Human Evolution and Economic Development

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Economic Growth and Comparative Development

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  - Stimulated the take-off from an epoch of stagnation to sustained growth

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  - Long-Term Orientation (Galor-Özak, 2016; Galor-Özak-Sarid, 2016)

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  - Strong positive selection since the Neolithic transition (Mathieson et al., 2015)

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

Factor Supply

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

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- 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

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

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

$$y_t = x_t^{\alpha}$$

  - $x_t \equiv (A_t X)/H_t \equiv$ effective resources per worker

The Malthusian Structure – Effects of Technological Progress

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- 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

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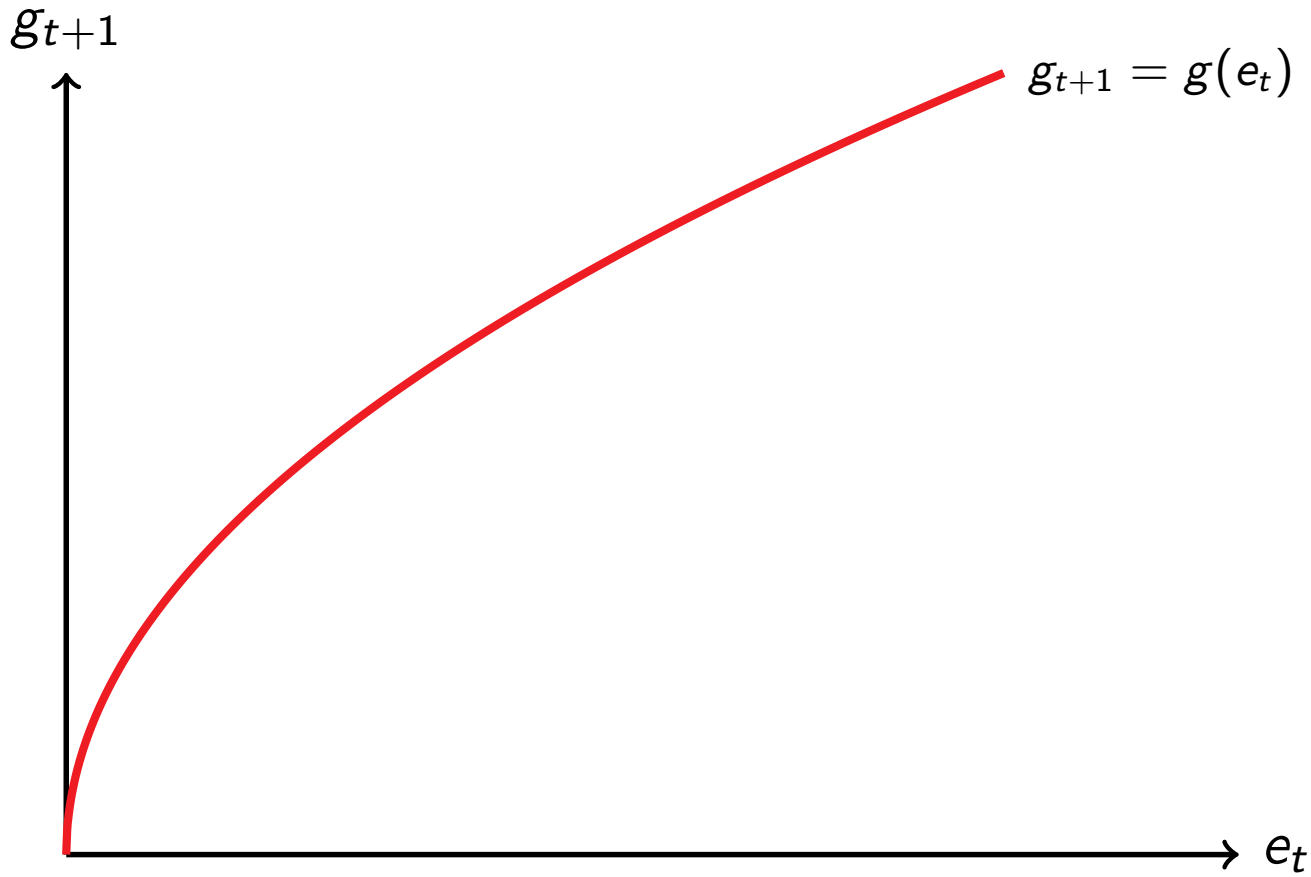
$$\psi'(e_t) > 0; \quad \psi''(e_t) < 0; \quad \psi(0) = 0$$

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

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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- $h(0, g) > 0$
  - Basic level of human capital

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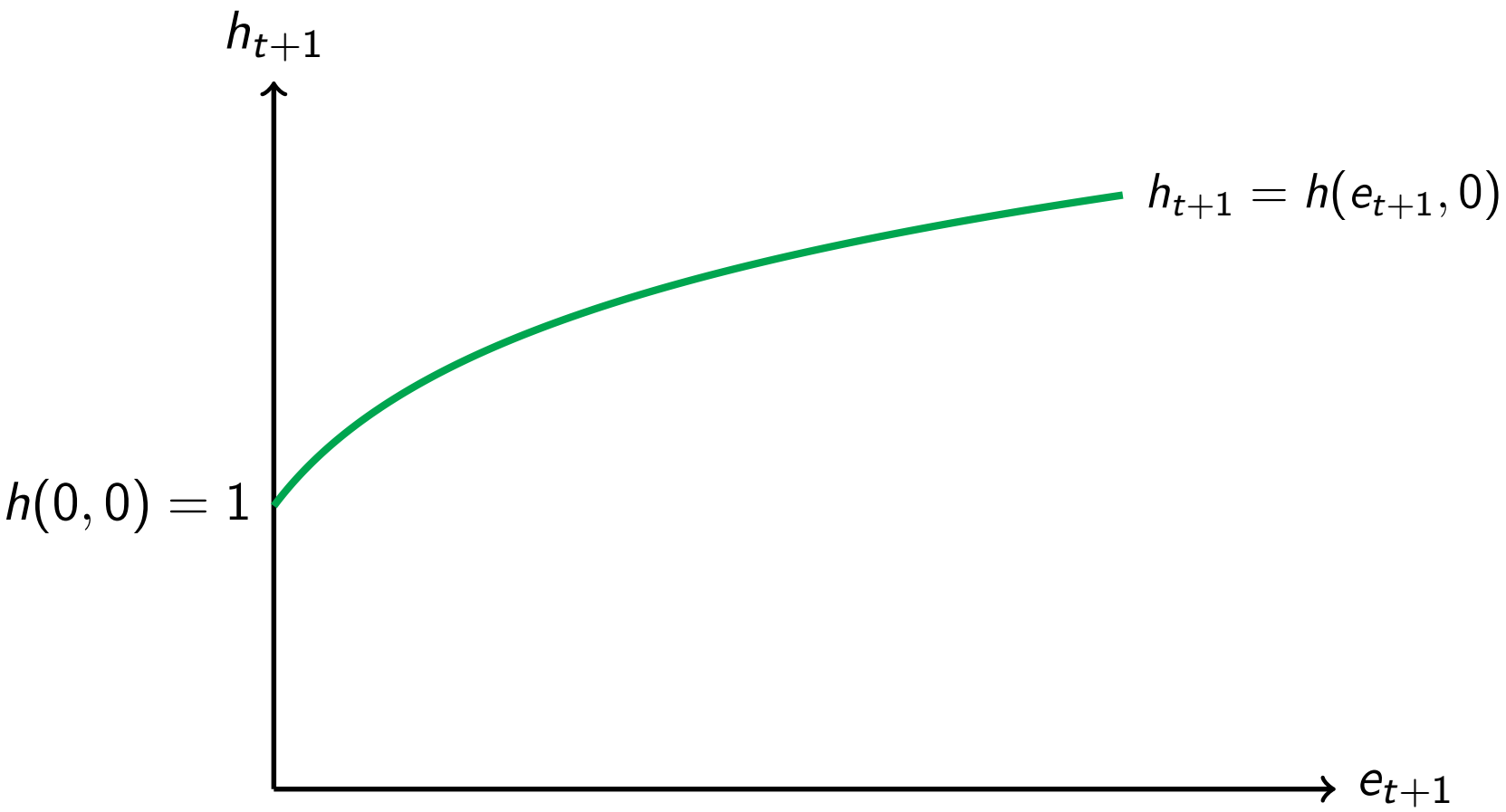

