

# Lectures on Economic Inequality

Warwick, Summer 2016, Slides 1

Debraj Ray

---

- Overview: Convergence and Divergence
- Inequality and Divergence: Economic Factors
- Inequality and Divergence: Psychological Factors
- Inequality, Polarization and Conflict
- Uneven Growth and Conflict

## Convergence and Divergence

- Cross-country:
  - Solow
- Within-country:
  - Kuznets

## Cross-Country

- Richest and poorest 10% of nations relative to world average:

### GNI per capita PPP

	1982	1988	1994	2000	2006	2009
top 10%/World av	4.05	3.99	4.06	4.20	4.15	3.96
bottom 10%/World av	0.10	0.09	0.07	0.06	0.06	0.06

### GDP per-capita PPP

	1982	1988	1994	2000	2006	2009
top 10%/World av	4.12	3.95	4.04	4.11	4.05	3.84
bottom 10%/World av	0.10	0.09	0.07	0.07	0.07	0.07

- In 2010, Alaska: Mississippi ratio = 2!

## Lots of Movement Within the Distribution

- World GDP per capita grew at 1.5% per year over 1970–2010.
- East Asia danced to a tune all its own.
  - 1960–1990: Japan 5.3%, Korea 6.1%, Hong Kong 6.6%, Indonesia 3.8%, Malaysia 4.2%, Singapore 6.4%, Thailand 5.1%
  - 1990–2010: slower: Japan < 1% (under world average), rest 3-4%.
  - China! 1980–1990, 7.6%. 1990–2010: 9.5%.
- India: 2.6% over 1960–1990, 3.6% over 1990–2000, 6.2% over 2000–2010.

- **Latin America** not too hot (from an economic point of view).
  - **1960–1980**: around 2.9% annually.
  - **1980–1990**, the “lost decade” for Latin America, **decline** of over 0.7% year over year, overall decline of around 10%. Argentina -2.9%, Brazil -0.5%, Mexico -0.3%, Peru -3.0%, Uruguay -0.7%.
  - Only Chile (2.1%) and Colombia (1.4%) had higher per capita income in 1990 than they did in 1980.
  - **1990–2010**, still slow, around world average (exceptions Chile, 4.7%, and Argentina, 3.6%).
  - **2000–2010**: Average well in excess of 2%. Argentina 3.3%, Brazil 2.4%, Chile 2.6%, Peru 4.3%, Uruguay 3.0%. Mexico not so well at 0.8%.
  
- **Sub-Saharan Africa** more stagnation.
  - **1980–1990** decline at 1% annual.
  - **1990–2000** decline at 0.4% annual.
  - **2000–2010** better, with growth at 2.2%.
  
- **Examples.**
  - **Nigeria** (-1.6%) and **Tanzania** (-2.0%) in the 1980s, stagnation 1990s, robust recovery over 2000–2010 (3.9% Nigeria, 4.0% Tanzania).
  - **Kenya** barely grew in the 1980s, declined in the 1990s, some recovery 2000–2010; overall 0.2% over 30 years.

- **Uganda** stagnated over the 1980s (-0.1%) before picking up pace and making substantial progress over 1990–2010, growing at over 3.5% annually.
  - **Rwanda**, crippled by negative growth in the 1980s (-1.2%) and 1990s (-0.7%) before a remarkable recovery over 2000–2010 (4.8%).
  - Yet **Burundi**'s negative growth rate of 3.2% in the 1990s made worse by near-stagnation over 2000–2010 (0.4%).
  - The **Democratic Republic of the Congo** in freefall over 1980–1990 (-2.2%) and 1990–2000 (-8.5%!) before 1.8% 2000–2010.
  - **Zimbabwe** stagnated in the 1980s (0.7%) and 1990s (-0.3%) before entering a freefall of its own (-4.8%) over 2000–2010.
- 
- **OECD**: 20 original members, fourteen additions. All the developed countries, a few middle-income countries also members.
  - **1970–1990**, OECD growth a bit over 2.4%
  - **1990–2000** 1.8%, a bit higher than world average
  - **2000–2010** Under world average at 0.8%
  - The **United States** mirrors OECD reasonably well:
    - 2.2% over 1970–1990
    - a bit under 2.2% in 1990–2000

## Summary So Far

- Over 1980–2010, distribution of world income stable or somewhat worsening.
  - Richest 10% of nations 4 times the world average
  - Poorest 10% had 6–10% of world average, generally declining.
- But lots of movement within the distribution.
  - Rise of Asia: Japan, then China and now India
  - Languishing of sub-Saharan Africa

## Within-Country

- Inter-country inequality compounded within countries:
  - 0–4,000 PPP (2000):

Country	GDP pc (c. 2000)	Share bot. 40%	Share top 20%
Malawi	546	13	56
Uganda	765	16	50
Tanzania	866	19	42
Bangladesh	893	22	40
Senegal	1,492	17	48
Pakistan	1,898	21	42
Nicaragua	2,157	12	55
Sri Lanka	3,106	17	48
Bolivia	3,402	7	63
Guatemala	3,350	11	59

## Within-Country

■ Inter-country inequality compounded within countries:

■ 4,000–13,000 PPP (2000):

Country	GDP pc (c. 2000)	Share bot. 40%	Share top 20%
El Salvador	5,183	10	55
Peru	5,444	11	57
Costa Rica	5,520	13	50
Thailand	5,568	11	59
Panama	5,840	8	60
Colombia	6,617	9	61
Brazil	7,911	7	65
Costa Rica	8,113	13	51
Venezuela	9,924	12	52
Mexico	12,095	12	56

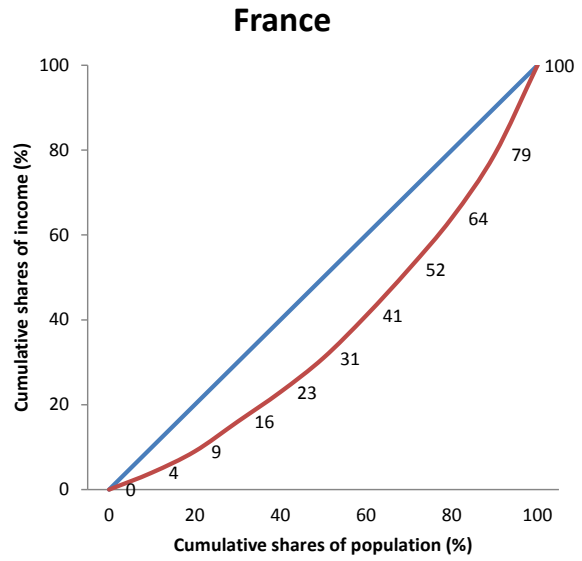
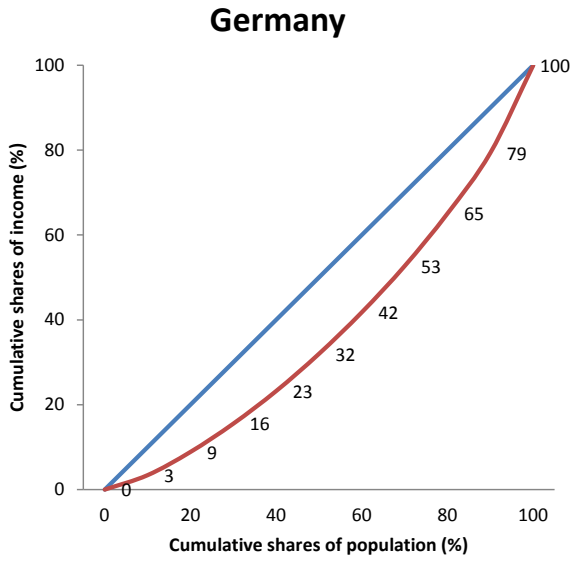
## Within-Country

