global inequality: Global divergence followed by convergence

Figure: Global inequality in 1800, 1975, and 2015.[3]

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[3] Roser, 2013

Inequality and inequalities
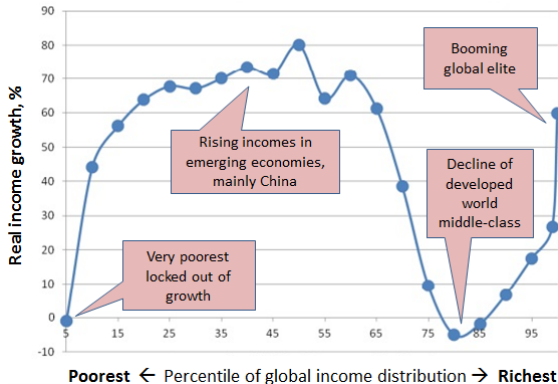## Global inequality: Branko Milanovic's Elephant graph

Figure: Global income growth from 1988 to 2008.[4]

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[4] Milanovic, 2012

The inequalities of climate change

The impact of climate change is unequal too. That's why **climate change is not just an environmental problem, but a major justice issue.** New research by Oxfam and the Stockholm Environment Institute (SEI) reveals the extreme carbon inequality in recent decades. From 1990 to 2015, a period in which annual emissions grew 60% and cumulative emissions doubled, it was estimated that[5]:

- The richest 10% of the world's population were responsible for 52% of the cumulative carbon emissions.
- The poorest 50% were responsible for just 7% of cumulative emissions.

[5]Oxfam, 2020

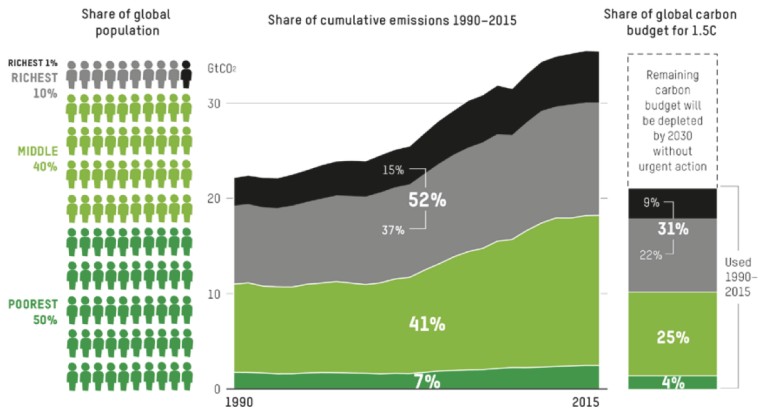# The inequalities of climate change

Figure: Share of cumulative emissions from 1990 to 2015 and use of the global carbon budget for 1.5C linked to consumption by different global income groups.[6]

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[6]Oxfam, 2020

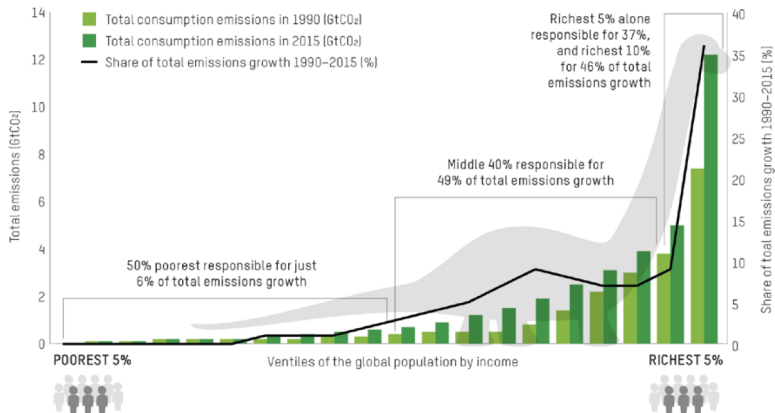# The inequalities of climate change

Figure: The 'dinosaur graph' of unequal carbon emissions growth 1990-2015.[7]

[7] Oxfam, 2020

The inequalities of climate change

Another dimension of the inequalities of climate change is the **social impacts of mitigation policies.** The Paris Agreement and the Sustainable Development Goals (SDGs) set ambitious targets for tackling environmental and socio-economic challenges. There are indirect and complex social and inequality impacts of climate change mitigation policies that need to be considered by policymakers to maximize the benefits and minimize the negative effects of climate change policies, especially in developing countries.[8]

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[8]Markkanen and Anger-Kraavi, 2019

