Horizons of Credit
Paolo Baffi Lecture

Nobuhiro Kiyotaki
Princeton University

November 23, 2021

Questions

To finance investment, many businesses raise external funds against their collateral assets and future cash flow

Cash-flow-based borrowing: debt is limited mostly by 3 to 4.5 years worth of EBITDA, according to Lian-Ma (2021)

Stock analysts typically provide 5-year earning forecast

Why are the horizons of external financiers short, even when the durations of businesses are long?

How does a persistent fall in interest rate affect the economy? What if the change of interest rate is medium-term?

A Model of Credit Horizon

Engineer's investment technology:

$$\left.\begin{array}{c}\text{goods}\\ \text{a building}\end{array}\right\} \longrightarrow \left\{\begin{array}{c}\text{a plant}\\ \text{maintenance capacity}\end{array}\right.$$

To finance investment, engineer sells the plant ownership to saver

With the engineer's continual maintenance, the plant yields returns $y_{t+1},\ y_{t+2},\ y_{t+3}, \ldots$. Once missed the maintenance, the plant stops yielding returns forever

Engineer cannot commit to maintain the plant unless paid every period. She can work for another plant in future

Value of investment to the society

$$U_t = \frac{y_{t+1}}{R} + \frac{y_{t+2}}{R^2} + \frac{y_{t+3}}{R^3} + \ldots$$

Owner's value after paying "wage" to the engineer, $w_{t+1}, w_{t+2}, \ldots$

$$\begin{aligned} V_t &= \frac{y_{t+1} - w_{t+1}}{R} + \frac{y_{t+2} - w_{t+2}}{R^2} + \frac{y_{t+3} - w_{t+3}}{R^3} + \ldots \\ &= \frac{1}{R}(y_{t+1} - w_{t+1} + V_{t+1}) \end{aligned}$$

Wage is bonus payment to a key member of personnel, say chief engineer, manager, or founder

The owner and the engineer bilaterally bargain over wage every period. The stake for the owner is the franchise value. The engineer's stake is wage of this period

$\longrightarrow$ The engineer receives a fraction $1-\theta$ fraction of the continuation value as wage *every period*

