# The Romer Model:
# Policy Implications

Prof. Lutz Hendricks

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# Policies have level effects

What are the effects of government policies?

We may expect policies to affect saving ($s_K$), R&D ($s_A$), or population growth ($n$).

Consider the case of $\phi < 1$, where growth is

$$g(A) = \frac{\lambda \ n}{1 - \phi} \tag{1}$$

**Main result**: Policies that affect only saving or investment in R&D ($s_A$) do not affect long-run growth.

Note: For policies that do not affect R&D the model behaves exactly like the Solow model.

# R&D Subsidies

Consider a permanent increase in $s_A$.

We must consider two equations:

$$g(A) = B \ (s_A L)^{\lambda} \ A^{\phi-1} \tag{2}$$

$$\dot{K} = s_K \ Y - d \ K \tag{3}$$

Note: Behavior of $A$ is independent of $K$ and $Y$.

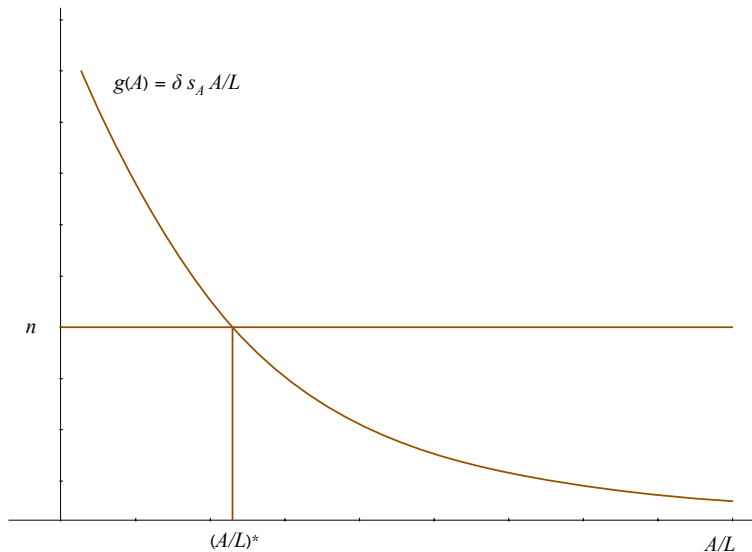Simplify by assuming $\lambda = 1$ and $\phi = 0$ so that

$$g(A) = B \ s_A \ L \ / \ A \tag{4}$$

Balanced growth rate:

$$g(A) = n$$

# R&D Subsidies

## Steady state and stability



$g(A) = \delta \, s_A \, A/L$
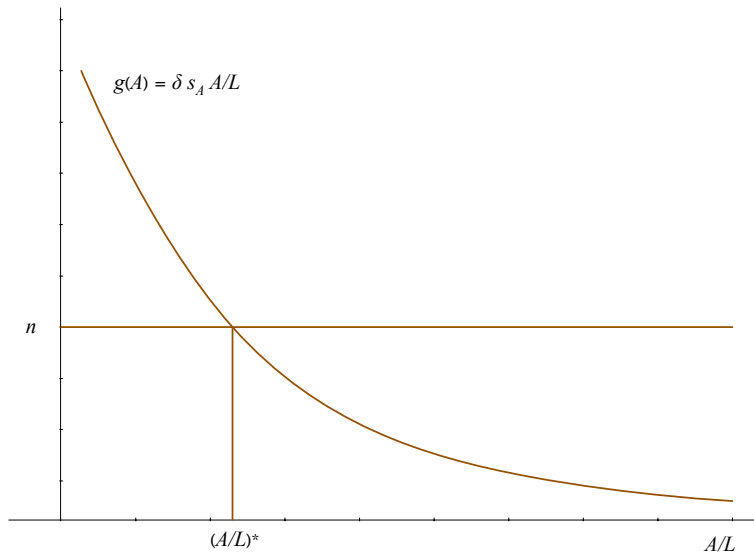
$n$

$(A/L)^*$

$A/L$

# R&D Subsidies

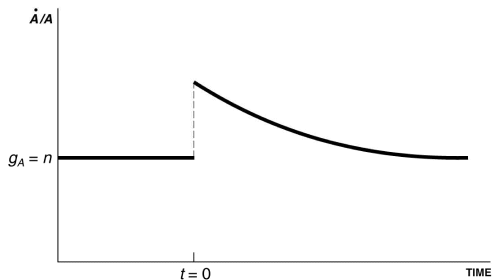- On a BGP, (4) determines $A/L$:

$$(A/L)^* = \frac{B \, s_A}{g(A)} = \frac{B \, s_A}{n} \tag{5}$$

- As long as $L/A$ is above BGP, $g(A) > n$ is above BGP.
- Therefore, $g(A)$ declines over time until it reaches $n$.

# Transition path after an increase in $s_A$



$g(A) = \delta\, s_A\, A/L$

$n$

$(A/L)^*$

$A/L$

# Time path of the growth rate of ideas

*Economic Growth,*
Copyright © 2004 W. W. N

A period of faster innovation builds up more ideas.
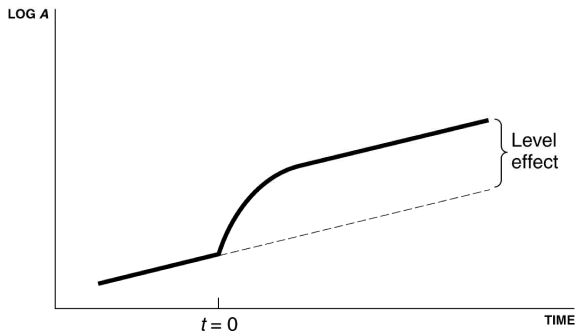
# Time path of A



**FIGURE 5.3 THE LEVEL OF TECHNOLOGY OVER TIME**

*Economic Growth,*
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Eventually growth levels off, but the higher level of $A$ remains forever.

