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# **Recollections of My Past Research in Economics**

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It is an honor and a pleasure to be named – alongside John Nash – an honorary professor at the Beijing Technology and Business University. I am grateful to Chairman Wang Shoufa, President Shen Yu, and the Faculty of BTBU for selecting me for one of these two delightful awards.

I think it might be interesting for students if I speak about my contribution to economics – I mean the thrust of it, not a catalog of all the books and papers. It is convenient, though, to mention several books and papers along the way.

I am an economic theorist. The younger economists today tend to use the term "theory" to refer to the theory of games and decisions; in fact, I have contributed to game theory. But my main theoretical interest is in economic systems – in systems of economic organization. I have found myself comparing the outcomes of a system against those of another system and in gauging the human rewards of different economic organizations.

My contribution falls mostly within what I like to call *modern* economics – the understanding of economies operating on a system in which the actors have *imperfect information* or they have *imperfect knowledge* or both. My work in this vein has generally been driven by macroeconomic interests in the broadest sense of the term macroeconomics: – an interest in economic *development* and an interest in aggregate economic *activity*. So the recurrent themes running through most of my theoretical work are the roles played by knowledge, beliefs, information, expectations, discovery and problem solving in determining various macroeconomic phenomena –

investment, research, adoption of innovations, wage setting and price setting, unemployment, slumps and booms, and human fulfillment.

My research did not begin with problems of either knowledge or information. In my research post at Yale's Cowles Foundation I worked at first in the area of what in those days we called "growth economics." When I entered this field, it was mostly about the productivity of investment in physical capital under conditions of *perfect* information and knowledge; the field treated investment in "human capital" in the same way. My earliest paper in this field, "The Golden Rule of Capital Accumulation," was of this type. It showed that among all balanced-growth paths the one with the highest consumption path is characterized by equality of the investment share to the profit share ; thus also equality of the rate of return on capital to the growth rate along any of the parallel growth paths.<sup>1</sup> A second paper, "The Accumulation of Risky Capital," was also of this type.

#### **Research Involving Imperfect Information or Imperfect Knowledge**

Nearly all of my subsequent research arose from problems of knowledge or of information. I began by theorizing about the creation and diffusion of knowledge – specifically, industrial *technology*. Technical advance, and entrepreneurial advances too, have to be conceived, which requires work as well as inspiration; they do not appear like manna from heaven.

*Technical advance and innovation.* In a 1968 paper I modeled the link between industrial research and development expenditure (R&D) and the rate of *technical progress.* This paper also extended the Golden Rule calculation to expenditure for research and development – to optimum technical progress, in other words.<sup>2</sup> The headline result was the implication that the rate of technical progress was ultimately limited by the growth rate of the number of researchers. It followed that the world's knowledge explosion in the past

<sup>&</sup>lt;sup>1</sup> This result sparked a wave of research on "optimal economic growth" by Koopmans, Cass and Weizsäcker and others. It also sparked further work on inefficient, or excessive, saving Koopmans and me and later by Cass

<sup>&</sup>lt;sup>2</sup> Uzawa, Lucas and others also modeled the link between R&D and technical progress. (In general I will not be able to cite parallel contributors in this brief and informal look back.)

couple of centuries would not have been possible without a population explosion – a lesson dubbed (by Nordhaus) the Mozart Proposition.<sup>3</sup>

I also took up *aspects* of *innovation*. In a 1966 paper with Richard Nelson it was argued that a liberal-arts education helps managers of business enterprises, such as farms and factories, to assess the desirability of adopting a new input for use in production or of entering a new market.<sup>4</sup> In any economy, for the advance of productivity there has to be the launch of a new product and there have to be potential users willing to pioneer its adoption. High productivity economies are good at both. This paper represented a radical departure from the "human capital" theory of the Chicago School. In our paper, the education possessed by labor force members was important to a country largely because it accelerated the diffusion of innovations; thus it was productive mainly, if not solely, for innovative economies, not for the static economies under Stalin and Nehru. (I would remark here that both the above papers were about a very large economy. In a small open economy, a firm may do research and innovate based on hopes of finding pioneering adoptions of its innovation in markets overseas.)