The inequalities of climate change

Overall policy objective	Policy measure	Potential equality outcome(s)				
		Health	Wealth/income	Gender	Ethnic	Risk of conflict
Reduced energy consumption	Programmes to improve energy efficiency in homes (a)[a]	↑↓	↑↓	↑		Low
	Removal of fossil fuel subsidies (b)	↑↓	↓	↑↓		Low
	Improved public transport networks (c)	↑	↑	↑	↑	Low
	Financial penalties for private car use (e)	↑	↓			Low
	Carbon pricing (f)	↑↓	↓	↓	↓	Medium
Renewable energy policies	Large-scale Renewable energy (RE) projects (carbon pricing and obligations) (g)	↑	↑			Medium
	Hydroelectric dams (g)	↑↓	↓		↓	High
	Financial support for small-scale RE generation (feed-in tariffs/premiums) (h)	↑	↑↓			Low
	Closure of coal, fuel and gas plants and coal mines (b,f,g)	↑↓	↓			High
	RE systems to improve access to energy in remote communities (i)	↑	↑↓	↑	↑	Medium
	Measures to support electrification of transport (j)	↑	↑↓			Low
	Disincentives to own or operate ICE vehicles (j)	↑	↓			Low
	Policy measures to incentivise the production and use of biofuels (k)	↑↓	↑↓			Medium
Policies to develop and preserve carbon 'sinks'	Forestry carbon projects (REDD, REDD+, PES) (l)	↑↓	↑↓	↑	↑↓	Medium/high

Figure: Summary of potential inequality impacts of selected climate change mitigation policies. [9]

Inequality measures

In essence, measuring inequality involves comparing income or wealth distributions across/within countries or over time. Various indexes have been developed that summarize different aspects of the dispersion in the distribution of outcomes (income or wealth or health or some other measure of well-being). This section will review the following inequality measures:

1. Quantile measures
2. Lorenz curve and Gini coefficient
3. Coefficient of variation
4. Atkinson index
5. Theil index and General Entropy measures

Inequality measures
Quantile measures

A common approach used in income analysis is based on a ranking of the units of analysis from the lowest to the highest, then dividing them into equally sized groups – called **quantiles** – and finally calculating the shares of income/wealth accruing to a given proportion of the units (e.g. persons or households).

When the population is divided into 5 equally sized groups, the quantiles are called *quintiles*, if there are 10 groups they are called *deciles*, and 100 groups gives *percentiles*. Ratios of percentile points may be used to summarise the relative distance between two points on the distribution, and statistics such as the P90/P10 ratio or the P80/P20 ratio provide a more robust indication of spread.

Inequality measures

Quantile measures

Figure: Expenditure share and Palma ratio based on expenditure per capita by race of household head, South Africa. [10]

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[10]Statistics South Africa, 2019
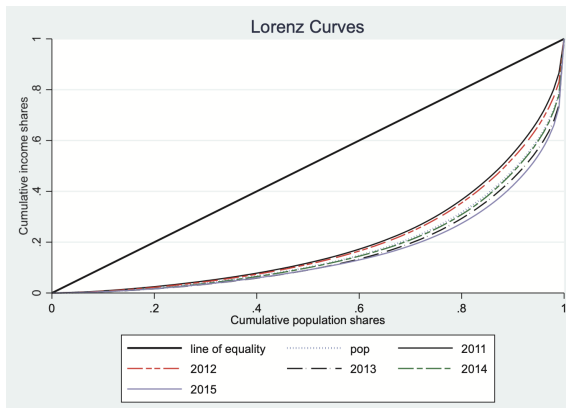
Inequality measures
Lorenz curve and Gini coefficient

The **Lorenz curve** is a graph with the horizontal axis showing the cumulative proportion of the population ranked according to their income/wealth and with the vertical axis showing the corresponding cumulative proportion of the population net worth.

The **Gini coefficient** can be defined by the Lorenz curve. It is the ratio of the area between the Lorenz curve and the diagonal, compared to the total area under the *"line of equality"*. The Gini coefficient equals zero when all people have the same level of income and equals one when 1 person receives all.

Inequality measures
Lorenz curve and Gini coefficient

Figure: Lorenz curves of real monthly earnings by year (2011–2015), South Africa.
[11]

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[11] Statistics South Africa, 2019

Inequality measures
Coefficient of variation

This measure is calculated by the dividing the standard deviation of the income distribution by its mean. **A smaller standard deviation indicates a more equal income distribution**. It is one of the simplest measures of inequality, however, it has important limitations (difficult interpretation and comparison, its main components may be exceedingly influenced by anomalously low- or high-income values) so it has been fairly limited in the public health literature.

