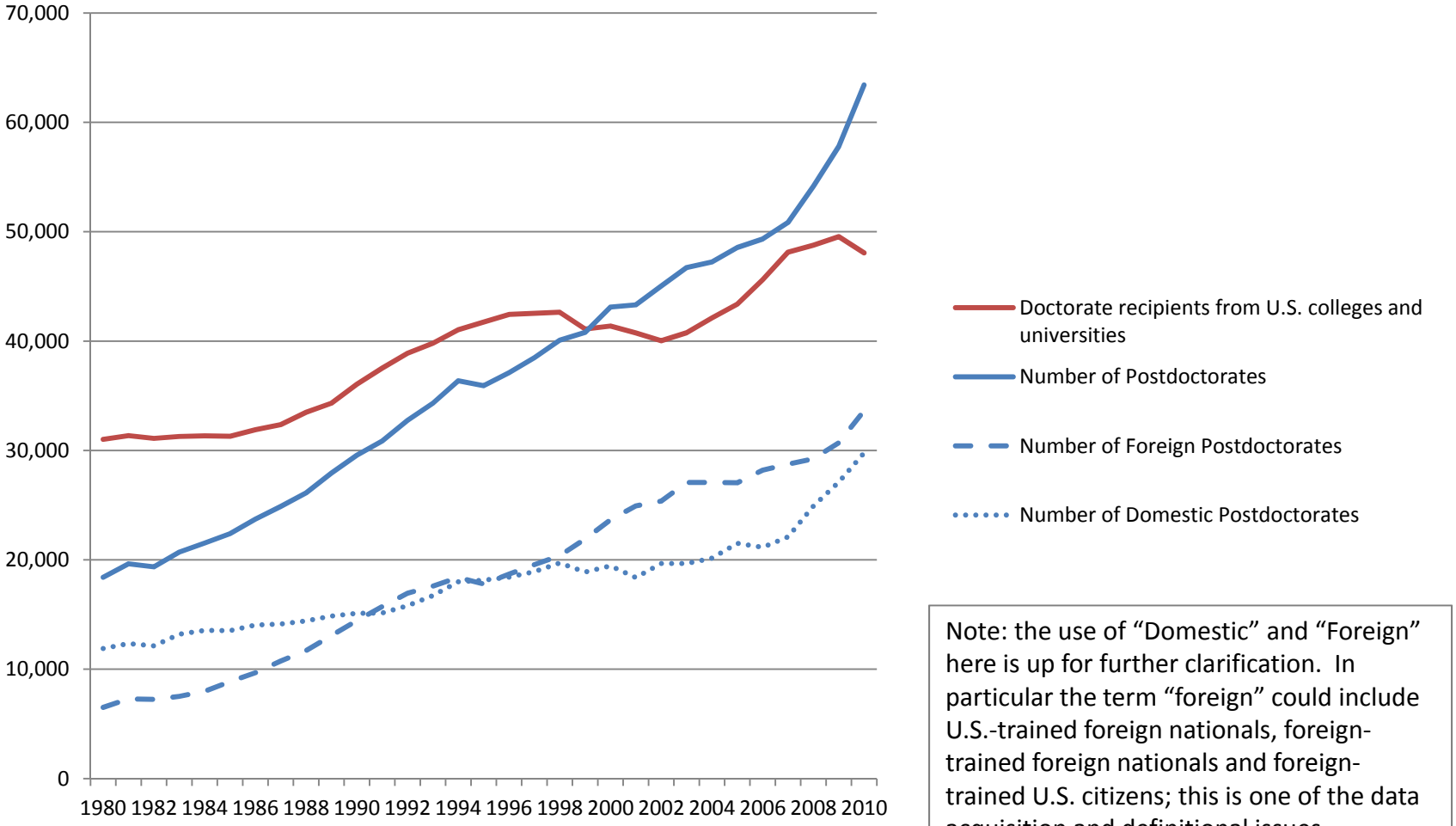
The Economics of the Postdoctoral Position

Paula Stephan
Georgia State University & NBER
National Postdoctoral Association
March 2013

Prologue

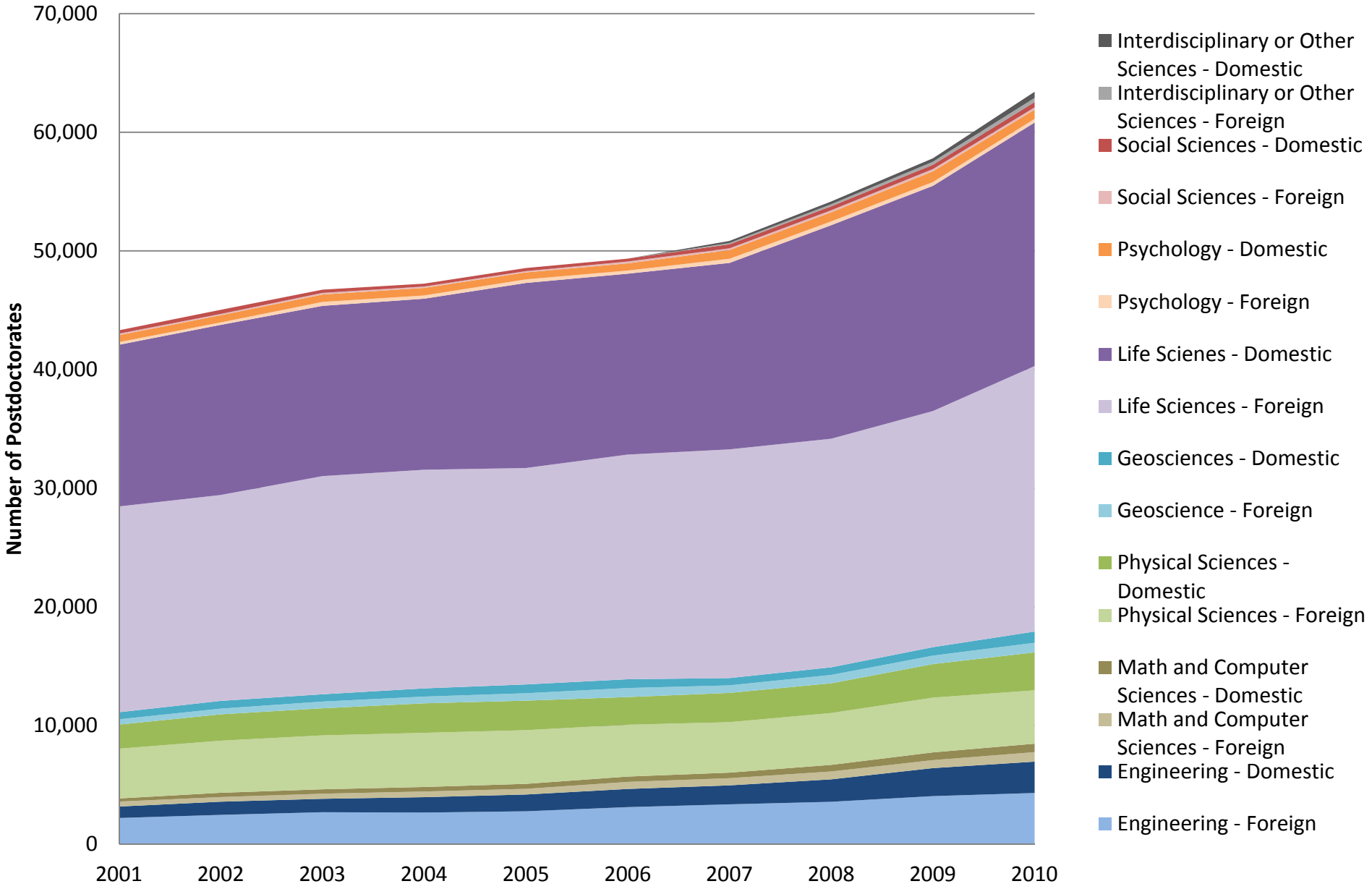
- Before looking at underlying economic forces
- Summarize postdoctoral trends over time
- Differentiate between
  - long term trends and
  - trends related to business cycle—especially recent events occurring in 2008

