Laudatio

Franco Peracchi

Edward C. Prescott was born in Glens Falls, New York in 1940. He is a Regents' Professor at the University of Minnesota and a Senior Advisor to the Federal Reserve Bank of Minneapolis. He has been a Professor of Economics at the University of Chicago and Carnegie Mellon University, and an Assistant Professor at the University of Pennsylvania. He was a Guggenheim Fellow, and is a Fellow of the Econometric Society and the American Academy of Arts and Sciences. He was awarded the year 2002 Erwin Plein Nemmers Prize in Economics and was the Richard T. Ely Lecturer at the American Economic Association Meetings in 2002.

Professor Prescott has played a very influential role in changing the direction of macroeconomics. He is one of the major contributors to real business cycle theory. Together with Finn Kydland, he is responsible for the discovery and analysis of the time-inconsistency problem in macroeconomics. He has been a pioneer in using applied general equilibrium models to study a number of issues in economics and finance, and has made important contributions to econometrics and statistics. Awarding a degree to Professor Prescott is also a tribute to the special relationship between Tor Vergata and the University of Minnesota.

I will discuss briefly each of these five points in turn.

1. Business cycles and economic growth

An important part of Prescott's work has focused on business cycles and economic growth. In the 1970s, it was common to treat business cycles and economic growth as separate phenomena driven by completely different factors. Monetary shocks were typically regarded as the main sources of the business cycle, whereas technological progress and the growth of productive inputs accounted for long-run economic growth. Prescott demonstrated that industry-level productivity shocks need not average out in the aggregate, and that the stochastic version of the neoclassical growth model (that is, the standard neoclassical growth model with random fluctuations in aggregate technological growth) also can explain business cycle fluctuations.

The basic version of this model is highly stylized, as it consists of only five relationships: (i) a constant-returns-to-scale aggregate production function with labor and capital as inputs and a homogeneous output that can be used for both consumption and investment, (ii) a law of motion for the capital stock, (iii) a technology parameter that varies randomly over time according to some simple stochastic process, (iv) a specification of people's preferences over lifetime consumption profiles, and (v) an equilibrium concept (competitive equilibrium). One of the remarkable discoveries of Professor Prescott is that, despite its high level of abstraction, the basic version of the model is able to reproduce the business cycle phenomena that are typically observed in actual economies. Over time, the stochastic neoclassical growth model has been extended, by Prescott and

others, in several directions to incorporate the choice between consumption and leisure (both intra- and inter-temporally), household production, heterogeneous workers, etc.

As a consequence of this research, modern business cycle theory treats growth and cycles as being integrated, and Prescott's theory that a substantial part of the business cycle is simply the best response of the economy to policy changes occupies a central place in macroeconomics.

Quoting his classical 1986 papers (Prescott, 1986), "the policy implication of this research is that costly efforts at stabilization are likely to be counterproductive. Economic fluctuations are optimal responses to uncertainty in the rate of technological change. However, this does not imply that the amount of technological change is optimal or invariant to policy. The average rate of technological change varies much both over time within a country and across national economies. What is needed is an understanding of the factors that determine the average rate at which technology advances. Such a theory surely will depend on the institutional arrangements societies adopt. If policies adopted to stabilize the economy reduce the average rate of technological change, then stabilization policy is costly."

Notice that this was written in 1986, well before new growth theory started and that Prescott has coherently remarked that to understand growth one needs to understand sources of growth and fluctuations in total factor productivity, and the barriers to technology adoption which are probably the main causes of poverty (Parente and Prescott, 1992 and 2000). These barriers can be political, institutional or simply economical (monopolies, unions, etc.).

2. Time inconsistency

Prescott's work also has focused on the importance of an organization's ability and willingness to commit to specific policies over the long term. Prescott argues that people put their trust in organizations -- including government and corporations -- because they believe those organizations will deliver on their commitments. Failure to follow through on commitments would make people unwilling to invest in those organizations in the future.

Prescott's work on the time inconsistency of optimal plans (Kydland and Prescott, 1976) has far-reaching policy implications. It implies, for example, that taxing investment, either in physical or human capital, is bad for growth and prosperity.

It also has important implications for the development of central banks that can act independently and maintain credibility in the marketplace. Professor Nancy Stokey, from the University of Chicago, says: "The greatest real-world impact of Prescott's work comes as a result of his analysis of the time inconsistency of optimal policy. His work, which shows how important it is for a central bank to operate as an independent body, has influenced the way monetary policy is conducted in many countries."

3. Applied general equilibrium models

Professor Prescott has been a pioneer in using applied general equilibrium models to analyze a number of issues in macroeconomics and finance. One of his important discoveries is the so-called "equity premium puzzle" (Mehra and Prescott, 1985), namely the fact that the large differential in average returns between risky stocks and risk-free Treasury bills cannot be accounted for by general equilibrium models that abstract from transaction costs, liquidity constraints and other frictions absent in the standard Arrow-Debreu setup.

