WOMEN’S AND MEN’S CAREER CHOICES IN ASTRONOMY AND ASTROPHYSICS

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LONGITUDINAL STUDY OF ASTRONOMY GRADUATE STUDENTS

• Partnership between American Institute of Physics and American Astronomical Society (AAS)
• Includes everyone who was in graduate school in astronomy or astrophysics in the US, 2006-07
• Data have been collected from the same cohort of people in order to document individual career paths
• Three waves of data have been collected:
  – 2007-08
  – 2012-13 five years later
  – 2015-16 eight years later
THIS ANALYSIS

• Second and third surveys
• limited to people who
  – completed PhDs at the time of the 2\textsuperscript{nd} survey
  – were not postdocs at the time of the surveys
LONGITUDINAL STUDY OF ASTRONOMY GRADUATE STUDENTS

• Result of Women in Astronomy Conference, 2003 in California, USA
• At that time, about 60% of younger members were women, and AAS wanted to know outcomes for these members.
• Would women have a higher attrition rate? Are women more likely to leave the field? If so, why?
HYPOTHESIS

We hypothesized that women would be more likely to work outside of astronomy and physics. In other words, being female would have a direct effect on leaving the field, independent of other factors.
IS WORKING IN OR OUT OF FIELD Affected BY

• Being male or female (40% female respondents)
• Taking a postdoc
• Two-body problem (a work/family balance problem that refers to the difficulty of finding 2 jobs in same geographic area)
• Having a mentor other than advisor
• Relationship with advisor
• Imposter syndrome (at time of first survey)
• Time since degree
SECOND SURVEY
PARTNER IN ASTRONOMY

% with partner who worked in or studied astronomy

Women

Men
SECOND SURVEY
TWO-BODY PROBLEM

- Relocated for spouse or partner
- Maintained different residence
- Limited career options for someone else

Bar chart showing the percentage of women and men for each category.
SECOND SURVEY
MENTOR OTHER THAN ADVISOR IN GRAD SCHOOL

- Women: 60%
- Men: 40%
SECOND SURVEY
FOUR MEASURES OF ADVISOR RELATIONSHIP

- Encouraged career goals
- Encouraged me to excel in research
- Gave adequate input
- Was easy to discuss ideas with

[Bar chart showing the percentage of encouraged responses for women and men]
FIRST SURVEY
IMPOSTER SYNDROME

Women: 60%
Men: 20%
HYPOTHESIS

We hypothesized that women would be more likely to work outside of astronomy and physics. In other words, being female would have a direct effect on leaving the field, independent of other factors.
SECOND SURVEY
DOES BEING MALE OR FEMALE INDEPENDENTLY AFFECT OTHER VARIABLES IN MODEL?

- Gender
- Not a post-doc
- Mentor other than advisor
- Advisor relationship
- Imposter score
- Two-body problem
- Time since degree

Working out of the field
SECOND SURVEY
FACTORS THAT INFLUENCE WORKING OUT OF FIELD

- Relocated for spouse or partner
- Limited career options for someone else
- Completed a postdoc
- Changed advisors

More likely to work out of field  More likely to work in field
ANOTHER HYPOTHESIS

• There may be indirect effects of gender on working out of field.
• In other words, women may be more likely to have experiences that increase the likelihood of working out of field.
SECOND SURVEY
TESTING INDIRECT EFFECTS OF GENDER EXAMPLE OF ONE MODEL

- Gender
- Mentor other than advisor
- Imposter Score
- Two-body problem
- Advisor Rating

Change Advisor
SECOND SURVEY
THE INDIRECT EFFECT OF GENDER ON WORKING OUT OF FIELD

Gender

Imposter score

Advisor rating

Relocated for spouse or partner

Was not a post-doc

Changed advisors

Limited career options for someone else

Working out of the field
CONCLUSIONS FROM SECOND SURVEY

• We hypothesized that women would be more likely to work outside of astronomy and physics. In other words, being female would have a direct effect on leaving the field, independent of other factors.

• However, there is no direct effect of being female on working outside the field. The effect of being female comes through other factors.

• Women may be more likely to leave astronomy because
  – Women are more likely to report less than satisfactory advising.
  – Women are more likely to report two-body problems related to the need to find two jobs in the same geographic area for a spouse or partner.
THIRD SURVEY, 2015

• What is it about the advising relationship that makes a difference?
• The 3\textsuperscript{rd} survey has additional items about the advisor relationship.
• Encourages me to present our research at scientific conferences
• Gives regular feedback on my research
• Gives the appropriate level of credit to me for my research contributions
• Engages me in writing grant proposals
• Provides information about academic career paths
• Provides information about non-academic career paths
ADVISOR QUESTIONS, THIRD SURVEY (FROM AMERICAN CHEMICAL SOCIETY)

• Helps me to develop professional relationships
• Advocates for me
• Supports my career path of choice
• Models good professional relationships

Encourages me to attain my goals

• Takes time to learn about my background, interests, and/or personal relationships
THIRD SURVEY
MY ADVISOR ENCOURAGES ME TO ATTAIN MY GOALS

Women
- Strongly agree: 35%
- Agree: 47%
- Disagree: 14%
- Strongly disagree: 4%

Men
- Strongly agree: 49%
- Agree: 45%
- Disagree: 5%
- Strongly disagree: 1%
FACTORS DIRECTLY AFFECTING WORKING OUT OF FIELD IN 2015

- Encourage to attain goals (1 step)
- Encourage to attain goals (2 steps)

Working out of field in 2012

Times more likely to work out of field
THE INDIRECT EFFECTS OF GENDER ON WORKING OUT OF FIELD 2012 & 2015

Gender

Imposter score

Advisor rating

Relocated for spouse or partner

Was not a post-doc

Changed advisors

Limited career options for someone else

Working out of the field (2012)

Working out of the field (2015)

Advisor encourages my goals
CONCLUSIONS FROM THIRD SURVEY

• There still is no direct effect of being female on working outside the field. The effect of being female comes through other factors.

• The 2015 survey found that the most important predictors of working out of field are
  – Having worked out of field previously
  – Reporting that your advisor did not encourage you to attain your goals

• In addition to the factors that contributed to working out of field in 2012, women may be more likely to leave astronomy because
  – Women are less likely to say that their advisor encouraged them to attain their goals.
  – Women were indirectly more likely to have worked out of field in 2012.
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OUTCOMES OF THOSE WITH PHDS, 2012-13

- PhDs: 83%
- Not PhDs: 17%
- Never Postdoc: 23%
- Completed Postdoc: 15%
- Current Postdoc: 40%
- Postdoc no details: 5%