Total Number of Postdoctoral Scholars, PhDs Awarded and Citizenship of Postdoctoral Scholars



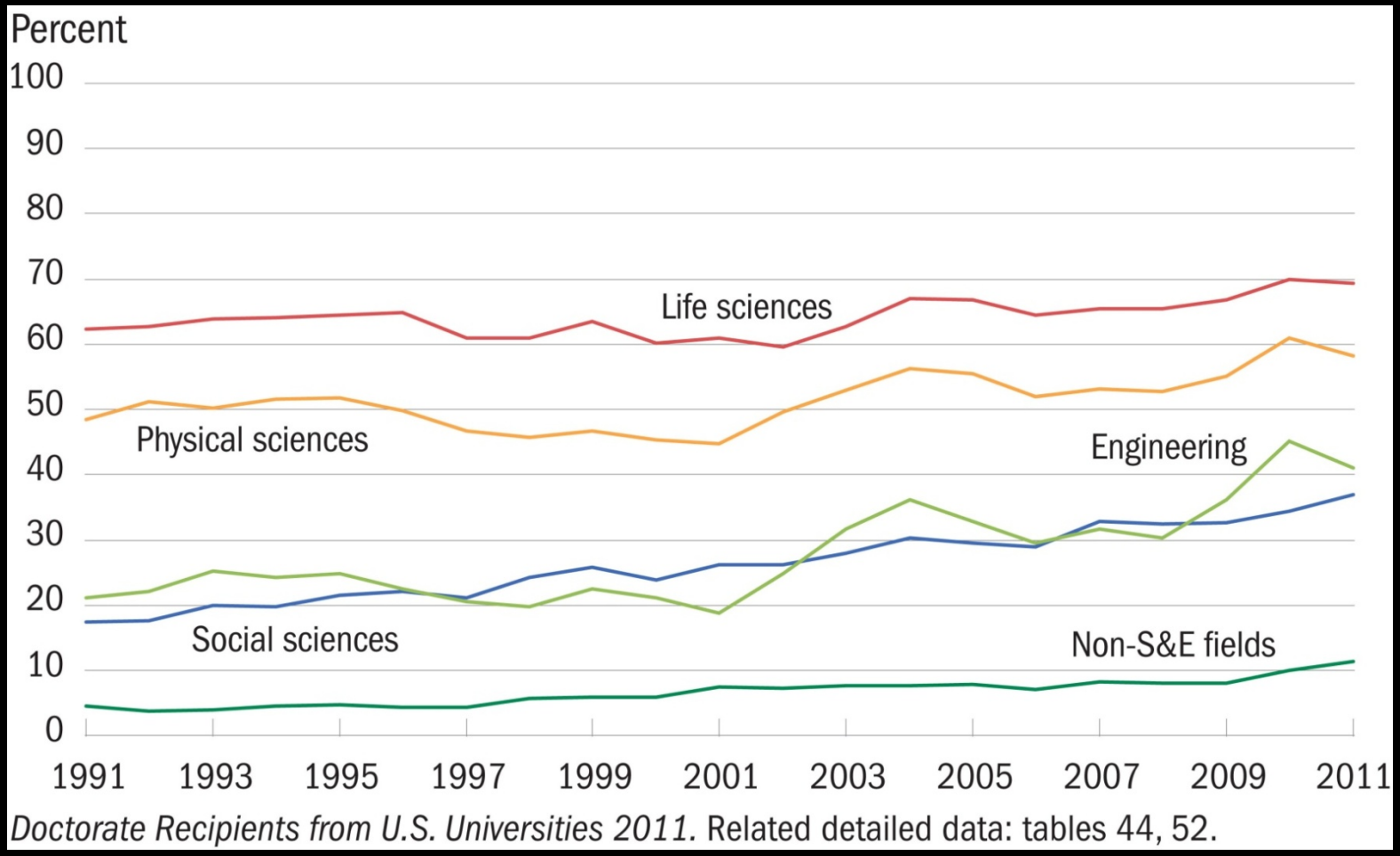
Note: the use of "Domestic" and "Foreign" here is up for further clarification. In particular the term "foreign" could include U.S.-trained foreign nationals, foreign-trained foreign nationals and foreign-trained U.S. citizens; this is one of the data acquisition and definitional issues.

Number of Foreign and Domestic Postdoctorates by Broad Field



The Life sciences are the largest contributor to the number of postdocs, foreign or domestic

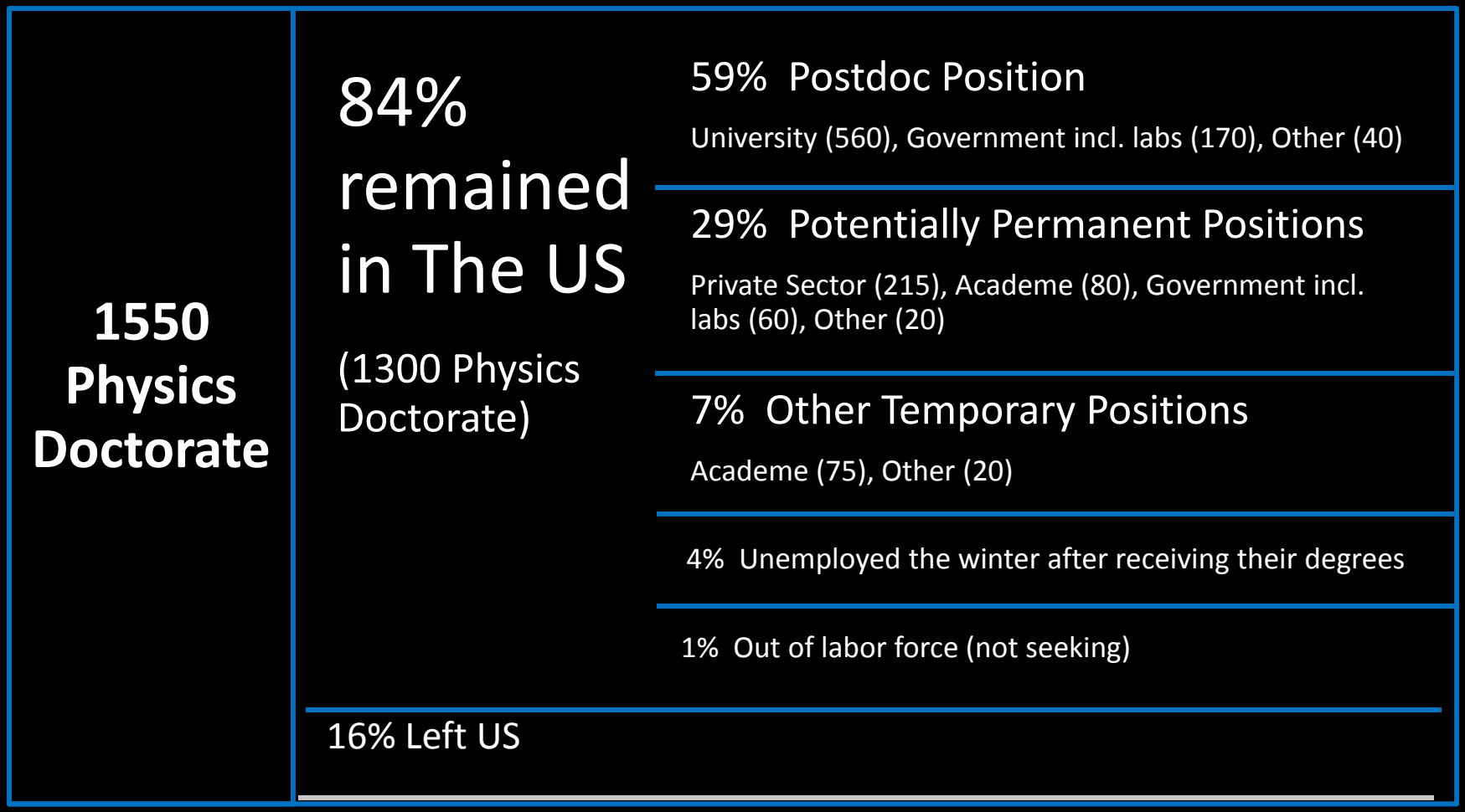
Postdoctoral Rate by Field



Doctorate Recipients from U.S. Universities 2011. Related detailed data: tables 44, 52.

