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## The Many Contributions of Edmund Phelps: American Economic Association Luncheon Speech Honoring the 2006 Nobel Laureate in Economics

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Throughout his career, Ned Phelps has made fundamental contributions to growth theory, macroeconomics, public finance and social welfare theory that deserved the high recognition accorded by the Nobel Prize committee in October, 2006. He is one of the most original thinkers in economics.

The citation issued when Phelps was made a Distinguished Fellow of the American Economic Association still speaks for the community of economists today:

The collection of papers from a conference that he organized, Microeconomic Foundations, pushed questions about theoretical foundations to the front of the research agenda and changed forever our notion of what constitutes an acceptable macroeconomic theory...

Throughout his career Phelps has been willing to step outside of the existing analytical framework and rethink the basic issues... He continues to push theorists and policy makers to rethink their analysis of expectations, inflation, and unemployment and to set a high standard for what it means to be an economic theorist. (American Economic Association 2001)

Phelps's output of original concepts, models and theorems has been vast. A partial list of his many achievements includes the concept of an "equilibrium" unemployment rate, or "natural" rate of unemployment, the expectations-augmented Phillips curve (1967; 1968a; 1970); the earliest analyses of optimal disinflation and optimal inflation targeting over time (1966a; 1972a; 1978a); models of "incentive-wage" setting and hiring, when firms invest in employees, that originated the literature on what have come to be known as "efficiency wages" (1968a; 1992); "customer market" models of price-setting when a firm's market share is a dynamic function of its price (1970; 1994); the concept of expectational equilibrium in the "islands parable" of search unemployment (1969; 1970); models of expectational equilibrium without market clearing (1968a); "full liquidity" as a normative proposal for optimal monetary policy (1965); analysis of the "inflation tax" within the context of an optimal tax structure (1973); the consequences of staggered wage commitments for inflation and unemployment dynamics (1977; 1968a; 1979) and for optimal disinflation policy (1978a); the role of education in the diffusion of technological innovations and economic growth (1966b); the analysis of the implications of population size for the rate of technological discovery (1968b); the concept of a "golden rule" for investment in physical capital (1961) and in research (1966a); the possibility of dynamic

inefficiency (1966); equilibrium models of capital accumulation when saving is determined by non-time-consistent preferences (1968); the concept of “hysteresis” in the labor market (1972b); the concept of statistical discrimination (1972c); early analysis of the marginal tax-rate schedules required for economic efficiency (1973); early analysis of the consequences of risk for the accumulation of capital (1962a); conditions required for the intergenerational fiscal neutrality of budget deficits (1965); important early work on alternatives to the postulate of rational expectations (1983).

These innovations have had substantial impact on the economics profession, and have led to development by others that have won much recognition. Phelps’s concept of the golden rule was the basis for the overtaking principle of Weizsäcker, and stimulated further research on optimal capital accumulation by Cass and Koopmans.

In the decade of the 1950s, there were charges that an economy that left national saving “to the market” would suffer from under-saving and thus a deficient long-run growth rate. The tacit message was that budget surpluses were needed to supplement the meager private saving. At the same time, the model of economic growth that Solow had contributed in 1956 possessed no normative apparatus with which to judge the indictment. The sole normative apparatus around, the 1928 Ramsey model of “optimum” national saving and effort, was not obviously applicable to an economy experiencing steady technical progress or steady population growth. Against this background, Phelps posed the question, what would be the largest rate of saving a country could justify, regardless of details about the intergenerational preferences of its families or the intertemporal preferences revealed by its government? Phelps’s arresting result was that, if the national saving-output ratio is the variable to be fixed (as in Solow’s model), any level of that ratio in excess of capital’s relative share of national income would lead to over-accumulation of capital—a permanent sacrifice of consumption. In steady state, the highest consumption path is obtained at a saving-output ratio equal to the (steady-state) level of capital’s share. That was the “golden rule” for maximizing the balanced-growth level of consumption.

This result, which Samuelson called a “gem of a theorem,” spawned a lot of research. A steady-state Phelps-Koopmans theorem soon emerged showing that it isn’t just steady growth paths with too high a capital-output ratio that are inefficient, actually lowering consumption more than they add to it. Even a path of accumulated capital that is not steady but nevertheless wanders indefinitely beyond the golden-rule path is also inefficient. The Phelps-Koopmans dynamic inefficiency theorem motivated research on capital theory by Cass (1972).

Phelps’s concept of intergenerational fiscal neutrality inspired the influential work of Auerbach and Kotlikoff (1987) on generational accounting. Phelps’s island parable prepared the ground for the celebrated rational-expectations model

of Lucas (1972). Phelps's work on optimal saving under uncertainty stimulated the further research of Samuelson, Hakansson and Merton. Phelps's concept of full liquidity as a normative ideal was the basis for Friedman's celebrated analysis of "the optimum quantity of money" (Friedman, 1969).

