Infant industry protection has a long history

James Stuart Mill : Principles of Political Economy, 1848

> The only case in which, on mere principles of political economy, protecting duties can be defensible, is when they are imposed temporarily (especially in a young and rising nation) in hopes of naturalizing a foreign industry, in itself perfectly suitable to the circumstances of the country. The superiority of one country over another in one branch of production often only arises from having begun it sooner. There may be no inherent advantage on one part, or disadvantage on the other, but only a present superiority of acquired skill and experience. A

A never-ending strory…

- G. Haberler (1936), G. Myrdal (1957), Rosenstein-Rodan (1963) stress the dynamic (learning) benefits from industry protection, provided protection is temporary.

- R. Baldwin (1969) objects to infant industry protection, on the ground that:

- static welfare losses from duties and tariffs are certain..
- dynamic benefits are uncertain

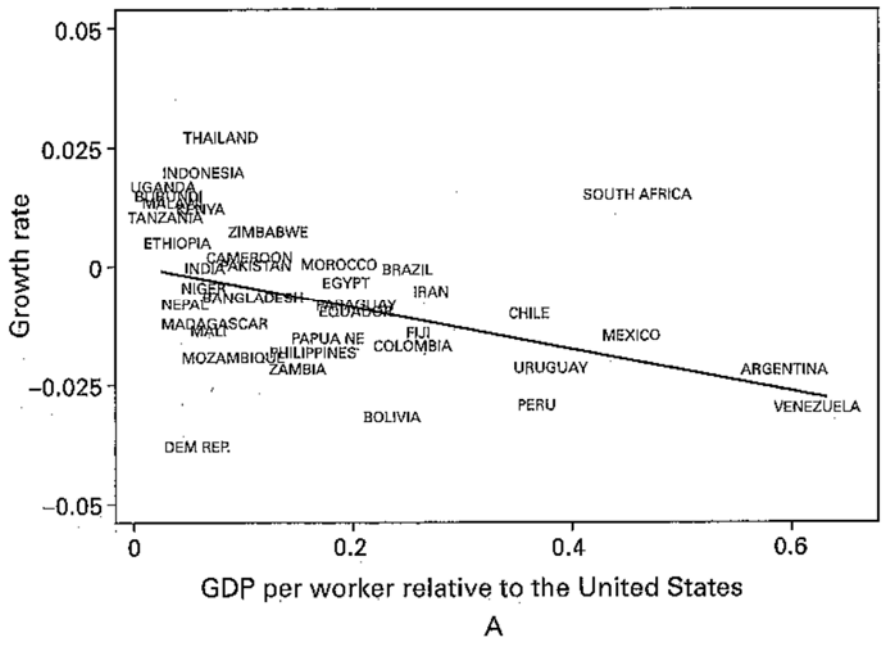
Hints from empirical literature (e. g. Harrison 1994 on Krueger and Tuncer, 1982 on the case of Turkey)

Conclusions 1: industry protection in a backward country has growth effects

Data show a statistically significant positive relation between some protection indicators and output growth.

Conclusions 2: Growth benefits from protection are temporary

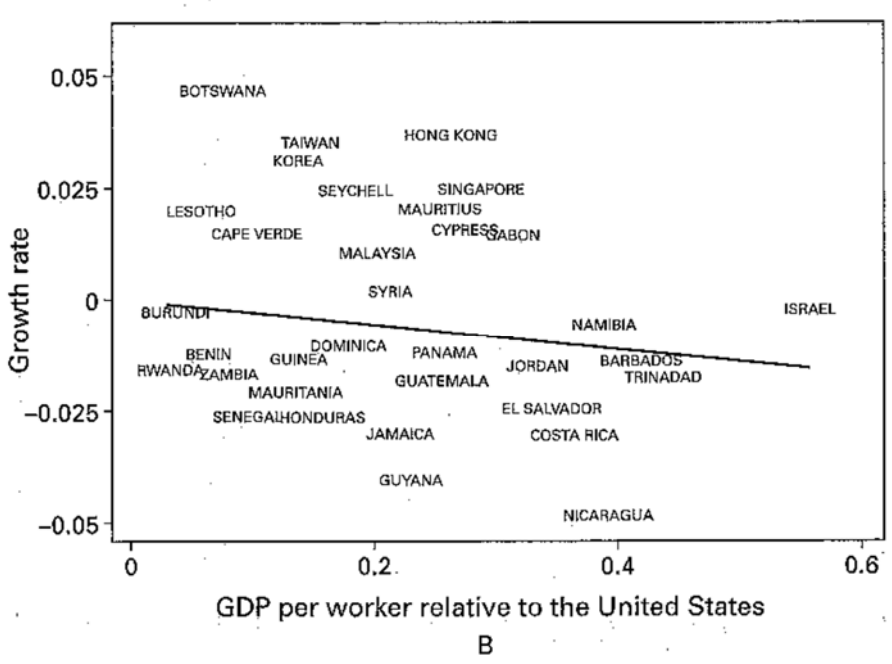
Distance to frontier and growth in countries with low openness: 1960-2000 (Acemoglu, Aghion, Zilibotti 2006)
In countries with low openness the growth advantage from being backward is positive and quite marked



A

Distance to frontier and growth in countries with high openness:1960-2000 (Acemoglu, Aghion, Zilibotti 2006)

In countries with high openness the growth advantage from being backward is positive but low



B

Interpretation:

Being technologically backward elicits..

