

CAREER CHOICES AND EARNINGS TRAJECTORIES OF SCIENTISTS

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A tale of two studies...

- **Industry or Academia, Basic or Applied?: Career Choices and Earnings Trajectories of Scientists**
 - Rajshree Agarwal and Atsushi Ohyama
 - Forthcoming in Management Science

- **Who has it all?: Gender Gap in Earnings of Scientists and Engineers in Academia and Industry**
 - Rajshree Agarwal, Waverly Ding and Atsushi Ohyama
 - Work in progress

Ne'er the twain shall meet...?



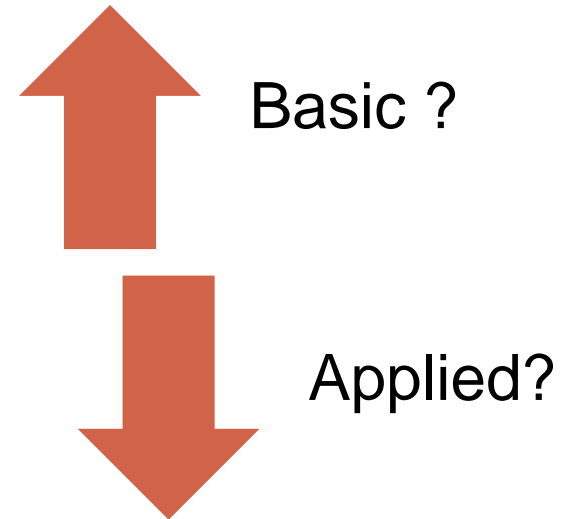
- *Satisfactory progress in basic science seldom occurs under conditions prevailing in the normal industrial laboratory.*

Science, The Endless Frontier (Bush, 1945)

- *Applied research is facing a shortage of its principal raw materials*

Charles Stine, Speech to Dupont Executive Committee, 1926 (Hounshell and Smith 1988, p. 366)

What should I do when I grow up?



Empirical context

- Scientists and Engineers Statistical Data System (SESTAT)
 - Survey of Doctoral Recipients 1995-2006
 - Graduates from US universities, working in the US
- Definition of careers
 - Industry—principal employment in private, for profit institution
 - Academia—principal employment in 4 year college or university, medical school, or research affiliates of university
 - Basic research – study directed toward gaining scientific knowledge **primarily for its own sake**
 - Applied research – study directed toward gaining scientific knowledge **to meet a recognized need**

Are the careers really orthogonal?

	Counts		Percentages	
	Basic Science	Applied Science	Basic Science	Applied Science
Academia	204,542	167,865	Total: 26.0	Total: 21.3
			Column: 66.2	Column: 35.1
			Row: 54.9	Row: 45.1
Industry	104,393	310,596	Total: 13.3	Total: 39.4
			Column: 33.8	Column: 64.9
			Row: 25.2	Row: 74.8

Source: 2003 SESTAT data using sample weights in SESTAT

Career choices and earnings trajectories: In a nutshell...



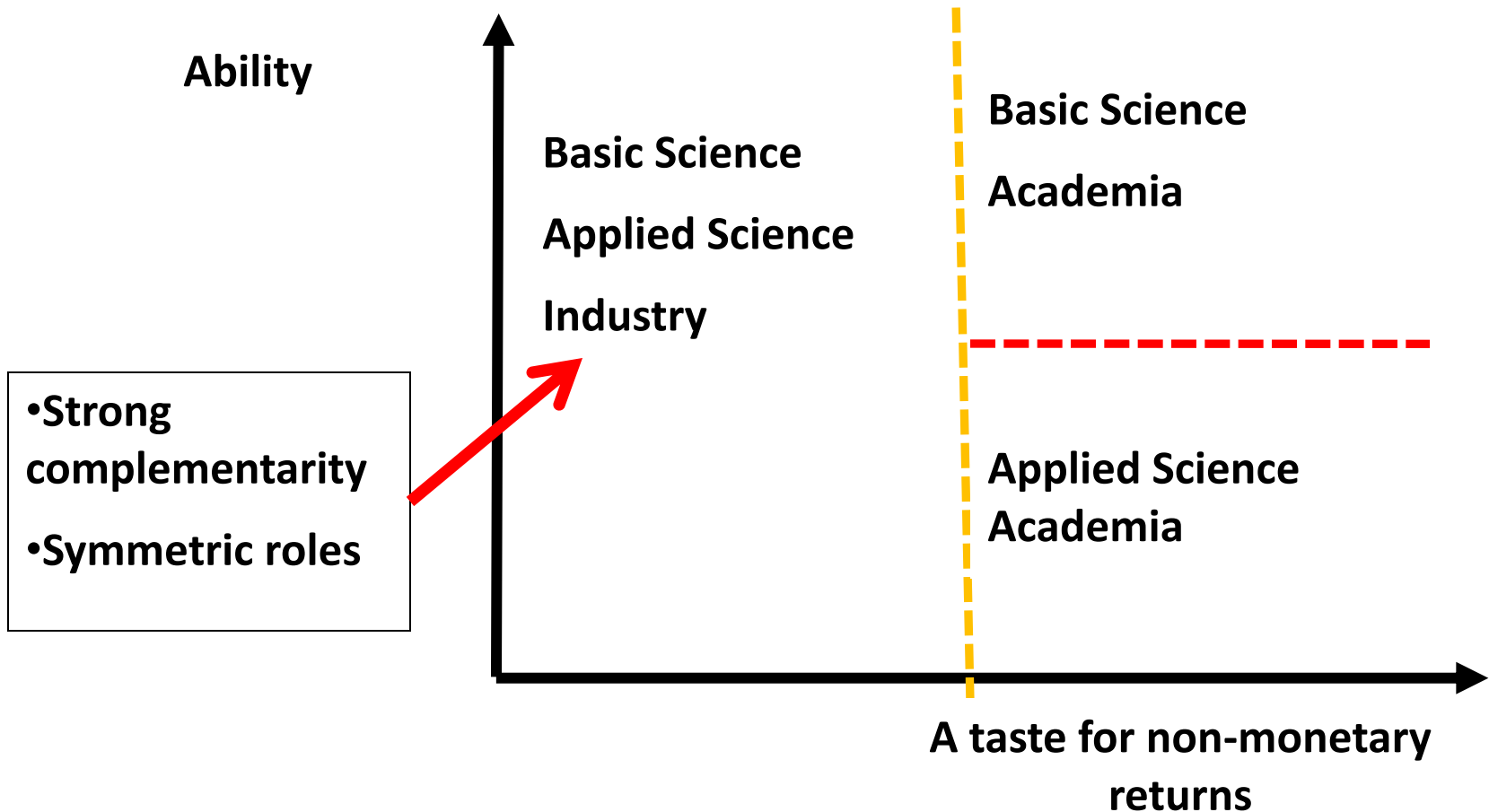
- Main research questions
 - What factors impact scientist career choices between industry or academia, and basic or applied science?
 - What are the implications of career choice on earnings trajectories?
- Key predictions and findings
 - A taste for non monetary returns
 - sorts scientists to choose careers in academia over industry,
 - but has little impact on the choice between basic and applied science
 - Ability
 - differentiates among academic scientists,
 - but no significant differences among industry scientists
 - Earnings profile
 - In industry, similar trajectories for basic and applied researchers
 - In academia, basic researchers start at lower levels of compensation, but earnings evolve at a higher rate
 - Basic researchers in academia ultimately make the same as industry scientists