The methodology of applied general equilibrium analysis is nicely summarized in Kydland and Prescott's paper in the 1996 Symposium of the *Journal of Economic Perspectives* on computational experiments in macroeconomics (Kydland and Prescott, 1996). Computational experiments are standard tools in the physical sciences, such as astronomy, hydrology, meteorology, etc., where simulations are routinely used to understand the properties of a complex model. Professor Prescott has pioneered their use for quantitative economic policy evaluation, in contexts where controlled experiments are either too costly or simply infeasible.

"In a computational experiment, the researcher starts by positing a well-defined quantitative question. Then the researcher uses both theory and measurement to construct a model economy that is a computer representation of a national economy. A model economy consists of households, firms and often a government. The people in the economy make economic decisions that correspond to those of their counterparts in the real world… The researcher then calibrates the model economy so that it mimics the world along a carefully specified set of dimensions. Finally, the computer is used to run experiments that answer the question." (Kydland and Prescott, 1996).

The models used so far are highly stylized. This has the dual advantage of minimizing the number of parameters to be calibrated and simplifying the calculations. The use of these stylized models, false almost by definition, marks a healthy departure from the traditional emphasis on statistical hypothesis testing as a tool for testing economic theory. Again quoting Kydland and Prescott (1996), "one way to test a theory is to determine whether model economies constructed according to the instructions of that theory mimic certain aspects of reality. Perhaps the ultimate test of a theory is whether its predictions are confirmed".

4. Econometrics and statistics

Two important contributions in these areas are the classical paper with Tom Cooley (Cooley and Prescott, 1976) on the estimation of time varying parameters models and the introduction of the so-called Hodrick-Prescott filter (Hodrick and Prescott, 1980).

The Hodrick-Prescott filter has become a standard tool for empirical researchers in macroeconomics. It is a statistical decomposition that summarizes what happens to an aggregate economic time series at business cycle frequencies. The underpinning of the filter is the notion that growth and business cycles are integrated, and not the sum of two

separate components driven by different factors, as typically assumed in the classical analysis of time series. The filter uses the technique of smoothing splines to statistically define the growth component as being the curve that best fits a time series in a least squares sense, subject to a penalty for lack of smoothness based on the sum of the second differences squared. For quarterly time series, Hodrick and Prescott (1980) found that a penalty parameter of 1600 made the fitted curve mimic well what business cycle analysts would draw.

What I regard as Prescott's main contribution to econometrics and statistics, however, is his emphasis on the interplay between good measurement of economic phenomena and good economic theory. Again quoting his 1986 paper, "the match between theory [the stochastic neoclassical growth model] and observation is excellent, but far from perfect.… An important part of this deviation could very well disappear if the economic variables were measured more in conformity with theory. That is why I argue that theory is now ahead of business cycle measurement and theory should be used to obtain better measures of key economic time series. Even with better measurement, there will likely be significant deviations from theory which can direct subsequent theoretical research. This feedback between theory and measurement is the way mature, quantitative sciences advance".

5. Tor Vergata and the University of Minnesota: A special link

Tor Vergata has a special link with the University of Minnesota. Currently, three of our Ph.D. students are also in the Ph.D. program at the University of Minnesota. This academic year, one more of our Ph.D. students and two of our Assistant Professors are visiting the University of Minnesota. I hope that they will bring back some of the ideas and some of the intellectual energy that made the graduate program in Economics at the University of Minnesota one of the very best in the United States. The research environment and intellectual energy of the University of Minnesota owe a lot to Professor Prescott. This degree is not only a tribute to his scientific achievements, but also to what he has done to inspire and promote scientific research, especially among Ph.D. students and young researchers.

For this reason, I asked to our people currently at the University of Minnesota to answer the following question: "Why is it a privilege for Tor Vergata to grant a honorary degree to Professor Prescott?". Here are their answers.

Pietro Senesi (Assistant Professors) says: "I think that this is a privilege for our University at least for the following reason: Ed Prescott contributed so massively in such an important area of economics as the conceptualization, detection, and representation of business cycles. This is of outstanding importance from the epistemological point of view. Not only he did show that "Theory is ahead of measurement", but also accomplished a lot in filling the gap. Just to give an example, we have formulations of the reduced form multisector optimal growth model in both continuous time and discrete time that are totally equivalent from the theoretical perspective. Although methodologies are being developed to enable using discrete time data for estimating parameters of

continuous time models, still the "applied" model is the discrete time one. This is because it can be applied to estimation and simulation in a very consistent manner, and for much of this Prescott must be acknowledged."