Inequality measures
Atkinson index

Is one of the most popular welfare-based measure of inequality. This measure depends on the degree of society aversion to inequality since it presents the percentage of total income that a given society would have to forego in order to have more equal shares of income between its members. **A higher value of the index indicates a greater social willingness by individuals to accept smaller incomes in exchange for a more equal distribution.**

Inequality measures
Theil index and General Entropy measures

The Generalised Entropy measures are equal to zero in the case of complete equality. An important feature of these measures is that they are fully decomposable, i.e. inequality may be broken down by population groups or other dimensions, which can prove useful to research and policy design.

The key parameter for constructing this indicators is α, which assigns a weight to distances between incomes in different parts of the income distribution. **The special case of α equals 0 corresponds to the Theil index.**

Inequality measures
Summary

Sex of household head	Year	Gini coefficient	Theil's indices		Atkinson indices		Palma ratio			
			GE(0)	GE(1)	A(1)	A(2)	Bottom 40%	Middle 50%	Top 10%	Ratio
Male	2006	0,66	0,86	0,89	0,58	0,76	6,1%	40,1%	53,8%	8,9
	2009	0,64	0,80	0,77	0,55	0,76	6,2%	44,8%	49,0%	7,9
	2011	0,64	0,80	0,80	0,55	0,75	6,4%	43,7%	49,9%	7,8
	2015	0,64	0,79	0,77	0,55	0,76	6,4%	44,4%	49,2%	7,7
Female	2006	0,63	0,69	0,92	0,50	0,66	9,2%	35,0%	55,8%	6,1
	2009	0,63	0,70	0,89	0,50	0,66	8,8%	36,7%	54,5%	6,2
	2011	0,61	0,65	0,81	0,48	0,65	9,3%	38,3%	52,4%	5,6
	2015	0,61	0,68	0,80	0,49	0,67	8,7%	39,5%	51,8%	6,0
Total population	2006	0,67	0,85	0,95	0,57	0,74	6,6%	36,2%	57,2%	8,6
	2009	0,65	0,81	0,86	0,56	0,74	6,5%	40,2%	53,3%	8,1
	2011	0,65	0,80	0,86	0,55	0,74	6,8%	39,9%	53,3%	7,9
	2015	0,65	0,80	0,84	0,55	0,75	6,6%	40,8%	52,6%	7,9

Figure: Inequality measures based on per capita expenditure by sex of household head, South Africa. [12]

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[12]Statistics South Africa, 2019

Problem Set
Trends in inequality of individuals and families

The problem set consists in the replication of the key results of this paper:

"Measuring the Trends in Inequality of Individuals and Families: Income and Consumption"[13]

The results are listed in the following slides.

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[13]Fisher, Johnson, and Smeeding, 2013

Problem Set
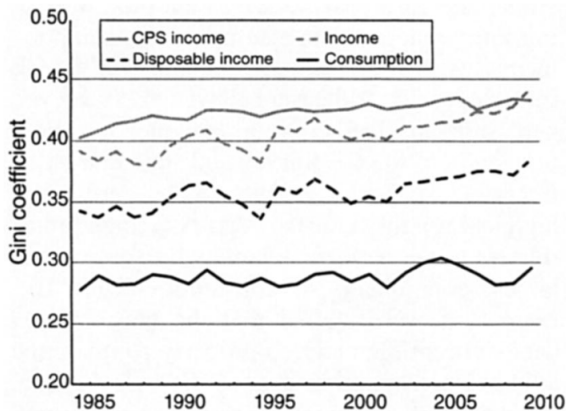
Trends in inequality of individuals and families

FIGURE 1. INEQUALITY USING THE GINI COEFFICIENT
(1985–2010)

Problem Set
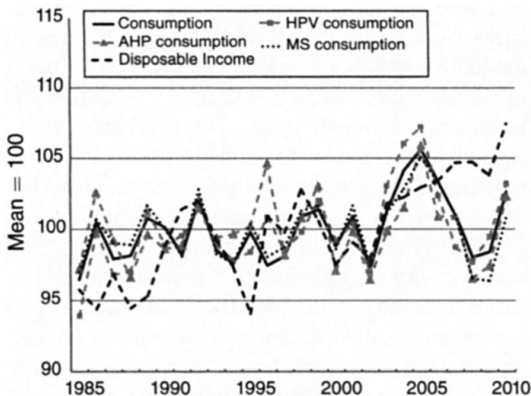
Trends in inequality of individuals and families

FIGURE 2. COMPARING THE TRENDS IN INEQUALITY USING
DIFFERENT CONSUMPTION MEASURES AND DISPOSABLE
INCOME WITH THE GINI COEFFICIENT (*Mean* = 100)

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