Model Setup: Scientific Labor Markets

- Incorporates matching theory into traditional lifecycle models of human capital investment
- Supply side heterogeneity in ability and preferences of scientists
- Demand side heterogeneity in complementary physical and human capital
 - Basic scientists have greater access to physical capital than applied in academia, reverse is true in industry
 - Basic and applied scientists are complements in scientific production function in industry, but not in academia

Positive Assortative Sorting: Basic vs. Applied and Academia vs. Industry



Proposition 1: Ability sorting in academia, but not in industry

Ability

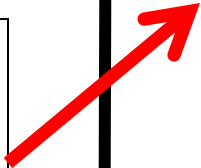
Basic Science
Applied Science
Industry

Basic Science
Academia

Applied Science
Academia

- Strong complementarity
- Symmetric roles

A taste for non-monetary returns



Ability

Basic Science

Applied Science

Industry

Basic Science

Academia

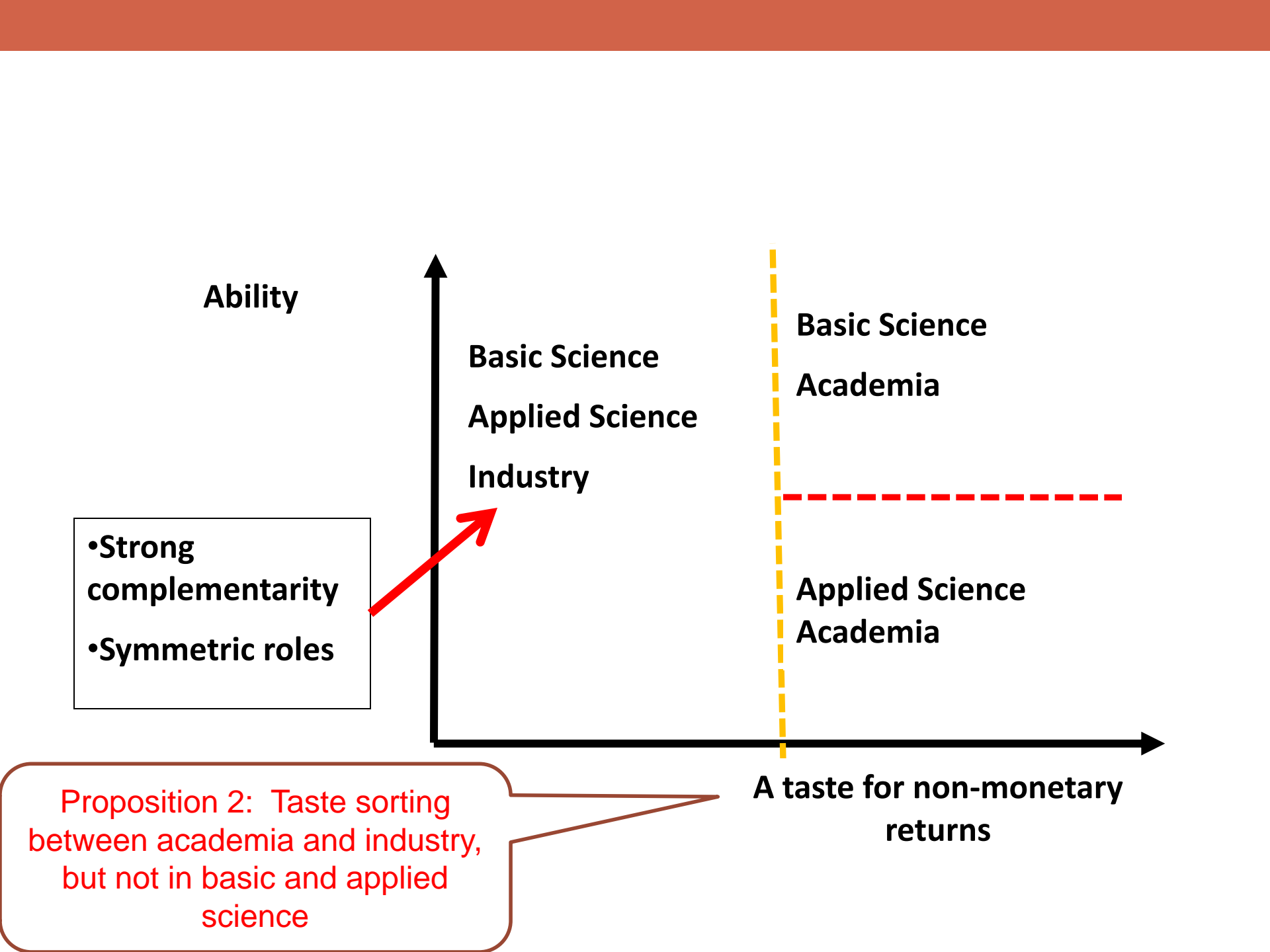
Applied Science

Academia

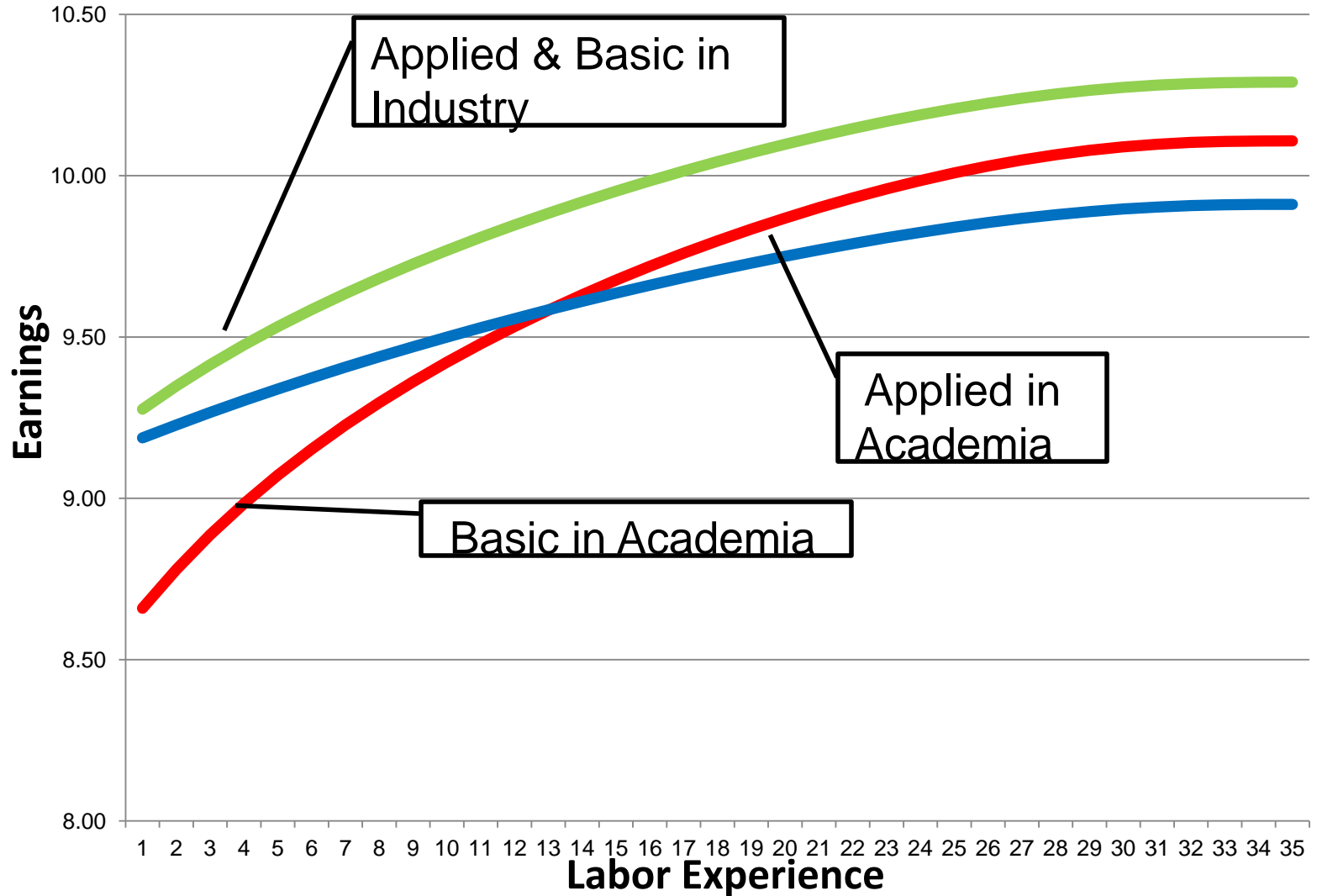
- **Strong complementarity**
- **Symmetric roles**