The paper proceeded to produce a little model of the rate at which "average technical practice" in a country increases as a result of the gap between average practice and "best practice" – the latter referring to the practice made possible by the latest innovation launched to date. The distinction is between the current level of technology represented by the latest methods and concepts (and capital goods embodying them), on the one hand, and the current level of technology practiced on average over all firms. We may call the former level the national *frontier* level and the latter level the *actual* level. In that terminology, the paper argued that the level of an economy's technology in practice will be increasing *faster* the *farther* it is from the frontier – that is, the greater is the "gap" between average and best – and the *higher* is the proportion of the labor force who possess a liberal-arts

<sup>&</sup>lt;sup>3</sup> This construction was usefully applied to time series studied of economic growth made by Chad Jones in the 1990s.

<sup>&</sup>lt;sup>4</sup> This idea echoed the view of the education theorist Alexander Miklejohn, who president of Amherst College and held posts at other universities in the 1920s and 1930s. His defense of liberal arts education was that, as a result of the experience, the student "learns how to learn."

college education. It was amazing to me how much influence such a simple construction could have – though it took 20 years for that influence to occur.<sup>5</sup>

The paper had another implication not made explicit. The firms of a country may be quite capable of innovating – whether original innovating or merely adapting/copying recent innovations made overseas. But if there are few managers with the education required to evaluate such new products and to make good use of them, adoption of such new products would be slow. It might be so slow that firms would not find it profitable to prepare innovations for the market – the home market at any rate. It takes two to innovate – a willing innovator and the prospect of an adoptor. Thus an innovative economy requires persons with capabilities for creating or adapting the new knowledge needed for a new product *and* an adequate pool of persons with capabilities for evaluating and using the new products embodying the new knowledge.

Investment requires saving, of course. I was fortunate also in this same period to be able to make a contribution to the theory of optimum national saving in a paper with Robert Pollak published in 1968. How much will a generation with some altruistic wish to benefit future generations decide to save and bequeath to the next generation if it does not know how well or badly (from its point of view) the next generation will make use of the extra wealth? – if each generation supposes only that future generations will have the same altruistic desires as itself, no more and no less? It turned out there was a straighforward solution to this puzzle.<sup>6</sup>

*Wage-setting, price-setting and unemployment.* The middle years of my research, from the mid-1960s to the end of the 1970s, were focused most of the time on the level of economic activity, as measured by employment and unemployment – with emphasis on monetary aspects. This work, starting with my 1967 paper in *Economica* and my 1968 paper in *Journal of Political Economy*, brought to the profession's attention the idea of a "natural" unemployment rate but, more important, introduced the mechanism by which

<sup>&</sup>lt;sup>5</sup> In the early 1990s it was finally taken up in a book on economic growth by Barro and Sala-i-Martin. Soon after it was used extensively and quite successfully by Aghion and Howitt and later by Aghion in research on Europe.

<sup>&</sup>lt;sup>6</sup> This work turned out to stimulate much research, under the name of "hyperbolic preferences," by David Laibson.

it is determined the size of the natural unemployment rate, made the case for regarding this equilibrium rate as invariant to the (expected and actual) inflation rate, and explained how a surge of "effective demand" such as might be brought about by a spontaneous decrease in the demand for money or an increase of consumer demand could and generally would drive the rate of wage inflation above the expected rate of wage inflation and thus drive actual unemployment below the natural rate of unemployment. The mechanism involved employee quitting; later employee shirking was brought in by others.<sup>7</sup>