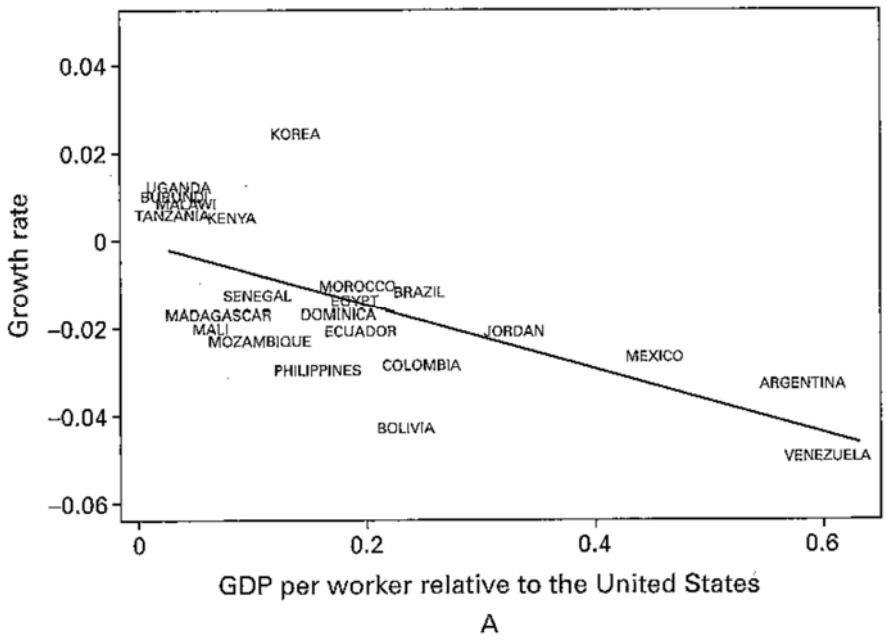
- faster learning
- faster catching-up

in countries less open to foreign competition ,

than in countries more open to foreign competition.

Distance to frontier and growth, high barriers to entry: 1960-2000 (Acemoglu, Aghion, Zilibotti 2006)

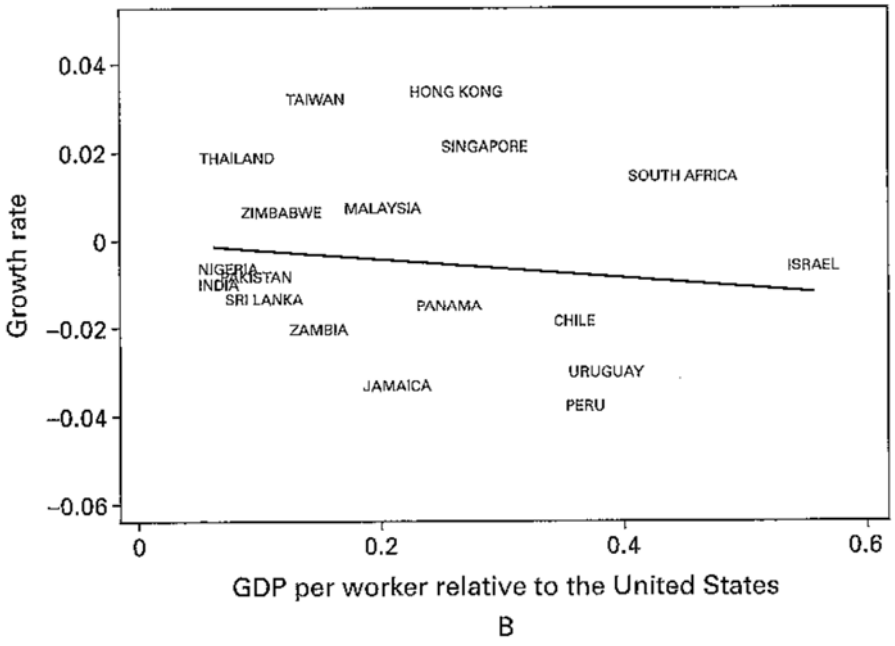
In countries with high barriers to entry, growth advantage from being backward is quite marked



A

Distance to frontier and growth, low barriers to entry: 1960-2000 (Acemoglu, Aghion, Zilibotti 2006)

In countries with low barriers to entry, growth advantage from being backward is quite poor



B

Interpretation is similar:

Being technologically backward elicits

- faster learning
- faster catching-up

in countries with higher barriers to entry (more restrictive regulation policy),

than in countries with lower barriers to entry (less restrictive regulation policy).

