

**EUROPEAN UNIVERSITY INSTITUTE, FLORENCE**

**DEPARTMENT OF ECONOMICS**

**EUI WORKING PAPER No. 86/222**

**ECONOMIC EQUILIBRIUM AND OTHER  
ECONOMIC CONCEPTS:  
A "NEW PALGRAVE" QUARTET"**

by

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Printed in Italy in June 1986  
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## 1. ECONOMIC EQUILIBRIUM

Economic equilibrium, at least as the term has traditionally been used, has always implied an outcome, typically from the application of some inputs, that conforms to the expectations of the participants in the economy. Many theorists, especially those employing the 'economic man' postulate, have also required the further condition for equilibrium that every participant was optimizing in relation to those correct expectations. However it is the former condition, correct expectations, that appears to be the essential property of equilibrium at least in the orthodox use of the term.

Economic equilibrium is therefore not defined in the same terms as physical equilibrium. The rest positions or damped oscillations of pendulums cannot be economic equilibria nor disequilibria since pendulums have no expectations.

Yet it is natural and obvious that the first applications of the equilibrium idea identified some position of rest, or stationary state, as being the equilibrium in the problem at hand. Undoubtedly the term equilibrium, referring to an 'equal weight' of forces pushing capital or what not in as pulling it out, owes its origins to the balance of forces prevailing in a stationary situation. But there can also be a sequence of positions in which there is a new balance with each new position. There was no reason why equilibriums might exist only among stationary states or balanced-growth paths.

Once efforts began to extend economic theory to the case of moving equilibrium paths the expectational meaning of equilibrium began to be explicit. Two of the pioneers here are Myrdal and Hayek. In his 1927 book on price determination and anticipations (in Swedish) Myrdal addresses the two-way interdependency arising in a dynamic analysis of an on-going economy: present disturbances influence future prices and antici-



pations of future disturbances affect present prices (the latter relation being Myrdal's main subject). In a 1928 article (in German) on what he called intertemporal equilibrium, Hayek drew the analogy between intertemporal trade and international (or interspatial) trade: prices of the same thing at two different places or times are not generally equal, though they may be pulled up or down together. In a 1929 article (in Swedish) Lindahl studied what is considered to be the first mathematical model of intertemporal equilibrium.

The English speaking world was slow to take up the new line of research. In his General Theory of 1936, Keynes speaks grandly of having shown the existence of an (implicitly moving) equilibrium with underemployment, and he does argue that the expectation of falling wages and thus prices makes the slump worse, which suggests he may have had an expectational notion of equilibrium in mind; but he is ambiguous about what he means by equilibrium, so both the nature and the basis of his claim are left unclear. The new topic of intertemporal equilibrium and the explicit expectational treatment of equilibrium make their English debut in Hicks's Value and Capital in 1939. (In the same year Harrod's expectational notion of "warranted growth", alias equilibrium, and the translation of Lindahl's writings appear). Hicks makes clear the analytical problem that the analyst and the economic agents alike must solve to find equilibrium: In view of the dependence of future endogenous variables, such as next period's price, on present actions of firms and households, and the dependence of such actions on expectations of those future variables, what expectation would cause the actual outcome to coincide with the expectation? For example, if the actual price  $P$  is a function  $f$  of the expected price  $P^e$  find the value of  $P^e$  such that  $P^e = f(P^e)$ . Thus the fixed-point character of equilibrium from a mathematical standpoint has a human, or real, interpretation. One might say, semi-jocularly, that pendulums have no economic equilibria since their motions, unlike those of trapeze artists, are not a function of expectations, if they have any.



In the postwar period the notion of equilibrium turns up in contexts quite different from that of the inter-war economic theorists. In game theory, begun by von Neumann and Morgenstern, the term equilibrium is used to refer to the theoretical solution to the policies, or play, of two or more players in strategic interaction. If the model postulates optimizing, or expected-utility-maximizing, behavior by all players, as game theorists' models invariably do, the equilibrium necessarily has the feature that no player can do better acting alone; but lying behind this feature is the essential property that each player has correctly expected the strategy of the others and hence optimized relative to those correct expectations.

In the late 1960s the notion of equilibrium begins to take root in the new territory of non-classical markets - markets without costless and thus complete information. An economy may have markets - the resort hotel market is perhaps a suitable example - in which there are costs in the acquisition or processing of information about prices (and perhaps product specifications) so that arbitrage tendencies are delayed and the classical law of one price operates only with a lag. One well-known portrait of such a market imagines that the national market is composed of Phelpsian islands lacking current-period information about one another's prices. Another image visualizes each firm as an island unto itself with its own stock of customers, who are not knowledgeable about the policies (and perhaps even the whereabouts or existence) of other firms. In such non-Walrasian markets the prevailing prices can be (and usually are) supposed to be market-clearing: no buyer or seller is then subjected to rationing (sometimes called non-price rationing by over-fastidious writers). However the market will be in equilibrium if and only if the prices (and other variables) reflect correct expectations on the part of suppliers and buyers about the prices prevailing elsewhere - at other islands or other firms; otherwise there is disequilibrium. An economy may also have markets - one may think of labor markets or markets for rental housing - in which, although information is immediate, the wage

or rental setters have to make decisions of some durability, however short-lived, and without advance information about the similar decisions of the other firms. In such quasi-Walrasian markets there may be reasons - having to do with incentives, or efficiency - why wages tend to exceed and rentals lie below the market-clearing level. Yet the market will be in equilibrium in the case (if such exists) in which no wage setter or rental setter experiences surprise at the corresponding decisions being made simultaneously (or perhaps somewhat later within the period of the commitment) by the other wage or rental setters; otherwise the market must be in disequilibrium, however long or brief. (See Phelps et al. 1970).

