Lectures on Economic Inequality

Warwick, Summer 2016, Slides 3

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

Psychological Traps

- So far, we studied economic constraints on equitable growth:
- Nonconvexities: Azariadis-Drazen 1990, Dasgupta-Ray 1986
- Imperfect credit markets: Banerjee-Newman 1993, Galor-Zeira 1993
- To be contrasted with psychological constraints:
- Hirschman's tunnel
- The capacity to aspire: Appadurai 2004, Ray 1998, 2006
- Stress and cognitive function: Mani-Mullainathan-Shafir-Zhao 2013
- Self-control Banerjee-Mullainathan 2010, Bernheim-Ray-Yeltekin 1999, 2015
- Information and poverty Madajewicz et al 2007 on groundwater contamination, Dupas 2011 on older sexual partners in Kenya.

Aspirations

"[UPA rule] is a period during which growth accelerated... [but] growth can also unleash powerful aspirations as well as frustrations, and political parties who can tap into these emotions reap the benefits." Ghatak-Ghosh-Kotwal, "Growth in the time of UPA: Myths and Reality," *Economic and Political Weekly*, April 19, 2014.

"[The] system that delivers these [educational] outcomes is sustained by aspiration: the faith that if we try hard enough we could join the elite ... From infancy to employment, this is a life-denying, love-denying mindset, informed ... by an ambition that is both desperate and pointless." *The Guardian*, June 9, 2015.

Aspirations and Society

- Two-way interaction:
- Aspirations $\rightarrow$ inspiration or frustration $\rightarrow$ investment

  (and investment shapes growth and distribution)

- Society $\rightarrow$ aspirations

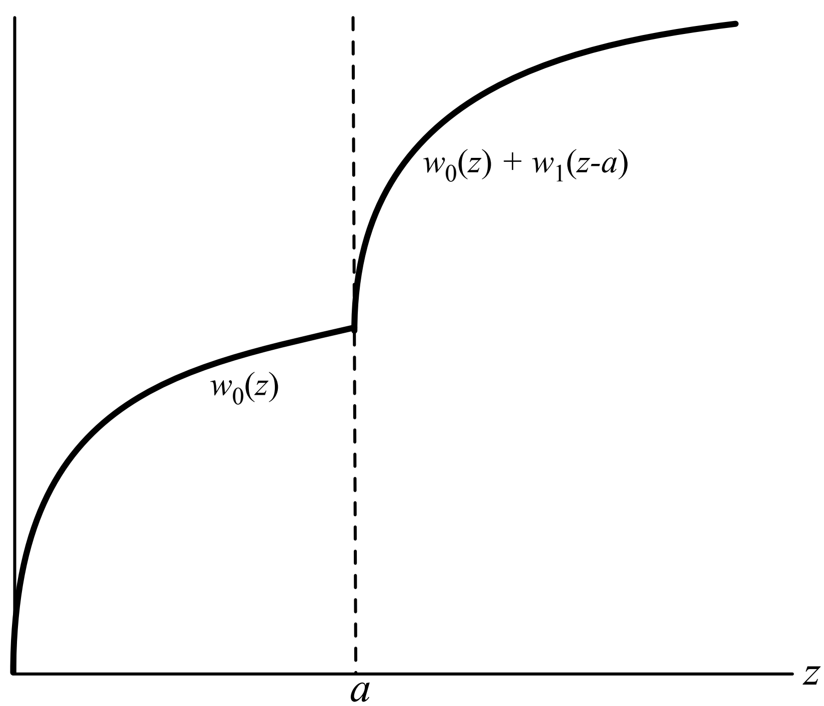
  (aspirations are shaped by the lives of others around us)

