

## Robert Solow: An Affectionate Portrait

Paul A. Samuelson

**T**he great Cambridge mathematician G. H. Hardy summed up his scholarly worth with the assertion: “I collaborated with Littlewood.” When I meet up with St. Peter in Heaven it will be my boast, “I collaborated with Bob Solow.”

Solow is the consummate economist’s economist. He does everything well and with apparent ease. What Ty Cobb was to baseball, Solow has been to our generation of economists. But with this difference. Cobb had a will to win that never let up. Solow acts as if he has nothing to prove. And what is most remarkable, as a youngster long before his merits had become clear to all, he displayed the same relaxed approach to economic science and academic life. The subjects of probability and mathematical economics he found to be the most fascinating things in life; and if you did not share this view, young Bob could only feel sorry for you. As an anthropologist who has spent a long lifetime observing achieving scholars and scientists, I can report how rare this relaxed approach is and how great must be the natural abilities of anyone with it who nevertheless attains the highest rung of the ladder.

I once said to Solow, “Bob, you are perfect except for one thing. You don’t play tennis.” Instead of reminding me that I don’t ski, sail, play chess, and after the age of 40 row for Balliol, Solow merely smiled.

### Meritocracy

My teachers were of the earlier American generations who came largely from farms and small towns. Frank Knight and Wesley Mitchell were typical specimens.

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Today Nobel winners in physics or medicine are more likely to come from the Bronx High School of Science. Even in my time, when the MIT graduate school was first becoming able to attract the most promising graduating seniors, they turned out to come from small colleges or large state universities distributed fairly randomly among geographical regions. Not so nowadays. I notice in recent years that the nation's NSF fellows tend to come from the dozen elite universities, as our meritocracy begins to do its sortings at an earlier age. A Ripon College in Wisconsin today has fewer weak students in its freshman class; but also those neighboring young stars whom it used to attract tend often to be lured away to Madison or Princeton or New Haven. The same tends to be true of the University of Buffalo or of Cincinnati.

Solow is a case in point. After Harvard learned how to locate Jim Tobins from Urbana, it discovered New York City. This is all summed up nicely in a conversation I eavesdropped on from my MIT office next to Solow's. After an eager Harvard visitor had mined Solow for information about a senior's honor thesis, I heard him say: "Excuse me, sir, can I ask you a personal question? I collect accents, sir. And, sir, I have you figured as Brooklyn filtered through Harvard." Bingo.

## War and Peace

Precocious academics are a dime a dozen. Bob Solow was precocious. (His mother tells the story that, bored with the pace at which his class learned to read, Bobby proceeded to read upside down. It reminds one of the unusual case when overnight a schoolchild's IQ halved. The economist Emile Despres grew so tired of having his test prowess discussed that he was discovered to be reversing his answers on every other quiz question.) Nevertheless, as an economist Solow was not notoriously an early bloomer.

*Table 1*

**Works by Robert M. Solow cited in this essay, listed in chronological order.**

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- [1] "On the Dynamics of the Income Distribution," doctoral thesis, Harvard University, 1951.
  - [2] "On the Structure of Linear Models," *Econometrica*, January 1952, 20, 29–46.
  - [3] "Balanced Growth Under Constant Returns to Scale" (with Paul A. Samuelson), *Econometrica*, July 1953, 21, 412–424.
  - [4] *Linear Programming and Economic Analysis* (with Robert Dorfman and Paul A. Samuelson). New York: McGraw-Hill, 1958.
  - [5] "Analytical Aspects of Anti-Inflation Policy" (with Paul A. Samuelson), *American Economic Review*, May 1960, 50, 177–94.
  - [6] "Capital Labor Substitution and Economic Efficiency" (with Kenneth Arrow, Hollis Chenery, and Bagicha Minhas), *Review of Economics and Statistics*, August 1961, 43, 225–50.
  - [7] *Capital Theory and the Rate of Return*. Amsterdam: North-Holland, 1963.
  - [8] "The New Industrial State or Son of Affluence," *The Public Interest*, Fall 1967, p. 108.
  - [9] "The State of Economics: The Behavioral and Social Sciences Survey: Discussion," *American Economic Review*, May 1971, 61, 63–65.
  - [10] "Comments From Inside Economics." In Klammer, Arjo, Donald McCloskey, and Robert M. Solow, eds., *The Consequences of Economic Rhetoric*. Cambridge: Cambridge University Press, 1988.
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Robert M. Solow

For one thing he liked to play horseshoes with the townies who lived around Harvard's Dunster House rather than split hairs with the virtuosi in the Junior Common Room. (In those days that section of Cambridge was called Kerry's Corner. Not only did you have to be Irish to live there, but if you didn't hail from County Kerry the neighbors would move your furniture out.)