Thus the analogy between intertemporal equilibrium and interspatial equilibrium, which was drawn by Hayek and others in their analysis of the former, now seems deeper than it could have at first. The expectational meaning of equilibrium, which is so unavoidably clear in the context of intertemporal equilibrium, where future prices are generally expected future prices, turns out to be just as natural and inevitable in the interspatial context as soon as one gives up the fictive device of the Walrasian auctioneer and thus admit that there are "other" prices elsewhere, about which there must be expectations, not merely a single market-wide price.

The 1970s witnessed the formal analysis of equilibrium in terms of expectations, or forecasts, of the probability distributions of prices. Lucas, adopting the device of separate market-clearing islands, analyzed a model in which there is non-public, or local, information (later called asymmetric information), namely local prices, and these price observations are used to up-date people's conditional forecasts of the currently unobserved prices elsewhere. There may exist a rational-expectations equilibrium in which everyone knows and uses the correct conditional expectations of the unobserved prices - that is, the statistically optimal forecasts conditional upon his particular information set. This is equilibrium with a qualification.

In surveying the meaning of equilibrium, Grossman has remarked that, in Hicks, "perfect foresight is an equilibrium concept rather than a condition of individual rationality". A similar comment applies, with even greater weight, to statistical equilibrium and to its rational-expectations variant. The agents of equilibrium models are not simply rational creatures; they have somehow come to possess fantastic knowledge. The equilibrium premise raises obvious problems of knowledge: Why should it be supposed that all the agents have hit upon the true model, and how did they manage to estimate it and conform to it more and more closely? There has always been a strand of thought, running from Morgenstern in the 1930s to Frydman in the present, that holds that we cannot hope to understand the major events in the life of an economy, and perhaps also its everyday behavior, without entertaining hypotheses of disequilibrium.



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## 2. PHILLIPS CURVES

By the 1950s there was achieved a working synthesis, despite some unsolved problems, of the contributions of Keynes to monetary theory with the older truths of his several predecessors Marshall, Pigou, Wicksell and Fisher. Given the supply of money, there is a nominal price level that is in some suitable sense the equilibrium price level; more generally, there is an equilibrium path of the price level. The equilibrium price level in the current period, given next period's price level, is just high enough to reduce the real value of this period's cash balances down to the quantity demanded - figured at the corresponding nominal rate of interest (which is a decreasing function of this period's price level) and output level (which was taken to be independent of the price level if nominal wages were also taken as finding their equilibrium level). If people expect that the general level of prices and nominal wages is higher, and we assume that the actual price level at first equals this expected level, the result will be disappointment - an unexpected weakening of sales. Presumably, the price and wage levels will then tend to adjust, and perhaps employment will detour from its equilibrium level in the process.

The disequilibrium dynamics of the adjustment process, however, remained terra incognita. Suppose there is a sudden and unexpected disturbance that displaces upwards or downwards the path of the equilibrium price level. Keynes had declared in his 1936 book that the money wages set by producers would not generally take the downward jumps occasionally necessary for continued maintenance of equilibrium, hence the need for a more general theory of interest and employment in which the nominal wage level was not on the equilibrium track. (He further opined that lessened wage inflexibility would be destabilizing). By the 1950s it was agreed that wages would gradually move from the former equilibrium path, if we assume they were originally in equilibrium, toward the new and lower equilibrium path, whether or not there would be later overshooting,



and further that, if there is such gradualness, the result will be a bulge of unemployment during the process of wage adjustment. Similarly, an upward displacement of the equilibrium path would likewise engender only a gradual adjustment of money wages, accompanied in this case by a dip of the unemployment rate below its equilibrium, or normal, level. Increasingly, economists spoke of buying a spell of abnormally low unemployment by generating a round of inflation. (Yet, some economists of Austro-Hungarian or German schooling, notably William Fellner, argued that successive doses of (equal) inflation would lose their effectiveness, so that the same effect on unemployment would require ever increasing doses, as anticipations of higher demand came to be built into wage contract increases). The term cost inflation arose to refer to the sort of inflation the avoidance of which needed the discipline, and social waste, of unemployment above what could be achieved through high demand.