Paula Stephan Georgia State University &
NBER

Physics PhDs 1 Year Later
Classes of 2009 &2010 Combined

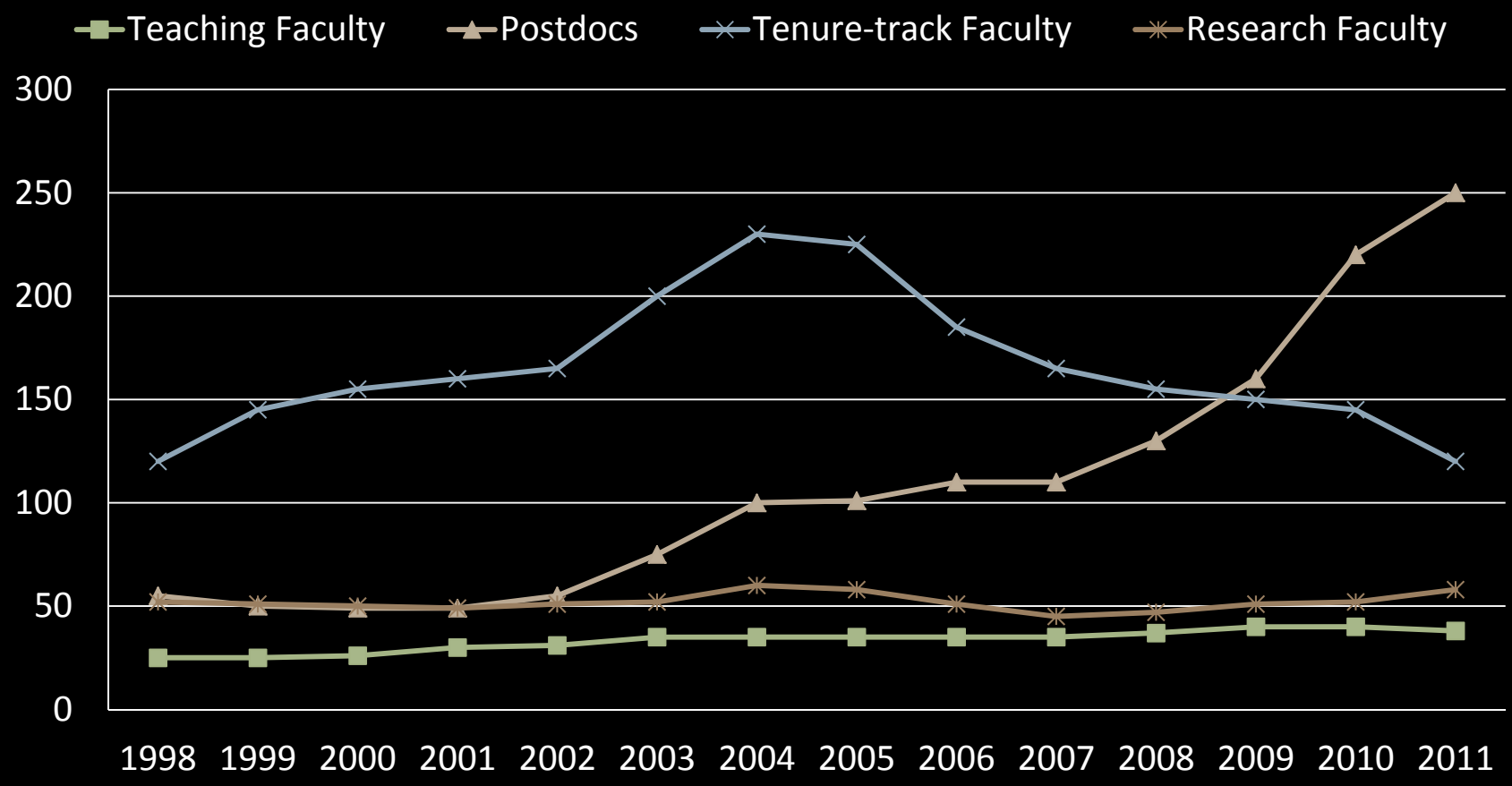


Source: American Institute of Physics (AIP)
Physics Trends Fall 2012, Statistical Research Center (www.aip.org/statistics)

Physics continued

- Physics
  - 13% of those who took postdoc position did so because they could not find permanent work, compared with 7% from classes of 2007 and 2008 (AIP)

Hiring of Computer Science Ph.D.'s in academia
three year-rolling average 1998-2011



Source: Anita Jones, "The Explosive Growth of Postdocs in Computer Science"
Viewpoint, Vol. 56., No.2., February 2013., pg. 37-39.

Trends

- Increase in postdoctoral-taking rate over time in all fields
- Number of postdoctoral scholars on temporary visas grew more quickly than that of citizens and permanent residents until 2008;
- Grew especially quickly during doubling of NIH budget

Trends Continued

- Percent taking postdoctoral positions also relates to state of the economy
  - Large increase in engineering after 2008
  - Decline in the biomedical science postdoc rate in the late 1990s and mid-2000s when job market in industry was strong
  - Increase in number of citizens and permanent residents taking postdoctoral positions after 2008 recession

Economics of the Postdoctoral Position

Economics Is about Incentives and Costs

- Incentives and costs have significant impact on number of postdoctoral scholars employed in the United States

Incentives

- Increased importance of
  - Specialization in research
  - Funding for research
  - Publications as a necessary condition for funding