■ Inter-country inequality compounded within countries:

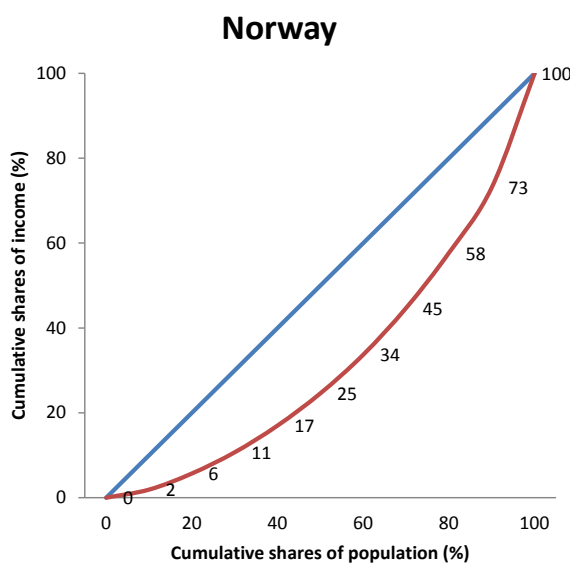
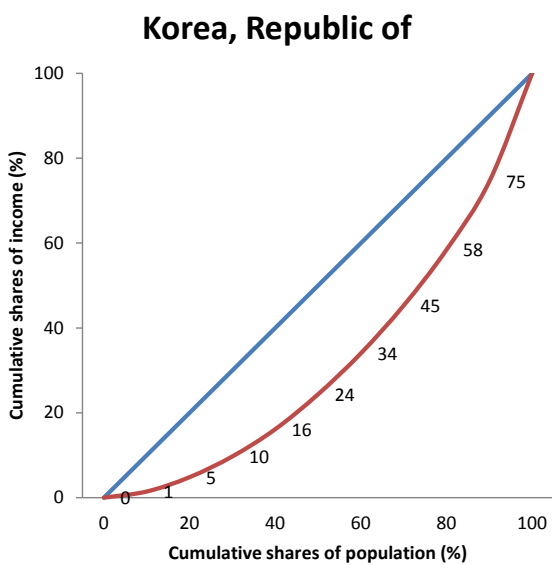
■ 13,000+ PPP (2000):

Country	GDP pc (c. 2000)	Share bot. 40%	Share top 20%
Korea	16,015	21	37
Spain	25,129	19	42
UK	28,575	18	44
Sweden	29,126	23	37
Switzerland	34,713	20	41
USA	39,578	16	46
Norway	43,642	24	37

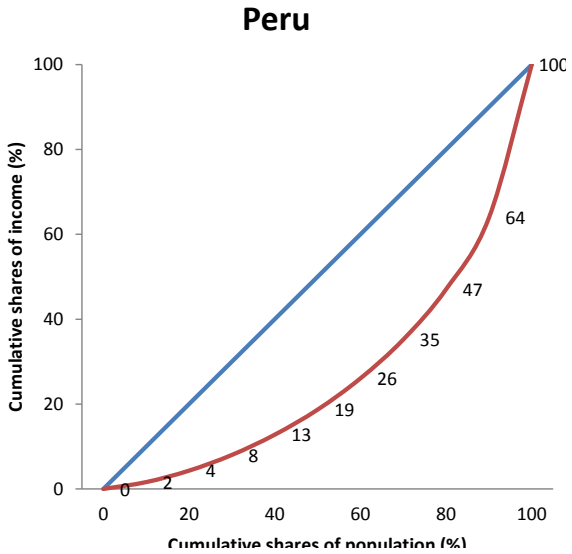
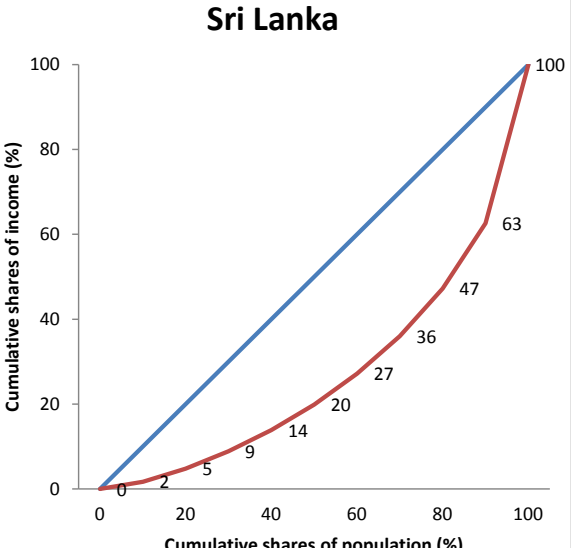
## Some Lorenz Curves



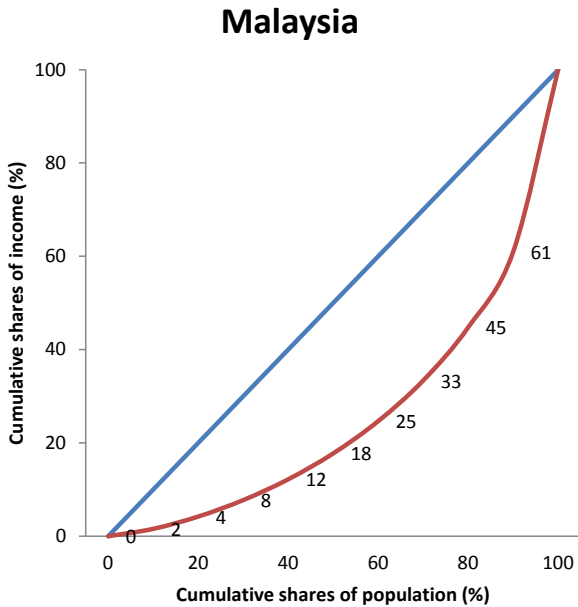
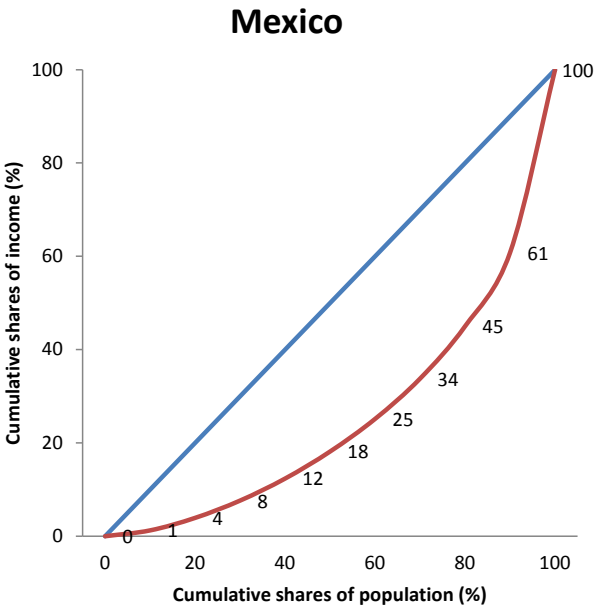
## Some Lorenz Curves