A taste for non-monetary returns

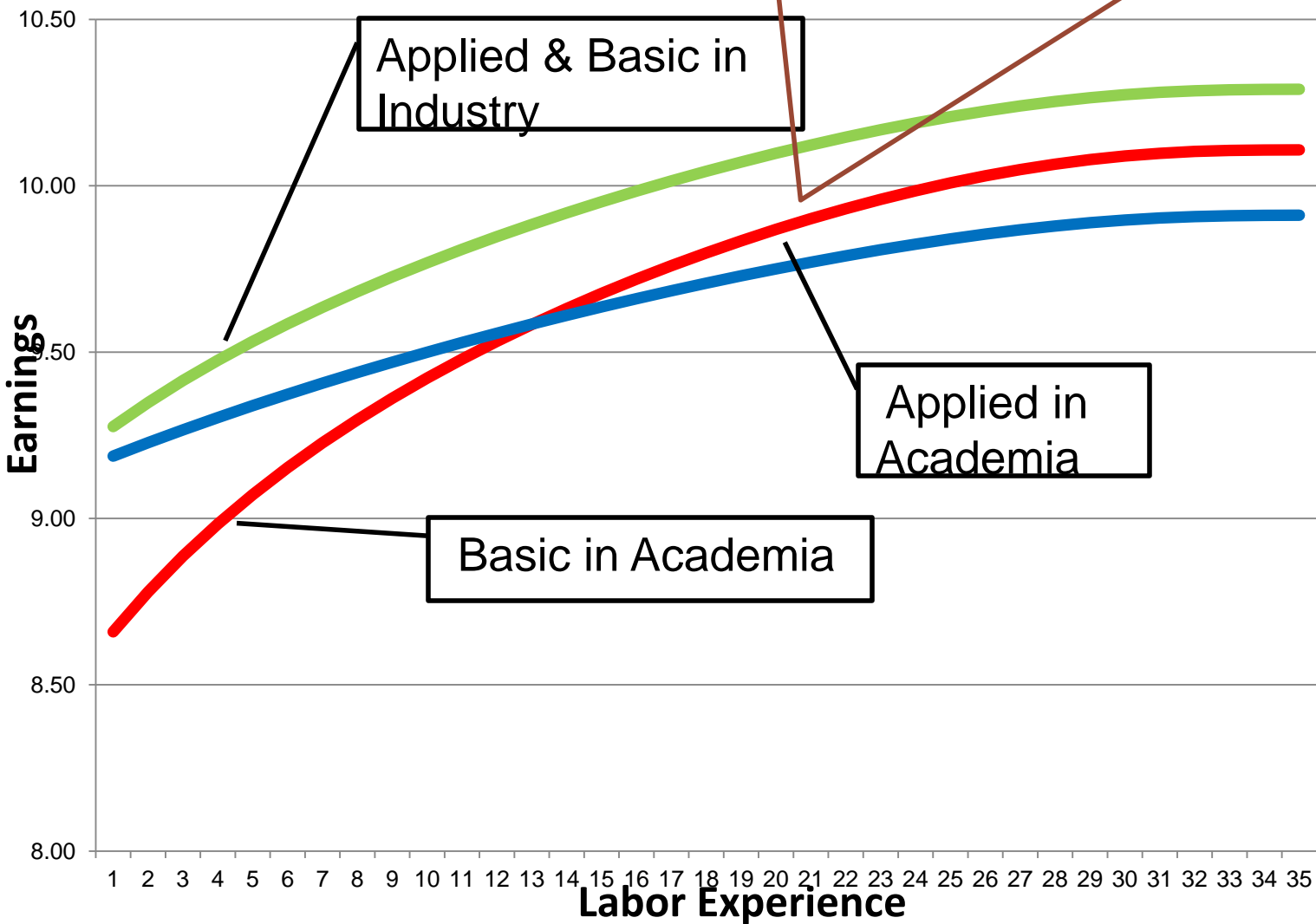
Proposition 2: Taste sorting between academia and industry, but not in basic and applied science