Distance to the Frontier and Changes in the Organization of Production I

- Structure of production changes over process of development, related to changes in internal organization of the firm and to a shift in the "growth strategy" of an economy.
- Consider less-developed economy that is behind the world technology frontier.
- Time is discrete and economy is populated by two-period lived overlapping generations of individuals.
- Total population is normalized to 1.
- Unique final good, also taken as the numeraire.
- Produced competitively according to standard Dixit-Stiglitz (constant elasticity of substitution) aggregator:

$$Y(t) = \int_0^1 A(v,t)^{1-\alpha} x(v,t)^{\alpha} \, dv, \tag{32}$$

v = industry index = intermediate good index

- Each intermediate produced by a monopolist $\nu \in [0,1]$ at a unit marginal cost in terms of unique final good.
- Monopolist faces competitive fringe that can copy technology and also produce identical intermediate good with productivity $A(\nu, t)$.
- Competitive fringe can produce each intermediate at the cost of $\chi > 1$ units of final good.
- Competitive fringe forces the monopolist to charge a *limit price*:

$$p(\nu, t) = \chi > 1. \tag{33}$$

- Will be an equilibrium when χ is not so high that the monopolist prefers lower unconstrained monopoly price.
- Condition for this is (impose throughout):

$$\chi \leq 1/\alpha,$$

$\chi - 1$ = cost of imitation depending on institutions (legal system, competition policy…)

Constrained Monopoly profit

- χ capturing technological factors and government regulations regarding competitive policy.
- Given demand implied by (32) and the equilibrium limit price in (33), monopoly profits are:

$$\pi(v,t) = \delta A(v,t), \tag{34}$$

δ = productivity adjusted monopoly profit

↓

is a measure of monopoly power

is an increasing function of χ

Technology adoption versus innovation

- Each monopolist $\nu \in [0,1]$ can increase $A(\nu, t)$ by two complementary processes:
  1. imitation (adoption of existing technologies); and
  2. innovation (discovery of new technologies).
- Key economic tradeoffs: different economic arrangements (organization of firms, growth strategy) will lead to different amounts of imitation and innovation.

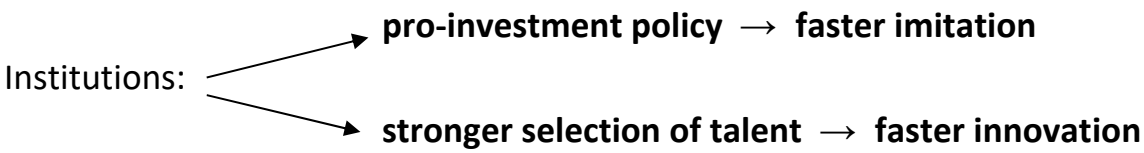
- Both innovation and imitation require some form of ‘effort’ but they are different processes, responding to different incentives

- **Imitation = exploitation of existing ideas** = adopting the known best practice methods + adaptation to local conditions
  Technology adoption takes place through investments in already established production activities. This occurs through:
  - building plants embodying best-practice technology: **requires large scale investment**
  - adaptation of technology to local conditions: **requires experience**

- **Innovation = exploration of new ideas** = improvement upon the world best-practice technology. Here high investment will not be enough. What is required is:

- propensity to undertake highly **risky R&D**
- **talent for novelty**

- **Institutions** can be either imitation improving or innovation improving



- Which institutions are more appropriate depends on distance from technology frontier

Average productivity

- Define average productivity of the economy:

$$A(t) \equiv \int_0^1 A(\nu, t)\, d\nu.$$

- $\bar{A}(t)$=productivity at the world technology frontier,

$$A(t) \leq \bar{A}(t)$$

- World technology frontier progresses according to:

$$\bar{A}(t) = (1+g)\,\bar{A}(t-1), \tag{35}$$

Here g is fixed exogenously.

Country technology dynamics

- Process of imitation and innovation leads to:

$$A(\nu, t) = \eta \bar{A}(t-1) + \gamma A(t-1) + \varepsilon(\nu, t), \qquad (37)$$

  where $\eta > 0$ and $\gamma > 0$.
- $\varepsilon(\nu, t)$ is a random variable with zero mean, capturing differences in innovation performance across firms and sectors.

- $\eta < 1$ is imitation parameter η is higher if firms invest more in **exploitation**
  $\eta \bar{A}(t-1)$ captures 'advantage from backwardness'.
  larger country distance from frontier → larger improvement from imitation.
- γ is innovation parameter γ is higher if talent for **exploration** is selected
  γ A(t – 1) states that improvement step from innovation depends on technology level in the country.