In his introduction to the Phelps volume—*The Microeconomic Foundations of Employment and Inflation Theory* (1970)—where he introduces the parable of the island economy in which agents (firms/workers) make decisions about employment and output in initial ignorance of developments on other islands, Phelps summarizes the central idea in a poetic and insightful fashion:

A common thread runs through all of these models. The actors of each model have to cope ignorant of the future and even of much of the present. Isolated and apprehensive, these Pinteresque figures construct expectations of the state of the economy—over space and over time—and maximize relative to that imagined world.

Phelps's idea of "incentive wages" as a reason for equilibrium wages to exceed the market-clearing level and for unemployment above the voluntary level, pioneered in his 1968 paper, was further developed by Stiglitz in 1972 (published in Stiglitz, 1975), by Salop in 1979, and in a large subsequent literature on "efficiency wages." The analysis in the same 1968 Phelps paper of the frictional costs to the firm of recruiting and training new hires spawned a large literature on models of frictional unemployment by Mortenson, McCall and others.

Phelps's 1968 remarks and 1970 appendix on wage staggering, and the Phelps-Taylor paper of 1977, led to further models of wage staggering by Fischer and Taylor, and ultimately to the econometric models of wage and price dynamics under rational expectations developed by Taylor (1993). The problem of optimal disinflation was revisited by Sargent (1999) under the name "the Phelps problem," and has led to a large recent literature on optimal inflation targeting, including the contributions of Lars Svensson, Michael Woodford, Bennet McCallum, Richard Clarida, Jordi Gali, and Paul Gertler, among others.

The Phelps-Winter customer-market model was further developed by Okun (1981), Kouri, and Krugman, and a subsequent literature on "customer-switching" models in industrial organization. It has also been incorporated into models of macroeconomic fluctuations by authors such as Greenwald and Stiglitz as well as Rotemberg and Woodford.

Phelps's 1972b concept of labor-market hysteresis was subsequently analyzed empirically by Blanchard, Summers, and Fischer (1986). The Nelson-Phelps view of the importance for economic growth of the higher education of managers has been supported by Benhabib and Siegel, further developed and tested by Aghion, Howitt, Brant-Collett, and García-Peñalosa (1998), and extended to the education of consumers by Bhidé (2008). The Phelps-Pollak model of time-inconsistent choice was elaborated by Laibson (1997) as one of the most influential models in

the recent literature on behavioral economics, and its game-equilibrium concept has also stimulated important work by game theorists. The link proposed by Phelps between population and technical progress relation is a cornerstone of the work of Jones (2000) and others on demographics and growth. Phelps's 'public finance' approach to the analysis of optimal inflation has been transformed into a positive theory of inflation by Spaventa and others. Phelps's concept of statistical discrimination has become a cornerstone of the economics of discrimination and was empirically confirmed by Goldin and Rouse (2000), among others.

Throughout his career, Phelps has been an intellectual Johnny Appleseed who made numerous, highly original, very influential and enduring contributions to many fields in economics. At the same time, it is possible to identify a few key themes that underlie many of his most important contributions.

The key to these contributions was his adoption of a view of the enterprise economy that was uncommon when he entered economics—a view first expressed by Keynes and Hayek in the 1930s that he absorbed, made explicit and developed. The common factor in these contributions is that they inject into macroeconomic theory the real-world complication that in an enterprise economy the firms, employees and savers routinely act under *incomplete information and, often, imperfect knowledge*. They therefore form *expectations* about what they do not observe or see reported and *beliefs* about what they do not know.

In the 1950s, when Phelps entered economics, formal models of the economy—models of capital accumulation, employment, etc. based on individual maximizing behavior—posited perfectly informed agents possessing perfect knowledge of how the economy works. The informal models in use, which varied greatly in their implications, said nothing at all about the information agents acquire and when they acquire it.

Phelps's initiatives in the mid-1960s triggered a revolution in macroeconomics—a reorientation away both from the neoclassical single-agent economies such as the Ramsey model and from the hydraulic "purely macroeconomic" models of the type that evolved as Keynesian economics. The "Phelps volume" (1970) produced from the historic conference organized by Phelps at the University of Pennsylvania in January 1969 became the focal point of a movement to re-found macroeconomics on a new microeconomics of imperfect information. That conference volume also became a rallying point for skepticism among the new generation of economists over the effectiveness of "high-pressure" monetary and budgetary policies as methods of securing high employment without inflation.

