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Career Impact Bonds – A Novel Institution for Linking Funding to PhD Student Career Outcomes

Problem

There is a mismatch between the supply of STEM PhD students and jobs that require those degrees:

- "There are too many laboratory scientists for too few jobs… The supply of scientists has grown far faster than the number of academic positions." [1]
- "The lack of permanent jobs leaves many PhD scientists doing routine laboratory work in low-wage postdoctoral fellowships. These positions used to last a year or two, but now it's not unusual to find scientists toiling away for six, seven, even 10 years." [1]
- "…In certain ways, the research enterprise itself at US universities *resembles a pyramid scheme*… A system of staffing labs with [students and Postdocs] … only works as long as the number of jobs grows quickly enough to absorb the newly trained. … However, … the number of tenure-track positions has failed to keep pace with the large number of newly minted PhDs. It is not uncommon for recent graduates to feel that *the system has not delivered what it promised*." [2]
- "One thing many PhD students have in common is dissatisfaction. Some describe their work as 'slave labor'. … "It isn't graduate school itself that is discouraging," says one student, … '*What's discouraging is realizing the end point has been yanked out of reach*'. [3]

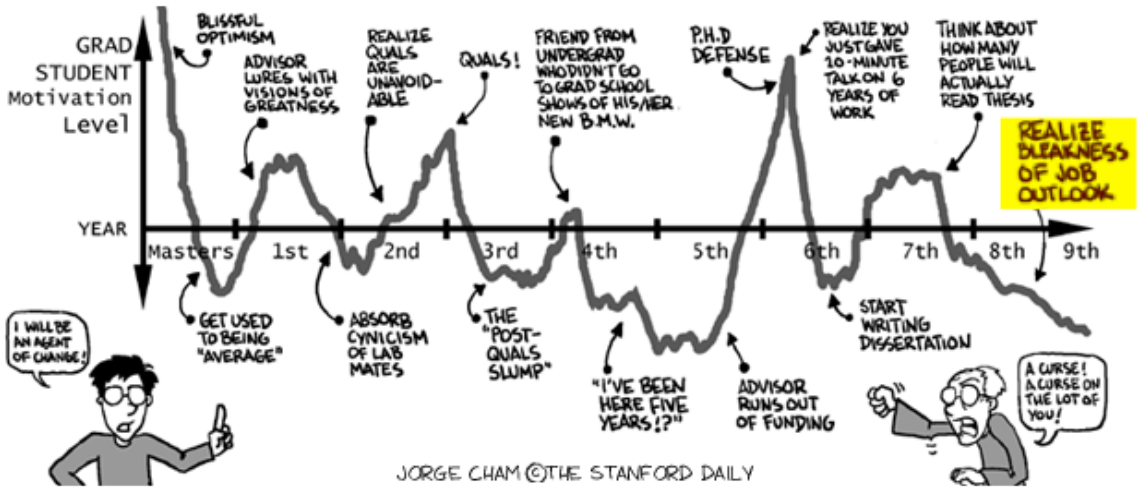

Figure 1. Satire from PhD Comics, with the impact on grad students highlighted. Source: [4]

Another way of characterizing this problem is that a mismatch exists between what STEM PhD students are being trained for – academic careers – and their most likely career path, which is non-academic. There are other symptoms: 1) high dropout rates, 2) excessive time-to-completion, and 3) high personal costs (e.g. postponing marriage/children).

In her 2012 book [2], Paula Stephan[1] asserts that the roots of this problem are *institutional*, and thus far beyond the ability of any single individual or group to change.

"Taken together, these statistics are going to *discourage people from pursuing graduate education and careers in academic science*." [5] Stephan identified misaligned incentives as primary root causes. *The Economist* newspaper summarizes:

> "The interests of professors and universities on the one hand and PhD students on the other are not well aligned. The more bright students stay at universities, the better it is for professors. Postdocs bring in grants and beef up their supervisors' publication records. … Some university departments and professors regard numbers of PhD graduates as an indicator of success and compete to produce more. For the students, *a measure of how quickly those students get a permanent job, and what they earn, would be more useful*. Where penalties are levied on professors who allow PhDs to overrun, the number of students who complete rises abruptly, suggesting that students were previously allowed to fester." [3]

What is needed is an institutional solution that aligns the incentives of all actors – university, departments, professors, funding agencies, potential employers, and PhD students/Postdocs themselves.

