Unemployment Shocks and Endogenous Labor Market Institutions[1]

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June 11, 1999

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I. Introduction

Economists who work on European unemployment often point to the large adverse incentive effects of Europe's generous welfare states. The policy implications appear simple, if not always popular with the electorate: cut the welfare state to reduce unemployment. There are two problems with this argument. The first and rather obvious point is that it is bad cost-benefit analysis to recommend cutting a certain policy because it has costs. Because the welfare state provides social insurance, the optimal thing to do, for all we know, could be to increase the generosity of the welfare state. The second problem with this argument is that a basic model of insurance suggests that, following an adverse shock that increases unemployment, policies like unemployment benefits should increase the most in countries which have the more severe incentive problems.

An important literature in public economics examines the optimal provision of unemployment insurance. Important papers include Shavell and Weiss (1979) and Hopenhayn and Nicolini (1997) on how UI benefits ought to be paid over time, Feldstein (1974, 1976) on the effect of UI on layoff and quit behavior and Mortensen (1977) on the effect on job search. In general, however, this literature does not look at the problem of providing unemployment insurance when the level of risk in the environment changes. Changing these models to address these questions is not always feasible. For example, the problem studied by Hopenhayn and Nicolini (1997) is how to achieve a certain level of insurance at minimum cost, so that changing some risk parameters in the problem will not answer the questions we are after. Hansen and Imrohoroglu (1992) present a model showing how costly it is to set the wrong (non-optimal) level of unemployment benefits in a general equilibrium model where there are liquidity constraints and moral hazard. We experimented with a (much) simpler version of that model to see if it could be used to study the determination of unemployment benefits at different levels of risk. The fundamental problem encountered is that the parameters that determine the unemployment rate and that could be used to capture the risk in the environment *also* affect the degree of risk aversion that individuals have. Thus, to our knowledge, it is impossible to disentangle in that model what is happening because individuals have become more risk-averse and what occurs because the environment is more risky.

To our knowledge the first paper which can be used to study the effect of risk on the determination of unemployment benefits is Wright (1986).[2] One drawback of this paper is the fact that there are no incentive effects or, in other words, unemployment benefits do not affect the unemployment rate. This is also the case in Atkinson (1990) where the focus is on tax considerations. In a previous paper (Di Tella and MacCulloch (1995)) we analyze the determination of unemployment benefits in a simple model where incentive effects are present and show some evidence consistent with the idea that unemployment benefits tend to increase when there are positive changes in the unemployment rate. Saint Paul (1996) presents a good review.

If right, this way of modeling labor market equilibrium may change our understanding of unemployment in important ways. For example, a large literature in macroeconomics builds on the idea that one can define the natural rate of unemployment independently of aggregate demand conditions and the current rate of unemployment (Friedman (1968), Phelps (1968, 1994)). The idea is that favorable aggregate demand conditions may produce a low rate of unemployment but that the equilibrium rate of unemployment is determined by the fundamentals of the system, particularly by its labor market institutions.[3] The approach suggested here implies that this distinction is problematic. If unemployment shocks generate changes in the institutions, then it would not be feasible to define the natural rate independently of the current unemployment rate.

Another implication of considering labor market institutions as being endogenous concerns hysteresis models.[4] Recently, Blanchard and Katz (1997) have argued that if unemployment increases unemployment benefits, then we have a way to explain the high persistence of

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[2] Although Wright (1986) is a positive model of unemployment benefit determination.
[3] Friedman (1968) defines the natural rate as *"the level which would be ground out by the Walrasian system of general equilibrium equations, provided that there is embedded in them the actual structural characteristics of the labor and commodity markets, including market imperfections, stochastic variability in demands and supplies, the cost of gathering information about job vacancies and labor availabilities, the cost of mobility, and so on."* See the symposium in the Journal of Economic Perspectives, (1997), 11(1).
[4] Classic papers on hysteresis are Blanchard and Summers (1986) and Lindbeck and Snower (1986).

unemployment shocks, something quite desirable given the European experience on the topic. Again the argument seems to depend on the size of the incentive effects. Presumably, if benefits have very large adverse effects on the unemployment rate, one would be less inclined to increase benefits after a bad shock.[5] This paper shows that the logic of endogenous labor market institutions is slightly more involved. Following a negative shock that increases unemployment, increases in benefits should be higher in countries where benefits interfere in the workings of the labor market the most. The intuition for this seemingly counter-intuitive result is provided by the notion that benefits are set optimally at all times, including the moment just before the shock occurs. Thus, countries where incentive effects of benefits are large have, optimally, lower initial levels of benefits so that increases in insurance have large marginal benefits in the presence of an unemployment shock.

Section II presents a simple model of the economy while section III presents some empirical evidence. Section IV concludes.

