I. A Model of Knowledge and the Economy

- Other observed inputs (e.g. labor, capital)
- Expected benefits of knowledge (e.g. economic growth)
- Output (e.g. Patents, publications)
- Research (e.g. R&D)
- Additions to knowledge

Unobserved influences
III. Measures of Research Inputs

- US R&D $402 billion in 2009
  - Real R&D expenditures grew 5.8%/year from 2004-09
III. Measures of Research Inputs

• Global R&D in 2009: $1,276 billion
  – Growing roughly 7% per year over last decade
  – One-half done in 3 countries:
    • US: $402 billion (31%)
    • China: $154 billion (12%)
    • Japan: $138 billion (11%)
  – Share of GDP devoted to R&D higher in high-income countries
    • US: 2.88%
    • Japan: 3.33%
    • Germany: 2.76%
    • China: 1.70%
    • Brazil: 1.08%
    • Egypt: 0.21%
IV. Measures of Research Outputs

U.S. Patent and R&D Trends

- Total R&D (millions 2005 US $)
- Domestic Patent Applications
- Domestic Patent Grants
IV. Measures of Research Outputs

• Share of publications (1997-2001)
  – US 34.86%
  – UK 9.43%
  – Japan 9.28%
  – Germany 8.76%
  – France 6.36%

• Share of citations
  – US 49.43%
  – UK 11.39%
  – Germany 10.02%
  – Japan 8.44%
  – France 6.89%
IV. Measures of Research Outputs

• Citations per publication 1993-2002
  – Switzerland 1.59 (ranked 14th for pub counts)
  – US 1.41
  – Denmark 1.33
  – Netherlands 1.33
  – UK 1.21

• This controls for the average quality of a publication

• The US moves to second, and the rest of the rankings change significantly.
IV. Measures of Research Outputs

• Publications in developing countries are growing

• Also note that there are more collaborations
  – 35% of articles in top journals are collaborations across countries