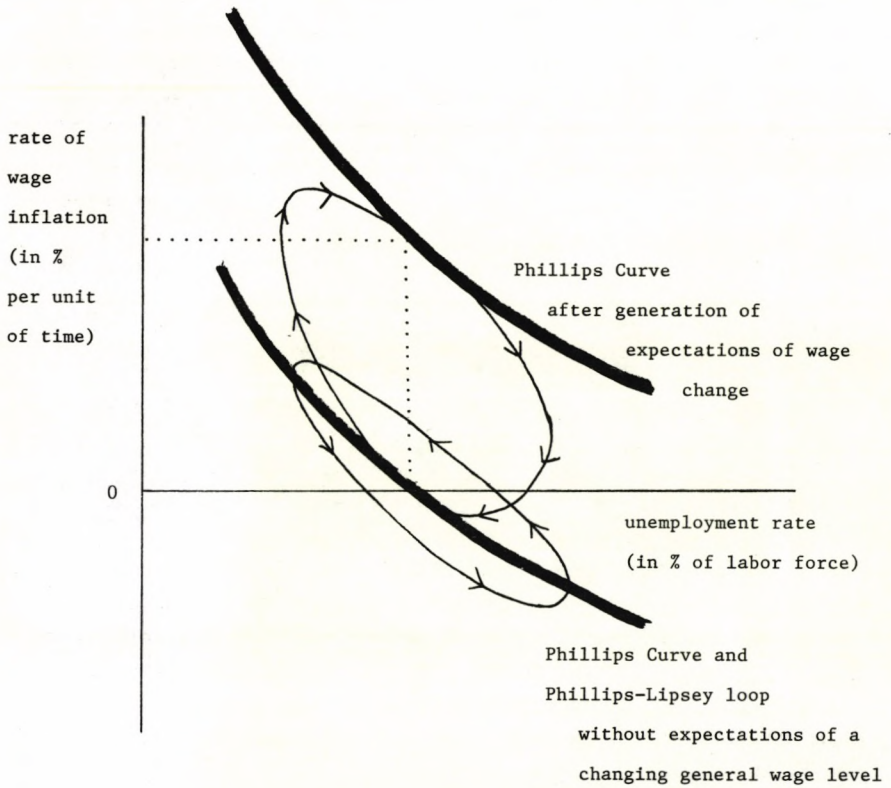
It was against this background that W.A. Phillips's extraordinary article, scholarly yet accessible, appeared in the academic journal Economica in 1957. Phillips changed the terms of discourse of the subject from the qualitative and discontinuous to ordinary quantitative terms: Other things equal, such as the rate of change of unemployment, the rate at which the nominal wage level is changing - the (algebraic) rate of wage inflation - is a decreasing function of the level of the unemployment rate. Further, the rate of unemployment required to hold down the rate of wage inflation to the level of normal experience - the average, and accustomed, rate - is certainly positive, perhaps 2 to 3 per cent in the United Kingdom, the domain of Phillips' data, and has not shifted notably over nearly a century of observation. Almost overnight Phillips' curve (so named in a discussion by Samuelson and Solow) invaded the language of macroeconomics.

Phillips uncovered another fact about past wage inflation. Among years with the same (annual) level of the unemployment rate there tended to be a higher rate of wage inflation when the annual unemployment rate



was falling, as in a cyclical recovery or developing boom, than when the annual unemployment rate was rising. Phillips drew a counterclockwise loop around the downward sloping Phillips Curve, to indicate the typical motion of the wage inflation rate in relation to the unemployment rate over the typical historical cycle. See the lower Phillips curve and the loop around it in Figure 1. It remained for R.G. Lipsey, also of the London School of Economics at that time, to express this historical phenomenon in quantitative terms too. Lipsey in 1960 published estimates obtained by regression analysis of the coefficients of a linear rate-of-wage-change equation in which the explanatory righthand-side variables were the level of the unemployment rate and its rate of change. The negative sign of Lipsey's estimate of the latter coefficient reflected the above loop. The statistical estimation of such Phillips-Lipsey equations rapidly developed from a cottage activity using electric calculators to a booming computerized industry.

In a way, the new and developing fact book seemed to contain information that was entirely reasonable and surely in keeping with existing theoretical (or pretheoretical) notions. (Indeed, a remarkably early anticipation of the Phillips Curve was later unearthed in an obscurely placed paper in 1926 by Irving Fisher). It seemed to say, essentially, that if there was an aggregate excess supply then nominal wages would be found falling and employment would be depressed - as long as wages remained too high to eliminate the excess supply - and both effects of the excess supply would be larger the greater was the size of the excess supply. More exactly, the sudden appearance of an excess supply that is maintained at a given level for a while would first generate a positive rate of change of unemployment alongside falling wages and only later, in a sort of disequilibrium steady state, a higher level of the unemployment rate without a positive rate of change. This part of the Phillips Curve story seemed unsurprising and unpuzzling.



