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Wage Rigidity and Unemployment: a Comment on Kohn*

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1. INTRODUCTION

In an article published in *AER*, Kohn (1981) argues that wage rigidity is essential for Keynesian unemployment. This argument supports the widespread view that Keynesian economics is the economics of wage rigidity, and that greater wage flexibility removes unemployment. However, it is against Keynes's (1936, chap. 19) own view that greater wage flexibility may be destabilizing and actually exacerbate the problem of unemployment rather than solve it.[1] The purpose of this note is to clarify the relation between wage flexibility and unemployment using Kohn's framework, and to argue in favor of Keynes's own view.

2. THE MODEL

The framework used here is only a slight modification of Kohn's sequence framework, where time is treated in discrete intervals to take into account the time-sequence of decisions and actions. Three markets are considered.

In the labor market purely competitive firms hire labor to produce output with a neoclassical production function

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[1] See Dutt (1986-7) and Dutt and Amadeo (1990a, 1990b).

$$Y_t = F(N_t) \tag{1}$$

with $F' < 0$ and $F'' > 0$, where Y_t is real output, and N_t is the level of employment of labor (all at time t), and where capital goods and technology are assumed to be given in the short period. Firms maximize profits given wages and price expectations, so that

$$F'(N_t) = W_t/P_{t+1}^e \tag{2}$$

where W_t is the money wage and P_{t+1}^e the expectation of the price in period t + 1 formed in period t (the production and employment decision and activity occurring this period, and the output being sold in the next period). The supply of labor is inelastically given at the level M_f.[2] Given the expected price, if the money wage is perfectly flexible to clear the market, full employment will always be achieved, and the market-clearing real (expected) wage will be given by

$$V^* = F'(N_f). \tag{3}$$

We, however, introduce money wage rigidity by assuming

$$W_t - W_{t-1} = \alpha(W^* - W_{t-1}) \tag{4}$$

which states that if the money wage is above (below) the market-clearing wage it will fall (rise) over time at a speed determined by the speed of adjustment constant α. If $\alpha = 1$ then the money wage is perfectly flexible, while if $\alpha = 0$ the money wage is fixed.

In the goods market output produced in the previous period, Y_{t-1}, is sold in this period in a purely competitive market. The demand for goods comes from two sources: consumption demand from households, and investment demand from firms. Households earn money income from income generated in the previous period, Z_{t-1}, and spend a fraction c of it, so that

$$P_t C_t = c_t Z_{t-1} \tag{5}$$

where C_t is real consumption, and P_t the current price. We assume that c depends inversely on the real interest rate in the present period, which is given by

$$r_t = (1 + i_t)/(i + \pi_t^e) - 1 \tag{6}$$

where π_t^e is the expected inflation rate, so that[3]

$$c_t = c(i_t, \pi_t^e) \tag{7}$$

where $c_i < 0$ and $c_\pi > 0$: a higher return to abstinence from consumption implies lower consumption. Firms make investment plans based on the costs of,

[2] Nothing of substance changes if labor supply responds to the real wage, or the expected real wage.
[3] We depart from Kohn by endogenizing c.

and returns to, investment. Costs are interest costs, and returns are prospective yields, which are summarized by the symbol θ, so that

$$I_t = I(i_t, \pi_t^e, \theta) \tag{8}$$

where $I_i < 0$, I_π and $I_e > 0$, and where I_t is real investment. Market clearing in the goods market is achieved, in any period, by variations in price, given π_t^e. The goods market equilibrium condition, given perfect price flexibility, is

$$Y_{t-1} = C_t + I_t. \tag{9}$$

At an instant, given π_t^e and the other parameters, and given Y_{t-1}, P_t, and therefore $\pi_t = (P_t - P_{t-1})/P_t$, adjusts to clear the market to satisfy (9). Since there is no guarantee that $\pi_t^e = \pi_t$, in the next period we assume that the expectation of inflation is revised adaptively.

Finally, for the assets markets, we assume there are two assets, money and bonds. Households have money held over now from the last period, H_{t-1}, to which they add their money income from the proceeds of the last period, and use this to consume, buy bonds, and hold money. The households' budget constraint is thus

$$M_t = H_{t-1} + Z_{t-1} = P_t c_t + B_t^H + H_t \tag{10}$$

where B_t^H is flow the demand for bonds by households, and H_t the flow demand for money (assuming that firms do not demand any money), and M_t the total flow of money available to households. The demand for money is assumed to depend on household money expenditures (on consumption) and the interest rate (measuring the opportunity cost of holding money), so that