### Some Lorenz Curves

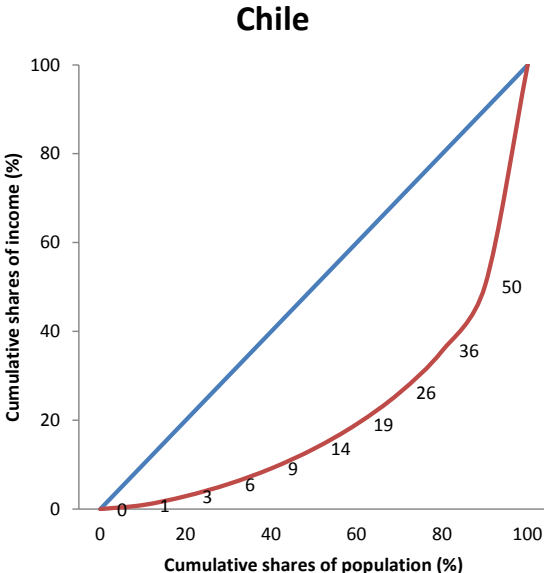
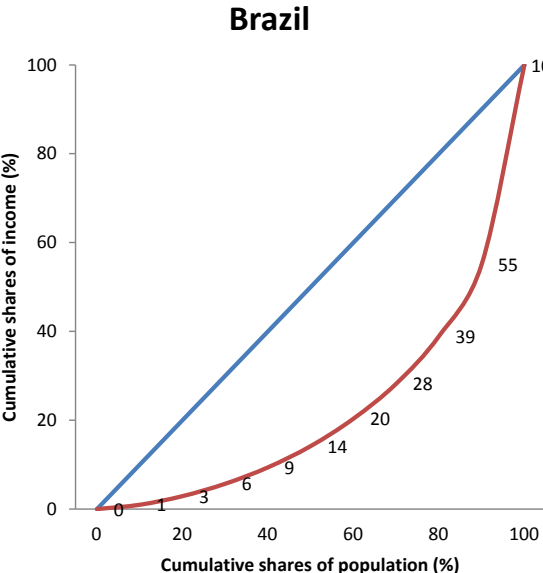


### Some Lorenz Curves

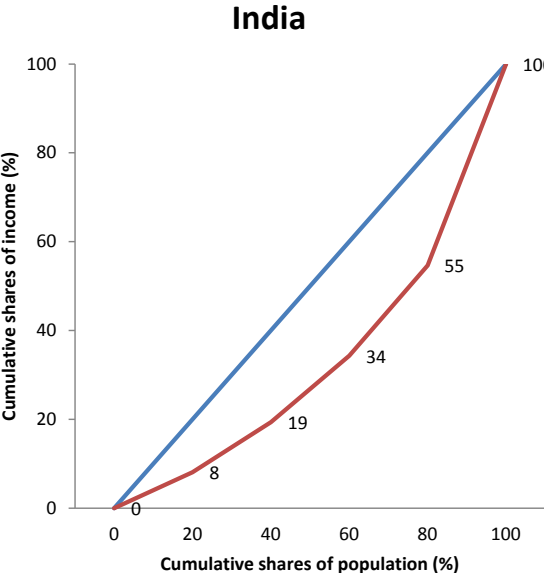
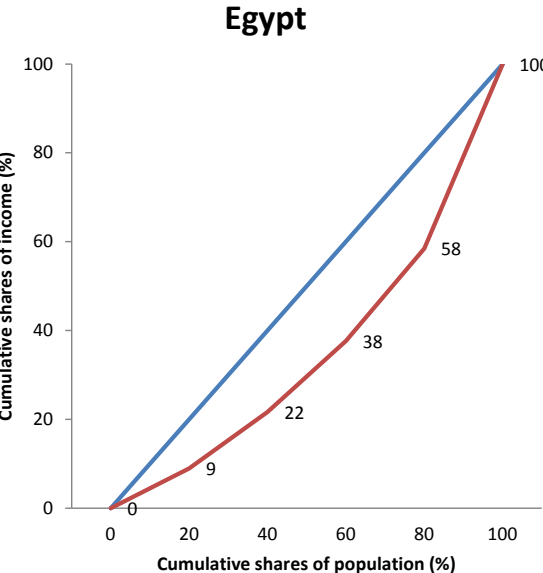




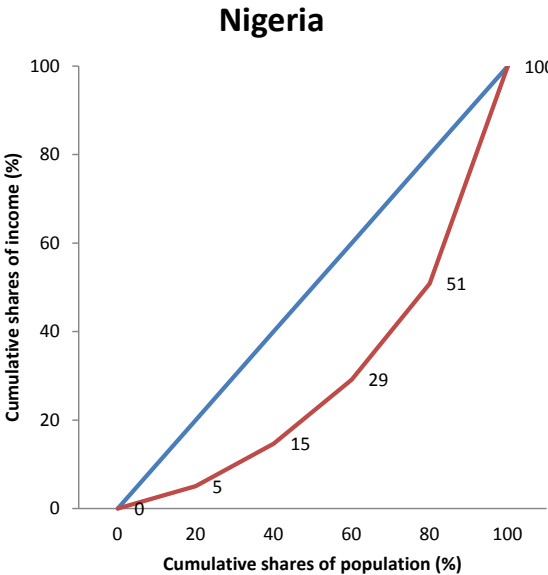
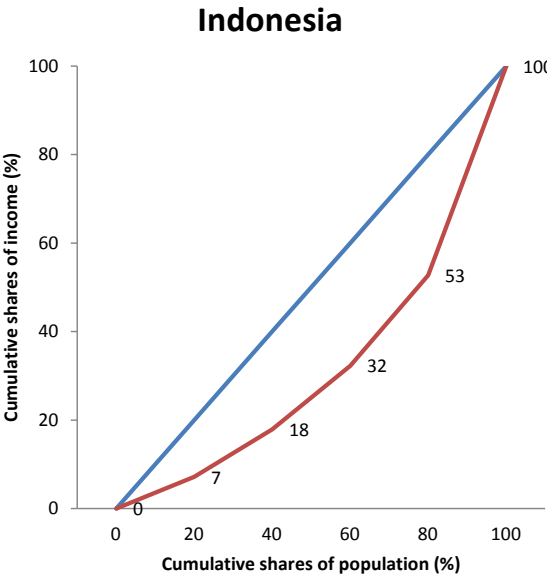
# Some Lorenz Curves



