

The Nobel Prize in Economic Sciences 2006

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Inflation and unemployment

According to the prevailing view during the 1960s there existed a stable negative relationship between inflation and unemployment, the so-called Phillips curve. This relationship was apparently confirmed by data from several countries. The implication was that there was a choice for economic policy between low inflation and low unemployment. By expanding demand through fiscal and monetary policy it was possible to reduce unemployment. According to the Phillips curve, this would come at the price of a one-time increase in the rate of inflation.

There were several problems associated with this view. The Phillips curve was a purely statistical relationship. There was no clear link to microeconomic theories about the behavior of individual firms and households. There was also no theory about the minimum possible unemployment. It was of course generally accepted that the unemployment rate could not be reduced to zero, but there was no clear understanding of what level of unemployment was compatible with equilibrium in the labor market.

In the late 1960s, **Edmund Phelps** challenged the earlier view on the relationship between inflation and unemployment. He recognized that inflation does not only de-

pend on unemployment but also on the expectations of firms and employees about price and wage increases. He formulated the first model of what has come to be known as the *expectations-augmented Phillips curve*. This says that for a given unemployment rate a one percentage point increase in expected inflation leads to a one percentage point increase in actual inflation. In setting prices and negotiating wages and salaries, firms and employees base their decisions on their beliefs about the development of prices and wages in general. This hypothesis has received overwhelming support in subsequent empirical research (with the possible proviso that the impact of inflation expectations on actual inflation may be smaller at very low inflation rates).

Phelps's analysis stood in contrast to the earlier views on the ability of an expansionary fiscal and monetary policy to permanently increase employment. Instead, his conclusion was that there is no long-run tradeoff between inflation and unemployment, since inflationary expectations will adapt to the actual inflation. In the long run, the economy is bound to approach the *equilibrium unemployment rate*, at which actual and expected inflation coincide. Equilibrium unemployment is only determined by the functioning of the labor market. Attempts to permanently reduce unemployment below the equilibrium rate will only result in continuously increasing inflation. Stabilization policy still has an important role to play in dampening the short-run fluctuations in unemployment around its equilibrium level.

Phelps's contributions highlighted the importance of analyzing how future possibilities of reaching the goals of stabilization policy are affected by today's policy: high inflation today means higher inflation expectations in the future, thereby rendering future policy choices more difficult. A policy of maintaining low inflation can therefore be regarded as an investment in low inflation expectations, enabling more favorable combinations of inflation and unemployment in the future than would otherwise be available.

Phelps also developed the first model of the determinants of equilibrium unemployment. In this model, firms set wages in order to affect the number of employees. The more a firm needs to expand its workforce and the lower the rate of market unemployment, the higher the wages it will offer. Phelps showed that there exists a unique equilibrium unemployment rate, at which the average firm will raise its wages at the same rate as wages are expected to rise on average in the economy. The innovative aspect of Phelps's approach was that it started from explicit assumptions about the behavior of individual agents in the labor market. Phelps's contribution was also the first to integrate the hypothesis of efficiency wages into macroeconomic theory. This hypothesis states that it may be in the best interest of a firm to set high wages in order to improve workers' morale, reduce labor turnover and attract better qualified employees. Such mechanisms may help to raise the level of unemployment in equilibrium.

Phelps was not alone in criticizing the Phillips curve in the late 1960s. Milton Friedman (1976 economics laureate) also emphasized the role of inflation expectations. In contrast to Friedman, Phelps emphasized that causation runs from unemployment to (unanticipated) inflation. He derived the expectations-augmented Phillips curve from an

explicit model of the wage-setting behavior of firms in a labor market in which matching the unemployed with vacant jobs is a time-consuming process.

Phelps's work has fundamentally altered our views on how the macroeconomy operates. The theoretical framework that he developed in the late 1960s soon proved fruitful in understanding the causes of the increases in both inflation and unemployment that took place during the 1970s. He also clarified the limitations of macroeconomic policy. As a result, policy is now conducted in a radically different fashion from before. One example is that central banks now routinely base their interest rate decisions on assessments of the equilibrium unemployment rate and the tradeoffs between the effects of policy at different horizons.

Capital formation

Viewing low-inflation policy as an investment in low inflation expectations was natural to Phelps against the background of his earlier work on capital formation. There he had asked what rate of aggregate capital formation (both in the form of physical capital and human capital, i.e. education as well as research and development) is desirable. What fraction of national income should be consumed now and how much should be invested in order to increase the capital stock, thereby boosting future production and consumption? This question is crucial for the distribution of consumption and welfare across generations. In this area as well, Phelps's contributions have opened the doors to later research and had a profound impact on the debate over economic policy.

