EC569 Economic Growth
Seminar 4

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Question

According to Chad Jones (2017), what new ideas did Romer bring about new ideas?

Assigned reading:

Chad Jones, “New ideas about new ideas: Paul Romer, Nobel laureate” VOX, 12 October 2018

In what key aspects Romer's endogenous growth model differ from Solow's exogenous growth model?

Technological change

is a result of efforts by

- researchers
- entrepreneurs
- inventors

who respond to economic incentives such as

- tax policy,
- research funding,
- education policy,
- intellectual property rights.

With these policies one can potentially impact economic growth.

How are ideas different than goods?

Ideas

- are non-rivalrous
  - not depleted by use
  - technologically possible to be used by any number of people at a time
- Leads to increasing returns to scale
  - production with rivalrous goods and ideas together exhibit increasing returns
- Necessitates imperfect competition

Question

According to Bloom, Van Reenen and Williams (2019)

1. Why should governments promote innovation?
2. What are the main policy tools to promote innovation?
3. How effective are these tools in promoting innovation?

Assigned Readings

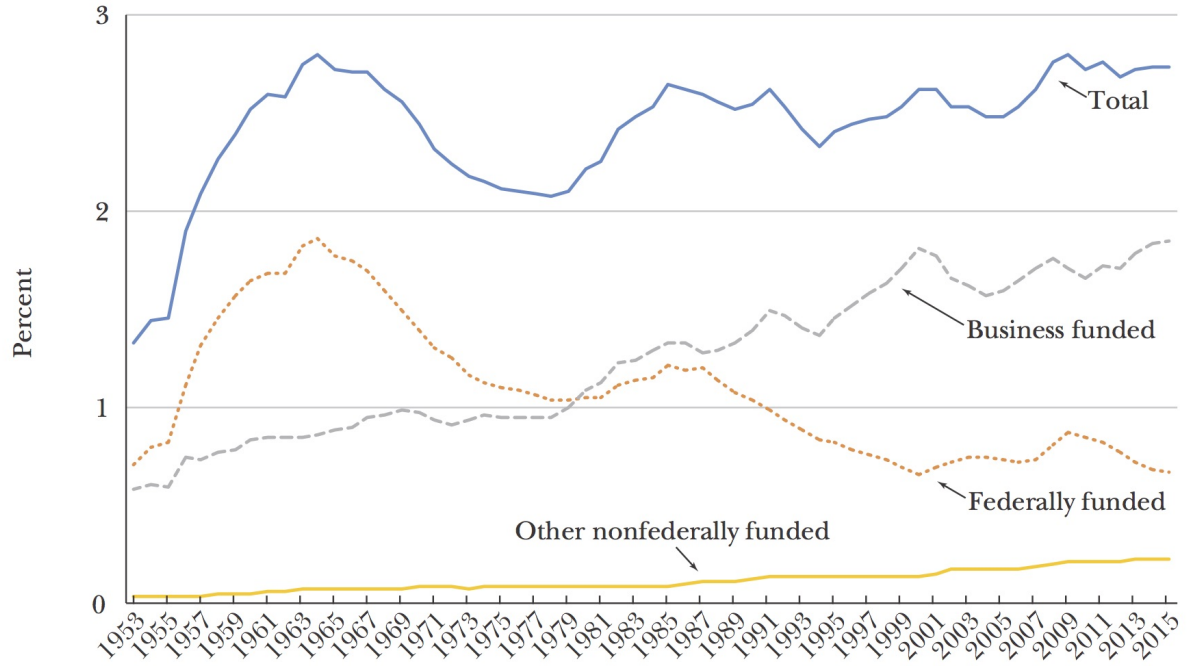
Bloom, N., Van Reenen, J., & Williams, H. (2019). A toolkit of policies to promote innovation. Journal of Economic Perspectives, 33(3), 163-84.

What is the motivation of this paper?