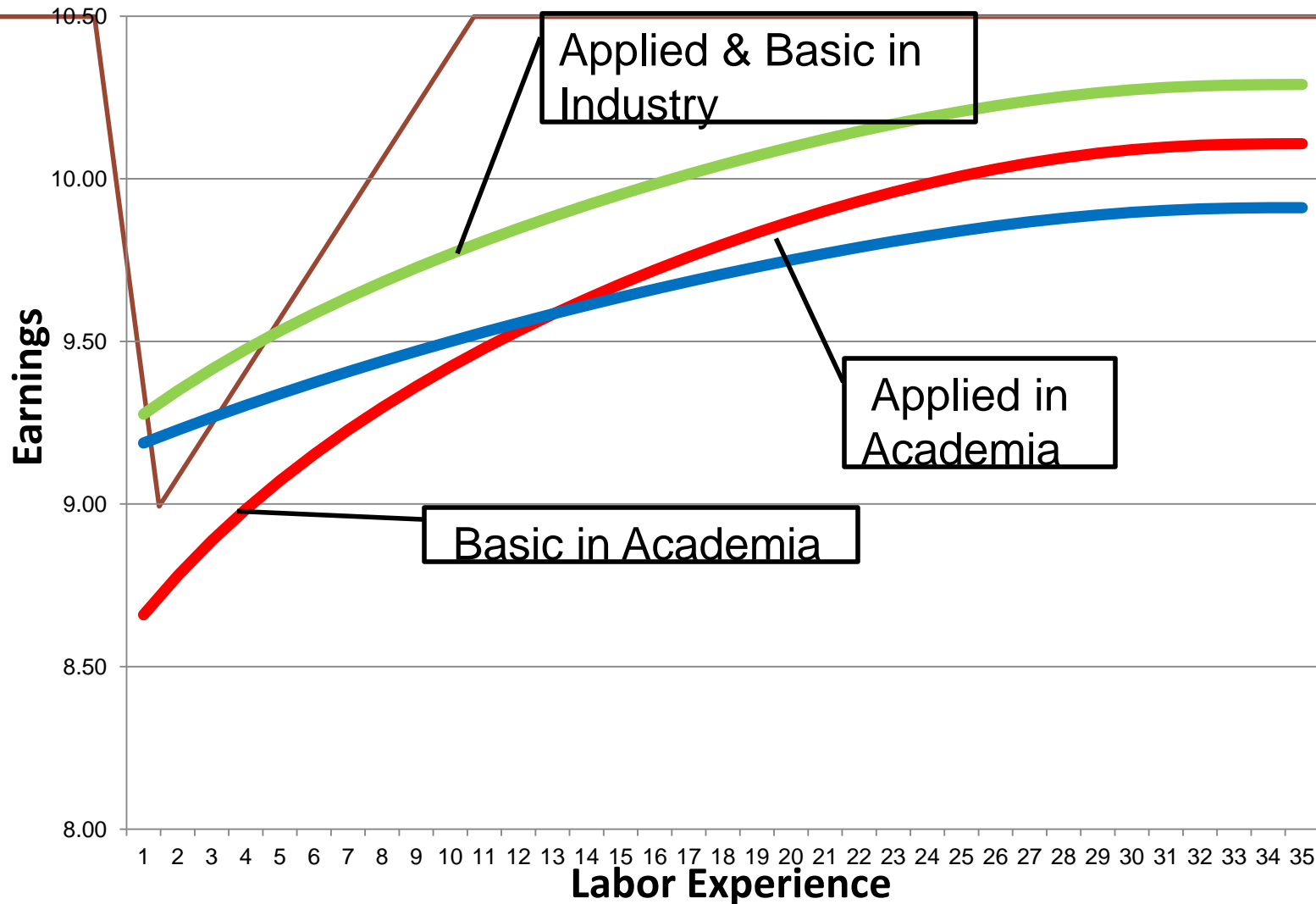
Earnings Evolution



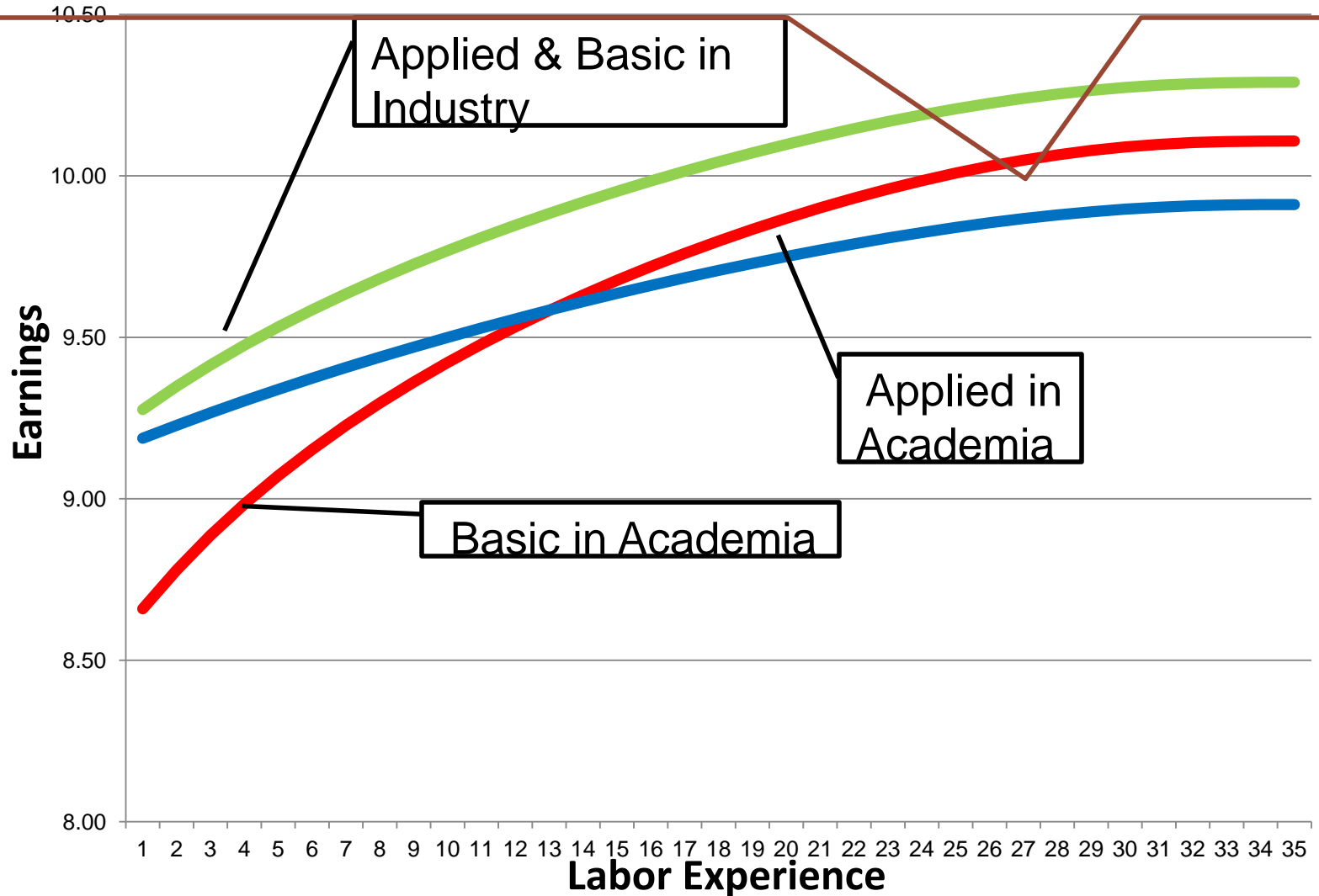
Proposition 3: Earnings in academia are lower than in industry



