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THE MANAGEMENT OF AN OPEN ECONOMY WITH "100% PLUS" WAGE INDEXATION

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INTERNATIONAL FINANCE SECTION

DEPARTMENT OF ECONOMICS

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1 Introduction

The purpose of this essay is to analyze the relationships among inflation, aggregate demand, external deficit, and government deficit in an open economy where wages are set from time to time in nationwide bargaining and protected by indexation at a rate of 100 per cent or more against changes in prices. We shall label this economy "100% plus." Our analysis will help us to identify economic policies that can be pursued in such an economy to reduce inflation and unemployment simultaneously.

A concrete example of a "100% plus" economy is provided by Italy, where an agreement was reached in early 1975 on a novel form of cost-of-living adjustment. All covered workers (the bulk of the labor force) were granted the *same* number of lire per point change in a designated cost-of-living index, *independently* of each worker's wage level.

The long discussion that has followed this agreement seems to have established the following points: (a) a large range of wages, and probably the majority of the wages of industrial workers, are now indexed at more than 100 per cent; (b) total wages in industry are indexed at about 96 per cent; (c) with continuing inflation, the system of wages would converge in time toward a unique real wage protected by 100 per cent indexation. An agreement of this type also has important redistributional effects, of course, because a persistent inflation will gradually reduce the initial wage spread (except to the extent that the spread might be regenerated through wage drift or new wage contracts). It will also tend to generate redistributive and distortive effects between industries by causing a relative increase in the labor costs of sectors relying more heavily on less skilled, lower-paid labor.

In the simple aggregative model on which we shall rely for our analysis, we neglect these redistributive aspects, which are specific to Italian institutions, and focus our attention instead on the implications of a high degree of overall wage indexation, possibly exceeding 100 per cent. This, incidentally, is the aspect that has received less consideration by economists who have analyzed Italian wage indexation, their thinking being conditioned by an intellectual climate where distributional problems have

This paper is an extensive revision of an earlier Italian version that appeared in *Moneta e Credito*, 30 (1° trimestre, 1977), under the title: "La Politica Economica in una Economia con Salari Indicizzati al 100 o Piú." The authors wish to express their deep appreciation to the many colleagues who read and criticized various drafts of the paper, in particular to Nino Andreatta, Lucio Izzo, Bruno Sitzia, Rudiger Dornbusch, Andrew Abel, and Jeffrey Sachs.

more importance than problems of growth. By considering only aggregate effects, however, more light can be shed on what looms these days as the most fundamental of all distributional problems, that between employed and unemployed.

We shall assume that the major objective of the political authority is to keep economic activity and employment at a high level while assuring a condition of price stability that will keep the external deficit within limits that can be financed. For more than forty years, this problem has been at the core of both macroeconomic thinking and economic policy. In a "100% plus" economy, however, it presents features that are significantly different from the usual ones. Our essay tries to shed light on these issues.

Some Propositions

In what follows, we endeavor to establish a number of propositions about the relationships among the real contractual wage, national income, inflation, and external balance, and about the effectiveness of various policy measures in a "100% plus" economy. For the convenience of the reader, we summarize here the major propositions that emerge from our analysis.

Proposition 1. For given levels of productivity and indirect and social security tax rates, there exists, for each level of the contractual real wage, at most one level of output and employment that is consistent with price stability. This critical level is referred to hereafter as the "noninflationary rate of output," or the NIRO.

Proposition 2. If output is maintained above the NIRO by appropriate demand policies, then, even if output is maintained below full employment, a process of continuous inflation will be set into motion. The rate of inflation will tend toward a steady value that is higher the greater the excess of output over the NIRO. There is thus a tradeoff between the rate of inflation and output, and it is monotonically increasing.

Proposition 3. The critical level of output and the tradeoff mentioned in proposition 2 are adversely affected by an increase in unit labor cost from any source, particularly by a rise in the contractual real wage or by a fall in productivity.

Proposition 4. Given the value of all the parameters listed in propositions 1 and 3, the rate of inflation will tend to be an increasing function of the frequency with which wages are adjusted for intervening changes in the escalator price index (unless, of course, output is at the critical NIRO level).

Proposition 5. It follows from proposition 2 that output can be maintained at any constant level above the NIRO if, and only if, the money

supply is allowed to grow at a constant rate appropriate to accommodate the rate of inflation associated with that output level. This result further implies that neither a one-time change in the money supply nor changes in fiscal-policy variables can permanently keep output above the NIRO for a given money supply.