Relative proximity *a(t)* to technology frontier

$$A(v,t) = \eta \bar{A}(t-1) + \gamma A(t-1) + \varepsilon(v,t), \qquad (37)$$

Summing across the variety of intermediates:

$$A(t) = \eta \bar{A}(t-1) + \gamma A(t-1)$$

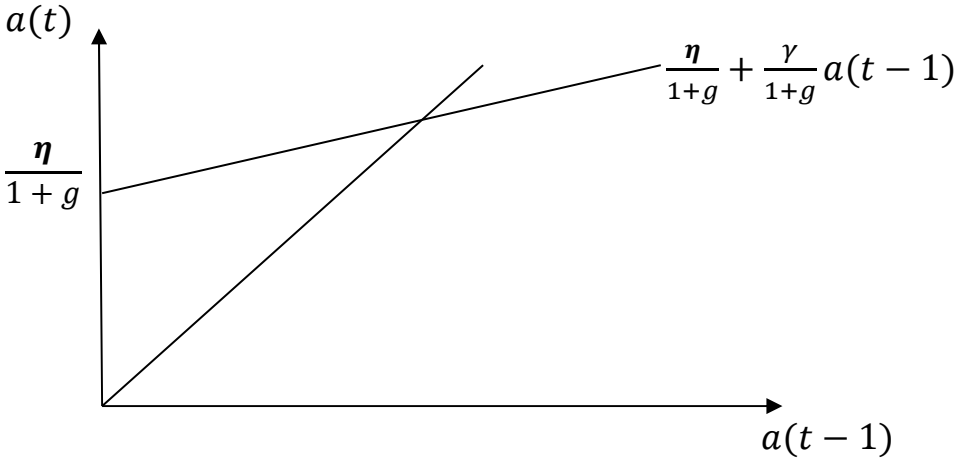
$$a(t) = \frac{A(t)}{\bar{A}(t)} = \eta \frac{\bar{A}(t-1)}{\bar{A}(t)} + \gamma \frac{A(t-1)}{\bar{A}(t)}$$

$$a(t) = \eta / (1+g) + \gamma\, a(t-1)/(1+g)$$

$$a(t) = \frac{\eta}{1+g} + \frac{\gamma}{1+g} a(t-1)$$

steady state a is defined by: $(1 + g - \gamma)a = \eta$

- Dual process of imitation and innovation may lead to a process of convergence.
- $\gamma < 1+g$ **$a(t)$ converges to $a = \eta / (1 + g - \gamma) \leq 1$**
- **$1 + g - \gamma \geq \eta$** $\eta + \gamma \geq 1 + g$



Proximity to technology frontier matters

$$a(t) = \frac{\boldsymbol{\eta}}{1+g} + \frac{\gamma}{1+g} a(t-1)$$

a(t − 1) close to 1 → proximity to world leading technology is 'high'
innovation parameter γ matters more for growth

a(t − 1) close to 0 → proximity to world leading technology is 'low'
imitation parameter η matters more for growth

Economic environment:

- overlapping generations model: contracts last one period and may or may not be renewed in the next
- separation between property and control of firms: monopolist is a manager, who responds to the share-holders
- Acemoglu, Aghion and Zilibotti (2006): η and γ as functions of investments by entrepreneurs and contractual arrangement between firms and entrepreneurs.
- Two types of entrepreneurs: high-skill and low-skill.
- When entrepreneur starts a business, skill level is unknown, revealed over time through subsequent performance.

- **high-skill:** manager-monopolist has a 'talent for novelty' (R&D activity)
- **low-skill:** manager-monopolist does not have 'talent for novelty'

- To improve its bargaining position with shareholders the old manager accumulates a stock of retained earnings providing a collateral, yielding easier access to credit markets

- Compared to a young outsider, the old manager has more ‘experience’, has proved ‘reliable’ and has more ‘acquaintance’ with credit institutions

- Firing a ‘untalented’ old entrepreneur comes at the cost of lowering firm capacity to finance investments on the credit market

- credit market imperfections assign more power to old managers in their bargaining with shareholders

Two institutional arrangements: regulation versus selection in the managerial market

- Two types of "growth strategies"
  - $R = 0$: *selection*: replace any entrepreneur that is revealed to be low skill.
    - ★ high degree of turning (creative destruction) and large number of young entrepreneurs
  - $R = 1$: maintain experienced entrepreneurs
    - ★ organization of firms relying on "longer-term relationships", emphasis on experience and cumulative earnings, less creative destruction.

Two growth strategies:

$(\bar{\eta}, \underline{\chi})$ **Pro imitation policy** ⟶ **favour experience**

$(\underline{\eta}, \bar{\gamma})$ **Pro innovation policy** ⟶ **favour selection of talent**

$$a(t) = [\bar{\eta}/(1+g)] + [\underline{\chi}/(1+g)]\, a(t-1) \quad \text{if } R = 1$$

$$a(t) = [\underline{\eta}/(1+g)] + [\bar{\gamma}/(1+g)]\, a(t-1) \quad \text{if } R = 0$$

