

Human Evolution and Economic Development

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 - Reinforced the growth process
 - stimulated the take-off from an epoch of stagnation to sustained growth

Selection of Predisposition Towards Child Quality

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 - Entrepreneurial spirit (Galor-Michalopoulos, 2012)

The Benchmark Model – Galor-Moav (QJE 2002)

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- 2 factors of production:
 - Labor (measured in efficiency units)
 - Land

Factor Supply

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- Efficiency units of labor evolves endogenously
 - Determined by households' decisions about the number and level of human capital of their children

Main Elements

- The Malthusian Structure
- The Darwinian Structure
- Sources of Technological Progress
- Origins of Human Capital Formation
- Triggers of the Demographic Transition

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- Output per capita fluctuates (with a negligible trend) around a constant level in the long-run
 - Reflecting diminishing returns to labor & positive effect of income on population

Production

- The output produced in period t

$$Y_t = H_t^{1-\alpha} (A_t X)^\alpha$$

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- $A_t \equiv$ technological level
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- Output per efficiency units of labor at time t

$$y_t = x_t^\alpha$$

- $x_t \equiv (A_t X) / H_{tt} \equiv$ effective resources per worker

The Malthusian Structure – Effects of Technological Progress

- Very short-run (for a given population):
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- Short-run (initial adjustment of population):
 - $y_t \uparrow \implies L_t \uparrow$
- Long-run (population reaches a new steady-state):
 - $L_t \uparrow \implies y \downarrow$ (back to \bar{y})

Sources of Technological Progress

- Average individuals' quality affects technological progress

$$e_t \uparrow \implies A_t \uparrow$$

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- human capital provides an advantage in adopting and advancing new technologies

Technological Progress

$$g_{t+1} \equiv \frac{A_{t+1} - A_t}{A_t} = \psi(e_t)$$

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$$\psi'(e_t) > 0; \quad \psi''(e_t) < 0; \quad \psi(0) = 0$$

- The average quality of the population has a positive and diminishing effect on technological progress

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 - Human capital permits individuals to better cope with the changes in the technological environment
 - The introduction of new technologies is skill-biased in the short-run, although the nature of the technology can be skill-biased or skill-saving in the long run

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Human capital of an individual who joins the labor force in period $t + 1$

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- $e_{t+1} \equiv$ the individual education level (determined by parental investment, subject to their subsistence constraint, in period t)
- $g_{t+1} \equiv$ rate of tech progress

Human Capital Formation

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- $h_e(e, g) > 0$ and $h_{ee}(e, g) < 0$
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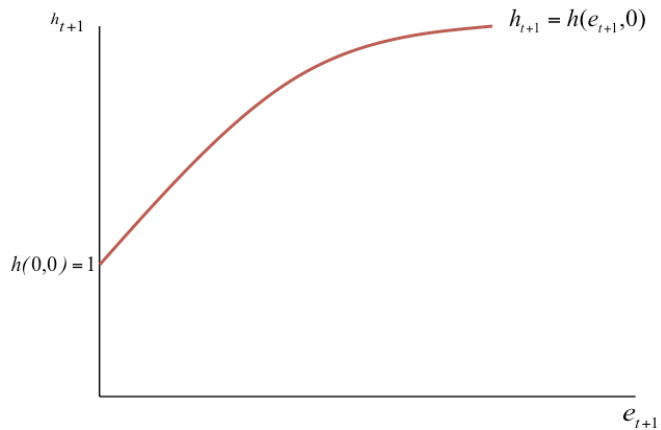
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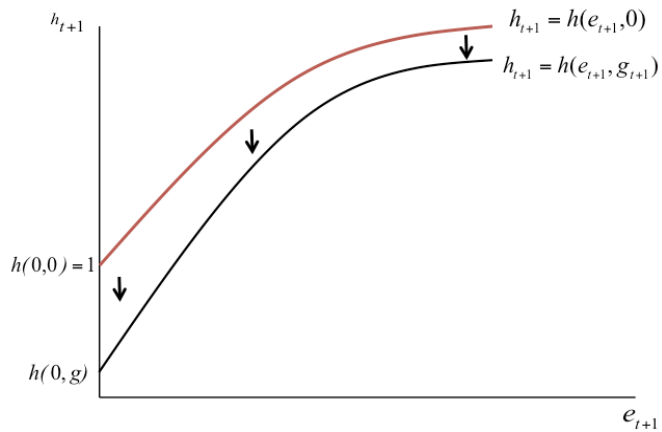
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- $h(0, g) > 0$
 - Basic level of human capital

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 - Population growth declines & human capital formation increases further

