

EE461

Lecture 5: Income distribution

February 18th, 2012

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INTRODUCTION: DISTRIBUTIONAL ANALYSIS

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Major Approaches to Distributional Analysis

- Consider 2 countries, A and B
- After some period of time, gov't of A and B declare their respective growth rate: A grew by 9%, B grew by 18%
- Question: Are people in B better off faster?
- Suppose that the poorest 40% of A and B used to contribute 36.3% of the income, but now the shares fall to 33.3% in A and 30.7% in B
- Question: Which one do you prefer? Initial situation, A, or B?

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The Second Example

- Consider 2 countries, C and D
- Initially both have 10% of people working in high-paying job (\$2), the rest got \$1
- Some time later, 20% of C got \$2 job and 80% in \$1 job, while 30% in D got \$2 job and 70% got \$1 job.
- Question: Which one do you prefer? Initial situation, C, or D?

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The Third Example

- Consider 2 countries, E and F
- Initial situation: the poorest 40% of both E & F receive an average income of \$40
- Sometimes later the poorest 40% of both countries still receive an average income of \$40
- Question: No economic growth in either countries?

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The Fourth Example

- Consider 2 countries, G and H
- We have data on previous and current incomes of these 2 countries
- In both G and H, the non-poor gained average income share while the poor lost
- The difference between the average change in income share of the non-poor vs. poor was 0.038 in G and 0.047 in H (more disparate income mobility in H)
- Question: Which one do you prefer? Initial situation, G, or H?

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Believe it or not?

- All 4 examples come from the same underlying data
 - Countries A, C, E, G = same country
 - Countries B, D, F, H = same country

- Income distribution:

- Initial: (1,1,1,1,1,1,1,1,1,2)

- A-C-E-G: (1,1,1,1,1,1,1,1,2,2)

- B-D-F-H: (1,1,1,1,1,1,1,2,2,2)

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Back to the 1st Example

- Initial: (1,1,1,1,1,1,1,1,1,2): Total income = 11
- “After some period of time,..., A grew by 9%, B grew by 18%”
- “The poorest 40% of A and B used to contribute 36.3% of the income, but now the shares fall to 33.3% in A and 30.7% in B”

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Back to the 2nd Example

- “Initially both C & D have 10% of people working in high-paying job (\$2), the rest got \$1”: (1,1,1,1,1,1,1,1,1,2)
- “Some time later, 20% of C got \$2 job and 80% in \$1 job, while 30% in D got \$2 job and 70% got \$1 job.”

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Back to the 3rd Example

- “Initial situation: the poorest 40% of both E & F receive an average income of \$40. Sometimes later, the poorest 40% of both countries still receive an average income of \$40”

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Back to the 4th Example

- “In both G and H, ..., The difference between the average change in income share of the non-poor vs. poor was 0.038 in G and 0.047 in H”
 - Initial: (1,1,1,1,1,1,1,1,1,2)
 - New G: (1,1,1,1,1,1,1,1,2,2)
 - New H: (1,1,1,1,1,1,1,2,2,2)

G

# of people	Initial income share	Final income share	Diff.
8			
1			
1			

H

# of people	Initial income share	Final income share	Diff.
7			
2			
1			

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What do we get?

- The 1st example uses the **approach** – exactly what Gini does (more later)
- The 2nd example uses the **approach** – how many people receive how much income
- The 3rd example uses the **approach** – the poorest group’s income is defined and their income is calculated
- The 4th example uses the **analysis** – possible when we can track’s same set of people’s income over time

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MEASUREMENT OF INEQUALITY: HOW UNEQUAL?

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How to determine inequality? (1)

- Suppose there are 2 groups of population, each consists of 4 persons as in the table below

Group 1

Group 2

Name	A	B	C	D
Income	\$1	\$2	\$3	\$4

Name	W	X	Y	Z
Income	\$1	\$2	\$3	\$4

- Which group has higher income inequality?

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How to determine inequality? (2)

- Suppose there are 2 groups of population, each consists of 4 persons as in the table below

Group 3

Group 4

Name	E	F	G	H
Income	\$2	\$4	\$6	\$8

Name	S	T	U	V
Income	\$1	\$2	\$3	\$4

- Which group has higher income inequality?