Proposition 6. Neither the NIRO nor the tradeoff between inflation and the excess of output over the NIRO can be affected by the standard fiscal instruments (government expenditure and income taxes) or by monetary policy. These generalizations must be qualified only in the sense that the noninflationary rate of employment may be affected by direct government employment policies.

Proposition 7. It follows from propositions 5 and 6 that fiscal policy can affect the *rate* of output only temporarily. Fiscal policy does, however, control the *composition* of output between the private and public sectors and between consumption and investment (contributing thereby to the determination of the real money supply). In the longer run, of course, the share of output devoted to investment will have effects on the tradeoff via productivity, and hence on unit labor costs.

Proposition 8. Proposition 6 does not hold if the fiscal action takes the form of an increase in indirect taxes. In the "100% plus" economy, such an increase cannot be used alone to shift the rate of inflation. But, because it is equivalent to a rise in direct unit costs, it produces an unfavorable shift in the entire inflation-output tradeoff, lowering the NIRO in the process. The increase in tax rates will generally reduce the deficit, but only at the cost of a permanent increase in inflation. It is not only a wasteful device for the purpose of making room for additional investment but it is inequitable. The only way that higher inflation can be avoided is by accepting a lower level of output, which may even imply a lower rate of investment, since in the "100% plus" economy the higher indirect taxes will fall largely, if not entirely, on profits.

Proposition 9. Proposition 8 applies equally well to a change in social security taxes, and for this reason a reduction in those taxes may appear to be a promising device to reduce inflation. However, if the reduction in social security taxes is financed by a corresponding increase in indirect taxes, the two tax changes will tend to offset one another, with little net beneficial effect on the NIRO.

Proposition 10. Given the rate of output and the associated rate of monetary growth, the rate of inflation is entirely independent of the magnitude of the real deficit or surplus in the government budget (except for limiting cases, and with due regard to the long-run effects of the deficit on the tradeoff via investment, mentioned under proposition 7).

Proposition 11. All the above propositions hold for the open economy with relatively minor modifications. The main qualification relates to propositions 1 and 6, to the extent that fiscal policy can be used to affect the volume of imports directly for a given level of aggregate income and given terms of trade. However, the mechanism driving inflation when output exceeds the NIRO differs in some important respects in the open economy. In the closed economy, inflation is driven basically by the inconsistency between the contractual real wage and the real wage that firms are prepared to pay to produce that output. In the open economy, this mechanism is overshadowed by the external deficit that develops when output exceeds the NIRO and causes a depreciation of the exchange rate, which fosters inflation and, in turn, leads to a further depreciation.

With the help of a simple aggregate model, we establish these propositions first for a closed economy in section 2, and then extend them to an open economy in section 3.

2 The Closed Economy

The Price-Wage Sector

The model. For the purpose of our aggregate analysis, the determinant of the price level can be modeled by means of the following equations:

$$P = (mWs/\pi)t \tag{2.1.1}$$

$$m = m(Q); \qquad m' \geqq 0;\ Q \leqq Q^0\ , \tag{2.1.2}$$

where P = overall price level, W = nominal hourly wages, π = output per man-hour, $s = 1 +$ social security tax rate, $t = 1 +$ rate of indirect taxation, Q = aggregate real output, and Q^0 = capacity output.

In equation (2.1.1), Ws denotes the cost of labor, including social security taxes, and therefore Ws/π measures unit labor costs. According to equation (2.1.1), price per unit of output, measured at factor cost, can be approximated in the short run by the expression mWs/π. Here the coefficient m denotes the relation between price at factor cost and unit labor cost, so that $m - 1$ represents the so-called "markup" on direct unit labor costs. Equation (2.1.1) can accordingly be regarded as an identity or as a definition of m.

The basic behavioral hypothesis is provided by equation (2.1.2), which states that, at least in the short run, the markup can be treated as a constant (if $m' = 0$) or as a stable increasing function of the rate of output. This formulation follows directly from the well-known Sylos Labini-Bain model of oligopolistic competition, which has already found ample con-

firmation in empirical studies (except that in that model π should be interpreted as "normal" or long-run productivity). In that model, too, the markup may have some tendency to decrease when there is a reduction in the rate of plant utilization, because oligopolistic discipline may weaken under such circumstances. However, the specification of $m' > 0$ is equally consistent with the classical model of short-run decreasing returns and market price determined by the short-run marginal cost (except that, in this case, π must be understood as a coefficient that can be deduced from the production function).