Yet some theoretical problems that had long lain submerged and unnoticed when the subject of disequilibrium adjustment was still muddy and relatively quiet came to surface once the Phillips-Lipsey formulation had stirred things up. Among these was the problem of explaining why nominal wages did not jump down to their new equilibrium level (with prices jumping after them) and, beyond that, the problem of determining the pace with which wages fell. The same theoretical void had been created more than a decade before Phillips's article when Samuelson in his Foundations, addressing Walrasian stability, simply postulated that the rate at which the price of a commodity falls is an increasing function of the excess supply of it. This was a macroeconomic hypothesis, perhaps a kind of theory by the behavioral standards of the day, but not a micro-economic theory running in terms of the motives and perceptions of the individual actors operating in the economy.

If the first problem was explaining that the Phillips Curve was sloping, the second problem was explaining its remarkably rightward position: Money wage rates tended to be rising over a range of positive unemployment rates, including rates exceeding the lower bound obtainable by high-pressure aggregate demand levels. If nominal wages tend to be rising as long as the unemployment rate stays above non-depression levels, then the Samuelsonian hypothesis explains that markets have normally operated in a state of considerable excess demand. But is that likely? Is a state of zero excess demand (and excess supply) really marked by a zero rate of wage change, or is something missing here? Somehow, it was evident, the factors of productivity growth and inflation needed to be brought into the analysis, but not just as incantations to make the problem go away.

For many economists there was the further problem of reconciling the empirical regularity depicted by the Phillips Curve, which seemed to possess an extraordinary stability, with the older Continental, or Austro-Hungarian, doctrine, propounded by Fellner and others, that below normal



unemployment constantly fuelled by a permissive monetary-fiscal policy will soon cause wages (and hence prices) to rise in ever-accelerating fashion until the hyperinflation finally brings collapse or structural change. This was the further problem of understanding in microeconomic terms the shiftability of the Phillips Curve.

The solution of the first problem, that of explaining the gradualness of the wage adjustment and the attendant slump of employment, led theorists in the 1960s in the same direction to which Keynes had been led in his search for an explanation of slumps. A key element of the solution was the fact that there is no coordination, to use Keynes's term, among the managers deciding upon wages and employment (*inter alia*) at the various production sites. If there is a weakening of aggregate demand - here, a curve in the output-price level plane - in a previously normal and equilibrium situation, the resulting fall in the demand curve facing the individual manager, or producer, even if seen by him as permanent, would not induce the workers employed there (or unemployed there) to accept the job-preserving money wage cut unless they were expecting workers elsewhere at the same moment to be facing and accepting the very same percentage wage cut; and they would have no reason to have that expectation unless there was news bearing on the scale of the decline in demand and such news was observed to have produced job-preserving wage cuts. Pending such news, then, there would be only an insufficient wage cut, so the supply price of output would fall by less than the demand price, and hence output and employment would remain. These impact effects would show a negative correlation between wage change and unemployment level (though here the true correlation is with the change of employment).

In the 1960s, however, a number of theorists pointed out the theoretical existence of a deeper Phillips Curve relation: The higher unemployment level comes about because "expected wages" in the economy as a whole exceed "actual wages", and as information comes in that actual wages elsewhere are lower than expected the ensuing downward revision of expectations

will induce workers to accept still lower actual wages. This latter wage fall grows out of the disequilibrium situation, like the higher unemployment. If one were to go so far as to posit static expectations, so that each observed wage decline is thought to be the last, there would exist a disequilibrium steady-state relationship between the size of the (swelling of the) unemployment rate and the magnitude of the rate of wage change. A 1969 Pennsylvania conference developed these points in a variety of models, and the conference volume published a year later served to popularize these expectational microeconomic foundations of unemployment and wage-price behavior (Phelps et al., 1970).

In the 1970s theorists moved toward rational expectations in the sense of Muth. In this case, the news of the initial fall of wages (together with any news on the unemployment front) is enough for workers to expect that the general wage level will now fall to exactly the job-preserving level, so that the unemployment rate will return to the equilibrium level; otherwise workers are implied to be repeatedly misforecasting the wage level, contrary to rational expectations. Here, too, the high unemployment precedes a wage fall (though large enough to eliminate the high unemployment), so that there is again a negative correlation between unemployment level and wage change. A microtheoretic model along these lines, involving known stationary stochastic processes, was developed by R.E. Lucas (1972, 1973) and an intertemporal model with which to show, as a corollary, the ineffectiveness of preannounced monetary policy in stabilizing output or employment was analyzed by T.J. Sargent (1973).

The rational expectations postulate seemed at first to point to the conclusion that, following an unexpected drop of aggregate demand, nominal wages would indeed jump - though too late to prevent a recession - once the news of the economic indicators signalling a slump was out, and that with that jump the unemployment rate would jump back to its steady-state equilibrium (and normal) level. But that would have been jumping to conclu-



sions, and fortunately so for the rational expectations hypothesis since there is convincing econometric evidence that the unemployment rate displays statistical persistence. It soon was remembered, however, that the antecedent literature on the costs of recruitment or training provided the basis for an equilibrium path of recovery from a downturn along which both the unemployment rate and the nominal wage level decline continuously, or gradually in discrete-time terms, rather than with a jump. There was also a development of the point made in the earlier literature that firms' wage commitments are apt to be durable and nonsynchronous, so that the respective firms in the economy take turns over the wage-setting cycle, or "year", in resetting their "annual" wage scales. In such a nonsynchronous wage-setting context, the average level of nominal wages cannot jump and hence employment will not recover from a recession with a jump. Further, a model of wage staggering, though quite different from the preceding types, likewise produces an explanation of the negative correlation between wage change and the unemployment rate, as shown by Taylor (1980).