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Absolute vs. Relative

- The first answer measures ***inequality*** while the second measures ***inequality***
 - Both are not alternative to one another
- Absolute inequality relies on ***dollar (or other unit of currency) differences*** in real income.
- Relative inequality is measured in terms of ***income ratios***.
- Which one to choose?

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3 Reasons for Relative Measures (*Income Homogeneity Axiom*)

(Also called Scale Independence)

1. If you see G3 and G4 equally unequal, then you are (probably not knowingly) using the relative measure.
2. Almost the entire literature on distribution and development uses it.
3. If you choose absolute measure, then economic growth always raises inequality! (Why?)

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How to determine inequality? (3)

- Suppose there are 2 groups of population as in the table below

Group 5

Name	I	J	K	L	M	N	O	P
Income	\$2	\$2	\$4	\$4	\$6	\$6	\$8	\$8

Group 4

Name	S	T	U	V
Income	\$2	\$4	\$6	\$8

- Which group has higher income inequality?

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To compare inequality with diff. population size

- Can we say that Group 5 is more unequal because it has more people thus higher standard deviation?

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How to determine inequality? (4)

- Back to the first example, suppose the richest in Group 3 transfer a dollar to the poorest

Initial Group 3

Name	E	F	G	H
Income	\$2	\$4	\$6	\$8

Final Group 3

Name	E	F	G	H
Income	\$3	\$4	\$6	\$7

- Which group has higher income inequality?

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MEASUREMENT OF INEQUALITY: LORENZ CURVE

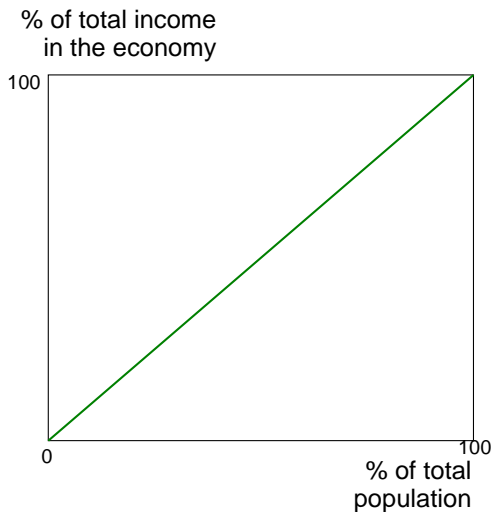
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Lorenz Curve

- Developed by Max O. Lorenz in 1905
- A graphical representation of the cumulative distribution function of the empirical probability distribution of wealth
- Used to represent income distribution,
 - The percentage of households is plotted on the x-axis, the percentage of income on the y-axis
- Perfect income distribution:

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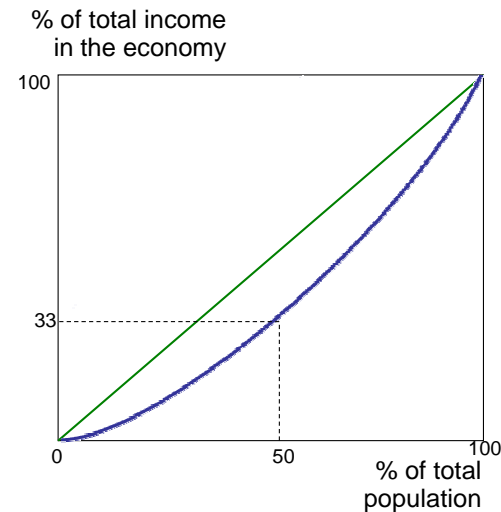
Lorenz Curve: Perfect Distribution



- With perfect income/wealth distribution, Lorenz curve is

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In reality...