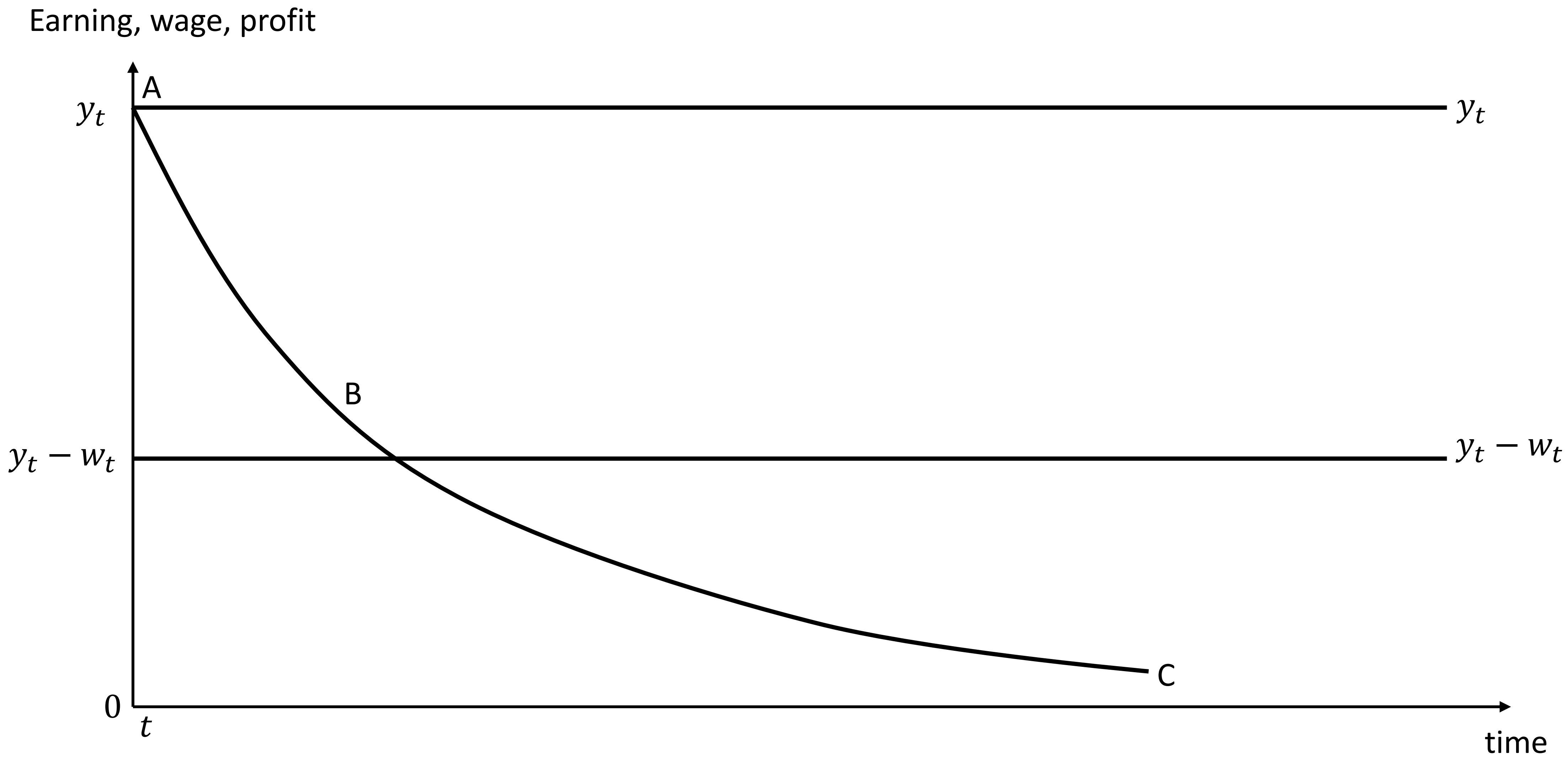
$$w_{t+1} = (1-\theta)V_{t+1}$$

The plant owner retains θ fraction of the continuation value $\longrightarrow$ The owner derives the value largely from near-future revenues

$$V_t = \frac{1}{R}y_{t+1} + \frac{\theta}{R^2}y_{t+2} + \frac{\theta^2}{R^3}y_{t+3} + \frac{\theta^3}{R^4}y_{t+4} + \dots$$

The engineer sells plant at price V_t to raise external funds: her borrowing capacity has a short horizon

Figure 1: Shares of Owner and Engineer



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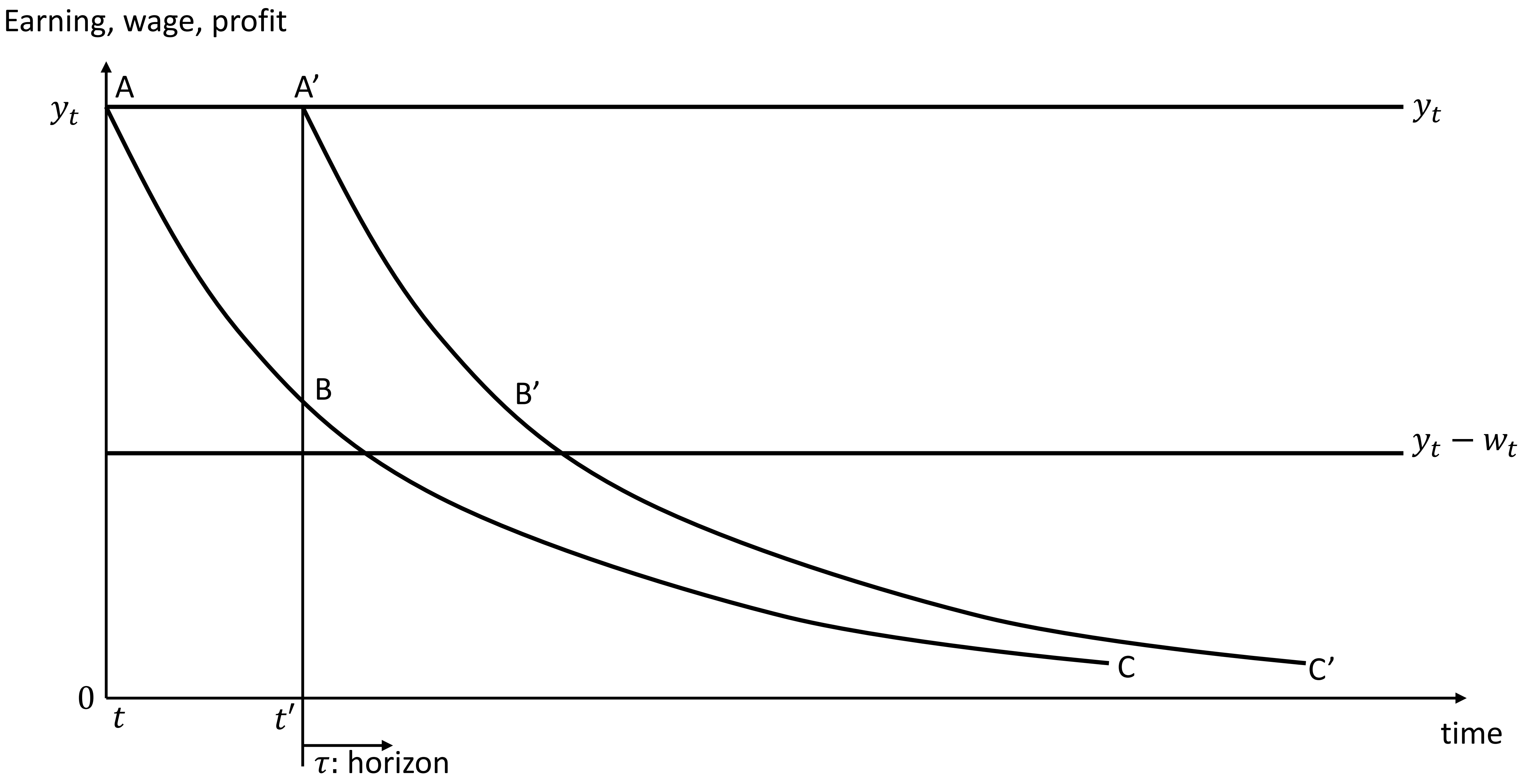