Fabrizio Colonna (Ph.D. student) says: "Edward Prescott is surely one of the most representative names of modern economics. For years he has been on the frontier of economic research, without ever stagnating in branches of the theory already exhausted or not suitable to the use of the most advanced methodologies available for economic analysis.

From his early papers, like `Rules Rather Than Discretion: The Inconsistency of Optimal Plans' (with Finn Kydland) up to his more recent work like the book *Barriers to Riches* (with Stephen Parente), Ed Prescott has always brilliantly succeeded in combining the use of the most sophisticated and modern mathematical tools with the awareness that economics is a social science, concerned with the behavior of men and women, whose actions are moved by rationality but also by `Pride and Prejudice' . Like few other economists, Prescott has been able to make the perfection of the mathematical analysis compatible with the imperfection of human beings' passions, bringing economic theory to a balance point between realism and technical elegance."

Marika Santoro (Ph.D. students) says: "Edward Prescott is an eminent name on the economics' scene. His theoretical work has focused on economic fluctuations and business cycles. He has demonstrated that economic fluctuations are mainly not due to monetary shocks or expectations changes but to agent optimal response to real changes, just as technological ones. Agents put their trust in organizations because they believe that those will deliver on their commitments, he argues. Furthermore projects, in firms just like in governments, need time and human effort to be implemented. So even though he never doubted about the fundamental task of mathematical models, he still showed that economic fluctuations are just related to deviations of any economic variable from its model-predicted value. In such a way he has recognized the role of economics as science studying phenomena built by human behaviours.

The greatest world impact of Prescott's studies comes from his claim that government policies affecting productivity are the crucial determinants of the twentieth century great depressions. So we can mention the time inconsistency of the optimal policy framework as a result of his analysis."

Finally, **Enrica Di Stefano** and **Giordano Zevi** (Ph.D. students) say: "Edward Prescott's most famous contributions to modern economic theory focus on the study of business cycles, methods of dynamic macroeconomic theory, economic growth and public policy. He identified and established the today's widely recognized necessity to take into account the individual maximizing behavior in addressing any relevant theoretical economic issue.

This fact, together with the soundly motivated need to focus on the long run trend of productivity growth and its determinants, holds as an unchallenged basis of any modern approach for both the economic theorists, and the institutional decision makers.

In fact, he is recognized as a key contributor to the revolutionary wave of research stemming from the incorporation of the rational expectations hypothesis into the theory, and examining its policy implications. His highly successful research in the field, and his attention to the long run causes of growth and decline of the economic systems, connect his thinking to the economists of the past whose writings, as he explained, were the correct ways to answer specific economic questions.

His deep knowledge of the quantitative methods led him to set tighter and clearer rules in approaching the economic data and in relating them to the economic theory.

However, as his achievements in the theory are impressive, what we can learn as today's economists from Edward Prescott is the ability of facing long standing open questions by looking at them from a ground-breaking and original perspective.

His indication of the necessity of a coherent and rigorous language for the economic theory, and his contributions in developing it had an impact comparable to his most celebrated results. As a matter of fact, the latter permitted economists to address in a consistent way a new range of questions and to give satisfactory answers to many open issues.

In our opinion, Edward C. Prescott contributed greatly to the way economists communicate their ideas nowadays, and his work constitutes a foundation for future advancements in the discipline. Acknowledging this is a honor to us."

References

Cooley, T.F., and E.C. Prescott (1976), "Estimation in the presence of stochastic parameter variation", *Econometrica*, 44, 167-184.

Hodrick, R.J., and E.C. Prescott (1980), "Post-war U.S. business cycles: An empirical investigation", Discussion Paper No. 451, Carnegie-Mellon University.

Kydland, F.E., and E.C. Prescott (1976), "Rules rather than discretion: The inconsistency of optimal plans", *Journal of Political Economy*, 85, 473-492.

Kydland, F.E., and E.C. Prescott (1982), "Time to build and aggregate fluctuations", *Econometrica*, 50, 1345-1370.

Kydland, F.E., and E.C. Prescott (1996), "The computational experiment: An econometric tool", *Journal of Economic Perspectives*, 10, 69-85.

Lucas, R.E., and E.C. Prescott (1972), "Investment under uncertainty", *Econometrica*, 39, 659-681.

Mehra, R., and E.C. Prescott (1985), "The equity premium: A puzzle", *Journal of Monetary Economics*, 15, 145-161.

Prescott, E.C. (1986), "Theory ahead of business cycle measurement", *Quarterly Review, Federal Reserve Bank of Minneapolis*, 10, 9-22.

Parente, S.L., and E.C. Prescott (1992), "Barriers to technology adoption and development", *Journal of Political Economy*, 102, 298-321.

Parente, S.L., and E.C. Prescott (2000), *Barriers to Riches*, MIT Press, Cambridge.