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## Unemployment persistence and the unemployment-productivity relation

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**UNEMPLOYMENT PERSISTENCE AND  
THE UNEMPLOYMENT-PRODUCTIVITY  
RELATION**

Dennis J Snower

*HUMAN RESOURCES*



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# UNEMPLOYMENT PERSISTENCE AND THE UNEMPLOYMENT-PRODUCTIVITY RELATION

Dennis J Snower

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## ABSTRACT

### Unemployment Persistence and the Unemployment-Productivity Relation\*

This paper explores the interrelation between the degree of unemployment persistence and the unemployment-productivity trade-off. The analysis suggests that the more effective are structural labour market policies (designed to change labour market institutions and laws, such as job security legislation) in making wages and prices more responsive to current unemployment and making unemployment less persistent, the less effective will be the growth-promoting supply-side policies (such as training schemes) in reducing unemployment.

JEL classification: E31, E32, J23, J31, J64, O50

Keywords: unemployment, productivity, unemployment persistence, inflation

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Submitted 19 July 1994

## NON-TECHNICAL SUMMARY

This paper analyses how the degree of unemployment persistence is related the unemployment-productivity trade-off.

The paper begins with a simple model of how productivity growth can reduce the natural rate of unemployment. The Phillips Curve is interpreted as the outcome of a wage-price spiral. In this context, an exogenous rise in productivity growth reduces the mark-up of prices over wages and thus, in equilibrium, the mark-up of wages over prices must rise by an equal proportion. This happens when the unemployment rate falls, thereby raising the wage mark-up and reducing the price mark-up.

The paper then considers two policy approaches to reducing unemployment: (i) supply-side policies (such as investment tax credits and training schemes) designed to stimulate the rate of productivity growth; and (ii) 'structural' labour market policies (such as the promotion of job centres and measures to dismantle job security legislation) designed to make the labour market more responsive to external conditions. Since the structural policies tend to make wages and prices more responsive to current unemployment and less responsive to past unemployment, they also reduce the degree of unemployment persistence. For example, policies reducing severance pay and simplifying firing procedures may reduce labour turnover costs; profit-sharing schemes may enfranchise outsiders in the wage setting process and thereby reduce the strength of insider membership effects; and job centres may speed up the matching process in the labour market and may thereby slow the rate at which unemployed workers' skills deteriorate and reduce the discouraged worker effects.

What this paper suggests is that there is a sense in which the two sets of policies above are substitutes: the more effective are the structural policies in making wages and prices more responsive to current unemployment and less responsive to past unemployment, the less effective will be the growth-promoting supply-side policies in reducing unemployment.

In particular, structural labour market policies are assumed to raise the 'inflation responsiveness parameter' (measuring the degree to which wage and price inflation respond to current unemployment) and reduce the 'inflation inertia parameter' (measuring the dependence of wage and price inflation on past unemployment). Both effects increase the degree of unemployment persistence. Then it can be shown how these policies reduce the responsiveness of unemployment to changes in productivity growth. The more responsive are wage and price inflation to current unemployment, the smaller the amount by which the unemployment rate must fall in order to bring the wage and price mark-ups in harmony with one another after an increase in productivity growth. In a similar

vein, the less responsive are wage and price inflation to past unemployment, the more a fall in unemployment will stimulate wage and price inflation in the long run, and consequently the less unemployment must fall in the aftermath of a productivity rise.

UNEMPLOYMENT PERSISTENCE AND  
THE UNEMPLOYMENT-PRODUCTIVITY RELATION\*

by Dennis J. Snower

1. Introduction

Ever since the late 1960s it has been appreciated that the rate of long-term productivity growth is an important determinant of the natural rate of unemployment, implying an inverse long-run relation between unemployment and productivity growth, which we will call the "unemployment-productivity relation" for short. More recently, a large literature has emerged on "unemployment persistence", of which hysteresis is an extreme case. A number of studies have shown how the degree of unemployment persistence depends on the magnitude of labor turnover costs,<sup>1</sup> insider membership effects,<sup>2</sup> and discouraged worker effects<sup>3</sup>. However, little if anything has been done thus far to explore the interrelation between the degree of unemployment persistence and the unemployment-productivity tradeoff. This is the subject of this paper.