$$H_t = H(P_t C_t, i_t) \tag{11}$$

where $H_1 > 0$ and $H_2 < 0$ and where the function H is assumed to be homogeneous with respect to P_t (assuming away money illusion). Given the pre-determined amount of money resources available to households, and their consumption plans described in equations (5) and (7), the demand for money implies a demand for bonds (or net supply of loanable funds by households) given by

$$B_t^H = M_t - cZ_{t-1} - H(cZ_{t-1}, i_t). \tag{12}$$

The supply of bonds (or demand for loanable funds) is given by

$$B_t^F = .P_t I_t. \tag{13}$$

Following Wicksell, we assume that banks fix the market rate of interest at i_m, and make up the difference between the demand and supply of loanable funds by creating (or destroying) credit money. Thus,

$$DM_t = B_t^F - B_t^H \tag{14}$$

where D refers to the change in the variable immediately following it. We assume that banks have no costs and no profits.

Having examined the three markets, we now turn to the examination of short-period equilibrium in this economy, at which Y_t, N_t and π_t attain constant values, and at which $\pi_t^e = \pi_t$, so that expectations of inflation are not revised. To do so, we derive supply and demand curves for the economy.

The supply curve shows levels of output that profit-maximizing firms produce each rate of inflation. In short-period equilibrium the level of output must be constant, and therefore, given profit-maximization by firms, so must the real wage, V. This implies that the money wage must change at the rate of inflation, implying

$$W_t = (1 + \pi)W_{t-1} \tag{15}$$

where π is the short-period constant level of the rate of inflation. Substituting equation (15) into (4) we get

$$V = \alpha V^*(1+\pi)(\alpha + \pi) \tag{16}$$

where V^* is the real wage at full employment. Substituting (16) into the marginal productivity condition, and solving for the profit-maximizing level of output we get

$$Y = F(F'^{-1} (\alpha V^*(1 + \pi)/(\alpha + \pi))) \tag{17}$$

which is the equation for the supply curve SS in Figure 1.

This curve has he following properties.[4] First, it is upward-rising in its economically relevant range. Differentiating Y with respect to π we get

$$dY/d\pi = -\alpha(1 - \alpha)V^*F'/F''(\alpha + \pi)^2 \tag{18}$$

Since $F' > 0$ and $F'' < 0$, it follows that $dY/d\pi > 0$. A higher rate of inflation, given the degree of wage flexibility, implies a lower real wage, and hence a higher level of output. Second, at $\pi = 0$, $Y = Y_f$, as can be seen by substituting $\pi = 0$ in (17). Third, in the neighborhood of $\pi = 0$, the slope of the curve falls as α rises. This is seen by noting that $F' = V$, and substituting from (16) into (17) and evaluating at $\pi = 0$ to get

$$dY/d\pi/_{\pi=0} = - [(1 - \alpha)/\alpha]\ V^{*2}/F''$$

which is positive and clearly falls with α. Curve SS is drawn in the figure for $0 < \alpha < 1$.

[4] The discussion follows Kohn (1981), with one minor difference regarding the first property.

The demand curve shows the level of output for each rate of inflation consistent with goods market equilibrium. For the goods market, using equations (5) and (7) through (9) and assuming that $\pi_t^e = \pi_t$, we get

$$Y_t = c(i_t, \pi_t) [Y_t/(1 + \pi_t)] + I(i_t, \pi_t, \theta). \tag{20}$$

which is the equation for the DD curves in Figure 1.

The slope of this curve is given by

$$dY/d\pi = \{I_\pi + c\pi[Y/(1 + \pi)] - cY/(1 + \pi)^2\}/[1\text{-}c/(1+\pi)] \tag{21}$$

Assuming that $Y = Y_f$ at $\pi = 0$ (which can be checked to be the case from equation (16)), and $\pi > -(1-c(i,0))$, the slope of this line at $\pi = 0$ depends on the relative magnitudes of I_π which is positive, and $c_\pi [Y/(1+\pi)] - cY/(1+\pi)^2$ which can be positive or negative. The first of these magnitudes shows the interest rate effect on investment of a higher inflation rate. In the second, the first term shows the corresponding interest effect on consumption, while the second term shows what may be called the forced savings effect due to a reduction in real income due to a higher inflation rate. If the positive interest rate effects on investment and consumption dominate the negative forced saving effect on aggregate demand, the demand curve will be upward rising. In the other case it will be downward sloping. Three cases are shown in Figure 1: in (a) the curve is downward sloping, in (b) it is upward rising but flatter than the SS curve, and in (c) it is upward rising and steeper than the SS curve.

