Arup Mallik Memorial Lecture

On Inequality

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Theme of the talk

- Inequality: Some data
- What drives inequality? Luck or low investment?
- Role of human capital
- Inequality and social mobility: A bit of modelling
- Growth and Inequality
- Inequality and innovation
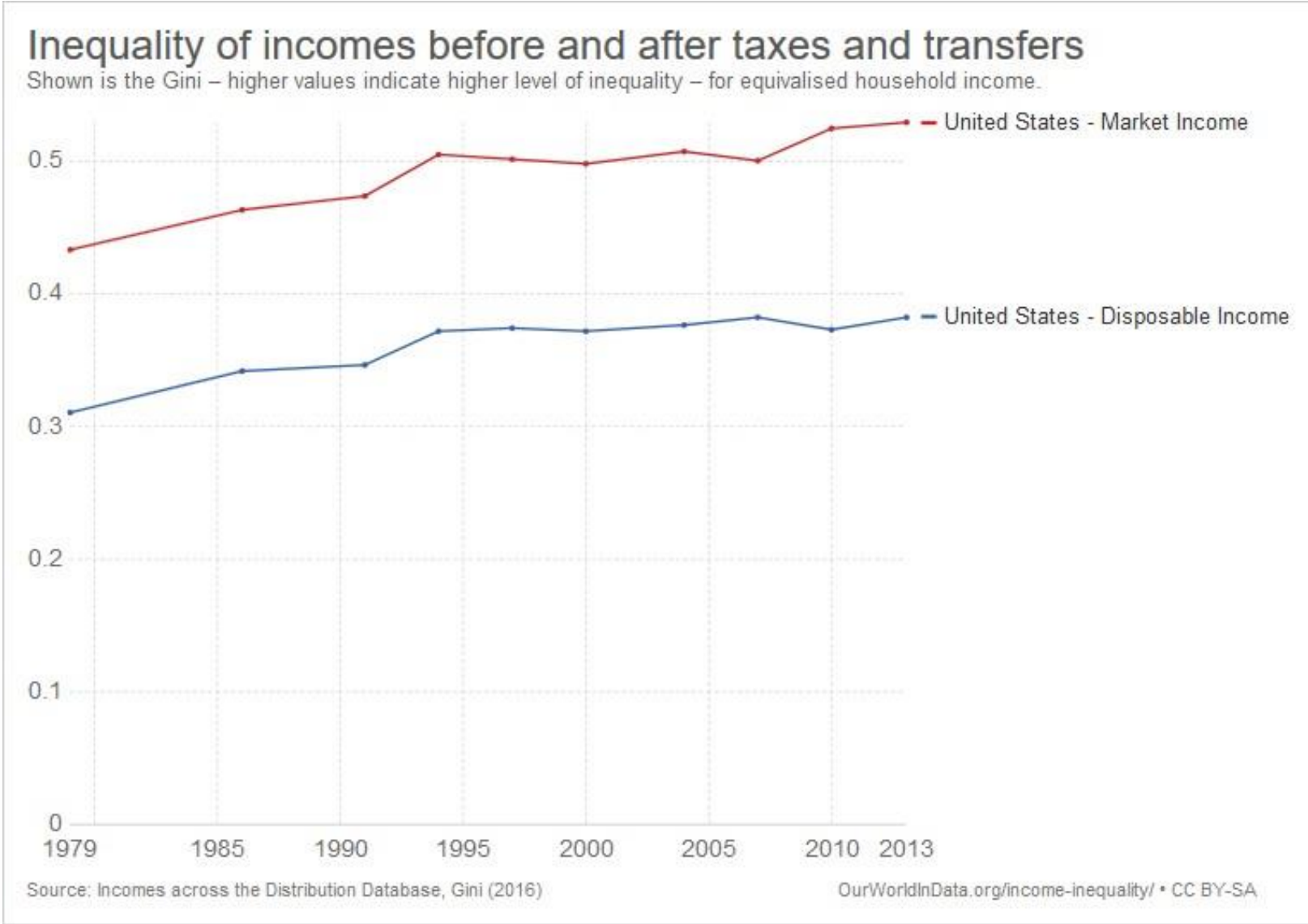- Inequality and the Stock Market