US R&D as a share of GDP

Figure 1

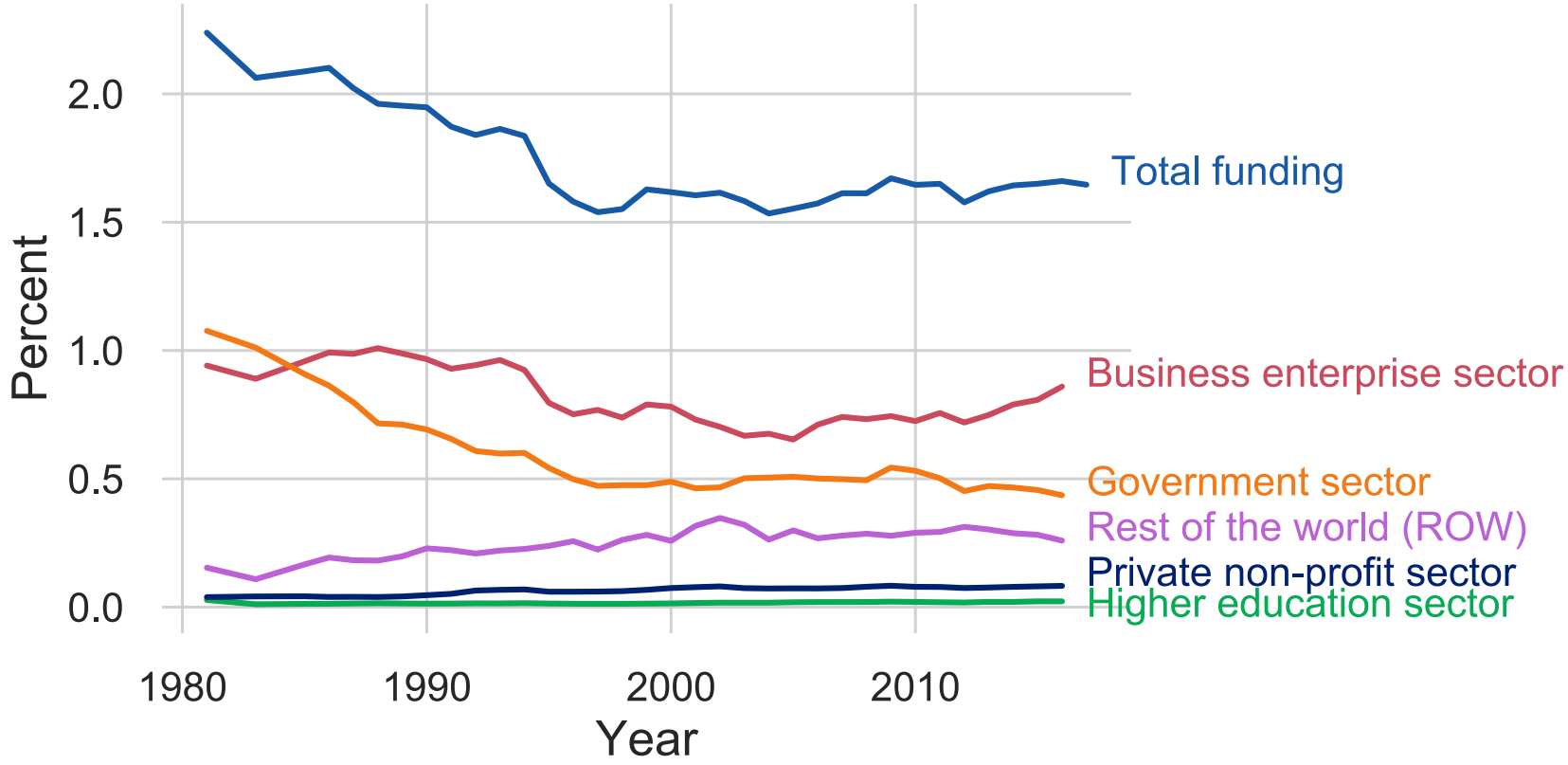
US Research and Development as a Share of GDP, by Source of Funds: 1953–2015



Source: This figure displays data from figure 4-3 of National Science Board (2018), chap. 4. The original data are drawn from the National Science Foundation, National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series).

Notes: The figure shows how spending on R&D performed in the United States, presented as a share of GDP, has evolved over time from 1953 to 2015, in total and broken down by source of R&D funding.