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Preferences

- The utility function of individual t (adult at time t)

$$u_t^i = (1 - \gamma) \ln c_t^i + \gamma [\ln n_t^i + \beta^i \ln h_{t+1}^i]$$

- $c_t^i \equiv$ consumption of individual of type i in generation t
 - $n_t^i \equiv$ number of children of individual of type i in generation t
 - $h_{t+1}^i \equiv$ level of human capital of each child of individual of type i in generation t
 - $\beta^i \equiv$ predisposition towards quality of individual of type i in generation t
- Intergenerational transmission of predisposition towards quality across individuals of type i

$$\beta_{t+1}^i = \beta_t^i = \beta^i$$

Budget and Subsistence Consumption Constraints

$$w_t h_t^i n_t^i (\tau + e_{t+1}^i) + c_t^i \leq w_t h_t^i \equiv z_t^i$$

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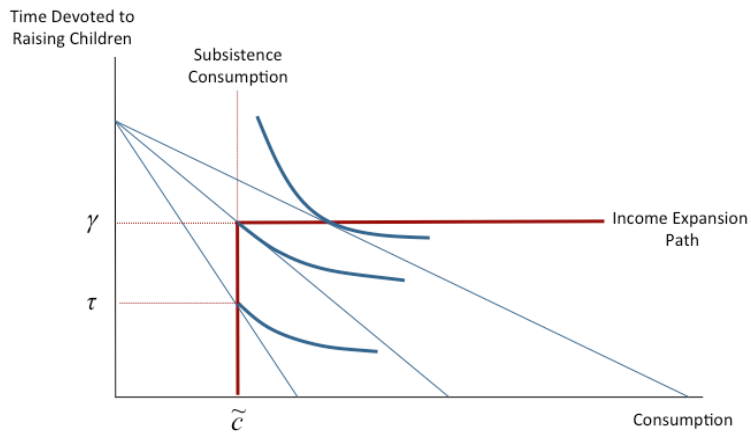
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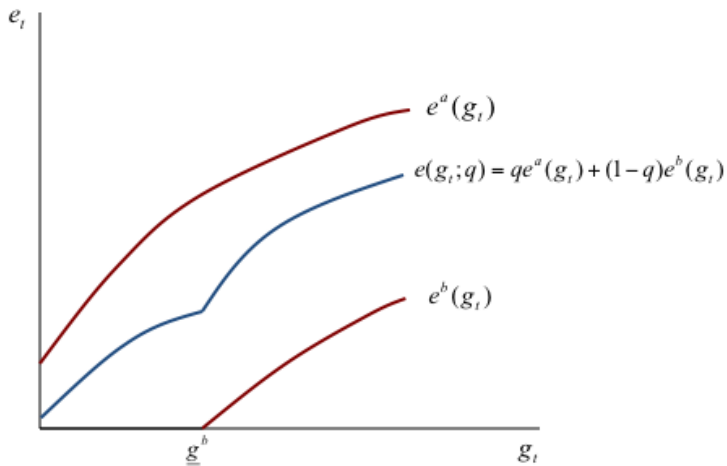
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$$c_t \geq \tilde{c}$$

