Economics of Human Capital

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Economics of Human Capital

Introduction

Philipp Eisenhauer

Human capital is defined as:

> *The knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being.*
>
> - OECD (2001)

Tasks

- definition and measurement of human capital
- determining the effect of human capital on a variety of personal, social and economic outcomes
- understanding the formation of human capital

Tasks

- identifying the driving forces behind the observed heterogeneity across and within countries
- search for effective policies to ameliorate disparities
- . . .

Facts

Figure: Years of schooling

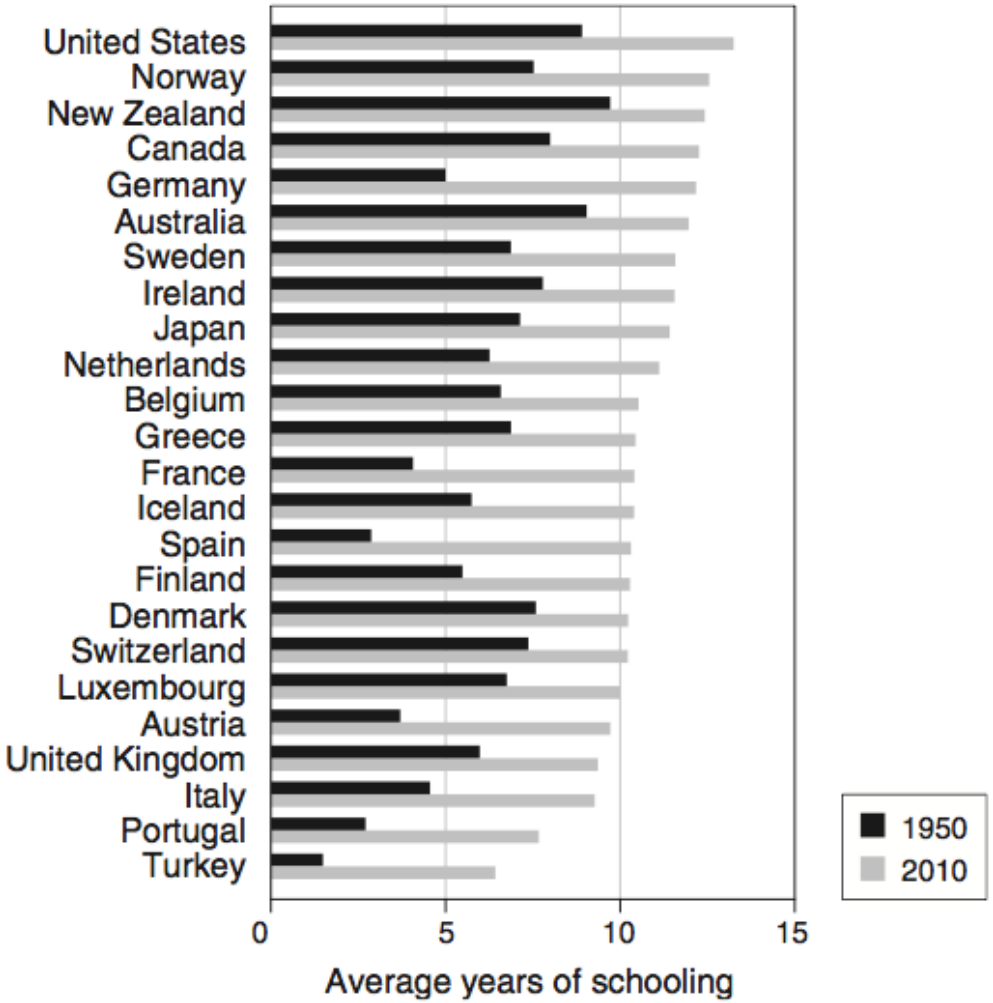


FIGURE 4.4

Years of schooling of the total population aged 25 and older.

Source: Barro and Lee (2010, education data set, available at www.barrolee.com/data).

Figure: Unemployment rates

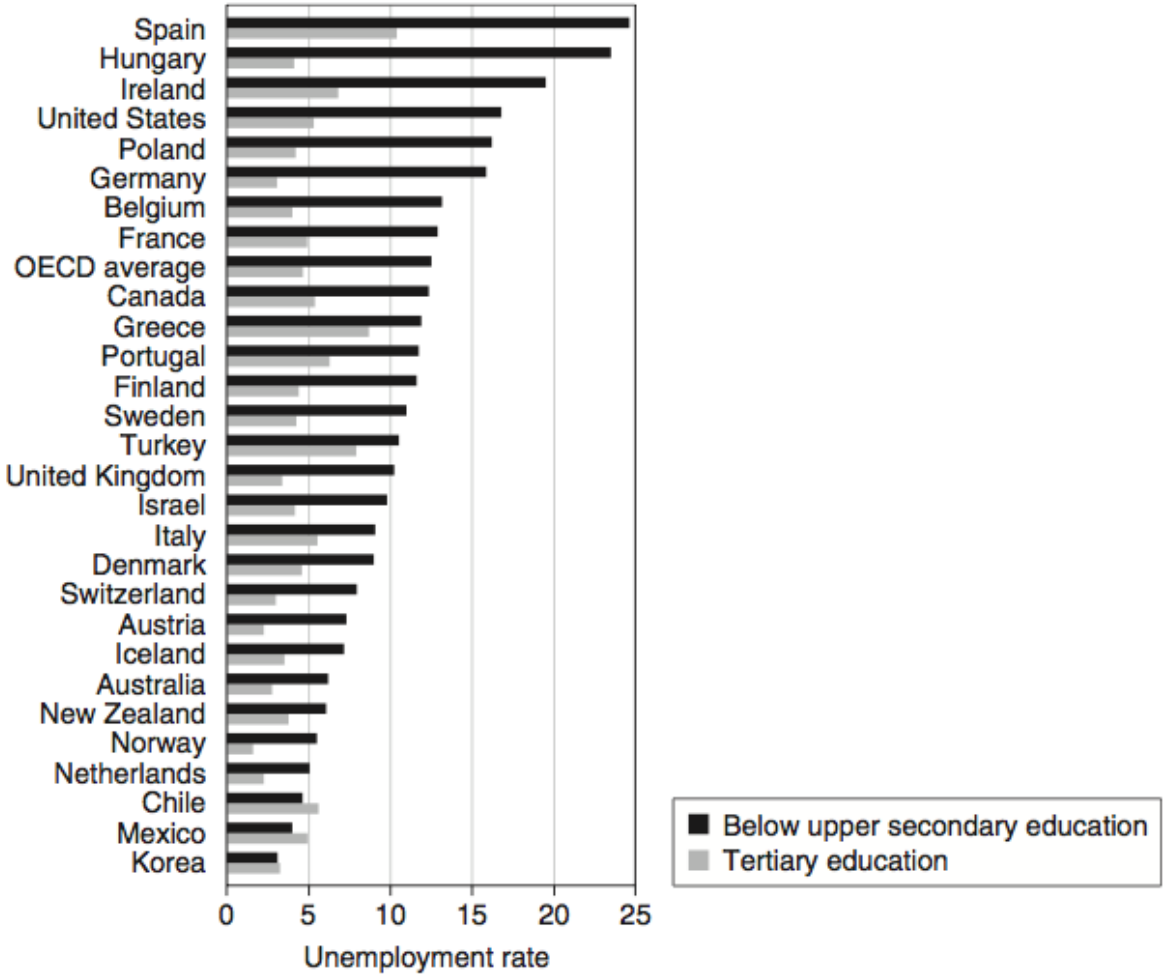


FIGURE 4.6

Unemployment rates by level of educational attainment for 25- to 64-year-olds, 2010. The OECD average is the nonweighted average of the 34 OECD countries, including those not represented on this figure. Data missing for non-OECD countries.

Source: OECD (2012, table A7.4a, p. 133).

Figure: Tertiary education

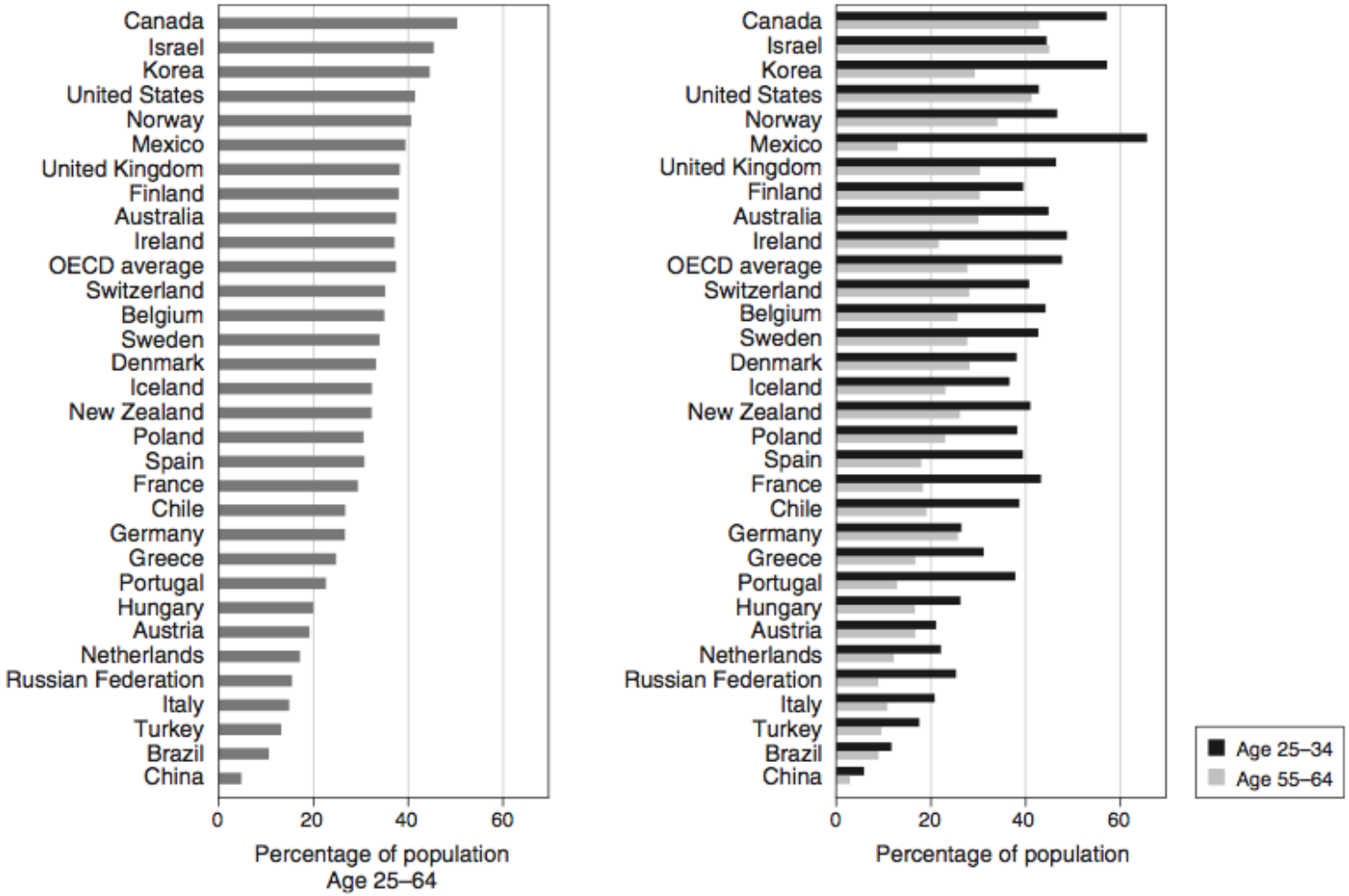


FIGURE 4.3

Percentage of the population that has attained at least tertiary education or advanced research programs, by age group, 2010. The OECD average is the nonweighted average of the 34 OECD countries, including those not represented in this figure. Brazil, China, and the Russian Federation are not part of the OECD.