The great economist Milton Friedman and I had to share the credit for injecting the notion of the natural rate into macroeconomics and showing how the economy can be blown off it's the natural path it has been following. Our additive efforts killed off the Phillips Curve and triggered the reformulation of monetary economics embodied in the subsequent New Keynesian literature, which I anticipated toward the end of my 1968 paper and which was developed at Columbia by Taylor, Calvo and myself in the second half of the 1970s. But I have to note that Friedman's parallel modeling of how an economy may be driven off an equilibrium course was about the natural rate of labor-force participation, not the natural rate of unemployment, which had confronted me with novel and thorny issues. And his focus on expected real wages versus actual real wages turned out not to have had as much influence as my focus on expected relative wages versus actual relative wages. Still, his forceful exposition of the natural rate idea and deft treatment of what was a less novel channel deserves much of the credit for raising economists' awareness of the new thinking.

To convey the basic mechanism generating demand-driven fluctuations of unemployment around a central tendency I sketched a variant of the model a year later. In this 1969 model, the economy consists of a set of islands fairly distant from one another and not in immediate communication. In this setting it is the workers who are fooled by increased wage inflation into staying on islands that, unbeknownst to them, are relatively low-wage islands.

<sup>&</sup>lt;sup>7</sup> This paper stimulated a whole line of research in this direction, including Dale Mortensen, a nonmonetary reformulation by Steven Salop, and "shirking" models of employment by Samuel Bowles, by Guillermo Calvo and by Robert Solow.

This sketch of a model was taken up by Robert Lucas in a celebrated 1973 model. There he imposed rational expectations onto the beliefs of the workers making their stay-or-leave decisions. That step succeeded in achieving a relatively simple order to an economy with a rather complicated structure. But something was lost in abstracting from the strong possibility in real life that workers in some situations systematically under-estimate (or over-estimate) the general wage level. Most of us have no idea what the average wage is in our industrial and professional categories.

One implication of my 1968 paper was quite radical and little noticed or understood at first. The paper implied that if the economy were initially in a situation in which wages just cleared the labor market, so that no one would be involuntarily unemployed, each firm would immediately see an advantage in raising his wage as a device to lower his costs, figuring that to become perceived as a high-wage firm would be repaid in reduced employee turnover. As all firms raise their wages, they force the equilibrium to be one where the general wage level exceeds the market clearing level. This aspect of my model and Akerlof's "lemons" model were the two fires that lit the asymmetric information modeling of the labor market.<sup>8</sup>

Quite a lot of economics was shaken up by these two papers. The 1969 paper showed that there could be market clearing in each island's labor market even without equilibrium in the expectational sense of the term (which was traditional from Marshall to Myrdal and Harrod, among others). The 1968 paper showed that there could be labor-market equilibrium in the expectational sense without market clearing. The dissemination of these results was speeded up with their recycling in the 1970 conference volume *Microeconomic Foundations of Employment and Inflation Theory*, which came out of a 1969 conference I organized at the University of Pennsylvania.

*Non-monetary equilibrium theory of the 'structuralist' kind.* In the late 1980s and early 1990s I engaged in the construction and general-equilibrium analysis of a theoretical non-monetary economy in order to show how

<sup>&</sup>lt;sup>8</sup> The non-market clearing phenomenon was the focus of papers by Stiglitz, by Salop and later a well-known paper by Shapiro and Stiglitz. The notion of a "wage curve" emerged explicitly in a 1977 analysis by Calvo and Phelps of an optimal wage-employment contract.

various exogenous market forces impacted on the size of the *natural rate itself* through their effects on the shadow price that employers put on additional job-ready employee and the opportunity cost of transforming new recruits into job-readiness ("training"). A collection of the resulting papers were published in the 1994 monograph Structural Slumps: The Modern Equilibrium Theory of Unemployment, Interest and Assets. The message is that the natural unemployment rate is not a constant: it may experience wide swings from one decade or era to another. Continental Europe's low unemployment in the glorious years from the mid-1950s to the mid-1970s was an exception, driven by the boom in rates of investment – investment in new plant and to some extent equipment, investment in new overseas customers and investment in new employees. When the Continent's technological "catch-up" had gone as far as it could under existing institutions, investment rates subsided and the "natural rate" rose to a far level. (It is tempting to refer to a plateau that the natural rate has since fluctuated around, but it appears likely that the plateau has risen still higher in some of the large Continental economies in recent years and has fallen back in some of smaller ones.)