The second Phillipsian problem, that of explaining the coexistence of rising nominal wages with above-minimum unemployment, had two answers, independent and additive. One answer lay in divorcing ourselves from thinking of the unemployment rate - or even the excess of the unemployment rate over the minimum rate achievable by stimulating aggregate demand - as a satisfactory measure of downward pressure on nominal wages. If the unemployment rate (or, more accurately, the aforementioned excess rate) were driven to zero, quitting would presumably be rampant and so the representative firm would endeavor to pay a wage premium - a positive differential over the wages paid elsewhere; if this average wage level is expected to be unchanged, the firm will therefore raise its wage to a level in excess of that average, with the consequence that the average wage will actually rise - resulting in an excess of "actual" over "expected", thus a disequilibrium. It is only when the unemployment rate (or the excess rate) is positive and high enough that the quit rate will be damped sufficiently to encourage the representative firm to content



itself with paying the representative wage. (The argument is implicit in Phelps, 1968, and the explicit focus of Stiglitz, 1974, and Salop, 1979). In this equilibrium there is involuntary unemployment in a natural sense of the term, since wages exceed the market-clearing level, and this unemployment may very well exceed job vacancies (if any), so there may be considerable excess supply. (See also Calvo, 1979, for another model).

The other answer to the problem lay in realizing that wages do not rise only when firms (or at least the representative firms) want to be more competitive than the others. Wages may also rise because the firms believe they must raise their wages just to avoid losing any of their present competitiveness. The same point can be made in terms of the excess-demand framework of Samuelson: The error in Samuelson's formulation was in excluding the possibility that wages will be increased in an anticipatory move that serves to prevent the emergence of an excess demand, not just in response to excess demands that are not previously expected and forestalled by intervening wage increases. Hence, nominal wages may be rising not because the labor market is in disequilibrium, marked by mutually inconsistent desires among the firms for superior competitiveness in the labor market, but rather because the prospect of productivity growth or of inflation or of both generates expectations that the general level of wages is going to increase. (Phelps, 1968).

With the latter insight our third problem, that of explaining the possible shift of the Phillips Curve, is also solved. When governments seek to exploit the Phillips Curve by trading off price stability in hopes of obtaining reduced unemployment in return, they ultimately engender expectations of regularly increasing wages. Such an increase in the expected rate of wage inflation (at each level of the unemployment rate) shifts up the Phillips Curve; a new one arises corresponding to the new expected rate of wage inflation. In Figure 1 see the upper Phillips curve, which has been driven higher by expectations of a rising general wage level. It is now evident that a political business cycle, by

alternately lifting and depressing the Phillips curve, would generate the clockwise loop shown in the figure.

If we posit, as a plausible approximation, that the expected wage inflation variable takes its place among the explanatory righthand variables (alongside the Phillips-Lipsey terms) with a unitary coefficient, the implication is that the steady-state equilibrium unemployment rate - at which expectations are borne out - is the same number independently of the inflation rate. Then, maintaining a steady unemployment rate below that constant equilibrium rate would entail rising inflation without bound. (Phelps, 1968; see also Friedman, 1968, discussed below). With this coefficient value of one (or any larger value) the model gives algebraic expression to the abiding accelerationist fears of the Austro-Hungarian school.

The notion that the equilibrium unemployment rate was a constant, as above, also emerged from a quite different formulation by Friedman (1968), where the constant was dubbed the natural rate of unemployment. There the rate of wage change is postulated to be a function of the unemployment rate plus the expected rate of price inflation. The implicit rationale was that the amount of labor supplied is an increasing function of the expected real value of the nominal wage. A way to synthesize the above wage-wage model (in which expected real-wage changes are captured in the Phillips-Lipsey terms) with the wage-price model is to add to a quasi-Phillips employment term a weighted average of the expected rates of wage inflation and price inflation where the latter weight is positive, zero, or negative as the labor supply curve is forward rising, vertical, or backward sloped (Phelps, 1979).



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### 3. THE GOLDEN RULE

The so-called golden rule, or golden rule of capital accumulation, is a proposition about the consequences for national consumption - more broadly, for national welfare possibilities - of alternative paths of national wealth, and hence of national saving, in a closed economy. It developed out of the dynamic models of capital accumulation and output growth, generally in a setting of steady technical progress and demographic increase, begun in 1956 by R.M. Solow and T.W. Swan after some early explorations by Harrod, Domar and Robinson. Solow and Swan had shown that, provided diminishing returns to capital set in strongly enough (whether or not smoothly), there exists a state of steady growth corresponding to each possible value of the saving-output ratio, and, interestingly enough, this steady-state growth rate is independent of the value of the saving ratio - and called often the natural rate of growth. Hence, an upward shift of saving at each level of output, through increased private thrift or else higher taxes or lower spending by the government, cannot have a permanent, or non-vanishing effect on the growth rate of output, only a transient effect.