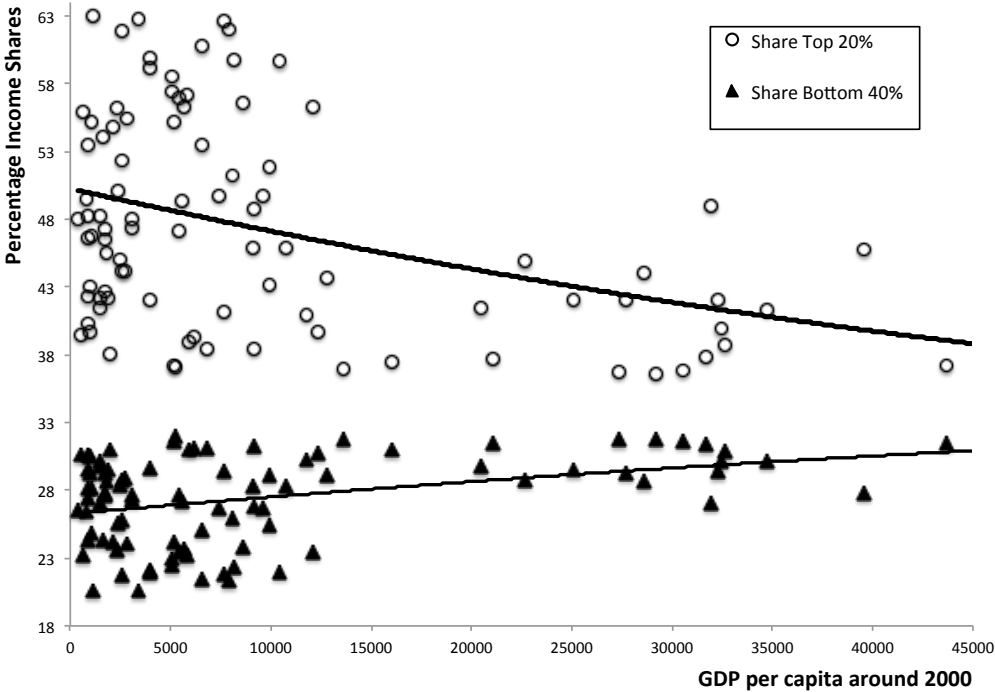
# Some Lorenz Curves: Consumption Data



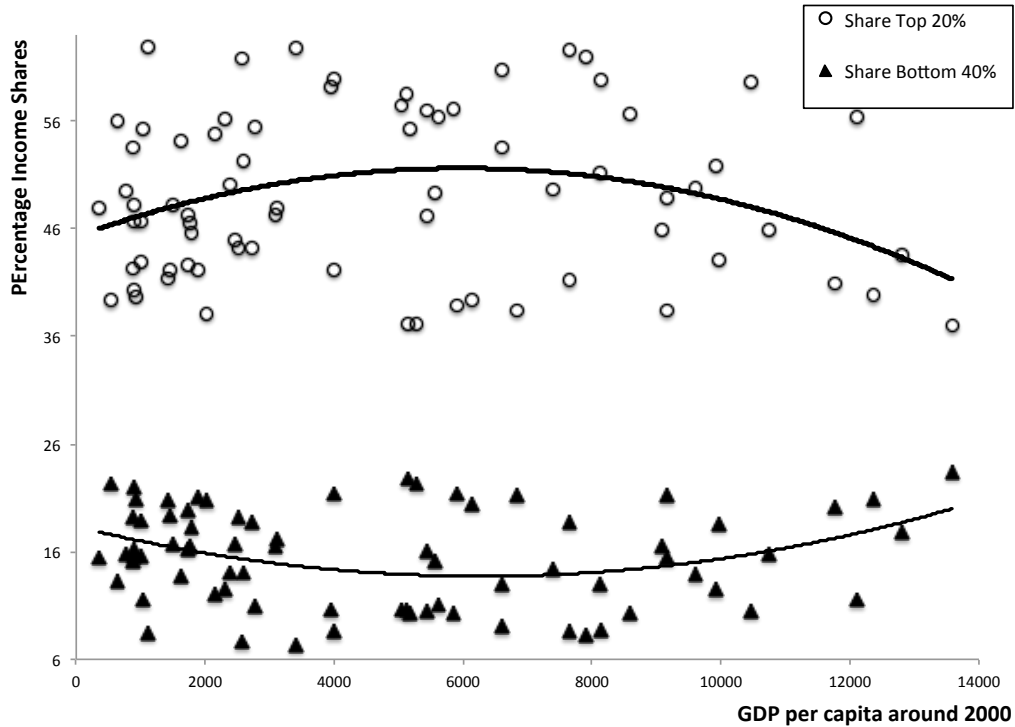
# Some Lorenz Curves: Consumption Data



■ Inequality and per-capita income: the whole range



- Inequality and per-capita income: up to \$8000, an inverted-U?



## Uneven and Compensating Changes

- Uneven growth, perhaps from a few sectors
- Then other sectors catch up, or people migrate
- Tends to generate an inverted-U, but no inevitability to it.
- Note: our diagram was on the cross-section.
- In fact, rising inequality in many countries (coming up!).

## Two Parallel Literatures

- Cross-country convergence
- Within-country narrowing of inequality
- Both literatures have been caught wrong-footed.

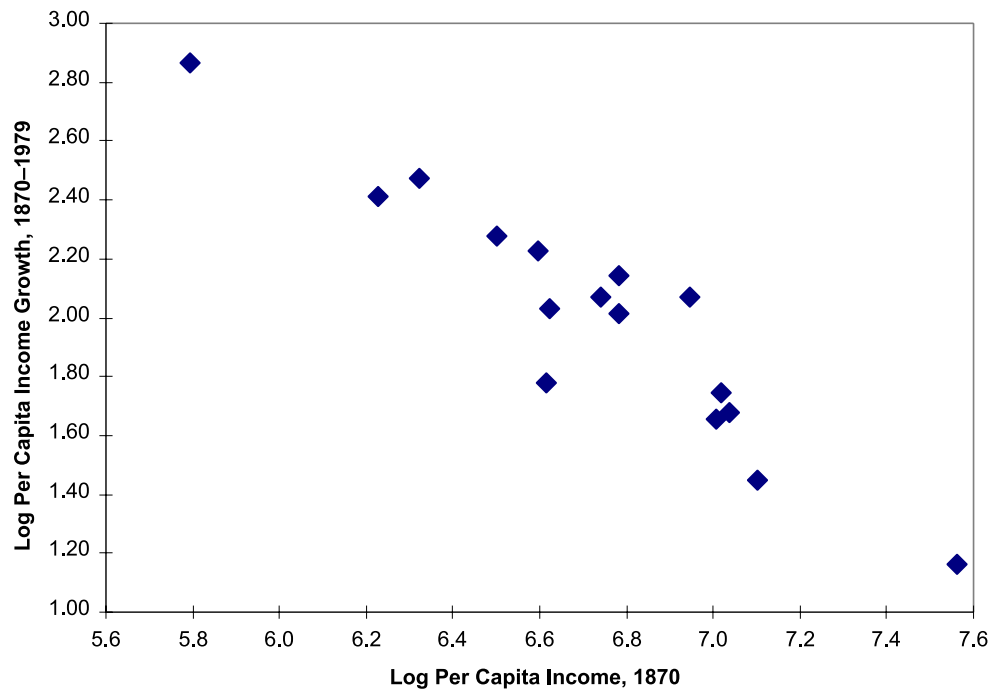
## Cross-Country: Testing Convergence

- 1. Baumol (AER 1986): 16 countries, among the richest in the world today.
- In order of poorest to richest in 1870: Japan, Finland, Sweden, Norway, Germany, Italy, Austria, France, Canada, Denmark, the United States, the Netherlands, Switzerland, Belgium, the United Kingdom, and Australia.
- Angus Maddison: per-capita incomes for 1870.
- Idea: regress 1870–1979 growth rate on 1870 incomes.