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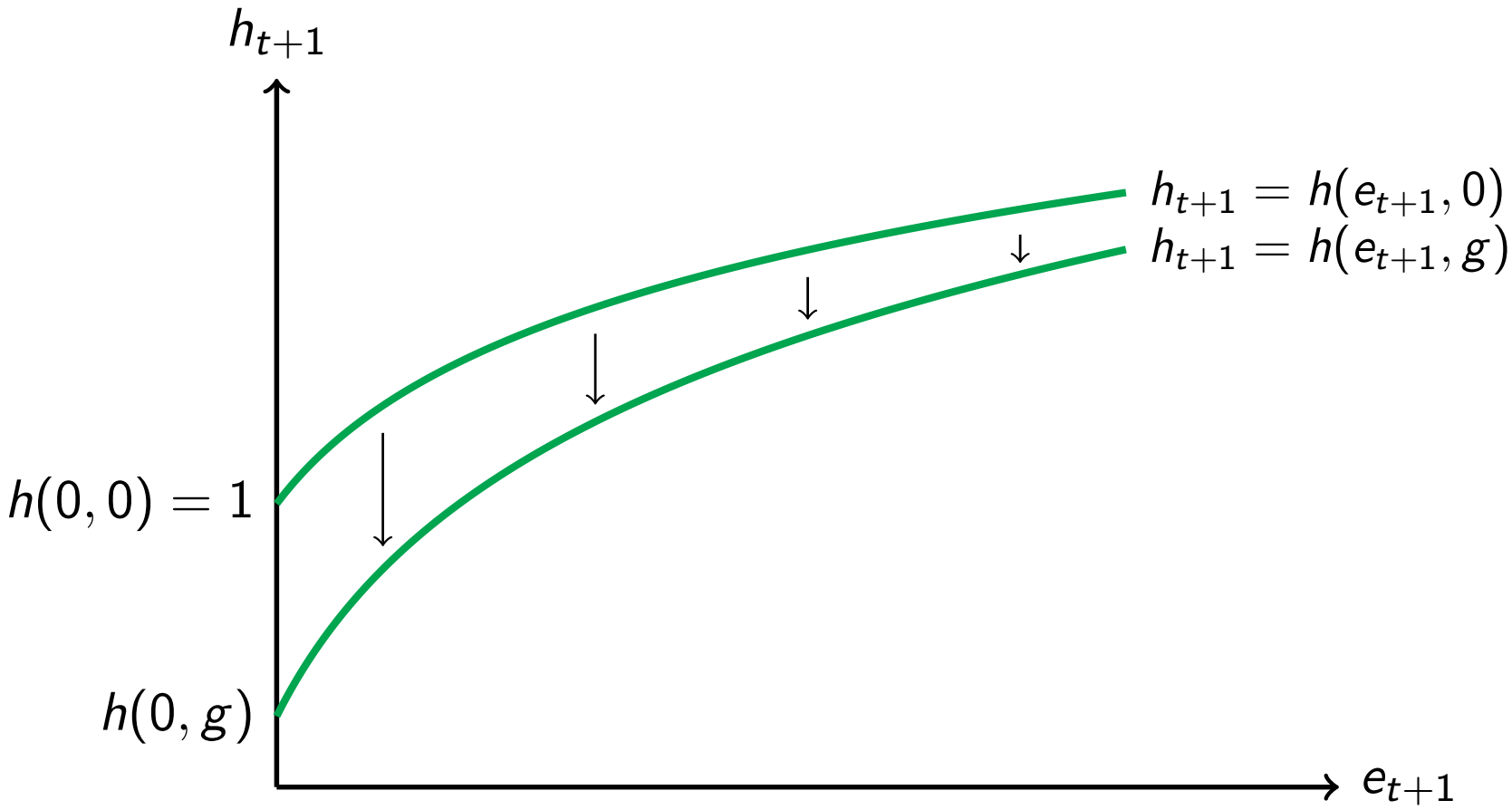

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    - Population growth declines & human capital formation increases further

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- Evolution
  - Changes in the composition of types

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- Intergenerational transmission of predisposition towards quality

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

Preferences

- Preferences reflect the implicit Darwinian survival strategy.
  - Individuals do not operate consciously so as to assure the evolutionary advantage of their type (i.e., their variant within the species)

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Budget and Subsistence Consumption Constraints

