

# Research Methods II

## Session 3: Measuring Inequality

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### Measuring Inequality

#### What is Inequality?

- **Economic inequality** refers to how economic variables are distributed among individuals in a group, among groups in a population, or among countries.
- Inequality of What?
  - inequality of opportunities, for example access to employment or education
  - inequality of outcomes, for example material dimensions of human well-being, such as the level of income, educational attainment, health status and so on.
- For now we will focus on **income** inequality.

#### How do you analyze (measure) inequality?

- There are various approaches that have been used for the analysis of Inequality
  - Intuitive approach
    - \* Unaxiomatic approach used to describe inequality.
  - Normative approach-Social welfare
    - \* Uses explicit concepts of welfare functions to quantify inequality
  - Information theory
    - \* Quantifies inequality treating it as a problem of comparing income distribution probabilities.
  - Axiomatic approach
    - \* Uses a series of axioms to create measures of inequality

## Preliminaries

- Regardless of the approach, there are some basic steps required to measure inequality
  - Define the population of interest
  - Define the measure of interest
  - Adjust for prices (if necessary)
  - Adjust for individual heterogeneity (needs) (if necessary)

## Mathematical Preliminaries

- Let  $y_i$  be the income of individual  $i$  in the population. Assume that  $y_i > 0$ .
- Assume that  $y_i$  can be characterized by a probability distribution function  $f(y)$ .

$$y_i \sim f(y) \rightarrow \int_{-\infty}^z f(y)dy = F(z)$$

$$F(0) = 0 \text{ \& } F(\infty) = 1$$

$$F(Q_y(p)) = p \rightarrow Q_y(p) = F^{-1}(p)$$

The  $p_{th}$  quantile of  $y_i$  is the value  $Q_y(p)$  such that  $p$  percent of the population has income below  $Q_y(p)$ .

## Mathematical Preliminaries

Mean of Standard of Living:

$$\mu_y = E(y) = \int_{-\infty}^{\infty} yf(y)dy = \int_0^1 Q(p)dp$$

Finally, the inequality measure can be written as:

$$I(y) = I(\mu_y, f(.)) = I(\mu_y, F(.))$$

## Visualization tools

- There are several tools that can be used to visualize income distribution:
  - Density Function/Histogram
  - Pen\_\_parade/Cumulative Distribution Function
  - Lorenz Curve

## Density/Histogram

- Density functions and histograms are used to visualize the distribution of income in the population.
- They could be used to detect multimodality, skewness, etc
- And could be used to compare distributions across groups.
- Stata Commands

```
histogram varname [weight] [if]
```

```
kdensity varname [weight] [if]
```

## Plots

```
set scheme white2
set linesize 255
color_style tableau
qui:frause oaxaca, clear
sum wt, meanonly
gen int wt2 = round(wt/r(min))
qui:two histogram lnwage [fw=wt2] ///
    || kdensity lnwage [w=wt2], ///
    ysize(5) xsize(9) xtitle("Log Wages") ///
    legend(order(1 "Histogram" 2 "Kernel Density") pos(6) col(2))
```

<IPython.core.display.HTML object>