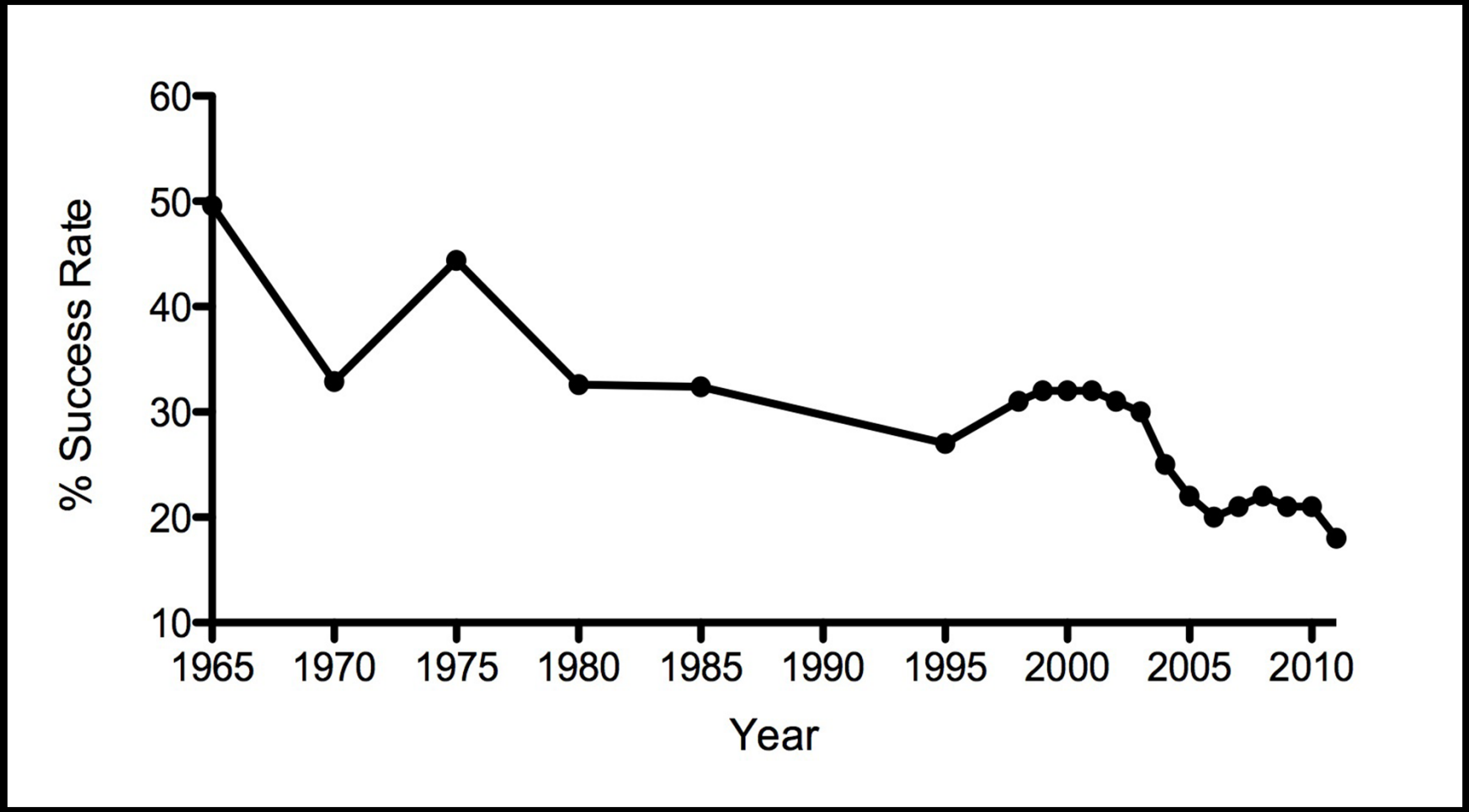
Specialization

- Sole author is a dinosaur when it comes to research—fewer than 15% of papers are now sole authored
  - Between 1955 and 2000 average number of authors in science almost doubled from 1.9 to 3.5
- Specialization means faculty increasingly look for individuals to work with them on research and to staff their labs

Increased Importance of Funding

- Faculty increasingly under pressure to bring in funding for research
- Long been model in biomedical and physical sciences; increasingly model in social sciences and even in humanities
- Pressure to bring in funding is particularly acute for faculty in soft money positions— “funding or famine” to quote Stephen Quake
- At same time, funding is in short supply and success rates are declining

NIH Success Rates



Ferric Fang

Focus on Grant Seeking

- Raises importance of having other people to work in the lab—PI's time is diverted to grant preparation
- Also raises importance of publications given important role publications play in grant review and grant success

Staffing of Labs

- Forces of specialization, funding and publications lead PIs to seek clever individuals to staff their labs and help in production of research
- Three groups to choose from:
  - graduate students
  - postdocs
  - staff scientists
- This is where costs begin to play a large role

Costs of a Graduate Student

- Stipend between $16,000 to $28,000
  - Can cost an additional $16,000 or more once tuition is included, depending upon limits set by funding agency and policies of university
- Survey of Big Ten Institutions in 2004 found median full cost (exclusive of indirect) of a GRA to be $29,000; high was $48,000; low was $17,000
- GRAs work approximately 1200 to 1500 hours per year
- Hourly rate is $25.00 to $40.00 with fringes on Big Ten campuses;
- Hourly rate as high as $37.00 on other campuses before fringes

Cost of Postdoctoral Scholars

- NIH current stipulated rate is $39,264 for NRSA first year postdoctoral scholar
  - Many institutions follow this rate for others
- Average postdoc reported working 2650 hours a year in life and physical sciences; 2550 in engineering and 2500 in math and computer sciences
- Hourly rate before fringes of $14.82 in biomedical sciences

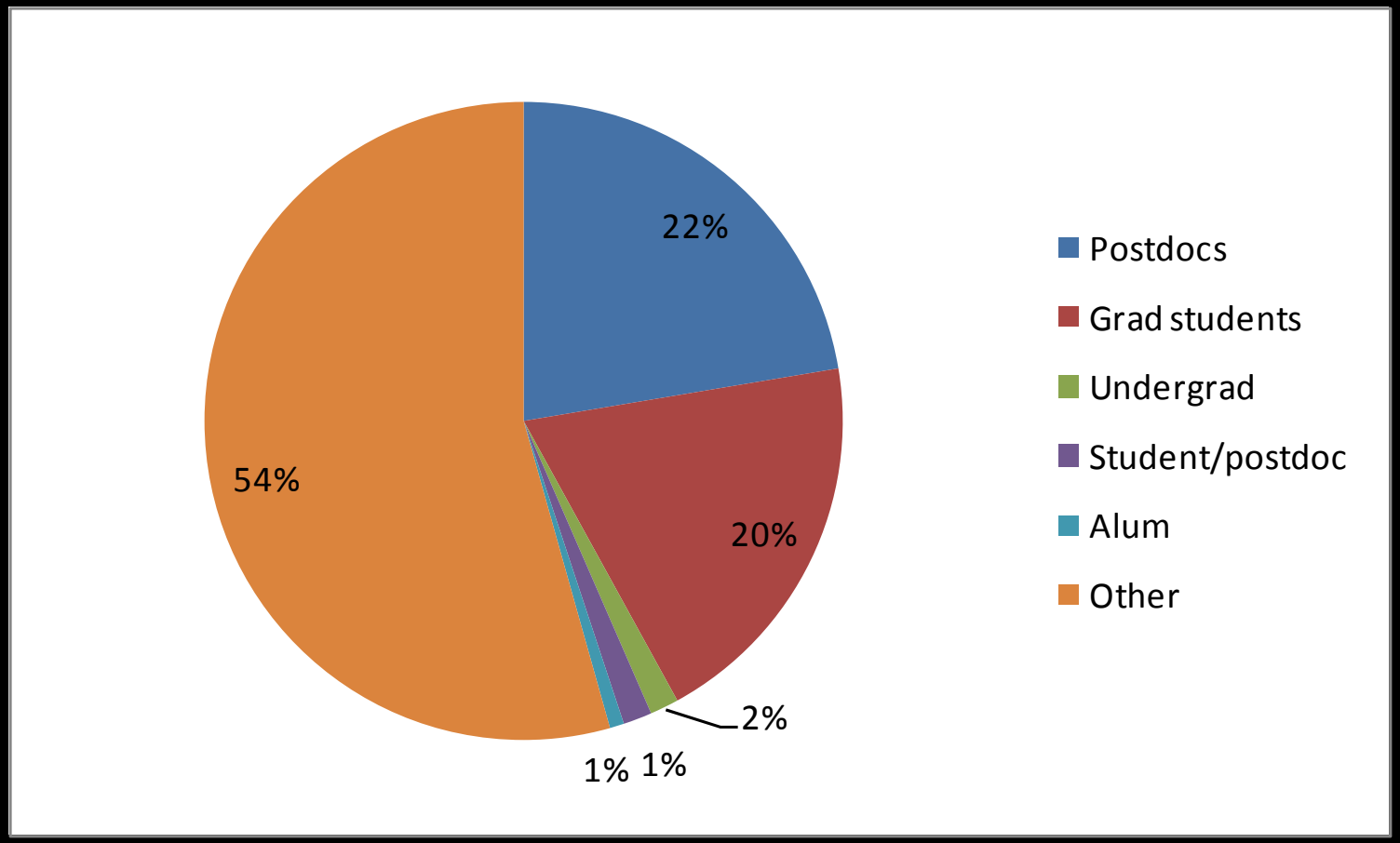
Cost of Staff Scientist

- Start at approximately $55,000
- Fringe benefits are significantly higher than those for a postdoc because they are treated as employees by university
- Hourly rate of approximately $25.00 before fringes