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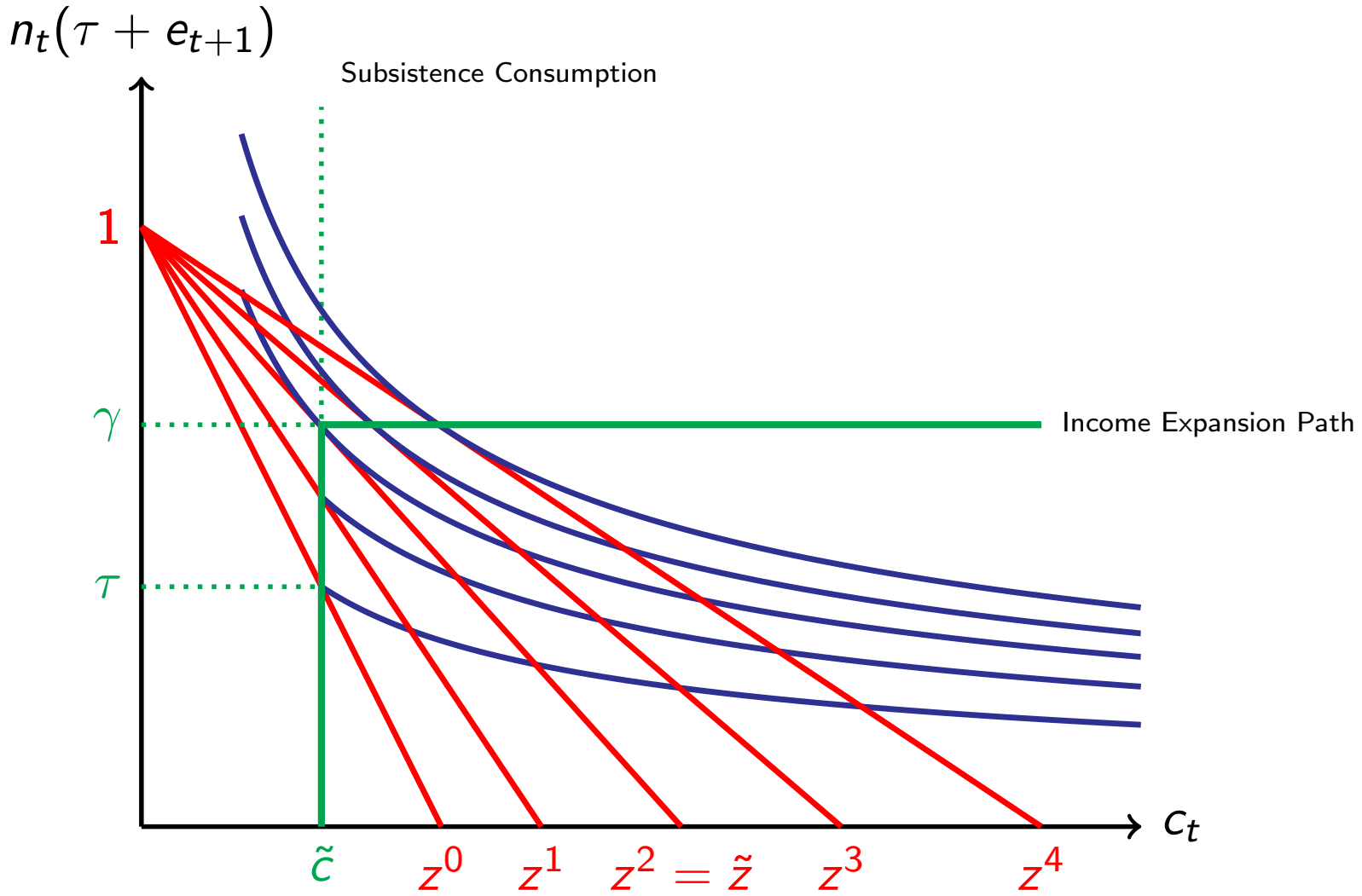
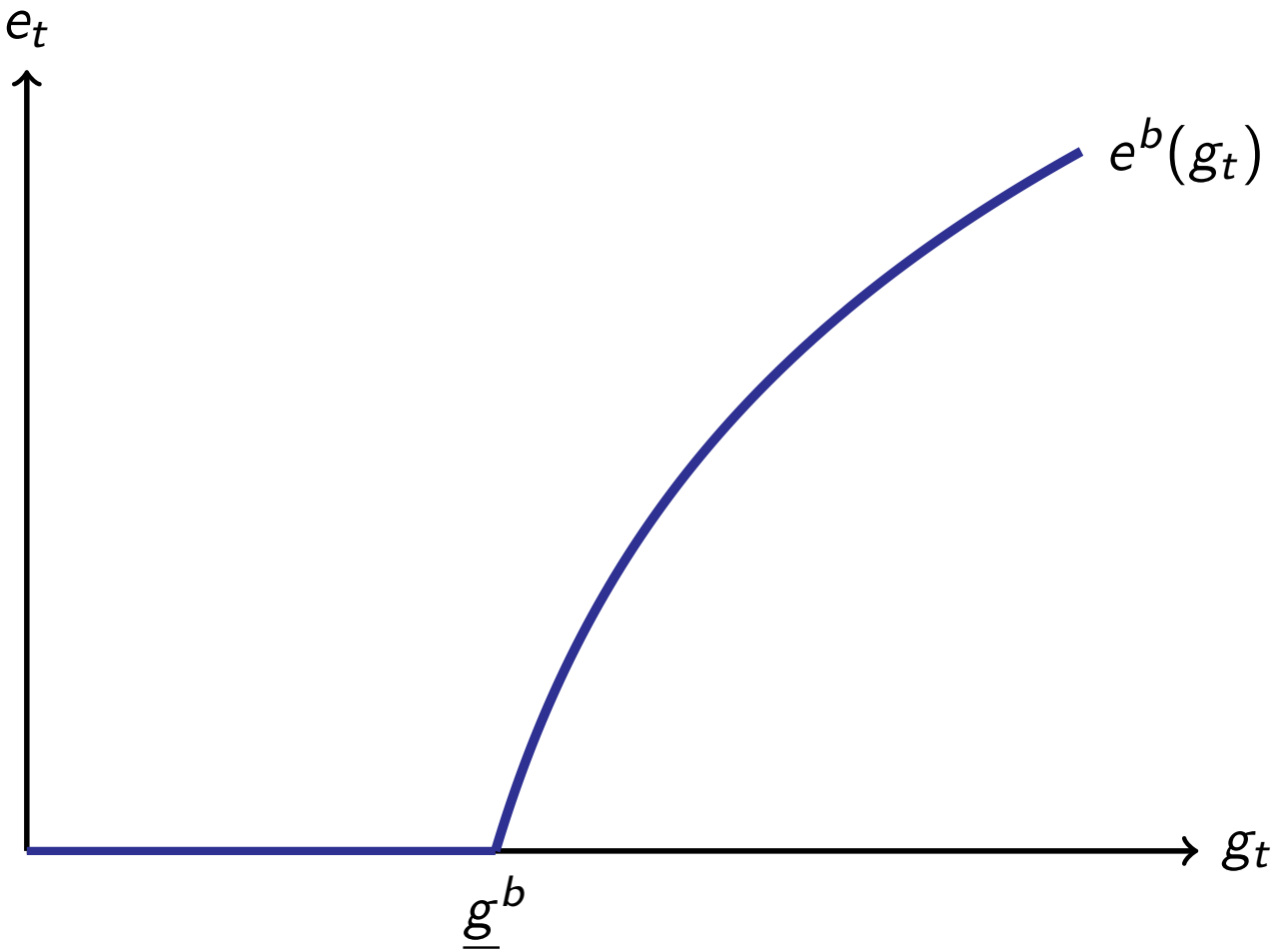
$$c_t \geq \tilde{c}$$

