COMMENTARY

Supply of and Demand for Atmospheric Sciences Professionals

BY ROGER A. PIELKE JR.

The January 2002 issue of *BAMS* contains an article (Vali et al. 2002) suggesting "alarming signs" about a potential "shortfall" of future Ph.D.s in the atmospheric sciences. The article expresses a need to understand the reasons behind an apparent drop in graduate student enrollments in the atmospheric sciences and to address the underlying causes. While Vali et al. have done the atmospheric sciences community a service by raising the issue of "needs" for atmospheric sciences professionals, they neglected to place the "shortfall of scientists" into the context of a broader and, at times, passionate debate on this topic in the science and engineering community. This essay seeks to describe this context and suggest its significance for the atmospheric sciences.

Specifically, policy recommendations related to the atmospheric sciences education and labor markets will likely be improved if grounded in an understanding of the debate of the early 1990s over warnings made by the National Science Foundation (NSF) of a looming crisis in the supply of scientific professionals (Ph.D.s in particular). This was a very public and, at times, nasty debate—and included congressional hearings—that in the end hurt the reputation of the NSF and the credibility of scientists making claims of an "undersupply" of Ph.D.s. And some argue that a result was bad public policy related to immigration and labor (see, e.g., Gover and Huray 1998). While times have changed and the atmospheric sciences are subject to their own particular idiosyncrasies, this essay provides a brief review of the debate of the early 1990s about the supply of scientists to provide some historical grounding for future community efforts to assess the state of atmospheric sciences education and labor markets.

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In April 1992, the U.S. House of Representatives Subcommittee on Investigations and Oversight of the Committee on Science, Space, and Technology held a hearing titled, "Projecting Science and Engineering Personnel Requirements for the 1990s: How Good are the Numbers?" chaired by Congressman Howard Wolpe. The hearing was described by a *Washington Post* report (Rensberger 1992) as follows:

> "The familiar claim that the United States faces a major shortage of scientists and engineers—often cited by National Science Foundation officials when seeking budget increases—is false and was based on a seriously flawed NSF study," seven scientists, engineers and government officials told a congressional subcommittee yesterday.

The hearings were acrimonious. Congressman Wolpe stated in the hearings that "one has a sense that the goal was to create the impression of a crisis to lend urgency to the effort to double the NSF's budget." Several days after the hearing, one witness, former NSF Director Eric Bloch, wrote to Congressman Wolpe: "Members of Congress, lawyers, and MBAs are not going to improve our competitive standing in the world. Scientists and engineers just might." Commentator Daniel Greenberg viewed this remark as a "disdainful jibe . . . that would have been unthinkable if he were still director of the Foundation" (Greenberg 2002, 143).

Debate on this topic persists in the science and engineering community to this day (cf. Greenberg 2002). On the one hand, some scientists view criticism of supply projections as criticism of the practice of science itself,[1] while on the other hand, some critics see calls for increasing the supply of scientists and engineers to reflect deeper issues in modern academia. Gover and Huray (1998, 11) provide a typical view of the latter perspective: "Research shows that today's supply of Ph.D. candidates in science and engineering has less to do with the labor market for Ph.D.s than it has to do with the production needs of academia, for example, providing low-cost teaching and research assistants." George Will (cited in Weinstein 1999) sees an institutional motive as well:

> There is a crisis of overproduction of Ph.D.s and underconsumption of scholarship. To save money, schools rely increasingly on "gypsy scholars" drawn from the reserve army of unemployed Ph.D.s. They are hired on short-term contracts to teach but are not on the tenure track and denied health care and other benefits.

As these examples suggest, the subject is not only important, but also falls very close to the sensitivities of those who employ as well as those employed.

One of the primary criticisms of the study produced by NSF that ultimately led to the House hearings was that it focused on the "supply" of scientists with no consideration of the "demand" in the marketplace. Congressman Wolpe observed

> The NSF study projected a shortfall of 675,000 scientists and engineers without considering the future demand for such individuals in the marketplace. It simply observed a decline in the number of 22-year-olds and projected this demographic trend would result in a huge shortfall. This could be termed the supply-side theory of the labor market analysis. But making labor market projections without considering the demand side of the equation doesn't pass the laugh test with experts in our field.[2]
>
> (Weinstein 1999)

Weinstein notes that while supply-side economics were politically in favor during the Reagan era, the approach was not a favorite among academics. He cites economist Paul Krugman, who makes an even stronger statement, "the supply-siders are cranks." Thus, the debate over NSF had a partisan element as well.