The Setting

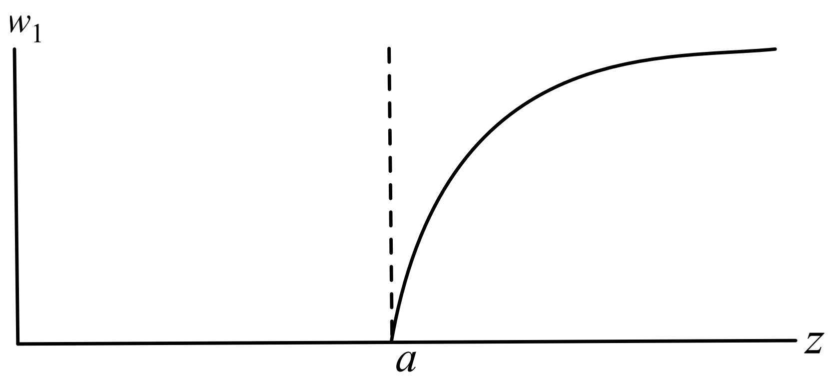
- Society: single-parent single-child strings (dynasties)
  - Lifetime income or wealth y; $y = c + k$.
  - $f(k) = z =$ wealth of child. Process continues forever.
- Preferences:

$$u(c) + w_0(z) + w_1(e),$$

  - where $e = \max\{z - a, 0\}$
  - and a is an aspiration.
  - w_0 intrinsic utility; w_1 aspirational utility.
  - Increasing, smooth, strictly concave.



■ Remark 1. Alternatives for w_1.



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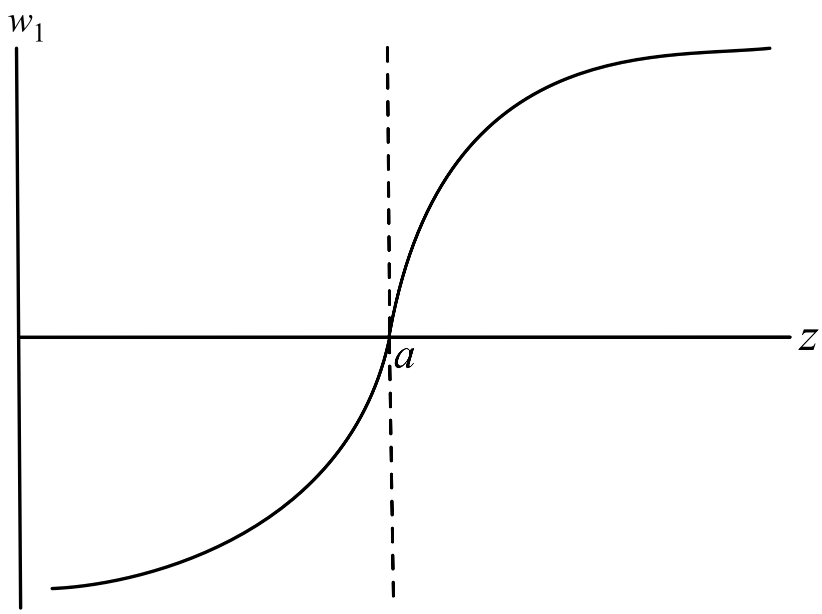