The market price P is obtained by multiplying the price at factor cost by the rate of indirect taxation t, which by hypothesis has no effect on the markup.

Equation (2.1.1) assumes that price adjusts promptly to variations in unit costs. In reality, for various reasons, the adjustment can be expected to occur only gradually. This phenomenon might be modeled by rewriting equation (2.1.1) in the following form:

$$P = g[(mWs/\pi)t] + (1 - g)\, P_{-1}; \qquad 0 < g \leq 1\,. \tag{2.1}$$

Assuming for the moment that the rate of indexation is precisely 100 per cent, the determinants of wages for the type of economy with which we are concerned can then be formalized by the equation

$$W = \mu P_{-1}\,. \tag{2.2}$$

Here, μ denotes the real wage established at the time of the latest national wage contract and preserved thereafter through indexation for the entire period during which the contract holds. The quantity μ is, accordingly, a parameter of the model. At the moment of the next national bargaining period, it becomes a variable determined by such forces as demand conditions, availability of labor, and the bargaining strength of the two sides.

The wage rate is assumed to depend on the *lagged* price level, in recognition of the fact that the labor contract does not (and cannot) prescribe a continuous contemporaneous adjustment of wages to prices. Rather, it establishes that the "correction" is to occur at stated intervals. In the case of Italy, for example, the adjustment is at present once a quarter. Note that the one-period lag formulation of equation (2.2) is consistent with any adjustment interval, provided this interval is conveniently chosen as the unit of measurement of time.

It is also worth noting that, in view of the lag of wages behind prices, the real wage at any point can differ from that established at the time of the contract; in this sense, the escalator clause does not totally insulate real wages from the effect of inflation.

If we now substitute equations (2.1.2) and (2.2) into equation (2.1), divide through by P_{-1}, and rearrange terms, we obtain $(P - P_{-1})/(P_{-1}) \equiv \dot{p} = g[m(Q)A\mu - 1]$, where $A \equiv (st)/\pi$. Here, $\dot{p}$ denotes rate of inflation per unit of time—for instance, the quarterly rate of inflation if the interval between successive adjustments of wages is one quarter. The annual rate of inflation, which we will denote by p, can then be approximated by

$$p \simeq ng\,[m(Q)A\mu - 1]\,, \tag{2.S.1}$$

where n denotes the number of wage adjustments per year[1] (e.g., 4 in the case of Italy).

The relationships among employment, inflation, and contractual real wages. Equation (2.S.1) enables us to establish several useful results, which can be conveniently illustrated by means of Figure 1. The rising curve denoted by B is a graphic representation of the markup function $m(Q)$ multiplied by the parametric constant A. From equation (2.1.1) we can infer that this curve represents the value of the ratio of price to wages that business firms will require in order to produce a given output. The slope of this curve at any point measures the sensitivity of the markup to variations in aggregate output.[2] The straight line parallel to the Q axis is the graphic representation of $1/\mu$. Since μ is the real wage imposed by union contracts, $1/\mu$ can be thought of as the value of P/W that is imposed by labor and is therefore denoted as L.

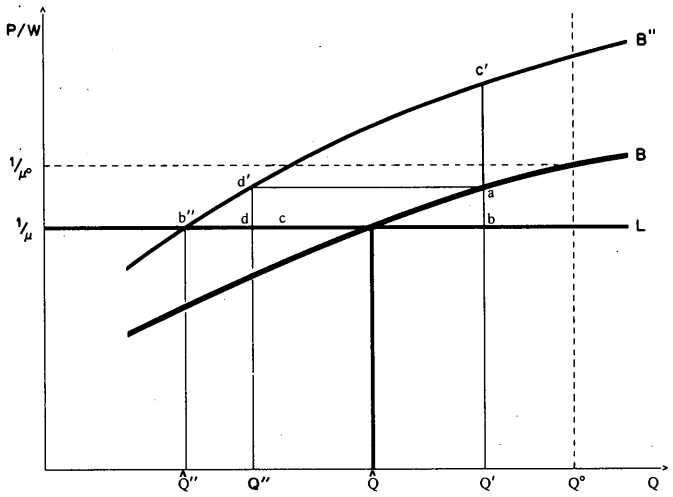
Equation (2.S.1) tells us that, for any given level of output, the rate of inflation P is proportional to the distance between curves B and L in Figure 1. Accordingly, there will exist (at most) one rate of output at which the price level will tend to be stable, namely the abscissa of the point of intersection of the two curves, denoted by $\hat{Q}$ in the figure. This output is the noninflationary rate of output, or NIRO, referred to in proposition 1. In terms of equation (2.S.1), the NIRO is that value of output, $\hat{Q}$, which satisfies $m(Q)A\mu - 1 = 0$. Note that there may not be a NIRO within the relevant range if curve B is horizontal or sufficiently flat.