UK R&D as a share of GDP by source of funds



Source: OECD and own calculations

Table 1

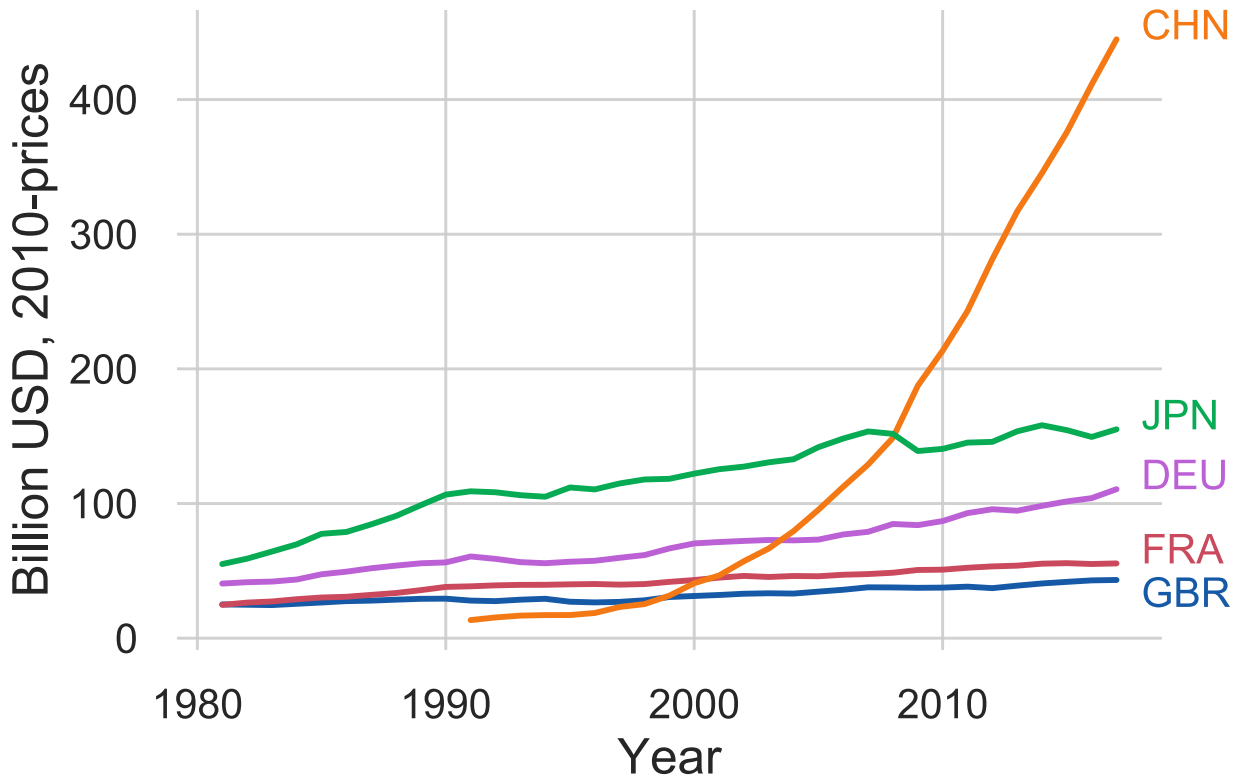
International Comparison of Research and Development Expenditures in 2015

Country	*R&D expenditures (billions of US$)*	*R&D/GDP (%)*
United States	496.6	2.7
China	408.8	2.1
India	50.3	0.6
Japan	170.0	3.3
Germany	114.8	2.9
Russia	38.1	1.1
Brazil	38.4	1.2
France	60.8	2.2
United Kingdom	46.3	1.7
Indonesia	2.1	0.1
OECD (average)	34.7	2.4

Source: These data are drawn from table 4-5 of National Science Board (2018), chap. 4. The original data are drawn from the OECD, Main Science and Technology Indicators (2017/1); United Nations Educational, Scientific, and Cultural Organization Institute for Statistics Data Centre (http://data.uis.unesco.org/; accessed October 13, 2017).

