

# Estimating the Indirect Economic Benefits from Research

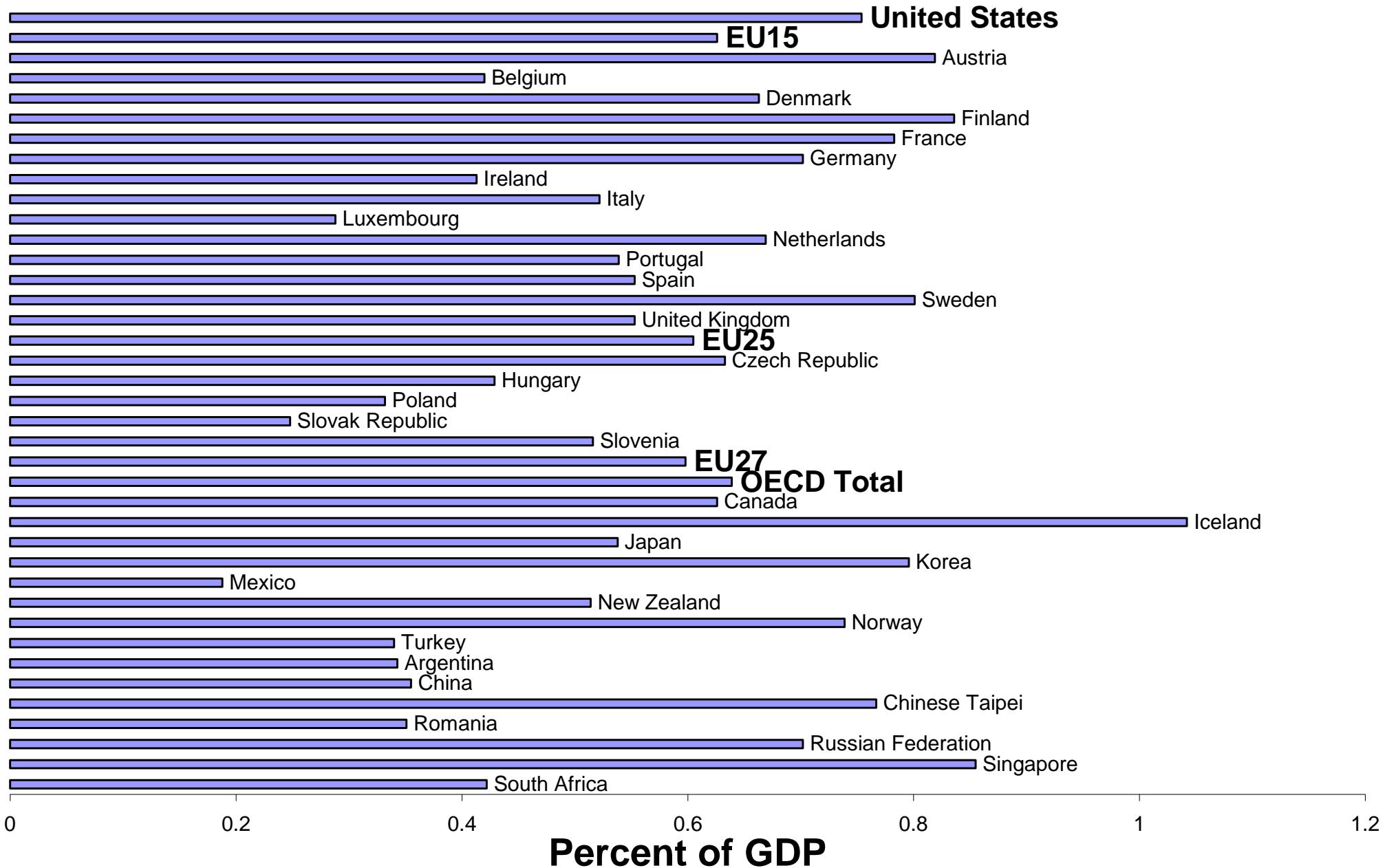
Bruce A. Weinberg  
Ohio State University, IZA, & NBER  
[www.bruceweinberg.net](http://www.bruceweinberg.net)

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# Background

- Governments are major supporters of research
- Research support increasingly justified by economic benefits, like Job Creation
- But the practical benefits of research are debated (even by scientists!) and no accepted methods

# Government Financed Gross GERD



# The Debate

- **Pro:** Research is engine of growth for Silicon Valley, Route 128
- **Con:** “There is considerable unease that the economic benefits of science spending are being oversold.” (Macilwain, 2010)
- Weak evidence on benefits of science