For another thing there came along World War II. Most who entered Harvard in 1940 could delay military involvement and arrange for national service via various officers' training schools. A student like Solow could easily have been tapped by Harvard's Edward Mason for the OSS, or recruited for one or another cryptographic think tank. Solow quietly enlisted, serving through the Italian invasion as a spotter in small planes for artillery guidance. He refused promotion beyond the rank of sergeant, wanting to return as soon as possible to his Radcliffe fiancée Barbara (Bobbie Lewis).

## Hegira Down the Charles

Several hundred veterans descended on the Harvard graduate school in economics. I wish I could take credit for having spotted Solow as the pick of the litter. It was my colleague the statistician Harold Freeman who came to me in the spring of 1949 and said, "I understand Robert Merton Solow is the best of Leontief's students. Why don't we try to get him for MIT?" It was surprisingly easily done. Although Schumpeter, Paul Sweezy, Richard Goodwin and Leontief knew Solow's caliber, no effective finger was lifted on his behalf. (Goodwin and Sweezy were themselves on the way out, but in their case the excuse could be made that political bigotry had some role to play.)

MIT competed unfairly. Not that we offered a salary no yuppie could refuse: instead our Department Head accepted the pittance that Solow had diffidently suggested. MIT appointed Solow before he had a Ph.D. (just as it had done with me a decade earlier). Also, we agreed to give him an initial leave of absence—unpaid!—to study mathematical statistics under the great Abraham Wald at Columbia. The academic year 1949–50 in New York City was a great one for both Bob at Columbia and Bobbie at the New York Fed: the statistics vacuum that Cambridge had not abhorred was replaced by intimate acquaintanceship with Wald's masterly foundations of stochastic inference, and lifelong friendships were made with the leaders of American mathematical statistics.

Solow's own Harvard thesis (1951) dealt with dynamic processes of income distribution. It naturally won the David Wells Prize for best dissertation of 1951. But Solow never received the princely emolument of \$500. Arthur Marget in the late 1920s had pocketed the prize but never crashed through with the revised version of his winning thesis. Therefore, by my time and thereafter, the once-bit Harvard authorities had stipulated: no publishable MS, no \$500 prize. Unfortunately Solow's perfectionism inhibited him from undertaking the revisions he deemed needed, with the result that for many years the work enjoyed a considerable private circulation via library loan. I toyed for a time with the thought of stealing the author's copy and having the Harvard University Press publish it in book form without the author's knowledge, but nothing ever came of that impulse.

The first decade at MIT proved to be a fruitful one for the newest assistant professor. Among my favorites in his list of publications were his magisterial summary of the properties shared by Perron–Frobenius and Markov matrixes, in their *input/output* and Metzlerian *multiplier* economic applications; also the 1953 generalized growth iterations that turned out to turn up in the most diverse economic models.

The Nobel authorities have properly singled out Solow's 1956 theoretical growth model and his 1957 econometric measurements of that model. Fermi-like, Solow scored a grand slam, covering both theory and empiricism. This work revived Paul Douglas's production-function measurements. Colinearity in the historical trends of labor and capital inputs had made it impossible for Douglas to identify the separate contribution of technical change. By the neat device of employing observable profit/wage shares, Solow was able to perform the identification task: to a good approximation, there could be estimated a constant trend of disembodied exogenous technical progress—so to speak the “residual” that could explain half of the enhanced productivity previously imputed primarily to the stock of capital. Suddenly illumination was provided for the concept of “total-factor” productivity, which econometric historians like Moses Abramovitz, John Kendrick, and Simon Kuznets had devised to correct the simplicities of traditional measures based solely on gross labor productivities. Although the Cobb–Douglas functional form with unitary elasticity of substitution and constancy of distributive shares fit Solow's sample tolerably well, later (with Arrow, Chenery, and Minhas) Solow pioneered the CES specification involving a common elasticity of substitution that could be any nonnegative number. (As in the cases of Newton and Leibniz or Darwin and Wallace, unknown to Solow were

independent experiments with the CES form on the part of Abram Bergson, of H. D. Dickinson, and of David Champernowne.)

Joan Robinson generated cogent doubts about the admissibility of reducing vectors of heterogeneous capital to aggregates describable by a scalar magnitude. The debates between Robinson and Solow<sup>1</sup> did them both credit, even though it may be confessed that some observers succumbed to the law of diminishing marginal utility. As a not disinterested participant, it is as well for me to leave it at that.

## Teacher and Publicist

At this time there is no need to review the many scholarly works in such diverse fields as resource economics, urban economic modeling, incomes policies and much else. Let me put in the record how witty Robert Solow has always been as a conversationalist, lecturer, and writer. Indeed, Solow's good-tempered but incisive review of Galbraith's "Son of Affluence" cost him for a year or two a treasured friendship. But it says something for the civility of the pre-1960 generation of economists that someone of Solow's New Deal ideology could forge a warm intimacy with a stalwart of the second Chicago School like George Stigler. In a famous Cook County debate on wage-price controls, Solow declared, "What Sydney Smith said to Thomas Babington Macaulay, I say to you, Milton: 'I wish, Babington, I was as sure of anything as you are of everything.'" No offense was taken from this by the sage who elsewhere observed: "One man and the truth is a majority."