Proposition 4: Initial earnings of basic scientists lower than applied scientists in academia



Proposition 5: Similar slopes in industry, but steeper slope for basic than applied in academia



Policy implications

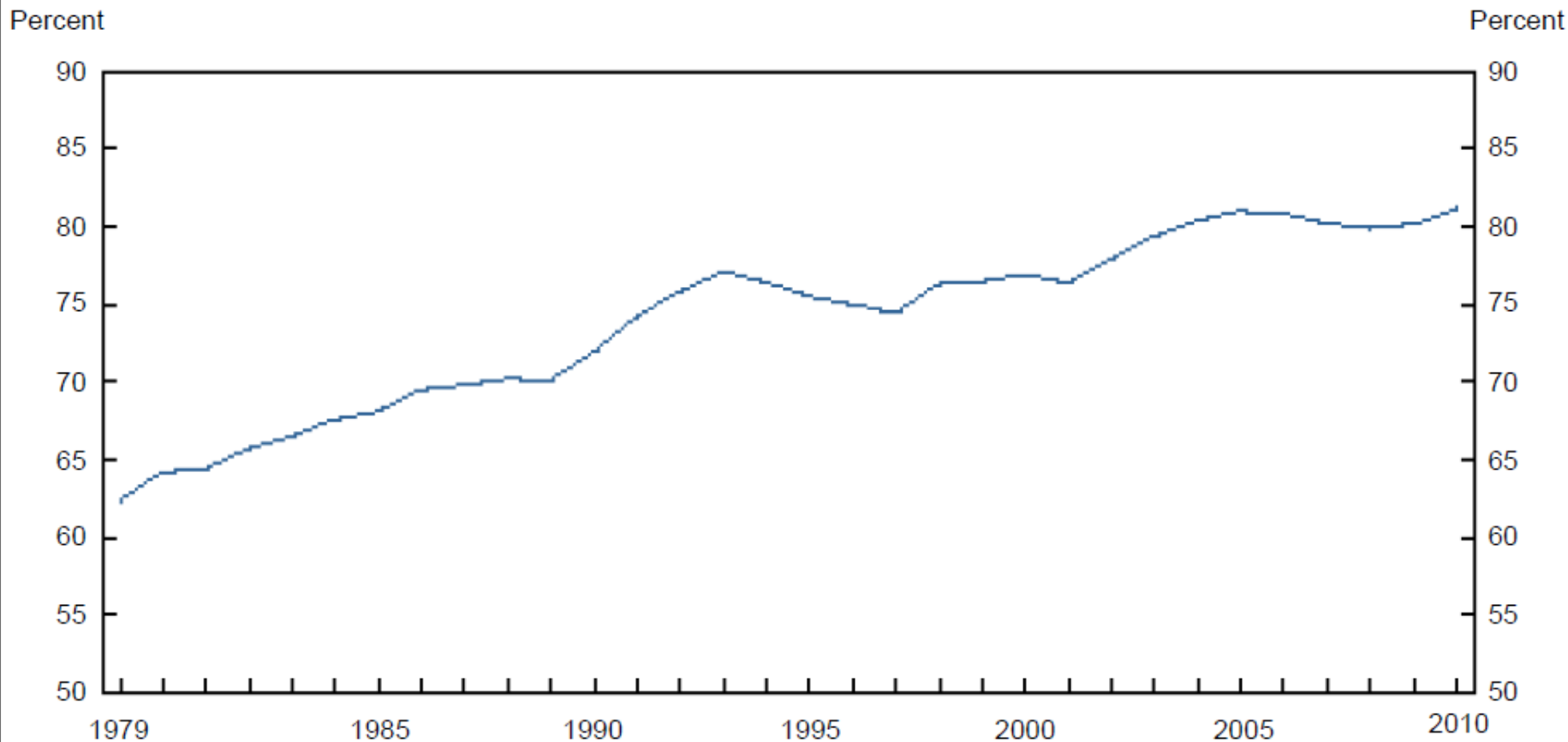
- Are we really doing all that we can in the universities to equip PhD students for the career options other than basic academic research?
 - There is *no* evidence of ability sorting between academia and industry
 - Need to develop programs
 - that systematically complement “science skills” with “business savvy”
 - that provide “career counseling” for PhD students to match them to career options
- Productivity gains (and higher earnings) in industry is due to true synergies between basic and applied science
 - If we want to encourage more university technology transfer, we need to break the “silos” of applied and basic research in academia

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Paycheck Fairness

Chart 1. Women's earnings as a percent of men's, full-time wage and salary workers, 1979–2010 annual averages



NOTE: Data relate to median usual weekly earnings of full-time wage and salary workers.