If this theorem was the first law of the new "growth economics", the golden rule of accumulation was the second law of growth economics. It states that the steady-growth state that gives the maximum path of consumption - the path layered on top of all the other steady-growth consumption tracks - is the one along which national consumption equals the national wage bill and thus national saving equals "profits" (gross of interest in the present use of the term). Equivalently, the consumption-maximizing steady-growth path is the steady state along which the competitive rate of interest, which is the social rate of return to investment and to saving, is equal to the natural rate of growth. (To see the equivalence divide profits and saving by capital). Hence, a country (with any given history) that now plans forever to equate saving to profits could not hope to achieve a sustainable increase in the

consumption path by some date in the future through a shift of policy toward increased saving; very possibly even a temporary increase of consumption would not result. The reason is that, despite a boost to future output brought by greater accumulation, the increase in future investment would eat up the increase in future output - and then some.

The arrival circa 1960 of the golden rule result was a classic case of multiple discoverers, which R.K. Merton's studies have shown to be the rule, rather than the exception, in normal science (and not uncommon among paradigmatic shifts either - witness the elements of Keynes's pivotal wage theory in Robertson and Pigou). And discovery seems the apt word since the golden rule theorem was just a simple insight about a set or sets of equations in existence for several years that was waiting to be noticed, not a creative vision of the world springing from an independent empirical sense; accordingly, many or most of the discoverers were fledgling, pre-flight theorists still working on the ground of existing models. The earliest publishers of the result were Phelps (1961), Robinson (1962), and Swan (1963). However it quickly became apparent that there were also discoveries on the Continent by von Weizsäcker and Allais and even within the tiny space of the Cowles Foundation at Yale there were additional independent discoveries by Beckmann and Srinivasan. Robinson coined the proposition the neoclassical theorem, but eventually Phelps's coinage, the golden rule, became the standard. This was not a case of bad money driving out good, as will be explained.

The term golden rule was something of a play on words. Mrs. Robinson had dubbed states of steady growth as "golden ages", so a proposition (if not exactly a maxim) about choosing among golden ages was natural to call a golden rule. In addition there was also an allusion in the term to the Biblical golden rule, do unto others as you would have them do unto you. The sense of that maxim, presumably, is that if one asserts a right to a certain policy, or treatment, from others then in one's own treatment of others one must accord them the right to the same policy; so the choice



of the rights to assert is subject to a reciprocity or cost constraint, which is a useful thing for otherwise one would demand the most extreme sacrifices of others. Of course, this precept of universalizability - the national saving policy, or national consumption function, that a future generation would have preceding ones follow, in view of its self-interests, it must likewise adopt on behalf of succeeding generations - does not by itself determine the just policy of national saving. Yet the golden rule perspective serves to alert us that there will be a limit to the austerity that future generations would ask of the present generation if they are obliged to practice the same austerity that they choose to preach. To make this effective, it must be noted, the saving policies from which society is to achieve must be linear-homogeneous, and thus expressed in terms of saving as a ratio to output or profits or some related variable. (Otherwise, a future generation could piously call for lower consumption only at the present, comparatively low, level of national income - and thus travel as a free rider).

The meaning and indeed the significance of the golden rule becomes quite transparent in the special case of an economy in which the technology and the (working-age) population are constant, so that the natural rate of growth of the economy is zero. In this case the golden rule state is the Schumpeterian zero-interest stationary state; and since the net rate of return to investment is then zero, gross profits are simply depreciation allowances and equal to gross investment, which is entirely replacement investment in a stationary state. Here it is abundantly clear why an alternative stationary state with a constant negative rate of interest would actually yield a lower path of consumption: the extra replacement investment would more than eat up the extra gross output, leaving an actual diminution of the net national product and consumption (to which NNP is equal). It is also perfectly clear that a society is not required as a matter of efficiency to aim for the Schumpeterian state; if the initial rate of return to investment is positive, it would take lower consumption in the present than would otherwise be possible on a sustainable basis



(simply by consuming income) in order to move to the Schumpeterian state so that in the future a higher consumption level can be sustained than would otherwise be possible. Neither is such a move required as a matter of justice. From the utilitarian side there are economists who cheerfully discount the utilities of future people, and from the 'maximin' perspective it is obvious that present people would not optimally sacrifice to make better off those who were not worse off than they to begin with. The basic significance of the golden rule, then, is as a warning against national policies of over-saving, or counterproductive austerity. The golden rule theorem is simply a generalization to a growing economy of these observations.