Cost Advantage Lies with Postdoctoral Scholar on Many Campuses

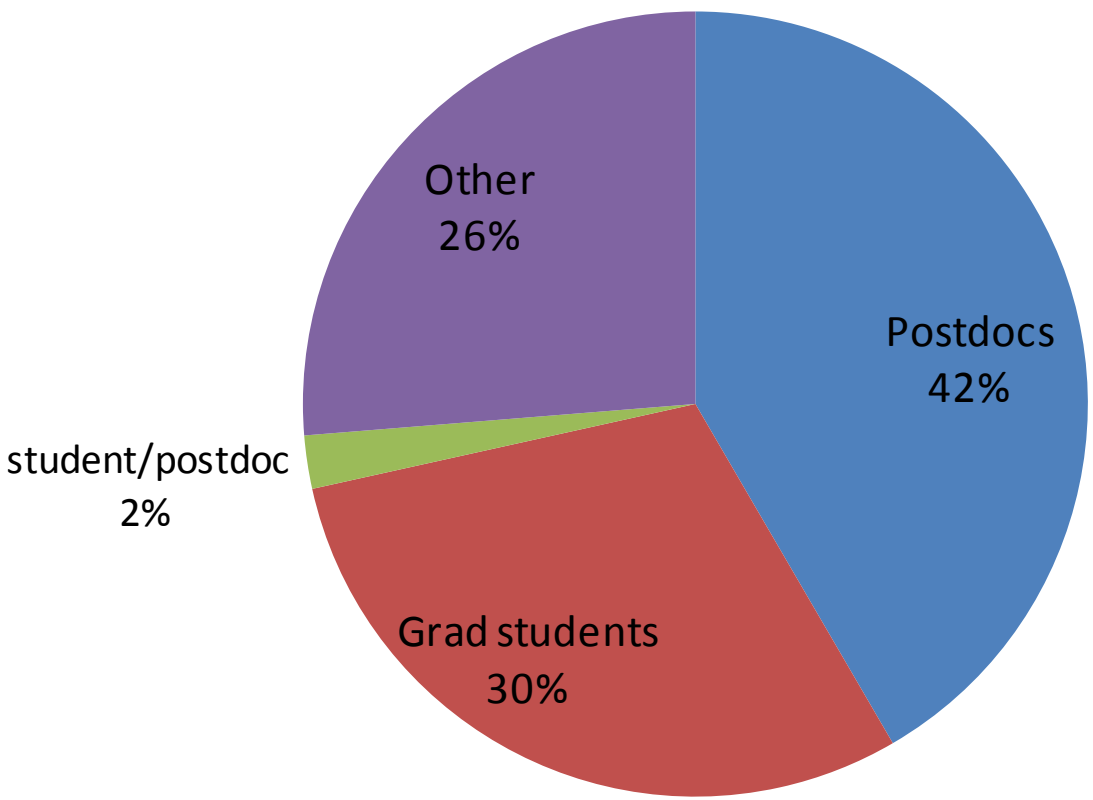
- Low salary and long hours of work mean postdoctoral scholars are half as expensive as graduate student or staff scientist on many campuses
- Higher level of skill than graduate student
- Possibly more motivated than staff scientist

