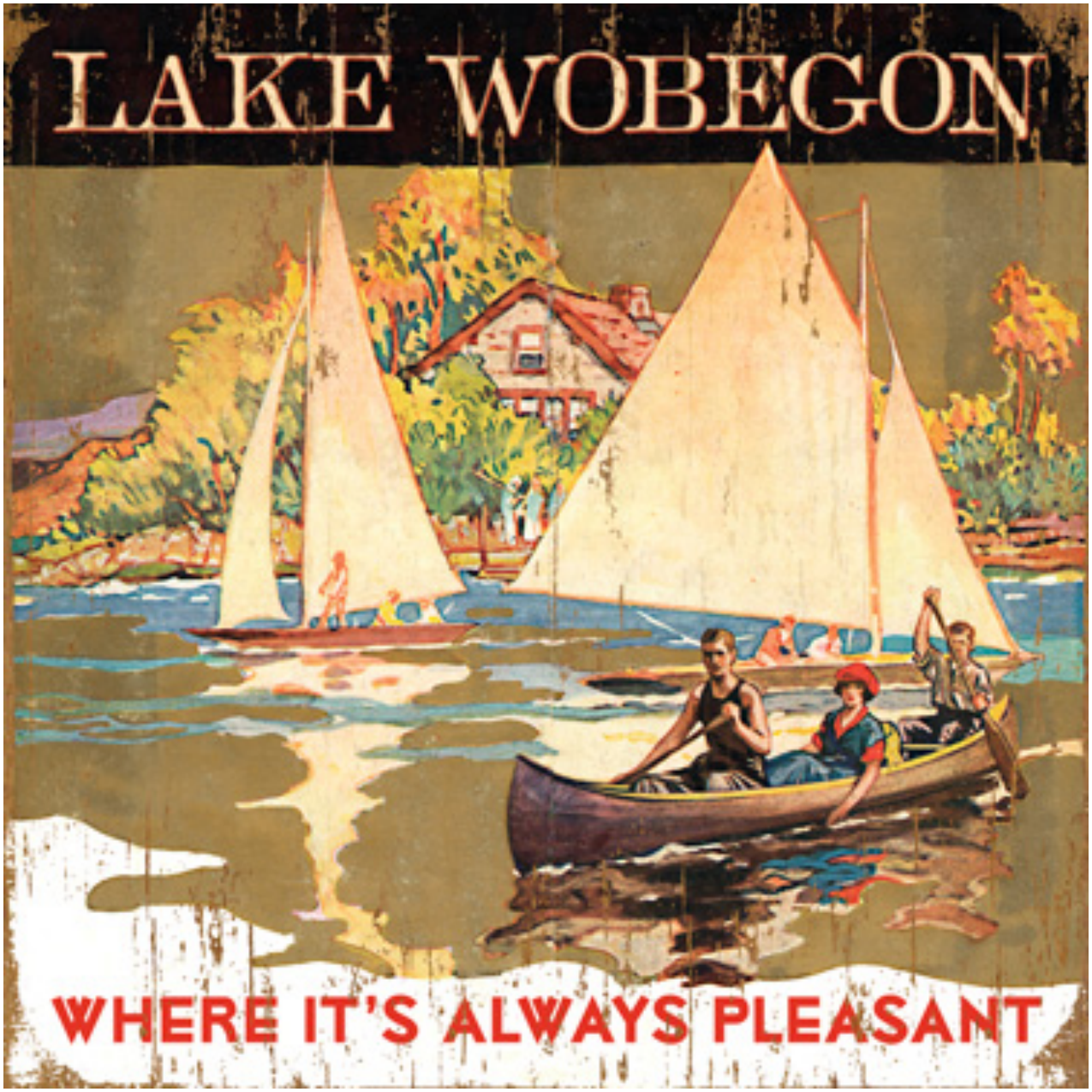
Getting to Lake Wobegon

Department-Level Diversity of PhD Chemistry Graduates

Sandra Laursen
Ethnography & Evaluation Research

Tim Weston
ATLAS Assessment & Research Center
U. Colorado Boulder

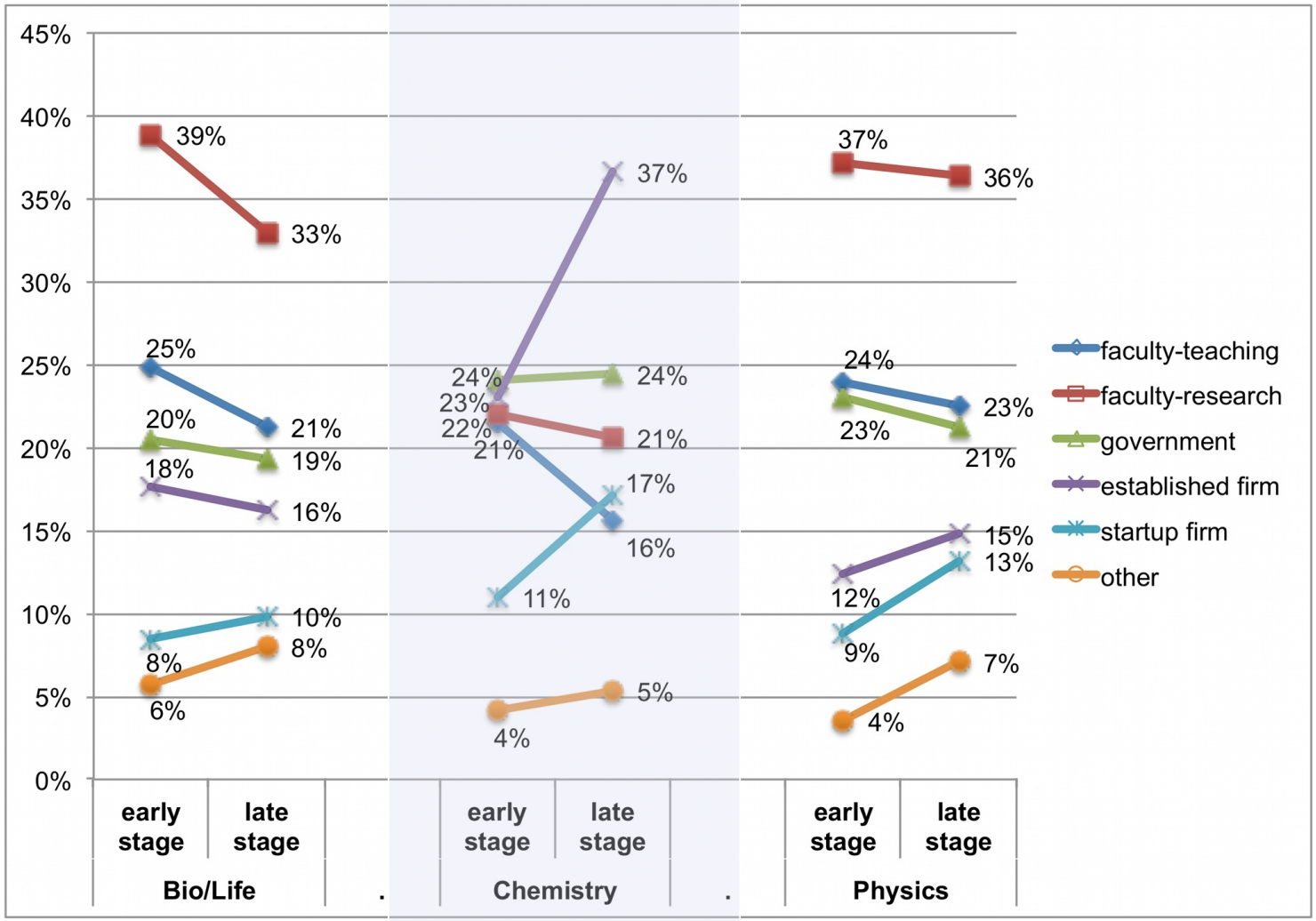

LAKE WOBEGON
WHERE IT'S ALWAYS PLEASANT

Overview of the study

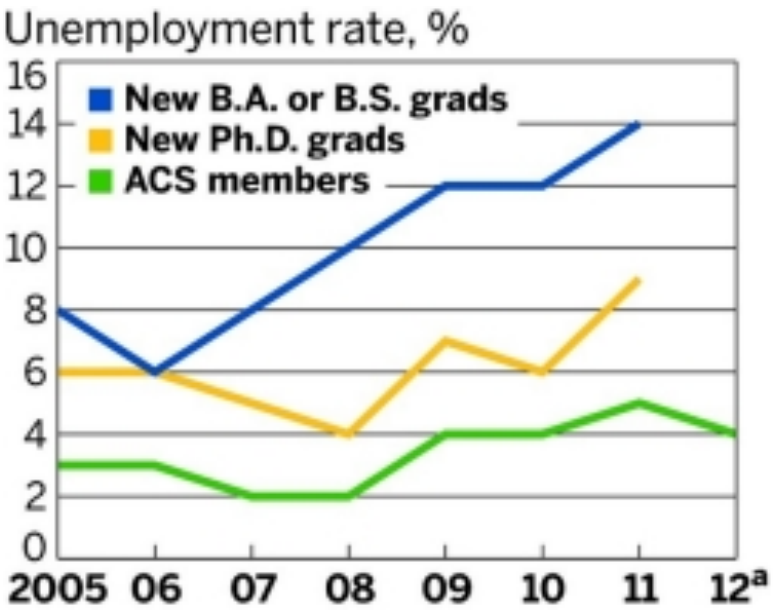
Professional Preparation of Ph.D. Chemists

- How are departments, faculty & students responding to the changing context of graduate education, and to calls for reform around professional preparation?
- What changes to practice are underway?
- What is working —or not—about Ph.D. science education today?
- How do students develop career skills & make career choices in graduate school?

Chemists have high interest in non-academic careers



Sauermann & Roach, 2012



Chemistry employment is becoming less secure…

…and more risky

Our two-pronged approach

1. **"Mapping"**: a broad survey of the landscape

   What is current practice in chemistry Ph.D. education with respect to career preparation & decision-making?

   Loshbaugh et al. (2011). J Chem Ed

   → Laursen & Weston (2014). This study

2. **In-depth case studies**: a closer look

   How do students, faculty, & other wise observers see the connection between graduate education, career preparation, & joining the discipline as a practitioner?

   Laursen et al. (2012). AERA conference paper

   Thiry et al. (2015). In review.

