Discurso de investidura como Doctor "Honoris Causa" del Excmo. Sr. D. Halbert L. White

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CONFESSIONS OF A SCIENTIFIC ECONOMIST

Excelentísimo Sr. Rector, Autoridades Universitas, Profesores, senoras y senores.

I am deeply honored to be the recipient of an Honorary Doctorate from this ancient and august institution of learning, indeed, one of the most venerable universities in the world. I also deeply appreciate the opportunity to address this learned gathering.

In thinking about this audience and what I might say to you, I was led almost immediately to what I find to be one of the most interesting debates concerning my field, economics. This debate is about the status of economics as a science. There seems to be no question that economics is a "social science." But is economics a science in the full sense of the word?

When I searched the internet, today's vast repository of knowledge and opinion, for answers to this question, one of the first items I found was a reference to an article that appeared in that prominent periodical, The Economist. There, I read that because "...unlike physics, economics yields no natural laws or universal constants" it follows that "...with or without experiments, economics is not and never can be a proper science."

But I also found many who compellingly argued that economics is indeed a science; not surprisingly, many of those supporting this view were economists. And, I confess, that as an economist I of course believe that when I do economics, I am doing science.

But as a scientist, I have to ask: am I really engaged in a scientific enterprise? Science is, if anything, a skeptical practice!

So I decided to apply a scientific approach to the status of economic as a science. To get started, I thought it would be a good idea to have clearly in mind the criteria required for a field of study to be a science. Then I could see whether economics fit these criteria or, if it didn't, which criteria it failed and which it satisfied, and to what extent.

But the first thing I discovered was the lack of an authoritative, universally accepted set of standards for what constitutes a science. Philosophers of

science have been arguing about what science is for hundreds of years, and revolutions and refinements in thought have not been so infrequent as to make us think that whatever consensus may presently exist might not be upset later.

I confess that not only did I find this interesting, but I found it deeply satisfying, because this lack goes quite far in explaining first, why there is a debate about the status of economics and second, why this debate is likely to flourish and proliferate: Nothing stimulates vigorous debate like the absence of any basis on which to resolve it.

Even better, this lack relieves me of the burden of providing the ultimate and final resolution of this weighty question. And, I confess, it permits me to have some fun by talking about some of the fascinating things that have been happening in economics recently.

Although there isn't a universal set of formal requirements for something to be a science, there are some commonly accepted criteria. I came across several statements that I found appealing. Paraphrasing and combining these, I offer the following partial description:

"Science is the concerted human effort to understand the external world and its history, with observable empirical evidence as the basis of that understanding. Science proceeds by analyzing, preferably quantitatively, either observations of empirical phenomena or observations of experiments that try to simulate empirical processes under controlled conditions."

But as Karl Popper, the influential philosopher of science, has suggested,

"I think that we shall have to get accustomed to the idea that we must not look upon science as a 'body of knowledge', but rather as a system of hypotheses, or as a system of guesses or anticipations that in principle cannot be justified, but with which we work as long as they stand up to tests, and of which we are never justified in saying that we know they are 'true' . . ."[1]

In other words, science is an evolving set of beliefs about the world around us in which we never place full faith, but which we update whenever contradictory evidence comes along. Moreover, the role of scientists is to go looking for that contradictory evidence, either by observation or experiment. Scientists are professional spoilsports.

Here is a story that offers more insight along these lines: A carpenter, a school teacher, and a scientist on a tour of Spain for the first time were traveling by train when they saw a black bull through the window of the train.

"Aha," said the carpenter, "I see that Spanish bulls are black."

"Hmm," said the school teacher, "You mean that some Spanish bulls are black."

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[1]Karl R. Popper, *The Logic of Scientific Discovery*, 1959.

"No," said the scientist sadly, "All we know is that there is at least one bull in Spain, and that at least one side of that one bull is black."

So how does economics stack up against these ideas? First, are economists trying to understand the external world and its history? Of course! Economists care about the prices of oil and cabbages, about unemployment and poverty, and about the output of industries and countries. These are all part of the world around us.

Next, do economists observe data from the world or from experiments? Absolutely! In both observational and experimental arenas, there is a rapidly accumulating wealth of data.

On the observational side, things have changed dramatically since the days when I was in graduate school. Back then, you had just twenty-five annual data points with which to try to understand the entire post-war economy of the U.S. That's not much data when you're trying to understand something so complex.

But now, not only do we observe much longer data histories, we face a Biblical flood of data in some areas. For example, at a conference just two weeks ago, one of my colleagues at New York University mentioned that his research center was receiving daily data on every transaction on every traded asset on every major stock exchange in the U.S. – eighty gigabytes of data per day!

Of course, what you do with all that data is another important question, but the availability of such rich datasets makes it possible to formulate, test, and reject increasingly nuanced ideas about how economic systems work. And this process of formulating, testing, and rejecting hypotheses – the essence of Popper's prescription – is exactly how economists pursue their research.

To give just one example, there has been a long-standing debate among economists about whether monetary policy – interest rates and the money supply – can have real effects on the economy. Of course, the U.S. Fed and the European Central Bank operate as if these effects are real, but leading economic thinkers have advanced strong arguments about why this might not be so, in which case a lot of people are fooling both themselves and others and are wasting a great deal of resources.

This idea that monetary policy has no real effect is an economic hypothesis, and we now have sufficient data on what happens when the Fed tries to target inflation and what happens when it doesn't to put this to the test. When we do, we reject this idea. The hypothesis of no real impact is not consistent with the data – monetary policy does have real impacts.[2] The U.S. Fed and (most likely)

[2] See Romer and Romer (1989), Angrist and Kuersteiner (2004), and White and Lu (2008).

the ECB are not just fooling around. (I say “most likely” for the ECB, since the studies so far have just focused on the U.S. economy. Let’s not forget the story of the scientist on the train!)