Lest one fall into the misperception of Robert Solow as a bland yea-sayer to every passerby, the reader will want to look up Solow's debate with his good friend Jack Gurley on new-left radical economics; and his rhetorical reactions to Donald McCloskey's thesis of rhetoric in economics.

When you say a scholar is brilliant, that is usually assumed to mean she or he is flakey. And, as I review the troops, I see there is enough truth in the stereotype to keep it alive. Solow is an exception. As with the late Arthur Okun, people seek his advice not because they agree with his eclectic post-Keynesian ideology but because his knowledge and respect for evidence makes his long-run batting average useful to a Japanese mutual fund, a regional Federal Reserve Bank, or scientific advisory committee of a major car producer. When one observes how he fits all this into a scientific program, while lecturing to hundreds of non-economist undergraduates and doing the dishes, one wonders what Alfred Marshall used to do with all that spare time Mary Paley Marshall made available to him.

A psychobiographer might speculate that had RMS been six inches shorter his bibliography would have been two feet longer. A good story to illustrate his lack of self-importance was told to me by Walter Heller, chairman of the all-star Camelot

<sup>1</sup> In his de Vries lectures on the *Return to Capital*, Solow preferred to finesse the issue of measuring capital by employing Irving Fisher's general equilibrium approach of intertemporal substitutions between vectors of produced inputs and outputs.

Council of Economic Advisers. (Heller, James Tobin, and Kermit Gordon were its elder statesmen in their early forties: its second rank had to settle for Kenneth Arrow, Art Okun, and Robert Solow! I was the out-of-town *éminence grise* who played Esther to King John F. Kennedy, usually from Scheherazade scripts written to CEA tunes.) Heller had been asked to revise and bring up to date an old encyclopedia article on the gift tax, a task just not compatible with the brutal midnight hours worked by the CEA. "Let Robert do this," Heller scribbled on the item to be revised. As Walter reported to me, "To my surprise the next day I saw on my desk an up-to-date manuscript much better than my original version. When I asked who had done it, I was embarrassed to learn that my secretary had given it to the wrong Bob, not to the youngest recruit on the civil service ladder. I hastened to apologize but Solow merely said, 'It was fun to do, and I learned a lot doing it.'"

Walter Heller used to say, "Behind every successful man, you'll find a surprised mother-in-law." Keeping steps with Bob Solow has always been Bobbie Solow. Her own career in economic history simmered on the back burner when they both brought up three children out in the wilds, but sure now Barbara Lewis Solow is a leading authority on Irish development and the dynamics of emancipation from serfdom and slavery.

## No One is Perfect?

Undiluted praise, however deserved and however fulsome, soon bores. I must therefore make the effort to find, or invent, a wart or two just to add to the verisimilitude of my portrait. I take my cue from the pre-puberty Niels Bohr. The great Danish physicist had for a younger brother the great Danish mathematician (and soccer player) Harald Bohr. The two brothers, we learned from biography, were very close and very fond of each other. Harald was as extrovertish and sparkling as Niels was inarticulate and reserved. One day Harald said to his older brother: "Let's take turns slamming each other. You say something critical about me, and I'll say something critical about you. It'll be lots of fun."

"Oh, I couldn't do that."

"Not even for me? To give me pleasure? Please, pretty please."

"Oh, all right. But you go first."

"Niels, the trouble with you is you mumble and never know when you start a sentence how it's going to end. No one can understand you, yourself least of all. There. Now it's your turn. Now you slam me."

"I couldn't do that."

"But you promised. So you must say something bad about me."

"Well . . . well, Harald, you have a string on your coat lapel."

If I try extra hard, the only possible string I can find on Robert Solow's waistcoat is his occasional tendency to dispose of some unlikely contention by rational expectationists with a devastating wisecrack. I admit it is often ludicrous to act as if aggregate markets clear within periods as short as a year or two and that it is not without humor

to hear a grown scholar allege that each new tax reduction will cause us to save more against the day when our children will be taxed to meet the entailed deficit. My point, though, is that a wisecrack does not a science build. The refutation of unrealistic paradigms will come from prosaic scientific researches, and even from investigations carried on by rational expectationists themselves. It is not elder statesmen's wisdoms that kills off a young whippersnapper's foolishnesses, but rather another whippersnapper's regression data.

But what is it I am saying and preaching? It is precisely what I have learned over the years by eavesdropping through Solow's office door. Our forty years together have passed as if but a day. Like *Oliver Twist* I look forward to forty more, and can say with Wordsworth that this would be "very heaven."

■ *I owe thanks for my post-doctoral fellowship to MIT's Sloan School of Management, and for editorial assistance to Aase Huggins (a treasure shared by Solow and me).*

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