In one of his first published articles from 1961, Phelps derived the so called *golden rule* of capital formation. Taking an inter-generational perspective he posited that the goal is to attain the maximum consumption per capita that is sustainable in the long run. The term golden rule makes reference to the ethic of reciprocity: "Do unto others as you would have them do unto you". Here the interpretation is that the consumption level should be the same for all generations. According to the rule, the desirable savings ratio fulfills a simple condition: it should equal the ratio of capital income to national income. An alternative statement is that the savings rate should be high enough to maintain a capital stock that yields a return (a real rate of interest) that is equal to the rate of growth in the economy. Similar conditions had been stated before by Maurice Allais (1988 economics laureate), among others. But it was Phelps's analysis that had the greatest influence on subsequent research.

Phelps's original analysis was restricted to comparing long-run situations, presuming that the economy was there "from the beginning". But the process of *changing* the savings ratio from one level to another may create distributional conflicts. If an increase in the savings rate is required in order to attain the golden rule, the welfare of future generations will increase but the current generation will lose. The reason is that the cur-

rent generation has to reduce its consumption in order to save more, whereas later generations will benefit from a larger capital stock allowing them to increase both consumption and saving. However, Phelps later demonstrated that there may be situations of *dynamic inefficiency*, where the capital stock is so large that it is possible to increase the welfare of all generations by reducing the savings rate. The explanation is simple. By reducing the savings rate, consumption can be increased immediately. If the original savings rate is above the golden-rule level, this reduction also implies a long-run gain in consumption. Despite a lower capital stock, and hence lower production, the lower savings rate offers scope for more consumption.

Parents tend to care about the welfare of their offspring. In a contribution from 1968 that was long before its time, Phelps (jointly with Robert Pollak) concluded that savings can be too low if the current generation has a different valuation of its own consumption in relation to that of the next generation (their children) than it has of the consumption of the children in relation to their grandchildren. Such so-called time-inconsistent preferences may be expressed as “my parents think that I should save more for my children than I think myself”. In these circumstances, public measures in order to increase the savings of all generations, e.g. through a public pension system, can increase the welfare of all generations. Time-inconsistent preferences, like those analyzed by Phelps and Pollak, have recently attracted a great deal of attention in the field of behavioral economics, where insights from psychology have been introduced into economic analysis.

Phelps also analyzed the role of investment in education (human capital) and research and development (R&D) in the growth process and shown that the golden rule can be generalized. In order to achieve maximum long-run consumption, R&D investments (which raise the technology level) should also be adjusted to the level where their return is equal to the growth rate in the economy. In joint work with Richard Nelson from 1966, Phelps emphasized how a better educated work force facilitates the dissemination of new technology, thereby making it easier for poorer countries to “catch up” with richer countries. This may explain why recent empirical research has found that GDP growth appears to depend on the existing stock of human capital, not just its growth rate. The Nelson-Phelps analysis also offered a possible explanation of why the return to education is often high in periods of rapid technological change: during such periods a well educated workforce is particularly important for increased productivity. Such arguments have been put forth in order to explain why the salaries of highly educated employees have increased significantly in the United States (and in many other countries) in recent decades, when the IT-revolution has initiated a rapid diffusion of new technology.

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NOBEL PRICE LAUREATS IN ECONOMICS

2006 - Edmund S. Phelps

2005 - Robert J. Aumann, Thomas C. Schelling

2004 - Finn E. Kydland, Edward C. Prescott

2003 - Robert F. Engle III, Clive W.J. Granger

2002 - Daniel Kahneman, Vernon L. Smith

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2000 - James J. Heckman, Daniel L. McFadden

1999 - Robert A. Mundell

1998 - Amartya Sen

1997 - Robert C. Merton, Myron S. Scholes

1996 - James A. Mirrlees, William Vickrey

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1994 - John C. Harsanyi, John F. Nash Jr., Reinhard Selten

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1991 - Ronald H. Coase

1990 - Harry M. Markowitz, Merton H. Miller, William F. Sharpe

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- 1983 - Gerard Debreu
- 1982 - George J. Stigler
- 1981 - James Tobin
- 1980 - Lawrence R. Klein
- 1979 - Theodore W. Schultz, Sir Arthur Lewis
- 1978 - Herbert A. Simon
- 1977 - Bertil Ohlin, James E. Meade
- 1976 - Milton Friedman
- 1975 - Leonid Vitaliyevich Kantorovich, Tjalling C. Koopmans
- 1974 - Gunnar Myrdal, Friedrich August von Hayek
- 1973 - Wassily Leontief
- 1972 - John R. Hicks, Kenneth J. Arrow
- 1971 - Simon Kuznets
- 1970 - Paul A. Samuelson
- 1969 - Ragnar Frisch, Jan Tinbergen