Short-period equilibrium is achieved at the intersection of the SS and DD curves, which determines the equilibrium values of Y_t and π_t. In the assets market, equations (12) through (14), setting $\pi_t = \pi_t^e$, imply that

$$(M_tP_t)(1+m_t) = Y_t + H(c(i_t,\pi_t)[Y_t/(1 + \pi_t)],i_t). \tag{22}$$

where $m_t = DM_t/M_t$. With $i_t = i_m$, once Y_t, and π_t, are determined this equation solves for M_t/P_t and m_t. Since M_t/P_t is determined, we must have $m_t = \pi_t$; substituting this in the left-hand side of (19) solves for M_t/P_t.

We start with a situation in which the two curves, SS and DD, intersect at $\pi = 0$. From (17) it follows that $Y_t = Y_f$. It also follows, from (19) that the interest rate is given by the solution of

$$Y_f - c(i_t, 0)\, Y_f = I(i_t,0)$$

which is the interest rate that equates saving and investment at full employment and zero inflation, called by Wicksell the natural rate of interest. Since $\pi_t = 0$, $m_t = 0$, implying that banks do not change the supply of money. We next consider a downward shift in θ which reduces investment, shifting the DD curve down to D'D' (assuming that $1 + \pi_t > c(i_t,0)$). The short-period equilibrium thus shifts from E_1 to E_2.

In each case the reduction in demand due to the fall in investment initially causes P_t to fall for given π_t^e, which, given the degree of money wage rigidity causes the real wage to rise, implying, subsequently, a fall in output, and a fall in the rate of inflation. The economy thus adjusts with unemployment and deflation. The fall in P_t also implies that π_t is lower than expected (initially, with π_t at short-period equilibrium, $\pi_t^e = 0$). This leads to a downward revision in $\pi_{t+1}{}^e$ which causes c and I to fall, other things constant. There will thus again be an excess supply in the goods market, causing further reductions in π and π^e. Whether this adjustment process will be stable depends on whether the expectations adjustment mechanism is stable, which we assume, and on the responsiveness of aggregate demand to changes in π, which, as noted above, determine the related slopes of the demand and supply curves. If the adjustment is stable, the economy will arrive at a new short-period equilibrium at which $\pi = \pi^e$. Assuming a stable expectations process, in Figures 1(a) and (b), the economy will converge to the short-run equilibrium level at E_2. But in Figure 1(c) the economy experiences diminishing levels of Y and π, moving further and further away from full employment.

This leads to two conclusions. First, the stability of the adjustment process depends on the slope of the demand curve. If it is downward sloping, then given the upward-rising supply curve adjustment is stable, as in case (a). If it is upward sloping, that is, if investment is more responsive to changes in the inflation rate than is consumption, stability depends on whether it is steeper or flatter than the supply curve. Second, and most importantly for our purposes, the nature of adjustment depends on the degree of wage rigidity in the economy. In the case of the downward-sloping demand curve, that is, case (a), greater wage rigidity, by causing the SS curve to be steeper (as shown by the curve S'S') implies a short-period equilibrium level of output which is lower than E_2, at E_3. Thus greater wage rigidity in this implies that the economy experiences a greater loss in employment and output for a given demand shock. If the demand curve is upward-rising, however, but the adjustment is stable, as in case (b), the demand shock will imply a lower reduction in output (at E_3, for instance) with greater wage rigidity. In this sense, greater wage rigidity may be a blessing for the economy. Moreover, if the degree of wage flexibility is very high (so that we come to case (c)), the economy will be destabilized, and given a demand shock it will experience continuously declining employment and output.[5] If the demand curve is upward-rising, the greater the degree of wage flexibility, the greater the chances for instability. Perfect wage flexibility will imply a horizontal supply curve, and there will *never* be a deviation from full employment. But surely perfect flexibility is an ideal which cannot be satisfied in any economy where the wage adjusts when unemployment appears. For such economies, if the demand curve is upward rising, more harm can be done by increasing the degree of wage flexibility.

All this is entirely consistent with the views of Keynes, who argued in chapter 19 of the *General Theory*, that greater wage flexibility is not good for the economy. Keynes provided several reasonsto support this claim, and Post Keynesians have added other reasons.[6] But in the model discussed in this paper, this

[5] We have only analyzed local stability properties, but local departures from full employment are the only ones that may be politically feasible in advanced capitalist economies.

[6] See Dutt (1986-7), Dutt and Amadeo (1990) for a discussion of these reasons.

happens when the demand curve is upward rising, that is, when greater deflation, by reducing consumption and investment demand through the real interest effect more than it increases consumption by reducing the level of forced saving due to inflation, reduces the level of aggregate demand.