# Policy implications

- Patent protection, R&D subsidies, and other policies affect $s_A$.
- These policies can raise the growth rate of output, although not in the long run.
- Policies do affect long-run levels of $Y/L$.

# Gains From Openness

- Traditional trade theory implies that gains from trade are small.
- The Romer model has a new channel for gains from trade.
- The idea:
  - each firm invests in technology capital $A$
  - closed economy: $A$ can be used in all domestic locations
  - open economy: $A$ can be used in more locations
  - productivity rises due to increasing returns to scale

# Evidence: Gains From Openness

Idea: do countries that open up grow faster?



%110

1973 JOINERS

Denmark
Ireland
U.K.

100

90

80

70

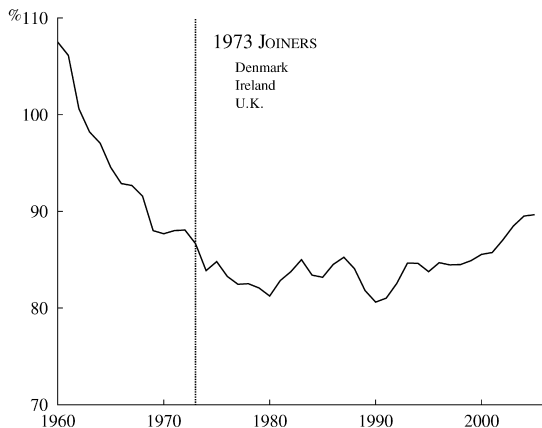1960     1970     1980     1990     2000

Fig. 2. 1973 joiners' labor productivity as a percentage of EU-6 (1960–2005).

Source: McGrattan and Prescott (2009)
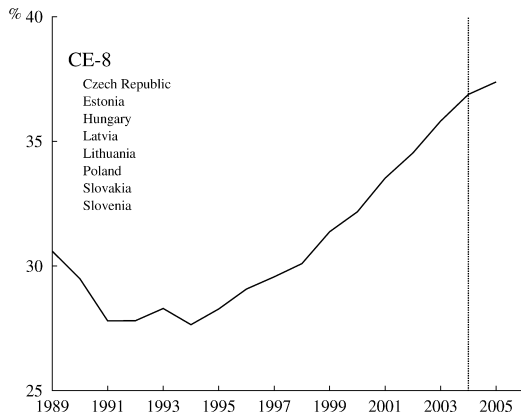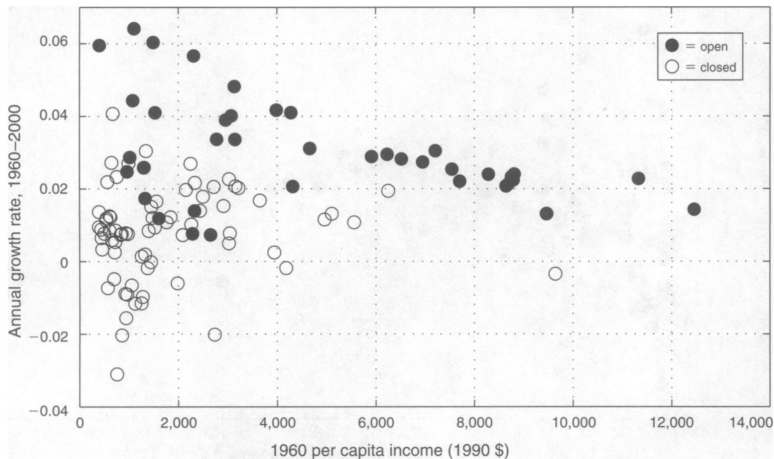
# Evidence: Gains From Openness



Fig. 5. CE-8 labor productivity as a percentage of EU-6 (1989–2005).

Source: McGrattan and Prescott (2009)

# Evidence: Gains From Openness



Lucas (2009): open economies converge to the frontier country.

# Summary

- Innovations are produced just like regular goods, but they are non-rival.
- Therefore, we have scale effects: larger markets support more rapid innovation.
- The growth rate of $Y/L$ is proportional to the population growth rate.
- A one-time increase in R&D effort (higher $L_A$) raises the rate of innovation permanently.
    - But this is not enough to sustain higher long-run growth.
- Policies only have level effects.

# Final Example

What is the effect of a permanent increase in

1. research productivity (easy)
2. population (holding $k$ fixed or not)
3. population growth (Europe)

# Reading

- Jones (2013b), ch. 5.

Optional:

- Romer (2011), ch. 3.1-3.4
- Jones (2013a), ch. 6

# Advanced Reading

- Jones (2005) talks in some detail about the economics of ideas.
- Lucas (2009) and McGrattan and Prescott (2009) on openness and growth

# References I

Jones, C. I. (2005): "Growth and ideas," *Handbook of economic growth*, 1, 1063–1111.

——— (2013a): *Macroeconomics*, W W Norton, 3rd ed.

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Lucas, R. E. (2009): "Trade and the Diffusion of the Industrial Revolution," *American Economic Journal: Macroeconomics*, 1–25.

McGrattan, E. R. and E. C. Prescott (2009): "Openness, technology capital, and development," *Journal of Economic Theory*, 144, 2454–2476.

Romer, D. (2011): *Advanced macroeconomics*, McGraw-Hill/Irwin.