The Career Path of the Postdoctoral Researcher

Karen L. Webber & Lijing Yang

To cite this article: Karen L. Webber & Lijing Yang (2015) The Career Path of the Postdoctoral Researcher, Change: The Magazine of Higher Learning, 47:6, 53-58, DOI: 10.1080/00091383.2015.1089760

To link to this article: https://doi.org/10.1080/00091383.2015.1089760

Published online: 16 Dec 2015.
In Short

- Concerns are mounting that postdocs are providing institutions with greater flexibility in staffing grant projects but not necessarily advancing the postdocs’ careers.
- Although taking a postdoctoral position increased the chances of obtaining a faculty position and the number of publications produced, taking two or more did not increase publications any further.
- Female and Asian doctoral-degree holders were significantly less likely to secure a tenured/tenure-track position than their male and white peers. Differences by level and sector of doctoral institution were also evident.
- In 2008, about a decade after doctoral-degree completion, 43 percent of science and engineering (S&E) doctoral recipients worked in educational institutions, and one-third held tenured or tenure-track faculty positions. Another 46 percent worked for business and industry, and 11 percent were employed in government agencies.
- Completion of one or more postdoc appointments did not contribute significantly to the individual’s salary ten years after doctoral-degree completion, possibly due to the relatively low salaries in the education sector compared with industry and government and the delayed entry of postdocs into ladder-rank faculty positions. Being female, older, or graduating from a public rather than a private institution had a statistically significant negative impact on salary.
Postdoctoral appointments have increasingly become "holding bays" rather than steppingstones that guarantee career advancement in higher education.

The number of doctoral recipients in the United States with postdoctoral research appointments in American universities is greater now than ever before (NSF, 2010). According to data from the 2010 National Science Foundation's Survey of Graduate Students and Postdoctorates in Science and Engineering (GSS, 2010), academic institutions in the sciences and engineering (S&E) fields employed 63,415 postdoctoral researchers (postdocs), almost double the number in the mid-1990s. The largest increases in postdoc participation rates are in the life and physical sciences, although such appointments are expanding beyond S&E as well.

In 2013, Debra Stewart's article for the March/April issue of Change described the challenges that face today's graduate-school leaders. Among her several "known unknowns" (pp. 44–45), she identified the need to better understand the preparation of graduate students for employment. Any such understanding of doctoral student preparation must include postdoctoral research activities.

As the number of postdoctoral positions has increased, the career paths of postdoctoral researchers are being transformed in ways that have important implications for college and university leaders. Traditionally seen as a stepping-stone to a faculty career, acquisition of a postdoctoral research position is also supposed to lead to an increase in research productivity. But in a recent examination of NSF's Survey of Doctorate Recipients (SDR) (Yang & Webber, 2015), we found that while taking one postdoc leads to an increase in scholarly publications, multiple postdoc positions did not significantly contribute to a further increase in research productivity.

Before the mid-1970s, as Zumeta (1984) noted, postdoctoral appointments attracted the most promising young scientists and led them to productive research careers, beginning with tenure-track faculty positions. However, the postdoc boom that began in the mid-1970s, combined with the recent economic downturn, has resulted in limited tenure-track openings with more applicants for them, and postdoctoral employment can no longer guarantee a faculty position.

Consistent with Zumeta's point, Nerad and Cerny (1999) found that postdoctoral appointments have increasingly become "holding bays" rather than steppingstones that guarantee career advancement in higher education. Concerns are mounting that postdocs are being hired as cheap labor (Cantwell, 2009; Vogel, 1999), providing institutions with greater flexibility in meeting the contract-based employment terms created by discrete grant projects (Stephan, 2012) but not necessarily advancing the postdocs' careers.