Trend in UK Inequality

Figure 12: Gini coefficients for disposable income by household type, 1977 to financial year ending 2017
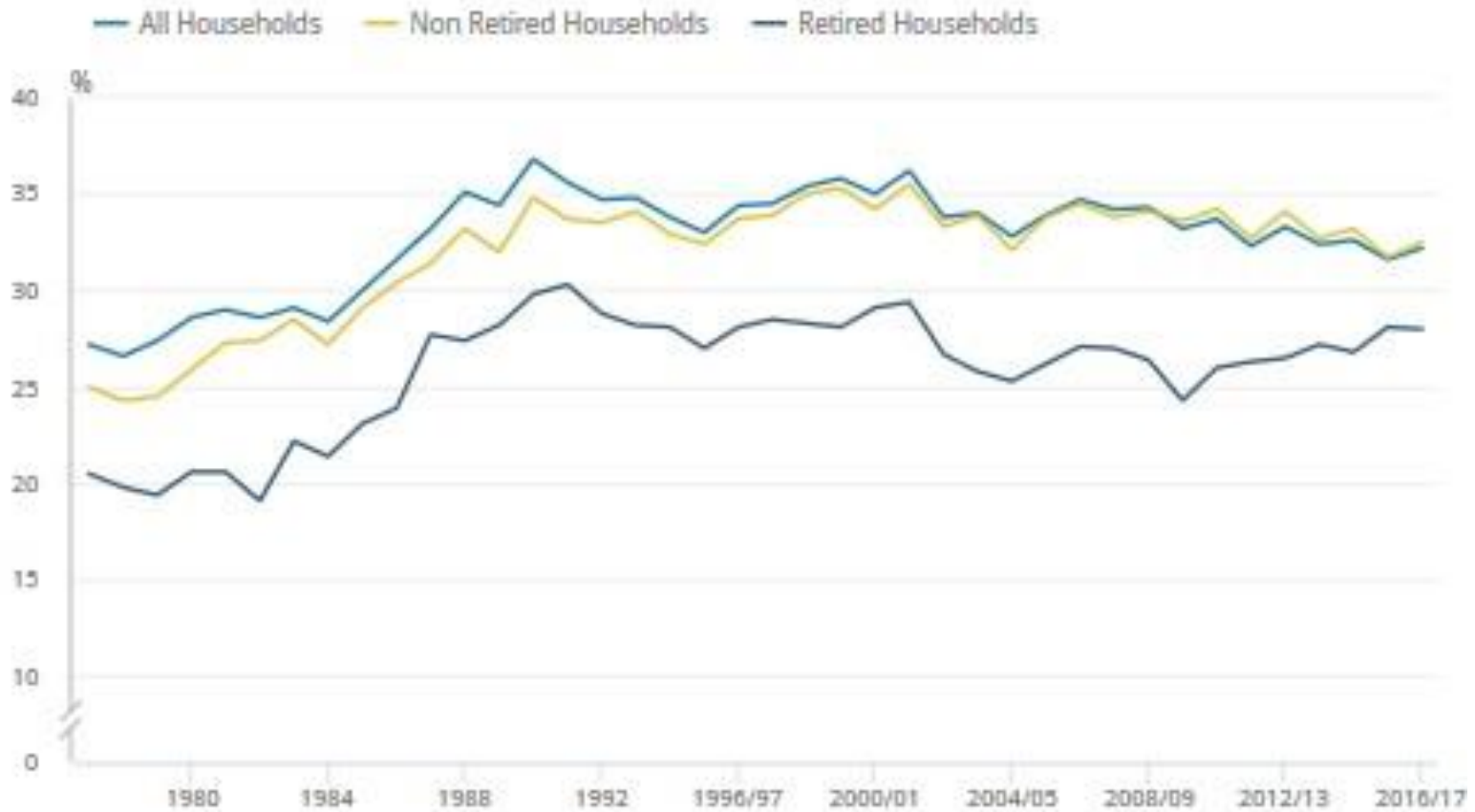
Source: Office for National Statistics

Before and after tax income inequality in the US

Inequality of incomes before and after taxes and transfers

Shown is the Gini – higher values indicate higher level of inequality – for equivalised household income.