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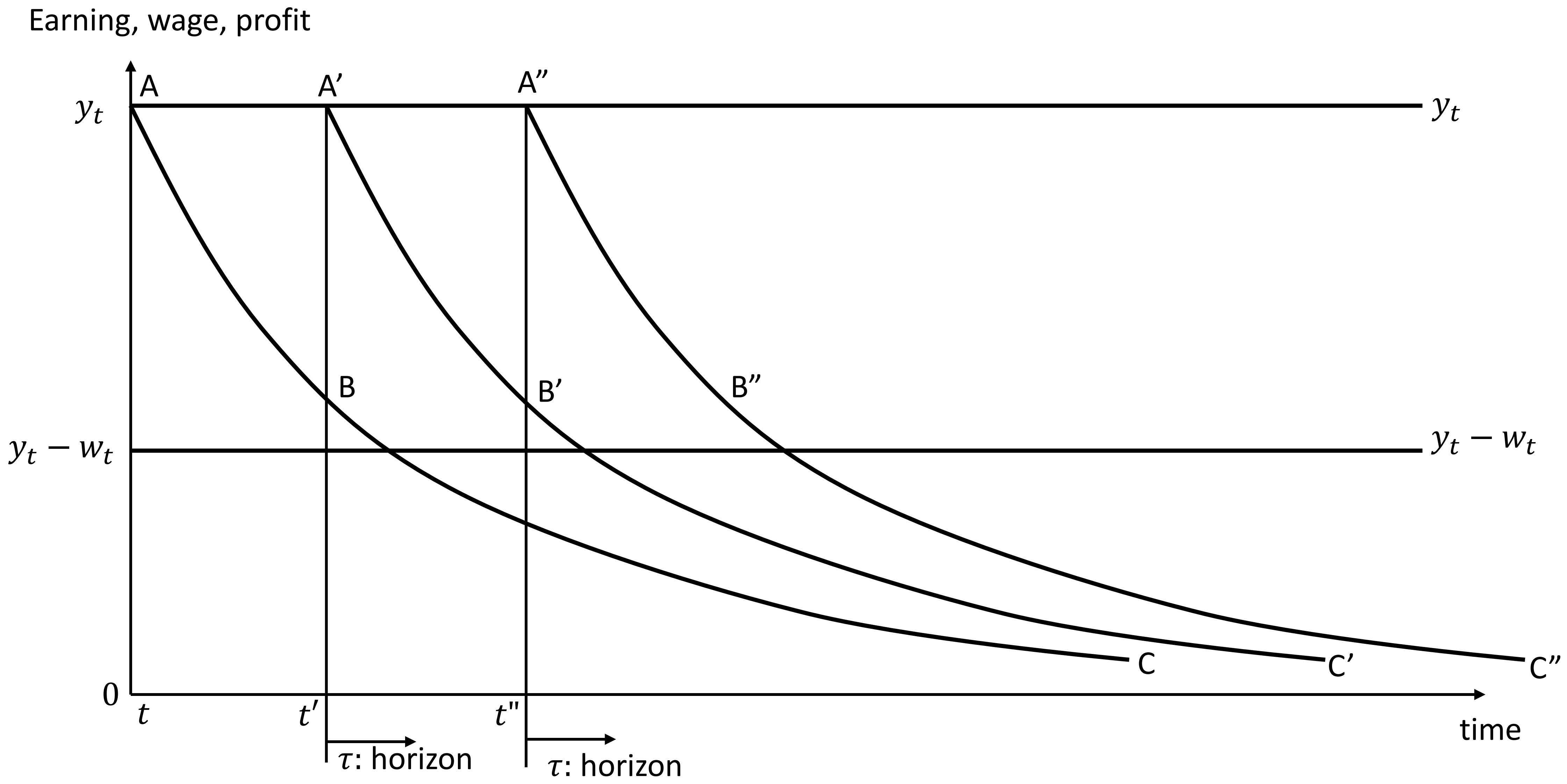


How is the owner's share determined?