Keynes, in his analysis, in fact ignored the forced saving effect by assuming that current consumption depends on current income generated from current production, rather than from money income earned in the previous period. Keynes can be taken here to imply that lags in consumption are shot (lags between production and income, as well as income and consumption) *or* that consumers base their consumption plans on expected income during that period, so that in an equilibrium situation, with expected income equal to actual income, consumption would depend on current realised income. The result of this modification is that the goods market equation (20) becomes

$$Y_t - c(i_t,\pi_t)Y_t = I(i_t,\pi_t,\theta). \qquad (23)$$

The effect of inflation on the market clearing level output is now

$$dY_t/d\pi_t = (i_\pi + c_\pi Y_t)/[1-c(i_t,\pi_t)]$$

which is necessarily positive, so that the demand curve is necessarily upward rising. Thus a Keynesian version of the model of this paper implies unambiguously that greater wage flexibility is a bad thing (in the sense described above).[7]

3. CONCLUSION

This note has shown that in Kohn's (1981) model, if the demand curve for the economy is upward rising, greater wage flexibility will increase the chances of macroeconomic instability (in the sense that demand shocks will cause unstable, rather than stable, adjustments in output and employment, and if adjustment is stable, it will imply greater reductions in employment and output for given demand shocks. Keynes's own analysis, by making consumption depend on *current* real in come makes the demand curve necessarily upward rising, and therefore necessarily makes greater wage flexibility a bad thing.[8]

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[7] Keynes was actually not so unambiguous about this. We get this unambiguous result in this model because it removes the stabilizing features of wage reductions — such as the so-called Keynes effect.
[8] Perfect wage flexibility, with $\alpha = 1$, will imply $Y_t = Y_f$, but given that this is an unrealistic ideal only reachable in the limit, our conclusion seems to be robust.

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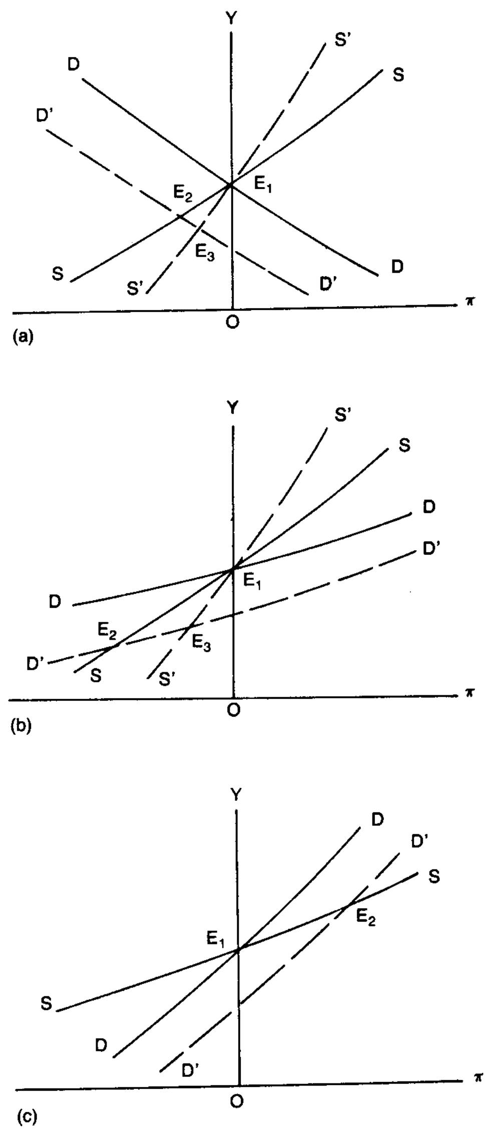
Figure 1



RESUMO

Este trabalho examina os modelos de fundos emprestáveis com uma taxa de juros estabilizada, na qual o sistema bancário preenche o hiato entre o fluxo de demanda e a provisão de fundos. Um típico modelo Mickseliano é desenvolvido para ressaltar a importância do crédito e inflação (deflação) em fechar o intervalo entre poupança e investimento. Substituindo a taxa nominal de juros pela real — uma modificação apropriada num modelo cuja inflação é relevante — e usando a definição de renda Robertsoniana, percebemos que, dependendo da reação da 'carência' (lacking) e investimento à inflação, existe a possiblidade do sistema se tornar instável. Introduzindo desemprego no sistema percebemos que o investimento é mais sensível do que a carência à inflação, quanto maior o grau de flexibilidade salarial, maior será o nível de equilíbrio de desemprego, em face do choque de demanda, e maiores as chances de instabilidade macroeconômica. Finalmente demonstramos que se substituirmos a definição de renda Robertsoniana pela Keynesiana, o investimento se torna mais sensível à inflação, tornando a rigidez salarial, necessariamente, um bom negócio.