United States - Market Income

United States - Disposable Income

0.5

0.4

0.3

0.2

0.1

0

1979   1985   1990   1995   2000   2005   2010 2013

Source: Incomes across the Distribution Database, Gini (2016)
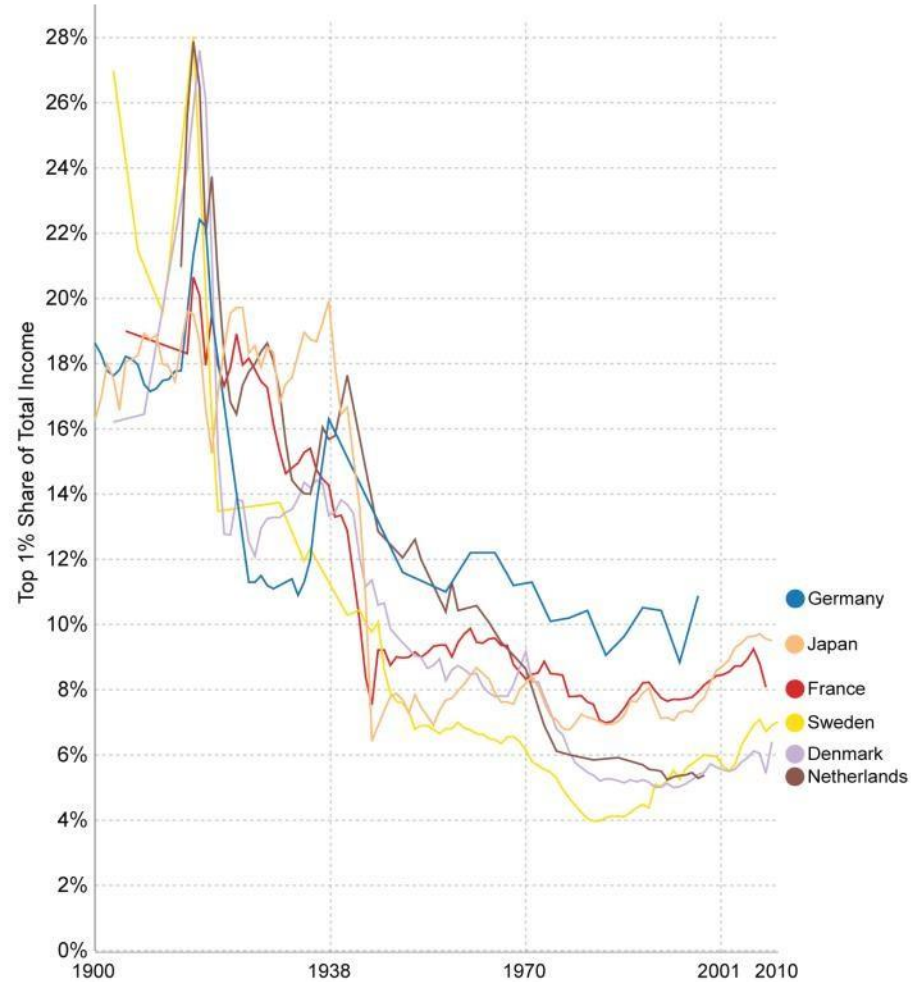
OurWorldInData.org/income-inequality/ • CC BY-SA

Trend in Inequality

Share of Total Income going to the Top 1%, 1900-2010

The evolution of inequality in English speaking countries followed a U-shape
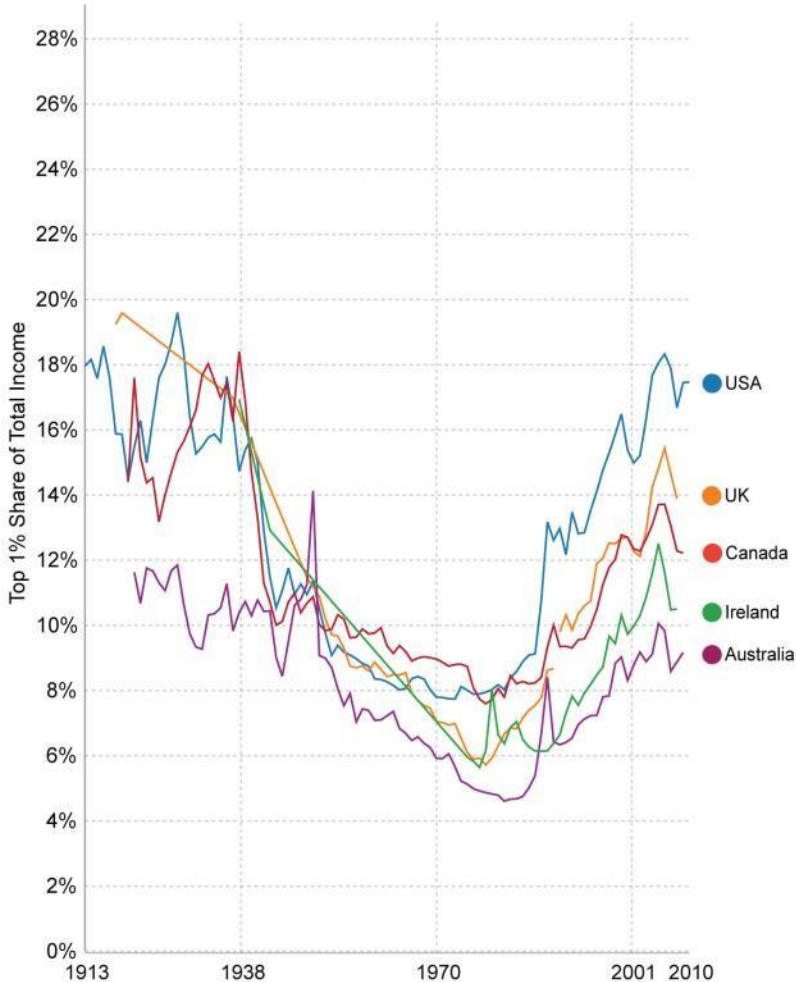
The evolution of inequality in continental Europe and Japan followed an L-shape

Data source: The World Top Incomes Database.

The interactive data visualisation is available at OurWorldinData.org. There you find the raw data and more visualisations on this topic.