Status quo for chemistry

~2400 PhDs in chemistry awarded each year

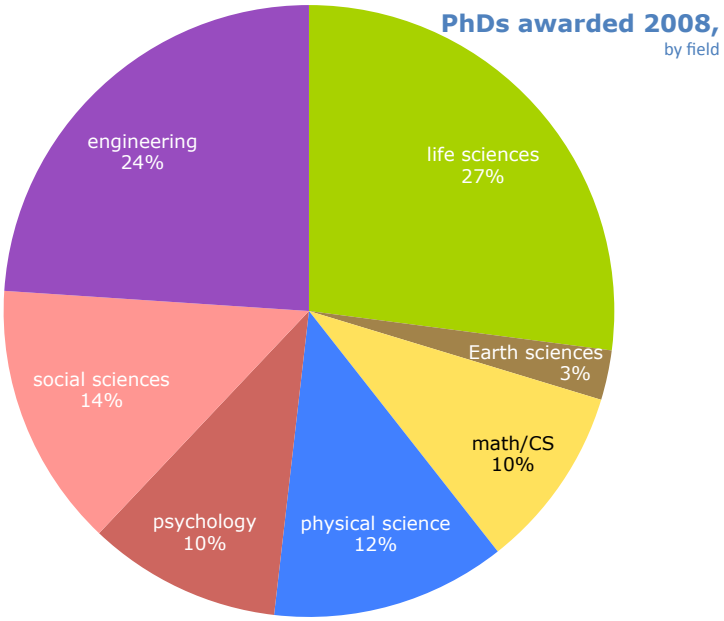
= 60% of PhDs in physical science

= 7% of PhDs in S&E (~33,000)

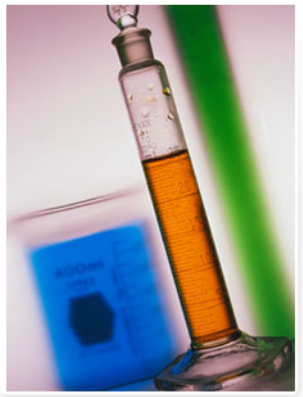
5% to underrepresented minorities ("URM")

34% to women

NSF SRS (2011 & 2006)



Our study sample



IPEDS (Integrated Postsec Ed Data System, US DoEd) time series data on PhDs awarded in chemistry:

- Annual, all subfields
- 1987-2009 resolved by gender
- 1995-2009 resolved by race/ethnicity & citizenship

"Top 50" using David Fraley's composite index (US News 2007 & 1998, NRC 1995)

→ Account for ~60% of all chem PhDs

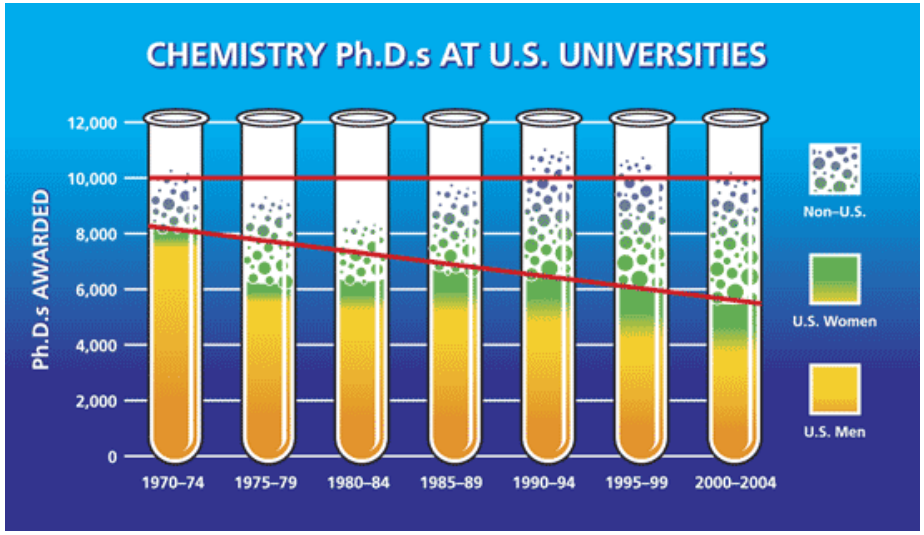
→ Practical cutoff: ~10 PhDs awarded/yr

Study variables

PhDs by institution (from IPEDS):

- Total # PhDs awarded
- % of PhDs by gender and by race
- % of PhDs to citizens and non-residents

Faculty by institution, by gender & race (from Nelson Diversity Surveys, 2007)



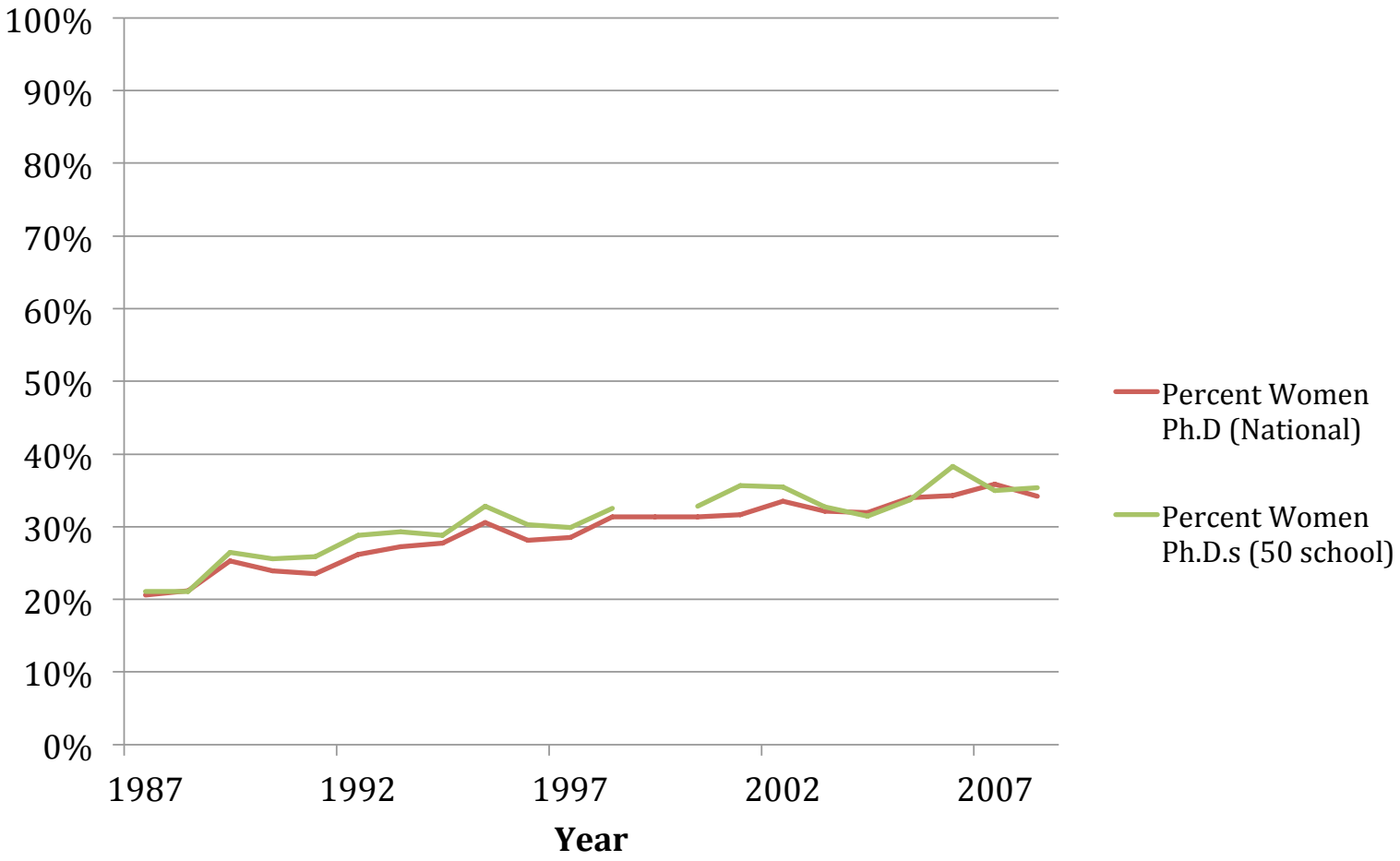
NRC (2007). The Future of US Chemistry Research