# Objectives

1. Lay out the ways in which research generates economic benefits
2. Outline how the economic benefits should and should not be estimated
3. Summarize the state of research
4. Point to directions for future work and useful data

# Take Homes

- Job creation is not the best way to estimate economic benefits of research
- Focus on productivity spillovers from research
- Some evidence for productive effects, but results are mixed at best
- Discuss issues estimating spillovers

# Types of Economic Benefits

1. Direct Benefits - Science is foundation for innovations (e.g. pharmaceuticals)
  - Many approaches with varying merits
  - Generally show large benefits
2. Spillover Benefits - Benefits beyond the value of innovations:
  - Better trained workforce
  - Ideas to solve industrial problems
  - Infrastructure/hub for innovation

# Estimating the Indirect Benefits

## 1. Job Creation

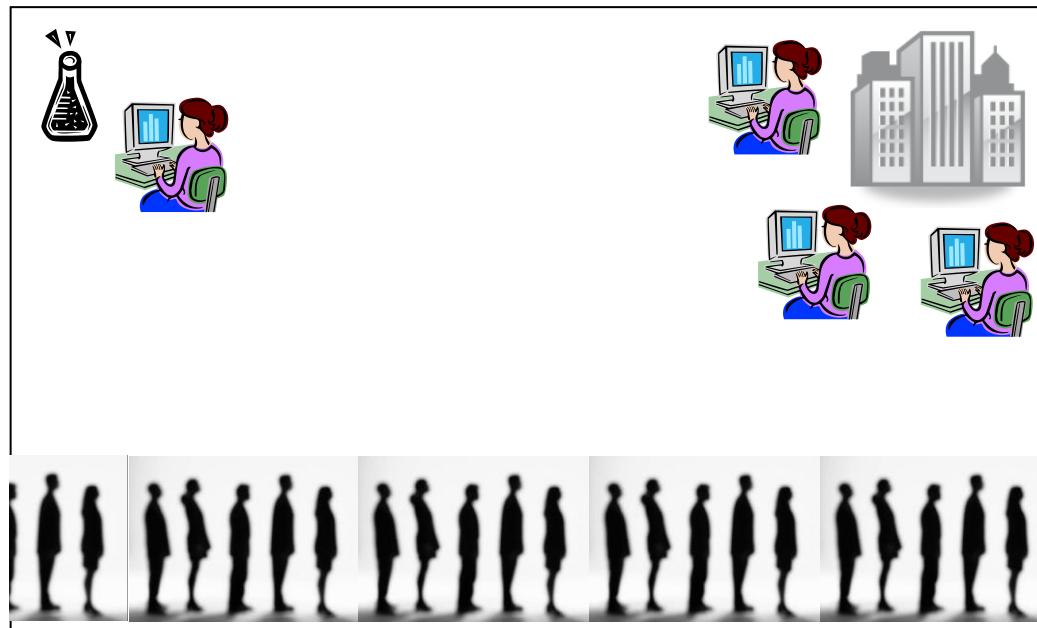
- Science employs people
- Poses fundamental and practical problems

## 2. Productivity Benefits

- Science raises productivity of local firms
- See if economic outcomes are better in cities with more scientific activity