Constraint and Optimization



Optimal Investment in Child Quality of the Quantity type



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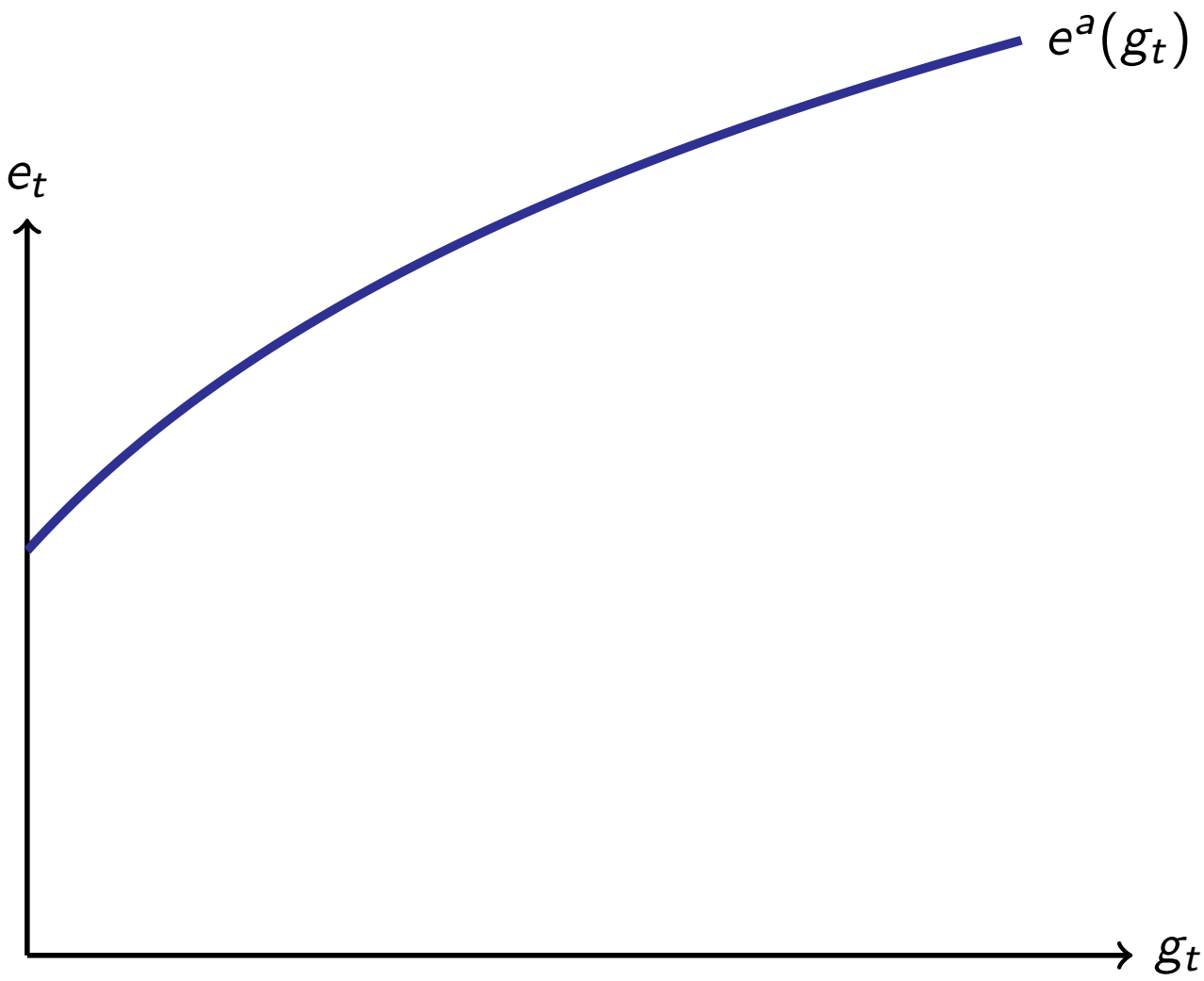
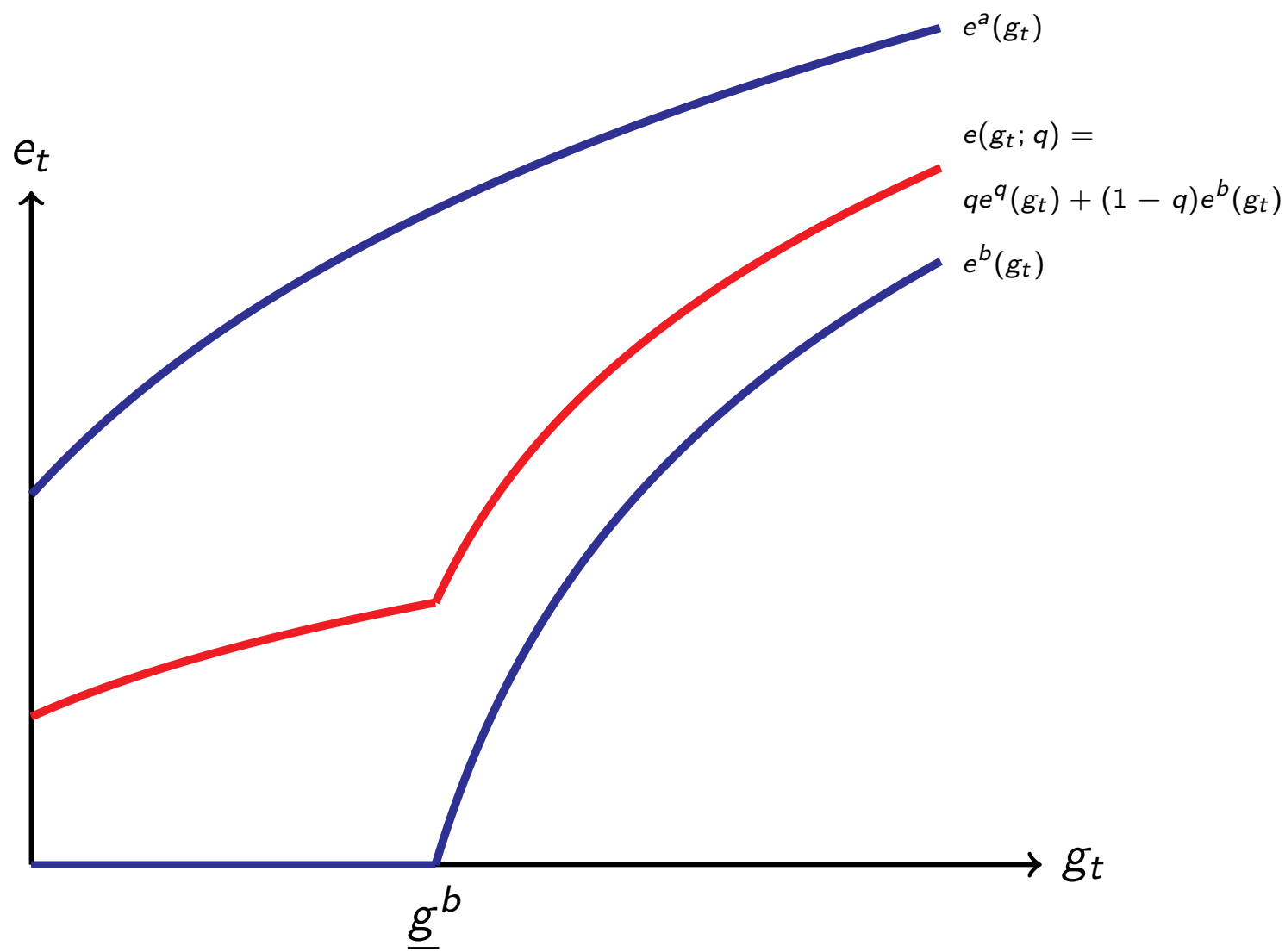
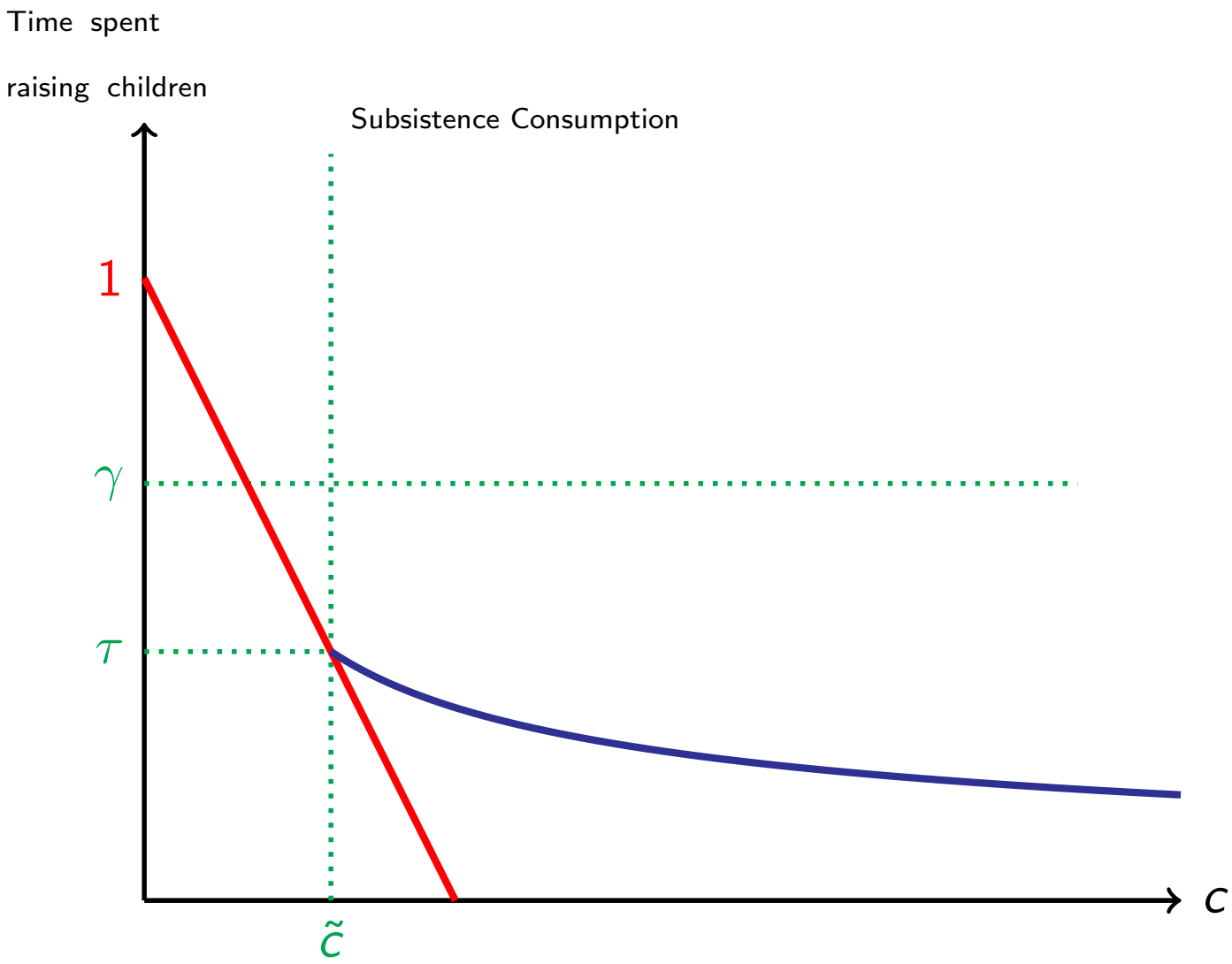


