

Physics PhDs Ten Years Later: Movement across Job Sectors

Results from the PhD plus 10 Study

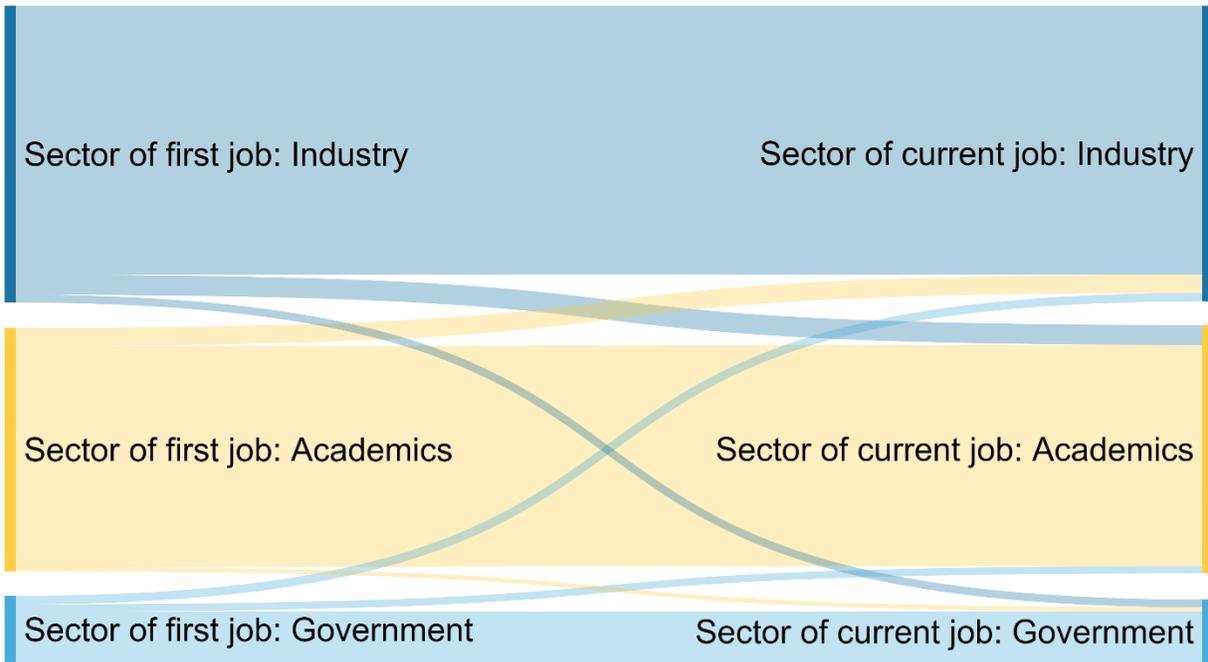
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How does the first job PhD physicists take affect their career paths? Is there quite a bit of mobility across employment sectors? Or does the first job set the course for physicists' career paths?

In the first-ever ten-year follow-up survey of physics PhD recipients, we contacted physics PhD recipients from the classes of 1996, 1997, 2000, and 2001 who were in the US during 2011. Among other things, we asked about the respondent's first job and job at the time of the survey – their current job. (The first job is, by definition, the first job taken after any postdocs.) So, we have a snapshot of outcomes for these PhD physicists ten to fifteen years after they earned their doctorates.

As seen in **Figure 1**, there appears to be little movement across broad employment sectors between the first job and jobs ten to fifteen years later: most of those currently in a given job sector report that their first job was in that same sector.

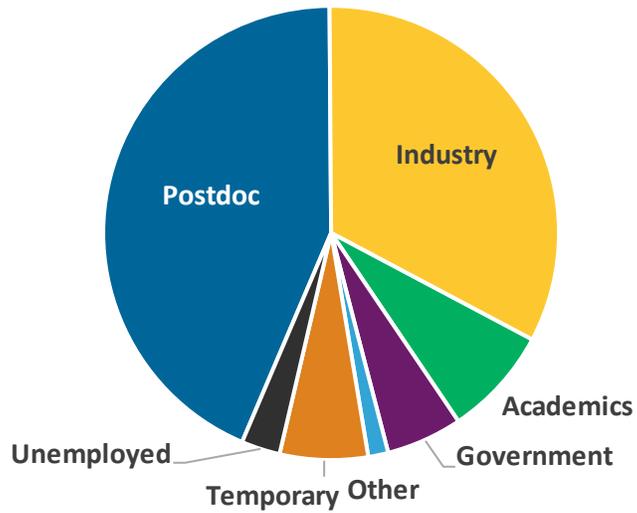
Figure 1
Movement between First and Current Job Sectors
 Physics PhD Classes of 1996, 1997, 2000, and 2001