Suppose that engineers can work for any other plant while plant owners can hire any engineers, and that the plant productivity of the next period is

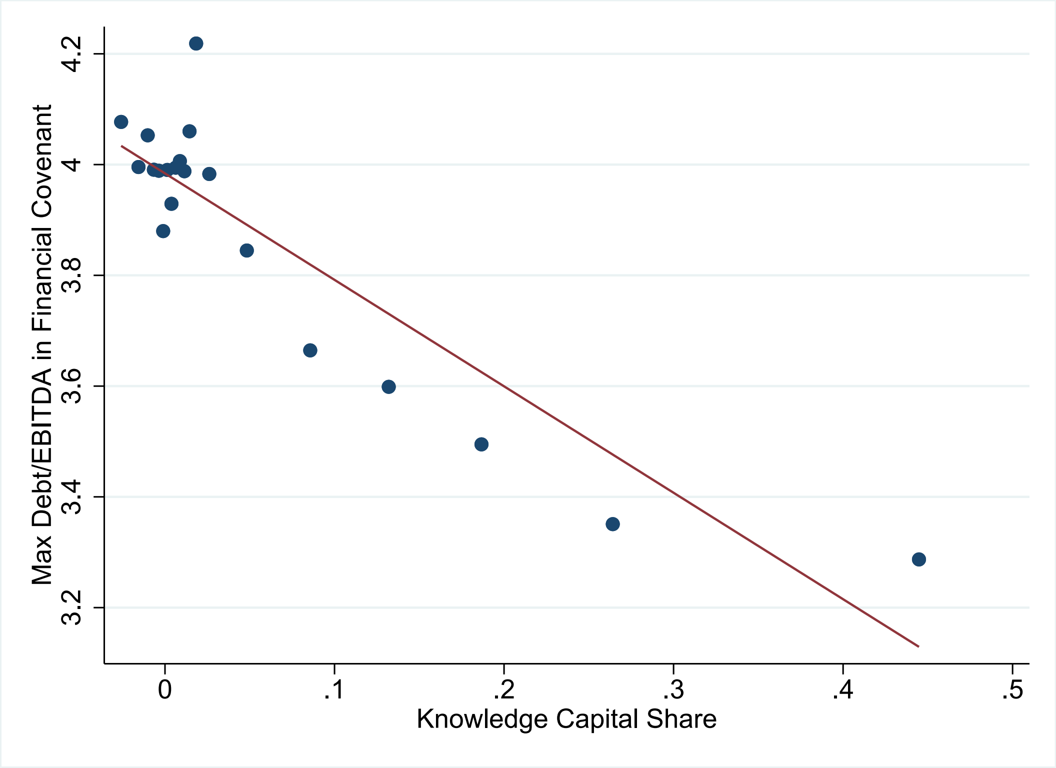
$$z' = z^{\theta} h^{1-\theta}$$

In competitive equilibrium,

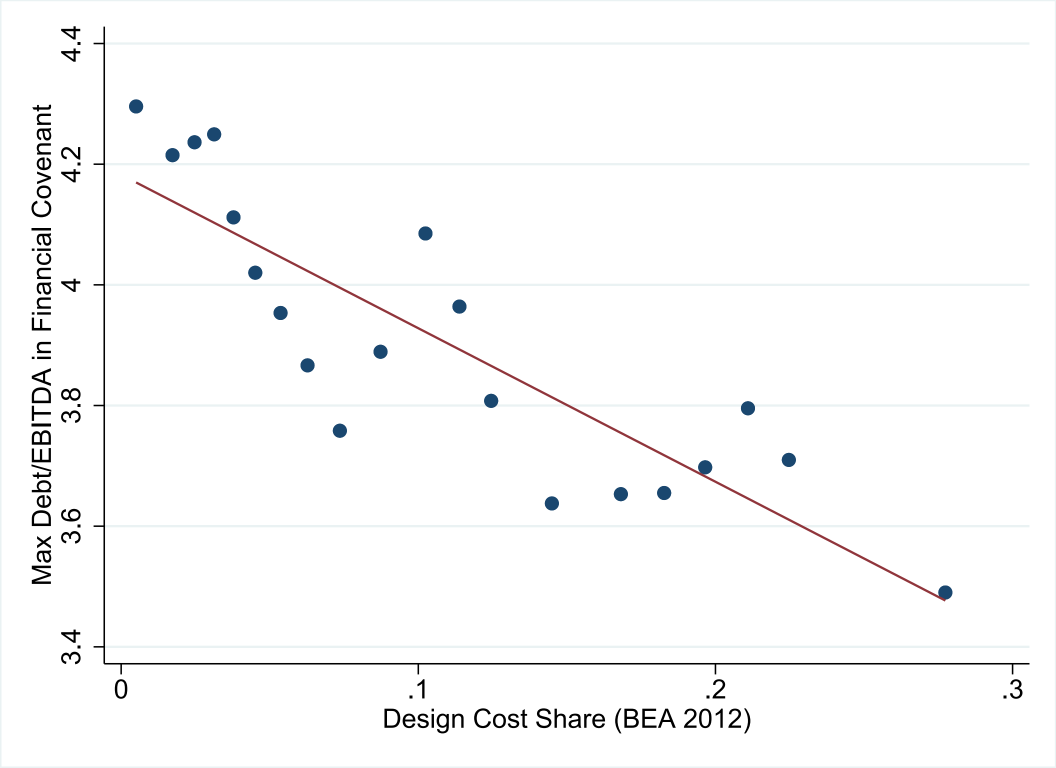
$$w_t = (1-\theta)\left(\frac{y_{t+1}}{R} + \frac{\theta y_{t+2}}{R^2} + \frac{\theta^2 y_{t+3}}{R^3} + ...\right)$$

$$= \text{PV of marginal product of engineer's input}$$

The plant owner derives the value from near future revenue, reflecting the declining impact of the initial productivity