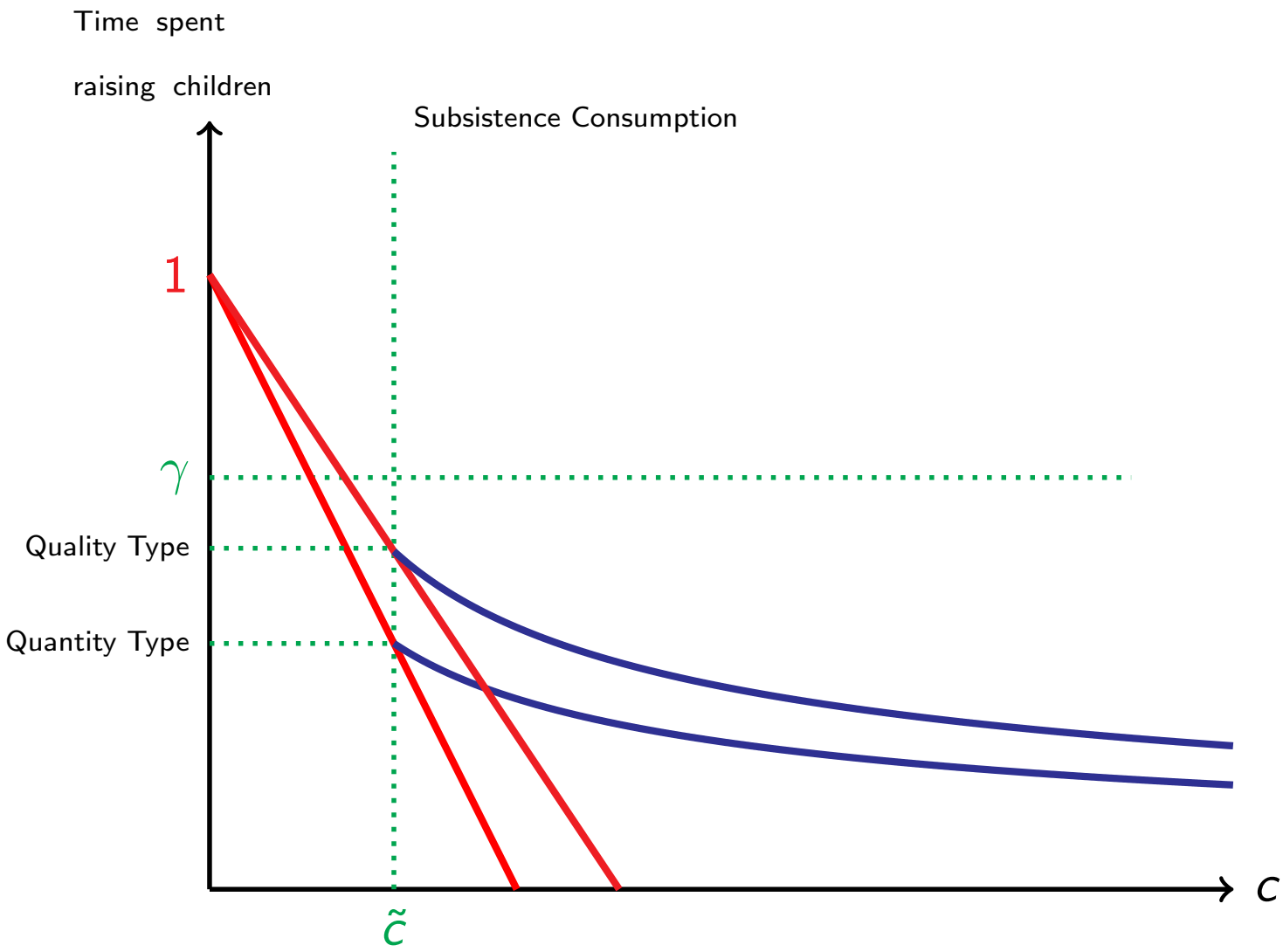
Optimal Investment in Child Quality - Quality type - and Quantity type