Includes only degree recipients who remained in the US
First job is first job after any postdocs

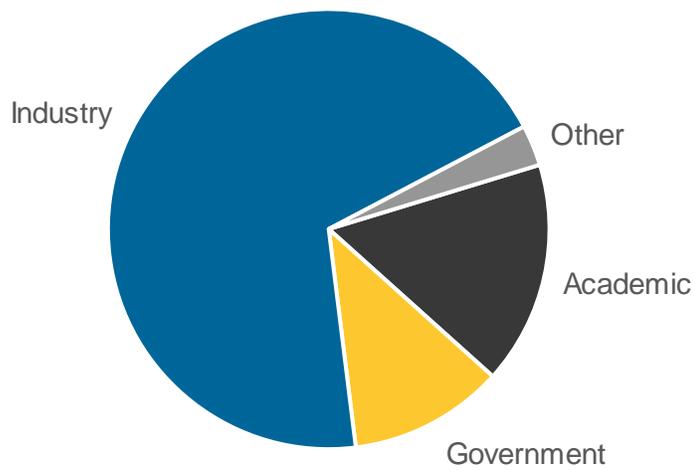
The Statistical Research Center at AIP has a wealth of data on what physics PhD recipients are doing one year after graduation (see www.aip.org/statistics/employment). For the classes included in our PhD plus 10 study (1996, 1997, 2000, and 2001), our data shows that about 45% accepted potentially permanent positions. (By definition, a potentially permanent position is one with no set ending date.) Over 40% took postdocs. (The others accepted temporary positions or were unemployed.) **Figure 2** shows the initial outcomes (including postdocs) for PhD recipients in the study; **Figure 3** includes only the graduates who took potentially permanent positions immediately after graduating.

Figure 2
Initial Outcomes
 1996, 1997, 2000, and 2001 Physics PhD Recipients



Includes only degree recipients who remained in the US

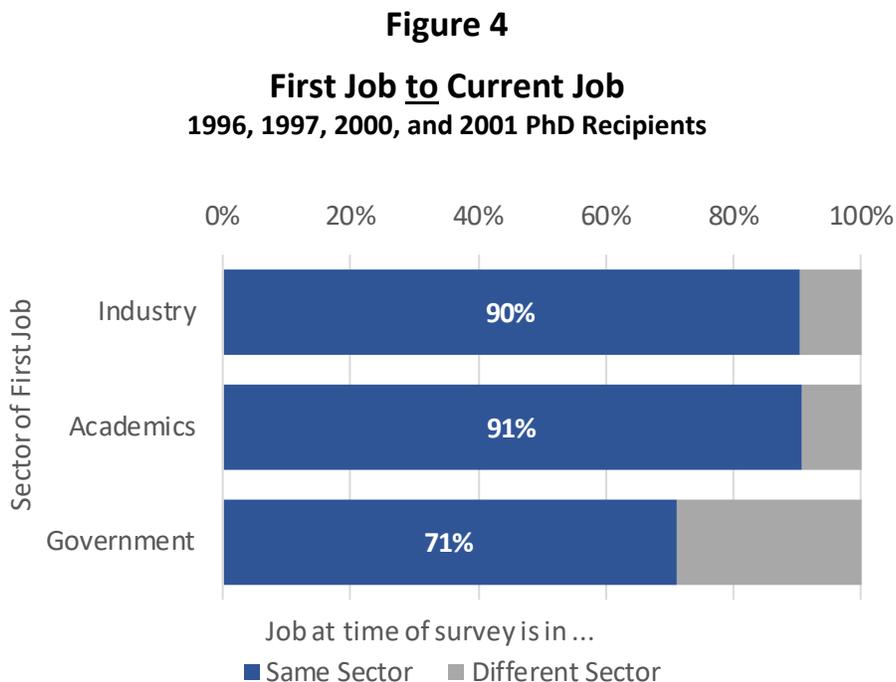
Figure 3
Employment Sectors
 1996, 1997, 2000, and 2001 Physics PhD Recipients
 Accepting Potentially Permanent Positions



Includes only degree recipients who remained in the US

As seen in **Figure 2**, just over 40% of this cohort accepted a postdoc, about one in fourteen accepted a job in academics (which includes two-year colleges and university-affiliated research institutes), and about one in twenty were employed in government positions (which includes both state and federal). The overwhelming majority of those not taking a postdoc immediately after graduating found jobs in industry. (See **Figure 3**.)

There are two ways to look at movement across job sectors: (1) the transition from first job to current job and (2) retrospectively, given the sector of the current job, the transition from one's first job. **Figures 4** and **5** (following pages), depict these alternate views.