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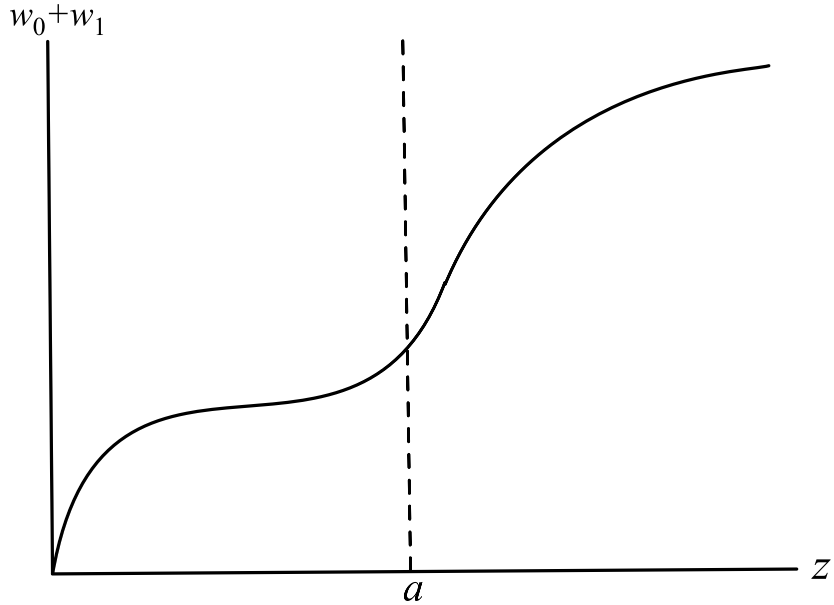
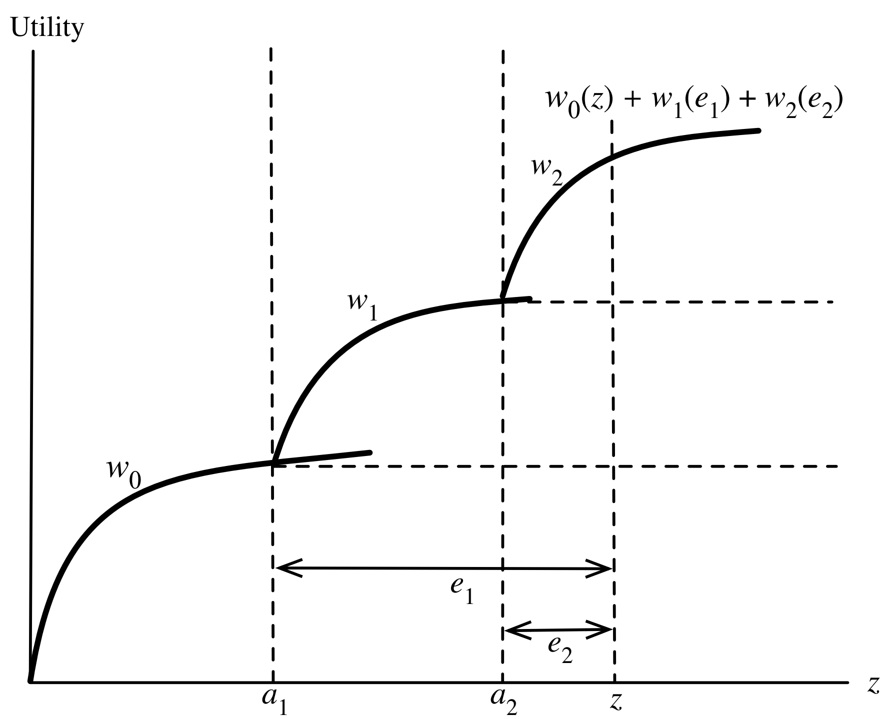
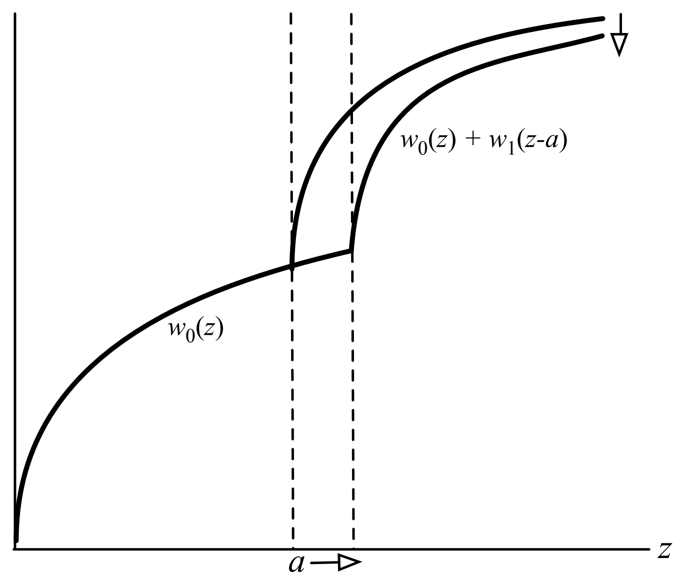


■ Remark 2. Extends to aspiration vectors.



- **Remark 3.**

- Higher aspirations always bad for happiness in the short-run:



The Formation of Aspirations

$$a = \Psi(y, F)$$

where F is current distribution of lifetime incomes.

- Define F^λ by $F^\lambda(\lambda y) = F(y)$ for all y.

- **Assumptions:**

- [regular] $\Psi(y, F)$ is continuous in (y, F), nondecreasing in y.