As this line of work developed, there was a tendency toward more and more tightly structured models aimed at compatibility with various lines of thought, from rational expectations to neo-Ricardian equivalence, with which Phelps had little sympathy. He instead urged recognition of the crucial role occasionally

played by large-scale expectational disequilibrium and the implausibility of the tenet that enterprise economies reliably move along a stochastic expectational equilibrium path.

Phelps's first major effort at modeling imperfect information, undertaken in the second half of the 1960s, pioneered a first generation of micro-macro models of unemployment and inflation in which firms and employees have to make their current decisions before learning or inferring the average price, wage, and employment decisions made by others. This was followed in the next decade with models that he developed which exhibited long-lived wage or price commitments, so that the firm's effective expectational error might grow large even if it were originally rational. In a more radical effort in the early 1980s, he explored models in which each firm uses a model to form its expectations, but the model requires estimating the expectations of others, while other firms use different models, or make different assumptions about the expectations of others.

Finally, his nonmonetary micro-macro models in the 1990s show that, even if one excludes all errors in expectations, exogenous forces driving changes in the structure of the economy can generate large shifts or temporary swings in the equilibrium path of unemployment owing to effects on incentives affecting quitting, shirking and other employee behavior that results from asymmetries of information. His interests in information, knowledge, and expectations also influence his work on a variety of microeconomic topics, including saving, education, discrimination, and unions.

Phelps was not the only economist to break from the neoclassical paradigm of perfect information and perfect knowledge. Among prewar theorists, Schumpeter, Knight, Keynes, and Hayek each dissented in their own way from neoclassical doctrine, although their ideas were not accepted by all and certainly not assimilated into the maximizing behavior assumed in standard economics. Among postwar theorists, Akerlof, Arrow, Diamond, McCall, Marschak, Mortensen, Spence, and Stiglitz also spearheaded critiques and revisions of the information and knowledge postulates of the neoclassical paradigm. But Phelps was the first to launch a broad program to refound macroeconomics on the basis of imperfect information, and his program was the first to have a wide impact—with the unemployment/inflation papers in (1967; 1968a; 1969), the 1970 "Phelps volume" from the Penn conference of 1969, and his freewheeling 1972a book.

He was also in the forefront of efforts to model the effects of incomplete knowledge—with his 1977 model of a labor contract model in which the firm's "state" is unknowable, being in the entrepreneur's mind. He wrote a 1983 paper on the consequences of every agent's apprehension that other agents may interpret data differently. Phelps was thus a critical figure in the "information revolution" in macroeconomic theory, which led to (but not only to) the celebrated "New

Classical” work of Lucas, Sargent, Barro and others in the 1970s, and which continues today.

Less recognized, but worthy of mention, are Phelps’s contributions to the methodology of macroeconomics. He was among the very first-macro or micro-economists to use dynamic programming in economics. He breathed the air of the early 1960s Rand Corporation environment where Bellman was a dominant force. His *Econometrica* paper (1962a) on sequential dynamic investment showed the power of a tool then neglected by economists.

#### IN SUMMARY

Phelps has led the way in placing macroeconomics on microeconomic foundations, pioneering a macroeconomics based on imperfect information. Some of his other research in macro, his research on growth, and his work in capital theory have also launched entire fields and defined the agenda for careers of famous economists, many attending this lunch. His impact on economics is deep and his influence pervasive.

It is a great mystery why it took the Nobel Prize committee so long to acknowledge this brilliant body of work. The full answer would take a longer time than I have today to elaborate. The short answer is that Ned has always been a loner, not a groupie. It’s the nature of his personality and a reason why, so often, and so creatively, he has challenged mainstream “wisdom”. Loners do not always get the recognition that they deserve. We are all glad that this creative loner was finally recognized for his magnificent and varied achievements.

I close with a story that typifies Phelps’s creativity, courage, and good spirit. Around 1975, Phelps was invited to speak at Chicago in George Stigler’s legendary blunt-talk workshop on industrial organization. His topic was the role of altruism in economics. At that time Chicago dogma ruled out social interactions and any approach but the methodological individualism of agents interacting only through markets. Altruism and social interactions were not on the table in mainstream Chicago economics. A pantheon of Chicago price theorists was in attendance including Gary Becker, Reuben Kessel, Richard Posner, and George Stigler among many others.

He started his workshop with D.H. Robertson’s question: “what is it that economists economize?” The answer: “love, the scarcest and most precious of all resources” (1956).

For the next hour and twenty minutes Phelps took a pounding from the infuriated methodological individualists. The outrage and outpouring of anger expressed by the assembled participants brought to my mind the performance of Nikita Khrushchev at the UN in 1961 when he pounded the table with his shoe. Phelps sat back and rolled with the punches, and gave back all that he got and

more. On the way back to my office, crossing the Midway, Phelps laughed and said, “I wanted to show the group at Chicago that there is more to economics than price-quantity plots.”

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