Further results on the inefficiency entailed by exceeding, so to speak, the golden rule in certain respects were later obtained. It was shown with the help of T.C. Koopmans that a policy that maintained the capital-output ratio indefinitely in excess (by a non-vanishing amount) of the golden-rule level would be dominated in terms of consumption and thus utility by another path, feasible from the same initial conditions, along which the capital-output ratio is always "epsilon" smaller (Phelps, 1965, 1966). A much more general analysis came later from D. Cass in 1972 in which the borderline between efficient and dynamically inefficient paths is systematically examined.

"But the golden rule path could be the social optimum, couldn't it? Certainly it is very beautiful, and not obviously unjust!". There was a tendency among some to regard it as the optimum at least provisionally, for working purposes. However, any budding claims that may have existed for the "optimality" of the golden rule path met with an objection by I.F. Pearce (1962). Start there at  $T_1$ , Pearce said, and end there at  $T_2$ . Then, if there is steady population growth, so the golden-rule interest rate is positive (being equal to the population growth rate), it will increase the integral of total utility to save more now and less later, causing the capital stock to arch over its golden-rule track, since more

saving will increase output. There could be no denying this, although some utilitarians prefer to sum the per capita utility of people over time (or the utility of per capita consumption), which suggests there is a maximin impulse in their otherwise utilitarian hearts; from this angle it would not be preferable to deviate along Pearce's arching detour. Then, using the per capita utility version of utilitarianism, P.A. Samuelson (1967) took up the cudgels with a revision of the Pearce argument: If there is steady technical progress, so the golden-rule interest rate exceeds the population growth rate, it will increase the integral of per capita utility to cause the capital stock to arch above its golden-rule track since more saving will increase per capita output - as long as the interest rate remains above Samuelson's "biological" level, which is the population growth rate. Again, it is nolo contendere from the golden rule side. Yet maximin advocates might object that if the per capita utility received by succeeding generations is rising and unavoidably so, so that the oldest generation extant is always the worst-off, the detour from the golden rule path proposed by Samuelson would presumably entail some belt-tightening by the oldest generation along with the others in order to produce the consumption splurge for the benefit of some younger or future generations - hence a reduction in minimum per capita utility across generations. That cannot be a maximin improvement and is indeed a maximin worsening. Thus goes the maximin rejoinder to the turnpike 'refutation' of the golden rule.

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#### 4. DISTRIBUTIVE JUSTICE

Social justice is justice in all of the relationships occurring in society, hence the treatment of criminals, children and the elderly, domestic animals, rival countries, and so forth. Distributive justice is a narrower concept for which another name is economic justice. It is justice in the economic relationships within society: collaboration in production, trade in consumer goods, and the provision of collective goods. There is typically room for mutual gains from such exchange, especially voluntary exchange, and distributive justice is justice in the arrangements affecting the distribution (and thus generally the total production) of those individual gains among the participants in view of their respective efforts, opportunity costs, and contributions.

In earlier times the discussion of distributive justice tended to focus upon the obligations of the individual toward those with whom he or she had exchanges. So an employer was expected to be just or not to be unjust, and the problem was to demarcate employer injustice. With the rise of governments capable of redistribution and the spread of economic liberalism, the focus shifted to the distributional obligations of the central government. Let enterprises and households pursue their self interests while the government attends to distribution (within the limits of its just powers). Distributive justice is now largely about redistributive taxation and subsidies. The latter may take many forms such as public expenditures for schooling and vocational training (beyond the point justified only by the Pareto principle from the status quo ante) as well as cash subsidies for the employment of labor or low-wage labor (whether paid to employer or employee).

We note that the so-called negative income tax, whatever the claims for or against it as a tool of social justice, does not appear to be an instrument for distributive justice unless restricted somehow to those participating (more than some threshold amount?) in the economy (and thus

in the generation of the gains to be (re)distributed). In any case, it will not be discussed here, although some propositions about subsidies apply also to the negative tax.

The suggestion that distributive justice might (at least in principle) require subsidies, not merely tax concessions or tax forgiveness for the working poor, tends to raise the eyebrows of some and accounts for the fact that distributive justice raises the hackles of a few. As long as the Iriquois and the Sioux have no contact, there are no gains to be distributed and distributive justice does not apply; if they are let free to engage in bilateral inter-tribal exchanges, however, the payment of a subsidy to pull up the wage of the lowest earners, who are Sioux, say, would come partly or wholly at the expense of the Iriquois. Now some commentators object to the notion that the Sioux, whose exchanges with the Iriquois are entirely voluntary and all of whom have benefitted (or could have), we may suppose, might deserve an additional payment from the Iriquois, perhaps through some supra-tribal authority. Ayn Rand, for example, argues that it is one thing to require of a poor person a fare for riding a bus with empty seats that the other riders can finance out of the benefits they receive from the bus - she has no qualms about such a free ride - and another thing for the poor person to tax the other riders (1973). But she has got the economics wrong in the application of her (actually rather Rawlsian) ethical premise. Up to a point, a subsidy to the poorest-earning group (the Sioux in the above example) would leave the others (the Iriquois) still with a net gain - a gain after the tax needed to pay the subsidy. This is because of diminishing returns: When the group of Sioux workers is added to the fixed pool of Iriquois labor and land, the extra product added by the first arrivals - and, more generally, the average of the extra products added by the succession of Sioux workers - is larger than the extra product resulting from the last of these workers, which is the "marginal product" of Sioux labor; the Iriquois could afford a subsidy equal to the excess of the average extra product over the marginal product. Correctly applied, then, the Randian objection is to a gain-



erasing or, at any rate, a gain-reversing subsidy, not to any subsidy whatsoever.