The issue is of self-evident policy importance. Two well-known policy approaches to reducing unemployment are (i) supply-side policies (such as investment tax credits and training schemes) designed to stimulate the rate of productivity growth and (ii) "structural" labor market policies (such as promotion of job centers measures to dismantle job security legislation) designed to make the labor market more responsive to external conditions. Since

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<sup>1</sup>For example, Bertola (1989), Lindbeck and Snower (1988), and Nickell (1979).

<sup>2</sup>These are concerned with the rate at which hired workers gain insider status and fired workers lose it. See, for example, Blanchard and Summers (1986), Gottfries and Horn (1987), and Lindbeck and Snower (1987).

<sup>3</sup>These are concerned with job search intensity falling with the duration of unemployment. See, for example, Bean and Layard (1990).

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the structural policies tend to make wages and prices more responsive to current unemployment and less responsive to past unemployment, they also reduce the degree of unemployment persistence. For example, policies reducing severance pay and simplifying firing procedures may reduce labor turnover costs; profit-sharing schemes may enfranchise outsiders in the wage setting process and thereby reduce the strength of insider membership effects; and job centers may speed up the matching process in the labor market and may thereby slow the rate at which unemployed workers' skills deteriorate and reduce the discouraged worker effects. What this paper suggests is that there is a sense in which the two sets of policies above are substitutes: the more effective are the structural policies in making wages and prices more responsive to current unemployment and less responsive to past unemployment, the less effective will be the growth-promoting supply-side policies in reducing unemployment.<sup>4</sup>

This paper presents a very simple and well-known model of how productivity growth can reduce the natural rate of unemployment. Following Tobin (1972), Layard and Nickell (1985) and others, we interpret the Phillips Curve as the outcome of a wage-price spiral. In this context, an exogenous rise in productivity growth reduces the markup of prices over wages and thus, in equilibrium, the markup of wages over prices must rise by an equal proportion. This happens when the unemployment rate falls, thereby raising the wage markup and reducing the price markup.

Within this analytical framework, structural labor market policies are assumed to work through two parameters: the "inflation responsiveness parameter" ( $R$ ) measuring the degree to which wage and price inflation respond to current unemployment, and the "inflation inertia parameter" ( $I$ ) measuring the dependence of wage and price inflation on past unemployment. Specifically, the structural policies are assumed to raise  $R$  and reduce  $I$ . Both effects clearly increase the degree of unemployment persistence. It then becomes straightforward to

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<sup>4</sup>This, of course, is not to be construed as an argument against the structural policies, since these generally reduce unemployment in their own right and may, under certain conditions, be more effective at doing so than the growth-promoting supply-side policies.



show how these policies reduce the responsiveness of unemployment to changes in productivity growth. The more responsive are wage and price inflation to current unemployment, the smaller the amount by which the unemployment rate must fall in order to bring the wage and price markups into harmony with one another after an increase in productivity growth. In a similar vein, the less responsive are wage and price inflation to past unemployment, the more a fall in unemployment will stimulate wage and price inflation in the long run, and consequently the less unemployment must fall in the aftermath of a productivity rise.

Section 2 derives the unemployment-productivity relation from a traditional expectations-augmented Phillips Curve (without unemployment persistence). Section 3 includes unemployment persistence and relates it to the slope of the unemployment-productivity relation. Section 4 considers some empirical evidence and concludes.

## 2. The Traditional Phillips Curve and the Unemployment-Productivity Tradeoff

To derive the traditional expectations-augmented Phillips Curve as the outcome of a wage-price spiral, we specify an equation describing price inflation and another describing wage inflation and then substitute one into the other. Let  $\dot{P}$  be price inflation,  $\dot{W}$  be wage inflation,  $\dot{z}$  be the growth of productivity, and  $u$  be the unemployment rate. Then the price inflation equation may be specified as follows:

$$(1) \dot{P} = a_0 - a_1 \cdot u + \dot{W} - \dot{z},$$

where  $a_0$  and  $a_1$  are positive constants. This may be interpreted as a description of prices as a mark-up over wages or as the condition setting the marginal value product of labor equal to the nominal wage.<sup>5</sup>

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<sup>5</sup>The marginal condition may be written as  $P \cdot (1-m) \cdot \gamma \cdot f'(n) = W$ , where  $m$  is the inverse of the firm's price elasticity of product demand and the firm's production function is  $q = \gamma \cdot f(n)$ . In most empirical models

The wage inflation equation may be expressed as

$$(2) \dot{W} = b_0 - b_1 \cdot u + \dot{P}^e,$$

where  $\dot{P}^e$  is the rate of expected price inflation, and  $b_0$  and  $b_1$  are constants. Equation (2) may be interpreted as the real wage ( $w = (W/P)$ ) that minimizes the efficiency wage ( $w/e$ ), where worker productivity depends (in part) on the unemployment rate ( $e = e(u)$ ). Alternatively, it may be seen as the outcome of a collective bargain in which the firms' and workers' fall-back positions depend (in part) on the unemployment rate.