**The Study**

The study of postdoctoral researchers whose findings are described here emanated from a previous study that examined the salary trajectories of US doctoral recipients. Funded by the National Science Foundation (NSF) and the National Center for Education Statistics (NCES) and administered by the Association for Institutional Research (AIR), the previous study examined SDR data and discovered interesting trends in respondents who engaged in postdoctoral work (Webber, 2013; Webber & González Canché, 2015). This led us to explore the issues of postdoctoral researchers in more detail.

We examined respondents who received their doctorate in 1997 or 1998 and who continuously participated in all the subsequent SD Rs from 1999 through 2008. Guided by theories of human capital (Becker, 1962) and academic socialization (Brayley, 1996; Weidman, Twale & Stein, 2001), we examined the early career choices of recent doctoral recipients, differences between doctoral recipients who took on postdocs and those who did not, and the benefits of completing the postdoctoral appointment.

**Findings**

Detailed findings are available from the authors; we offer a summary here. We found that approximately a third (30.16 percent) of the doctoral recipients who earned doctorates in 1997 or 1998 and who continuously participated in the 1999–2008 SD Rs took one postdoc appointment by 2006, and about 7 percent said they held two or more postdoc appointments (less than 1 percent completed three to four postdoc appointments). Among the respondents, only 8 percent of the sample entered a tenure-track faculty position within one year after graduation without completing a postdoc.

The average age of the postdocs in 1999 was 34. As shown in Table 1, this group, from a variety of S&E disciplines, included a low proportion of women (35.3 percent), a high percentage of Asian Americans (20.25 percent), and a small proportion of underrepresented minorities (7.4 percent, including Hispanics, African Americans, and Native Americans). About 17 percent of foreign-born individuals were in the country on temporary work visas in 1999.

In 2008, about a decade after doctoral-degree completion, 43 percent of these doctoral recipients worked in educational institutions, and one-third held tenured or tenure-track faculty positions. Another 46 percent worked for business and industry, and 11 percent were employed in government agencies. The average salary of these doctorates 10 years after graduation was $102,644, but it was considerably lower in the education sector ($82,109) than in the business/industry sector ($121,887).
We completed a series of logistic regression analyses to examine how postdoc work and other factors contributed to these doctorate holders’ choice of employment sector and to their obtaining a tenured or tenure-track position. After controlling for early career path, degree cohort, demographics, and doctoral training, we found that the odds of eventually working in academia for individuals who had one postdoc appointment in educational institutions, government, or industry in 2008 were two and a half times higher than their non-postdoc peers, while the odds of those who had two to four postdocs were four times higher.

These findings indicate that the degree recipients who took multiple postdoc positions may have been focused on entry into a faculty position, regardless of how long it took. But female and Asian doctoral-degree holders were significantly less likely to secure a tenured tenure-track faculty position than their male and white peers in 2008, and doctorates from the S&E fields were somewhat less likely to enter a tenure-track faculty position by 2008 than non-S&E recipients.

These postdocs were unevenly spread among educational institutions, business/industry, and government. Older doctorate recipients were more likely to work in educational institutions, while Asian Americans were less likely to enter the educational sector than they were to work in business and industry. Discipline mattered as well: Compared with peers in the social sciences, doctorate holders from engineering were less likely to choose a position in the education sector in 2008.

A postdoctoral appointment does offer the time to produce research, and a single postdoc appointment seems to have the desired effect of increasing scholarly productivity. Respondents who completed one postdoc by 2006 produced almost twice as many refereed journal articles and other publications as their non-postdoc peers. However, those who took several postdocs did not produce more research than their peers who had only one.

### Demographic and Institutional Differences

Although being female, being older, or having children were negatively associated with the production of refereed articles and other publications, there were no significant differences in productivity by marital status, race, or nationality. The results did reveal differences by level and sector of doctoral institution, though. Graduating from a Research I or II university and being satisfied with one’s doctoral program bore a statistically significant positive relationship with research productivity compared to institutions in other Carnegie classifications, and graduating from a public institution (as compared to a private) and finishing the degree with debt were statistically significant negative predictors.