- [range-bound] $\min F \leq \Psi(y, F) \leq \max F$.

- [scale-free] $\lambda\Psi(y, F) = \Psi(\lambda y, F^\lambda)$ for $\lambda > 0$.

- [socially sensitive] $\Psi(y, F^\lambda) > \Psi(y, F)$ for $\lambda > 1$.

- Regularity used throughout. Others when mentioned.

Aspirations in the Growth Model

- Start with F_t.
  - Then $a_t = \Psi(y, F_t)$ for every $y \in \text{Supp } F_t$.
  - At income y, choose $z \in [0, f(y)]$ to max

$$u\left(y - k(z)\right) + w_0\left(z\right) + w_1\left(\max\{z - a_t, 0\}\right)$$

where $k(z) \equiv f^{-1}(z)$.

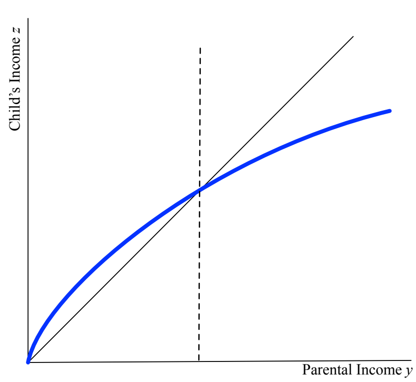
- From F_0, recursively generates equilibrium sequence $\{F_t\}$:
- Proposition 0. An equilibrium (trivially) exists.

Benchmark: No Aspirations

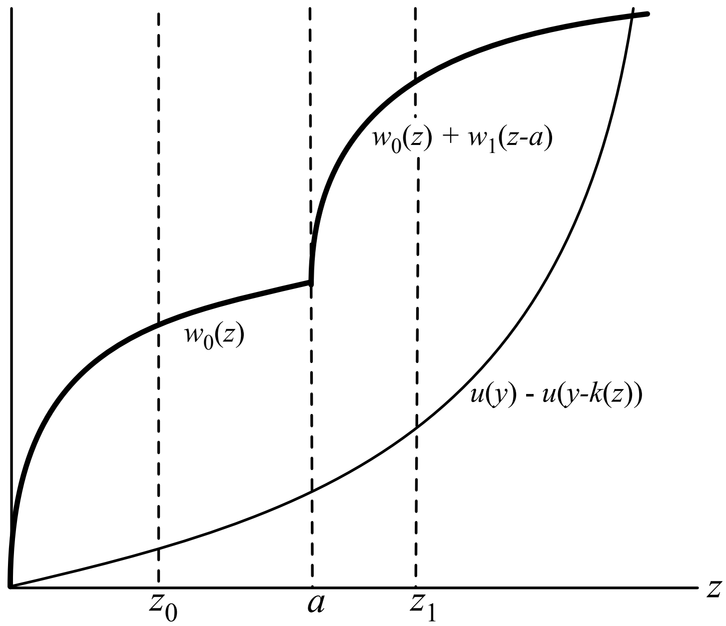
- Choose $z \in [0, f(y)]$ to max

$$u\left(y - k(z)\right) + w_0\left(z\right)$$

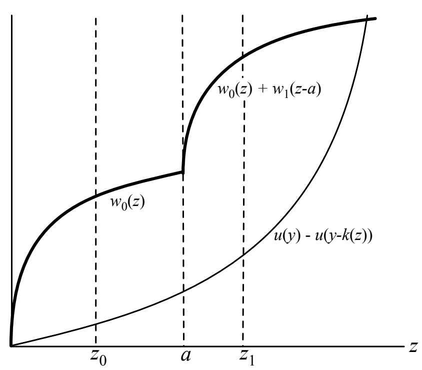
- Assumption:
  - [positive solution] $z \geq y$ for all y small enough.



From Aspirations and Wealth To Investment



- At most one "local" solution on either side of a.



Lower solution z_0 as in benchmark:

$$-\left[u'\left(y-k(z_0)\right)/f'(k(z_0))\right]+w_0'\left(z_0\right)=0,$$

where $k(z) \equiv f^{-1}(z)$.