4.2
4
3.8
3.6
3.4
3.2
Max Debt/EBITDA in Financial Covenant
0
.1
.2
.3
.4
.5
Knowledge Capital Share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3.4
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.2
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Design Cost Share (BEA 2012)

Problem of Short Credit Horizon

Each agent sometimes has an investment opportunity (engineer), sometimes not (saver), follows Markov

$$\left.\begin{array}{c} x \text{ goods} \\ 1 \text{ building} \end{array}\right\} \to \left\{\begin{array}{c} 1 \text{ plant with initial productivity } 1 \\ 1 \text{ unit of human capital of E} \end{array}\right.$$

Production

$$\left.\begin{array}{c} \text{productivity } z \text{ plant} \\ h \text{ human capital} \end{array}\right\} \to \left\{\begin{array}{c} y = az \text{ goods} \\ \text{plant of productivity } z' = z^{\theta} h^{1-\theta} \\ h \text{ human capital} \end{array}\right.$$

Alternative use of building

$$1 \text{ building} \to \left\{\begin{array}{c} f \ \text{ goods} \\ 1 \text{ building} \end{array}\right.$$

$\to$ Price of building $q = f/(R-1)$

Guess all plants continue with productivity $z' = z^{\theta} h^{1-\theta} = 1$ and $y = a$. Can verify this guess later if $f \leq f^{critical}$

Engineer raises fund by selling plant at price

$$\begin{aligned} b &= V = \frac{a}{R} + \frac{\theta a}{R^2} + \frac{\theta^2 a}{R^2} + \ldots \\ &< \frac{a}{R} + \frac{a}{R^2} + \frac{a}{R^2} + \ldots = U : \text{ social value} \end{aligned}$$