Authorship Patterns U.S. Articles with 10 or fewer authors in *Science*



Paula Stephan Georgia State University &
NBER

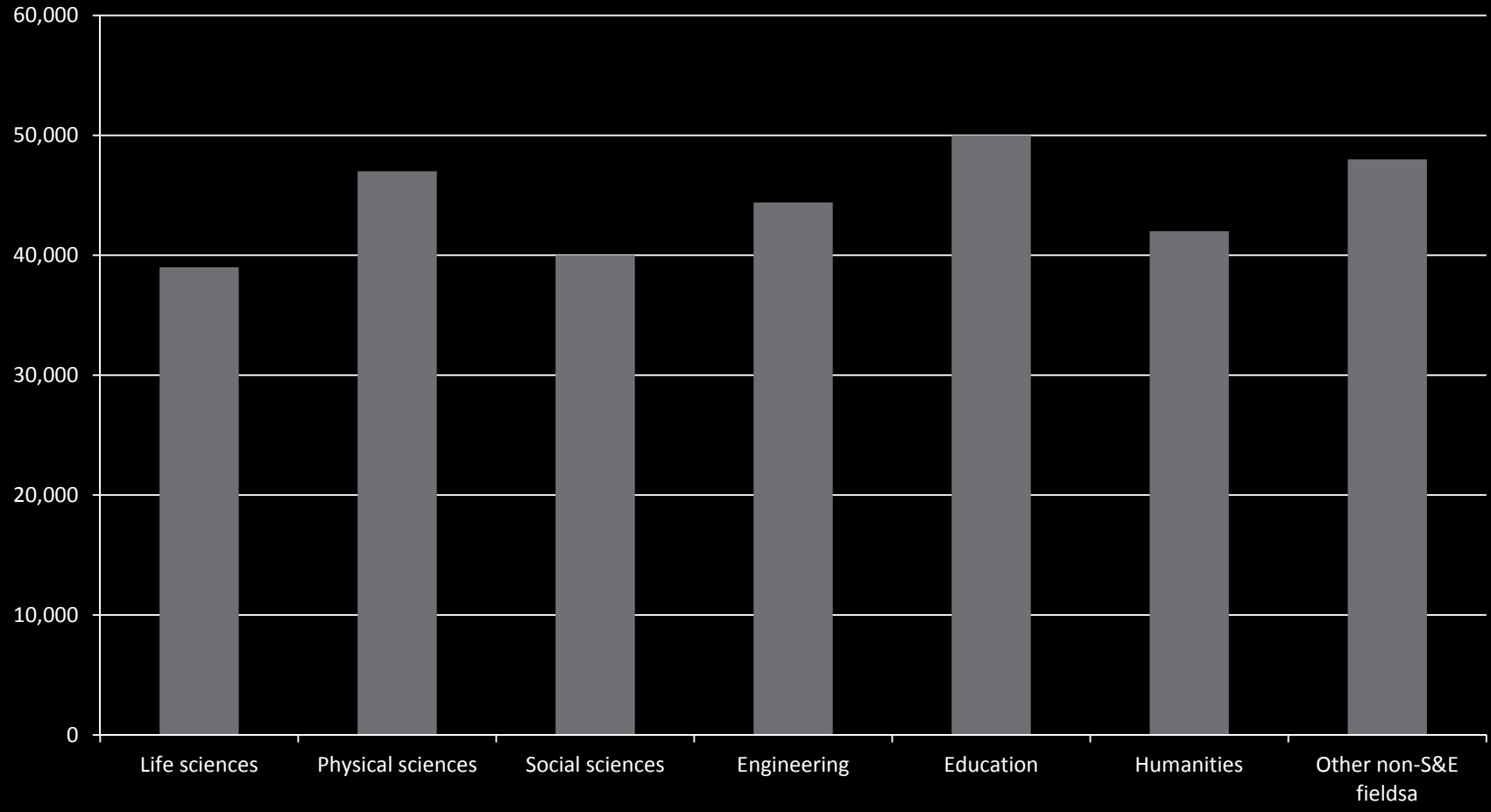
First Authors: N=137



“Cost Advantage” Suggests a Closer Look at Why Postdoctoral Wages Are Low

Paula Stephan Georgia State University &
NBER

2011 Median Postdoctoral Salary, New PhDs

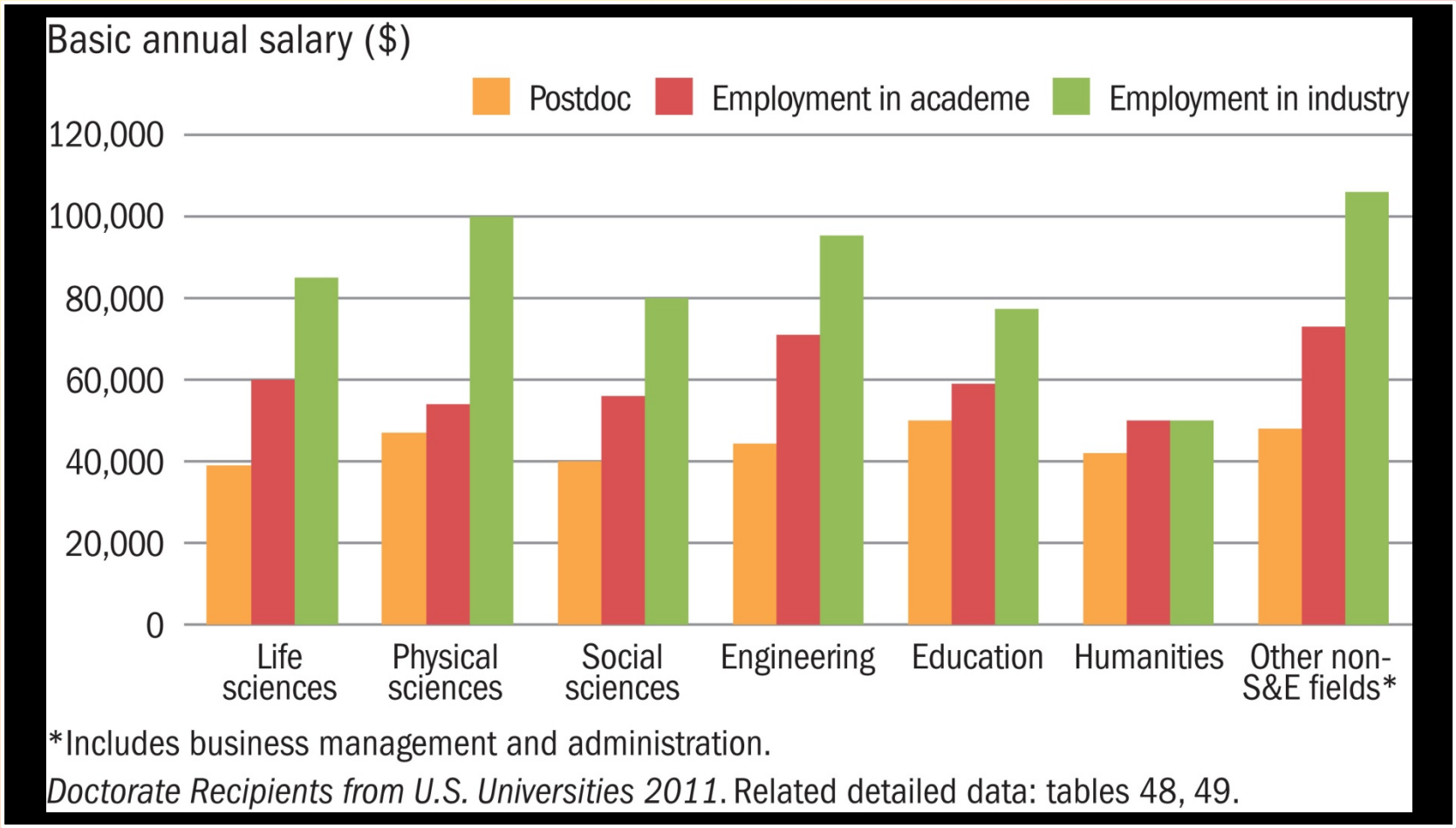


Survey of Earned Doctorates; definite commitments

Salary Relative to Alternatives

- BA with 7 years of experience, no graduate school, $58,000 in 2008
- Average hourly wage for fulltime workers—regardless of level of education-- in the United States is $23.22—but they work 34 hours per week.
  - Means average U.S. worker takes home just about the same amount every week as a postdoc but works about 20 hours a week less.
- PhD starting in academe: $54,000-$70,000 depending on field
- PhD starting in industry: $50,000 to $106,000, depending on field

Median basic annual salary of doctorate recipients with definite commitments in the United States, by position type and field of study: 2011



Doctorate Recipients from U.S. Universities 2011; **www.nsf.gov/statistics/sed/**

Why So Low?

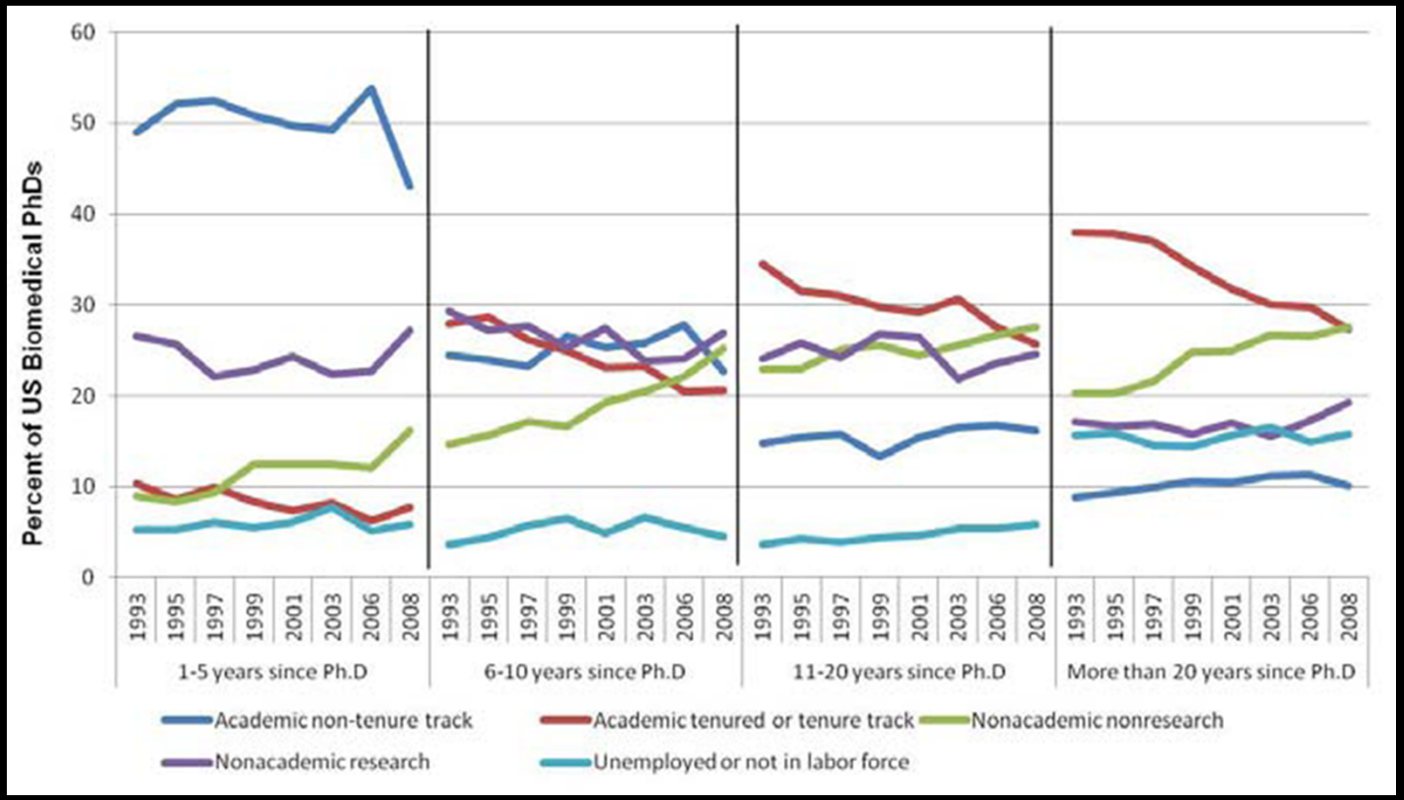
Training Argument

- Low pay to postdoctoral scholars is due to large training component of position
- Argument is that training received is portable to another position and thus should be paid for by the postdoctoral scholar in the form of reduced wages;
  - low wages are a down payment on a research career

Validity of Training Argument

- Definitely strong training component in many postdoctoral positions
  - But in some labs training component is minimal and postdoctoral scholars are relied on for routine procedures
- High cost of training
  - Classmates who did not get a PhD are earning about $58,000 seven years after graduating; an hourly rate of approximately $34.00
  - Compare this to $15.00. A high cost of training!
  - Especially when many of the skills learned may not be transferable into a non-research position—a likely outcome for many

Employment Outcomes by Cohort Biomedical Sciences



NIH Workforce Committee

Alternative Explanation
Low Wages

- Not a real market
- Postdoc pay set by NIH in biomedical sciences; many campuses follow this for other fields
- Ample supply of domestically produced PhDs and the large supply of PhDs educated abroad keep salaries low

Why Do Postdoctoral Scholars Take the Position?