Two growth strategies **Assumptions:**

$a(t) = [\underline{\eta}/(1+g)] + [\bar{\gamma}/(1+g)]\, a(t-1)$ if R = 0

$a(t) = [\bar{\eta}/(1+g)] + [\underline{\gamma}/(1+g)]\, a(t-1)$ if R = 1

→ *convergence to* $a = \underline{\eta} / (1 + g - \bar{\gamma}) = 1$ if R^0

→ *convergence to* $a = \bar{\eta} / (1 + g - \underline{\gamma}) < 1$ if R^1

this follows from: $\bar{\eta} + \underline{\gamma} < (1+g) = \underline{\eta} + \bar{\gamma}$

Growth maximizing strategy

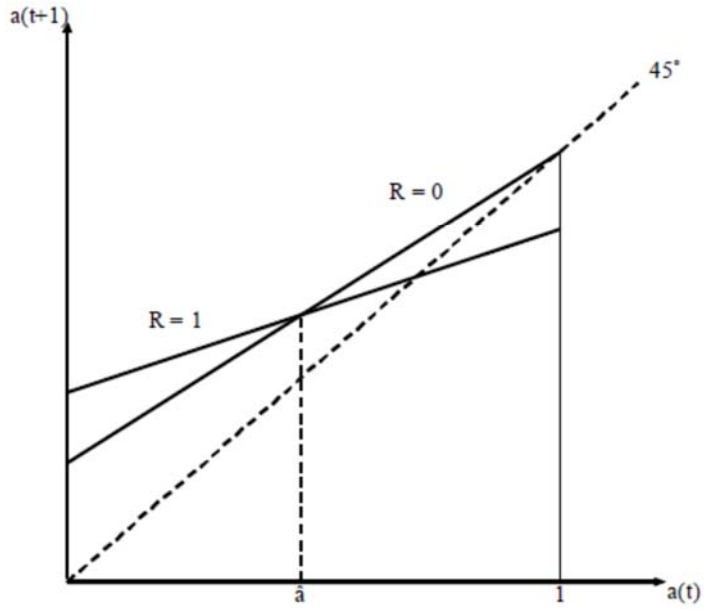


Figure: The growth-maximizing threshold and the dynamics of the distance to frontier in the growth-maximizing equilibrium.

Growth maximizing strategy

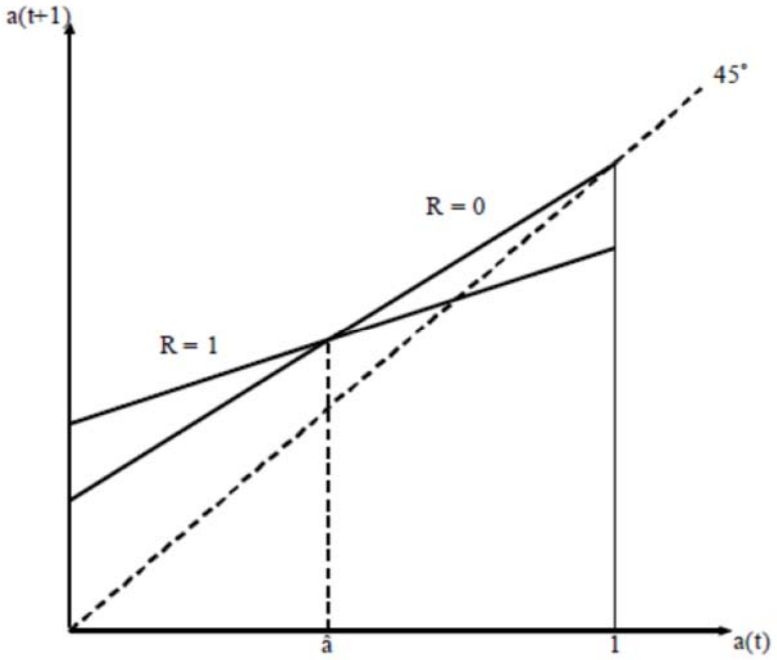
There is a critical value $\hat{a}$ such that if:

$a(t-1) = \hat{a}$	then	$[a(t) \mid R^1] = [a(t) \mid R^0]$
$a(t-1) < \hat{a}$	then	$[a(t) \mid R^1] > [a(t) \mid R^0]$
$a(t-1) > \hat{a}$	then	$[a(t) \mid R^1] < [a(t) \mid R^0]$

$$[\bar{\eta}/(1+g)] \quad + \quad [\underline{\gamma}/(1+g)]\,\hat{a} \quad =$$
$$[\underline{\eta}/(1+g)] \quad + \quad [\bar{\gamma}/(1+g)]\,\hat{a}$$

$$\bar{\eta} + \underline{\gamma}\,\hat{a} = \underline{\eta} + \bar{\gamma}\,\hat{a}$$

$$\hat{a} \equiv \frac{\bar{\eta} - \underline{\eta}}{\bar{\gamma} - \underline{\gamma}} \in (0, 1)$$



- a < â implies that R = 1 (long-term contractual relations) is growth maximizing
- a > â implies that R = 0 (selection, high competition) is growth maximizing
- Growth-maximizing sequence of strategies: start with $R = 1$ and then switch to $R = 0$.