If

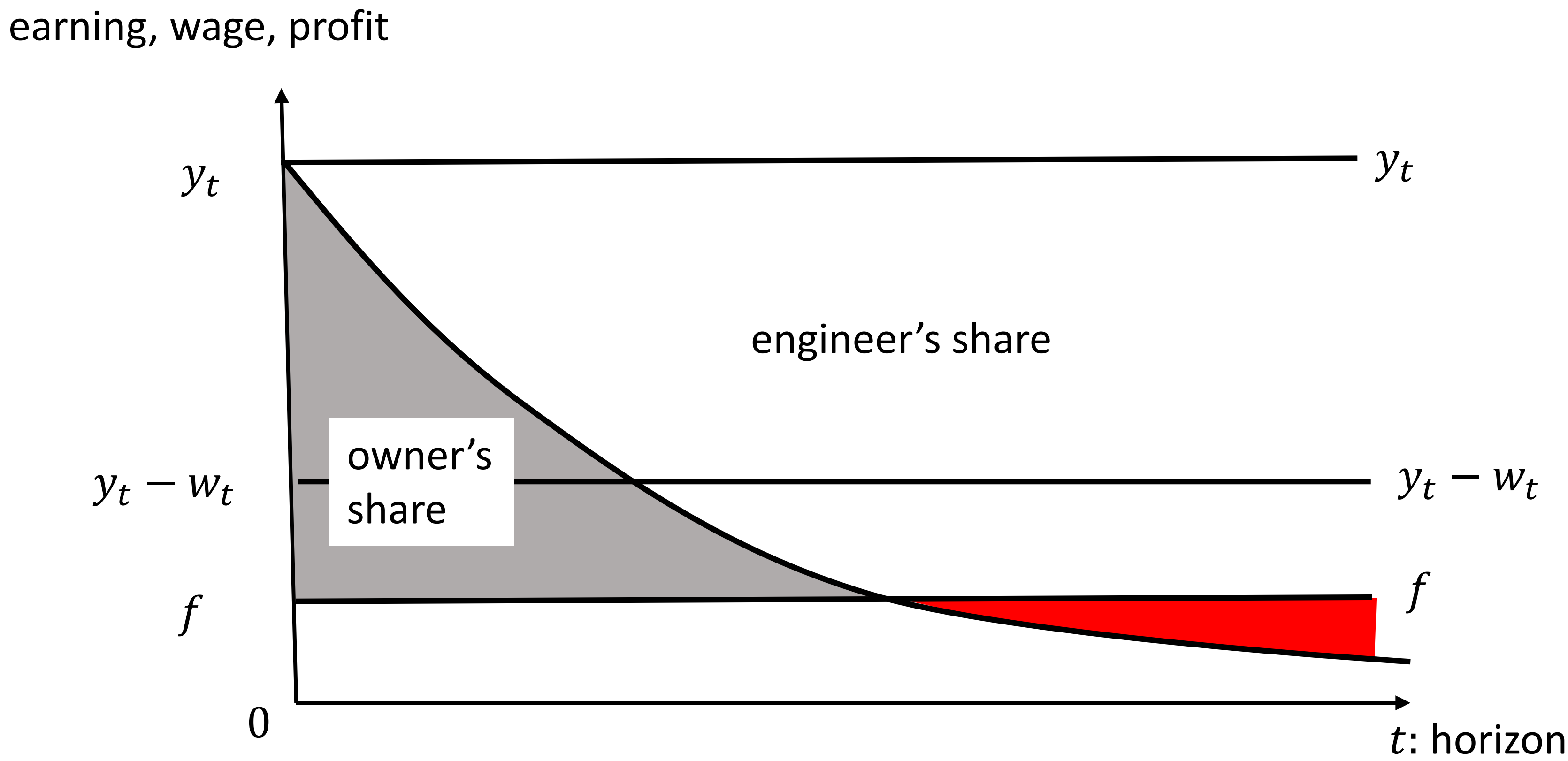
$$b < x + q < U,$$

then

$$\text{engineer's investment } = \frac{\text{her net worth}}{x + q - b}$$

Investment is too small relative to the first best

Figure 3: Durations of Owner's Share and Building Cost



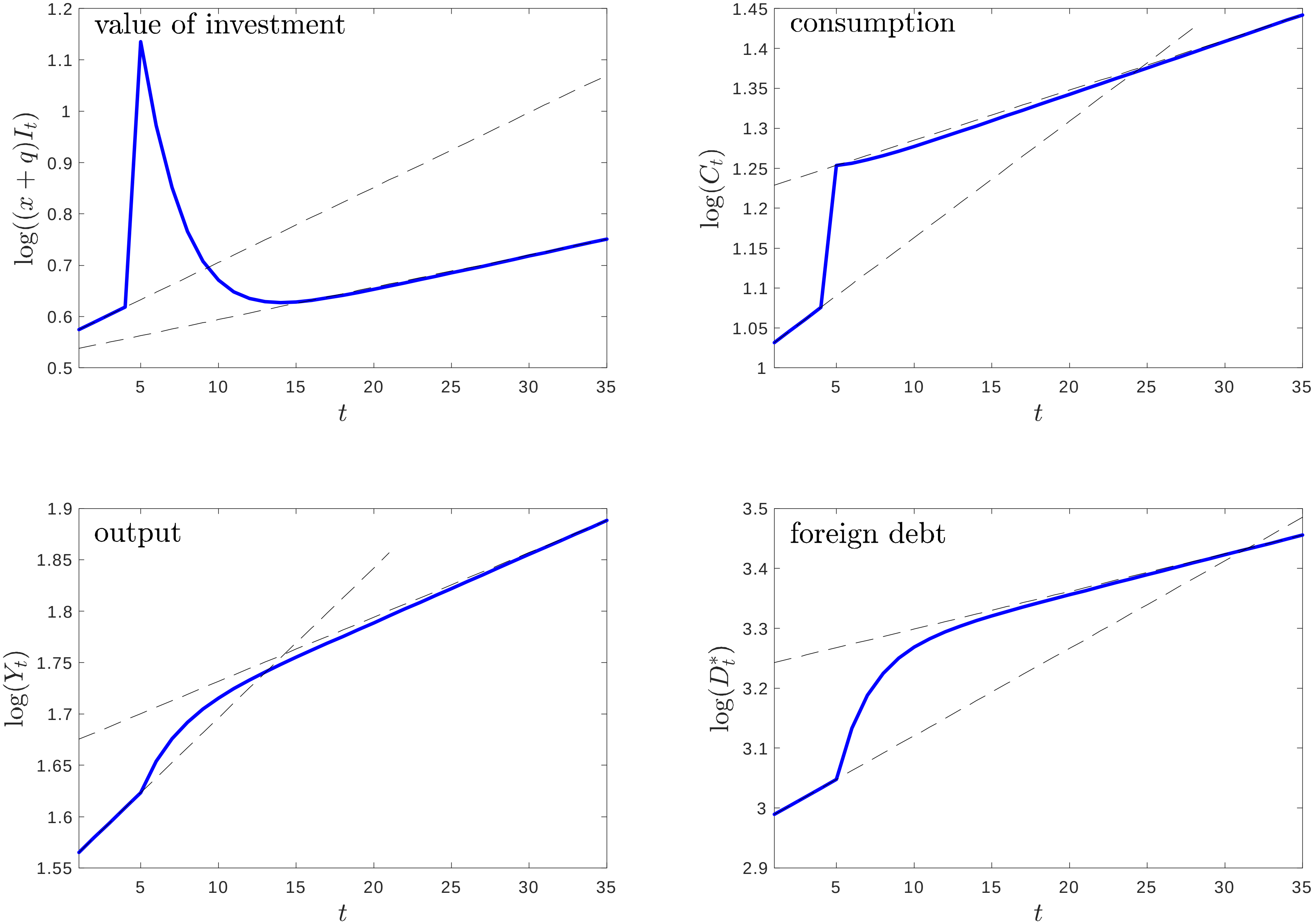
Effects of a Permanent Fall in Interest Rate