Incentives from Their Point of View

- Interest in science
- Aspirations
- Information (lack of)
- Lack of alternatives

Interest/Aspirations

- Postdoctoral scholars get satisfaction from engaging in research
- They perceive their chances/their ability as being better than that of others in their field
  - (Sauermann and Roach find majority of students rate themselves as being more able than their peers)
- Postdoctoral position is logical step for those who want to be a research scientist—acquire skills and build resumé—and for those who want to be an academic

Information

- Information is in short supply
  - Many students receive minimal information about career options when they decide to go to graduate school or start graduate training
  - Programs rarely post job outcomes on Web pages; many doctoral programs offer few seminars or workshops that provide students with information on careers other than those in academia
  - Many faculty resist students seeking information regarding alternative careers
- Postdoctoral position is often first time information concerning jobs becomes available and is talked about

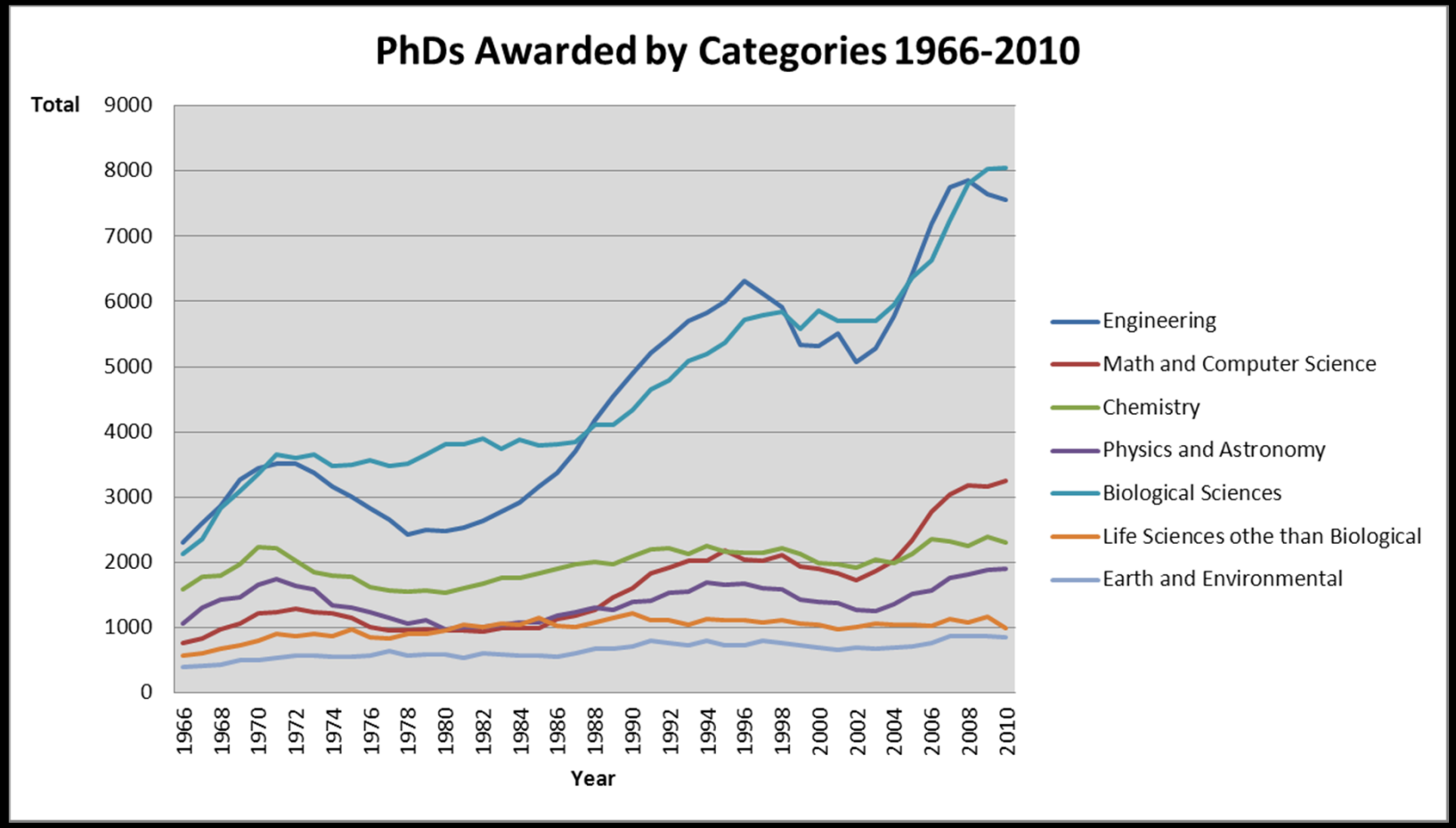
Survey of 45 Departments, Three Fields

- Only two reported on web page where students were placed
- By contrast, common in business schools and economics programs to report placements on web
- Note that NRC Committee “Trends in the Early Careers of Life Scientists” made recommendation that departments disseminate information regarding career outcomes—1998!