Upper solution z_1:

$$-\left[u'\left(y-k(z_1)\right)/f'(k(z_1))\right]+w_0'\left(z_1\right)+w_1'(z_1-a)=0.$$

- Compare, and pick the one with the higher payoff.

- An aspiration a is satisfied if optimum is no less than a.

  It is frustrated if optimum strictly smaller than a.

- When is an aspiration satisfied, and when is it frustrated?

- useful partial equilibrium exercise, aspirations "exogenous."

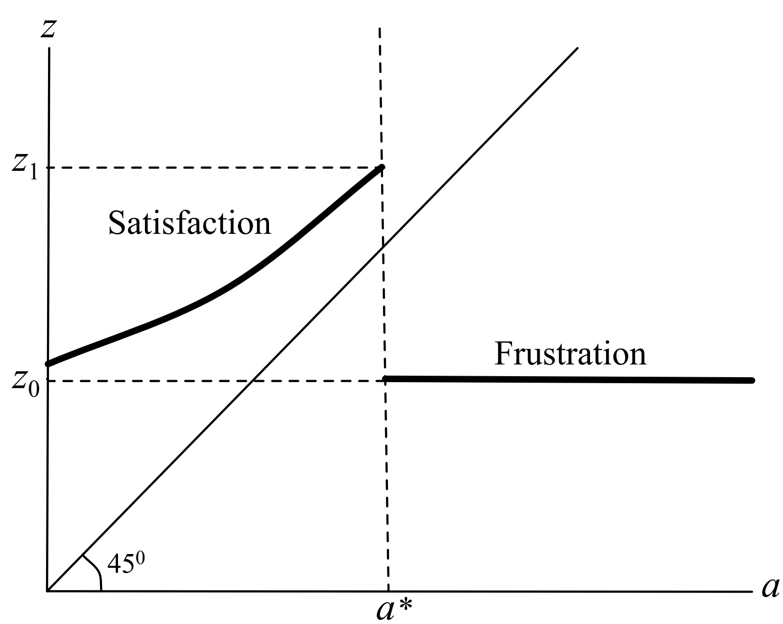
- rise of television, advertising or the internet

- change in the income distribution

- Proposition 1. Fix current wealth.

- There is a unique threshold value of aspirations below which aspirations are satisfied, and above which they are frustrated.

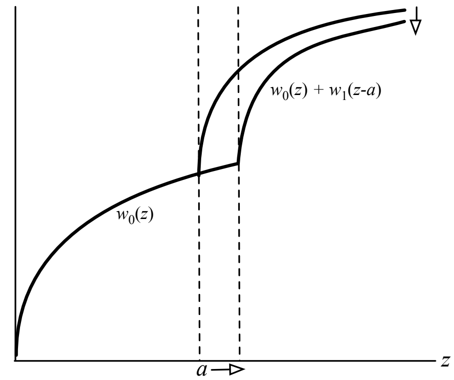
- As long as aspirations are satisfied, chosen wealth grows with aspirations. Once aspirations are frustrated, chosen wealth becomes insensitive to aspirations.



- Note the discontinuous jump-down.

On Frustration

- Recall that aspirational growth always lowers direct utility:



- If aspirations are frustrated, no inspirational role either:

- "The French found their position all the more intolerable as it became better." de Tocqueville, 1856

- Lowered aspirations of low income students reduces school dropout Kearney-Levine, 2014, for the US; Goux-Gurgand-Maurin, 2014, for France

A Variant: Aspirations-Wealth Ratios (More partial equilibrium)

- Introducing the canonical linear model:

- Linear production: $f(k) = \rho k$.

- Constant-elasticity utility:

$$u(c) = c^{1-\sigma}, w_0(z) = \delta z^{1-\sigma}, \text{ and } w_1(e) = \delta\pi e^{1-\sigma}$$

- Investment choice: Given (y, a), pick z to maximize

$$\left(y - \frac{z}{\rho}\right)^{1-\sigma} + \delta\left[z^{1-\sigma} + \pi\left(\max\{z-a, 0\}\right)^{1-\sigma}\right].$$