Testing trends in representation

Hierarchical Linear Modeling (HLM) tests linear trends:

- Appropriate for "nested" data. In our study, years are nested within institutions. Model accounts for dependency within institutions.
- Model tests growth over years:
  Is representation going up or down over years?
- Do other variables such as size of school predict *rate of growth* among schools, e.g.:
  Are growth rates higher at larger or smaller schools?

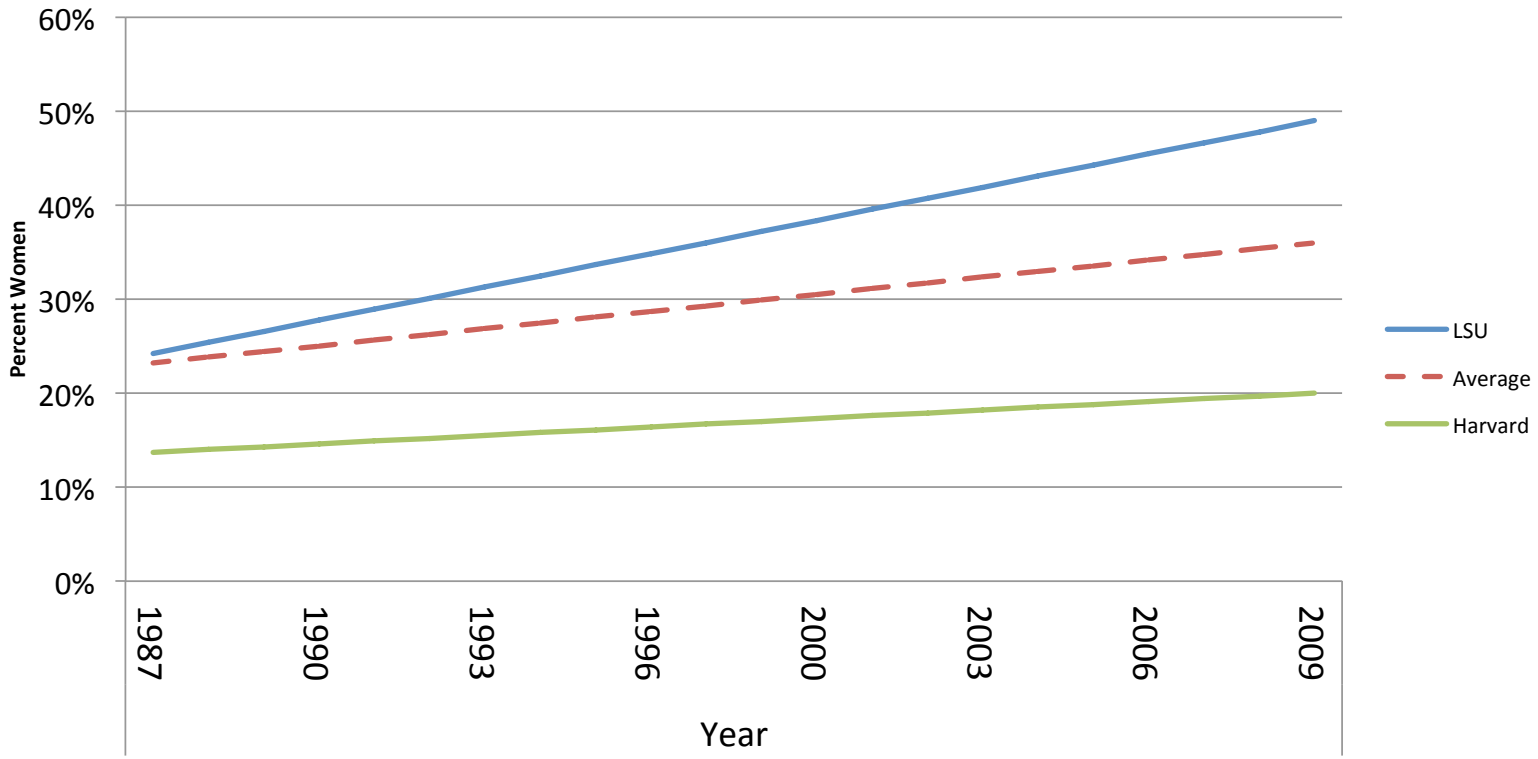
The proportion of women earning PhDs is increasing nationally…