$$\ln y_i^{1979} - \ln y_i^{1870} = A + b \ln y_i^{1870} + \epsilon_i$$

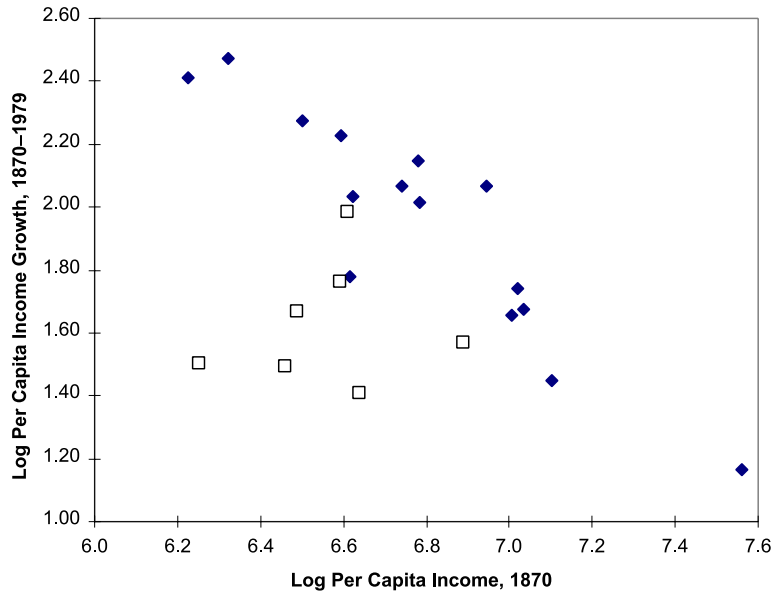
- Unconditional convergence  $\Rightarrow b \simeq -1$ .
- Get  $b = -0.995$ ,  $R^2 = 0.88$ .

■ What's wrong with this picture?



■ De Long critique (AER 1988):

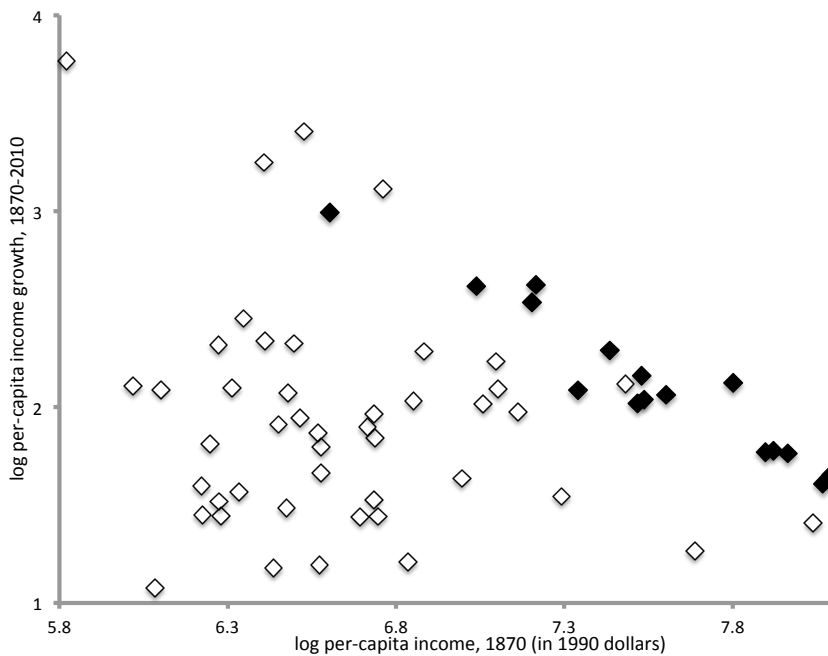
- Add seven more countries to Maddison's 16.
- In 1870, they had as much claim to membership in the "convergence club" as any included in the 16: Argentina, Chile, East Germany, Ireland, New Zealand, Portugal, and Spain.
- New Zealand, Argentina, and Chile were in the list of top ten recipients of British and French overseas investment (in per capita terms) as late as 1913.
- All had per capita GDP higher than Finland in 1870.
- Strategy: drop Japan (why?), add the 7.



- Slope still negative, though loses significance.
- Correct for measurement error, game over.

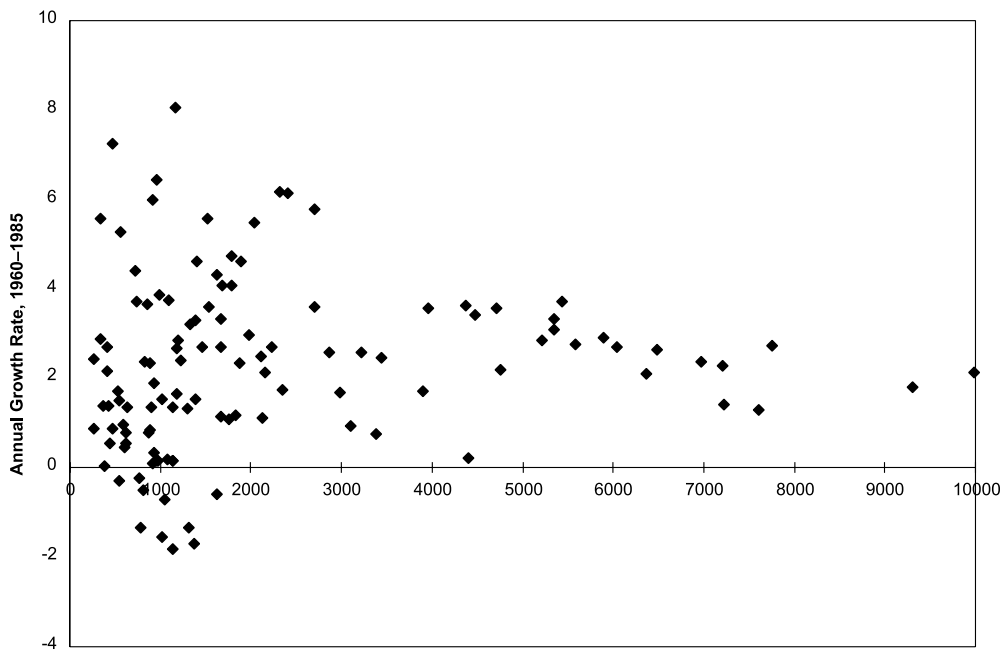
■ 2. More Countries

■ 2a. Updated Maddison dataset 2013, 60 countries:



■ 2b. Even More Countries.

- Barro (QJE 1991): 100+ countries over 1960–1985.



■ 2c. Even More Countries + Long Time Horizon (Pritchett)

- What about more countries **and** more time?

- Problem: no data going back to 1870.

- Pritchett assumption: no country can fall below \$250 per capita (1985 PPP)

- **Defense 1:** lowest 5-year average ever is Ethiopia \$275 (1961–5).

- **Defense 2:** below extreme nutrition-based poverty lines actually used in poor countries (see Ravallion, Dutt and van de Valle 1991, or nutrition lines at 2000Kcal)

- **Defense 3:** at any lower income, population too unhealthy to grow. Child mortality rate estimated to climb well above barrier of 600 per 1000.