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- Investment choice: Given a/y, pick z/y to maximize

$$\left(1 - \frac{z/y}{\rho}\right)^{1-\sigma} + \delta \left[(z/y)^{1-\sigma} + \pi \left(\max\left\{\frac{z}{y} - \frac{a}{y}, 0\right\}\right)^{1-\sigma}\right].$$

(dividing through by y)

- Investment choice:

- Aspirations ratio: $r \equiv a/y$. Choose growth $g \equiv z/y$ to max

$$\left(1 - \frac{g}{\rho}\right)^{1-\sigma} + \delta \left[g^{1-\sigma} + \pi \left(\max\{g - r, 0\}\right)^{1-\sigma}\right].$$

- Failed aspiration; solution $\underline{g}$ independent of r:

$$\left(1 - \frac{\underline{g}}{\rho}\right)^{-\sigma} = \delta \rho \underline{g}^{-\sigma}$$

- Satisfied aspiration; solution $g(r)$ depends on r:

$$\left(1 - \frac{g(r)}{\rho}\right)^{-\sigma} = \delta \rho \left[g(r)^{-\sigma} + \pi \left(g(r) - r\right)^{-\sigma}\right].$$

- Proposition 2.

  - There is a unique ratio r^* such that for $r \equiv a/y > r^*$, wealth grows at rate $\underline{g}$, and for all $r \equiv a/y < r^*$, wealth grows at rate $g(r)$.

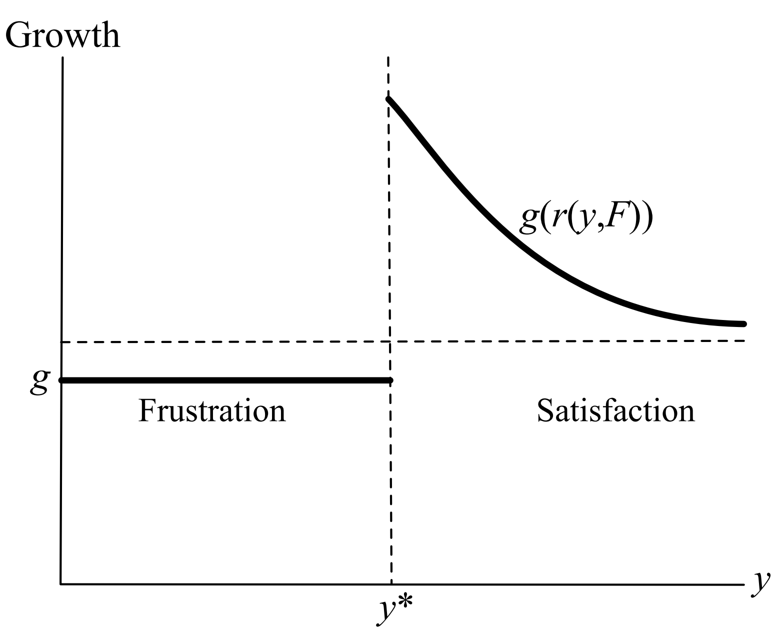
  - $g(r) \uparrow$ in r, but larger and bounded away from $\underline{g}$ in r.

  - Under social sensitivity, can link y to a/y:

- Proposition 3.

  - With social sensitivity, the aspirations ratio $r(y, F) \equiv \Psi(y, F)/y$ is strictly decreasing in y for each F.

- Combining Propositions 2 and 3:



General Equilibrium:

The Joint Evolution of Aspirations and Incomes

- Recall our recursive equilibrium notion:
  - Wealth distribution F_t at date t; $a_t = \Psi(y, F_t)$, $y \in \text{Supp } F_t$.
- Each person with wealth y chooses continuation z.
  - z is tomorrow's wealth, and F_{t+1} is new distribution.
  - From F_0, recursively generate F_t and $a_t = \Psi(y, F_t)$ for all y and t.
- Questions:
  - Persistent or growing inequality, or convergence?
  - Connections between initial distribution and subsequent growth.

Steady States

- Distribution F^* concentrated on strictly positive incomes:
  - $\{F^*, F^*, F^*, \ldots\}$ equilibrium from F^*.
  - Natural setting: incomes in compact support, as in Solow model.
- Proposition 4.
  - There is no steady state with perfect equality.
- Proof.
  - Perfect equality implies concentration of y and $\mathbf{a}$ at same point.
  - Contradiction: everyone wants to move away from $y = a$.
  - Related to symmetry-breaking.