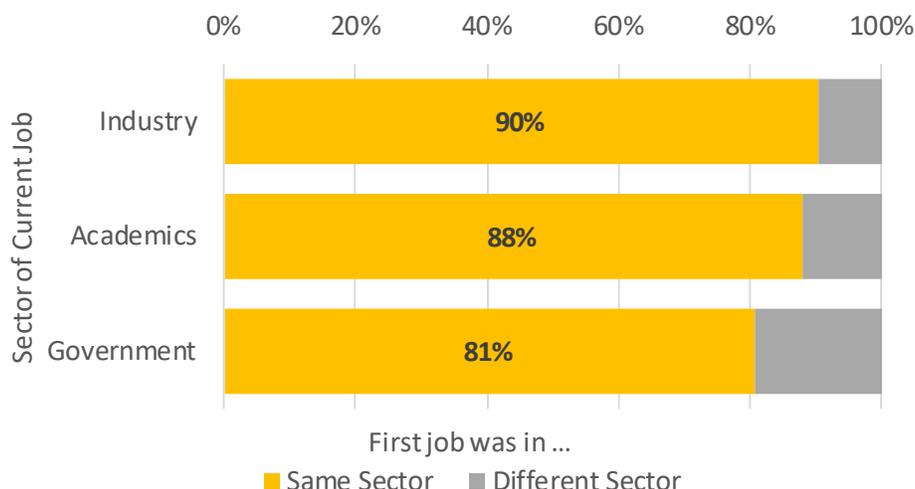


Includes only degree recipients who remained in the US

In **Figure 4**, we see that nine of ten respondents (90%) whose first job was in industry were working in industry at the time of the survey. The proportion is 91% for academics and 71% of the respondents whose first job was in government were still working in government at the time of the survey. In every case, at least 70% of the respondents whose first job was in a given job sector were working in the same sector at the time of the survey.

(How do **Figures 4** and **5** differ? In **Figure 4**, the categories on the y-axis are the sector of the first job after earning a physics PhD and completing any postdocs. In **Figure 5** (following page), the categories on the y-axis are the sector of employment at the time of the survey.)

Figure 5
First Job from Current Job
1996, 1997, 2000, and 2001 PhD Recipients



Includes only degree recipients who remained in the US

In **Figure 5**, we see that the first job for 90% of those working in industry at the time of the survey was in industry; the first job was in academics for 88% of those working in academics at the time of the survey.

Does the Initial Employment Sector Matter?

How much movement is there across broad employment sectors for physics PhD recipients? **Figures 1, 4 and 5** suggest there is very little. However, movement across employment sectors might differ for individuals who did (or did not) complete a postdoc, it might differ for those who are in different cohorts (1996 & 1997 or 2000 & 2001), and it might differ for men and women. Our data show that first job is related to taking a postdoc, with postdocs less likely to go into private sector jobs and more likely to go into academics. Will this difference persist across 10 to 15 years? There may be a cohort difference because there was an economic downturn around 2001, so graduates in the more recent cohort were looking for work in a less favorable economy. Finally, women are hired at greater than their availability rates for faculty jobs, so we know that gender affects initial employment.

We can test for statistically significant differences in outcomes for these factors using logistic regression. This technique is similar to ordinary least squares regression and is used when the dependent variable is binary. In this case, our dependent variable is whether or not the respondent's current job is in a particular job sector. We estimate three different models: one for each of the broad employment sectors.

Since we have two data points about employment sector – a respondent’s initial employment sector (after completing any postdocs) and their employment sector at the time of the survey, we use the following model to test for any statistically significant impact of the initial employment sector, whether or not a respondent had completed a postdoc, and the gender of the respondent on the job sector at the time of the survey. We estimate four models: one for each of the four sectors. The generic model is

$$E_{[K]} = f([E_A, E_G, E_I, E_O], \text{postdoc}, \text{cohort}, \text{gender})$$

Where

- $E_{[K]}$ is a binary variable that indicates whether or not the respondent is currently employed in the sector of interest,
- $[E_A, E_G, E_I, E_O]$ are binary variables that indicate the respondent’s initial employment sector; (only three are used in a particular model; $E_{[K]}$ is excluded),
- *postdoc* is a binary variable indicating whether or not the respondent completed a postdoc,
- *cohort* is a binary variable indicating the cohort with which the respondent graduated (1996/97 or 2000/01), and
- *gender* is a binary variable indicates whether the respondent identified as female or male.

We have data from 1,386 respondents, most of whom are mid-career since they are ten to fifteen years removed from earning their PhDs. As noted, we analyze three separate models: one for current employment in each of the three broad employment sectors. In our results, statistical significance is indicated by the *p*-values shown in the tables. A *p*-value is a measure of whether the estimated value is significantly different from the null hypothesis. In our tests, our null hypothesis is that the initial job sector makes no difference in the sector of current job, controlling for gender, cohort and taking a postdoc. The alternative hypothesis is that there is a difference. A *p*-value ranges between 0 and 1, and a smaller *p*-value indicates stronger evidence to reject the null hypothesis.