- Claim: the \$250 bound “proves” divergence over long-run.
- The US grew four-fold from 1870 to 1960.
- Thus, any country whose income was not fourfold higher in 1960 than it was in 1870 grew more slowly than the United States.
- 42 out of 125 countries in the PWT have pcy below \$1,000 in 1960.
- Or try this:
  - extrapolate back so poorest country in 1960 hits exactly \$250 in 1870.
  - US: use actual figures.
  - preserve the relative rankings of all other countries (see footnote 11 of Pritchett)

	1870	1960	1990
USA (P\$)	2063	9895	18054
Poorest (P\$)	250	257	399
	(assumption)	(Ethiopia)	(Chad)
Ratio of GDP per capita of richest to poorest country	8.7	38.5	45.2
Average of seventeen “advanced capitalist” countries from Maddison (1995)	1757	6689	14845
Average LDCs from PWT5.6 for 1960, 1990 (imputed for 1870)	740	1579	3296
Average “advanced capitalist” to average of all other countries	2.4	4.2	4.5
Standard deviation of natural log of per capita incomes	.51	.88	1.06
Standard deviation of per capita incomes	P\$459	P\$2,112	P\$3,988
Average absolute income deficit from the leader	P\$1286	P\$7650	P\$12,662



■ Mobility matrix, 1982–2009

Cat 1: income < 1/4 world av; Cat 2: between 1/4 and 1/2 world av; Cat 3: between 1/2 world av and world av; Cat 4: between world av and twice world av; Cat 5: income > twice world av.

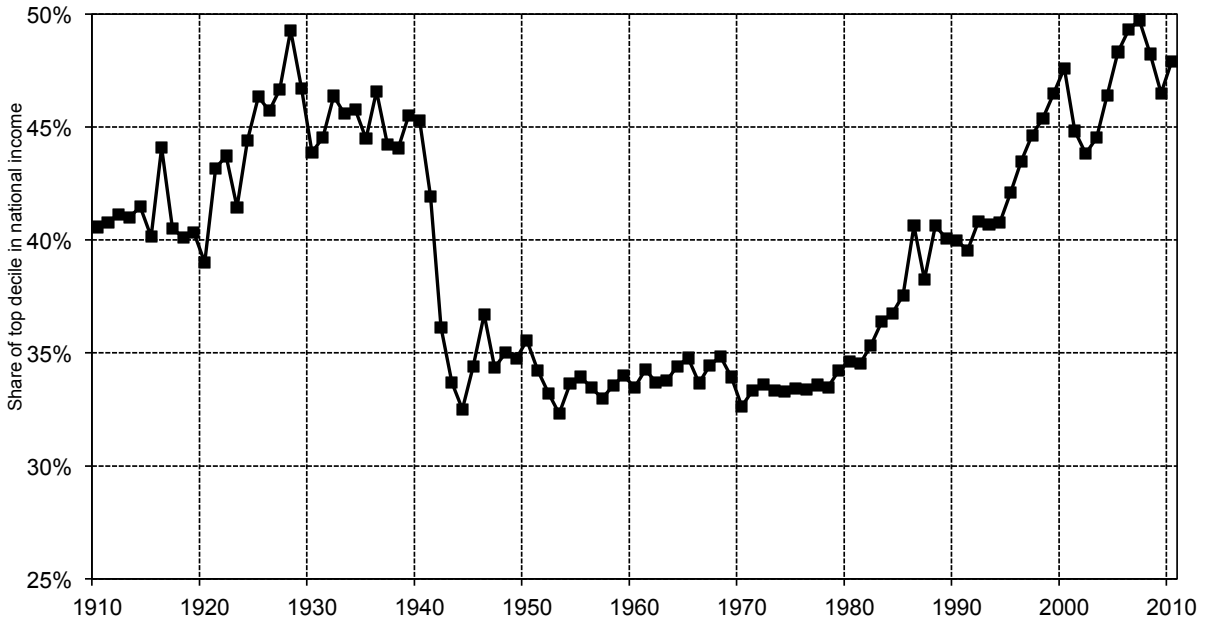
Obs	Cat	①	②	③	④	⑤
32	①	84	13	3	0	0
21	②	43	43	14	0	0
26	③	0	27	50	23	0
20	④	0	0	20	70	10
29	⑤	0	0	0	3	97

### Within-Country: The Return of Inequality

- The financial crisis sparked a new interest in inequality.
- But inequality has been historically high
- Growing steadily through late 20th century

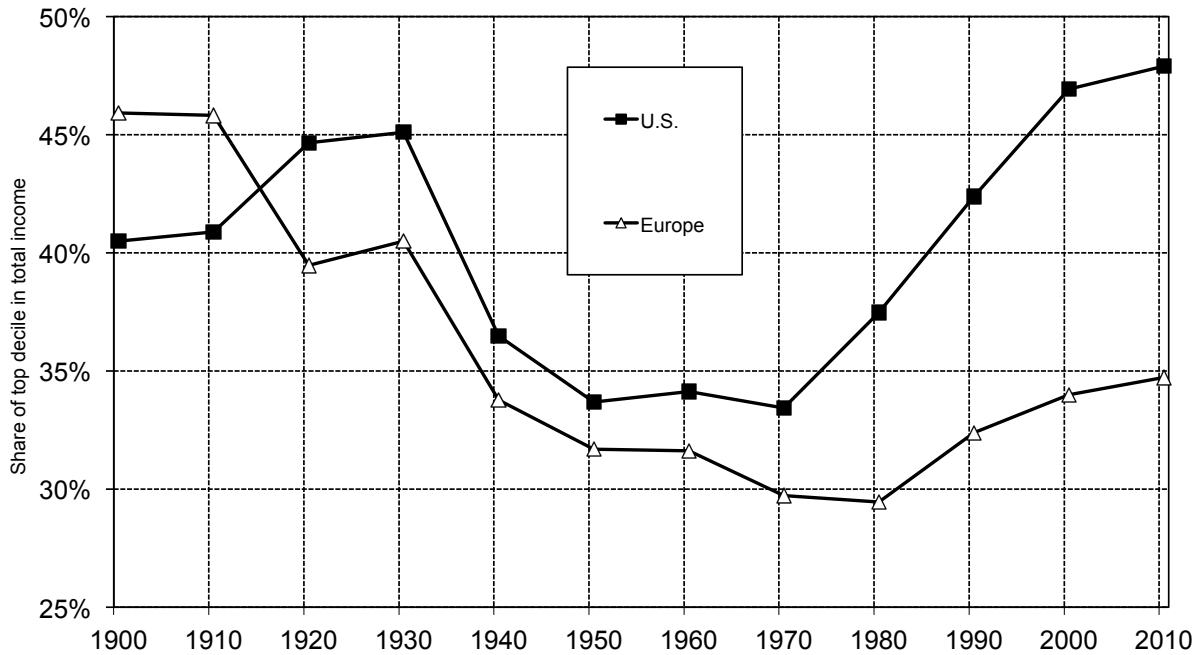
Wolff, Piketty, Saez, Atkinson, many others