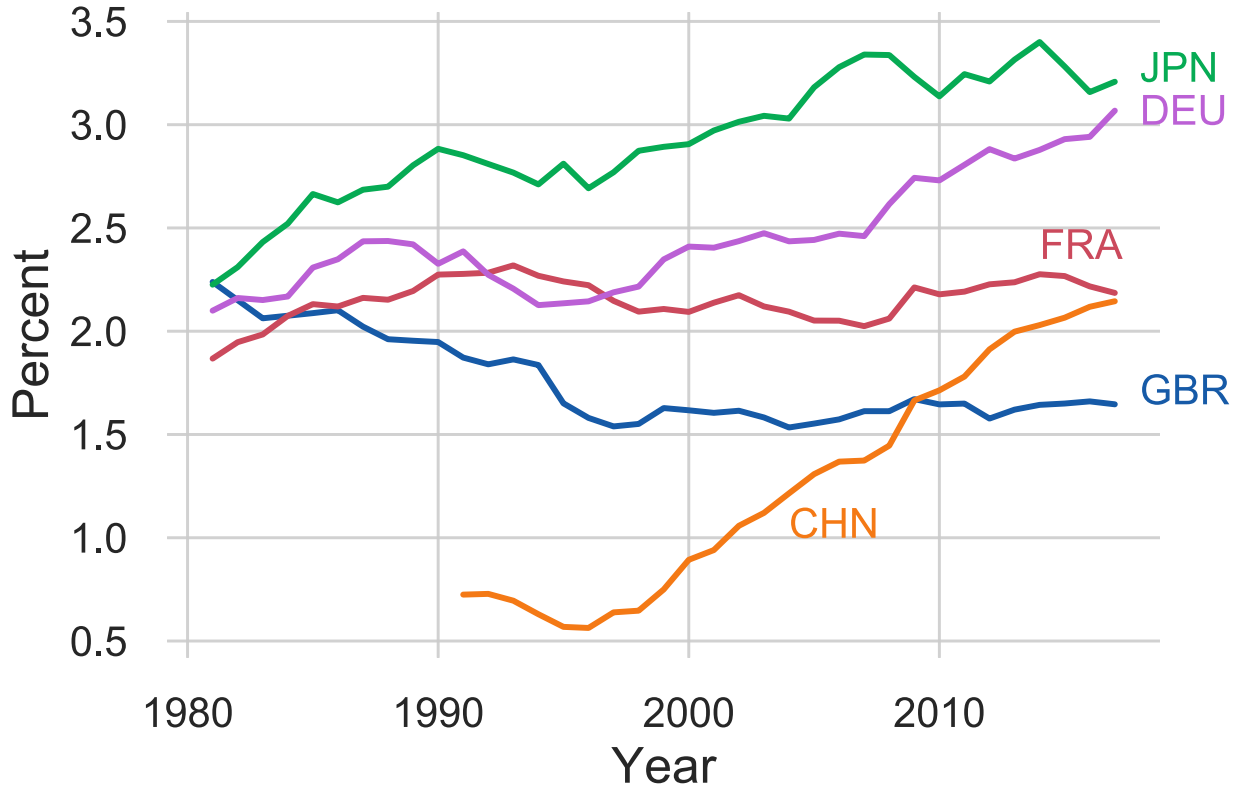
Notes: This table displays data on gross domestic expenditures on R&D (reported in purchasing power parity adjusted billions of US dollars) and R&D as a share of GDP for the United States, the nine other countries with the largest GDP in 2015, and the OECD average (averaged over all 36 member countries as of 2015).

R&D expenditures in different countries



Source: OECD and own calculations

R&D as a share of GDP in different countries



Source: OECD and own calculations

Why should governments promote innovation?

Justifications for government involvement in innovation market?

- Knowledge spillovers
  - Other firms can copy and learn from the original research
  - "Even with a well-designed intellectual property system, the benefits of new ideas are difficult to monetize in full."
  - Marginal social benefit of innovation is greater than marginal private benefit of innovation
  - In the market economy, there is too little innovation
- Product market spillovers
  - *Business-stealing* effect
  - "Inventor firms may steal market share from other firms without necessarily generating any social benefit."
  - In the market economy, there is too much innovation

Social returns to R&D

> "As a whole, this literature on spillovers has consistently estimated that social returns to R&D are much higher than private returns, which provides a justificatin for government policy."

Lucking, Bloom, and Van Reenen (2018) estimate that, in the US

- social returns to R&D in the United States are about 60 percent
- private returns are about 15 percent

Why not just give property rights to inventors

- Patents have efficiency loss
  - enables firms to have high markups
- Other firms can invent around patents

Failures in other markets

- Financial constraints limit innovation
- Since intellectual property is intangible, it's harder to use it as collateral
- Equity financing has challenges:
  - You cannot reveal your innovative idea before you actually patent it
  - You cannot get funding if you don't explain your idea

What are the main policy tools to promote innovation?

What are the main policy tools to promote innovation?

1. Tax incentives
2. Patent boxes
3. Human capital supply
4. Intellectual property
5. Product market competition and international trade
6. Targeting small firms
7. Moonshots

How effective are these tools in promoting innovation?