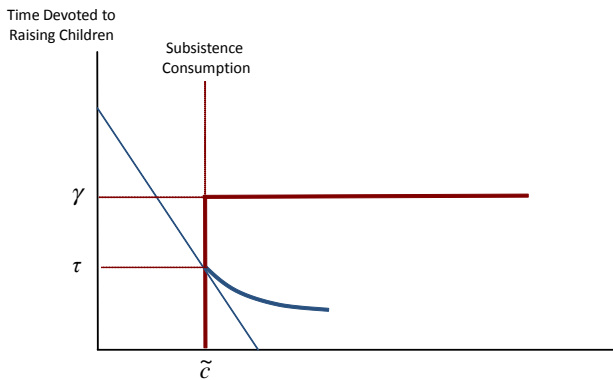
Constraint and Optimization



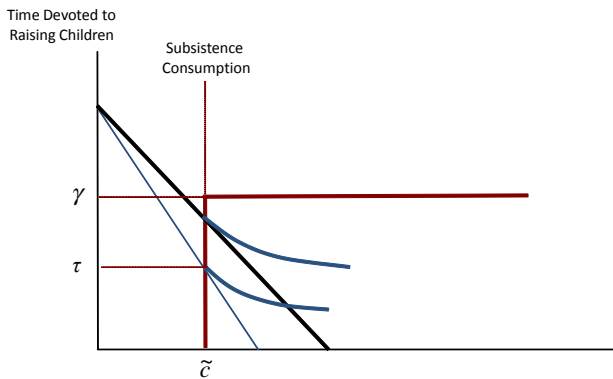
Optimal Investment in Child Quality



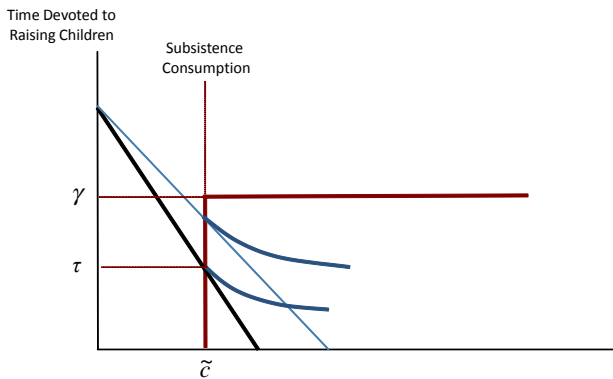
Optimization – Malthusian Epoch



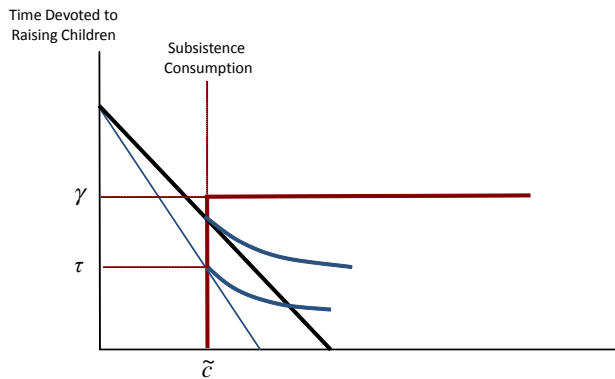
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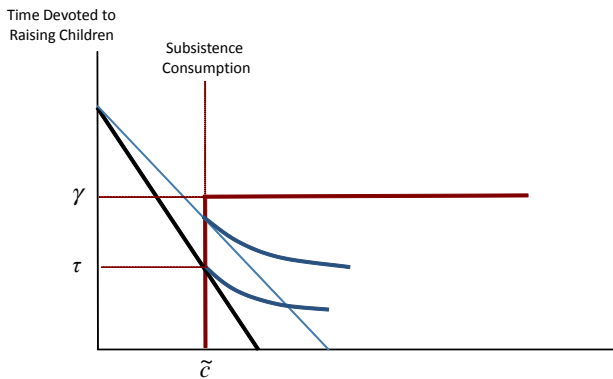
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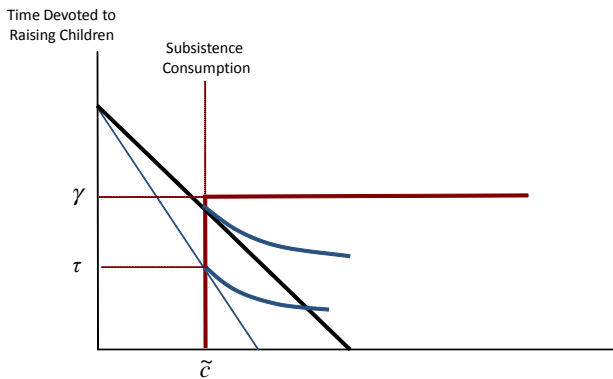
Income Expansion Path – Malthusian Epoch



