Towards a Data Driven STEM Workforce Policy Discussion[1]

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I'm pleased to be here this afternoon to discuss the STEM workforce, which is central to the *New Competitiveness Debate.* Competitiveness seems to be the term du jour, being attached to a variety of policy issues from taxes to healthcare to infrastructure. And of course it's also attached to many, if not most, science and technology policy issues - and appropriately so. But I think the key to responding to the new competitiveness challenges will reside in how we shape the American STEM workforce system, so this conference is particularly important.

I use the term *new* to distinguish it from the old competitiveness debate. That debate, which began in the late 1970s, had much more to do with improving the productivity of American companies and the quality of their products. This time around it is not about companies competing across border but rather American workers who are now competing head-to-head with workers who can afford to be paid less. And it is increasingly American corporations that are competing their American workers against their workers in low-cost countries. This implies competitiveness, at least with respect to globalization, is really about ensuring that American workers can justify their salary premiums, often 5X premiums. And they can justify those salary premiums either through better relative productivity or by crowding into non-tradable jobs.

Princeton University's Alan Blinder estimates that a large share of STEM jobs is becoming more tradable and as a result they are increasingly vulnerable to offshoring. So the scale and scope of the impacts of offshoring on the STEM labor market are likely to be significant.

The responses to the changes wrought by globalization, responses by employers, workers, educational institutions and government will take place. The question is whether those responses are going to be based on data driven inquiry or simply by impressions, impressions that often come from interested parties.

I think, to date, our policy discussion about the implications of globalization has relied too heavily on impressions rather than data driven analysis. But issues surrounding

[1] These remarks reflect the author's own viewpoints.

globalization are not alone. The lack of analysis also characterizes many, if not most, of our policy discussions about the myriad other factors shaping the STEM workforce, from the talent pool to skills mismatches to the pipeline to underemployment.

Of course good analysis requires data, and the STEM workforce data project provides much of the data we need. But *good* analysis also requires thoughtful uses of data. Too often policy discussions and proposals are driven by a single variable presented in isolation. For example, much ink has been spilled over the number of degrees. Those discussions ignore other system variables key to diagnosing and predicting how the entire system would respond to particular policy changes. They also frequently treat the STEM labor market as homogeneous, when in fact it is better characterized as multiple labor markets, segmented by occupation, level of degree, geographic location, industry-specific knowledge, and years of experience, and probably many other factors.

Let me illustrate my point with three views of the STEM labor market. One from industry, one from academia, and the last from a STEM worker.

Technology employers have focused much of their lobbying efforts on immediately expanding the talent pool on hand. They claim that demand persistently outstrips domestic supply. In their eyes the government should immediately supplement the domestic STEM supply with more foreign workers by liberalizing immigration policies. Microsoft's Bill Gates summed up this viewpoint in a Washington Post op-ed, saying, "Demand for specialized technical skills has long exceeded the supply of native-born workers with advanced degrees, and scientists and engineers from other countries fill this gap. This issue has reached a crisis point." In fact, Mr. Gates has stated that immigration policy liberalization is the number one issue for Microsoft's lobbying efforts.

Some university leaders use equally dire language when describing the future U.S. STEM workforce. Rensselaer Polytechnic Institute's President Shirley Ann Jackson describes the coming "crisis", of a growing *shortage* of domestic STEM talent, as a threat to "both national security and [America's] economic status in a global economy."

And most of the Presidential candidates, from both parties, agree with this diagnosis, lamenting the STEM supply shortfall in public statements and on their campaign websites. They have offered a variety of proposals to expand the current and future STEM workforce.

Inadequate supply may be how the crisis is defined by business and academic leaders, but some STEM workers view the problem very differently. A recent entry in a popular blog by a technology worker offers this starkly different picture. He says:

> I am a former American tech worker, programmer and systems analyst who is now functionally unemployed at the age of 50. What happened? Why? What to do? Does anyone relate to this or give a darn? These are some questions I wake up to and live with each day, trying to turn 20+ years of work on large scale IBM business systems and databases into a salvageable work life. Since 2003, I've worked in real estate (not a "real" job in most places), substitute teacher, Home Depot flooring associate, contract writer for a struggling home builder, and tech writer for a small

> tech business with a spotty business history. Why was I once employable, making a reasonable income, and now almost unemployable with the business and tech skills amassed over 20+ years?

This blog entry cannot be dismissed as an isolated anecdote, because it faithfully represents the experiences and concerns of a sizable share of STEM workers. I have heard and read thousands of similar stories over the past few years from workers in a variety of STEM fields. Many are unemployed or underemployed, while still others are very anxious about their job security. Not surprisingly these workers believe that the real STEM crisis is lack of demand.

