

# An Introduction to Levin, Klevorick, Nelson, and Winter (1987)

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There are several areas of economics where we know much more today than we did 50 years ago as a result of the accumulation of empirical research. More needs to be done, and much remains debated, but economists have made real progress in behavioral economics, labor economics, and financial economics. And in recent years the use of controlled experiments is helping to revolutionize development economics. Even industrial organization has come along. Yet the economics of innovation has not advanced much.

Not from the lack of trying though. There are easily hundreds of published studies of innovation and technical progress. Nonetheless, Wesley Cohen's 2010 summary of *Fifty Years of Empirical Studies of Innovative Activity and Performance* finds few robust findings and ends with a plea for more and better data.<sup>1</sup>

According to Cohen, one of the preeminent empirical economists in this area, “we still have little empirical understanding of the tradeoff for industries’ R&D incentives...” and “our understanding of the role of firm-level variables is more primitive still.” Progress has been made on the dynamics of innovation but, “[o]nce again ... the availability of data ... represents an important brake on the advance of empirical testing.” He doesn't quite say this but comes close: one of the problems in this area is that the empirical economists produce results that are hard to explain in the absence of theory, and the theoretical economists produce models that can't be tested with available data.<sup>2</sup>

There is, unfortunately, a fundamental problem faced by empirical research on the economics of innovation. Labor economists can measure wages, financial economists can measure equity prices, and behavioral economists can observe actual laboratory choices. And they often have pretty good measures of the possible determinants of these outcome variables. Empirical researchers on innovation do not have it so lucky.

No one really knows how to measure innovation. To do studies, economists reach for what they can get. They began with the number of patents. But no one who knows how patents are created could seriously think that patent counts reveal much. Over time economists made this a more meaningful variable by at least adjusting for patent citations under the theory that better patents get more citations. In addition, it is very hard to measure the inputs into innovation. Again economists tend to measure what they can. That could be research and development spending. But companies account for this in different ways and sometimes, particularly for small and young companies, not at all. So the basic problem is that empirical research tries to relate dubious measures of outputs with unreliable measures of inputs.

Cohen calls for better data but he also questions the overwhelming use of econometric models which—my words not his—often in this area are afflicted with the famous garbage-in/garbage-out problem. He observes,

[M]uch of our empirical understanding of innovation derives not from the estimation of econometric models, but from the use of other empirical methods. [T]he historical and case-study literatures provide a rich array of insights and factual information... More strikingly, many

of the most credible empirical regularities have been established not by estimating and testing elaborate models with published data but by the painstaking collection of original data, often in the responses to simple questions.”

That brings me to our classic, *Appropriating the Returns from Industrial Research*, which was authored by four giants of innovation economics: Richard Levin, Alvin Klevorick, Richard Nelson, and Sidney Winter. They tackled one of the core issues in innovation policy: how do firms harvest the fruits of their innovative efforts and how important are patents in enabling this? If they had just run more inconclusive regressions based on publicly available data they would not have created one of the most frequently cited empirical papers on innovation. Instead they asked people in companies who were actually responsible for innovation how they protected the results of their efforts and the relative importance of alternative methods. They conducted their survey across a number of different industries, which then allowed them to say something about the relative importance of different methods for appropriating returns, and the role of patents, in diverse settings.

This research methodology is hardly immune to criticism. People do not necessarily answer questions accurately. Respondents don't use the same metrics, making it difficult to compare responses. Looking at the results, there is tremendous variation even with the same industry. There are many reasons for professional economists to dismiss this effort.

These authors, however, decided not to let the perfect be the enemy of the good. Nor did they resist going against the grain of professional orthodoxy at the time. It paid off. Many of the empirical nuggets—such as the importance of patents in some industries like pharmaceuticals but not in many others—are still quoted. A number of influential papers, some by combinations of the authors of this article and some by others, have built on the original work. The *Appropriating the Returns* authors found that firms did not patent in part because they believed others could invent around them. A subsequent study by Cohen, for example, found that was true but that firms were also concerned about disclosing information in patent filings that could help rivals imitate them.<sup>3</sup>

The empirical literature on innovation tends towards very narrow analyses of innovation with an almost obsessive focus on the patent process. Levin, Klevorick, Nelson and Winter look at innovation much more broadly. They recognize that there are many ways that firms can protect the fruits of their efforts. These range from trying to get a head start on their rivals, to keeping innovations secret, to providing better service, to patents. If one were going to repeat the study the list would surely be expanded.

The critics and defenders of patents both seem to forget the limited role that patents play in the process of innovation. There are many creations of the mind that are not protected by patents at all. There is some irony in the fact that Albert Einstein could get refrigerator patent for an innovation that has long since been forgotten but a measly Nobel Prize for the photoelectric effect. For all its patents, Apple has not been able to stop the flood of iPad imitators. And somehow innovation happens even when there are no patents available. As Levin and his co-authors showed us, even companies that get patents use many other ways to protect their intellectual property. Patents are but one arrow in the quiver—sometimes a more important, sometimes less important, one. As a result critics and defenders of patents overstate their importance—in both cases because there are imperfect substitutes to which firms would turn if patent rights were eliminated or reduced.

A related point is that too little thought goes into how firms and other institutions such as SSOs would alter

their behavior in the face of changes in patent policy. With even imperfect substitutes available any business that faces a change in one of the inputs into its production process will make other changes in response. The only way to evaluate a change in patent policy is to situate patents, and their various elements, in the broader array of tools for appropriating the returns from R&D.

A bit more than 25 years ago Richard Levin, Alvin Klevorick, Richard Nelson, and Sidney Winter pioneered an important new way of doing empirical research on innovation and produced one of the most durable works in an fragile literature. It is one of CPI's younger but still deserving classics. ▲

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1. Wesley M. Cohen, "Fifty Years of Empirical Studies of Innovative Activity and Performance," Chapter 4, Bronwyn Hall and Nathan Rosenberg, *Handbook of Economics of Innovation*, Elsevier 2010, pp. 129-213.
2. In light of the state of the literature on innovation I find it remarkable when economists who venture into policy entrepreneurship rest confident proposals on this very shaky foundation.
3. Cohen, id, 184.