Out of this research came a recognition of market forces that had not previously been seen as playing an important role. Two of these new forces were the world real interest rate facing a small (or not so small) open economy and the amount of private wealth held by households and thus directly or indirectly available to most members of the labor force. A rise in overseas real interest rates facing an open economy drives down the shadow price, or value, of every business asset in which domestic firms might invest, which is contractionary for employment. An accumulation of additional private wealth, in decreasing the ratio of wage to wealth (or income from wealth), has deleterious effects on employees' incentives not to quit, not to shirk, and so forth, which raises employers' costs and thus contracts employment. At the same time, the new model almost singlehandedly put an end to the importance given to "hysteresis" as a factor exerting a strong influence over the path of employment.

I must mention an advance in this research at the end of the 1990s. I saw that sudden expectations of a surge of technical progress – and therefore

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productivity – in the *future* would, generally speaking, cause an investment boom in the *present* in anticipation of the increased profits that the increased productivity would bring. The value put on new employees is immediately increased on the speculation that new employees would have higher productivity in the future than they were previously expected to have; while, at the same time, the cost (or opportunity cost) of hiring more employees is not yet increased. Paradoxically, if the expectations are realized, and so productivity does in fact surge as expected, that will cause the boom – and the elevation of employment – to subside.

This was quite a wrenching change of thinking from the so-called Real Business Cycle theory built on neoclassical lines. It suggests that *most* if not all of the big booms in the economy are the result of changes in the forward*looking visions* of entrepreneurs and financiers – precisely as held by the early 20<sup>th</sup> century German School of Spiethoff and Cassel. In the United States the 1920s were a period of elevated expectations for the next decade (the 1930s), and those expectations created an investment boom; in the 1930s productivity raced ahead, just as expected, but employment was depressed. The 1950s were another decade in which firms investing in business assets and households investing in corporate shares had ebullient expectations about the next decade and, as a result, employment was pretty high over most of the 1950s - higher than over most of the 1960s. The 1990s were the most recent decade of high expectations for the future, particular in the last half of the decade, and again there was high investment and high employment; and, sure enough, productivity has been rapid in the present decade, just as foretold by the high share prices and corporate enthusiasm so evident in the 1990s. (See my analysis in January 2004 in the Wall Street Journal.)

A critique of 'rational expectations.' A very basic feature of the future, of course, is that it is not observable – not as long as it is the future. (Even some conditions in the present are not observed, of course; yet much of the present is observable or approximately so.) We have to *construct* our notions of the future prospects awaiting our economy. (Psychologists say that our past is largely constructed too, since we forget things not long after they have happened.) Further, while the present is unchanging, the future will likely have changed in important respects relative to the present – just as the distant

past looks different in many respects, both quantitatively and qualitatively, from the present. Finally, rational expectations have to do with a model's implied predictions of its endogenous variables, not with big exogenous forces like technologies, climate, wars, famines and disease; their "expected values" cannot be posited to be constantly equal to zero. As a consequence, rational expectations has no applicability to future prospects of the big, exogenous kind. We cannot plausibly pretend that the next war and the continuing explosion of medical expenditures obey know statistical distributions. The actors in the economy can only make guesses about the strength of such forces. Yet, as a 2005 paper of mine argues, the emergence of new future prospects and changes in existing ones appear to be the major source of the forces driving economic activity. Much of the big swings in activity appear to be speculative, driven by unscientific, though rarely pathological, hopes and fears about the future.