It is also apparent that at any given point in time there is a single value of the real wage that is consistent with price stability *and* full-employ-

[1] In (2.S.1) we approximate $(1 + \dot{p})^n - 1$ with $n\dot{p}$.

[2] The hypothesis underlying the figure that $m' > 0$, which is supported by empirical evidence for a number of countries, is convenient when dealing with a closed economy in that it helps ensure price stability for some positive rate of output. If $m' = 0$, price stability would be impossible at any output whenever real contractual wages exceeded the level consistent with full employment. However, in the open economy, whether m' is positive or zero turns out to be of little consequence.

Figure 1



ment output, say Q^0. It is the value given by $1/\mu^0 = m(Q^0)A$ and is represented in our figure by the dashed horizontal line that intersects B at Q^0. Whenever the value μ exceeds μ^0, full employment becomes inconsistent with price stability.

If, through appropriate aggregate demand policies, the authorities succeed in maintaining output at some level higher than the NIRO, such as Q' in Figure 1, then, even if Q' is below the full-employment level, the outcome must be steady inflation, at a rate increasing with the excess of Q' over the NIRO (proposition 2). In Figure 1, this rate is proportional to the vertical distance between points a and b.

Recall that the height of curve B is proportional to A. Hence, it is directly proportional to the rate of direct and social security taxes and inversely proportional to productivity. Similarly, the height of curve L is inversely proportional to the contractual real wage. We can conclude, therefore, that an increase in real unit labor cost, from whatever source, will uniformly impair the tradeoff between inflation and output. In particular, it will lower the value of the NIRO (proposition 3).

If the curves B and L in Figure 1 do not intersect in the relevant range of outputs, or, equivalently, there is no value of output that makes the right-hand side of (2.S.1.) equal to zero, inflation will occur at all relevant levels of output, although the rate will still be an increasing function of output as long as curve B has any positive slope at all.

Equation (2.S.1) also shows that for given values of A and μ, the rate

of inflation corresponding to any output larger than the NIRO is proportional to ng, and hence presumably will tend to be higher the greater the frequency, n, with which wages are adjusted for the changes in the cost of living (proposition 4). Indeed, if the value of g were independent of n, the rate of inflation would grow in proportion to n. For example, let us suppose that the distance between the two curves in Figure 1 is 6 per cent and the adjustment of prices to wages in the course of the quarter is very rapid, say, $g = 1$. In this case, the rate of inflation would be 6 per cent per year if the adjustment occurred once a year. But if the adjustment occurred once a quarter, so that $n = 4$, the rate of inflation would be approximately 24 per cent per year [more precisely $(1.06)^4 - 1 = 26$ per cent per year].

In general, however, unless the speed of adjustment is very high, the adjustment per period, g, may be expected to decrease as the adjustment period becomes shorter (as n rises). Accordingly, ng will tend to change less than proportionally to n. To illustrate, suppose the adjustment is 30 per cent within one quarter. The adjustment within a one-year interval will then be 76 per cent.[3] In this case, if wages adjust once a quarter ($n = 4$), the annual rate of inflation will tend to be 7.2 per cent per year. Cutting down the frequency to one adjustment per year will reduce the annual rate of inflation to 4.6 per cent per year, or by a factor of less than 2, even though n has been reduced four times.

Equation (2.S.1) and the three propositions based on it apply directly to the case in which indexation is at the 100 per cent rate. But the analysis can be extended without difficulty to the case in which indexation is not at that rate, particularly when it is higher. In this case, in fact, the real wage rate implied by the original contract becomes a function of the price level, taking as a base the level prevailing at the time of the last contract: the parameter μ must be replaced by the variable $\mu(P)$, with $\mu' \gtrless 1$ according to whether indexation is higher than, equal to, or lower than 100 per cent. We do not propose to give a formal treatment of this case here, and it will be neglected in what follows. But the qualitative effect can easily be seen, since the price level is simply the integral of inflation. For instance, if indexation is above 100 per cent and output is maintained at a level higher than the initial NIRO, the horizontal line L in Figure 1 will decline in time as the price level rises, causing a progressive decline in the NIRO and a steadily increasing rate of inflation, which in turn will displace L downward at an increasing rate. Clearly, the system is unstable except in the neighborhood of the NIRO implied

[3] If we denote by g_o the annual rate of adjustment and by g_n the rate of adjustment for a period of $1/n$ years, then $(1 - g_o) = (1 - g_n)^n$.

by the initial real wage. For the same reason, indexation at a rate lower than 100 per cent is stabilizing insofar as it tends to cause the line L to rise, thus tending to cause inflation to die down, although in this case, line L is likely to make a large downward jump when the labor contract is renewed.