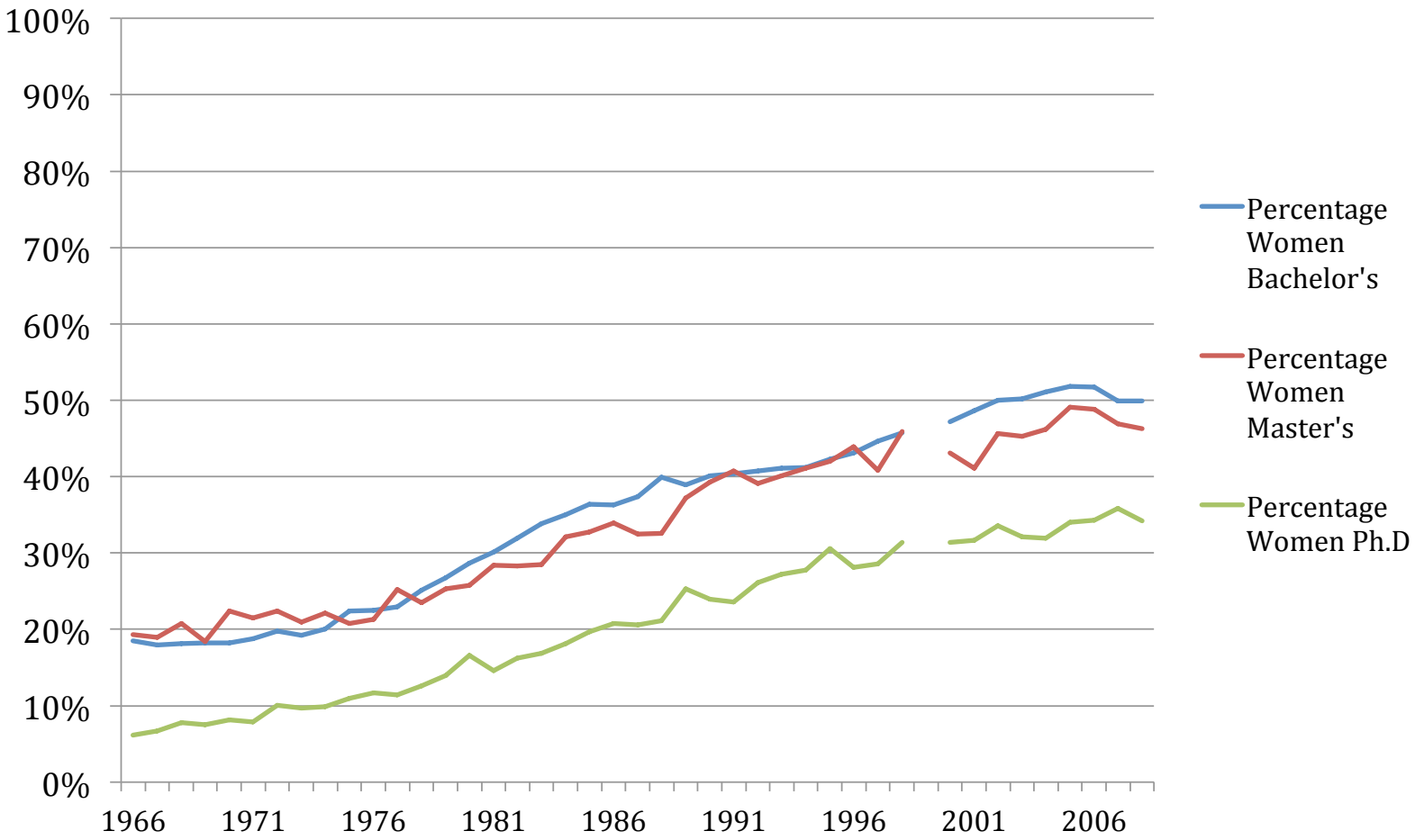
…but women's representation does not increase evenly across institutions

Mean	*36%*	*14%*			
Top 8	**%W**	**growth '87-09**	**Bottom 8**	**%W**	**growth '87-09**
LSU	49%	23%	Harvard	20%	7%
U Washington	47%	30%	U Chicago	24%	5%
Michigan State	47%	29%	Columbia	27%	9%
Florida	45%	27%	Colorado State	28%	6%
Emory	44%	10%	Ohio State	28%	12%
Georgia Tech	41%	20%	Washington St L	28%	-3%
Purdue	40%	15%	UCSB	30%	3%
NC Chapel Hill	40%	11%	Iowa State	30%	8%

Variation from the Mean: Representation of Women PhDs



The pool of potential applicants is growing…
but PhDs to women trail growth in BS/MS degrees



What influences growth in % women PhDs?