Differences by discipline and employment sector were also evident. Those whose degrees were in the life sciences...
had more total publications and refereed articles completed by 2008 than those graduating in other disciplines. It is interesting (albeit not surprising) to note that being employed in business and industry had a statistically significant negative contribution to total publications and refereed articles.

**Salaries**

We have mentioned the contributions of early career choice to salary. Overall, though, completion of one or more postdoc appointments did not contribute significantly to the individual’s salary ten years after doctoral-degree completion. Since postdocs typically earn relatively low salaries, a decade may not be long enough to see greater gains from the postdoc experience; to see them may require follow-up even longer after degree completion. However, being female, older, or graduating from a public rather than a private institution had a statistically significant negative impact on salary in 2008.

Having a doctorate from a research university—and especially being in the fields of computer science, mathematics, life sciences, or engineering—contributes positively to salary, compared with earning a degree in the social sciences. Additionally, doctorate recipients who worked in business and industry or government earned higher salaries than those who worked in education (see Figure 1).

**Implications for Academic Leaders**

Our findings lead us to echo Stewart’s (2013) call for more information to fill the data gaps on the outcomes of graduate education. It seems that the postdoc experience soon after degree completion encourages individuals to work in an educational institution, obtain a tenure-track faculty position, and achieve higher research productivity. Staying too long, however, seems to signal that the position is a kind of holding bay. This is not an efficient use of human resources.

The postdoc appointment provides opportunities to do publishable research and learn to become an independent scholar. Developing these skills serves individuals well within research universities, which need to have faculty members who are producing new scientific knowledge and who receive extramural funding. Research and development (R&D) funds greatly contribute to an institution’s ability to carry out its research mission.

**Productivity**

However, more than two postdoc appointments did not necessarily contribute to increased research productivity. This finding parallels that of other scholars (e.g., Nerad & Cerny, 1999; Su, 2011) who found that the benefit from extended periods of postdoc time diminish after a few years, largely due to decreased motivation created by being in a holding bay and the likelihood that the postdocs would not be developing additional knowledge stock, norms, and behavioral patterns by virtue of the extra time spent.

A cademic policies need to ensure that individuals remain in postdoctoral appointments for only a limited period of time. While postdoc employment is a time to further strengthen skills and boost institutional R&D, beyond about four years it begins to become exploitative.

Senior institutional officials and faculty mentors also need to discuss career options with postdocs and doctoral students who may be considering taking postdoc appointments. The limitations on the number of faculty appointments are not likely to change in the near future, and the opportunities in business or government may provide wider options. Faculty mentors need to better understand employment options for students beyond academic appointments and discuss those options with doctoral students as they approach the time to make post-degree plans.

Since refereed or peer-review journal articles are often used as an indicator of high-quality research, and completing one postdoc appointment seems to lead to a greater number of these research products than are produced by those who directly enter academe after degree completion, the original purpose of the postdoc appointment—to gain additional skills in research and scholarship—may be being fulfilled.

It makes sense that having been a postdoc does not have a statistically significant influence on salary after controlling for demographics, doctoral training, and employment sectors. Although a few postdoc positions are available in industry, postdoc work is a very strong predictor for a commitment to educational institutions and faculty positions.

---

**Figure 1. 2008 Average Reported Annual Salary**

<table>
<thead>
<tr>
<th>Salary Range</th>
<th>Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 – $20,000</td>
<td>Educational Institution</td>
</tr>
<tr>
<td>$20,000 – $40,000</td>
<td>Government</td>
</tr>
<tr>
<td>$40,000 – $140,000</td>
<td>Business &amp; Industry</td>
</tr>
</tbody>
</table>
Thus, the relatively low salaries of the education sector compared with industry and government, as well as the delayed entry of postdocs into ladder-rank faculty positions, helps explain their lower earnings ten years later. However, in light of increases in educational debt, particularly for graduate students, this issue needs much more focused study.