**Figure I.1. Income inequality in the United States, 1910-2010**



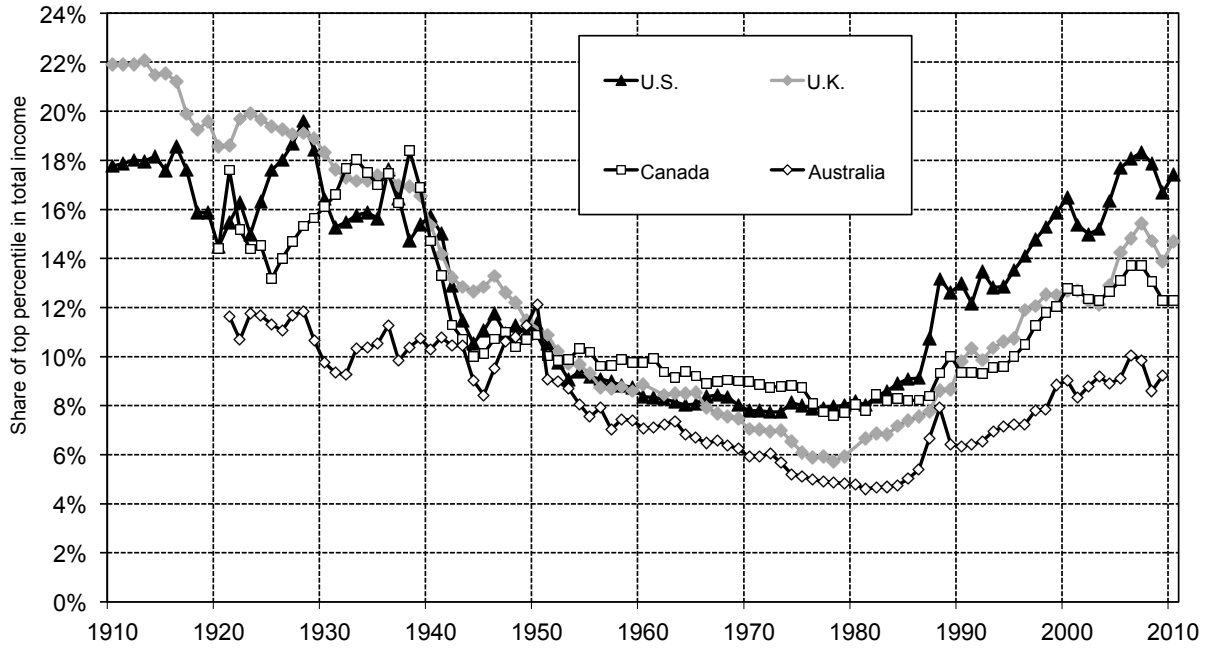
Source: Piketty (2014)

**Figure 9.8. Income inequality: Europe vs. the United States, 1900-2010**



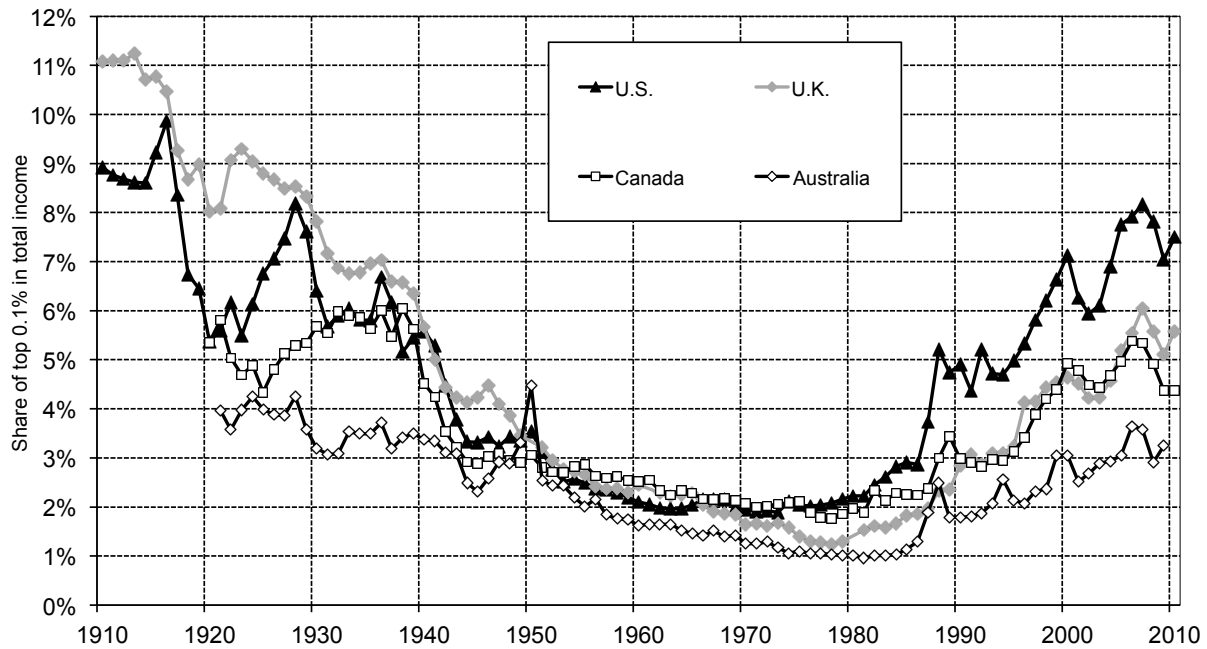
Source: Piketty (2014)

Figure 9.2. Income inequality in Anglo-saxon countries, 1910-2010



Source: Piketty (2014)

Figure 9.5. The top 0.1% income share in Anglo-saxon countries, 1910-2010



Source: Piketty (2014)

## Why Do We Care?

- Inequality is of **intrinsic** as well as **instrumental** interest
  - **Intrinsic:**
    - inequality measurement: evaluate and compare distributions
    - evolution of inequality in societies
  - **Instrumental:** connections between inequality and development
    - inequality and various outcomes: growth, nutrition, employment
    - inequality and history-dependence
  - **Goal:** To study some of these theories and connections.
- 
- **A recent book by Piketty**
    - summarizes the evidence (compelling and useful)
    - describes three “fundamental laws”
    - is a runaway hit in the United States, touching a raw nerve

## Piketty's Three Fundamental Laws

### ■ The First Fundamental Law:

$$\frac{\text{Capital Income}}{\text{Total Income}} = \frac{\text{Capital Income}}{\text{Capital Stock}} \times \frac{\text{Capital Stock}}{\text{Total Income}}.$$

### ■ Share of capital income equals rate of return on capital multiplied by the capital-output ratio.

- Useful in organizing our mental accounting system.
- But it explains nothing.

### ■ The Second Fundamental Law:

#### ■ Growth rate equals savings rate divided by capital-output ratio.

- investment = savings:  $I(t) = S(t) = s(t)Y(t)$

#### ■ investment adds to capital stock

$$K(t+1) = [1 - \delta(t)]K(t) + I(t) = [1 - \delta(t)]K(t) + s(t)Y(t)$$

#### ■ Convert to growth rates:

$$G(t) = \frac{s(t)}{\theta(t)} - \delta(t),$$

where  $G(t) = [K(t+1) - K(t)]/K(t)$  and  $\theta(t) = K(t)/Y(t)$ .