This brings me to my previous criticisms of rational expectations. From my 1968 paper onward I preferred not to use the rational expectations premise and have used it only when I thought that doing so would not be misleading for the purposes at hand. In a paper published from a 1982 conference that Roman Frydman and I organized on rational expectations, I argued that the operational content of models with rational expectations model may be sensitive to what agents assume with regard to others' beliefs about exogenous factors outside the model. The paper shows that it is not sufficient for every actor in the economy to have the right expectation about some exogenous event; the prevalence of this expectation must be public knowledge - now called "common knowledge." The introduction to the conference volume suggests that the change of view is that in the *Microeconomic Foundations* volume "the individual agent 'models' the *conduct*, to use Hayek's term, of the other agents, but not the expectations function that generates that conduct [while] this book contemplates the agents' model of the other agents' model."

I have recently added a deeper criticism of rational expectations with the argument that in the sort of entrepreneurial economy called capitalism the actors cannot possibly have perfect knowledge of the "model" of the economy. The reason is that some of them – namely, the entrepreneurs – are

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conspicuously and constantly creating and recreating the reality of the economy (the true model) in the course of their entrepreneurial activity;<sup>9</sup> and nearly everyone else is in the business of learning and deciding how best to adapt to the changes in the economy that the entreprenueurs are making. With the deepened understanding of the nature of the capitalist economy that Hayek, Michael Polanyi and Keynes began reaching in the 1930s, the entrepreneur becomes a creator of a model and the marketplace becomes the setting in which the truth of that model is tested – the stage that Hayek termed the "discovery process." In my presentation at the 2003 conference honoring Joseph Stiglitz I emphasized that these entrepreneurs are betting and acting on knowledge some strategic part of which is not generally given to the other actors. To postulate that the actions generally have rational expectations is to suppose that there are no entrepreneurs in the Austrian sense of the term.

So I have come back full circle to the basic insight of Keynes in his 1936 *General Theory*. Booms and lulls are typically a product of the visions – or absence of vision – of entrepreneurs. The entrepreneurial economy is a *creative social process*, rather than a randomly vibrating bridge or other stationary-stochastic process. And without recognition of that it is simply impossible to understand, except at a very superficial level, such an economy's tendency to experience great swings and shifts, which are its most important kind of fluctuation.

#### What High Performance Is and What Institutions It Requires

In the 1990s, intrigued by the issues facing the former Soviet Union, I began exploring in another direction, working on the choice of institutions. Legal institutions such as property rights were essential for a market economy, of course. But market economies differ in their economic institutions and the system of institutions on which a market economy rests is crucial. It was necessary to understand why market socialism failed in Poland and Hungary in the 1980s and why we could expect that further experiments with market

<sup>&</sup>lt;sup>9</sup> An essay from the 1960s (I believe) by two Minneapolis entrepreneurs, the well-known Bradley brothers who endowed the foundation named after them, is, so far as I know, the first to say explicitly that the entrepreneur acts from a new model of his own creation. The tension between rational expectations and capitalism has long been a theme of Roman Frydman.

socialism, which some were seeking, would also be a mistake.<sup>10</sup> Now, in what is presumably my final period, I am trying to put these strands together: to show that even in the advanced economies of the West some economic institutions may be obstacles to good economic performance – and that some other economic institutions are powerful aids to good performance.

A critical factor in a country's selection of its economic institutions is the country's *conception* of economic performance – of what a good business life *is*. Clearly working-age people want a wide *range of careers* open to them; that requires that wage rates be high in a wide range of jobs, hence that productivity is high. Another point here is that active-age people want living and working conditions in which they can function: to be able to think, to work, to rest and so forth. These conditions in turn require that people can afford adequate space around them, protection from severe cold and heat at home and at work; and affording these things requires high productivity. So, on both these counts, high productivity is an *input* to high performance. But what must jobs offer for a wide range of careers to be of great value and a serious engagement in one's job to be highly rewarding?