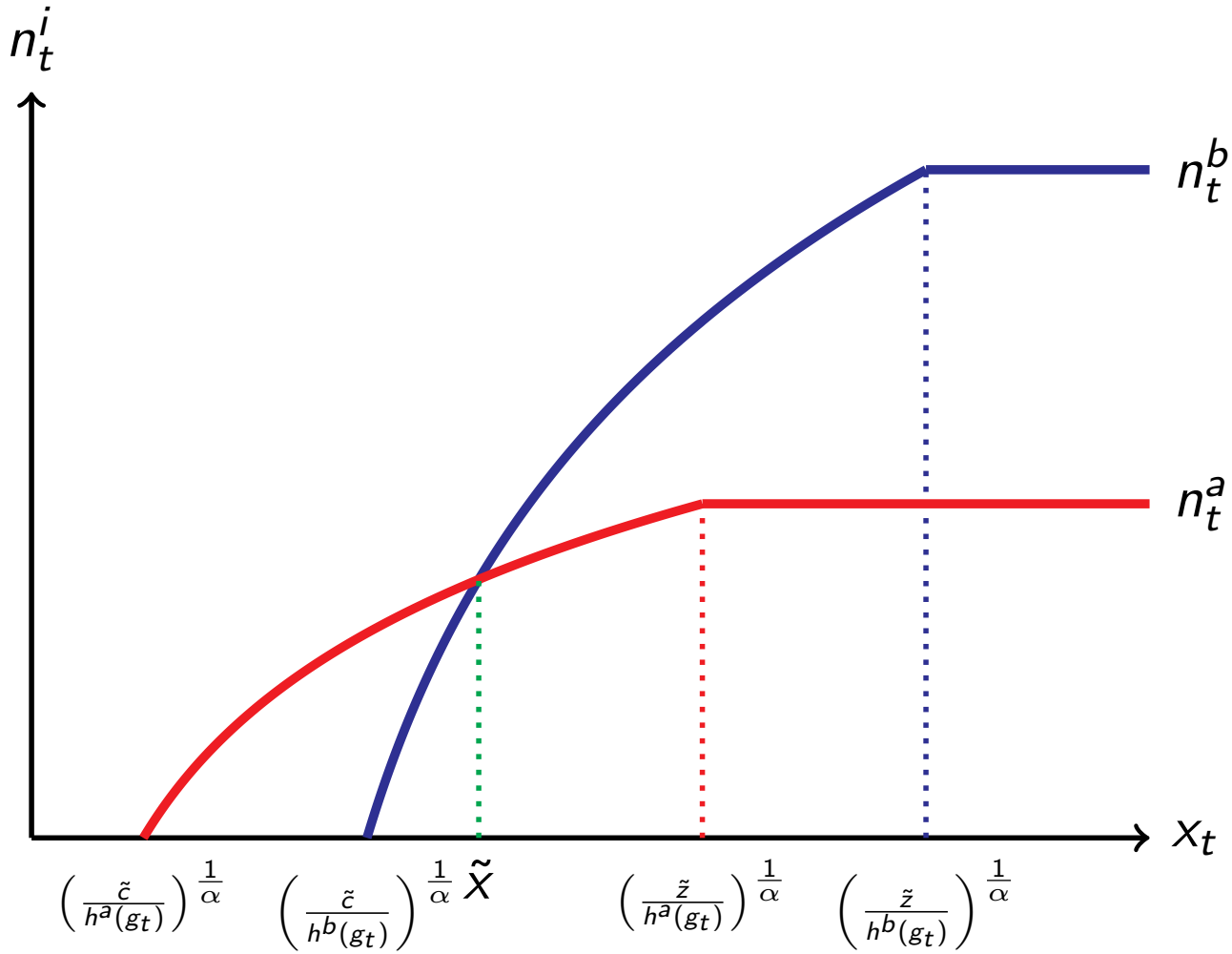
Optimization – Malthusian Epoch



Evolutionary Advantage of the Quality Type



Differential Fertility Across Types



The Dynamical System

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

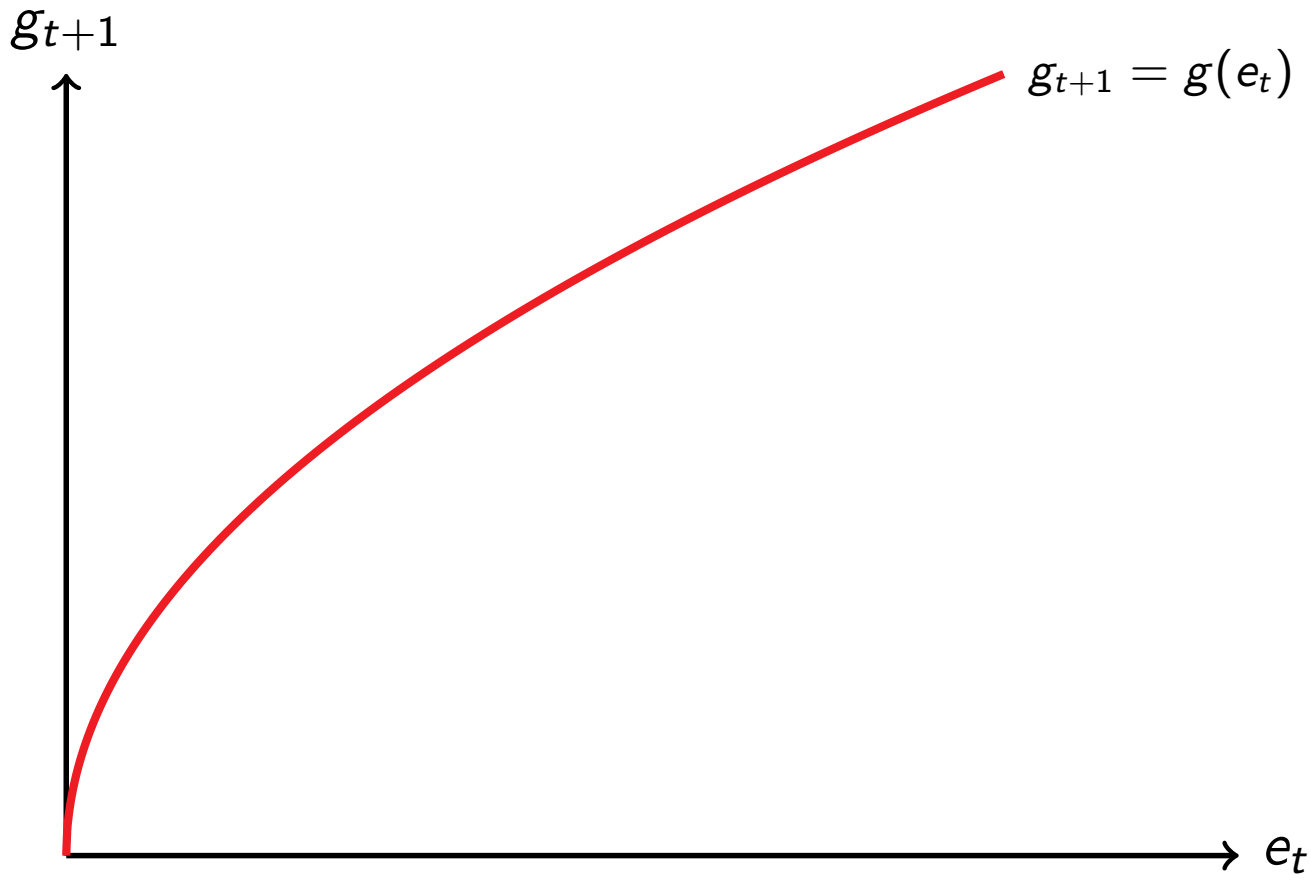
$$\begin{cases} x_{t+1} = x(g_t, x_t, q_t) \\ q_{t+1} = q(g_t, x_t, q_t) \\ g_{t+1} = \psi(e_t) \\ e_t = e(g_t, q_t) \end{cases}$$