Alternative Jobs Are in Short Supply

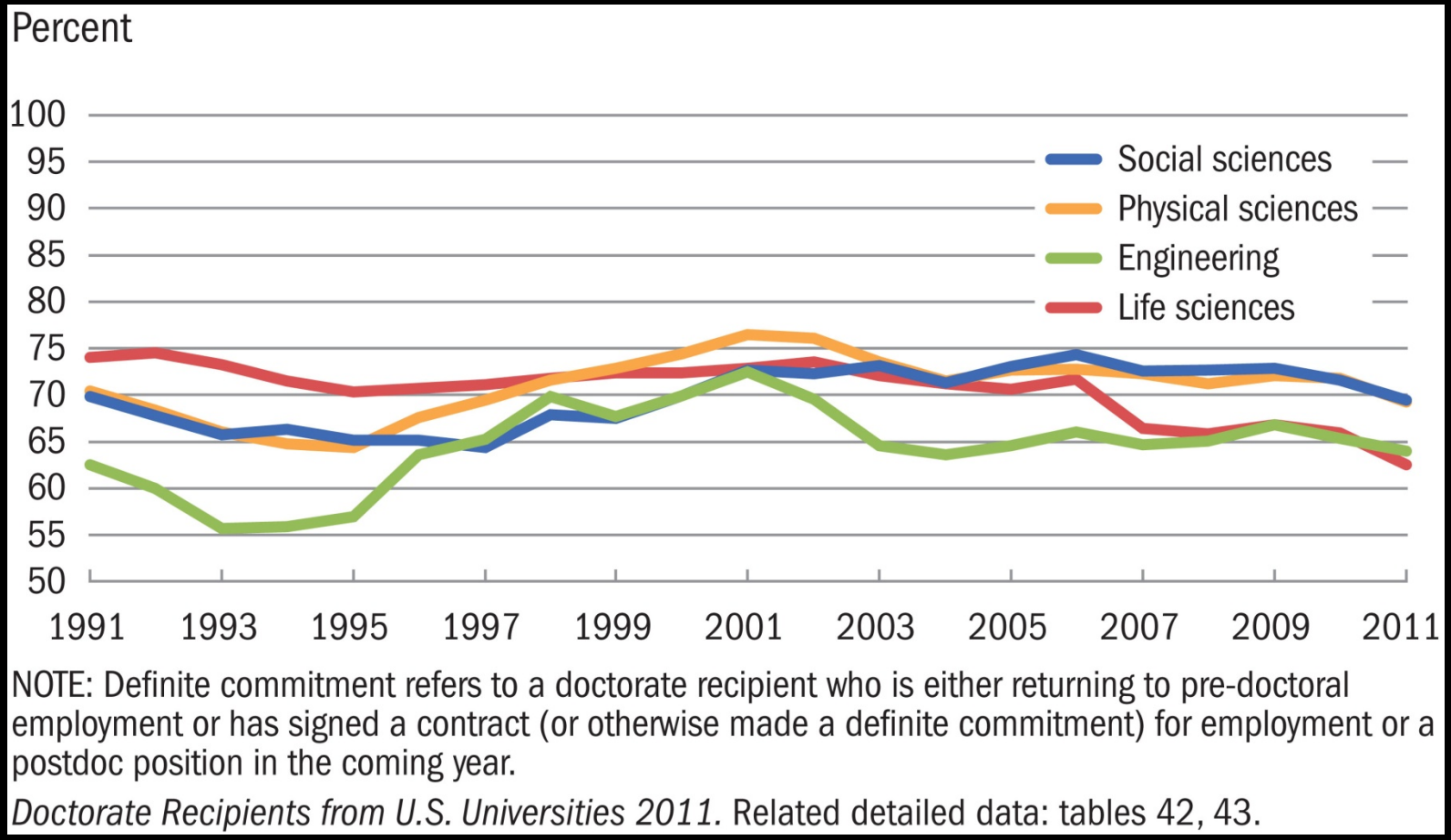
- Demand is weak
- Supply of PhDs has increased
- Probability of finding position has declined

Production of PhDs



Paula Stephan Georgia State University &
NBER

Definite Commitment at Time of Doctorate Award



NOTE: Definite commitment refers to a doctorate recipient who is either returning to pre-doctoral employment or has signed a contract (or otherwise made a definite commitment) for employment or a postdoc position in the coming year.

Doctorate Recipients from U.S. Universities 2011. Related detailed data: tables 42, 43.

Moving Forward
Possible Solutions

Fix What's Broken
Cut Back Demand for Postdocs

- Discourage overreliance on postdocs—make costs reflect their social cost
  - Raise salary and benefits significantly
  - Place a "training tax" on position that can be used to enhance quality of training programs
- Encourage institutions and provide incentives for institutions to create more staff scientists positions; common at NIH but less common in university community
- Limit amount of salary charged off grants, thereby diminishing demand for graduate students and postdocs

Cut Back Supply of Postdocs

- Provide information regarding different career paths early in the graduate training experience; don't wait for career counseling until the postdoc!
- Encourage internships during graduate school experience
- Require departments to post placement information on line
- Lessen coupling between research and training, thereby decreasing supply of PhDs: Effective training requires a research environment but effective research does not require a training environment

NIH Workforce Committee

- Made recommendations consistent with a number of these suggestions
- NIH recently announced it will implement some of them
- However, two of the more radical proposals—limit amount of salary that could be written off a grant and shift funds from GRA and postdoc positions to training grants-- were not on the list.
- Disappointing!

Increase in Salary?

- Workforce Committee failed to recommend a significant increase in salary for postdoctoral scholars
- The most effective way to fix the system and bring it back into equilibrium

Take Note

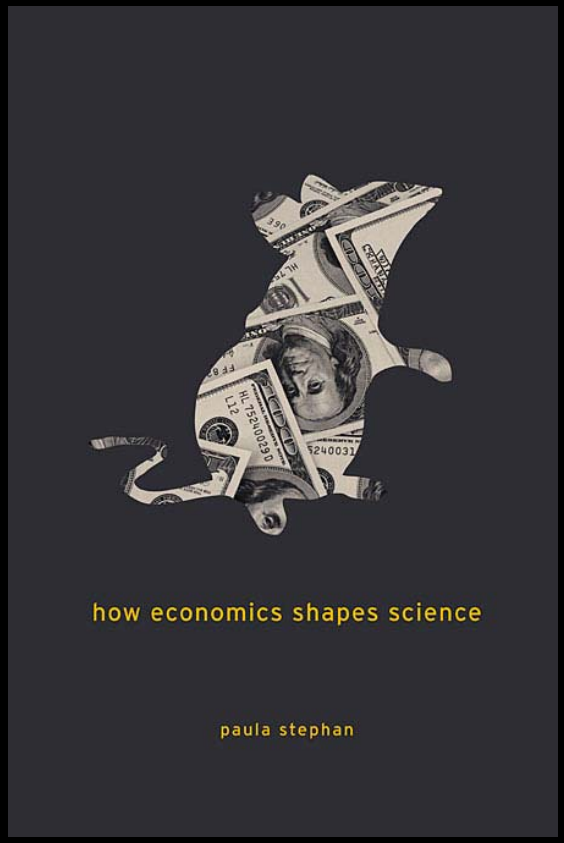
- More funding would help but it does not address the underlying issue of positive feedback in the system
  - Increased funding is accompanied by increased training which is accompanied by increased demand for funding and postdocs; unstable system
- Need to address incentives that have allowed system to evolve to current situation

Data Sources

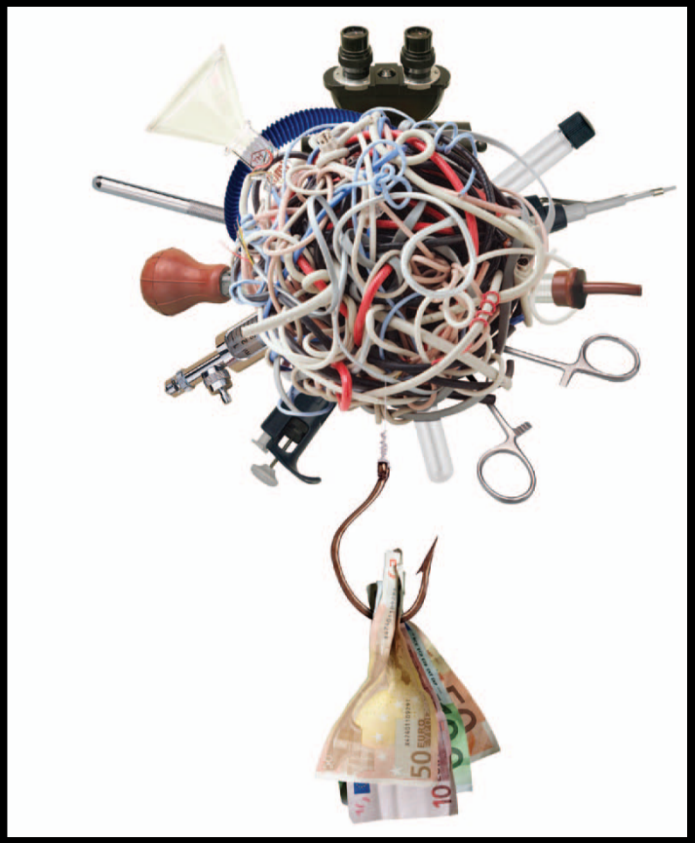
- Survey of Doctorate Recipients
- Survey of Earned Doctorates
- GSS: Survey of Graduate Students and Postdoctorates in Science and Engineering
- BLS data

Drawn from

Recent book



Comment in *Nature*



Questions/Comments?

- pstephan@gsu.edu