Another objection to the concept of distributive justice and to the admissibility of subsidies argues that if these notions were sound it would make sense, by analogy, to apply them to marriage allocation, to the matching of husbands and wives; since we never hear of such applications the ideas are presumably unsound. Of course, it would strike us as novel and foreign to see a proposal for a tax on marriage with Iriquois men and a subsidy to marriage to Sioux men on the ground that the former were apparently more attractive to women (from either tribe) and the resulting inequality of benefits unjust and demanding correction. But the reasons might be other than the supposed unacceptability of the ideas of distributive justice. Maybe the impracticality of deciding on the taxes and subsidies stands in the way. Perhaps a marriage subsidy would be demeaning while employment subsidies would not, being graduated or even a flat amount per hour. Yet the key observation may be that, although there is economic exchange here and although racial discrimination or racial prejudices could cause real injustices, the Sioux and Iriquois men in this example are not cooperating for mutual gain and so no problem about the just division of such gains can arise; they are competing, or contesting, for partners, not forming partnerships with one another. Thus distributive justice cannot apply here.

The terms offered to the working poor, as already implied, is the locus classicus to which notions of distributive justice have been applied. However, two other arenas in which issues of justice are being fought out should be mentioned. One of these is the problem of intergenerational justice. It was first addressed in a celebrated paper in 1928 by Frank Ramsey, who adopted as the criterion of optimality the standard associated with utilitarianism - the sum of utilities over time. This conception of intergenerational justice encountered difficulties when in the 1960s it was applied to optimum saving of a society in which the population is to grow



without bound, although that odd demographic case may have put utilitarianism to an unfair (and absurd) test. In 1970 John Rawls struggled with the problem of intergenerational justice in a famously problematic section of his, only to conclude that "...the difference principle [i.e., Rawls's maximin or, more accurately, leximin principle] does not apply to the savings problem. There is no way for later generations to improve the situation of the least fortunate first generation." This seems to say that intergenerational justice, if there is such a thing, is not a problem of distributive justice, since there is no cooperation for mutual gain among generations, not even between adjacent ones in the chain. But the premise that the current generation cannot be helped by succeeding generations appears, on the face of it, to be a slip in Rawls's economics. In a closed economy, we can help future generations by providing them with more capital - even in an open economy enjoying perfect capital mobility, we can provide them with social overhead capital that the world capital market would not provide (or not so cheaply) - and, if overlapping with us, they can help us by meeting consumption claims we make through our issue of public debt and pension entitlements. Thus distributive justice does apply here, with a precision fit. What Rawls may be interpreted to mean is that if, being the least fortunate owing to heaven-sent technological discoveries over the future, the present generation is permitted to invest nothing (not even gross of depreciation!) - rather as we can imagine the poorest in the static problem to begin by sullenly asking for equality - the future generations cannot bribe the present one to do something in their mutual interest - unlike the static problem in which the rich can explain the benefits of trickle-down. But the next generation can bribe the present one with some old-age consumption in return for some investment. It may be conjectured that a maximin-optimal growth path would still exist in a model along the lines of the Phelps-Riley model notwithstanding the introduction of technological progress.

The other area in which we find a debate over distributive justice is the international trade field. When a giant nation trades with a small

number of pygmy countries, not large enough even in the aggregate to influence relative prices in the giant state, the latter receive all the gains from trade and the former gets nothing and loses nothing; this is exactly the Rawlsian maximin solution if perchance the pygmy countries are poorer (in some suitably defined way) than the giant. But if these tiny countries "spoil the market", worsening their terms of trade in the course of exporting to and importing from the giant, because they are not of negligible size at least in the aggregate, then the Rawlsian solution is not obtained by the free market. The recent North-South problem of which the "Southern" countries complain can be understood as the tendency of the "Northern" countries that are already the richest countries, such as the North American and European countries, to retain the gain from trade resulting from the aforementioned change in the terms of trade caused by the "Southern" countries through their trade with the "Northern" ones. The "Southern" countries believe justice to require that the "Northern" countries arrange to give back that gain through some appropriate international transfer mechanism.

There are able and serious philosophers who would be happy to see distributive justice left to the economists. In fact, the history of philosophy has been seen as a process of divesting itself of a sub-field as soon as it could thrive independently. Likewise, there are economists who would leave the subject to philosophers. But, whichever group receives the lion's share of the contract to work on it, it seems that the economics (as well as philosophy) of the problems being studied is an essential element of the subject. In this sense and for this reason, the necessary cross listing notwithstanding, distributive justice is an important field under economics.

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