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# India

Top 1% national income share, India, 1947-2015

World Inequality database

Growth and Inequality

Income inequality and growth across OECD European regions, 2012

Each dot on this graph is a different sub-national region within Europe (France, for example, is divided in 22 different regions). The vertical axis measures the average annual growth rate of GDP per capita in the period 2008-2012, and the horizontal axis measures inequality in 2007 (Gini coefficients - higher values reflect more inequality).
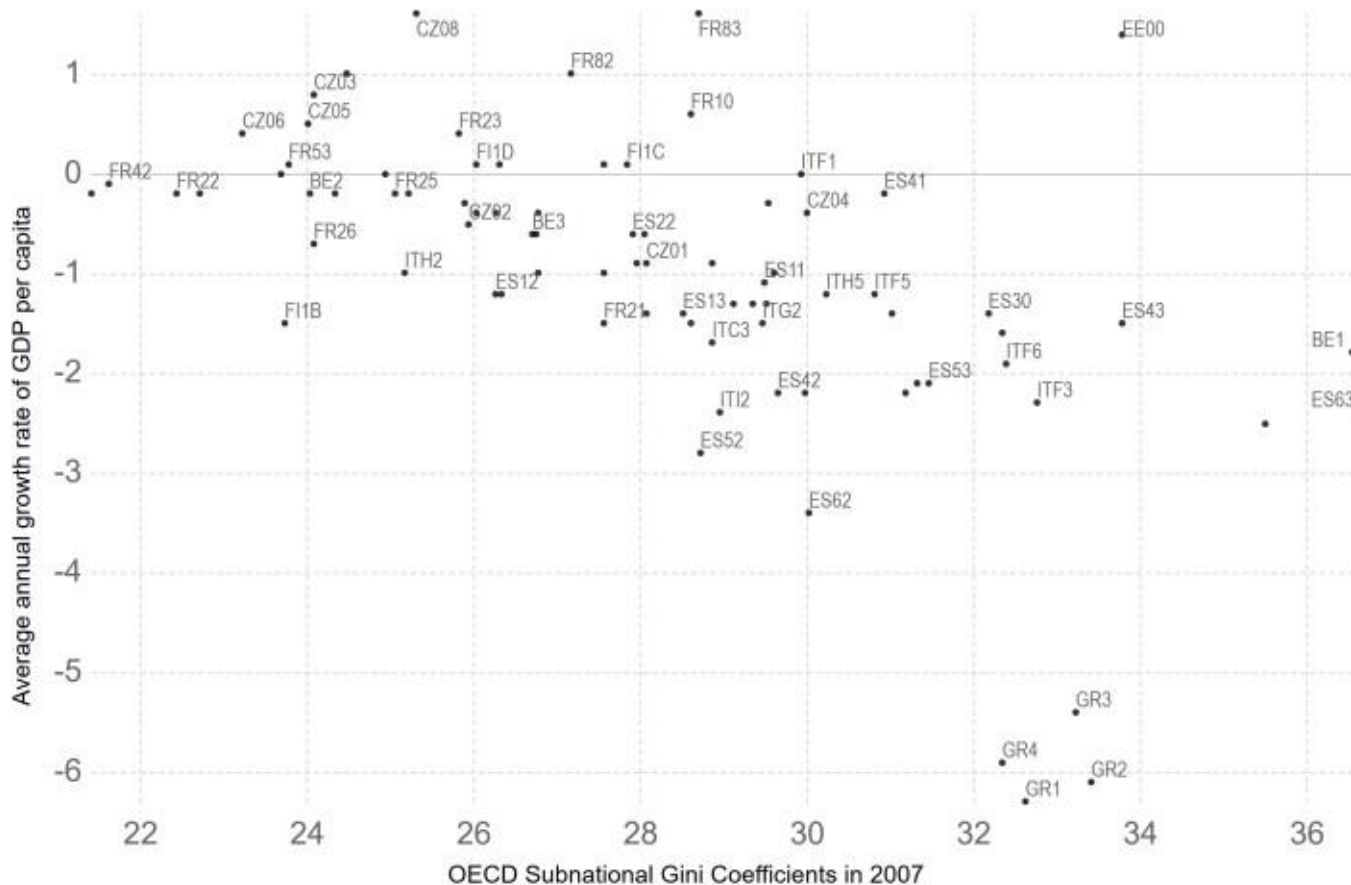
Emerging questions

- What drives inequality?

- Initial condition, Luck or Investment?

- Becker and Tomes (1979): A stable equilibrium distribution of income can emerge which could be explained by individual and market lucks alone if credit markets are perfect.

Emerging questions

- Initial condition: Born poor (poor parents)

- Die poor? (no social mobility)

- Die rich? (High intergenerational mobility)

- Low social mobility means inequality perpetuates across generations.

Emerging questions

- What can I do not to die poor?

- Education, investment in human capital?

But here is the problem!!

- To invest in education I need money.

- If I am poor who gives me the money

- Banks: Credit market

- But credit market is imperfect. I may not be credit worthy.

- Thus if I am born poor I may die poor if credit market is imperfect.

- Imperfect credit market means it may perpetuate across generations.
- A considerable literature, Loury, 1981, Mulligan, 1997, Banerjee and Newman, 1993, Galore and Zeira, 1993, Mookherjee and Ray (2002), Bandyopadhyay and Basu, 2005), evolved emphasizing the role of credit market imperfection in perpetuating the inequality.
- **A recurring theme of my research:** *how credit market imperfection   perpetuates inequality when other frictions are present.*
- In Basu and Guariglia, FDI, Inequality and Growth (JMACRO, 2007) we show that FDI escalates inequality if credit market is imperfect.