The Conditional Evolution of Technology and Education

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

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

Technological Progress



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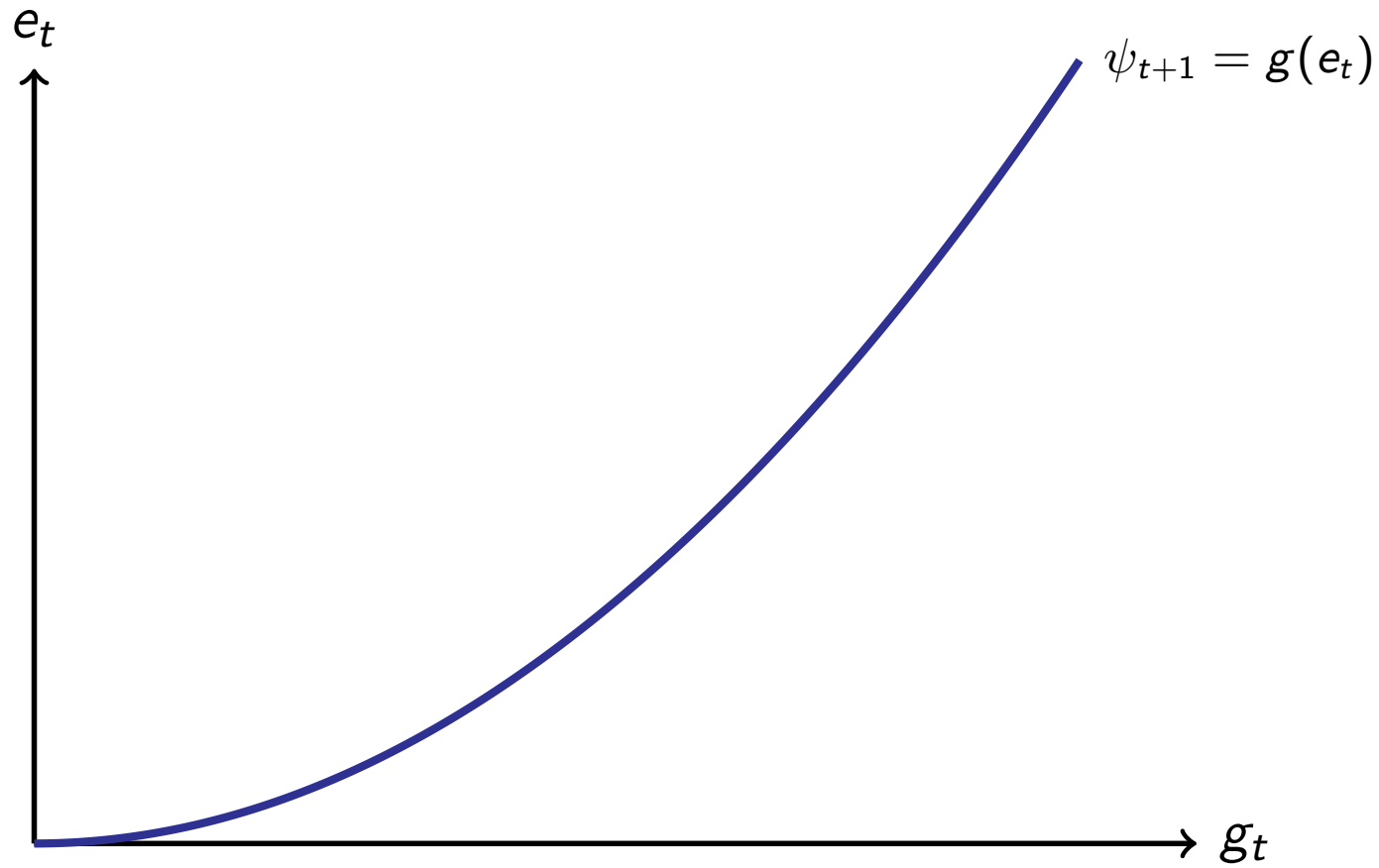
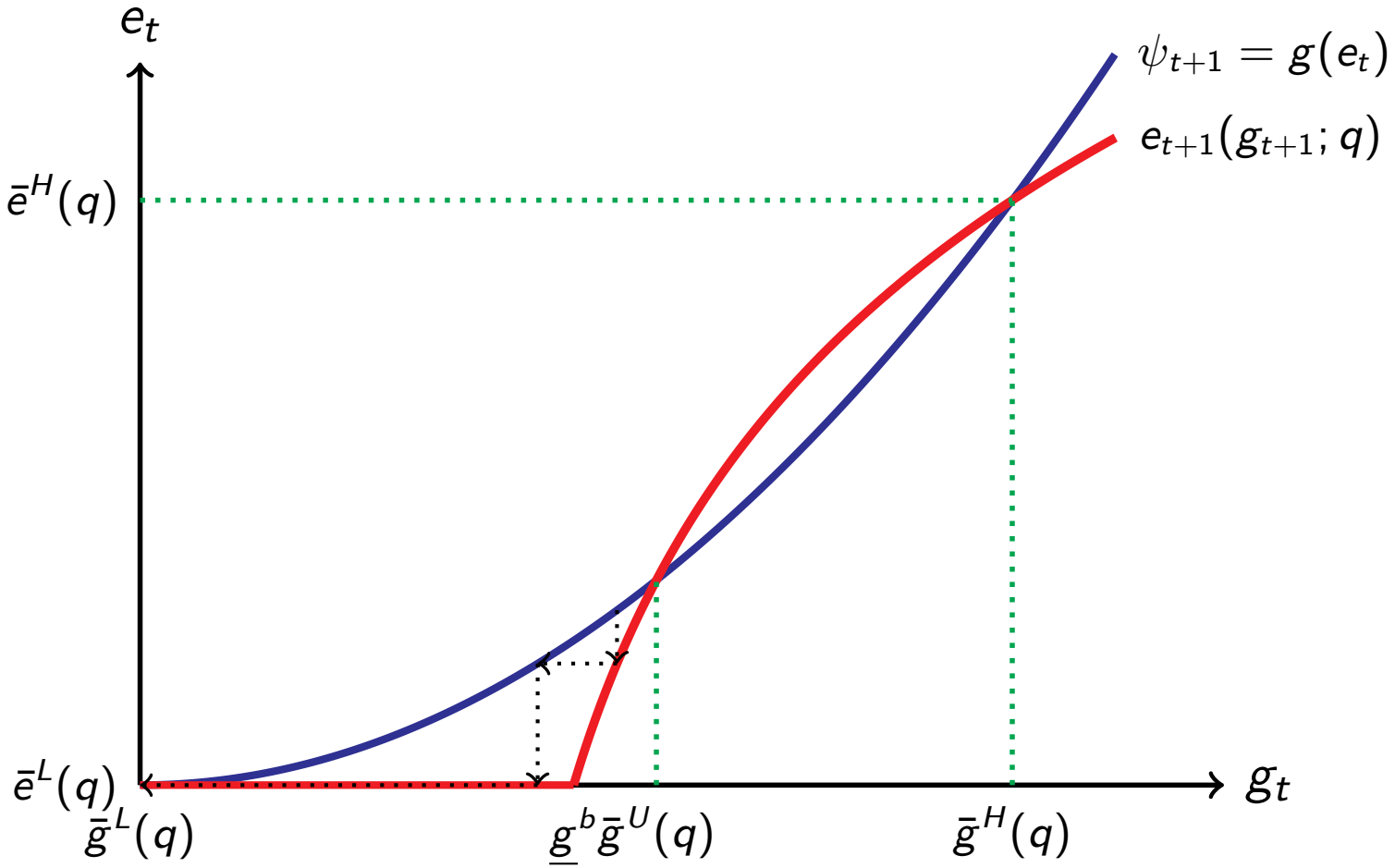
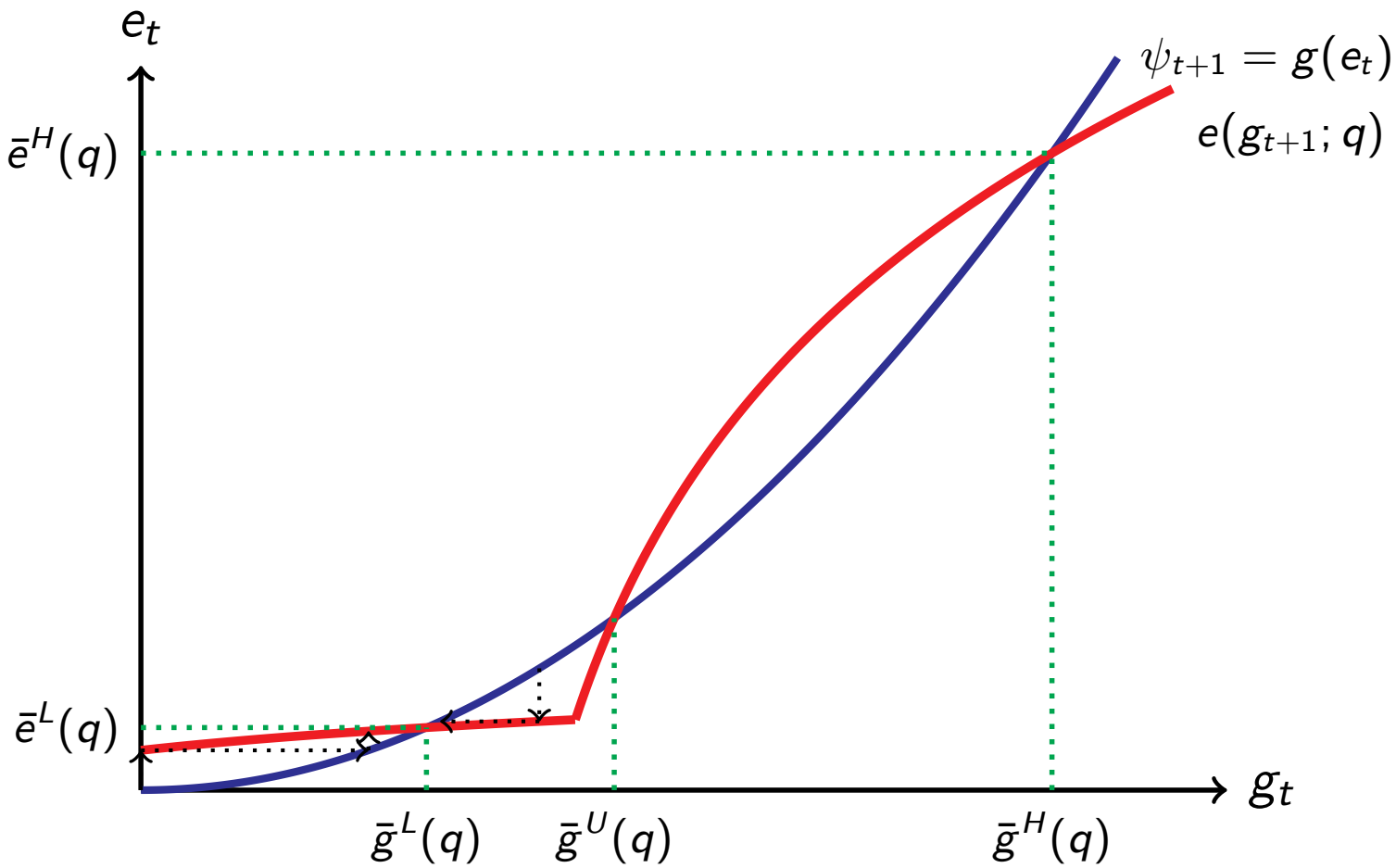