But politics aside, there were real issues about strategies of supply and demand in the analysis of the production of science Ph.D.s. Berliner and Biddle (1995) write

> The [NSF] study in question argued that supplies of scientists and engineers would shortly decline in America and that this meant we had to increase production of people with these skills. This thesis was dubious at best, but, worse, the study made no estimates of job-market demands for scientists and engineers. Thus, the research completely forgot about whether these people were likely to find jobs.
>
> (Weinstein 1999)

[1] See, e.g., the exchange of Bloch and Wolpe cited earlier.

[2] E. Weinstein is codirector of the Project on the Economics of Advanced Training (PEAT) in Science, Engineering and Related Disciplines of Harvard University and the National Bureau of Economic Research.

The debate over the supply and demand of scientists in the 1990s had important implications for not only science policies, but also for immigration and labor policies (North 1995).

The debate over methodologies took on a new light when studies performed in the years following the Wolpe hearing indicated that there was in fact a glut of scientists and engineers. A highly respected 1995 study by Stanford's W. Massey and RAND's C. Goldman concluded that

> Perhaps twenty-five percent of newly-minted doctorates end up unemployed. . . . The natural production rate of doctorates is driven by departmental needs [in universities] for research and teaching assistants, and departmental doctoral-student intake is limited by financial constraints rather than output market considerations. . . . Faculty tend to believe that more scientifically trained manpower is better than less, and that job opportunities will materialize somehow. . . . In any case, the department's shortrun requirements for inexpensive research and teaching labor, and the desire of faculty to replicate their own skills, is of stronger relevance to admissions decisions than the more abstract and distant concept of labor market balance.
>
> (Greenberg 2002, 145)

Others see fewer problems in an oversupply of scientific Ph.D.s in the job market. Weinstein notes "the question of whether the effects of a flooded market are good or bad for the nation is not at all clear and is frequently contested between even the most knowledgeable of analysts."

What constructive guidance does the history of the debate over supply and demand of Ph.D.s provide to the atmospheric sciences community?

First and foremost, it suggests the importance of discussing supply and demand together. Any discussion of the "needs" for atmospheric sciences graduates, should also discuss the job market or societal needs for atmospheric sciences professionals. There are several professional societies who collect such information for their disciplines, among them the American Institute of Physics, the American Mathematical Society, and the American Chemical Society (see also the American Association for the Advancement of Science's *Next Wave*); more information is available online at http://www.aip.org/statistics/trends/emptrends.htm, http://www.ams.org/employment/surveyreports.html, http://pubs.acs.org/cen/coverstory/8031/8031salary.html, and http://nextwave.sciencemag.org, respectively). Based on the readily available examples of disciplines that do in various ways track demand, one recommendation for the atmospheric sciences community is that any effort to assess supply should be done in the context of also seeking to assess demand. Specifically, UCAR and the AMS should ensure that any future surveys that they undertake include characterization of demand, as well as supply (cf. Vali et al. 2002).

In 1997 Congressman George Brown diagnosed the implications of considering the production of Ph.D.s only in terms of supply:

> The unthinking linkage of R&D to graduate education means that the number of Ph.D.s produced reflects the availability of academic R&D funding, rather than having a relationship to a set of national goals for science and engineering education. . . . The predictable result of this haphazard system is a series of surprises such as the current "overproduction" of science and engineering Ph.D.s. . . . Funding for federal R&D will not only not fix the problems in graduate education, but may make them worse. If true, the data indicates that broad science and engineering education reform is needed before we can discuss levels of funding.
>
> (Brown 1997)

Following Congressman Brown's suggestions, a more compelling focus than "shortfall" or "surplus" would be to first focus on the job market for atmospheric sciences graduates once they have left the university setting and then given an analysis of that market, to focus what sort of education and training might best serve the student and society broadly. During a 2000 workshop sponsored by the U.S. Weather Research Program (USWRP) on the research needs of the private sector, several participants noted that graduates in the atmospheric sciences are largely unprepared for private sector careers because they lack appropriate breadth in their education (USWRP 2001).

A second recommendation is to recognize the importance for policy analyses in the atmospheric sciences to be grounded in the context of broader science and technology policy issues. Lack of awareness or acknowledgement of the earlier NSF-inspired debate on the supply of scientists could lead atmospheric scientists into a minefield of hot-button issues that have been considered in considerable depth in other parts of the science and engineering community.

Broader awareness of the degree to which such issues have been discussed, debated, and resolved outside of the atmospheric sciences would elevate both the quality of debate and corresponding policy recommendations. Debate of public- and private-sector roles and responsibilities is another area of discussion in the atmospheric sciences that suffers from an apparent lack of awareness of the broader science and technology policy context (cf. USWRP 2001).

The science and technology community generally experienced considerable loss of credibility in the early 1990s when a number of prominent figures claimed a looming shortage of scientists. Leaders in the atmospheric sciences are in a position to use experience to avoid such errors in future assessments of the labor market. In particular, considerable care must be taken in raising expectations of potential students and policymakers about the future prospects for employment.

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