Social Mobility

How does one measure social mobility?

- I use the phrases Social mobility and inter-generational mobility interchangeably although there are subtle differences.
- You run a regression of child's income on parent's income. If the correlation is high it means low social mobility and if it is low, it means high mobility.
- Gregory Clark uses surnames to track generations and finds that the true rates of social mobility are far slower than conventional estimates. See his book the "The Son Also Rises."
- Basu and Getachew (J of Macro, 2015) shows how this regression coefficient depends on the inherent inertia of human being to respond slowly to incentive.

Modelling Inequality and Social Mobility (from Basu and Getachew, 2015)

Basic Story

- When the credit market is missing, individual's investment opportunities (which is investment in human capital in our model) are limited to the resources they have in hand.
- Due to diminishing returns to capital, poor households have a higher marginal product of capital than rich.
- This difference cannot be equalized due to missing credit market.
- Capital-poor agents with high marginal product of capital will try to equalize the difference in wealth by investing more.
- However, capital adjustment cost will slow down the process of convergence.
- Both these technological factors contribute to greater persistence of inequality of wealth and income.

Modelling inequality

- A continuum of heterogeneous households $i \in [0, 1]$. Each household i consists of an adult of generation t tied to a child of generation t + 1.
- Adult, at t puts a unit raw labour into the production process which translates into h_{it} efficiency units (human capital) for the production of final goods and services to earn income (y_{it}) using:

$$y_{it} = a_1 \, \phi_{it} h_{it}^\alpha h_t^{1-\alpha}$$

where individual luck, $\ln \phi_{it} \sim N(-\upsilon^2/2, \upsilon^2)$, $\ln h_{it} \sim N(\mu_t, \sigma_t^2)$, h_t =aggregate human capital.

- μ_0, σ_0^2 =given. We will tell a story for the evolution of μ_t, σ_t^2.

Technology of human capital production

- The production of human capital at date $t + 1$ (h_{it+1}) takes place with the aid of: (i) past human capital (h_{it}), (ii) investment in schooling (s_{it}):

$$h_{it+1} = a_2 h_{it}^{1-\theta} \mathbf{f}(1-\delta)h_{it} + s_{it} g^{\theta}$$
$$\text{where } 0 < \theta < 1, a_2 > 0.$$

- θ = the degree of adjustment cost in the production of human capital in the same spirit as in Lucas and Prescott (1971), Basu (1987), Basu, Gillman and Pearlman (2011).
- For $0 < \theta < 1 \Rightarrow$ diminishing investment returns (because $\frac{\partial h_{it+1}}{\partial s_{it}}$ is decreasing in s_{it}) due to adj cost.
- If $\theta = 1$ (zero adjustment cost).
- If $\theta = 0$, capital stock does not move (in…nite adjustment cost).

Utility function and budget constraint

- Agents care about their own consumption (c_{it}) and the human capital stock of their children (h_{it+1}), "joy of giving". Since h_{it+1} has a home production component, such a utility function can be thought of as a reduced form as in Greenwood et. al. (1995):

$$u\left(c_{it}, h_{it+1}\right) = \ln c_{it} + \beta \ln h_{it+1} \tag{1}$$

- The budget constraint:

$$c_{it} + s_{it} = y_{it} \tag{2}$$

Equilibrium

- Optimization: An adult at date t solves the following problem:

$$\max_{s_{it}} \ln(y_{it} - s_{it}) + \beta \ln a_2 h_{it} (1 - \delta + s_{it}/h_{it})^\theta$$

- The optimal investment and parental care:

$$s_{it} = (y_{it} \, \theta\beta \, (1 - \delta) \, h_{it}) \, / \, (1 + \theta\beta)$$

- Investment in schooling is lower if depreciation cost (δ) is lower and adjustment cost (θ) is higher.

- Aggregate Consistency: (i) $c_t \int_i c_{it} di$, $s_t \int_i s_{it} di$, $y_t \int_i y_{it} di$, $h_t \int_i h_{it} di$

- (ii) $c_t + s_t = y_t$.

Individual optimal human capital accumulation

- The ith adult's optimal human capital accumulation is given by,

$$h_{it+1} = \varphi h_{it} \left[1 - \delta + a_1 \phi_{it} h_t^{1-\alpha} h_{it}^{\alpha-1} \right]^\theta$$

$$\varphi = a_2 \left(\theta\beta / (1 + \theta\beta) \right)^\theta$$

- Thus, the ith individual offspring's human capital is determined by her human capital stock and also her luck.

Are kids poor because parents are poor or parents are unlucky?