[1] Recognizing the significance of her book, *Science* Careers named the author, Paula Stephan, their first Person of the Year. The award "honors an individual who, during the past 12 months, has made an especially significant and sustained contribution to the welfare of early-career scientists".
http://sciencecareers.sciencemag.org/career_magazine/previous_issues/articles/2012_12_21/caredit.a1200140

Proposed Solution

The basic idea is this: *tie today's funding*[2] *to PhD student career outcomes*[3] *after they complete their studies*, whether students complete by graduating, switching to a different degree or program, or by dropping out.

Because there is a time span of ten or more years between funding decisions and career outcomes, there needs to be institutional mechanisms to provide finance over a long period and also to process information related to likelihood of various outcomes. Also, some method is needed to estimate the effect of actions and behaviors performed in the present (e.g. mentoring, career counseling, placement services) on long-term career outcomes.

I propose an institution for sharing gains and risks associated with PhD student career outcomes, centered on a financial instrument called "*Career Impact Bond*" (CIB) (Figure 2). The name "Career Impact Bond" (CIB) was chosen to be similar to "Social Impact Bonds" (SIB) [7, 8, 9, 10], which are based on similar theories [6], concepts, and values.

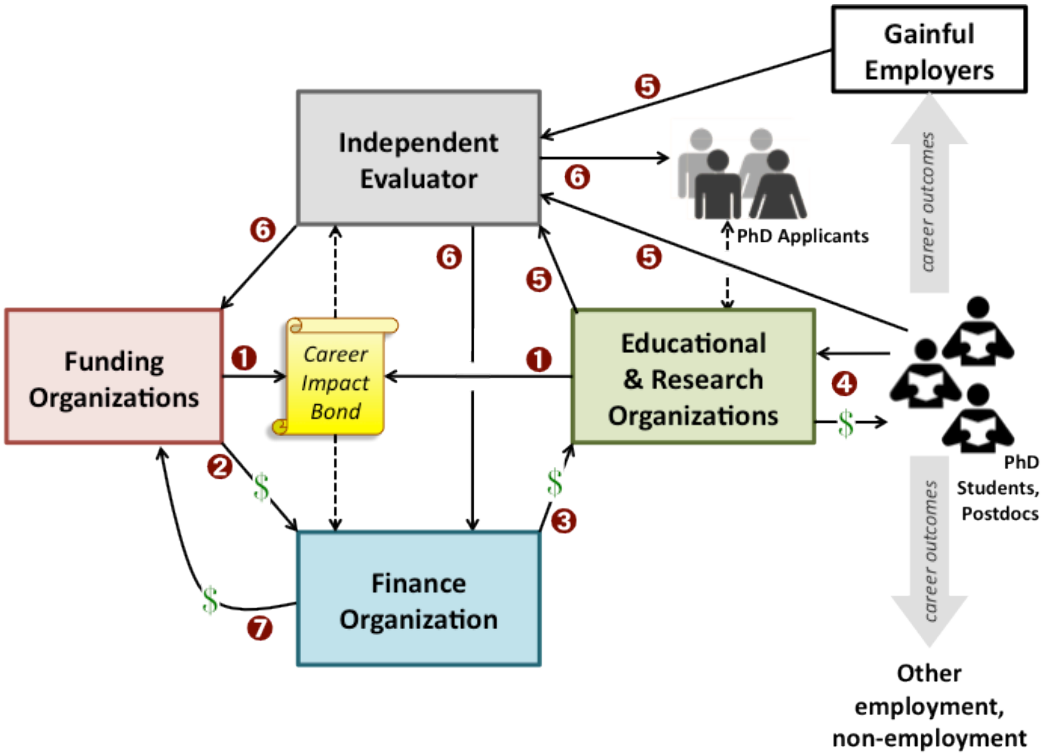

Figure 2. Schematic of Career Impact Bond institution elements and interactions.

[2] "Funding" refers to money directly allocated to graduate assistantships, studentships, training, internships, or Postdoc salaries.
[3] "Career outcomes" refer to a set of observable conditions for a population of students, possibly including time-to-graduation, graduation %, first salary post graduation, time-to-first-gainful-employment, first salary after Postdoc, and others.

The following is a simplified process description spanning a full funding-to-outcome cycle (~10 year period).

- *Funding Organizations* (e.g. NSF, NIH, foundations, corporations, donors) and *Education/Research Organizations* enter into a funding agreement using a *Career Impact Bond* (CIB). The CIB defines outcome measures, funding level and intervals, indicators, schedule, and other terms, to be executed by *Finance Organization* and *Independent Evaluator*, acting as agents.