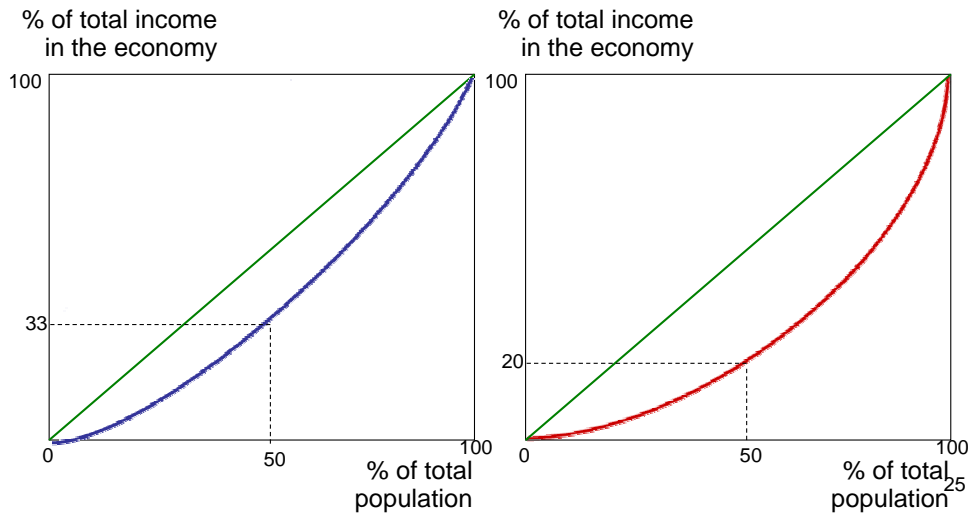
- Lorenz curve usually falls below the diagonal line
- The more 'convex', the higher inequality
- In this case...

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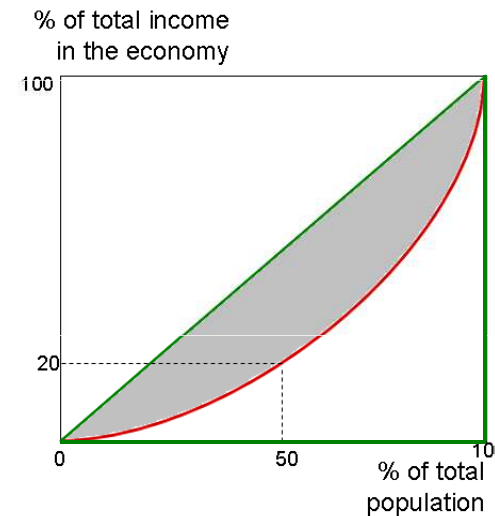
International Comparison

Country A

Country B



Measurement of Income Distribution assoc. with Lorenz Curve



- Gini Coefficient: the ratio of the grey area and the green-bordered triangle
- With perfect income distribution,

Formalized Version of Lorenz curve & Gini Coefficient

- For a probability density function $f(x)$ with the cumulative distribution function $F(x)$, the Lorenz curve $L(F(x))$ is given by

$$L(F(x)) = \frac{\int_{-\infty}^x t f(t) dt}{\int_{-\infty}^{\infty} t f(t) dt}$$

- For a cumulative distribution function $F(x)$ with inverse $x(F)$, the Lorenz curve $L(F)$ is given by:

$$L(F) = \frac{\int_0^F x(F_1) dF_1}{\int_0^1 x(F_1) dF_1}$$

- If the Lorenz curve is represented by the function $Y = L(X)$, the value of Gini can be found with integration: $G = 1 - 2 \int_0^1 L(X) dX$.

Gini in Action

- Worldwide, Gini coefficients for income range from approximately 0.247 in Denmark to 0.743 in Namibia

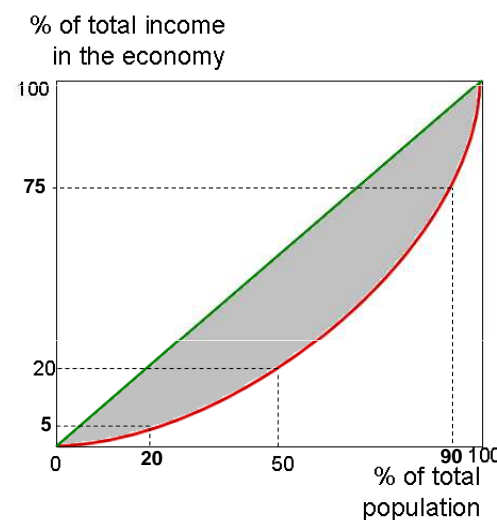
Country	Gini	Year
USA		2010
EU		2010
S. Africa		2009
Japan		2008
Laos		2008
Philippines		2008
Slovakia		2008
Singapore		2008
Thailand		2009

Limitations with the Gini

- 1) Two **different** distributions can yield exactly the same GINI coefficient
- 2) Gives only information on the shape of the **entire distribution**, not on how the poorest, for instance, relate to the mean or to the better off.
- 3) Very **insensitive** to changes in the lower tail