Some implications. What makes it possible to maintain output at a level higher than the NIRO, even at the cost of a high rate of inflation? The answer to this question is simple in the limiting case in which the speed of adjustment of prices to costs is unitary. In this case, it is obvious from equation (2.1) that the markup will remain continuously at the level appropriate to Q'. This means that the real wage or its reciprocal, P/W, will remain precisely at the level "required" by firms in order to produce that output, and this independently of the contractual real wage. In Figure 1, the realized value of P/W will always fall on curve B, whatever the position of curve L. For instance, if output is at Q', it will be given by the ordinate of point a. This result comes about through the lag in the adjustment of money wages. It does not follow that the contractual real wage has no role to play, but its role is reduced to determining the rate of inflation: the larger the real wage established in the contract (that is, the lower line L relative to the level that is appropriate to output Q'), the higher will be the rate of inflation.

When the speed of adjustment of prices to costs is distinctly below 1, the situation becomes somewhat more complex. In this case, the effective real wage or its reciprocal, P/W, will fall between the contractual level $1/\mu$ corresponding to line L and the equilibrium level required by firms on curve B. In Figure 1, if output is maintained at Q' , the realized P/W will be represented by a point on the line $Q'a$ in the interval ab. The closer g is to zero, the closer to b the point will lie, and conversely. In this case, obviously, the contractual salary influences the effective real wage. As μ increases and line L falls, the value of P/W will fall also, although at the same time inflation will increase.

This last result must be interpreted with caution because it assumes that the speed of adjustment of prices is constant, whereas there are good reasons to suspect that it is variable. The speed of adjustment may be low when the cost increase is at least partly unexpected, is of modest size, and does not hit all firms in the system simultaneously and uniformly. But when a high rate of inflation becomes chronic and generalized, there is reason to think that the speed of adjustment will tend to grow and approach unity.

This consideration suggests that the conclusion based on equation (2.S.1) (that to any value of output higher than the NIRO there cor-

responds a stable rate of inflation) is likely to hold only in the short run. If the inflation rate given by this equation is high, the speed of adjustment and therefore the inflation rate itself are more likely to increase in time, so that, for that same level of output, there will be a growing and not a constant rate of inflation. This process will reach a limit when the speed of adjustment becomes unity. However, one must also recognize that as this begins to happen and the rate of inflation rises, real wages will shrink because of the lag in adjustment. The unions will then try to increase the frequency of cost-of-living adjustments, in order to defend the real wage. The result, of course, will be a further increase in the rate of inflation, while the benefit to real wages will tend to be smaller the closer the speed of adjustment has come to unity.

In summary, even though it is possible in the short run to maintain levels of output distinctly higher than the NIRO, possibly at the cost of a high but stable rate of inflation, this equilibrium tends to become unstable in the longer run. The only stable level is in the neighborhood of the NIRO. In this sense, the contractual real wage or, more generally, the unit labor cost corresponding to this real wage has a fundamental role to play in determining the level of output and employment that the system can hope to achieve and maintain.

Determinants and Control of Aggregate Demand and the Inflation Rate

The model and its steady-state properties. So far, we have treated the level of output as an exogenous variable, concentrating on its effect on the inflation rate. It is useful at this point to endogenize output in order to examine how far output and inflation can be controlled through monetary and fiscal policies, and whether such policies can affect the tradeoff between inflation and output.

For this purpose it is sufficient to limit ourselves to a highly aggregated type of macro model of the Hicksian IS-LM type. Starting from the well-known identities of the national accounts and taking into account the consumption function and the fact that it depends on income net of direct taxes and social security taxes, we can approximate aggregate demand for a closed economy with the following equations:

$$X = Q + (W/P)G\,, \tag{2.3.1}$$

$$Q = Q(st,\ \theta,\ (W/P)G,\ Q_g,\ Q_i) \simeq \{(st)\ /\ [st - c(1-\theta)]\} \\ [(Q_g + Q_i) + c(1-\theta)(W/P)G]\,, \tag{2.3.2}$$

where X = real national product, Q = real value added by the private