Women in the Academy

In order to contribute to the production of new knowledge and to build national economic strength, academic leaders need to avoid the underutilization of women scientists. However, previous studies have shown that the likelihood for women doctoral recipients or postdocs to obtain tenure-track faculty appointments is lower than that of their male peers.

Once they are hired, work-life balance becomes a challenge for individual female workers and for organizational policies. If they want to benefit from contributions of women scientists, academic administrators must consider female faculty members’ special challenges in balancing life demands and work among them, their family-planning desires.

On many campuses, postdoctoral researchers have faculty or professional staff status, and academic planners need to consider how policies such as parental leave apply to them. Such policies affect both male and female postdocs, but they are apt to be particularly important to women.

Academic leaders also need to consider how postdoc appointments fit into the institutional culture. The messages that are sent as to acceptability of leave policies for pregnancy, family leave after childbirth, and/or eldercare are extremely important to the success of female postdocs.

Because of the extensive work hours and gender biases that may exist in labs (Beyond Bias Report, 2006), some women doctorate holders may decide to not seek postdoctoral appointments—even though, especially for women in the sciences, the decision to not consider a postdoc appointment may hurt their chances of earning a tenure-track faculty appointment. Other women who have or wish to begin a family may perceive a postdoc as making fewer demands and offering a somewhat slower pace than a faculty position would. However, a lengthy postdoc appointment extends the probationary period leading up to tenure and can contribute to stagnation in women’s careers.

Institution officials should consider providing greater support to men and women with childcare or eldercare responsibilities to ensure that scientists do not feel forced to modify or leave their intended career path because of obstacles they experience in combining family and career.

Foreign-Born Postdocs

The number of international postdoctoral researchers in American higher education has increased over the past two decades, concomitant with the growing number of international doctoral students. For example, Nerad and Cerny (1999) reported that half of the US-trained international mathematicians remained in the US as postdocs, even though postdoc positions in mathematics are less common than in other S&E disciplines and therefore even more competitive.

Previous literature (e.g., Corley & Sabharwal, 2007; Libaers, 2007; Su, 2013) noted that foreign-born scientists went through a strict selection process before coming to the United States, so they are likely to be particularly productive and have some advantages over their US peers in securing faculty positions. In addition, our results are consistent with Cantwell’s (2011) argument that most temporary visa holders stay in the United States because of the positive environment for scientific research and personal and professional stability. [Editor’s note: See Brian Coppola’s article in the July/August 2015 issue of Change on the reverse brain drain that is beginning to occur, due to the declining US investment in scientific research.]

Roles and Expectations

In light of our findings that postdoctoral training contributes to the likelihood of obtaining a tenure-track faculty career in the future, academic planners may want to allocate resources for workshops or other training to improve the postdocs’ skills and to help them understand campus culture, in order to maximize their chances of success.

Officials also need to establish policies regarding the roles and responsibilities of postdocs, including expectations for teaching versus research and the maximum length of a postdoc appointment. A report from the Committee on Science, Engineering, and Public Policy (COSEPUP) outlines a number of calls to action, among which is the recommendation to impose a term limit on postdoc training: typically no more than five years, whether taken as one or multiple successive appointments.

Although more improvements are needed, we acknowledge recent efforts at universities to pay more attention to postdoctoral research. The National Postdoctoral Association (nationalpostdoc.org) actively engages in discussions with research institutions, postdoctoral professional organizations, and scientific funding agencies that effect administrative and policy changes for postdocs.

We also note institutional improvements, such as The University of Georgia’s 2008 policy for postdoctoral research appointments (http://research.uga.edu/docs/policies/opa/postdoctoral-research-appointments.pdf), which defines expectations of the postdoc, the terms of appointment, evaluation, and compensation minimums. Providing this kind of detailed information on postdoctoral researchers’ roles and the expectations the institution has of them can improve the postdoctoral experience for the postdocs, the supervising faculty members, and graduate program officials.