- *Growth-maximizing equilibrium*:

$$R(t) = \begin{cases} 1 & \text{if} \quad a(t-1) < \hat{a} \\ \\ 0 & \text{if} \quad a(t-1) \geq \hat{a} \end{cases}$$

  - Economy achieves upper envelope of the two lines in Figure
  - No possibility of outside intervention to increase growth rate.
  - Economy starting with $a(0) < 1$ always achieves a growth rate greater than g, and ultimately $a(t) \to 1$.
  - Economy first starts with a particular set of organizations/institutions, corresponding to $R = 1$.
  - Then, consistent with Kuznets' vision, change in organizational form and growth strategy, and switches to $R = 0$.
  - Here structural transformation implies long-term relationships disappearing and replaced by shorter-term relationships, greater competition, and better selection.

Equilibrium sequence may not be growth maximizing

- In imitation-based regime: incumbent entrepreneurs are sheltered from the competition of younger entrepreneurs.
- In innovation-based regime: organizational form relying on greater selection and greater emphasis on maximizing innovation at expense of experience, imitation and investment.
- Have not specified what the equilibrium sequence of $\{R(t)\}_{t=0}^{\infty}$ is.
- Equilibrium behavior involves selection of entrepreneurs as well as functioning of credit markets.
- Four configurations which may arise under different institutional settings.

Market Equilibrium sequence $\{R(t)\}_0^{\infty}$

- Depends on the choice of strategy by shareholders evaluating net benefits from not firing old 'unskilled' manager, against net benefits from assuming young manager:

old 'unskilled' manager:	young manager:
higher experience (faster imitation)	no experience (slower imitation)
accumulated retained earnings	no past retained earnings
age-based remuneration K	no age-based remuneration
no talent at innovation	higher <u>expected</u> innovation performance

Strategy choice

- Relative weight of incentives to favor replacement or experience determines:

  Size of critical $a_r(\delta)$ such that:

  R = 1 is adopted if $a(t-1) < a_r(\delta)$
  R = 0 is adopted if $a(t-1) > a_r(\delta)$

- $\delta = \delta(\chi)$ constrained monopoly profit

- δ higher $\rightarrow$ monopoly profit higher $\rightarrow$ retained earnings higher $\rightarrow$ $a_r(\delta)$ higher (greater incentives to 'keep' old untalented but experienced managers)

- incentive to adopt R = 1 stronger if share of retained earnings μ is higher

Strategy choice: 'market' selection of $a_r(\delta)$

Here 'market' selection reflects the interests of shareholders

$\rightarrow$ at a given δ, $a_r(\delta)$ is higher if:

- proportion μ of retained earnings is higher
- credit market imperfections are stronger
- age-based (rather than performance based) extra payment to old manager is lower

If $a_r(\delta)$ is higher, the policy shift $R^1 \rightarrow R^0$ occurs at a higher $a(t-1)$

Remark:

- Self-reinforcing effect of product market competition ($1/\delta$) on the 'market' selection of competition policy $a_r(\delta)$.
- If δ is higher (lower product market competition), firms' retained earnings are higher and this provides more incentive to confirm the experienced, but inefficient, managers. $a_r(\delta)$ is higher
- If δ is lower (higher product market competition), firms' retained earnings are lower and this provides more incentive to fire the experienced, but inefficient, managers. $a_r(\delta)$ is lower
-