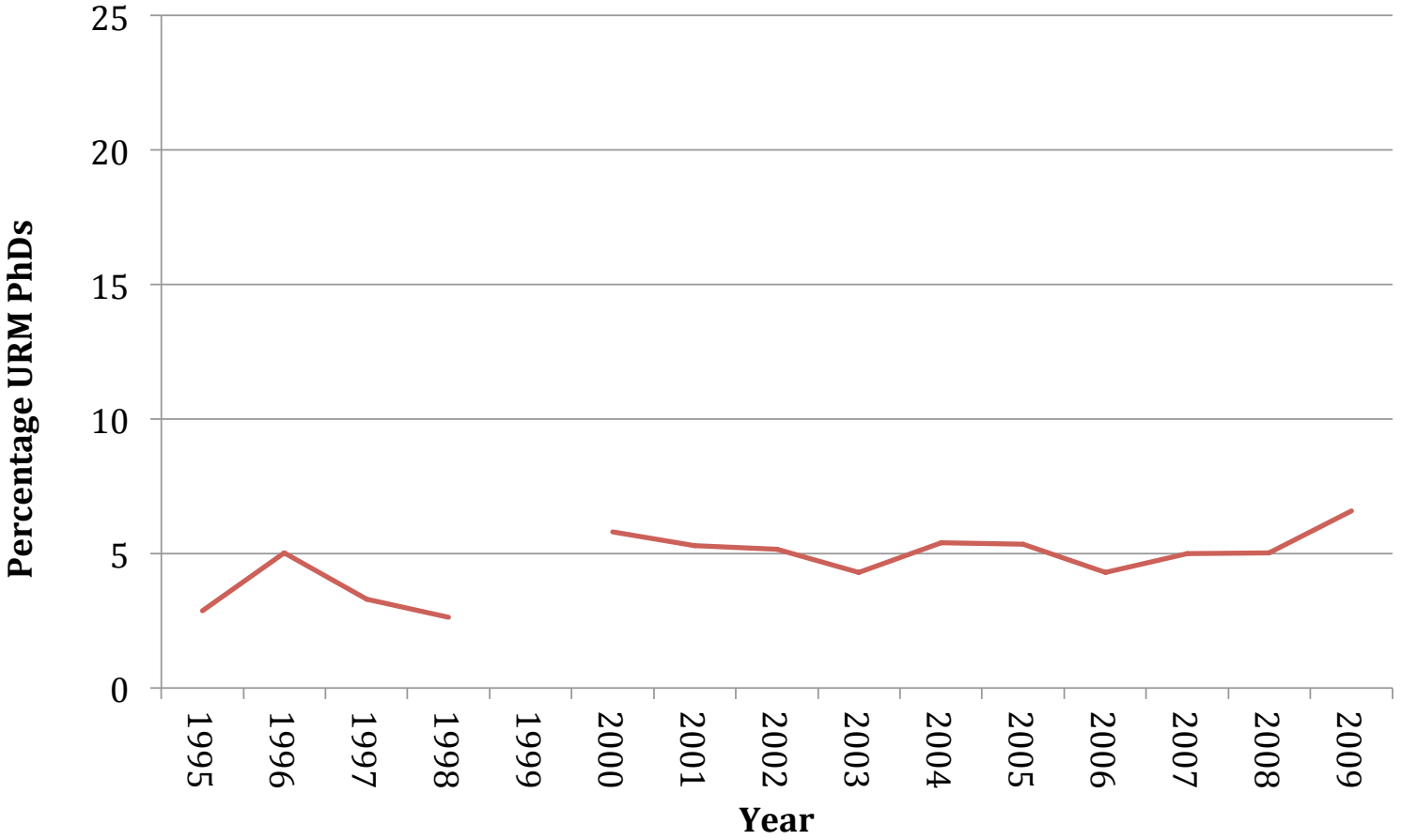
- Departments that grant more degrees overall grant *fewer* to women (big depts are less gender-balanced)
- Overall growth in PhD grads correlates *positively* with growth in women grads (depts grow by adding women)

• No statistical relationship between %women PhDs & %women faculty

• Literature: critical mass, mentoring, collegial environment, interdisciplinary work