- This can be easily seen from the loglineraized decision rule:

$$\ln h_{it+1} \ln h_{jt+1} = \chi \ln \phi_{it} \ln \phi_{jt}) + \$ (\ln h_{it} \ln h_{jt})$$

- where $\$ 1 \chi (1 \alpha) 2 (0, 1)$, $\chi \theta a_1 / (1 \delta + a_1) 2 (0, 1)$.
- the …rst term is the luck e¤ect and the second term is the initial wealth e¤ect.
- Lower θ, lower δ dampen the luck e¤ect but amplify the initial wealth e¤ect .
- The initial wealth di¤erence tends to have a more persistent e¤ect on the current inequality in the presence of higher adjustment cost (lower θ) and lower depreciation cost (lower δ).

- Loglinearized version of distributional dynamics is:

$$\sigma_{t+1}^2 = \$^2 \sigma_t^2 + \Lambda^2 \upsilon^2$$

- Distributional dynamics of income

$$\sigma_{t+1,y}^2 = \$^2 \hat{\sigma}_{t,y}^2 + \upsilon^2 \ 1 \ \$^2 + \alpha^2 \Lambda^2$$

where

$$\$ \ 1 \ \Lambda(1 \ \alpha) \ 2 \ (0, 1)$$
$$\Lambda \ \theta a_1 / \ (1 \ \delta + a_1) \ 2 \ (0, 1)$$

- Three key technology parameters determine distributional dynamics namely, α, θ and δ.

Long run growth and Inequality

- The steady-state human capital inequality:

$$\sigma^2 = \Lambda^2 u^2 / 1 \text{ \$}^2$$

- The steady-state income inequality (σ_y^2)

$$\sigma_{,y}{}^2 = u^2 1 \text{ \$}^2 + \alpha^2 \Lambda^2 / 1 \text{ \$}^2$$

- Inequality in the long-run is thus mainly the result of individuals' di¤erences in human capital investment decision as a response to di¤erences in luck.

Proposition

The long-run distribution of wealth (σ^2) is a function of initial distribution in luck (u^2) and independent of the initial distribution of σ_0^2 whereas σ^2 increases in α and θ.

Inequality and Growth

- Is inequality harmful for growth?
- Not very clear.
- No cause and effect relationship exists.
- Both are endogenous. The relationship depends on policy and structural factors.
- A growth enhancing policy could exacerbate inequality because of priority to efficiency.
- A populist policy of redistribution would lower inequality but could kill incentive and lower growth.
- Classic trade-off between efficiency and equity.
- In my latest redistributive innovations, we address

this issue.

Inequality and Growth

- Barro (2001) documents that for rich countries growth and inequality correlate positively while it is the opposite for poor countries.
- Bandyopadhyay and Basu (2005) "What drives cross country growth inequality correlation?" (Canadian Journal of Economics, 2005) picks up this theme.
- We find several determinants of this cross-country correlation such as degree of redistribution, barriers to knowledge spill-over, skill intensity of technology.

Inequality and Growth

- In industrial countries, redistributive tax is high which might tend to lower inequality but it also adversely impacts growth. Thus growth-inequality correlation could be positive.
- In developing countries, credit market is imperfect. If the returns on human capital differ, it cannot be equalized by investment in human capital due to lack of finance. Less investment means less growth.
- Thus higher inequality is associated with lower growth.

Innovations and Inequality

- Does increased R&D raise or lower inequality?

- This is another theme of my present research.

- Basu and Getachew, "Redistributive Innovations and Inequality" (JPET, 2019) addresses this issue.

Regressive and Progressive Innovations

- Regressive innovations benefit rich. Example, IT innovations

- Progressive innovations benefit poor. Example agricultural innovations.