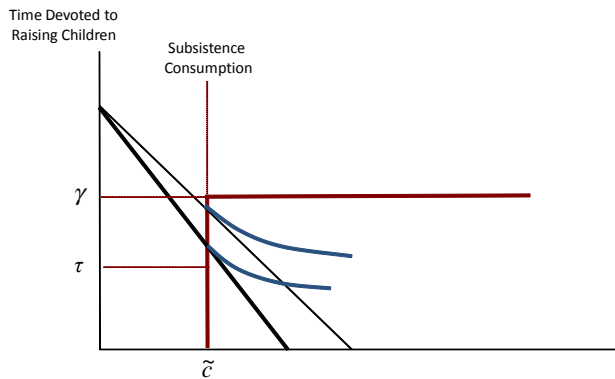
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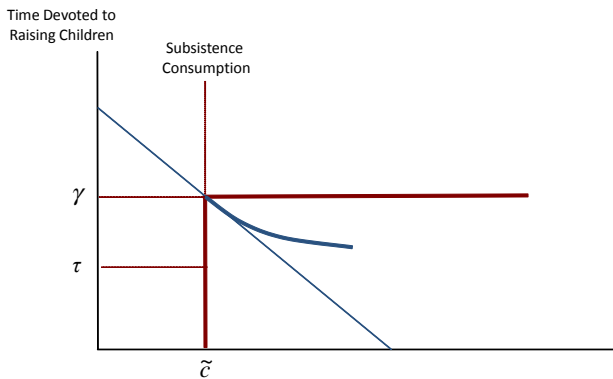
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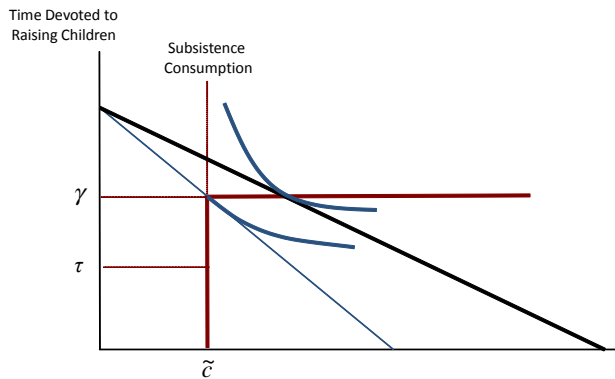
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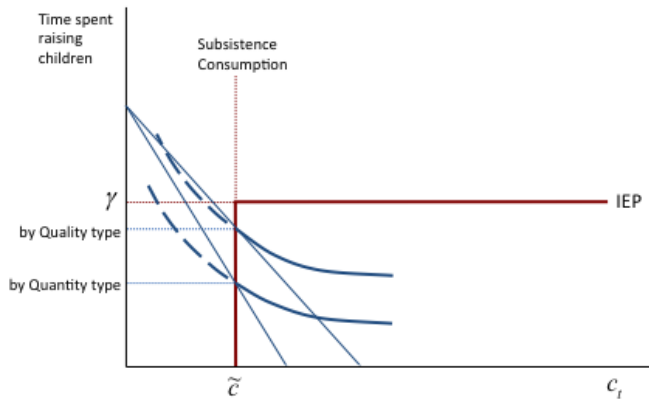
Income Expansion Path – Post-Demographic Transition



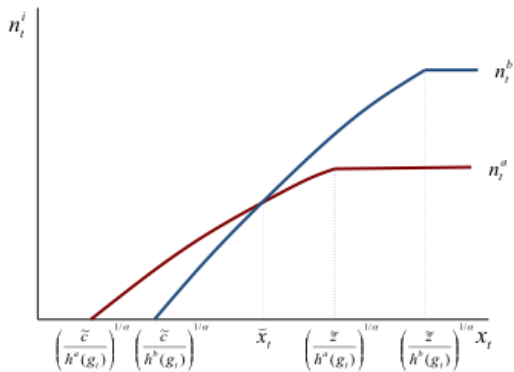
Income Expansion Path – Post-Demographic Transition



Differential Fertility Across Types



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The Dynamical System

A sequence $\{x_t, g_t, e_t, q_t\}_{t=0}^{\infty}$ such that:

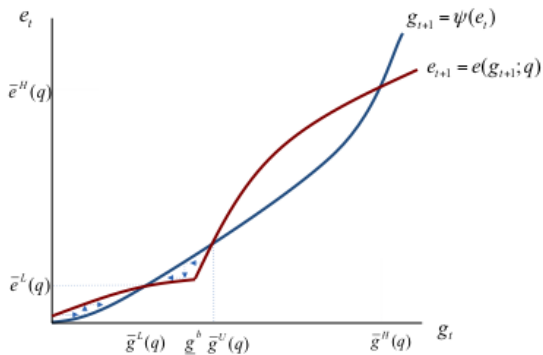
$$\begin{cases} x_{t+1} = x(g_t, x_t, q_t) \\ q_{t+1} = q(g_t, x_t, q_t) \\ g_{t+1} = \psi(e_t) \\ e_t = e(g_t, q_t) \end{cases}$$

The Conditional Evolution of Technology and Education

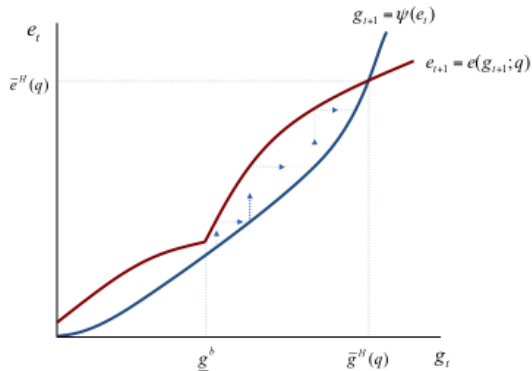
$\{g_t, e_t; q\}_{t=0}^{\infty}$ such that for all t

$$\begin{cases} e_t = e(g_t; q) \\ g_{t+1} = \psi(e_t). \end{cases}$$

The Evolution of Education and Technology: The Fraction of the Quality Type $q > 0$



The Evolution of Education and Technology: The Fraction of the Quality Type is Above the Threshold



The Evolution of the Quality Type and TFP Growth