It is obvious, based on the strong language used all around, that key stakeholders are highly dissatisfied with the current state and direction of the STEM labor market.
But they offer seemingly conflicting assessments and policy prescriptions.
So, which is it, a lack of supply or of demand? Or could both conditions exist simultaneously?

And more importantly what should policymakers do in response to these differing views? Do we ignore some while accommodating others?

It seems to me that we need to do a few things.

First, recognize that the STEM workforce is not monolithic. Instead it's a complex *system* - with many variables and multiple labor markets and it's a system that adapts.

Second, we should use data driven analysis to better understand how particular policy responses may affect *system* outcomes in the short- medium- and long-terms

Lastly, we should acknowledge openly that the interests of the various stakeholders (employers, educators, workers and students) can be at odds, and the distributional impacts of particular policy responses can vary widely. Put bluntly, policy solutions good for employers are not automatically good for workers and vice versa.

The policy debate should embrace this political reality. By doing so, policymakers will better be able to seek solutions that resolve inherent conflicts and better vet policy solutions with respect to their distributional impacts.

Now let me highlight some results from the STEM Workforce Data Project, results that I thought were particularly striking.

Most STEM workers are paid significantly higher than the average occupation. In 2005, the median STEM pay was $57,000 versus $34,000 for all occupations. But STEM salary growth has not outperformed other occupations. Between 1995 and 2005 STEM salaries grew approximately 6% - the same rate as all occupations. This finding seemingly contradicts the widespread belief amongst leaders that STEM workers are persistently in short supply because, if they were, their wages would be bid up faster than other occupations. Instead, salary changes indicate relatively balanced supply and demand - at least at the aggregate level. How would doubling the number of STEM graduates, as

prominent industry groups have argued for, affect this supply and demand balance, and salaries for incumbent STEM workers?

But if we look at the data at a more disaggregated level a different picture emerges. Over the 1995-2005 period, some STEM occupations had higher than average salary growth rates, such as aerospace engineering, which grew by 9 percent. While other groups fared worse than average. Salaries for all engineering occupations grew only 3 percent, half the rate of all occupations, and biological and life scientist salaries didn't even keep up with inflation, losing 1 percent. What do these outcomes tell us, if anything, about policy? Should we craft targeted responses for the individual labor markets?

Do salaries tell us the whole story about STEM labor markets?

There are many non-monetary rewards for STEM occupations. Missing from the project data are measures of job and career satisfaction. Are incumbent workers happy with their work and their work environment? The upcoming generation of "millenials" are expected to place more weight on non-monetary rewards such as whether their work is socially meaningful, fulfilling, and has the appropriate work-life balance. Will STEM occupations satisfy these new workers? Surely, these measures should be included in any meaningful look at the STEM workforce.

Let's look at some other surprising trends. Turning to employment growth, STEM employment levels have historically grown faster than the overall labor force. According to report one of the project STEM employment grew 190% between 1983 and 2000, versus a 136% increase in overall employment. However, report eight shows that this trend reversed course during from 2001 and 2006, when the STEM share of the overall workforce has actually been *shrinking*.

Of course STEM occupations grow (shrink) at widely different rates. As report one says, "Much of the increased employment during the period (1983-2000) can be attributed to the boom during the late 1980s and 1990s in the information technology and telecommunications industries. Most other sectors of employment did not do as well." And a significant share of that growth, approximately 38 percent, was filled by foreign-born workers.

These are just a few of the data that struck me as interesting. I don't suggest that any of them provides clear policy direction. Instead they highlight the gap between our public discussion and the nature of the STEM workforce system.

Let me wrap up by presenting two views of the STEM labor market. The first view holds that there are infinitely expanding opportunities that can be instantaneously filled. Adherents of this view argue that we should focus all of our efforts on expanding supply because supply creates its own demand – in other words, STEM workers create an ever increasing demand for themselves. The other view is that there are a fixed number of jobs for STEM workers in the economy. They believe that adding any new supply takes away opportunities from incumbent workers.

Both views are caricatures of the actual labor market. But I think you'd be surprised how many people hold one or the other as their mental model and how often they creep into the policy discussions. It leads us to policy solutions that are the proverbial hammer in search of a nail.

It seems to me that the challenge for us is to use data driven analysis to create richer and thicker, and more accurate, descriptions of STEM workforce dynamics. To replace the simplistic models from the policy discussion with something better. But just creating the descriptions is not sufficient. We must also ensure that they are disseminated widely, in understandable forms, for all decision makers – policymakers, employers, educators, students, and incumbent workers.