The highest level of economic performance – the level to which all countries can aspire though not all are equipped yet to achieve – is reached when the economy is so structured that its participants, including those who work in the nation's businesses, generally have a sense of *prospering* and of *developing*: this means in turn that the available jobs are rewarding in more than pecuniary ways and that such jobs are in ample supply. The sense of prospering comes not only from the paycheck but from activities at work that *engage the minds* of the jobholders and *enlist them in problem solving*. The sense of developing – of ongoing development – comes from jobs that lead people to *discover some of their talents* and to *expand their capabilities*. Such personal growth is a basic part of job satisfaction, which promotes high participation in the labor force, and it contributes to employee morale, which improves employee loyalty, thus lowering unemployment and adding to the number of good jobs available.

<sup>&</sup>lt;sup>10</sup> Some of this work was published in the Annual Economic Report of the European Bank for Reconstruction and Development, London, August 1993.

These attributes of prosperity and the process of development can be measured, however imperfectly. Productivity and unemployment in a country are the headline indicators of its economic performance. They serve as summary proxies of a variety of more basic considerations. High productivity indicates that wage rates are generally high, so people can afford to opt for the more rewarding jobs rather than the higher paying ones; and that incomes are high, so that people can have the comforts, the diet, and so forth needed to function well. A low unemployment rate indicates that members of the labor force can readily find vacancies in a wide range of jobs, few employed people are quitting their jobs out of dissatisfaction, and few jobs are short-lived.

Labor force participation is an indicator in another dimension of economic performance. Uniformly high labor force participation rates are a sign that a generally high value is being placed on existing jobs and the wages they pay. In addition, participation rates are an indicator of another dimension of economic performance often called economic inclusion – inclusion in the mainstream economy: For one thing, they may reflect the extent to which mainstream jobs provide people with economic independence from the family and from the state. They may also reflect the degree and breadth of the access to mainstream jobs, thus indicating the country's success or failure in removing barriers to inclusion.

Next, what character must the economy have to create in the workplace this prosperity and this human development? The answer, I would argue, is *dynamism*. Only an economy whose structure makes it permanently innovative and in productive, useful ways, can do the trick.

Clearly, then, high economic performance depends on a *structure of policies and institutions* suited to generate this dynamism. Some skeptics, though, ask how can it be believed that poor performance is a function of a poor economic structure when some economies have been observed to experience severe changes in fortune without appearing to have suffered any great change in their structure? They cite Europe as an example. My answer is that an economy's fortunes may be lifted up by good market

opportunities arising from outside that country. But that does not demonstrate that the economy had a good internal structure then or now.

Is a dearth of dynamism the main cause of the Continent's generally poor performance ? Or is the main cause something else?

If what I have hypothesized to be the nature of high economic performance is correct, if a huge part of an advanced economy's potential performance is the stimulus and challenge presented by jobs and the consequent discovery and development of talents – a possibility requiring the economy to be structured for well-aimed innovation – we should then be prepared to find that the economies that exhibit a high participation rate, a low unemployment rate and a high level of productivity are economies with relatively good opportunities for problem-solving and personal growth in the workplace – hence, economies with economic institutions and an economic culture favorable to well-chosen innovation. Taxation, unless it is aimed against innovation, is not necessarily crucial.

In contrast, neo-liberals and supply-siders infer that exorbitant levels reached by the average tax rate on personal income and by the social contribution levied on employment are a major sources of the elevation of unemployment rates and the depression in participation rates.