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Income Ratio



- Share of total incomes of say the richest 10% of population as a ratio to the incomes of the poorest 20%: $IR_{10/20}$
- Back to our earlier example: $IR_{10/20}$ would be

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IRs in Action

- Worldwide, $IR_{10/10}$ coefficients for income range from approximately 4.5 in Japan to 168.1 in Bolivia
- Still, $IR_{10/10}$ does not seem to have any association with the stage of development in each country

Country	$IR_{10/10}$	Year
USA		2008
EU		2008
S. Africa		2008
Japan		2008
Laos		2008
Philippines		2008
Slovakia		2008
Singapore		2008
Thailand		2008

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Limitation with Income Ratio

- Income Ratio does not say anything about those in the middle income range
 - Which could be problematic if Lorenz curve is not a smooth convex curve

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EFFECT OF ECONOMIC GROWTH ON INCOME DISTRIBUTION: H₁: THE KUZNETS CURVE

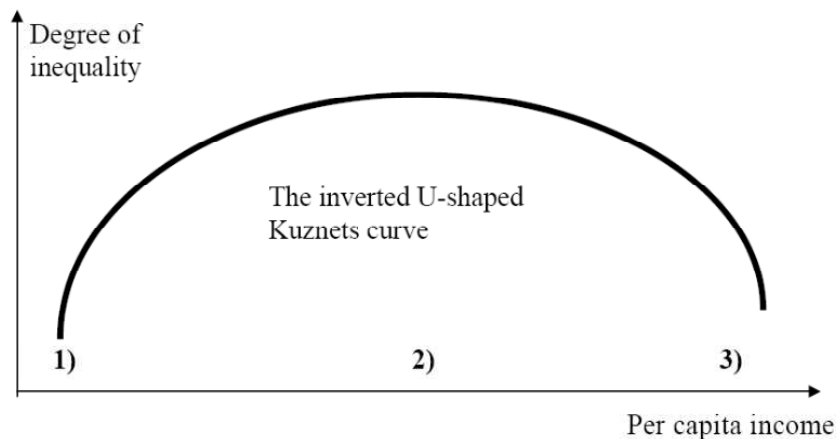
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Three Phases of Development

- Phase 1: All labor in agriculture
 - Even distribution,
- Phase 2: Labor allocated evenly between agriculture and industry, *assuming industry wage to exceed agri. wage*
 - Large inequality
- Phase 3: Almost all labor in industry
- Where is Thailand?

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Three Phases of Development



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EFFECT OF ECONOMIC GROWTH ON INCOME DISTRIBUTION: H₂ GROWTH LEADS TO INEQUALITY

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Second Hypothesis

“Growth in market economies can not take place without a worsening of the income distribution” But why?

1. Wealth and other income-generating **assets are unevenly distributed** historically and only the rich can save and invest.
 - Income growth goes to

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Second Hypothesis

2. **Technological progress** is inherently biased in favor of
 - Of whom marginal product goes up the most?
3. Only the rich can put up collateral and have access to (more in lecture on Microfinancing)

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EFFECT OF ECONOMIC GROWTH ON INCOME DISTRIBUTION: H_3 NO GENERAL LINKAGE

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Through Many Channels...

Reduce Inequality	Increase Inequality
<ul style="list-style-type: none">• Public health care provision (with a lag)• Free public education (with a lag)• Openness to trade• Democracy and rule of law• Financial market access for the poor• ...	<ul style="list-style-type: none">• Share of oil and minerals in exports• Macroeconomic instability and inflation• Corruption• ...

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EFFECT OF INCOME DISTRIBUTION ON ECONOMIC GROWTH

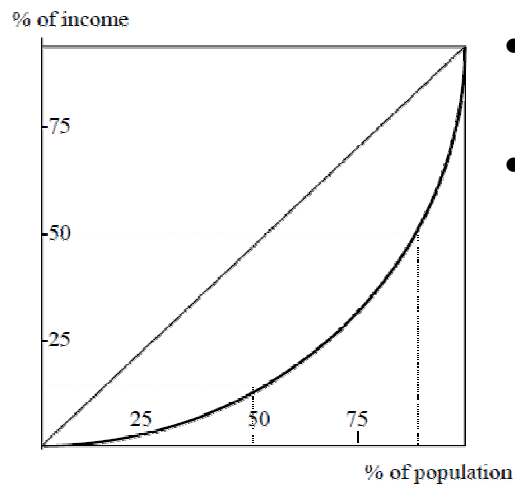
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Four main mechanisms