Substituting (2) into (1) yields a traditional Phillips Curve:

$$(3) \dot{P} = A - R \cdot u - \dot{z} + \dot{P}^e,$$

where  $A \equiv (a_0 + b_0)$  may be termed the "autonomous inflation parameter" and  $R \equiv (a_1 + b_1)$  is the "inflation responsiveness parameter", representing the sum of the responses of wage and price inflation to changes in current unemployment.

In equilibrium, when expectations are correct ( $\dot{P} = \dot{P}^e$ ), unemployment is equal to its natural rate ( $u^*$ ):

$$(4) u^* = \left[ \frac{A - \dot{z}}{R} \right].$$

This is the unemployment-productivity relation<sup>6</sup> corresponding to the

$a_1 = 0$  in equation (1), and the resulting equation may be derived by assuming  $f'' = 0$ , logarithmically differentiating the marginal condition and linearizing. Then  $z$  captures the upward trend in the productivity parameter  $\gamma$  and  $a_0$  captures trend changes in the number of firms and the aggregate labor supply.

<sup>6</sup>This relation is of course quite distinct from Okun's Law, whereby the difference between unemployment and its natural rate is inversely related to the GNP gap. In Okun's Law, the natural rate of unemployment is generally assumed to be constant, while equation (4) is concerned with the relation between the natural rate of unemployment and the rate of productivity growth. Okun's Law is commonly rationalized by describing output as  $Q = z \cdot h \cdot (1-u) \cdot L$  (where  $z$  is the level of productivity,  $h$  is the average number of hours worked, and  $L$  is the labor force) and assuming that  $z$ ,  $h$ ,  $(1-u)$ , and  $L$  are

traditional Phillips Curve (3).

### 3. Unemployment Persistence and the Unemployment-Productivity Relation

The standard way of incorporating unemployment persistence arising from labor turnover costs in this Phillips Curve model is to rewrite the price inflation equation as follows:

$$(1') \quad \dot{P} = a_0 - a_1 \cdot u + a_2 \cdot u_{-1} + \dot{W} - \dot{z},$$

The greater are firms' hiring, training, and firing costs, the more will their current pricing decisions depend on past their employment levels and thereby on the past unemployment rate.<sup>7</sup>

Unemployment persistence arising from insider membership effects or discouraged worker effects may be captured by rewriting the wage inflation equation in the following way:

$$(2') \quad \dot{W} = b_0 - b_1 \cdot u + b_2 \cdot u_{-1} + \dot{P}^e,$$

The more restrictive the entry into the insider workforce and the lower the average search intensities of the long-run employed<sup>8</sup>, the more will current wage decisions depend on past unemployment.

The resulting Phillips Curve is

move together in the short run, so that the level of unemployment is related to the level of output. This presupposes an inverse relation between the unemployment rate and the level of productivity, rather than the growth rate of productivity, as in equation (4).

<sup>7</sup>Strictly speaking, the condition setting the marginal value product of labor equal to the wage relates the price level to the level of employment, and thereby to the unemployment rate. The relation between price inflation and the unemployment rate (equation (1)) implies a relation between the price level and the integral unemployment rates through time, and this may itself arise from the existence of labor turnover costs. Including a lagged unemployment term in the price inflation equation simply gives past unemployment rates greater weight in the determination of the price level. This, too, may be rationalized in terms of labor turnover costs.

<sup>8</sup>In the context of our model, the long-run unemployed are those workers who are unemployed for more than one time period.

$$(3') \quad \dot{P} = A - R \cdot u + I \cdot u_{-1} - \dot{z} + \dot{P}^e,$$

where  $I \equiv (a_2 + b_2)$  is the "inflation inertia parameter", representing the sum of the responses of wage and price inflation to lagged unemployment.