Summary of results

Table 2

Innovation Policy Toolkit

Policy	*Quality of evidence (1)*	*Conclusiveness of evidence (2)*	*Net benefit (3)*	*Time frame (4)*	*Effect on inequality (5)*
Direct R&D grants	Medium	Medium	💡💡	Medium run	↑
R&D tax credits	High	High	💡💡💡	Short run	↑
Patent box	Medium	Medium	Negative	NA	↑
Skilled immigration	High	High	💡💡💡	Short to medium run	↓
Universities: incentives	Medium	Low	💡	Medium run	↑
Universities: STEM supply	Medium	Medium	💡💡	Long run	↓
Trade and competition	High	Medium	💡💡💡	Medium run	↑
Intellectual property reform	Medium	Low	Unknown	Medium run	Unknown
Mission-oriented policies	Low	Low	💡	Medium run	Unknown

Source: The authors.

Notes: This is our highly subjective reading of the evidence. Column 1 reflects a mixture of the number of studies and the quality of the research design. Column 2 indicates whether the existing evidence delivers any firm policy conclusions. Column 3 is our assessment of the magnitude of the benefits minus the costs (assuming these are positive). Column 4 delineates whether the main benefits (if there are any) are likely to be seen in the short run (roughly, the next three to four years) or in the longer run (roughly ten years or more); NA means not applicable. Column 5 lists the likely effect on inequality.

Tax incentives

- Elasticity of R&D with respect to tax-price of R&D is about 1.

Concerns:

- relabelling existing expenditure as R&D
  - patenting and productivity also increases after tax credits
- relocation of R&D different locations to take advantage of tax credits
  - some evidence of relocation
  - relocation in itself does not account for all the increase in R&D

> "Overall, the conclusion from this literature is that despite some relocation across place, the aggregate effect of tax credits at the national level both on the volume of R&D and on productivity is substantial."

Patent boxes

Patent box: lower tax on revenues linked to patents as opposed to other revenues

- Used in 16 OECD countries as of 2017
- Firms can manipulate stated revenues from patents
- Choi (2019): 'such policies do not have on the real location or the quantity of either R&D or innovation'

> "In contrast to well-designed research and development tax credits – for which it is hard to manipulate the stated location of research labs – patent boxes should be discouraged."

Government research grants

- Harder to target R&D tax credits to maximize social benefit
- Target basic R&D
- Potential crowding out of private R&D
- Or adds in to private R&D spending (crowd-in)
- Jacob and Lefgren (2011): grants produce positive but small effects on research output
- Other resarchers: public R&D crowds in private R&D
- Positive impact of academic R&D on corporate patenting
- Government funding of own labs

Human Capital Supply

> "Increasing the quantity of innovative activity requires increasing the supply of workers with human capital needed to carry out research, as emphasized by Romer (2001)"

- Increase the number of individuals with STEM degrees
  - Bianchi and Giorcelli (2018): change in enrollment requirements in Italy $\rightarrow \uparrow$ STEM graduates $\rightarrow$ more innovation
- Migration
  - Immigrants in the US make up 18 percent of the labor force over age 25
  - Immigrants constitute 26 percents of STEM workforce
  - Immigrrants own 28 percent of higher-quality patents

> "Overall, most of the available evidence suggests that increasing the supply of human capital through expanded university programs and/or relaxed immigration rules is likely to be an effective innovation policy."

- Bell et al. (2019): children born into top 1 percent income distribution is 10 times as likely to be an inventor than children born into bottom half.
  - differences in innate ability explain only a little of the discrepency
  - differentiated exposure to inventors in childhood
  - better schooling, greater exposure to inventor role models, mentoring needed

Intellectual property

- Patents, copyrights, trademarks, ...

> "A patent grants – in exchange for disclosure of invention – a limited-term property right to an inventor, during which time the inventor has the right to exclude others from making, using, or selling their invention."

- Boldrin and Levine (2013) argue that patent system should be abolished
  - no evidence that patents increase innvation and productivity
- Social costs might be greater than social benefits
- Patent trolls

Product market competition and international trade

Theoretical impact of competition on innovation is ambiguous.

- Competition reduces innovation
  - The reward to innovation is monopoly profits.
  - Competition reduces profits and hence incentives to innovate.
  - Also reduces funds to finance innovation.
- Competition increases innovation
  - Monopolists have no incentive to innovate
  - An entrant has no rents to lose, so it can engage in destructive innovation
  - If competition reduces demand for a firm's products, it will be forced to innovate

Competition

- Empirical evidence suggests that competition increases innovation, especially in markets with low level of competition
  - In South America, Asia and Europe, competition from China increased innovation
  - In North America, competition from China reduced innovation in manufacturing
- Increase innovation by increasing the market size

> "Greater competition and trade opennes typically increase innovation."