The engineer's borrowing capacity has a shorter duration than building

With a permanent fall in interest rate, the borrowing capacity may fail to catch up with the rising investment cost. Can offset a rise of net worth $\longrightarrow$ stifle investment and growth:

$$\text{gross investment} \downarrow \; =$$

$$\beta \times \frac{\text{net worth of engineers} \uparrow}{\text{investment cost } \; (x+q)\uparrow\uparrow - \; \text{fund-raising capacity } \; (b)\uparrow}$$



value of investment
$\log((x+q)I_t)$
t
consumption
$\log(C_t)$
t
output
$\log(Y_t)$
t
foreign debt
$\log(D_t^*)$
t

Policy

Engineers do not maintain unless paid every period: impossible to keep track of each engineer's trading history

If plant is easy to locate, then perhaps government could tax the plant owner's payroll at rate τ. Use the revenue to subsidize investment at rate s

$$\text{investment} = \frac{\text{engineers' net worth} \downarrow}{x + q - s - b \downdownarrows} \uparrow$$

$\rightarrow \frac{\partial G}{\partial \tau} > 0$

Population-weighted average of the expected discounted utilities of engineers and savers rises with τ for small τ

Government acts as a social creditor to engineers

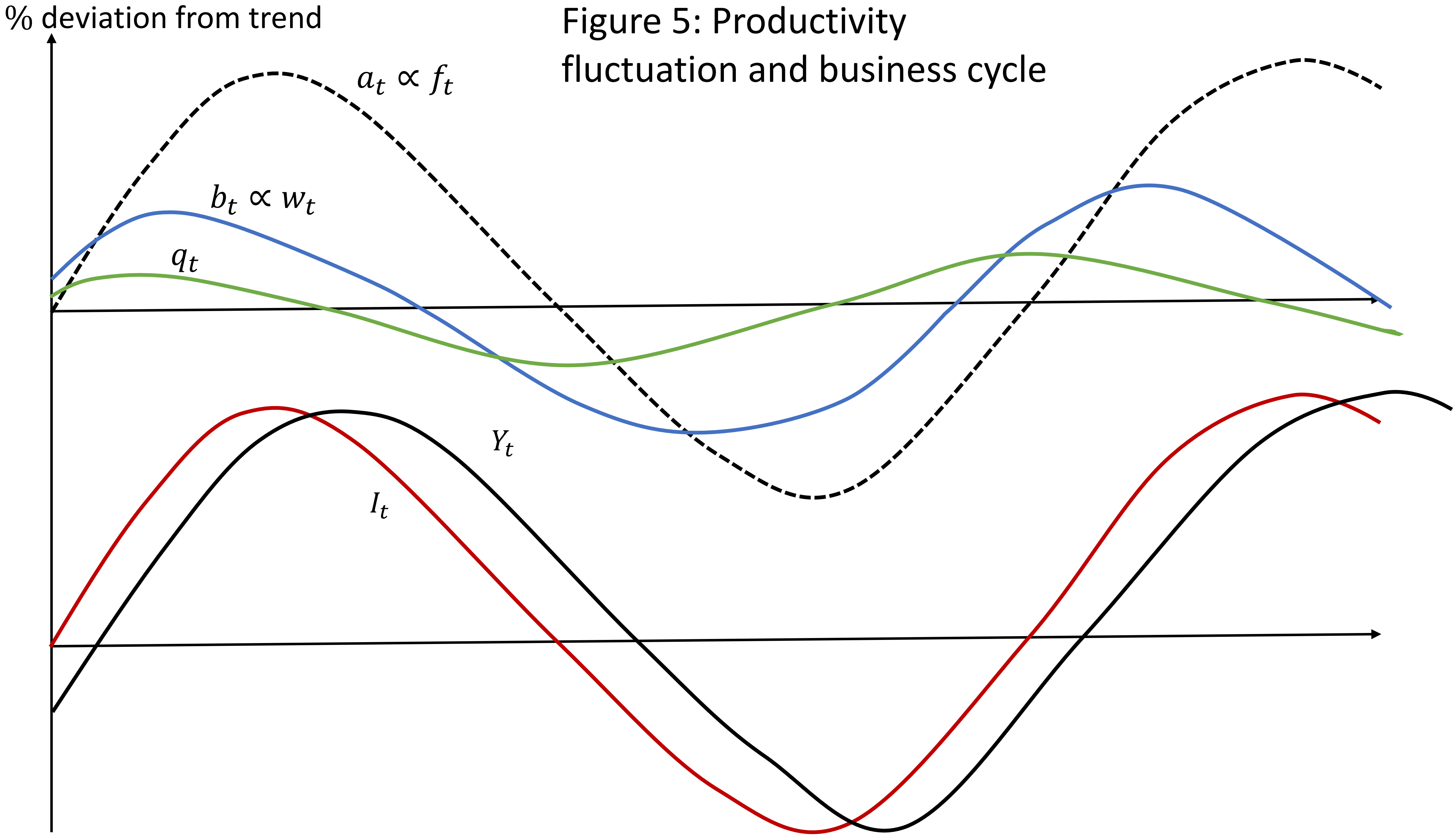


Figure 5: Productivity fluctuation and business cycle

Figure 6: Interest rate fluctuation and business cycle

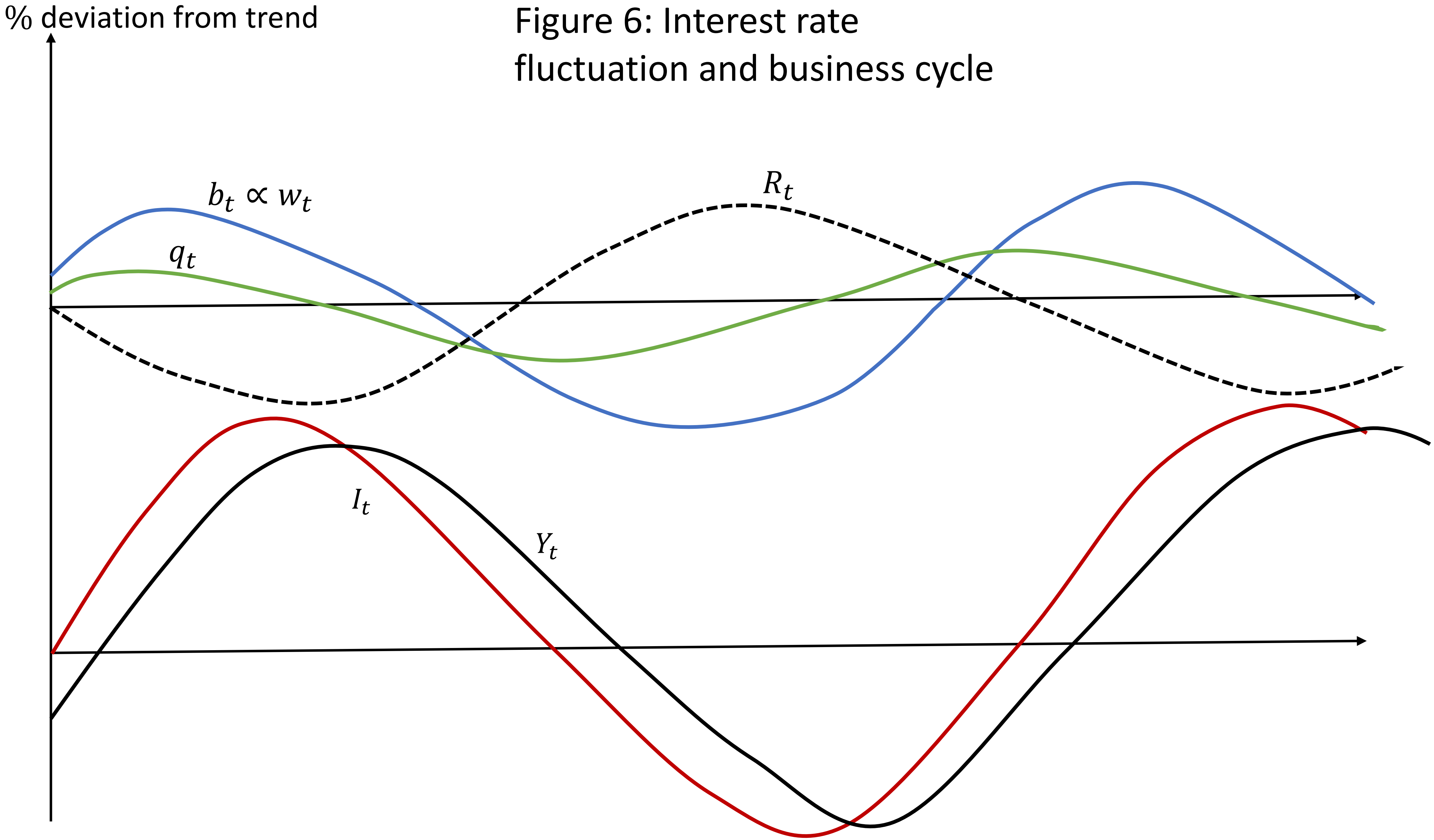


Figure 7: Persistent interest rate fluctuation and business cycle