Thus, in the short-run equilibrium - where  $\dot{P} = \dot{P}^e$  but  $u$  is not necessarily equal to  $u_{-1}$  - the unemployment-productivity relation becomes:

$$(4a) \quad u = \left[ \frac{A - \dot{z}}{R} \right] + \left[ \frac{I}{R} \right] \cdot u_{-1}.$$

Here the degree of unemployment persistence may be measured quite simply by the ratio of the inflation inertia parameter to the inflation responsiveness parameter. The greater the degree of unemployment persistence, the more long-lasting are the effects of *temporary* labor market shocks on the short-run equilibrium unemployment rate<sup>9</sup>, and the longer it takes for the full effects of a *permanent* labor market shock on the short-run equilibrium unemployment rate to work themselves out.<sup>10</sup> The ratio  $(I/R)$  may be called the "unemployment persistence coefficient".

In the long-run equilibrium - where  $\dot{P} = \dot{P}^e$  and  $u = u_{-1}$  - the unemployment-productivity relation is

$$(4b) \quad u = \left[ \frac{A - \dot{z}}{R - I} \right].$$

where  $\dot{z}$  is now to be interpreted as the trend rate of productivity

<sup>9</sup>Specifically, let a temporary shock be represented by a rise in  $c_0$  for one period, after which it returns to its original level and remains there. The resulting effect on the short-run equilibrium unemployment rate in period  $t$  is  $du_t^{SR}/dc_0 = c_1^{t-1}$ , which clearly depends positively on the magnitude of the unemployment persistence coefficient.

<sup>10</sup>In particular, the effect of a permanent rise  $c_0$  on the short-run equilibrium unemployment rate in period  $t$  is  $du_t^{SR}/dc_0 = (I + c_1^{t-1})$ . Here, the greater is the unemployment persistence coefficient, the greater is the difference between the short- and long-run equilibrium rates in any period of time  $t$ . (The long-run effect is clearly  $du_t^{SR}/dc_0 = I$ .)

growth.

By equations (4a) and (4b), we find that

*Proposition: 1. An increase in the inflation inertia parameter (I), ceteris paribus, raises the degree of unemployment persistence and makes the long-run unemployment rate more responsive to changes in productivity growth.*

*2. An increase in the inflation responsiveness parameter (R), ceteris paribus, reduces the degree of unemployment persistence and makes the long-run unemployment rate less responsive to changes in productivity growth.*

*3. If unemployment persistence takes the extreme form of hysteresis,  $(I/R) = 1$ , there is a "natural rate of productivity growth":  $\dot{z} = A$ .*

Moreover, given that the long-run unemployment rate is positive, an increase in the inflation inertia parameter raises this unemployment rate, while an increase in the inflation responsiveness parameter reduces it.<sup>11</sup>

Policies designed to reduce labor turnover costs may be expected primarily to reduce the inflation inertia parameter; those aimed at reducing the barriers to the entry of new firms and opening the economy to foreign competition are likely to have their main impact in raising the inflation responsiveness coefficient; while those whose purpose is to enfranchise outsiders or reduce discouraged worker effects may be expected both to reduce the inflation inertia parameter and increase the inflation responsiveness parameter.

#### 4. Some Empirical Evidence

Table 1 summarizes the results from estimating equation (4a) for a number of countries.<sup>12</sup> Observe that the coefficient on productivity growth ( $\dot{z}$ ) yields the inflation responsiveness parameter (R). This

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<sup>11</sup>By (4b), the long-run unemployment rate is positive when  $(A - \dot{z}) > 0$ . Then  $(\partial u/\partial I) > 0$  and  $(\partial u/\partial R) < 0$ .

<sup>12</sup>The results come from OLS estimations, but instrumenting  $\dot{z}$  has no substantive effect on the coefficient values.

parameter, together with the coefficient on lagged unemployment (unemployment persistence coefficient,  $(R/I)$ ) yields the inflation inertia parameter. These two parameter are then used to derive the slope of the unemployment-productivity tradeoff,  $1/(R-I)$ .