Clustering in Steady State

- Recall benchmark model without aspirations: maximize

$$u(y - k(z)) + w_0(z)$$

- Interior steady states, each characterized by

$$d(y) \equiv -\frac{u'(y - k(y))}{f'(k(y))} + w_0'(y) = 0.$$

- Assumption for unique steady state in benchmark model:

[D] $d(y)$ is decreasing in y.

- Proposition 5.

- Assume D, range-bound, scale-free and socially sensitive aspirations.

- Then steady states must all be bimodal.

Constructing a Bimodal Steady State

- Two-point distribution F^*. (y_ℓ, y_h, p):

- $y_\ell < y_h$, and p is population weight on y_ℓ.

- Aspirations satisfy

$$a_i = \Psi(y_i, F^*).$$

  for $i = \ell, h$. ▪ By range-boundedness, a_ℓ is a failed aspiration, so

$$d(y_\ell) = 0,$$

- And a_h is a satisfied aspiration, so

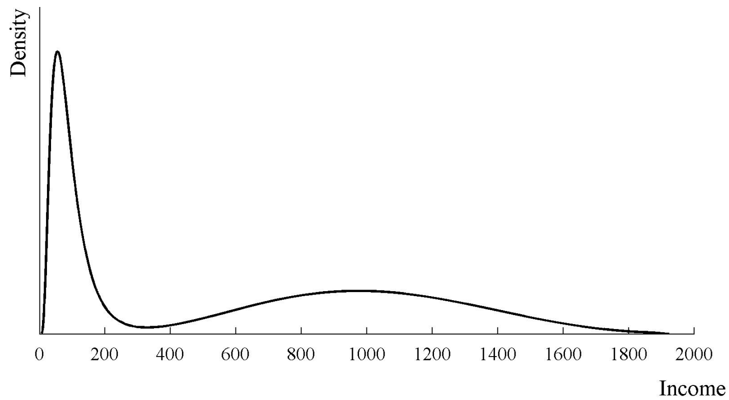
$$d(y_h) + w_1'(y_h - a_h) = 0.$$

- One degree of freedom left, but we need to use some of it.

Remarks on Clustering

■ Of course, convergence to degenerate poles is an artifact (akin to single steady-state income in Solow model.)

■ With stochastic shocks (e.g., Brock-Mirman 1972): smoothly dispersed but multi-modal distribution.



Constant-elasticity utility: $\sigma = 0.8$, $\delta = 0.8$ and $\pi = 1$; $f(k, \theta) = \theta(A/\beta)k^{\beta}$, where $\beta = 0.8$, $A = 4$ and θ lognormal with mean 1. a = average of own y and mean y.

■ Multimodality in the literature:

■ [US] Pittau-Zelli 2004, Sala-i-Martin 2006, Zhu 2005

■ [world] convergence clubs

Durlauf-Johnson 1995, Quah 1993, 1996, Durlauf-Quah, 1999

■ Quah uses the term "twin peaks."

■ Bimodality also a feature of polarized distributions

Esteban-Ray 1994, Wolfson 1994.

Aspirations, Inequality and Endogenous Growth

- Return to canonical linear model:
  - constant-elasticity utility, linear production.
- Recall aspirations ratio $r = a/y$.
  - And recall Proposition 3: there is r^* such that:
  - if $r > r^*$, grow at $\underline{g}$
  - if $r \leq r^*$, grow at $g(r)$ (convention at "=")

Ultimate Equality | Perpetually Widening Inequality

- Proposition 6. Assume aspirations are range-bound, scale-free and socially sensitive. Let F_0 be initial distribution of with compact support. Then there are just two possibilities:

I. Convergence to Perfect Equality. There is $g^* > 1$ such that $y_t/{g^*}^t$ converges to a single point independent of $y_0 \in$ Supp F_0; or