However, the fact that tax rates rose when – or before – unemployment rates rose on the Continent is not persuasive, since a great many other developments coincided with – or preceded – the rise in unemployment. Moreover, it is one thing to find, as *Structural Slumps* did, that an increase in tax rates has a strong impact on employment when private wealth *has not had time to adjust* and another to find such an impact *after wealth has adjusted*. To estimate the long-run effect of the size of government, including the welfare state, we might ask whether in the present era inter-country differences in employment among the advanced economies of the OECD members are explained by inter-country differences in the tax on labor.<sup>11</sup>

<sup>&</sup>lt;sup>11</sup> The failure of some of the explanations critiqued here were first noted in Phelps and Zoega, "Natural-Rate Theory and OECD Employment," *Economic Journal*, 108, May 1998, 782-801. They were also reconfirmed in Phelps and Zoega, "The Search for Routes to Better Economic Performance in Continental Europe," *CESifo Forum*,.Spring 2004, 3-11.



Figure 1a. Taxes and unemployment.



Unemployment (OECD) is measured in 1996. Taxes are taken from Nickell (2003) and measure the sum of payroll tax rates, income tax rates and consumption tax rates. Taxes are calculated for the period 1988-1995. Labor force participation (OECD) is measured in 1996.

Figure 1 suggests that, within a considerable range at any rate, a high average tax rate has rather little effect on employment. Even the very high-tax economies of Denmark and Sweden do not have high unemployment and low participation. Neo-liberals have to argue that many high-tax countries have some compensating conditions averting high unemployment and low participation.

The issues before us now are fascinating and I hope I will have the opportunity to work several more years on them.

Thank you very much.

### APPENDIX: Short Biography of Edmund Phelps

Edmund Phelps is a seminal figure in modern economics, recognized early in his career for his new ideas on economic growth produced at Yale's Cowles Foundation in the early 1960s and soon after for his pioneering research on inflation, unemployment and business fluctuations conducted at Pennsylvania in the late 1960s and at Columbia in the 1970s. The thread running through most of his theoretical work is the roles played by knowledge, beliefs, information and expectations in investment, research, adoption of innovations, inflationary and disinflationary disequilibria, involuntary unemployment, slumps and booms.

Growth economics, as shaped in the 1950s, explained increases of physical capital: increases in knowledge rained down exogenously, like manna from heaven. Phelps took up knowledge formation through research. The rate of technical progress was ultimately limited by the growth rate of researchers. So the population explosion was required for the world's knowledge to take place. Phelps also took up the diffusion of innovations, arguing with Nelson that the sort of knowledge, or thinking, acquired in a liberal-arts college education helps managers assess new products and markets. Thus entrepreneurs' frontier innovations are scant or nil in economies where too few have a higher education.

Phelps twice rewrote the macroeconomics of unemployment and its fluctuation. Up to the early 1960s "macro" had posited perfect information in fully integrated markets. Phelps saw information costs as making the firm not in touch, possibly creating separate "islands" of firms, and making firms' employees and customers into valued business assets that firms compete to retain through "incentive wages" and concessionary "mark-ups." In his 1968 paper and his Microeconomic Foundations conference volume (1970) Phelps showed that a general shock to "effective demand" that would otherwise be neutral for the employment path would impact on hiring and unemployment, since firms would not know that other firms were experiencing the same disturbance to demand. In showing that firms are driven to raise their wages above the market-clearing level he also laid the modern basis for involuntary unemployment. Most famously, he introduced in a 1967 paper the concept of an "equilibrium" rate of unemployment, later dubbed the "natural" rate, thus prophesying the inflation "acceleration" of the late 1960s and the stagflation of the 1970s. A regime of high anticipated inflation has much the same employment has a regime of lower anticipated inflation. Deviation from an equilibrium path result from misexpectations by firms in their uncoordinated wage and price decisions. Or, as Phelps, Taylor and Calvo showed in the 1970s, it can result from nonsynchronization in firms' wage or price setting – the property of of New Keynesian models. These innovations laid the overdue "micro-economic foundation" for the then-standard Keynesian/ monetarist model of employment fluctuations.