#### ■ Approximate per-capita version: subtract $n(t)$ , the rate of population growth.

$$g(t) \simeq \frac{s(t)}{\theta(t)} - \delta(t) - n(t),$$

$$g(t) \simeq \frac{s(t)}{\theta(t)} - \delta(t) - n(t),$$

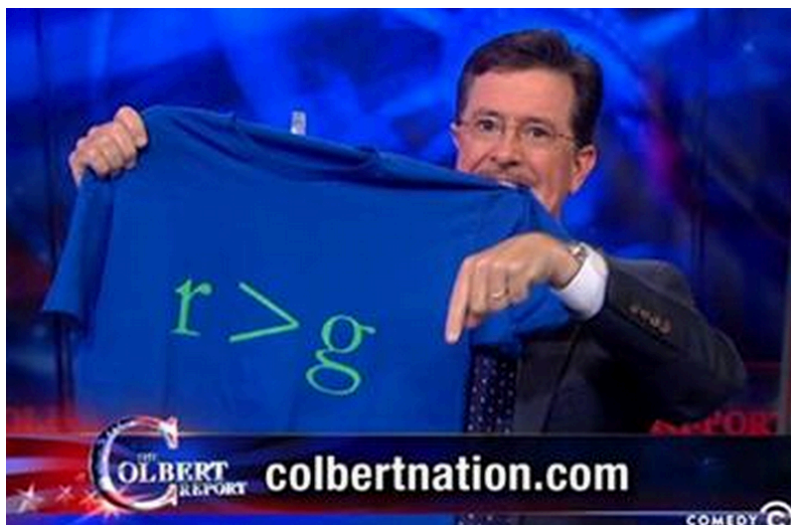
- This isn't a theory unless you take a stand on one or more of the variables.
- E.g., as Harrod or Solow did. Piketty doesn't appear to.

“If one now combines variations in growth rates with variations in savings rate, **it is easy to explain** why different countries accumulate very different quantities of capital, and why the capital-income ratio has risen sharply since 1970. One particularly clear case is that of Japan: with a savings rate close to 15 percent a year and a growth rate barely above 2 percent, it is hardly surprising that Japan has over the long run accumulated a capital stock worth six to seven years of national income. This is an automatic consequence of the [second] dynamic law of accumulation.” (p.175)

“The very sharp increase in private wealth observed in the rich countries, and especially in Europe and Japan, between 1970 and 2010 thus **can be explained** largely by slower growth coupled with continued high savings, using the [second] law ...” (p. 183)

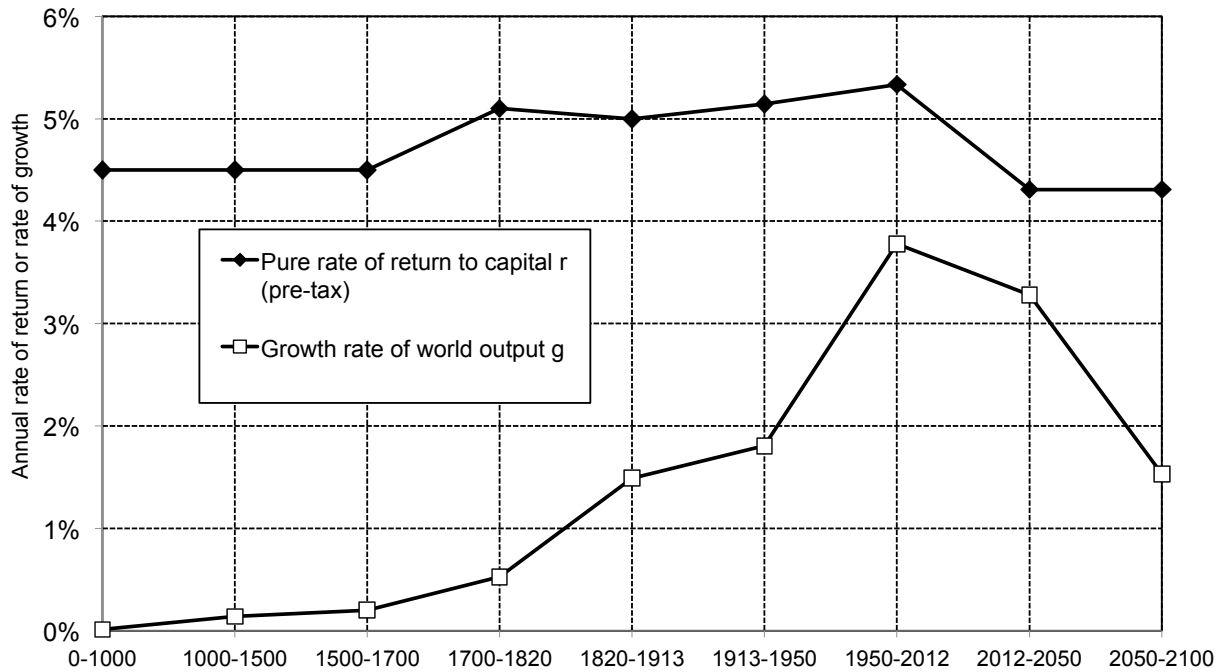
- **The Third Fundamental Law:**

- $r > g$



- Piketty: “**the central contradiction of capitalism.**”

- $r > g$  in the data.



- Supposedly explains widening inequalities via capital income. [Yes or no?](#)

- Begin again with the capital accumulation equation:

$$K(t+1) = [1 - \delta(t)]K(t) + s(t)Y(t)$$

- Start disciplining:  $s(t) = s$ ,  $\delta(t) = \delta$ , and

$$Y_t = AK_t^\theta [(1 + \gamma)^t L_t]^{1-\theta},$$

- where  $L_t$  grows at rate  $n$ , and  $\gamma$  is [technical progress](#).

- [Normalized capital-labor ratio](#):  $k_t \equiv K_t / L_t (1 + \gamma)^t$ ; then

$$(1 + n)(1 + \gamma)k_{t+1} = (1 - \delta)k_t + sAk_t^\theta,$$

- so that  $k_t \rightarrow k^* \simeq \left[ \frac{sA}{n + \gamma + \delta} \right]^{1/(1-\theta)}$ .

- This is the [Solow model](#).

- So the overall rate of growth converges to  $n + \gamma$ .
- Rate of return on capital is given by the marginal product:

$$\begin{aligned}
 r_t &= \theta A [K_t / (1 + \gamma)^t L_t]^{\theta-1} \\
 &= \theta A k_t^{\theta-1} \\
 &\rightarrow \theta A \left[ \frac{sA}{n + \gamma + \delta} \right]^{-1} \\
 &= \frac{\theta}{s} [n + \gamma + \delta],
 \end{aligned}$$

- So down to comparing  $r = \frac{\theta}{s} [n + \gamma + \delta]$  with  $g = n + \gamma$ .
- Piketty's Third Law follows if  $\theta \geq s$ .
- Surely true empirically.
- Deeper argument:  $\theta \geq s$  because of the transversality condition.

- $s$  is inefficient if consumption can be improved in all periods.

- Easy example:  $s = 1$ .

- More generally, recall that  $k_t \rightarrow k^* \simeq \left[ \frac{sA}{n + \gamma + \delta} \right]^{1/(1-\theta)}$ .

- So per-capita output converges to

$$A^{1/(1-\theta)} (1 + \gamma)^t \left( \frac{s}{n + \gamma + \delta} \right)^{\theta/(1-\theta)}$$

- and per-capita consumption converges to the path

$$A^{1/(1-\theta)} (1 + \gamma)^t \left( \frac{s}{n + \gamma + \delta} \right)^{\theta/(1-\theta)} (1 - s).$$

It follows that if  $s > \theta$ , the growth path is inefficient.

- So efficiency implies  $r > g$ , but there is no prediction for inequality.



## Summary

- Piketty's work is pathbreaking in recording the evolution of inequality.
- As a [theory of inequality](#), it leaves much to be desired.
- In what follows, we study some theories of inequality.