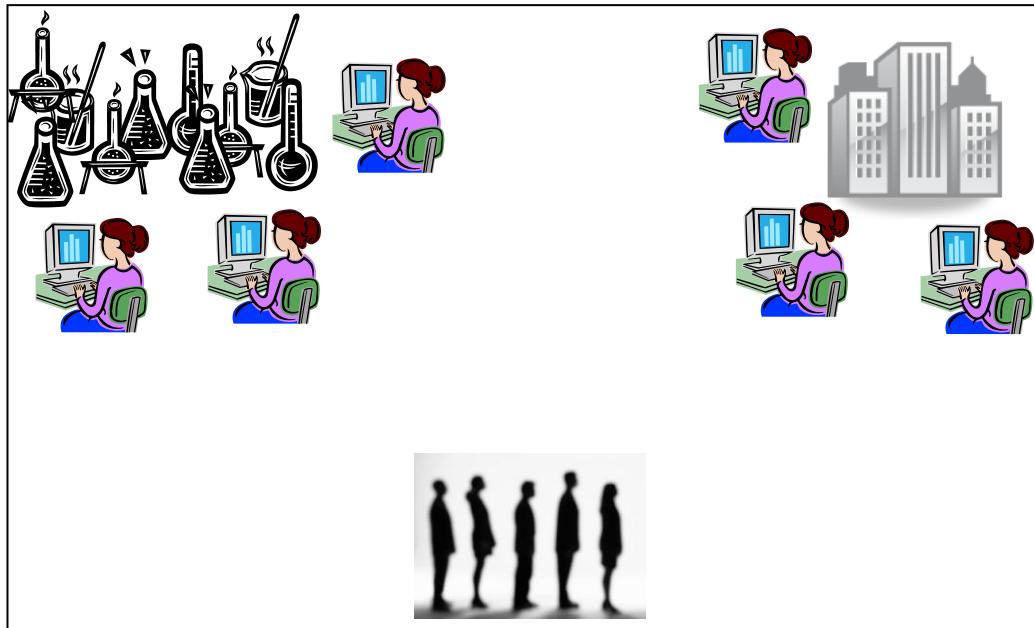
# Classic Job Creation View

- Lots of unemployed guys



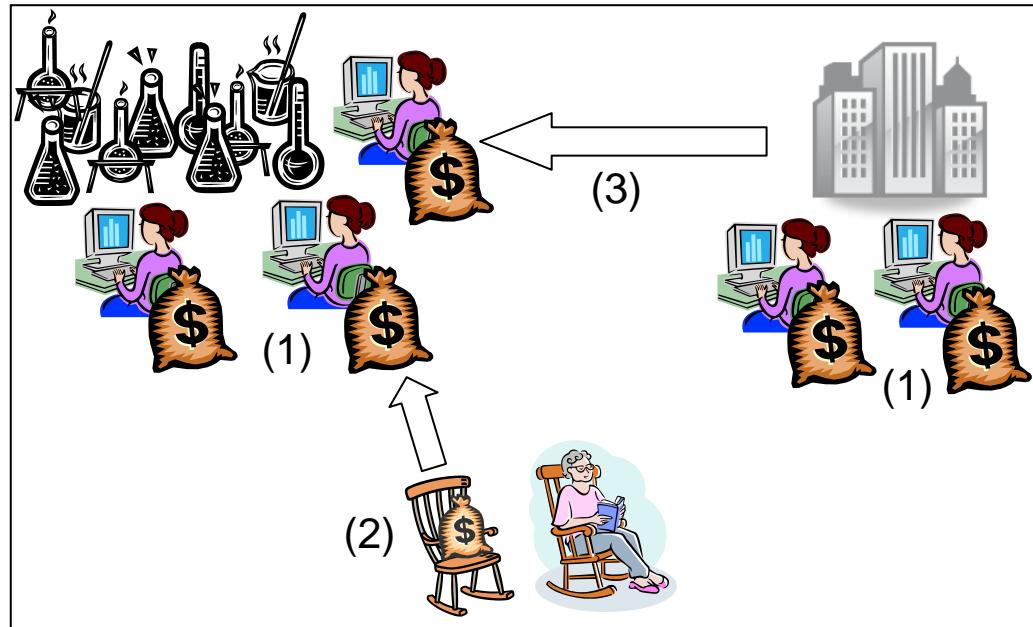
# Classic Job Creation View

- Invest in research and jobs get created



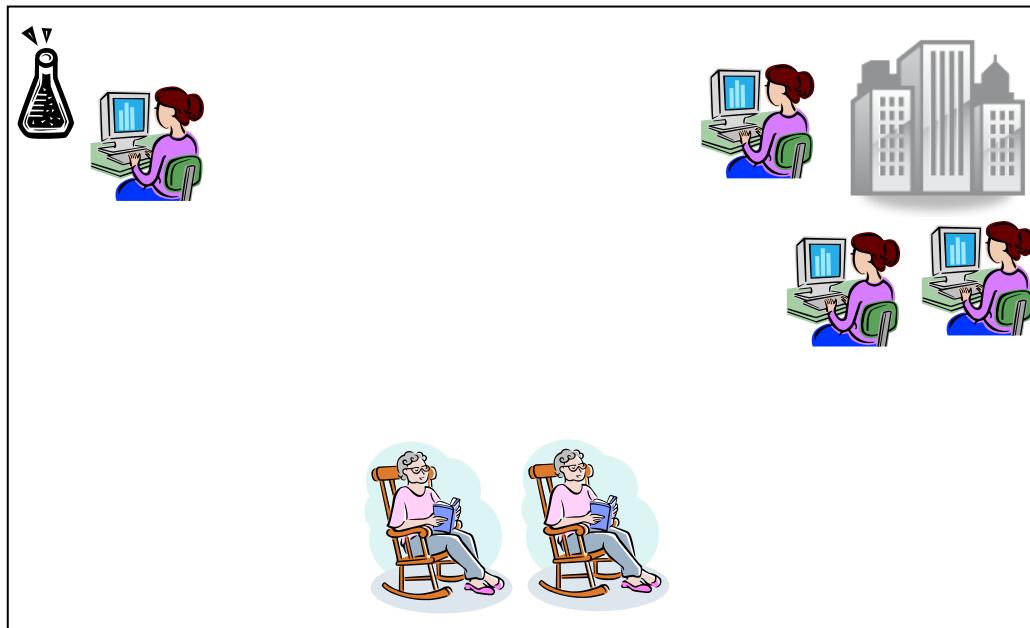
# Fundamental Job Creation Issues

1. Research raises pay as well as creating jobs
2. Hard to put a dollar value on new jobs
  - How much do workers value new jobs?
3. Research jobs created may displace other jobs