The number of minority PhDs is small

Percent URM students 1995 - 2009



Trends: Race & ethnicity

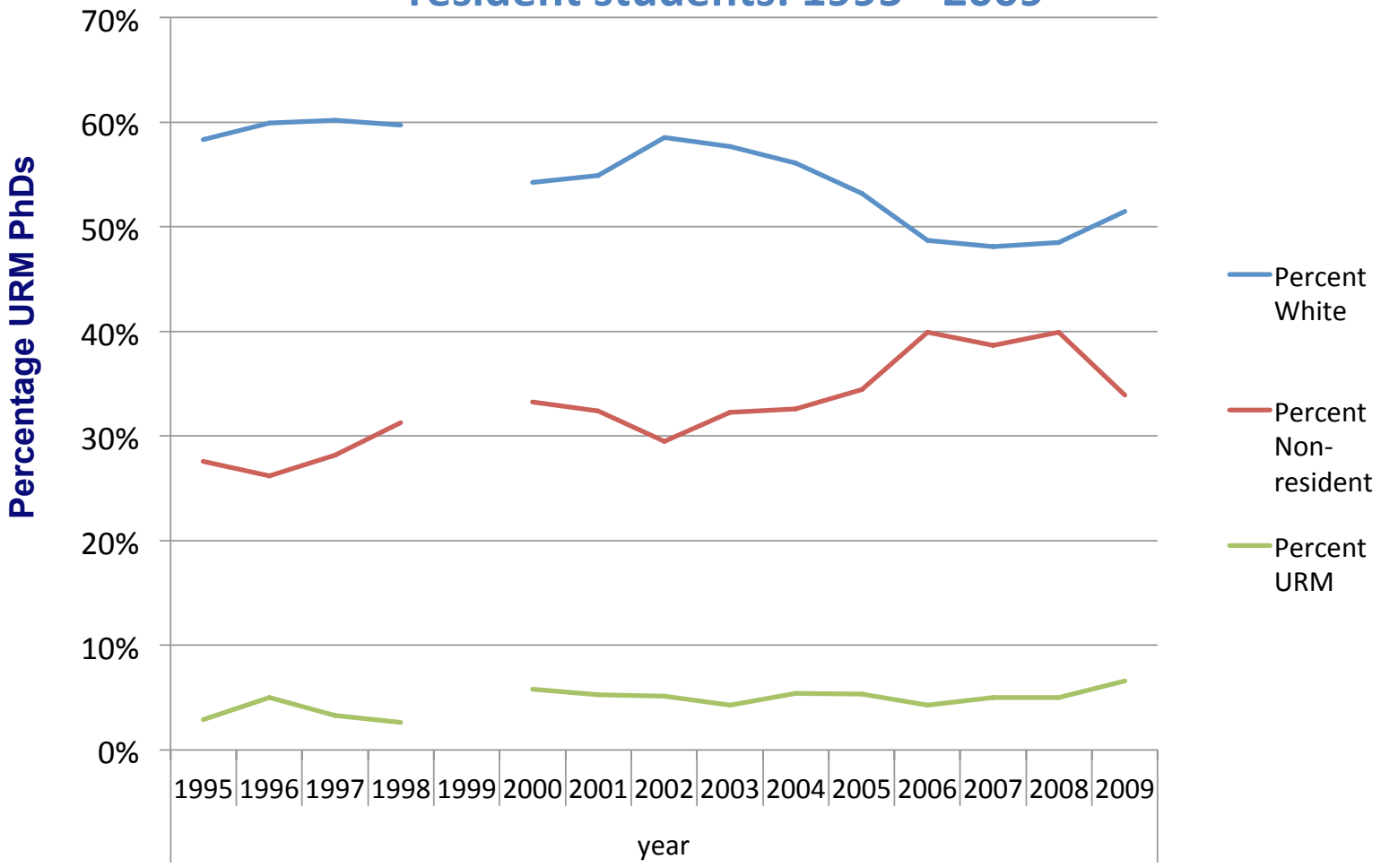
Student bodies are becoming more diverse ‘95-’09

- ✓ Proportion of US white students fell 11%
- ✓ Proportion of US Hispanics rose 1.4%
- ✓ Proportion of non-residents rose 11%

Larger departments have proportionately…

- ✓ more white students
- ✓ fewer Black & Hispanic students
- ✓ fewer non-resident students

Ph.D representation for US white, US URM & non-resident students: 1995 - 2009



Relationship to faculty composition

Departments with more white faculty have…

- ✓ more white students
- ✓ fewer Hispanic, Asian & non-resident students

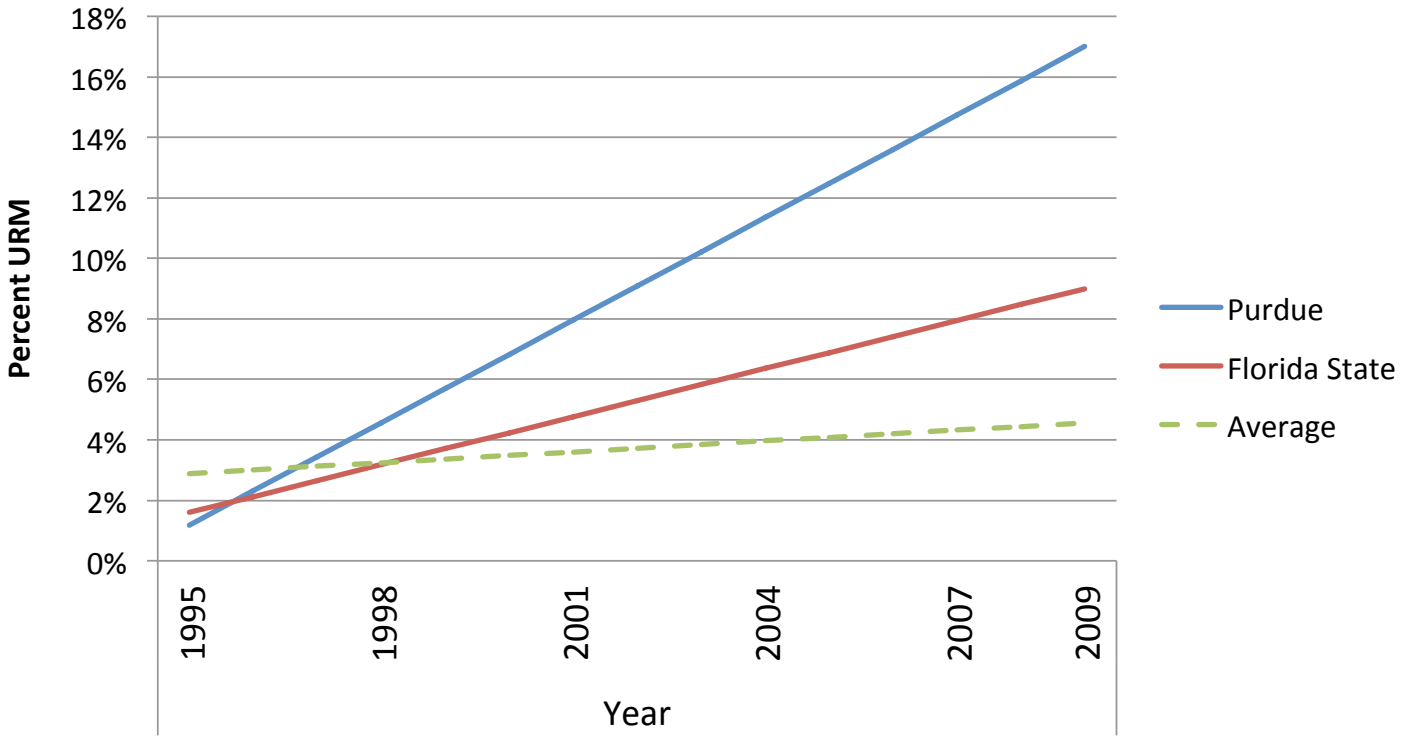
Departments with more Black faculty have