The results are shown in **Table 1**. They indicate the relative likelihood of one outcome as compared to another. If a factor has no statistically significant impact on the current employment sector, then the outcome is equally likely regardless of the factor (whether or not the respondent completed a postdoc, for example).

The industry sector includes all private sector jobs. The academic sector includes jobs at two- and four-year colleges and at high schools. The government sector includes local, state, and federal government jobs; employment in one of the branches of the military is also included. Private contractors working for the government are considered to be employed in industry. The other sector includes jobs in medicine and jobs at not-for-profit organizations.

Impact of First Job Sector on Current Job Sector

As the results show, the first job sector impacts the current job sector. The results for each sector are shown in a column in **Table 1**. We found no evidence to suggest any difference in current job sector for respondents in the different cohorts and no evidence to suggest a difference for men and women. We describe the results below.

For respondents whose current job is in industry: Respondents whose first job was in academics or in government are about 40 to 70 times less likely to be working in industry than those whose first job was in industry. Those whose first job was in some other sector are more than 160 times less likely to be working in industry than those whose first job was in industry. In addition, respondents who took a postdoc are about 2 times less likely to be working in industry than those who did not.

Table 1
Employment Sector Differences among
Respondents Working in Various Sectors at the Time of the Survey
1995, 1996, 2000, and 2001 PhD Recipients who Remained in the US

Variables	Current Job Sector (Read down each column for the results from each regression.)		
	Industry	Academics	Government
First job in Industry	‡	-81.9 (<0.0005)	-59.5 (<0.0005)
First job in Academics	-71.2 (<0.0005)	‡	-167.3 (<0.0005)
First job in Government	-40.5 (<0.0005)	-79.0 (<0.005)	‡
First job in Other Sector	-163.4 (<0.0005)	-410.9 (<0.0005)	-86.6 (<0.0005)
Took postdoc	-1.9 (0.001)	1.5 (0.041)	Not significant (>0.05)
<i>Interpretation:</i>	If the respondent (<i>left column</i>), they are ___ times more (or -less) likely to be employed in (<i>column heading</i>) now (<i>p</i> -value shown in parentheses)		

‡ this is the reference category for the first job sectors

There were no statistically significant differences between respondents in the early and late cohorts (1996/97 or 2000/01).

There were no statistically significant differences between men and women.

For respondents whose current job is in academics: Respondents whose first job was in industry or in government are about 80 times less likely to be working in academics than those whose first job was in academics. Those whose first job was in some other sector are more than 400 times less likely to be working in academics. In addition, respondents who took a postdoc are 1.5 times more likely to be working in academics.

For respondents whose current job is in government: Respondents whose first job was in industry or in academics are about 60 to 170 times less likely to be working in the government sector than those whose first job was in government. Those whose first job was in some other sector are more than 80 times less likely to be working in government.

Summary

The data suggest that the employment sector of the first job a physics PhD recipient takes affects his or her employment sector ten to fifteen years later. While our data are not necessarily representative of all physics PhDs (See **Survey Methodology**, below.), the p -values are small enough to suggest that the likelihood of moving across job sectors is low. Of course, these data are taken from PhD recipients in the classes of 1996, 1997, 2000, and 2001. Graduates from later classes will not necessarily experience the same economic circumstances, and their job experiences may differ.

Survey Methodology

During 2011, we contacted over 3,400 physics PhD recipients from the classes of 1996, 1997, 2000, and 2001 for whom we had names and contact information. There were 5,194 physics PhDs awarded in these classes, and we had names for 4,402 of the recipients. We believe we found contact information for about 3,400 of these 4,402.¹ We received responses from 1,544 individuals who were in the physics PhD classes for 1996, 1997, 2000, and 2001.

We know that the respondents are not representative. It was easier to find members of the more recent classes than the earlier classes, and, based on an analysis of the respondents by contact wave, we believe that it was harder to contact individuals employed in industry than those in academics or the government. So, academics are over-represented among our respondents.

For a complete overview of the methodology, please see the Appendix in *Common Careers of Physicists in the Private Sector* by Roman Czujko and Garrett Anderson. This report is available online [here](#) (or at <https://www.aip.org/statistics/reports/common-careers-physicists-private-sector>).

¹ We found 4,402 email or postal addresses (1) for names that appeared to match the names we were looking for and (2) that did not result in bounced email messages or returned letters. We cannot be sure that we actually contacted all 4,402.