1. Through demand for **redistribution policies** that induces distortions
2. Through **savings and investment**
3. Through imperfections in **credit markets** and markets for human capital creation (more in later lectures)
4. **Social unrest** (civil strife and war) (more in later lectures)

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First Mechanism: Redistribution



- A relatively **uneven distribution**
- Half the population only have 15% of total income and about 12% of the population have half of all income

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First Mechanism: Redistribution

- Since median income (50th percentile) is lower than average income, more than half the population will favor redistribution
- If accomplished through taxation that distorts the allocation of factors of production and/or reduces the investment ratio,

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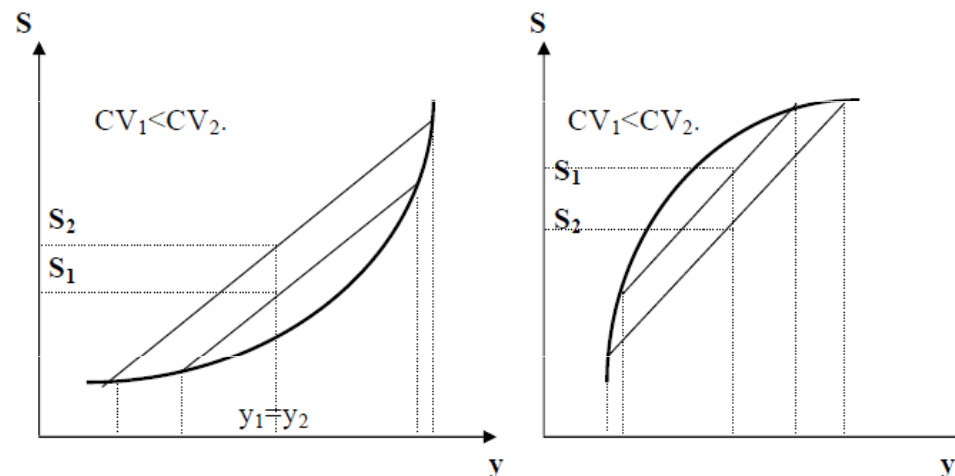
Second Mechanism: Saving and Investment

Assumptions:

- 1) Two countries with the same per-capita income ($y_1 = y_2$)
- 2) The income are assumed to be **more equally distributed in country 1** as measured by the coefficient of variation ($CV = \sigma/y$); that is $CV_1 < CV_2$

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Possible Scenarios



(1) Kaldor/Stiglitz; the rich save more

(2) The rich saves less
(or abroad!)

Outcomes

- 1) When the rich save proportionally (the savings function is convex), the **more even** distribution (country 1), the **the savings ratio**.
 - 2) When the rich saves proportionally (the savings function is concave), the **more even** distribution (country 1), the **the savings ratio**.
- What is the implication of higher saving ratio?

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EMPIRICAL EVIDENCE

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World Income Distribution

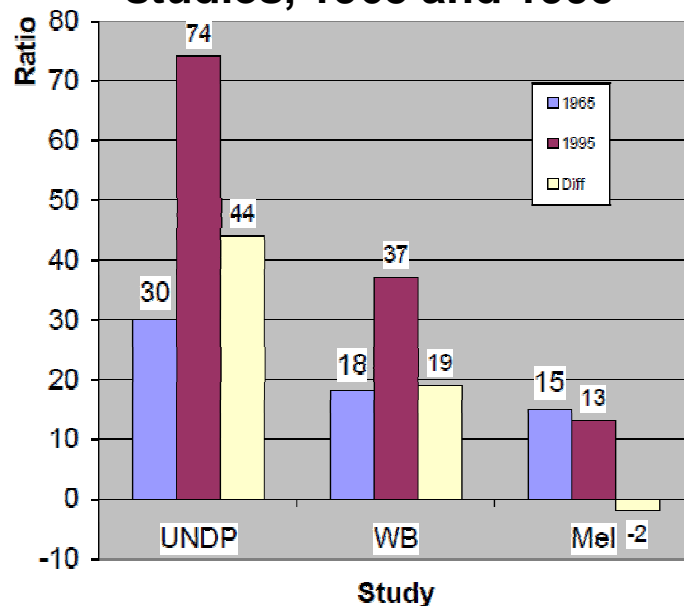
Study	Period	Distribution	Results
UNDP 1999	1960-1995	Ratio rich 20% /poor 20%	Drastic increase in ratio
World Bank 2000/01	1960-1997	Ratio rich 5%/ poor 5 %	Drastic increase in ratio
Firebaugh 1999	1960-1988	Various ratios and Gini	Slight <i>fall</i> in Gini and in ratios
Schultz 1998	1960-1988		
Melchior 2000	1965-1997		
Sala-i-Martin 2002	1970-1998		