II. A Simple Model

Assume an economy populated with risk averse individuals with concave utility function defined over income, $U(.)$, with $U_i>0$ and $U_{ii}<0$ where subscripts denote derivatives with respect to variable i. Individuals cannot save nor insure themselves in private insurance markets.[6] There is equilibrium involuntary unemployment and the government wishes to set up an unemployment benefit program, each period paying b to the unemployed. The program will be funded with a tax equal to T levied on employed individuals who earn a wage w.

We assume unemployment is affected by a shock (with mean zero), e, and by the generosity of the unemployment benefit program, b.[7] Denote the unemployment rate, $u=f(b, e)$.

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[5] One could think of the incentive effects as the coefficient on unemployment benefits in an unemployment regression.

[6] On the role of private information in explaining the failure of private insurance markets, see Chiu and Karni (1998).

[7] For concreteness we can think of a simple search model. The fact that individuals are risk-averse makes it difficult to solve the incentive compatibility constraint in an efficiency wage model.

Each period the Government observes the shock and then sets benefits to maximize the expected utility of a random individual, subject to the possibility that higher benefits may cause higher unemployment and the budget constraint. The problem is to:

$$Max_b \quad (1-u)U(w-T) + uU(b) \tag{1}$$

such that $\quad u = f(b, e) \qquad$ Incentive Constraint

and $\quad T = \dfrac{ub}{1-u} \qquad$ Budget Constraint

This formulation implies the simplest assumption regarding transitional dynamics, namely we assume each period the probability of being employed is *(1-u)* regardless of previous employment history. The same is true for the unemployed.[8] Let the net wage be *W=w-T*.

We study the behavior of this problem around *e=0*. The First Order Condition (FOC) is:

$$(1-u)U_W\left[-\frac{u}{1-u} - \frac{u_b}{(1-u)^2}\right] + uU_b(b) - u_b[U(W) - U(b)] = 0 \tag{2}$$

where subscripts denote derivatives.

When the second order condition holds, the FOC implicitly defines optimal benefits as a function of the magnitude of the incentive effects, *b=b(a)*.[9] Clearly if there are no adverse incentive effects of benefits, marginal utility must be equalized across states and we simply have full insurance.

Inspection of the FOC above suggests that incentive effects would sometimes tend to reduce the optimal level of benefits. There are no general results. We assume logarithmic utility

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Explicitly solving for a search model is simpler, though it still introduces a number of features that are unnecessary for our analysis. For details, see Di Tella and MacCulloch (1995).

[8] Kimball (1994) looks at labor market dynamics assuming benefits are exogenous.

[9] A sufficient condition for the Second Order Condition to hold is *a£c*.

and that the incentive effects are linear. Thus, assume unemployment at each point in time is given by $u=c+ab+e$.

Proposition 1: If utility is logarithmic and incentive effects are linear, the government should set benefits low when there are large incentive effects.

Proof: Compute $db/da<0$, using the implicit function rule on the FOC (2). #

We can also study what happens to the optimal level of benefits when there is an exogenous shock to the unemployment rate. Let the function *F(.)* be equal to the left hand side of (2). Then we know that the $sgn(db/de)= sgn(-F_e/F_b)= sgn(F_e)$, by the implicit function rule. Furthermore $sgn(F_e)$ is equal to

$$\operatorname{sgn}[u_e\ U_b + U_W(-u_e - \frac{a\,b\,u_e}{(1-u)^2}) + U_{WW}(-\frac{b\,u_e}{(1-u)^2})(-u - \frac{a\,b}{1-u}) - a\,U_W\,(-\frac{b\,u_e}{(1-u)^2})] \tag{3}$$

Noting that $u_e=1$, this can be simplified to

$$\operatorname{sgn}[\frac{U_b}{U_W} - 1 + \frac{s\ R}{(1-u)^2}(-u - \frac{a\ b}{1-u})\ ] \tag{4}$$

where $R=b/W$ (the replacement ratio) and $s=-U_{ww}W\,/U_w$ (the Coefficient of Relative Risk Aversion).

Proposition 2: If utility is logarithmic and incentive effects are linear,

a. the government should reduce benefits following the occurrence of an adverse shock if incentive effects are small.
b. the government should increase benefits following the occurrence of an adverse shock if incentive effects are large.