Note that the relation between a country's unemployment persistence coefficient' and the slope of its unemployment-productivity tradeoff depends on its inflation responsiveness and inertia parameters. In particular, letting  $k = I/R$  be the unemployment persistence coefficient and  $\kappa = 1/(R - I)$  be the slope of the unemployment-productivity relation,

$$(5) \quad \kappa = \frac{I}{(I-k) \cdot R} = \frac{I}{\frac{(I-k) \cdot I}{k}} .$$

Given inter-country differences in inflation responsiveness and inflation inertia parameters, we cannot expect that countries with the highest unemployment persistence coefficients will necessarily be the ones whose unemployment rates are least responsive to changes in productivity growth.

Nevertheless, Table 1 shows that this is generally the case. For example, from the countries listed, France ranks highest in terms of both unemployment persistence and the responsiveness of unemployment to productivity growth (viz, the highest slope of the unemployment-productivity relation); it is followed by the UK in both dimensions. Japan, Norway, and Sweden all feature low unemployment persistence and comparatively little responsiveness of unemployment to productivity growth. Belgium, Canada, Finland, Germany, and the Netherlands all occupy an intermediate range. The only countries that blatantly do not fit the pattern are the US (with comparatively low unemployment persistence and comparatively high responsiveness of unemployment to productivity growth) and Greece (with the opposite characteristics).

Table 1

Unemployment Persistence and the Unemployment-Productivity Relation  
 Dependent variable:  $u$

	UK	US	GERMANY	JAPAN	FRANCE	NETHERLANDS
Constant	0.007 (2.43)	0.02 (3.85)	0.008 (2.03)	0.007 (4.69)	0.01 (4.23)	0.008 (2.90)
$U_{-1}$	0.95 (23.39)	0.80 (9.5)	0.89 (10.46)	0.79 (13.66)	0.96 (36.16)	0.91 (21.23)
$Z^2$	-0.16 (-1.95)	-0.47 (-4.79)	-0.13 (-2.40)	-0.04 (-4.86)	-0.23 (-4.32)	-0.12 (-2.48)
$\dot{P}_m$		-0.05 (-2.33)		-0.007 (-3.19)		
MA(1)	0.65 (3.26)					0.57 (3.26)
MA(2)						
AR(1)			0.38 (1.93)			
AR(2)						
$\bar{R}^2$	0.94	0.74	0.93	0.91	0.98	0.95
DW	1.94	1.74	1.95	1.95	1.84	1.98
R	6.38	2.11	7.78	22.51	4.28	8.3
I	6.07	1.70	6.95	17.82	4.13	7.6
I/R	0.95	0.80	0.89	0.79	0.96	0.91
$1/(R-I)$	3.23	2.44	1.20	0.21	6.66	1.43

Continued..

Table 1 (Continued)

Unemployment Persistence and the Unemployment-Productivity Relation  
 Dependent variable:u

	CANADA	FINLAND	NORWAY	SWEDEN	AUSTRIA	BELGIUM	GREECE
Constant	0.014 (3.01)	0.01 (5.05)	0.01 (3.16)	0.01 (3.67)	0.005 (2.52)	0.009 (2.14)	0.008 (3.14)
$U_{-1}$	0.85 (13.70)	0.82 (13.95)	0.56 (2.96)	0.62 (5.02)	0.92 (14.05)	0.91 (16.87)	0.89 (17.81)
$\dot{z}$	-0.21 (-2.29)	-0.19 (-4.77)	-0.07 (-1.83)	-0.09 (-2.44)	-0.07 (-2.82)	-0.12 (-1.74)	-0.07 (-2.70)
$\dot{p}_m$			-0.03 (-2.18)	-0.01 (-1.65)			
MA(1)	0.48 (1.09)	0.49 (2.71)		0.63 (2.93)		0.66 (2.87)	0.60 (2.88)
MA(2)							0.62 (2.98)
AR(1)	-0.19 (-0.47)		0.52 (2.34)			0.33 (1.77)	
AR(2)			-0.52 (-3.00)				
$\bar{R}^2$	0.85	0.88	0.54	0.61	0.85	0.97	0.94
DW	1.97	1.99	1.96	1.99	1.64	1.99	1.98
R	4.77	5.12	14.76	10.71	13.41	8.27	15.05
I	4.06	4.22	8.32	6.61	12.34	7.57	13.46
I/R	0.85	0.82	0.56	0.62	0.92	0.91	0.89
1/(R-I)	1.41	1.11	0.16	0.24	0.93	1.43	0.63

T-Statistic in parenthesis

Sample period: 1952 - 1988

Source: OECD data bank



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