Source: OECD (2012, table A1.3a, p. 36).

Figure: Secondary education

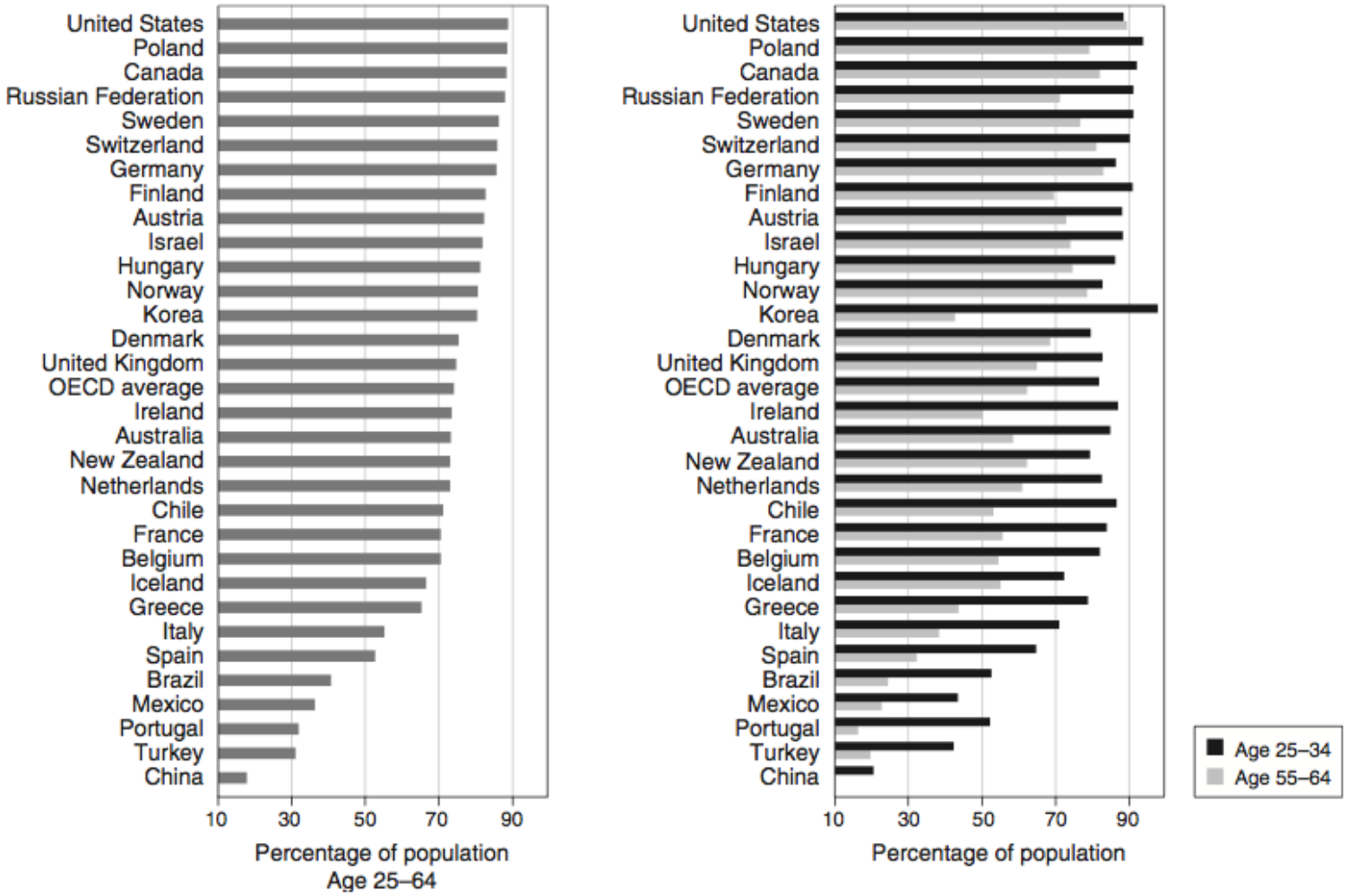


FIGURE 4.2

Percentage of the population that has attained at least upper secondary education, by age group, 2010. The OECD average is the nonweighted average of the 34 OECD countries, including those not represented in this figure. Brazil, China, and the Russian Federation are not part of the OECD.

Source: OECD (2012, table A1.2a, p. 35).

Figure: Expenditures

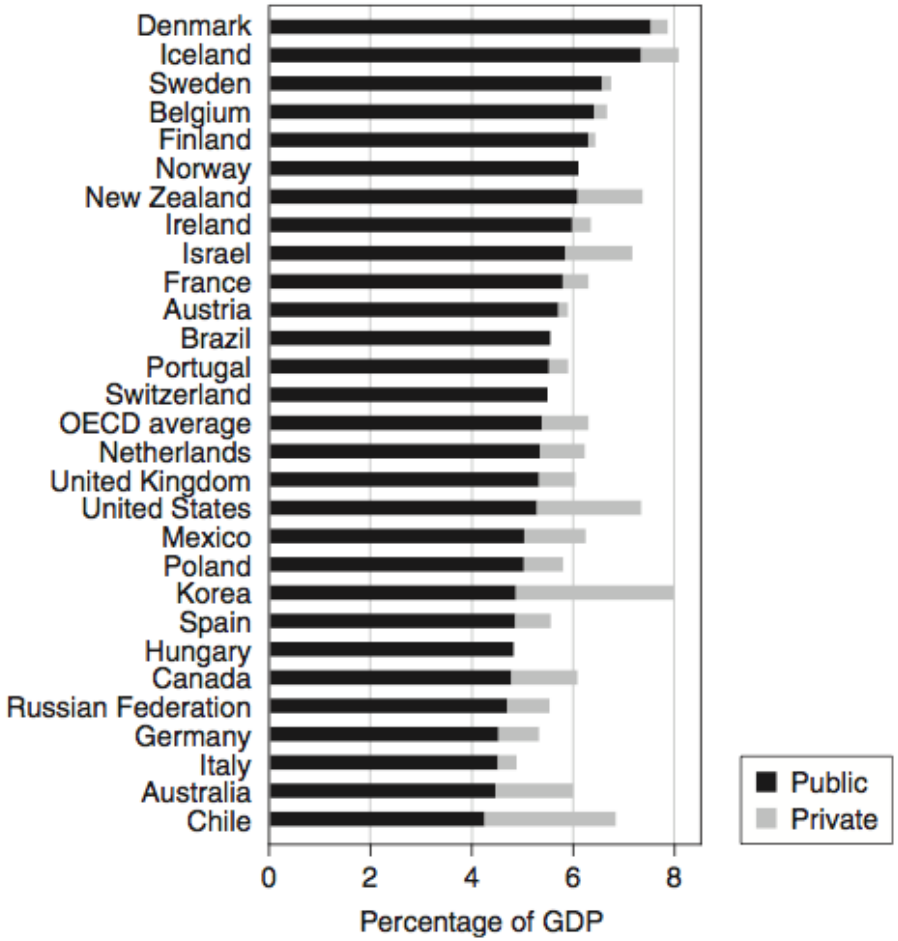


FIGURE 4.1

Expenditure on educational institutions as a percentage of GDP, 2009. The OECD average is the nonweighted average of the 34 OECD countries, including those not represented in this figure. Brazil and the Russian Federation are not part of the OECD. Private expenditure is missing for Brazil, Hungary, Norway, and Switzerland. Data are missing for China, Greece and Turkey.

Source: OECD (2012, table B2.3, p. 246).

Figure: Relative earnings

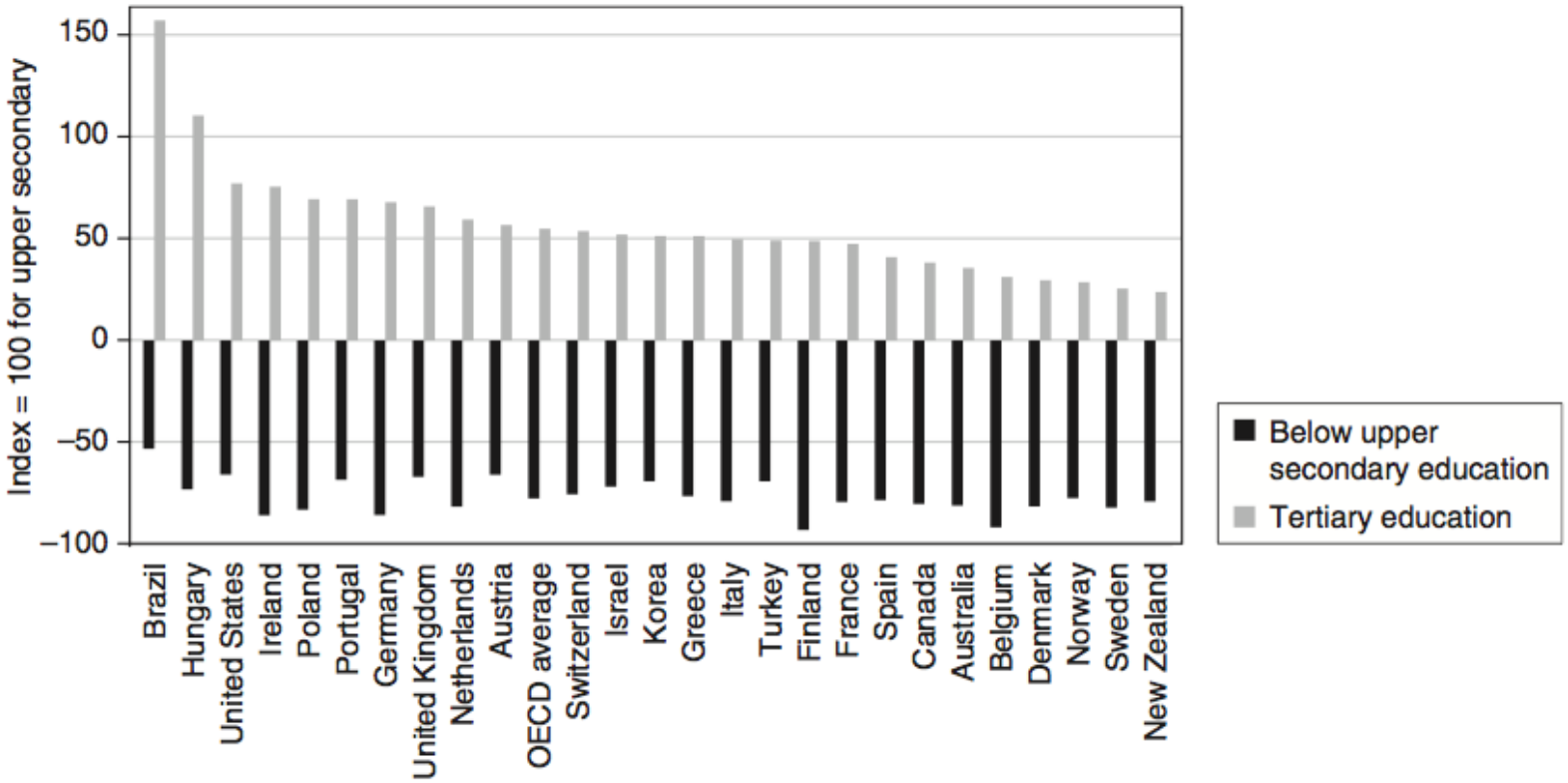


FIGURE 4.5

Relative earnings from employment among 25- to 64-year-olds, by level of educational attainment (2010 or latest available year). Upper secondary and post-secondary nontertiary education = 100. The OECD average is the nonweighted average of the 34 OECD countries, including those not represented in this figure. Brazil is not part of the OECD. Data missing for Chile, China, Iceland, Mexico, and the Russian Federation.