- ✓ Proportionally more Black students

URM representation does not increase evenly

Mean	*5.0%*	*1.6%*			
Top 8	**%URM**	**Growth '95-09**	**Bottom 8**	**%URM**	**Growth '95-09**
LSU	20%	11%	Wisconsin	0%	-3%
Purdue	17%	17%	Illinois	0%	-2%
UCSD	11%	7%	Columbia	0%	-2%
UCLA	10%	9%	USC	0%	-1%
Florida State	9%	9%	Penn	1%	-3%
UC Irvine	9%	8%	Chicago	1%	-2%
Harvard	9%	6%	Minnesota	1%	-1%
UCSB	9%	2%	Pitt	1%	-1%

Beating the pack: Graduation of URM PhDs



Diversity offers benefits and challenges

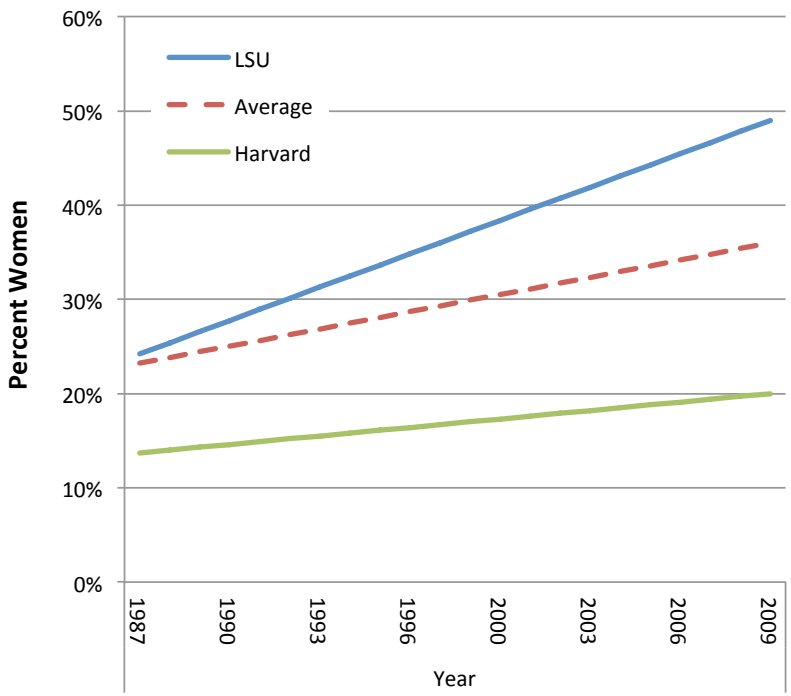
From our interviews

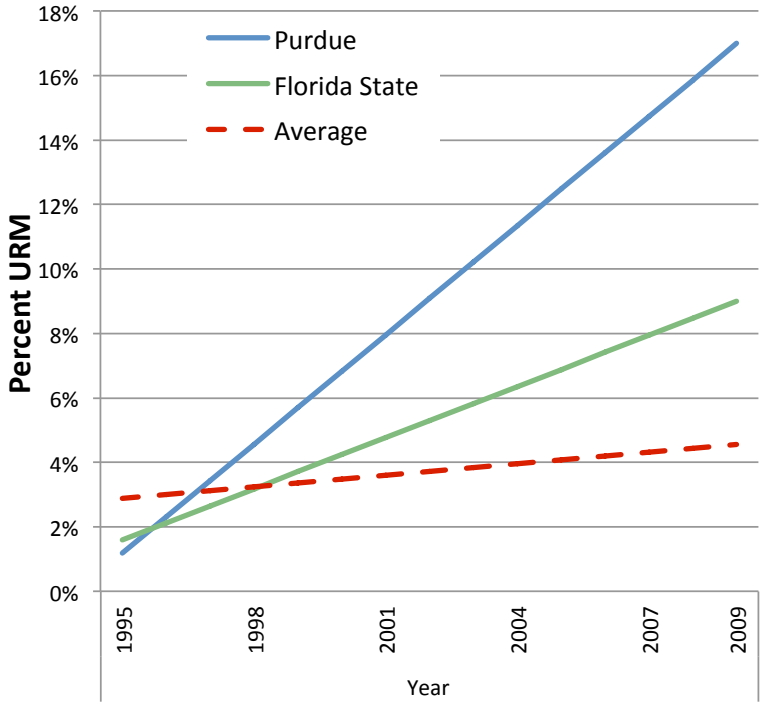
- Diversity of student bodies varies widely among depts
- Some depts actively & intentionally seek diversity
  - Know & track data; prepare diversity plans; define who is accountable (see Purdue, LSU examples)
- Successful strategies combine recruitment efforts with student support plans
- A climate of nurturing the whole person is a good retention tool

Diversity has a snowball effect

Departments that have built a critical mass find that recruitment & retention "take care of themselves"

What does it take to be “above average”?





Resources

Purdue plan for broadening participation

U Michigan Rackham Grad School, “Recruiting for Diversity”

Washington GO-MAP recruiting best practices

Diversity & the PhD, Woodrow Wilson Foundation, 2005

Strategictoolkit.org

StratEGIC

Strategies for Effecting Gender Equity and Institutional Change

Laursen & Weston (2014). J Chem Ed

http://www.colorado.edu/eer/research/grad.html