Underinvestment equilibrium

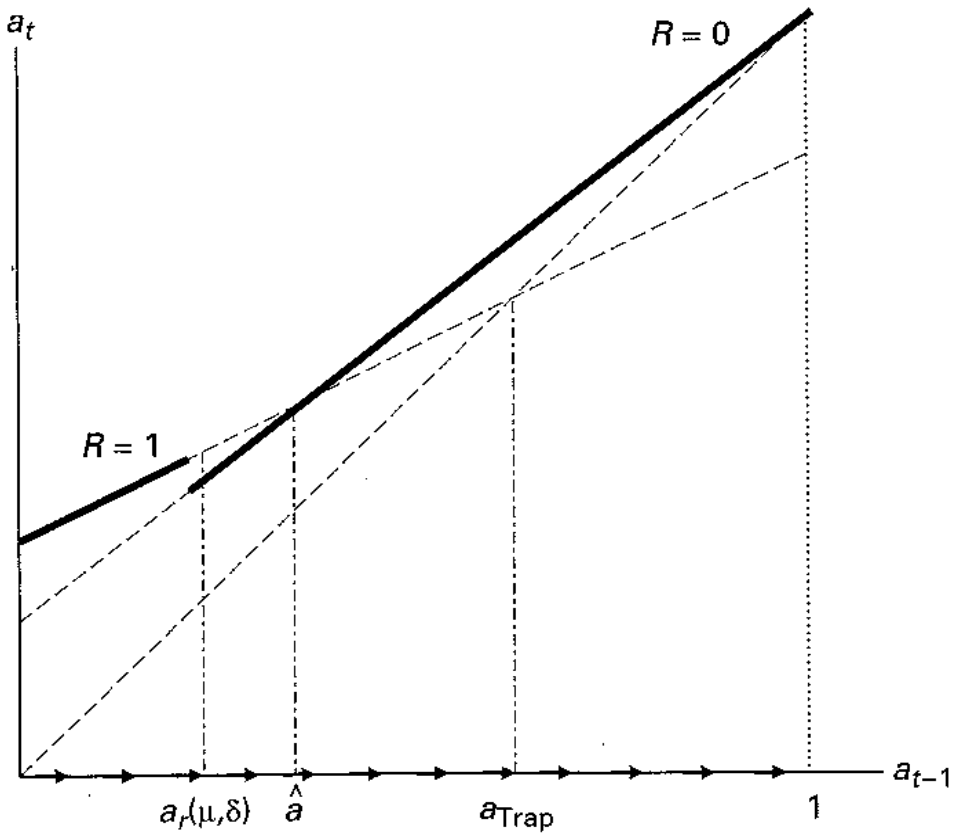


Figure 11.4

- *Underinvestment equilibrium*:

$$R(t) = \begin{cases} 1 & \text{if} \quad a(t-1) < a_r(\delta) \\ 0 & \text{if} \quad a(t-1) \geq a_r(\delta) \end{cases}$$

where $a_r(\delta) < \hat{a}$.

- $a_r(\delta) < \hat{a}$ is more likely to happen when:
  - greater competition in product market lowers retained earnings
  - greater competition in credit markets makes 'collateral' less relevant

Government intervention through competition policy…

- Competition in product market has an indirect effect on the equilibrium, $a_r(\delta)$.
- Higher level of δ, lower competition in product market (i.e., higher χ), increase $a_r(\delta)$: close the gap between $a_r(\delta)$ and $\hat{a}$.
- But reducing competition will create static distortions (because of higher markups), and can have much more detrimental effects on growth.

Sclerotic equilibrium

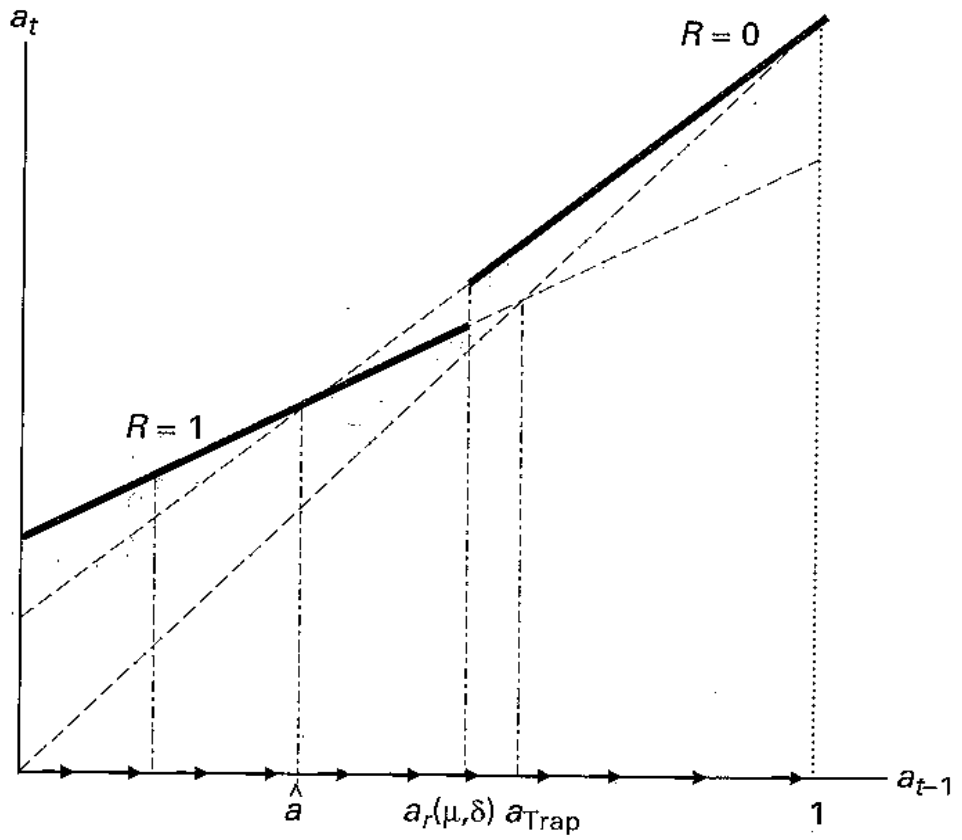
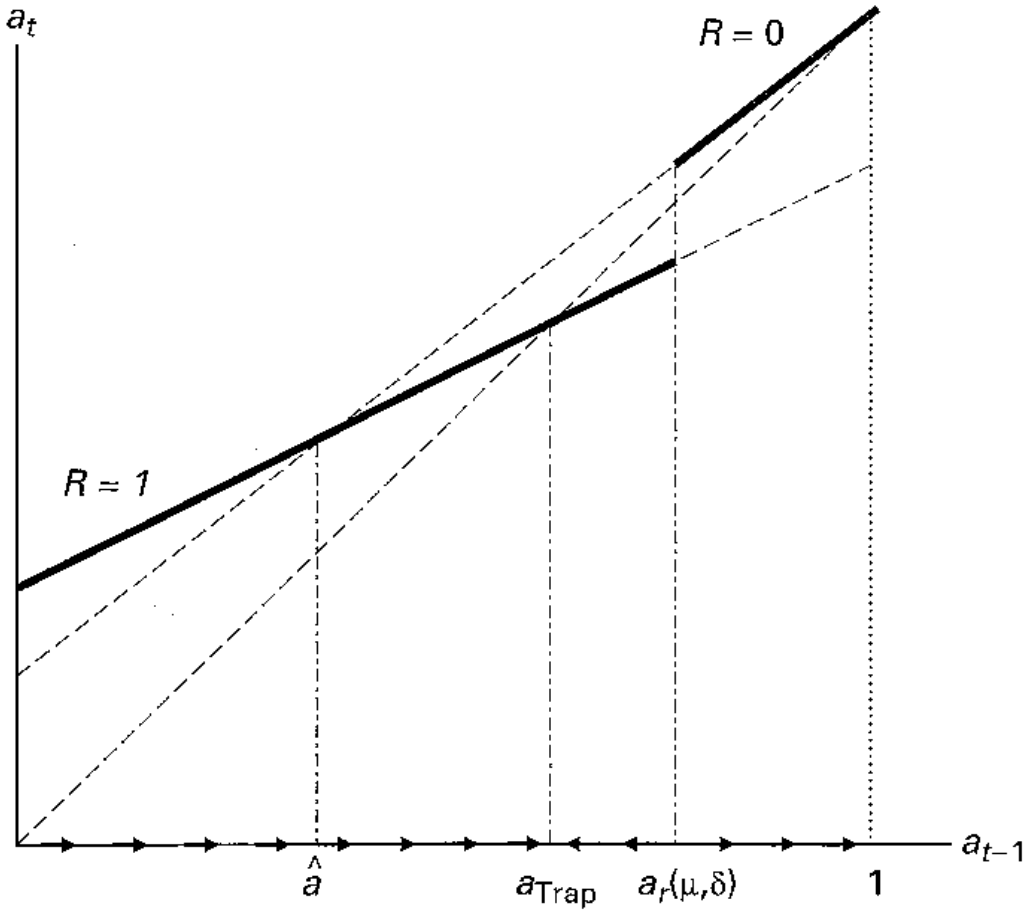