- A regressive innovation would exacerbate inequality while a progressive R&D would lower it.
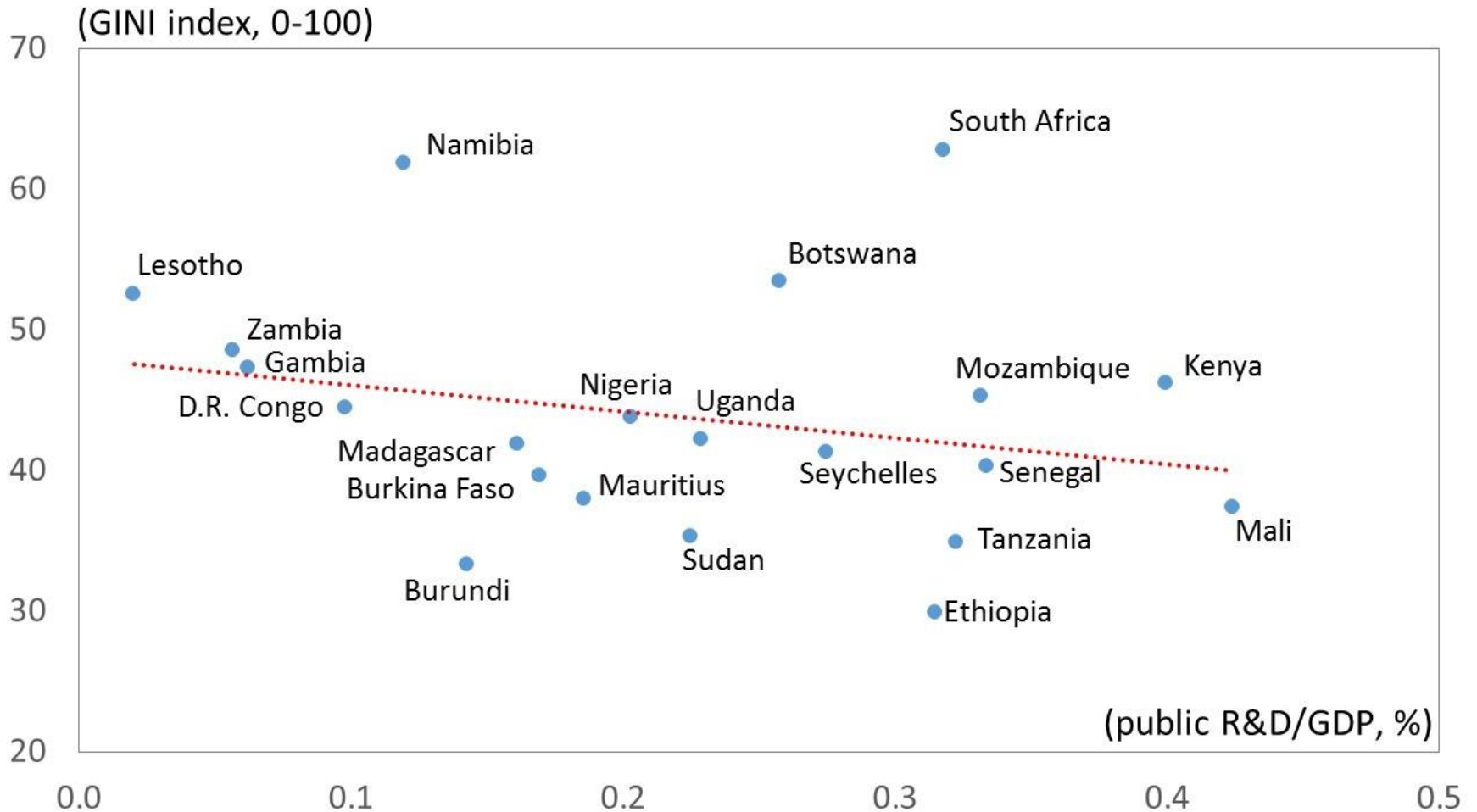
Stylized Facts

- R&D is more regressive in the US

- It is progressive in SSA countries.

- See the data in my latest JPET (2019) paper with Yoseph Getachew.

Inequality and R&D Intensity in US states (2007-2011, US Census Bureau)
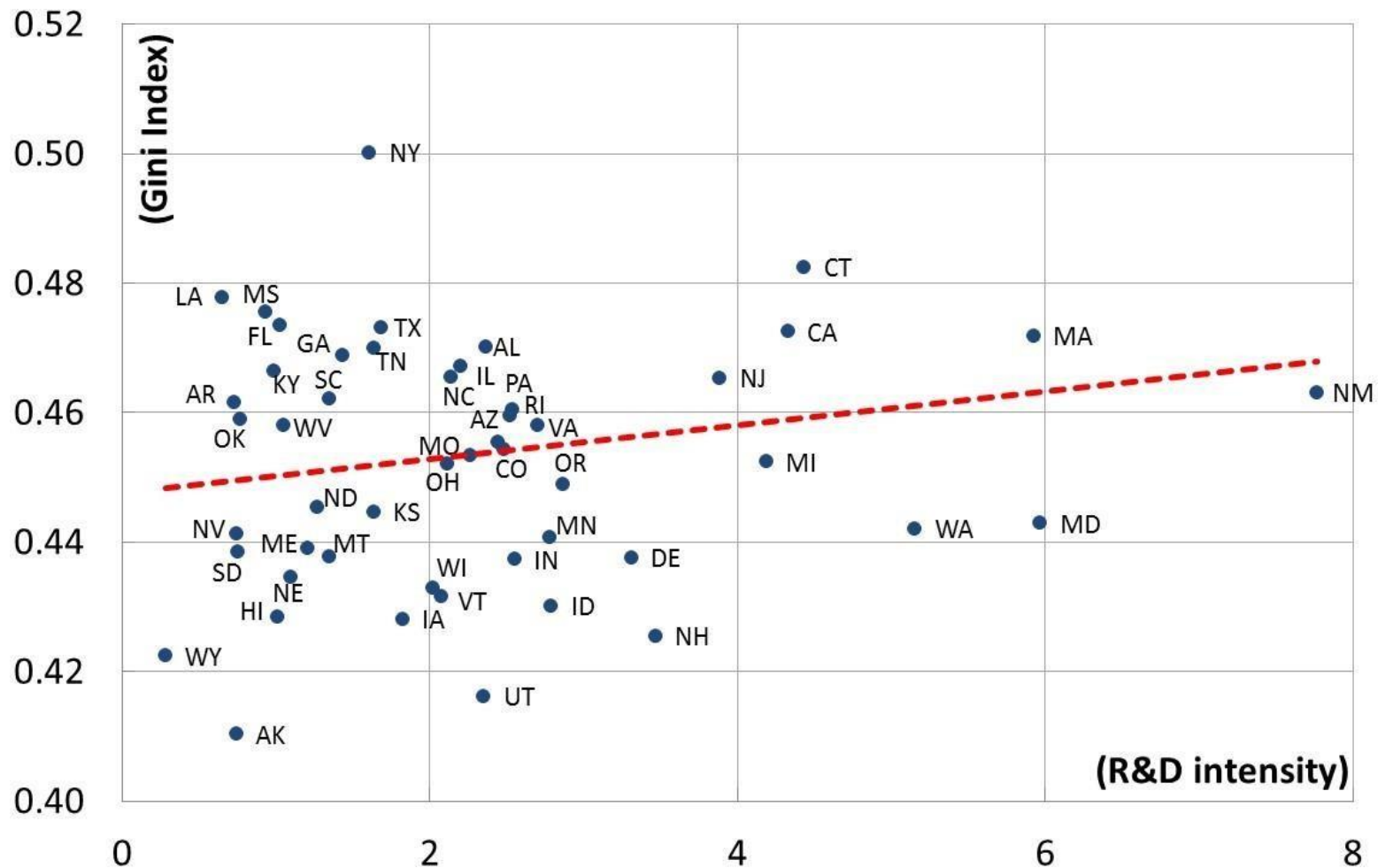
Inequality and Public R&D, SSA