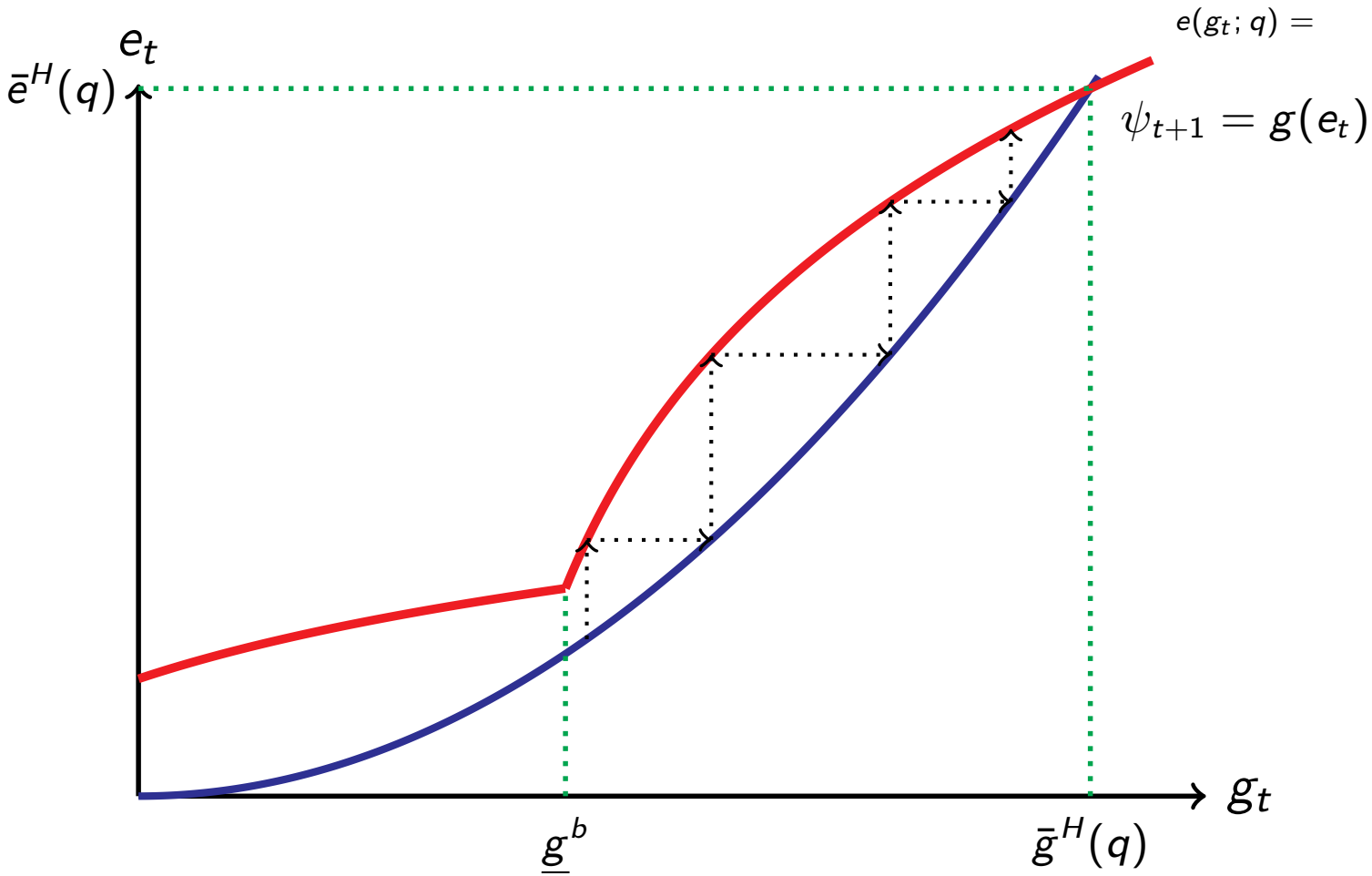
The Evolution of Education and Technology: The Fraction of the Quality Type $q = 0$



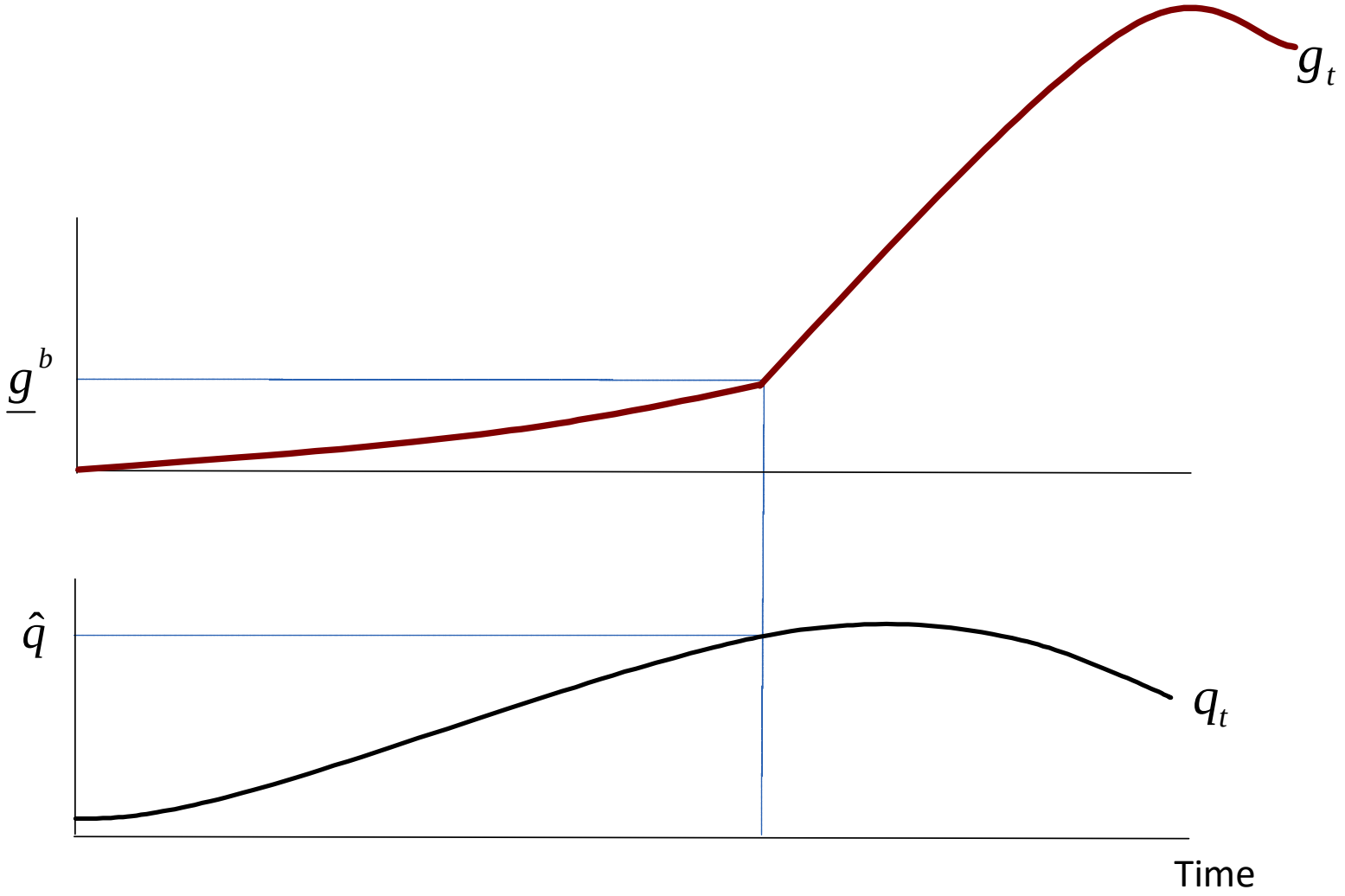
The Evolution of Education and Technology: The Fraction of the Quality Type $q > 0$



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



Conclusions

Evolutionary Growth Theory

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    e.g. genes, culture, human capital, technology
- Allows the analysis of the effect of socio-economic and geographical environment on the development process
- Origins and persistent effect of culture, language and other intergenerationally transmitted traits