A Few Words of Caution

- Different ratios are used and, hence, countries covered
- Measures of income differs (PPP or unadjusted)
- Definition of distribution differs (ratios vs Gini)
- Different years of comparison
- Data sampling differ (two years or time series)

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Ratio of per capita income in the richest and the poorest countries, selected studies, 1965 and 1995



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Characteristics and Flaws in the Various Studies

UNDP

- Per-capita incomes in the countries with the 20% richest population to per-capita income in the countries with 20% poorest population
- **No adjustment** for PPP in income data
- Comparison of **two random years**

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Characteristics and Flaws in the Various Studies

World Bank

- Per-capita incomes in the 20 countries with the highest income as a ratio to the 20 countries with the lowest incomes (irrespective of the size of the population and **ad hoc exclusion of China!**)
- Adjustment for **PPP in income data**
- Comparison of two **random years**

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Characteristics and Flaws in the Various Studies

Melchoir and Sala-i-Martin (and several other studies)

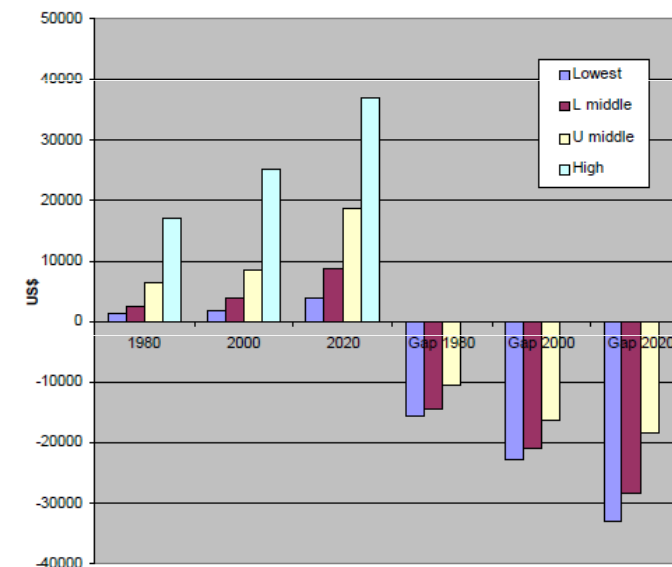
- Per-capita incomes in the countries with the 20% richest to the per capita income in the countries with 20% poorest (same as UNDP)
- Adjustment for PPP in income data (same as World Bank)
- Estimates for every single year 1965-1997⁵⁴

Conclusions from Melchoir and Sala-i-Martin

- Distribution deteriorated before 1965 but has been rather stable since
- Distribution in the bottom end deteriorated (Sub Saharan Africa)
- What could be the causes?

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Absolute income and income gaps between developing countries, by income group, and the high income countries in 1980, 2000 and projection for year 2020 (real per-capita income in US\$, PPP adjusted)



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Observations

- More or less unchanged relative distribution across countries, but growing absolute income gaps
 - Actual absolute income gaps in 1980 and 2000 have increased for all three groups of developing countries
- The projected absolute gaps will tend to grow notably, even though the relative growth rate is assumed to be twice as high in the developing countries

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Convergence?

- In the growth literature, when developing countries are growing faster *in relative terms*, this is referred to as “**convergence**”, or that they are “catching up”.
- If the relative growth rate is higher in poor countries than in rich countries, they will eventually “catch up”
- BUT this may take many generations, and in between,

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So Many Things...

- Lots of measurements, concepts, theories, empirics, criticisms, etc.
- What defines inequality in one case does not need to do so in others
- Stage of development could also play a role
- Economic growth and inequality could be 2-way causation
- Lots of room for future research

CONCLUSION

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