Source: OECD (2012, chart A8.1, p. 140).

Figure: Unemployment rates

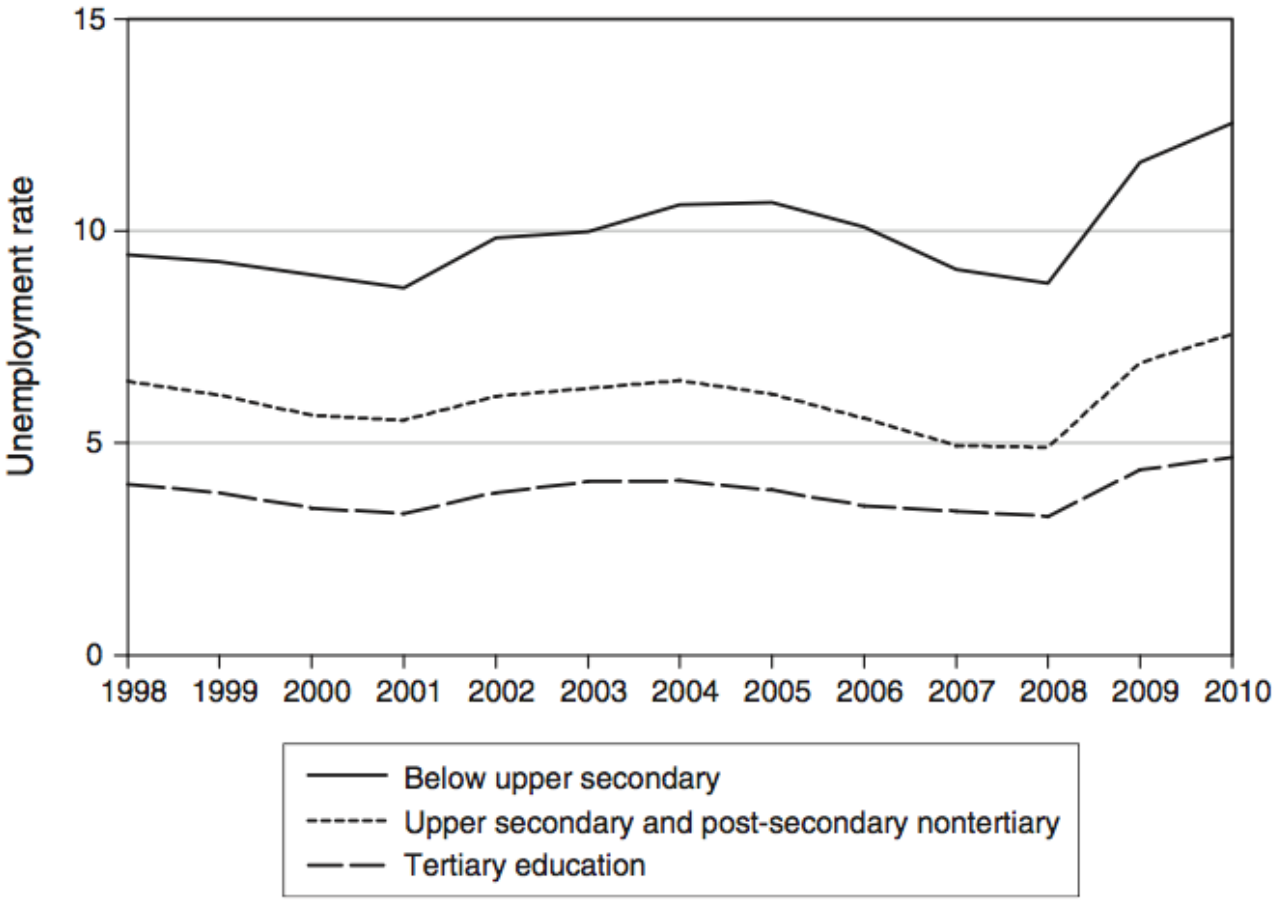


FIGURE 4.7

Unemployment rates by level of educational attainment for 25- to 64-year-olds, 2010. The OECD average is the nonweighted average of the 34 OECD countries.

Source: OECD (2012, table A7.4a, p. 133).

Life-cycle of earnings

Stylized Facts

- Life-cycle earnings are increasing at early ages and decline towards the end.
- Wages tend to increase over the life-cycle with a weak tendency to decline at the end of working life.
- Hours of work increase at early ages and decline in old age, with the peak occurring earlier than in the wage profiles.

See Weiss (1986) for comprehensive modeling framework that allows to interpret all these facts.

Figure: Wage gains

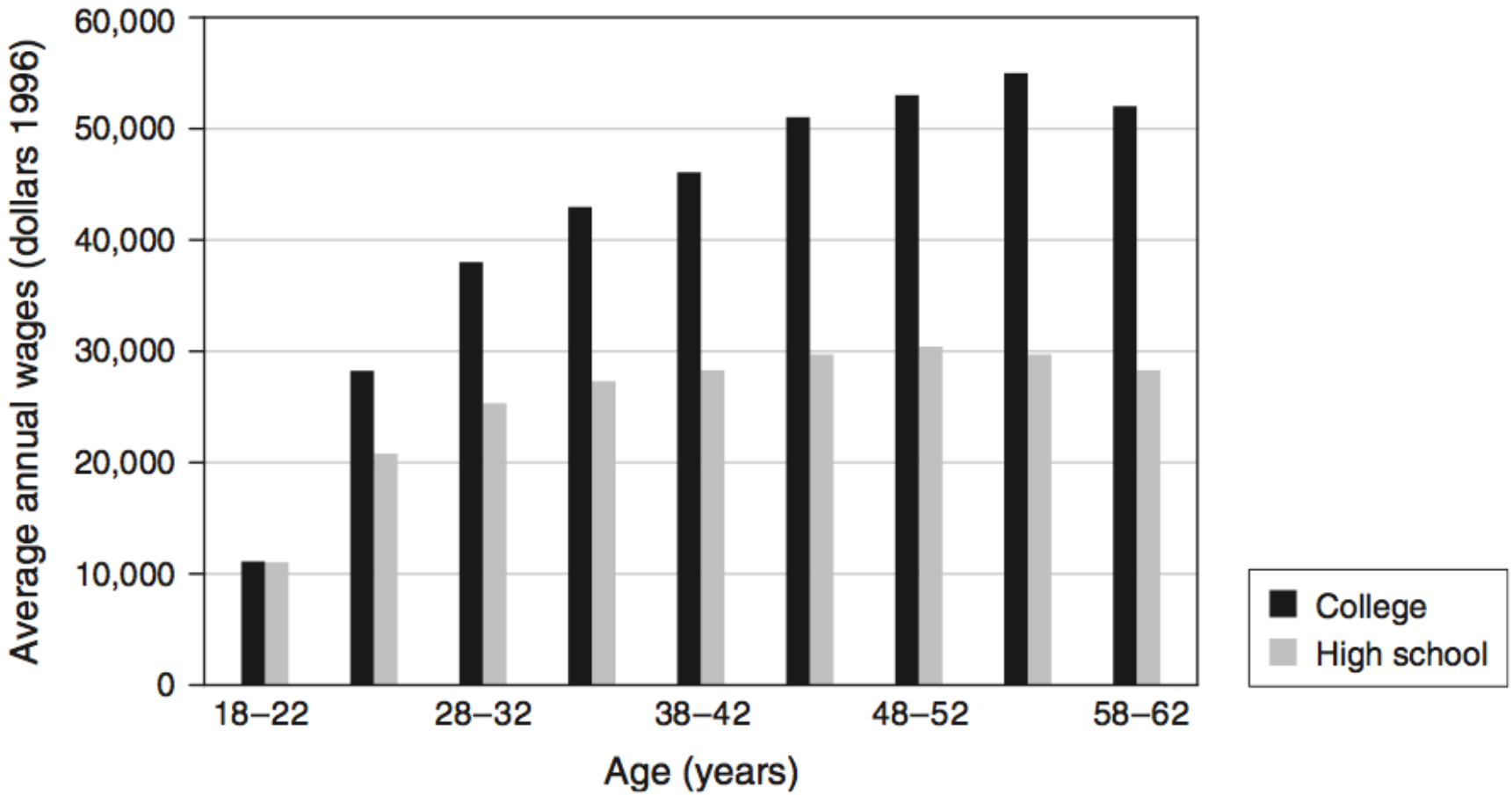


FIGURE 4.8

Average wage gains for college and high school graduates in the United States in 1996.

Source: Ashenfelter and Rouse (1999).

We study a version of the seminal Ben-Porath Model (Ben-Porath, 1967) that relates human capital accumulation to life-cycle earnings.

Why do economists use mathematical models? (slides)

This material is best studied using the following resource.

- Cahuc, P., & Zylberberg, A. (2004). *Labor economics* (1st ed.). Cambridge, MA: MIT Press.