Figure 11.5

- *Sclerotic equilibrium*: $a_r(\delta) > \hat{a}$, so that incumbent low-skill, low-productivity firms survive even when potentially damaging to economic growth.
  - Can also arise in equilibrium because retained earnings of incumbent entrepreneurs act as a *shield* against creative destruction.
  - Economy fails to achieve maximum growth rate for a range $a \in (\hat{a}, a_r(\delta))$: innovation-based regime would be growth-maximizing, but economy is stuck with imitation-based.
  - Also pattern in line with Kuznets's vision and also convergence to $a = 1$.
- Convergence to a = 1 occurs because straight line R = 1 crosses 45° line at $a(t-1) > a_r(\delta)$

Low productivity trap



- Define: $a_{trap} \equiv$ intersection of straight line R = 1 with 45° line.

$$a_{trap} \equiv \frac{\bar{\eta}}{1+g-\underline{\gamma}}.$$

$$a_{trap} > \hat{a}$$

- Non-convergence trap equilibrium occurs if $a_r(\delta) \geq a_{trap}$

  - if $a(t-1) = a_{trap}$ and R = 1 the economy will remain in a_{trap}
    if $a(t-1) < a_r(\delta)$ and R = 1 the economy will converge to a_{trap} and remain there

Non convergence trap

- Experience of incumbent firms afford them so much protection that the economy never transitions to $R = 0$.
- Only equilibrium pattern in which the economy fails to converge to the frontier.
- With $R = 1$, economy does not grow beyond a_{trap}, and at this distance to frontier, equilibrium keeps choosing $R = 1$.
- Encouraging imitation-based growth, may appear as a good policy but condemns economy to non-convergence.
- NO Kuznetsian structural transformation: the resulting economy is underdeveloped.

Conclusions

- No presumption that the efficient sequence of growth-maximizing strategies will be pursued.
- Government intervention with pro-regulation policies limiting competition and protecting incumbents can be growth promoting if $\alpha_r(\delta) < \hat{\alpha}$
- It may prove difficult reversing such polcies and this may lead to $\alpha_r(\delta) \geq \hat{\alpha}$ causing slower convergence to the frontier $a(t) = 1$ or, worse…
- It may cause $\alpha_r(\delta) \geq \alpha_{trap}$ and a consequent underdevelopment trap which can be removed only through policies lowering $\alpha_r(\delta)$, namely anti-regulation and pro-competition policies in product and credit markets.