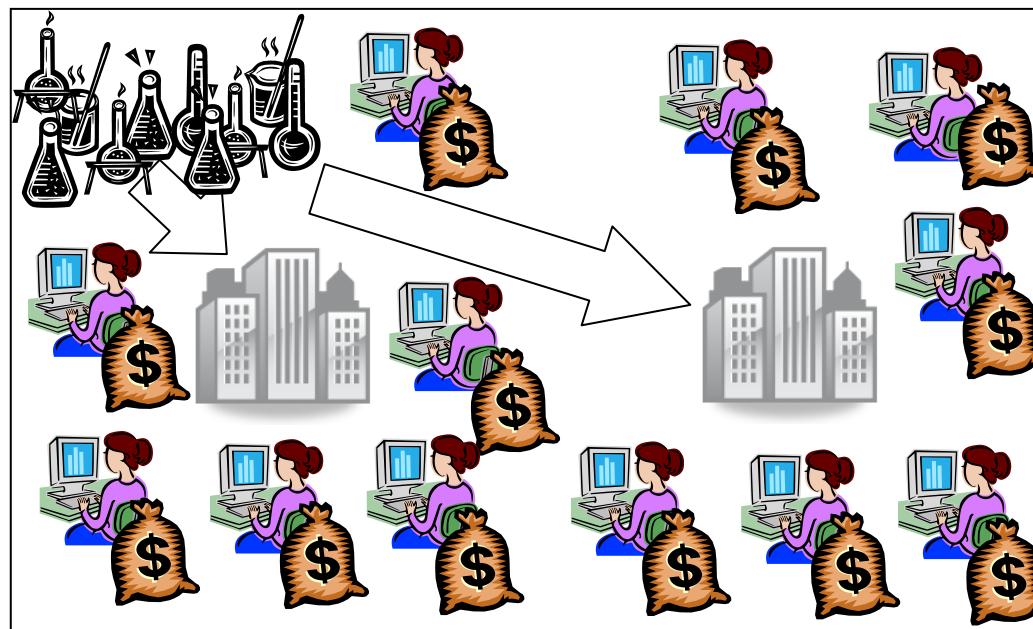
# Productivity View

- Research raises productivity at local companies through spillovers



# Productivity View

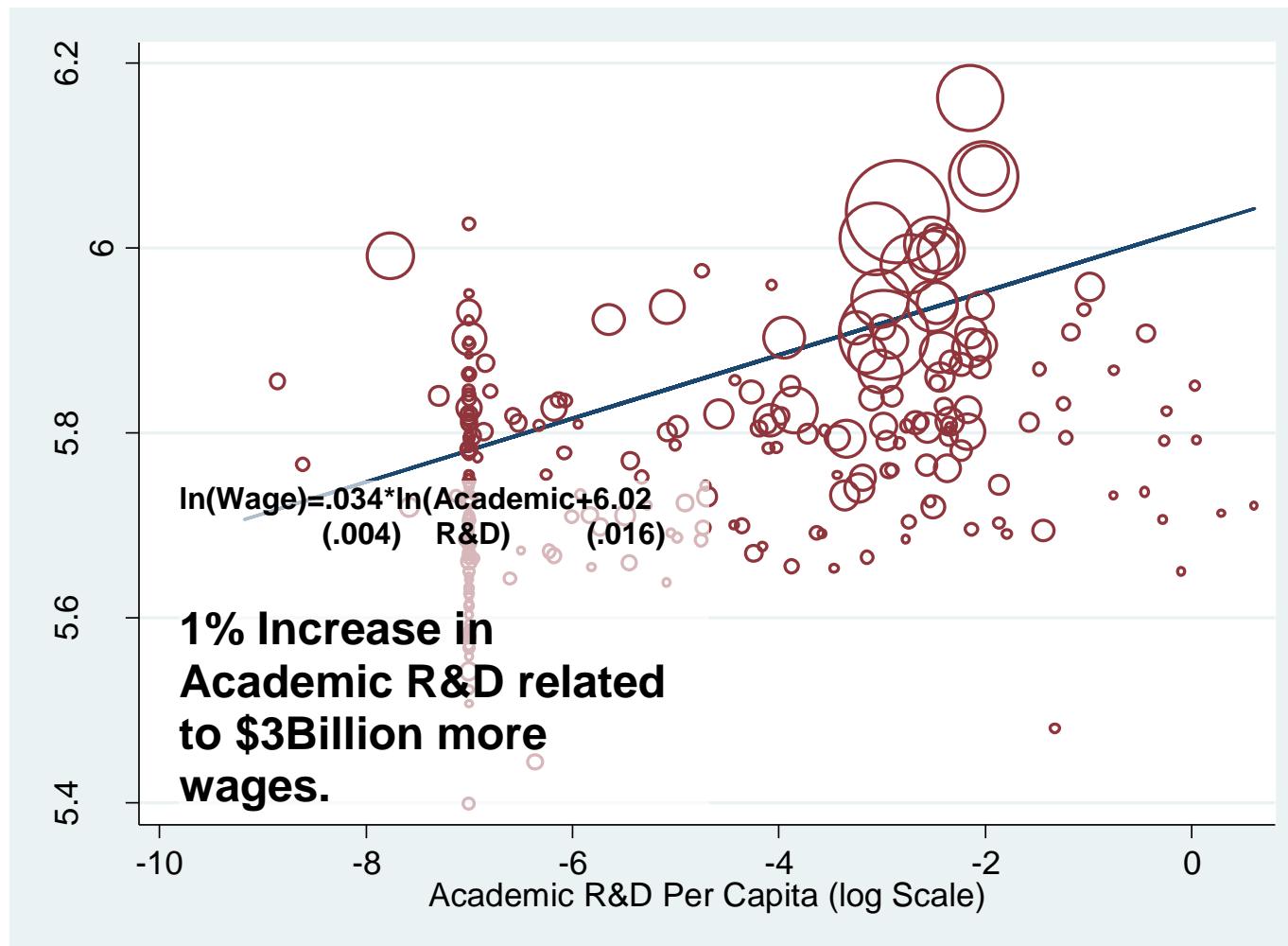
- Research increases productivity, wages, and employment at local firms
- Estimate those benefits