Policy Questions

- Should the government invest more resources in regressive or progressive R&D?

- If it prioritizes regressive R&D, it will escalate inequality but growth will be higher because regressive R&D promotes efficiency due to its high tech nature.

- Again higher growth will be associated with higher inequality as seen by Robert Barro.

Modelling redistributive innovations policy (JPET, 2019 article)

- Public R&D Policy is formulated as:

$$g_{it} = e^{it} (h_{it} / h_t)^{\omega} g_t$$

- If $\omega = 0$, for instance, $g_{it} = g_t$ is a pure public good where all …rms equiproportionately bene…t from public R&D.
- A positive ω implies $g_{it} > g_t$ if $h_{it} > h_t$ which is a merit based public expenditure.
- A negative ω implies $g_{it} > g_t$ if $h_{it} < h_t$, small …rms with a relatively lower level of initial knowledge bene…t more from public spending on R&D.
- A positive and negative ω as regressive and progressive public expenditure, respectively.
- ω is the key redistributive policy parameter. We determine ω

  optimally.

Inequality and Stock market risk

- Basic arbitrage condition in a risk neutral world is that the expected return di¤ernetial between risky and risk free bonds equal.
- In a world with risk averse consumers/investors, risk premium dirves a wedge between expected return on stock and a riskfree bond.
- This wedge is dirven a stochastic discount factor which is also known as a pricing kernel.
- In a consumption based asset pricing model, This arbitrage condtion can thus be written as:

$$E_t \underbrace{\frac{\beta u^0(c_{t+1})}{u^0(c_t)}}_{\text{Pricing Kernel}}[R_{mt+1} - R_{Ft}] = 0]$$

- The equity risk premium is then

$$E_t R_{mt+1} - R_{Ft} = \frac{Cov_t(\frac{\beta u^0(c_{t+1})}{u^0(c_t)}, R_{mt+1} R_{Ft})}{E_t \frac{\beta u^0(c_{t+1})}{u^0(c_t)}}$$

- The well known equity premium puzzle arises from the low covariance between aggregate consumption and excess stock return.
- If you bring cross sectional consumption inequality, the picing kernel will have an additional terms which is the cross sectional variance of consumption (Constantiniides and Du¢e, 1996) which could help explain the high equity premium (Basu and Wada, 2006 and Basu et al., 2011) address this.
- Bottomline is that a higher consumption inequality can boost the stock market premium.

- The relationship between social welfare, growth and inequality is nonlinear. It also depends on how you de…ne social welfare.
- In a representative agent utilitarian world,

$$W = f (\underset{+}{\text{growth, Inequality}})$$

- But growth responds positively to e¢ciency/incentive, while greater e¢ciency might exacerbate inequality.
- Thus any growth enhancing policy has nonlinear e¤ects on social welfare.
- Perennial con‡ict between equity and e¢ciency.

- Thomas Piketty amasses data to document that return on capital exceeds growth rate and makes a dire prediction that capitalists' income will dominate the share of overall income.
- This is corroborated by the disturbing rise in the share of top 1% income group.
- In all standard neoclassical growth model including mine, return on capital usually exceeds a balanced growth via an Euler equation: $1 + g = \beta(1 + r \; \delta)$.
- Yet a stable distribution of income is achieved in the long run. See Debraj Ray's critique of Piketty, Nit-Piketty (2014).
- How can we twig these models to generate a secular rise in inequality?