- *Funding Organizations* issue funds to *Finance Organization* at 100% valuation (i.e. assuming 100% achievement of career goals).

- *Finance Organization* issues periodic funding installments to *Education/Research Organizations*, discounted according to expected value of CIB, based on current indicators (see).

- *Education/Research Organizations* pays stipend or salary to *Students/Postdocs* in exchange for training, research assistance, and research.

- *Independent Evaluator* periodically collects information regarding indicators[4] and outcomes.

- *Independent Evaluator* produces statistical reports and distributes to all stakeholders, protecting private information in the process.

- At designated periods (e.g. 5 yrs, 7 yrs, 10 yrs), *Finance Organization* issues refund (if any) to *Funding Organizations* based on actual career outcomes if they are lower than 100% of goals set in CIB. (Not shown: if actual outcomes exceed CIB goals, bonuses are paid to *Education/Research Organizations.*)

Gainful Employers are those that employ the *PhD Students/Postdocs* full time in positions that require or benefit from their PhD education, with commensurate pay.

In the financial sense, there is very little risk transfer in this institution and no financial leverage is involved. *Funding Organizations* retain the financial risk associated with their funding efforts, namely that they may not produce career results for PhD students and Postdocs. The *Finance Organization* only bears the financial risk that actual outcomes will be different than predicted outcomes, based on *ex ante* indicators. *Independent Evaluator* bears no financial risk, and are paid fee-for-service. *Education/Research Organizations* retain the financial risk associated with selecting good *PhD Applicants* and adequately supporting *PhD*

[4] "Indicators" refer to metrics and other evidence related to activities and behaviors designed to improve career outcomes, e.g. mentoring, internships, presentation experience, placement services, etc.

Students/Postdocs so that goals for career success are met or exceeded. If the goals are exceeded, their indicators improve and, as a result, they will receive larger funding awards through the *Finance Organization* based on revised valuation. *Finance Organization* only earns money by investing the 'float' (i.e. the undispersed funds), and thus has no financial interest in the PhD student career outcomes.

Potential Impact

STEM PhD students will benefit from this proposed institution in several ways. First, applicants would get relevant information about their career prospects before application. Also, departments would pay more attention during the grad school application process to the career prospects of each applicant. Second, once accepted as a student, their department will be more inclined to hire and reward professors that excel at career mentoring for their graduate students. Non-academic career paths would receive more attention and support.

Their university will be more inclined to offer services that improve career outcomes, e.g. internships, placement services, professional development courses, etc. Universities will also have more incentive to see that students finish their PhD program on schedule. Furthermore, universities would be more likely to include placement in their strategies for technology transfer, intellectual property (IP), industry partnerships, and new ventures.

Funding Organizations and Educational/Research Organizations will have much less incentive to use graduate students and Postdocs as 'cheap labor' since the cost of poor career outcomes will exceed the cost savings. Ultimately, this could reduce funding for disciplines that have poor aggregate career prospects, but that would be a healthy adjustment.

Flexibility and adaptability are strengths of the proposed solution. It should work equally well with any mix of government or private funding, and even with funding mixes that change over time. Also, since it is oriented to outcomes, it should be very adaptable to non-traditional research organizations, including 'agile teams' and open innovation communities.

Last, this institution could dramatically improve public disclosure. In turn, this should improve policy implementation and policy innovation.

Viability

I believe the proposed solution is viable because of three reasons. First, there are other programs and regulations with similar goals applied to other areas of education. Their existence also suggests that linking funding to career outcomes is viable. One example is the US Department of Education's 2012 regulation for student loan eligibility [11,12], where degree-granting institutions are required to report the rates of 'gainful employment' by their graduates, and would only be eligible for student loans of that rate is above some specified level.

Second, the proposed financial instrument is analogous to 'Social Impact Bonds' [7, 8, 9, 10], which have demonstrated its viability in the context of social service non-profits and funding agencies. Though Social Impact Bonds have not yet been used in the setting of post-secondary education, their use in social service settings provides some evidence in favor of the viability of the financial instrument and associated institutional processes. It also suggests how stakeholder acceptance can be achieved.

Finally, NSF, NIH, the National Academies, and others have accumulated considerable data on STEM graduate education and career outcomes. These data can serve as a viable foundation for predictive analytics to support the functions of the Finance Organization and Independent Evaluator.

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