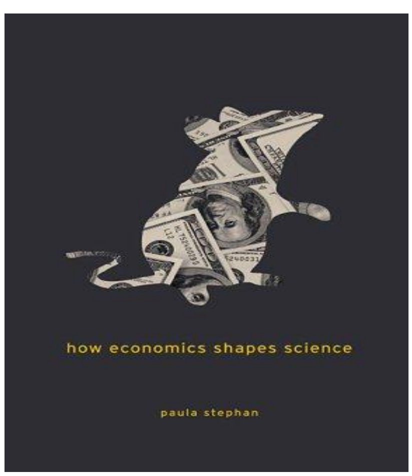
THE ECONOMICS OF SCIENCE

Why is it that we do science? The answer most scientists may provide to this question is that their curiosity that drove them towards a career in science. The urge to learn and to discover. For most, this curiosity and passion for science is so strong that they take into account long hours and salaries that are lower than those in other professions. But such passion does of course not mean that there cannot be a quantitative study of the way science works, and of those doing science. Indeed, this is what Paula Stephan from Georgia State University undertakes in her book, *How Economics Shapes Science*. We can understand a lot by applying economic theory to understand the way we do science. This is not only important to reach a better way of doing science, but it might also lead to a better appreciation of the benefits that come from doing science. How well public funds are spent, and how important science is for all of us. The returns on investment, to use an economic term.



One of the first question the book addresses is of course to understand why are people doing research? What drives them in addition to the obvious curiosity? What's the economic currency that makes a career in science lucrative? Money of course, let's face it, is one reason. Some scientists really do get rich from all the startups and patent revenues – and Stephan provides good examples. But of course, that's just one aspect. A stronger driver perhaps are fame and recognition. Making an important discovery can create a historic legacy that is unrivalled in comparison to other professions. We know the names of famous scientists even after centuries but not nearly as well those of successful business men.

The points that Stephan make here are all interesting and plausible. Indeed, my impression is that economics already knows a lot about the people doing science. The salaries of scientists, the economic costs of doing a PhD (basically, in most cases you lose out financially). International migration patterns. The increasing number of people studying science, and consequently the fact that fewer and fewer of the scientists we train have a long-term perspective in academia. Academia no longer educates mainly for itself, but for others. There is a lot of data on that and the people working in science, and this book gives a great summary.

Another area the book tries to tackle is that of science policy issues, although clearly there is still a lot that needs to be understood about the larger economic implications of doing science.

What is the payback; can it be measured at all? How much public money to spend on science? As much as possible? Scientific research does pay back a lot in areas such as health or engineering. But surely there is a point where investing too much means a lot of irrelevant research being done. But how much investment then? We have not really a good idea of how to do science efficiently and in the best way. Take US universities. As Stephan mentions, these are like shopping malls – inviting scientists to set up shop, bring in the money for these shops in terms of research grants, and then hoping customers will come, leading to lots of students as well as technology transfer. But is such a grant-driven system really the best way of doing long-term science versus short-term grant-based science where tough selection procedures mean that often you know the outcome before you even start the research? Hardly.

The same with science eduction. The book makes it pretty clear that the PhD and postdoc system is heavily tilted to the benefit of laboratory heads. There is not much specific, institution-based information available on the career paths of PhDs and postdocs. My own PhD granting institution certainly never followed up with me on my career path. Indeed, laboratory heads usually are eager to educate as many PhD students if possible, irrespective of their future career perspectives. And as Stephan consequently asks, is it really the best economics to educate a lot of

PhDs only to have them become teachers, venture capitalists, journalists (ahem!) and so on.

And she has a point. Of course, too much planning of careers can be disastrous. Higher education is a long process, and the economic situation can change. The call for more engineering students in one year can lead to disappointed faces a few years down the line when too many graduates mean that employment perspectives are meagre. But generally, it might be useful to adjust the economics by making it more ‘expensive’ to use PhD or postdoc resources. Or as Stephan suggested, separating education of PhDs from research labs by creating more research institutes outside of universities.

It is generally difficult to find the right balance in science policy. Take technology transfer. Between 1989 and 1999 US universities have increased patent applications from 1,245 to 3,689 per year. But although patent revenues might be a welcome boost for the budget of universities their wider economic benefit for most universities might not be as compelling and as outlined in the book, they might stifle scientific discoveries elsewhere. The obvious alternative that would benefit businesses and not universities is to publish scientific results freely, and to ‘transfer’ technology to companies by recruiting scientists from universities.

There is a great quote by J. Robert Oppenheimer in the book: “The best way to send information is to wrap it up in a person.” Start-ups out of universities could also be a great tool to stimulate economic activity and to benefit universities at the same time. A 1997 study by BankBoston also cited in the book found that by 1994 a total of 4,000 companies were founded by MIT faculty, employing a total of 1.1 million people. But which system makes the most sense on the macro-economic scale? My own opinion here is that universities should not try too hard to be corporate entities but instead should have sufficient public funding.

Such issues also play into the broader issue of how to best organize science. And the answer is that we don’t know. Issues that we have to deal with are short versus long-term policy incentives, and short versus long-term research goals. How to deal with the international connectivity of science and the fact that funding mostly happens locally? How much weight should science funding get in times of tight public budgets? We only know a few obvious things, for example that short-term ups and downs in science funding don’t do much good as science isn’t done on the tap. Otherwise, we often are short of useful data.

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