Decades later, in the late 1980s and early 1990s, Phelps created a new non-monetary theory of employment in which business asset values drive the natural rate. This theory, first broadly set out in his book *Structural Slumps* (1994) and a 1997 paper (with Hoon), explain Europe's 1980s slump without appeal to disinflation: a strong rise of the world real rate of interest, the depletion of opportunities for further technological catch-up and mushrooming social wealth granted by Europe's new welfare state play the main causal roles. Two sequel papers in 2000 and 2001 (with Zoega et al.) on 'structural booms' explain America's inflationless investment boom in the late 1990s and imply its transience. These papers propose to view the great economic swings felt in the West in the past century not only as originating in non-monetary

shocks but also as operating fundamentally through non-monetary mechanisms. They also propose that future prospects, however uncertain, are the driver behind most big swings.

Phelps's current work is about the benefits and sources of a country's structural dynamism – the enterprise and creativity of entrepreneurs, the skill of financiers in selecting and supporting the best projects, and the knowledge managers draw upon in evaluating and making use of new methods and products. Every dynamic economy has its doldrums and even undynamic economies may rise, perhaps with delay, to an extraordinary opportunity. Yet great dynamism, he argues, brings advantages in virtually every dimension of economic performance, not just in productivity. The challenges presented in a creative and evolving business sector, where it exists, provides most people with the main vehicle for the exploration, exercise and development of their talents. In the already advanced economies this is perhaps the best reason for policy to aim to build a business sector of high dynamism and broad inclusion. The research task is to identify the institutions that are pathways to dynamism and the institutions that are obstructions. Phelps's own research on dynamism began in 1990 and 1992-93 at the European Bank for Reconstruction and Development, where he worked on the theory of capitalism and issues of mass privatization in eastern Europe. Later he turned to the functioning of the economic institutions in western Europe and those in the United States. He conducted research with a focus on the Italian economy as Senior Advisor to the Project 'Italy in Europe' at the Consiglio Nazionale delle Ricerche in 1997-2000. In 2001 he founded with Roman Frydman the Center on Capitalism & Society at Columbia, now within the Earth Institute, to conduct and promote research on capitalism.

A companion theme of Phelps's work in the past decade is the importance of wide economic "inclusion." This work follows up on his earlier research in the 1970s on some policy requirements for Rawlsian economic justice. In the recent work Phelps argues that in a country whose economic system is the main source – and a rather richly inventive source – of new problems to be solved, and thus the main vehicle for the discovery of talents and personal growth, there are large social costs from closing off this mainstream economy to the less advantaged in the working-age population, driving them into the underground economy or crime; it is moreover a moral imperative that no one willing and able to contribute something to this economic mainstream ought to be left excluded or discouraged from participating, even if access for the less advantaged will lessen the gains of the more advantaged. In his 1997 book *Rewarding Work* and at subsequent conferences within the OECD and elsewhere he has made the case for wage subsidies to the employer of low-wage workers as a means of pulling up their pay, reducing their unemployment, and enlisting more of them into labor force. A 2003 conference volume he edited, *Designing Inclusion*, analyzes the merits and limitations of a range of like-minded policy instruments.

Phelps was elected to membership in the National Academy of Sciences in 1981 at age 47. He is also a fellow of the American Academy of Arts and Sciences and of the Econometric Society. In 2000 he was named a Distinguished Fellow of the American Economic Association. Besides his B.A. from Amherst College in 1955 and his Ph.D. from Yale in 1959 he has six honorary doctorates: Amherst College (1985), University of Rome 'Tor Vergata' (2001), University of Mannheim (2001), Universidade Nova Lisbon (2003), University of Paris-Dauphine (2004) and, in October, the University of Iceland (2004). In May 2004 he was named an honorary professor at Renmin University, Beijing. A 2001 Festschrift for Phelps has been published in his honor: Aghion, Frydman, Stiglitz and Woodford (eds.), *Knowledge, Information and Expectations in Modern Economics* (2003).