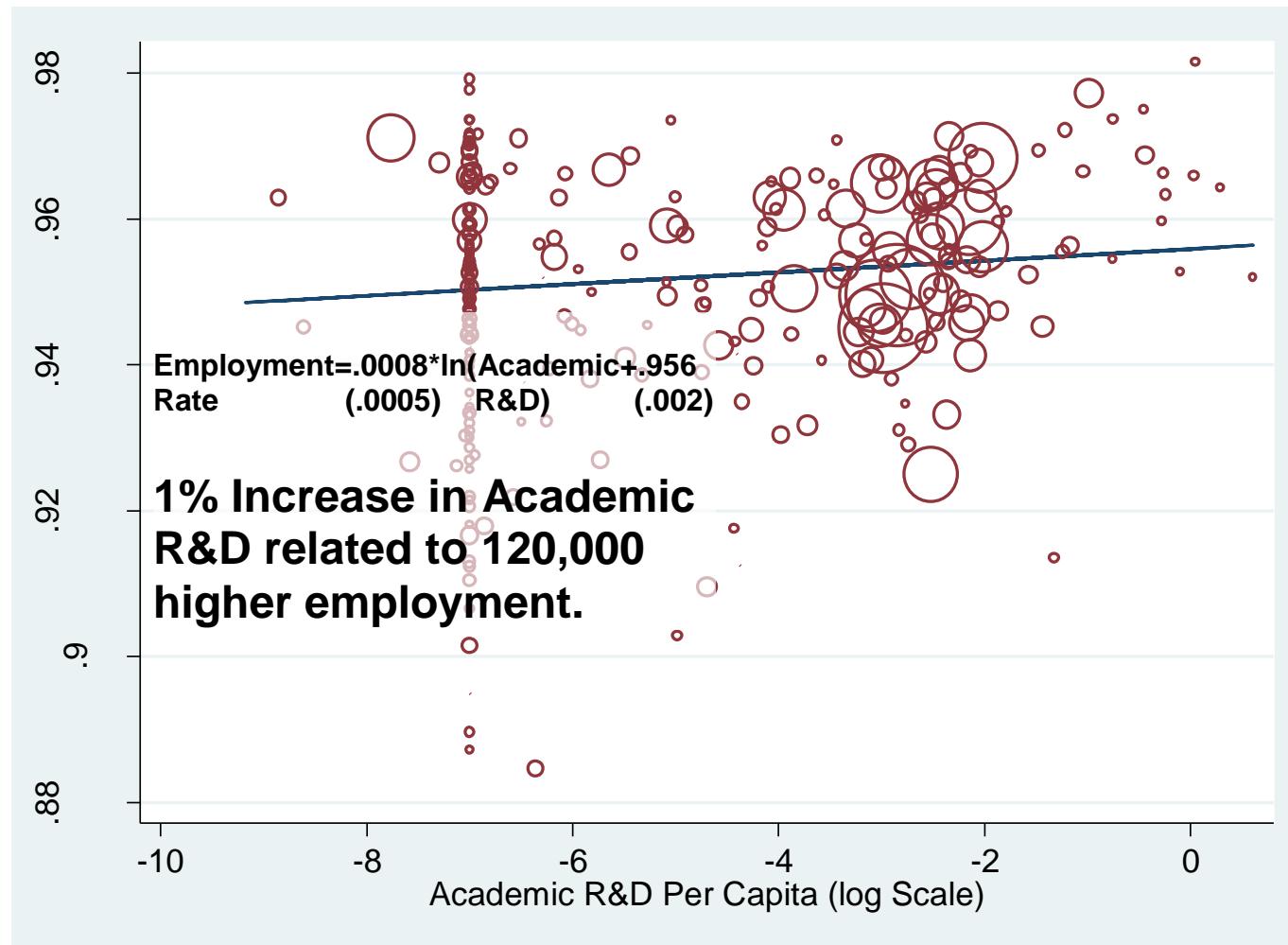
# Estimating Productivity Effects

- Relate economic outcomes across cities to measures of research
- See if wages, employment are higher in cities with more research
- Unpack intermediate steps: Is innovation (e.g. patenting) higher in cities with more science?

# Preliminary Analysis: Wages and Academic R&D



# Preliminary Analysis: Employment & Academic R&D



# Complicating Factors

1. Research-intensive cities may be different from other cities
  - If nicer, may understate benefits
2. If research raises productivity in a city, firms and workers will move there
  - May under or over state benefits
3. Potential differences in worker ability across cities
  - Likely to overstate benefits

# Complicating Factors

4. Estimate benefits in terms of surplus, not employment or wages

- Effects on wages and employment depend on demand and supply elasticities
- Estimating surplus is not straightforward

# Existing Work

- A few studies have estimated the productive effects of research
- Often measure science with academic R&D; control for education levels
- Address differences across cities with fixed effects and instrumental variables; often increases effects
- Important to think about time lags

# Existing Work

- Some evidence for effects on wages, industrial composition, patenting
- Results are mixed at best
- But, the literature has not addressed issues convincingly

# Directions for the Future

- Focus on productivity effects over job creation
- Employ strong designs to estimate productivity effects
- Unpack mechanisms by developing data that link technologies to research

# Valuable Data

1. Data linking innovations (e.g. patents) to the research they build on
2. Data linking research and students from universities to companies
3. Data tracing technology commercialization through licensing
4. Data tracking subcontracts



Thoughts:

(1) Why are there productivity spillovers?

a. Science raises productivity in a city (more for skilled). External effect, so not just through worker skill; And, not all benefits of innovation are competed away, at least not in product markets; Of course, profits are competed away in the factor market side, or at least may be. Not sure that you even need to assume that profits aren't competed away on the product market side.

(2) Can look at employment benefits from people being hired; or "employment spillovers," Either way elasticities mess this up

# Complicating Factors

## 5. Demand and Supply Elasticities

- Want to think about how science changes surplus, not employment (or wages)
- Consider low supply elasticity
- Reduces employment response
- Increases wage response, which benefits workers
- Reduces surplus

- Not trivial to extrapolate from employment and wage changes to surplus