Basic Notation

$s(t)$	fraction devoted to training
$h(t)$	stock of human capital
$w(t)$	wage
δ	depreciation of knowledge

The individual's objective is to maximize the discounted sum of wages over their life-cycle.

$$\Omega = \int_0^T w(t)\, e^{-rt} dt$$

Their economic environment is characterized by the production functions for wages and human capital.

$$w(t) = A[1 - s(t)]h(t)$$

$$\dot{h} = \theta g(s(t), h(t)) - \delta h(t) \qquad g' > 0, g'' < 0$$

Notable Features

- Individuals cannot work and learn at the same time.
- There is no individual heterogeneity.
- There is no direct cost of education but there are the opportunity cost of lost wages.
- *. . .*

Model Specification

We study the implementation in Cahuc and Zylberberg (2004).

$$g(h(t), s(t) = (h(t)s(t))^{0.71}$$

$$A = 0.75 \qquad \delta = 0.06 \qquad r = 0.05$$

$$h_0 = 5 \qquad T = 60 \qquad \theta = 0.5$$

Figure: Contour plot of human capital production function

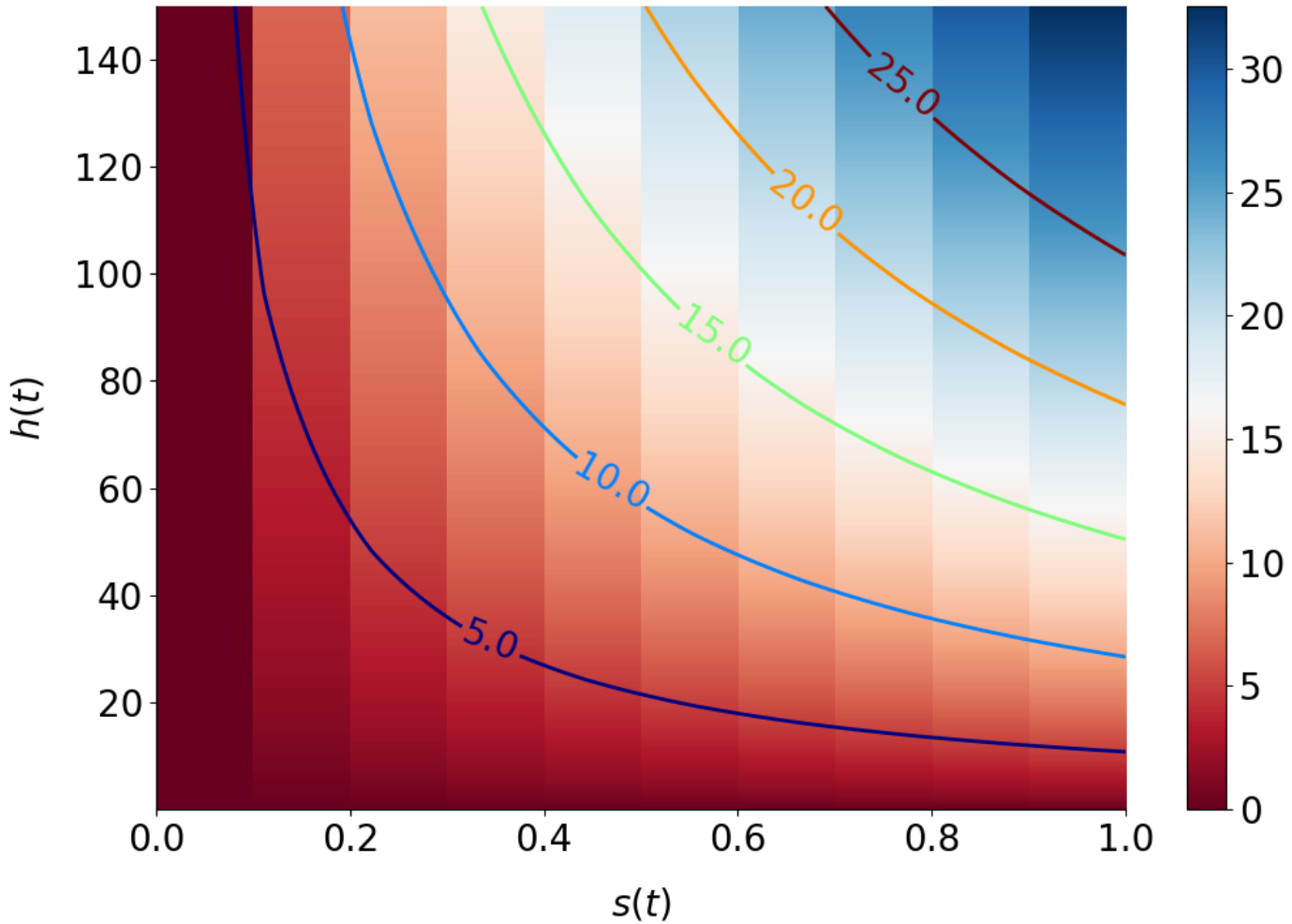


Figure: Surface plot of human capital production function

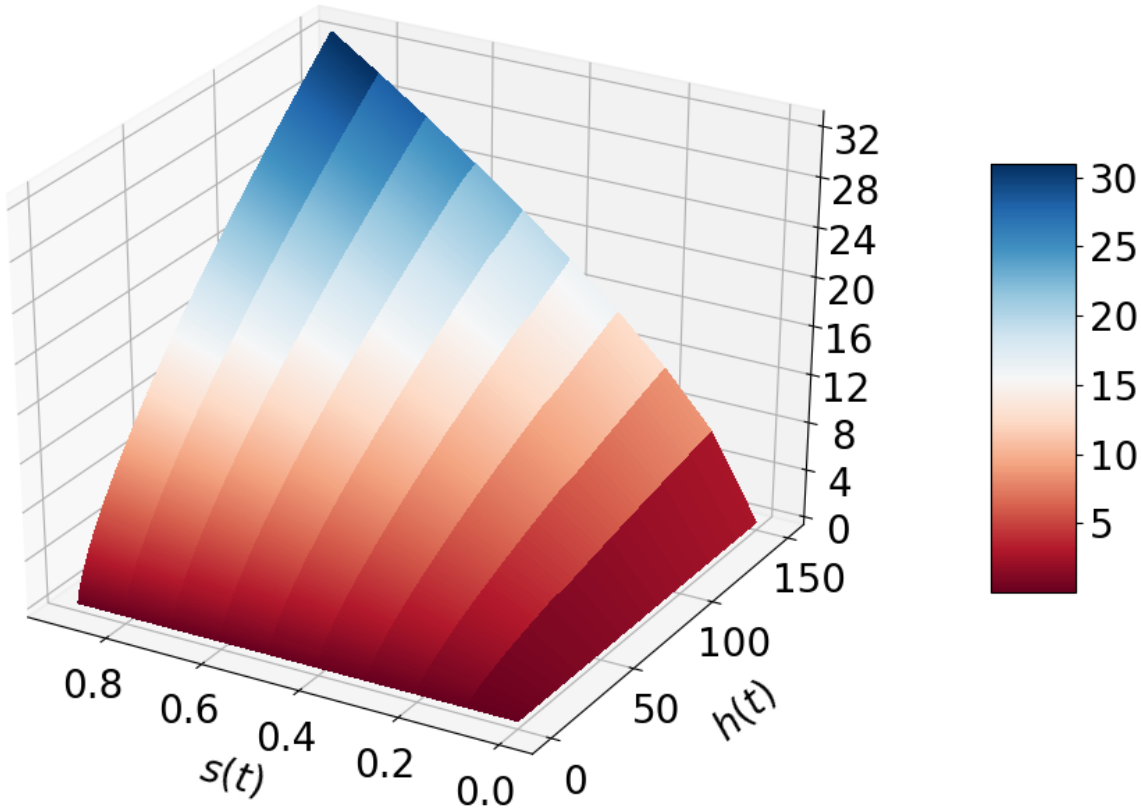


Figure: Wage production

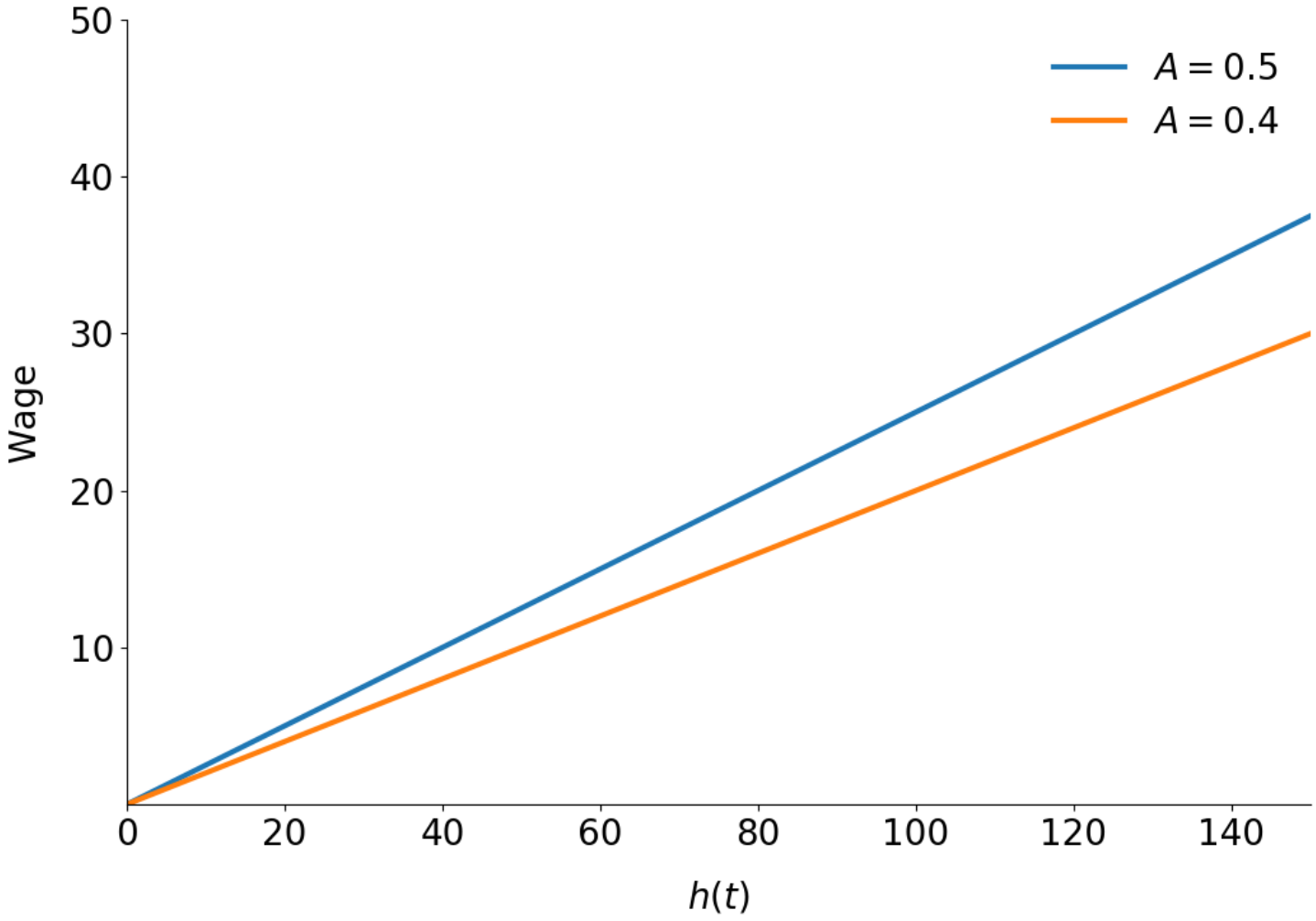


Figure: Wage $w(t)$ over the life-cycle

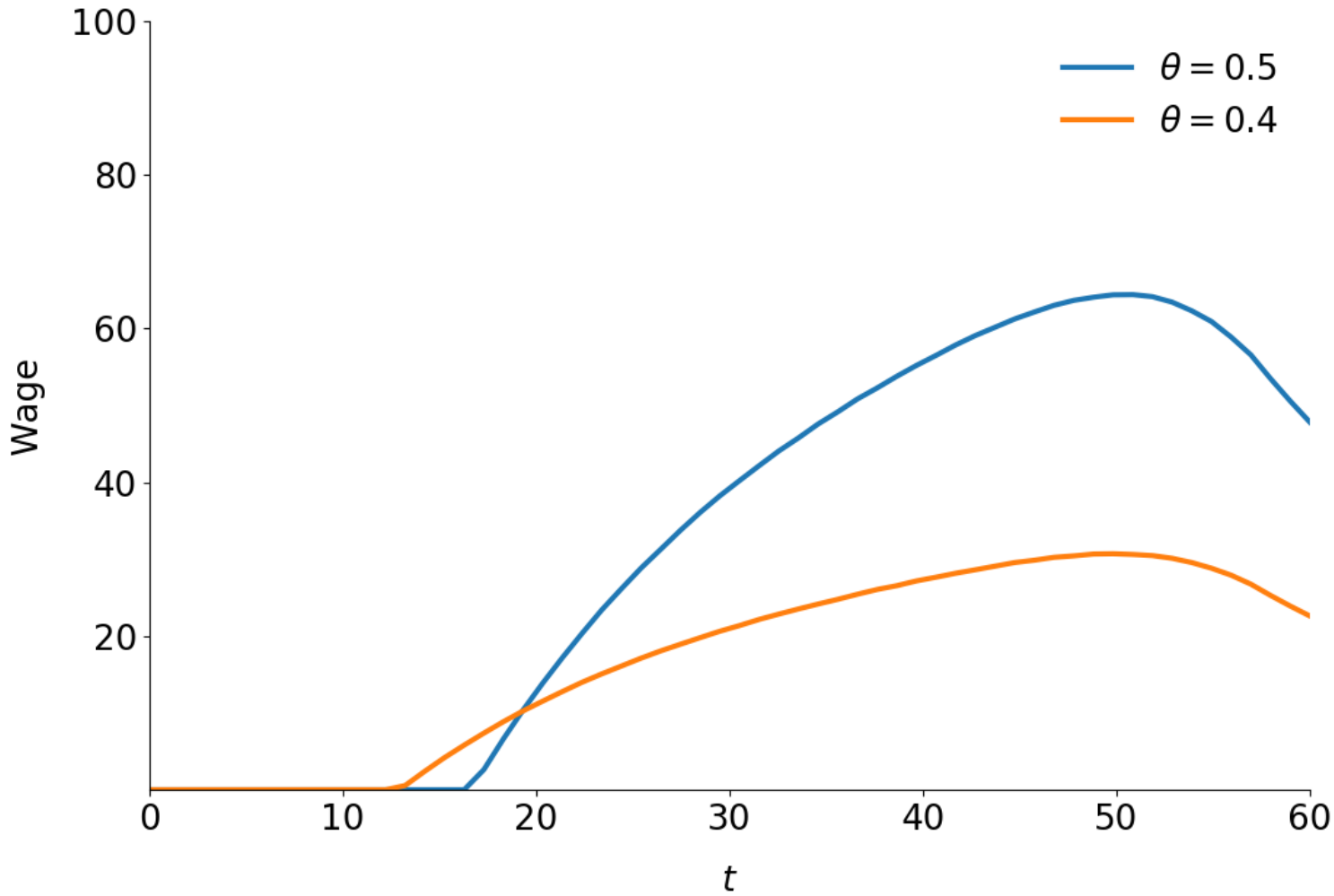


Figure: Stock of human capital $h(t)$ over the life-cycle

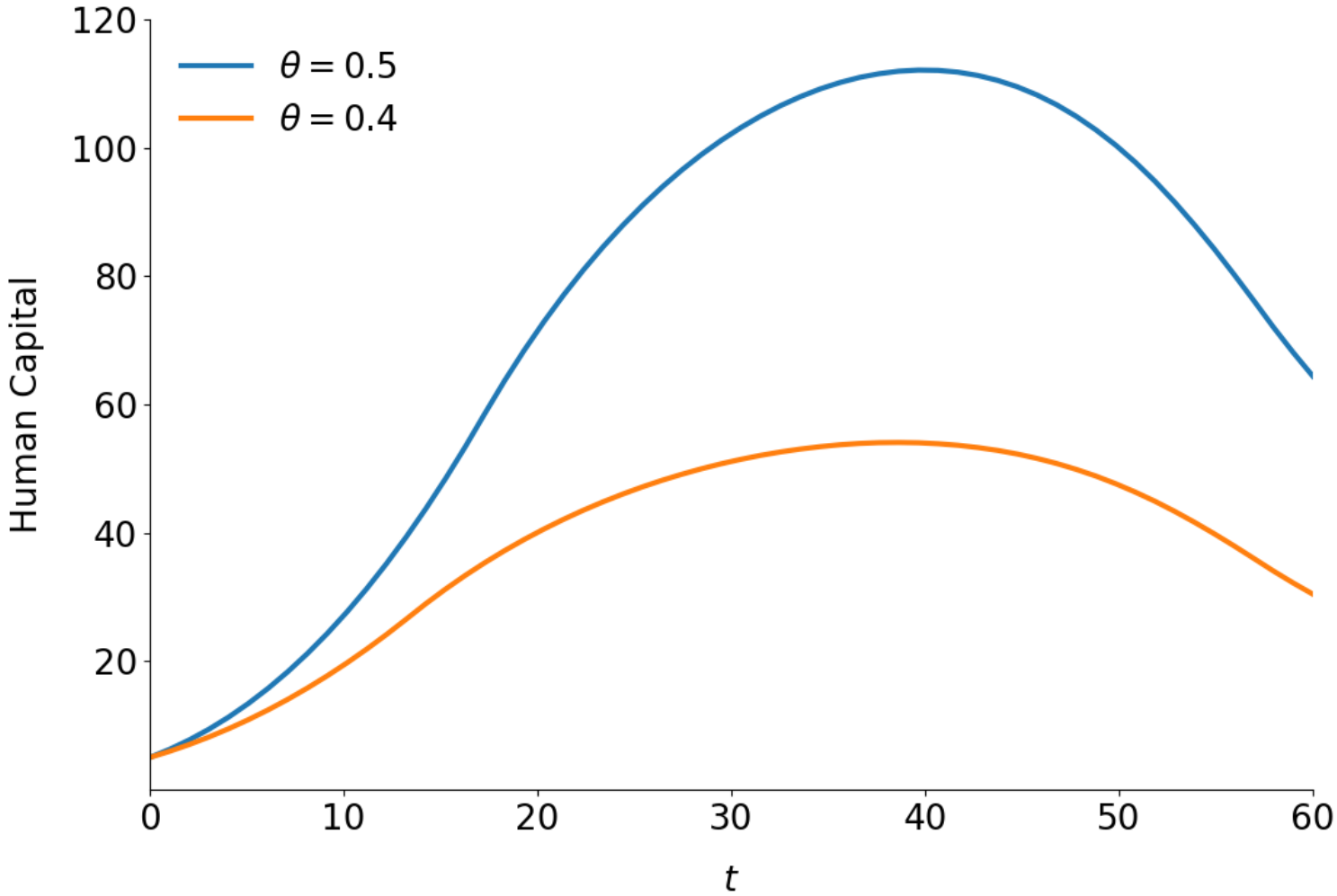


Figure: Human capital investment $s(t)$ over the life-cycle

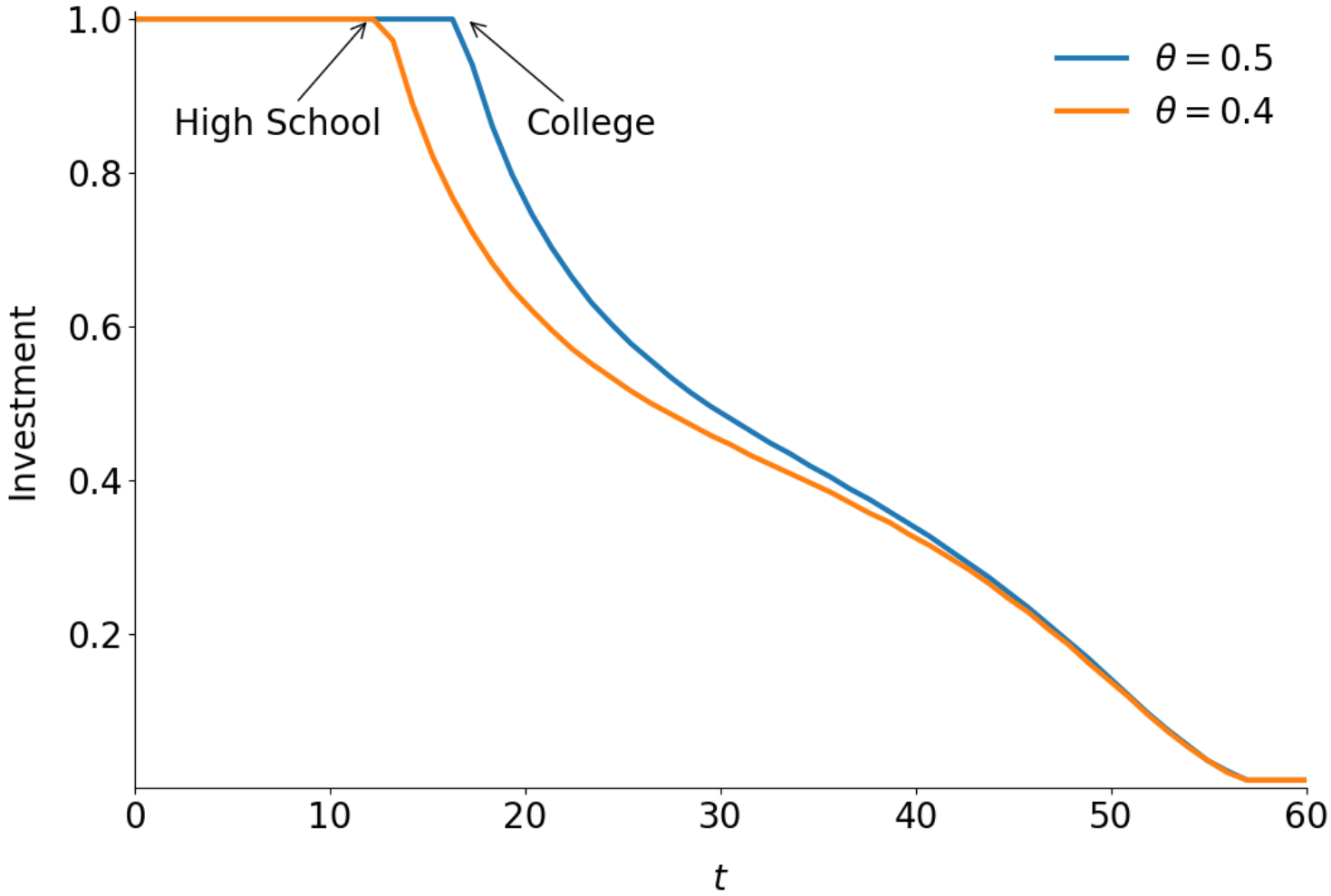
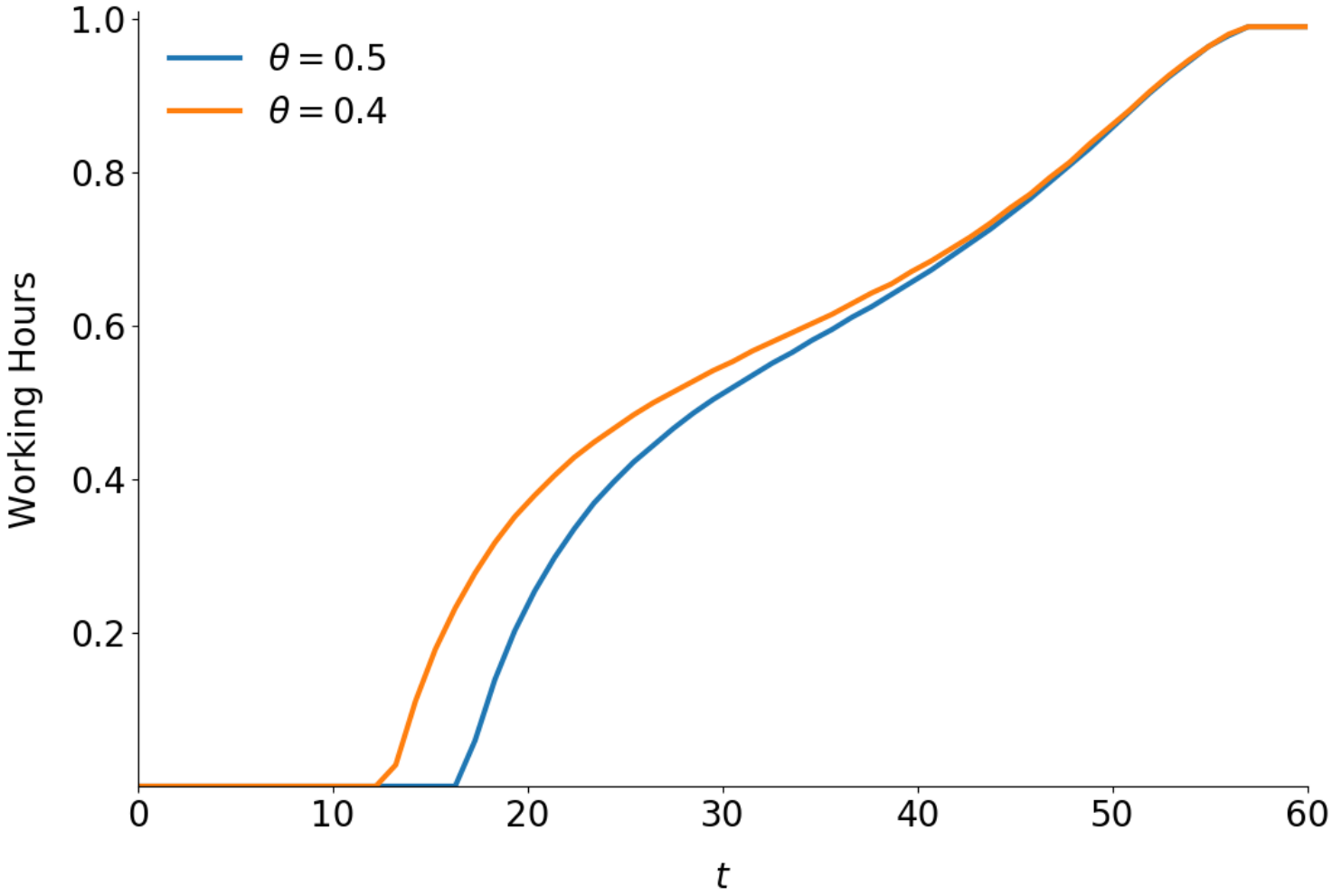


Figure: Hours worked $(1 - s(t))$ over the life-cycle



How well does the model do?

Extensions

Weiss (1986) reviews a host of alternative extensions to the basic model.

- general versus specific training
- hours worked
- uncertainty
- borrowing-constraints
- . . .

Job market signaling

This material is best studied using the following resource.

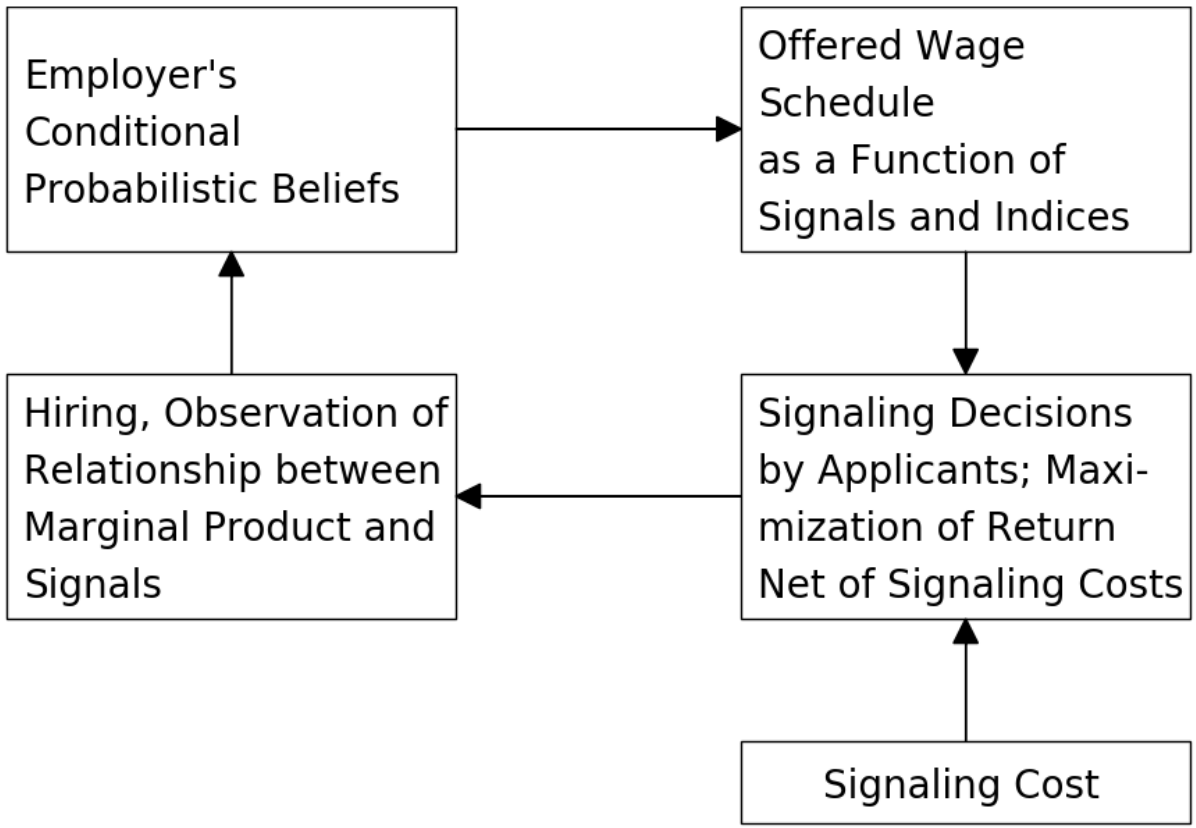
- Spence, M. (1973). Job market signaling. *The Quarterly Journal of Economics*, *87*(3), 355-374.

We study the seminal model presented in Spence (1973).

- There are two groups $j \in \{H, L\}$ in the population facing one employer, where $h_{j \in \{L,H\}}$ denotes the respective level of productivity.
- Group L is a proportion q_L in the population.
- Education y is measured by an index y of level and achievement and is subject to individual choice.
- Education costs are both monetary and psychic and differ by group $c_{j \in \{L,H\}}$.

- The productivity type is unobservable by the employer.
- Individual decisions about y can provide a signal about the underlying productivity.
- Wage schedule is set conditional on y.

Figure: Informational feedback



We explore the following parameterized version.

$$h_L = 1 \qquad h_H = 2$$

$$c_L = y \qquad c_H = \frac{1}{2}y$$

Thus there is an inverse relationship between productivity and signaling cost.