The analysis I just described is one where economists can take advantage of natural experiments, in this case, the experiments carried out by the U.S. Fed in their attempts to stabilize the economy. More and more, though, economics is also relying on laboratory experiments. In 2002, Vernon Smith received the Nobel Prize in Economics for his foundational work, beginning in the 1950’s, on what is now called “experimental economics.”

Back in the 1950’s, Smith was one of only a very few economists attempting to use lab experiments to understand economic behavior, but today this is an area of rapid growth, attracting not only exceptionally talented young researchers, but also some of the best of the established members of the profession. Experimental economics is having a significant impact on the field.

The area of game theory, developed in the 1940’s by John von Neumann and Oskar Morgenstern, provides a nice illustration of this impact. First, I should tell you a bit about game theory[3]. For economists, a game is not just a pleasant way to pass the time. It is any contest in which there is something valuable at stake, a “payoff,” and the players are competing for some or all of that payoff.

Game theory studies how the players in a game choose strategies to achieve payoffs dictated by the rules of the game. The players can be people, but they can also be genes, companies, groups, or nation-states. Payoffs can be food, reproduction, a not guilty verdict, a monetary payment, or a victory in battle – anything that the players value. Player strategies can be instincts, bidding methods, legal defenses, corporate practices, or a battle plan in war. Game theory applies to an amazing range of interactions between competitors.

Consider, for example, what happens when a football player is making a penalty kick and the goalie is trying to block it. There are two players, and the payoff is a point. The kicker’s strategy is to kick either right or left. The goalie’s strategy is to dive one way or the other. The kicker wants to avoid the goalie, but the goalie wants to be where the kicker is kicking. What strategy should each of these players adopt?

This game is an example of what economists call “hide-and-seek” games. These games occur whenever one player wins by matching the other player’s strategy but the other wins by mismatching. Other examples are election campaigns where a challenger can win only by campaigning in areas different from the incumbent or the world of fashion, where ordinary people want to mimic the elite and the elite wish to distinguish themselves.

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[3] What follows is drawn from Camerer (2003) and Crawford and Iriberri (2007).

Game theory often makes clear predictions about what strategies players should choose. If these predictions are valid, the insights of game theory can serve as a powerful guide to decision-making in strategic situations. Yet when Tel Aviv University's Ariel Rubenstein and his colleagues studied how hide-and-seek games were played under controlled conditions in the lab, the results didn't line up with game theory predictions[4].

According to Karl Popper, what should happen in such cases is that we should toss out the old ideas and then try to come up with a new way of understanding what we see. But we don't necessarily need to start all over. Instead, it's often productive to try to identify the weakest part of a theory and see if we can change just that part to explain things. Once we find such a change, then we can design further experiments to see if the new theory holds up.

This is just what my UCSD colleague Vince Crawford and his co-author, Nagore Iriberri of Universitat Pompeu Fabra in Barcelona have done. They point out that one of the key ideas built into game theory is that in deciding on a strategy, each player engages in a kind of infinite regress of strategic thinking: if you, the goalie, know that I will kick right, then you will dive that way, but you know that I know that, and I know that you know that I know that, and I know that you know that I know that you know … and so on. Although it turns out that there is an elegant mathematical solution to this problem, in the real world all this does is to create severe headaches. This exhaustive strategic thinking is not really plausible.

Because of the weakness of this part of the theory, Crawford and Iriberri supposed that players do not engage in exhaustive strategizing, but that instead there are different types of players. So-called "level 0" players pick a strategy at random. "Level 1" players pick a strategy that is best against level 0 players. "Level 2" players pick a strategy that is best against level 1 players, and so on.

When they re-analyzed the original experiments, they found that the observed results agreed closely with the predictions of this new explanation. Like good scientists, they also considered other explanations, but because their level-based strategy idea was the least complicated and explained the data just as well, they advocated that approach. And the way is now clear for someone to see if they can find evidence against this new idea.

In this way, experimental economics has opened the door for what is now called "behavioral game theory." This is game theory, but constrained by the behavior that economists observe in the lab.[5]

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[4]Rubinstein and Tversky (1993); Rubinstein, Tversky, and Heller (1996); Rubeinstein (1999).
[5]Camerer, Behavioral Game Theory, 2003.

And this is not all. Recent advances in imaging the brain, functional magnetic resonance imaging or fMRI, have made it possible to see what parts of the brain are actively involved in making economic decisions and, specifically, in deciding on strategies in games like hide-and-seek. Colin Camerer of CalTech, one of the leading researchers in this new area, with the sexy name “neuroeconomics,” opines that this new ability to see how decisions get made at the most fundamental level has the potential for unifying the social sciences. Taking a long view, I do not feel this assessment is overly optimistic.

So, is economics a science? Economics is an attempt to understand an important part of the world around us: our reward-seeking interactions with our fellow humans. We work with data that we observe and that we generate in the lab. At every step, we economists make progress by formulating hypotheses, subjecting them to test, and, when a hypothesis is rejected, coming up with new hypotheses.

But as I have confessed already, I’m not going to give you the ultimate and final answer. Until there is an authoritative definition of “science,” that isn’t possible in any case. But I have offered data, and you can apply your own test to the idea that economics is or isn’t a science. And, I confess, when I apply my personal test to the hypothesis that economics is not a science, I reject it.