SOURCE: U.S. Bureau of Labor Statistics.

What about highly skilled labor markets?

- Our explicit focus:
- Individuals with a PhD in Science and Engineering

	Industry (private, for profit)	Academia (4 year educational institutions)
Male	155,560 (80.6%)	182,920 (67.4%)
Female	37,340 (19.4%)	88,620 (32.6%)

Source: NSF SESTAT data, 2006

Gender issues salient in both sectors



“Having it all...depended almost entirely on what type of job I had”

Anne-Marie Slaughter,
Princeton University



“The moment a woman starts thinking about having a child, she doesn’t raise her hand anymore”

Sheryl Sandberg,
Facebook



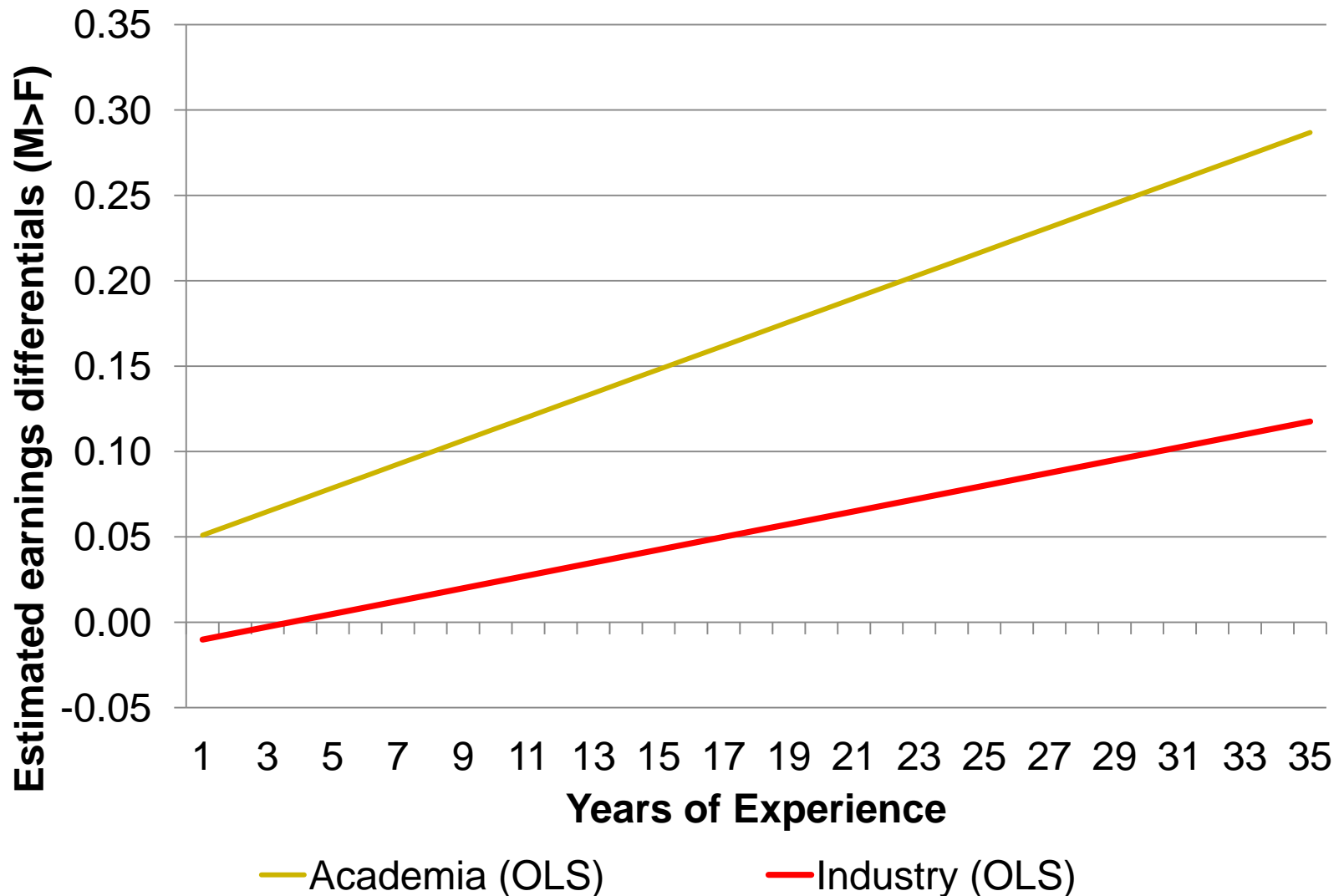
Gender gap in academia vs. industry



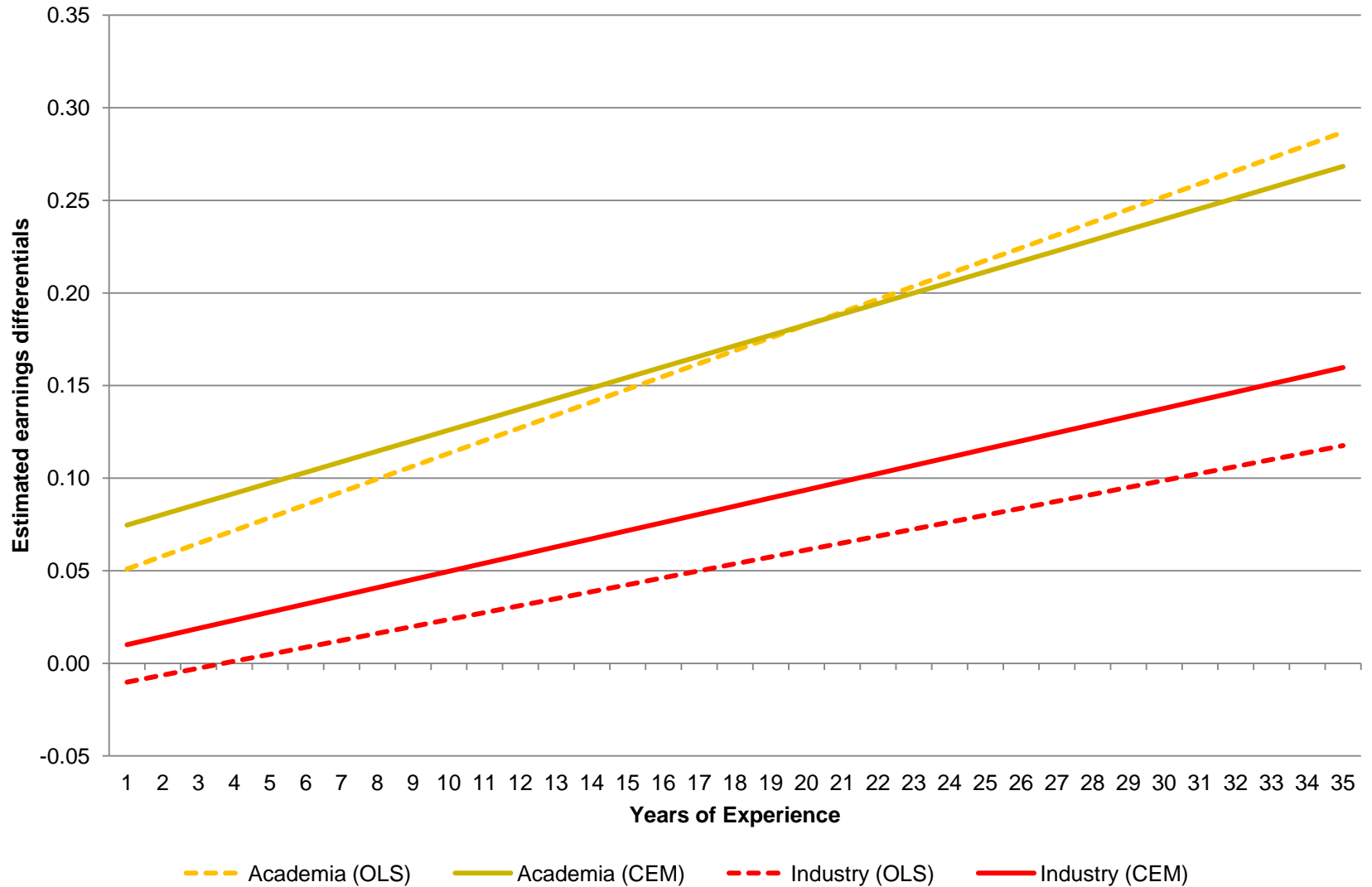
- Main research questions
 - Is the gender gap higher in industry or academia?
 - What are the potential explanatory factors, particularly as it relates to family status?
- Quick poll...
 - Where do *you* think that the gender gap is higher?
 - Why?
- Methodology to estimate gender gap
 - Parametric (OLS) regression with controls for ability, demographics, family status...
 - Non parametric Coarsened Exact Matching by creating “twins” based on ability, demographics, family status...

OLS Estimation of Earnings Gap

(LogSalary ~ marriage, children, spousal working, school ranking, parental edu, exp, exp², white, citizenship, occupation)



OLS vs. CEM estimation



Possible Explanations?



- “Work-life” balance issues
 - Dual Careers
 - Women in academia may be more restricted in options of universities in major metropolitan areas
 - The “Baby Penalty”
 - Child rearing responsibilities disproportionately affect women in academia given coincidence of having babies and getting tenure
- “Good Ol’ Boys” effect
 - Market forces may be stronger in industry vs. academia
- The Pink Ghetto argument
 - Women are more segregated into lower paying sectors in academia than in industry
- Cohort effects
 - Widening gap over experience maybe due to compositional differences in cohorts



Your help...

- Tried to do sub-samples to get at “pink ghetto effects”
 - Not enough observations to get CEM matches
- Cohort differences?
 - Will be getting 2008 SESTAT data, but still have issues related to number of distinct points across cohorts
- Other human capital investment considerations?
- How to attribute residual to “Good Ol Boys Club”?
- Other??