II. Persistent Divergence. F_t "separates" into two components defined by threshold $y^* \in$ int Range F_0:

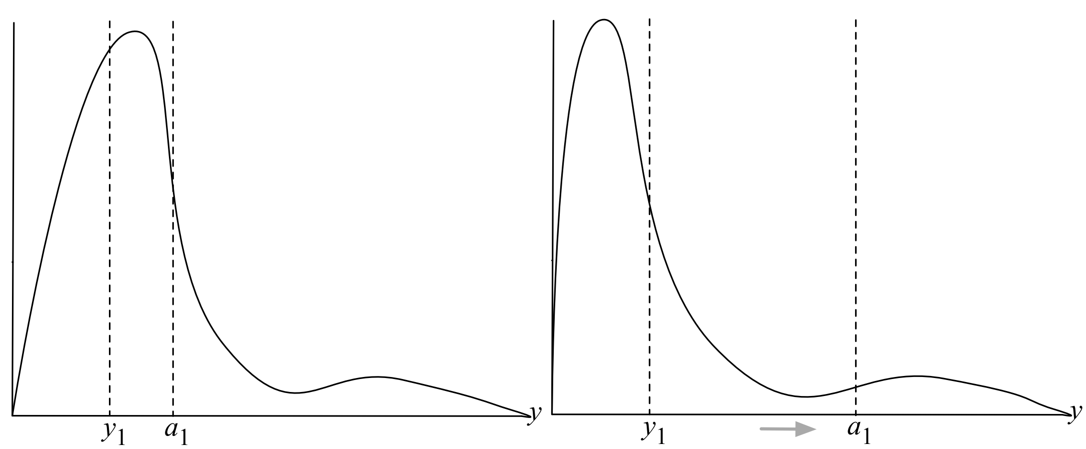
- If $y < y^*$, income grows forever after at $\underline{g}$.
- If $y > y^*$, income has asymptotic growth $\bar{g} > \underline{g}$, with $\bar{g} - 1 > 0$, and $y_t/\bar{g}^t$ has the same limit independent of y_0, as long as y_0 exceeds y^*.
- $\underline{g} < \bar{g} \leq g^*$: equality exhibits faster growth.
- In Case II, relative inequality never settles, it perpetually widens.

Discussion of Equality-Inequality Proposition

- Significantly narrows the ways in which a distribution can evolve.
- I. Everyone has satisfied aspirations at date 0.
  - Requires high equality in the initial distribution.
- II. Some — but not all — have satisfied aspirations at date 0.
  - Inequality never stops increasing, even in relative terms.
  - Cf. Piketty-Saez 2003, Atkinson-Piketty-Saez 2011, Piketty 2014
- Note: result crucially hinges on social sensitivity
  - Proposition 4: $y_1 < y_2 \Rightarrow r(y_2) < r(y_1)$.

Social Sensitivity and the Equality-Inequality Proposition

- Take aspirations to be conditional mean above income.



- Equivalently, at least along a range in the cross-section, aspirations might rise faster than incomes.

- Can social sensitivity be dropped free of charge?

- Weaker assumption:

  - [upper sensitivity] If incomes above y all rise and there are no crossings from below, aspirations at y must rise.

- Central observation. Consider continuous time limit. Once frustrated, this state is permanent.

  - Proof. A frustrated individual has lowest growth rate + scale-free aspirations.

  - Implication. The fraction of frustrated people is monotone in time; converges.

- Among the frustrated, all grow at the same factor $\underline{g}$.

  - The satisfied have $g > \underline{g}$, thereby generating ever-widening inequality.

- Minimum incomes among the satisfied grow fastest, maximal incomes slowest.

  - In continuous time, convergence among the satisfied.

Summary

- We build a theory of aspirations formation.

  - Emphasizes the social foundations of individual aspirations

  - Relates those aspirations to investment and growth.

  - Such behavior can be aggregated, thus closing the model.

- Central feature: aspirations can incentivize and frustrate.

  - Aspirations above incomes can encourage high investment.

  - But aspirations that are too high will discourage investment.

  - Rising aspirations have instrumental value — but up to a point.

- Steady state distributions must exhibit inequality.
  - With socially sensitive aspirations, steady states are bipolar.
- The canonical linear model permits sustained growth.
  - Either convergence to equality, or perennially widening inequality.
- The model is tractable and may be useful in other contexts.