Figure: Benefit of education

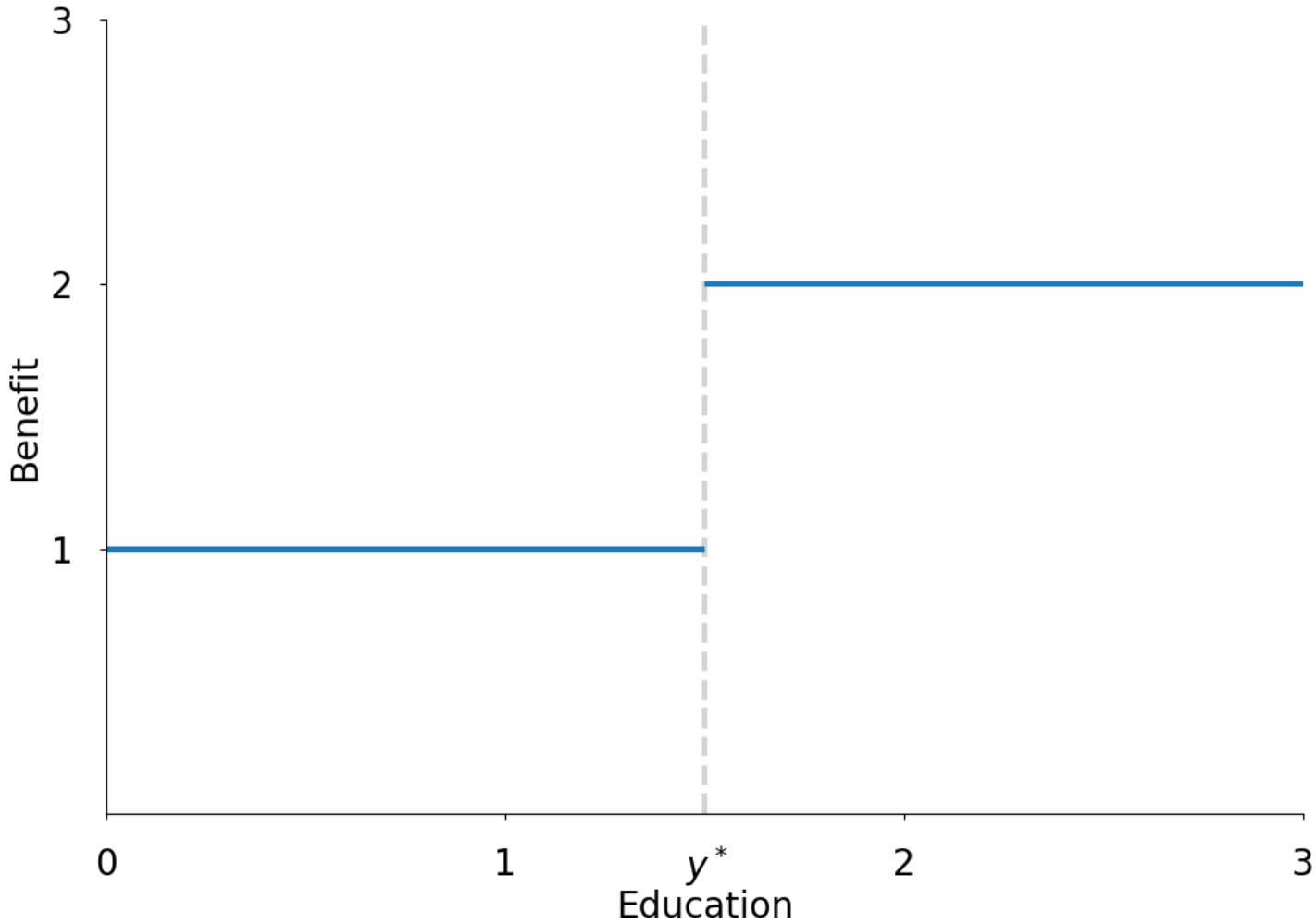


Figure: Cost of education

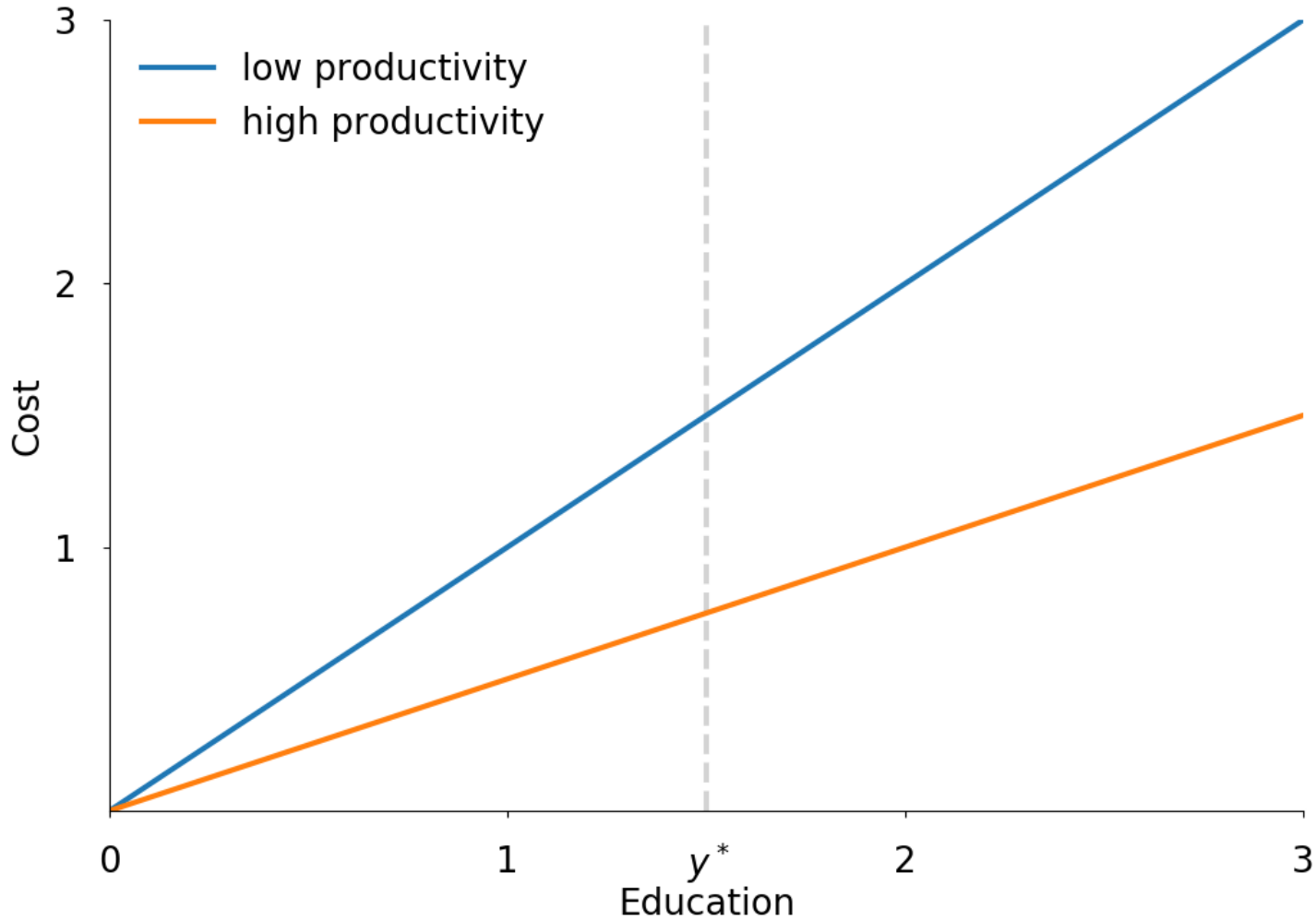
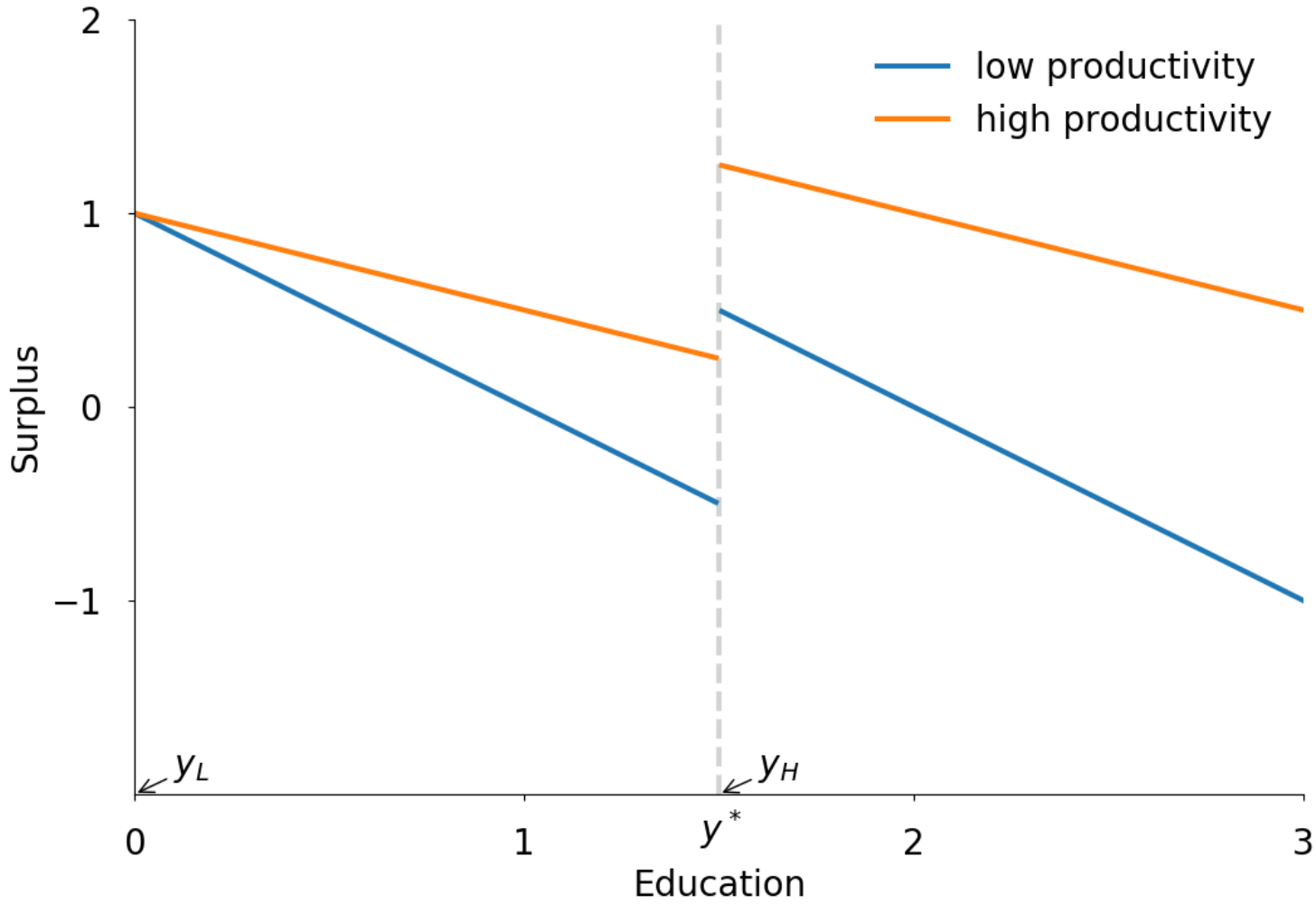


Figure: Surplus of education I



- For $y^* = 1.5$ the employer's beliefs are confirmed. More generally, L chooses $y_L = 0$ if $1 > 2 - y^*$ and H acquires $y_H = y^*$ provided that $2 - 0.5\,y^* > 1$.
- Beliefs are confirmed provided that the following holds:

$$1 < y^* < 2$$

Figure: Surplus of education II

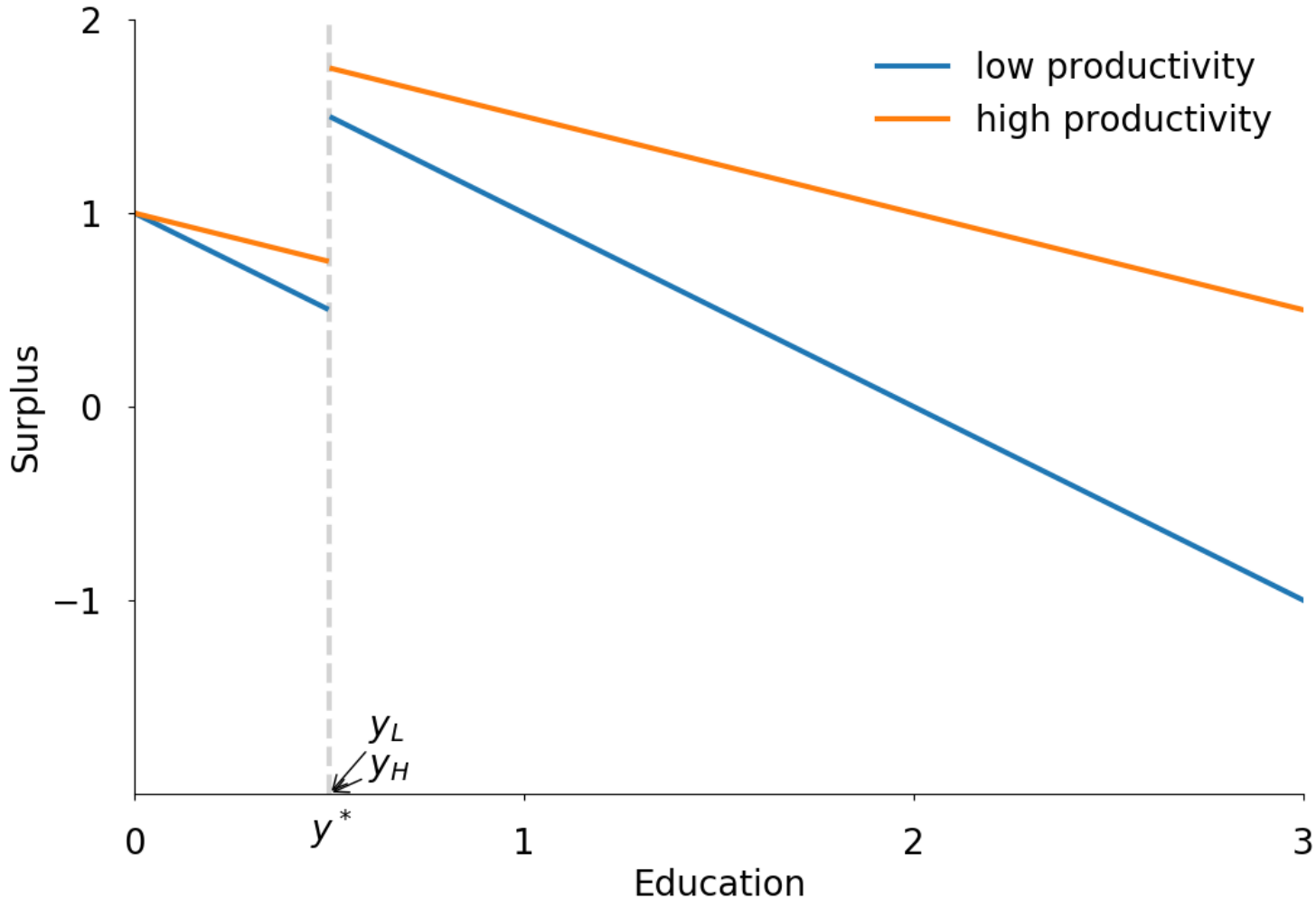
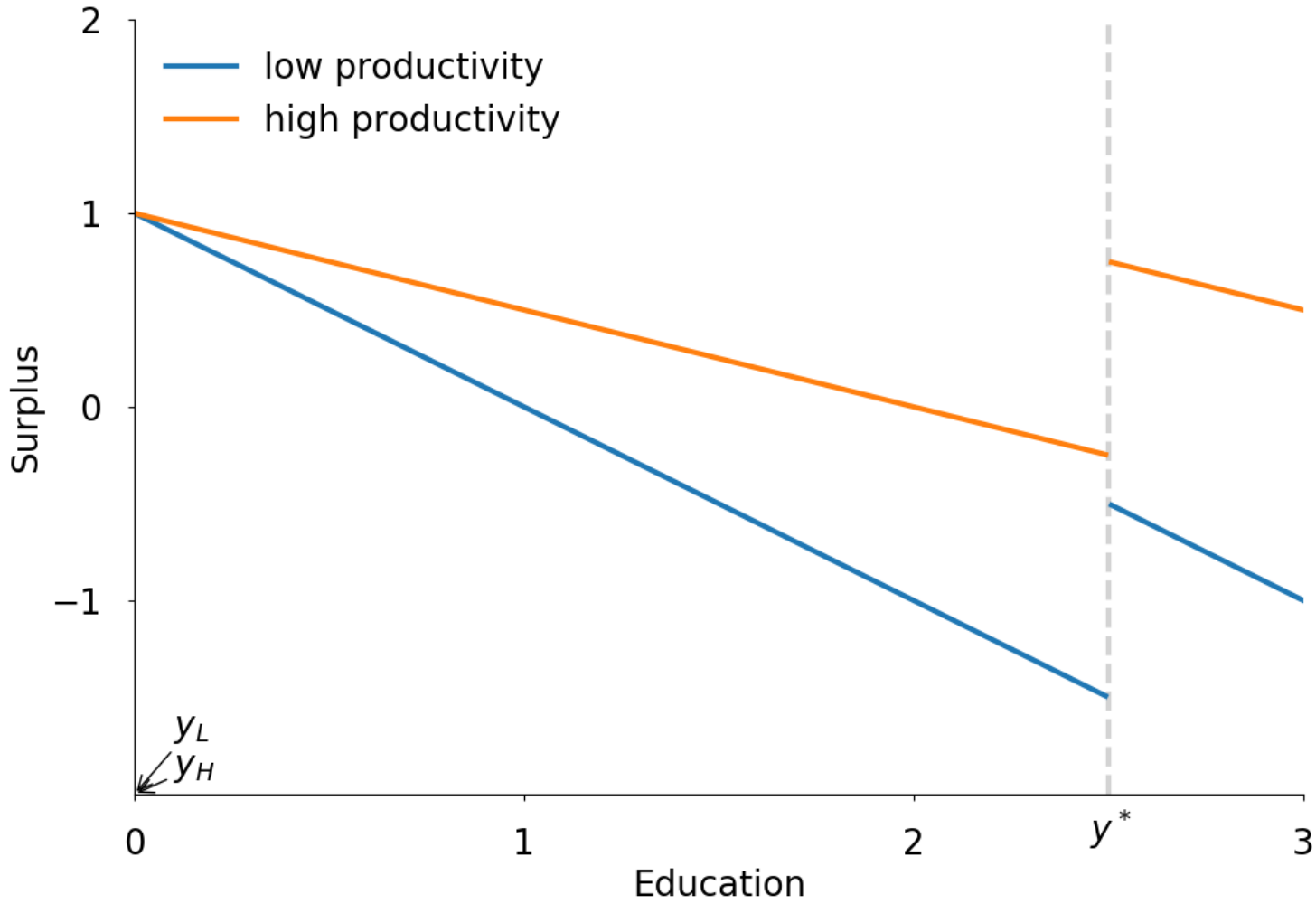


Figure: Surplus of education III



- From the outside, education appears to be productive and is for the individual. However, there is no real effect on the marginal product.

Can we distinguish between the two models based on simple information on individual education and wages?

- In the absence of signaling, both groups are paid the unconditional expected marginal product.

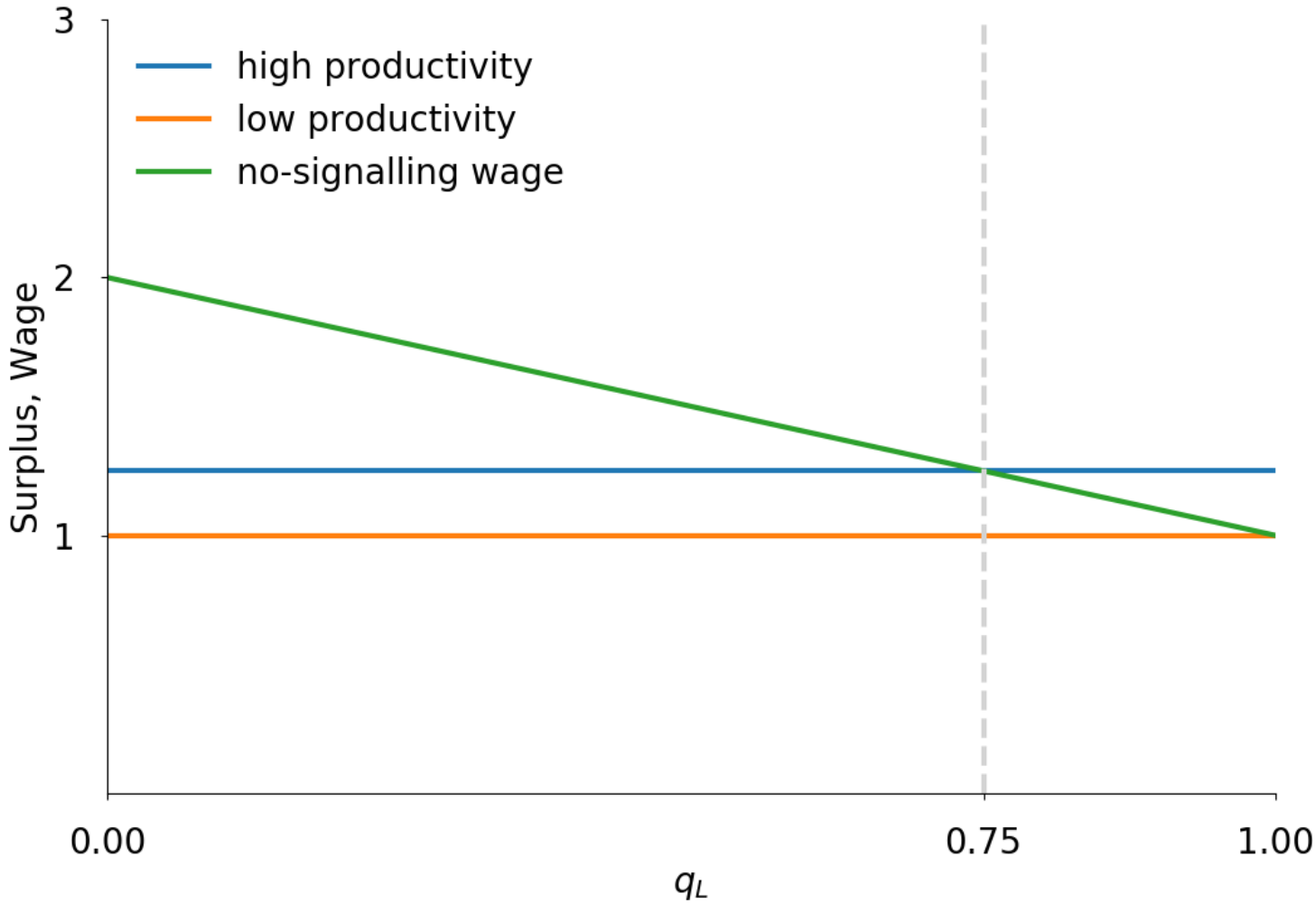
$$q_L \times 1 + (1 - q_L) \times 2$$

- It depends on the share of low productivity individuals whether high productivity individuals actually prefer a no-signaling case. Their surplus is determined as follows:

$$\begin{array}{ll} \text{signaling} & 2 - \frac{1}{2} y^* \\ \text{no-signaling} & 2 - q_L \end{array}$$

- High productivity individuals prefer the signaling case as long as $y^* \leq 2q_L$.

Figure: Market structure



- The ability to signal has a detrimental effect on low productivity workers, while the consequences are ambiguous for high productivity workers.
- High productivity workers benefit from their ability to send a signal if their proportion is sufficiently small with respect to the productivity gap to low productivity individuals.

Dataset

I present a basic overview on the **National Longitudinal Survey of Youth 1979 (NLSY79)** dataset (Bureau of Labor Statistics, 2014). The slide deck is under constant development and available at the link below.

http://bit.ly/2JeEGGt

Appendix

References

Becker, G. S. (1964). *Human capital* (1st ed.). New York City, NY: Columbia University Press.

Ben-Porath, Y. (1967). The production of human capital and the life cycle of earnings. *Journal of Political Economy*, *75*(4), 352–365.

Bureau of Labor Statistics. (2014). *National longitudinal survey of youth 1979 cohort, 1979-2012 (rounds 1-25)*. Columbus, OH: Produced and distributed by the Center for Human Resource Research, The Ohio State University.

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