Proof:

Part a. As *a* ®*0*, the FOC implies U_w®U_b and hence *R*®*1*. Furthermore, *u*®*c* and (4), which equals *sgn(db/de)*, becomes

$$\operatorname{sgn}[-\frac{s\ c}{(1-c)^2}], \tag{5}$$

which is negative. Hence *db/de* <0. #

Part b. As *a* ®*4*, benefits must initially be set low. Provided the incentive effects are large enough so that $b<(1+u/(1-u)^2)^{-1}W$, the effect of an adverse shock on benefits is positive. To see this, rewrite the FOC (2) as $-u-ab/(1-u)=aW \log R^{-1}-u/R$. Substituting into (4) shows that *sgn(db/de)* is equal to

$$\operatorname{sgn}[\frac{1}{R}-1+\frac{R}{(1-u)^2}(a\,W\log R^{-1}-\frac{u}{R})\,] \tag{6}$$

since $U_b/U_w=1/R\ (=W/b)$ and $s=1$ for logarithmic utility. Hence *db/de* is positive if

$$b<(1+\frac{u}{(1-u)^2})^{-1}W \tag{7}$$

Hence when $u<0.5$, a sufficient condition for benefits to be increased in the face of an adverse shock is $b<(1+0.5/0.25)^{-1}W=0.33W$. In other words, the replacement ratio must be less than one-third. #

If there are only small (or zero) incentive effects of benefits on unemployment, benefits should decrease due to exogenous adverse shocks to unemployment. The reason is that benefits should be initially set at relatively generous levels (the replacement ratio is close to 1) when *a* is small, and the main impact of the shock is then to raise taxes (via the budget constraint) and reduce the affordable level of benefits.

However, when the incentive effects of benefits on unemployment, *a*, become large so that benefits are initially set at relatively low levels, the optimal response to an unemployment shock may be to *increase*, rather than reduce, the generosity of unemployment benefits.

An Example

Let *w=1* and *c=0.03*. Figure 1 in Appendix I shows how social welfare varies with benefits in the case with small incentive effects, *a=0.002*. The optimal level of benefits is *0.915* and the unemployment rate is *0.032*. Figure 2 shows the impact of a shock to unemployment of size, *e=0.07*. The optimal level of benefits falls to *0.885* and the unemployment rate rises to *0.102*. This result is the consequence of the higher taxes needed to fund benefits after the shock.

Figure 3 shows how social welfare varies with benefits in the case of larger incentive effects, *a=0.02*. The optimal level of benefits is *0.650* and the unemployment rate is *0.043*. Figure 4 shows the impact of a shock to unemployment of size, *e=0.07*. The optimal level of benefits rises to *0.770* and the unemployment rate rises to *0.123* (the optimal replacement ratio rises from *0.670* to *0.863*).

The intuition for the result of this last simulation is as follows: the replacement ratio should be set initially well below unity when the incentive effects of benefits are large. In the face of an adverse shock to unemployment which increases the risk of being unemployed, benefits should then be *increased* since the marginal benefit of more insurance has become greater. In other words, the insurance effect dominates the tax effect.

III. Some Empirical Evidence

Data and Empirical Strategy

Our objective in this section is to take a first look at the evidence. We seek to find out whether there exists any evidence in favor of the predictions of the theory of endogenous benefits by studying the behavior of unemployment benefits in the OECD.

Because unemployment and benefits are endogenously determined it is difficult to provide convincing evidence of the effects discussed in our model. Furthermore the theory results depend on the size of the incentive effects across countries, for which no data are readily available. We do know, however, that the initial level of benefits should be inversely correlated with the size of the incentive effects. This means that, holding the size of the adverse unemployment shock constant, benefits should be expected to increase more in countries where the initial level of benefits is lower. And also that, holding initial levels of benefits constant (to proxy for incentive effects), benefits should increase more in countries where the shock is larger.

Thus, we estimate the following regression:

$$DBenefits(t+)_n = a + b\ Benefits(t-)_n + c\ DUnemployment(t-)_n + m_n \quad (8)$$

where t is the time the shock occurs, $DBenefits(t+)_n$ represents the change in unemployment benefits after the shock, $Benefits(t-)_n$ is benefits just before the shock occurs, $DUnemployment(t-)_n$ is the change in unemployment due to the shock and m_i is an error term (white noise). The subscript n denotes each country observation.

As an adverse shock we choose the oil shock of 1973. Thus our initial level of benefits is taken in 1973 and our measure of the negative shock to unemployment is the change in the unemployment rate between 1973 to 1975. Our dependent variable is the change in unemployment benefits after 1975 (to 1981). Our choice of dates for each variable reflect our concern to have as little overlap as possible to avoid, as much as is possible, simultaneity problems.

Our dependent variable (*Benefits*) is the parameters of the unemployment benefit system recently produced by the OECD. It is available every two years, for odd years. It is calculated as the pre-tax average of the unemployment benefit replacement ratios for two earnings levels, three family situations and three durations of unemployment (see Appendix II for the exact variable definitions).

In contrast to the measure of social insurance used in Rodrik (1998) our measure of unemployment insurance is *not* affected by the amount of unemployment in any country or year. Moreover, it is not weighted, for example, by the composition of unemployment. Importantly, since it covers a variety of typical cases (e.g. single, married with/without a dependent spouse) it is not prone to the weakness of other benefit data that do not reflect a common practice whereby cuts in one type of benefit are simply offset by a corresponding increase in another type. Although our data still have a number of weaknesses (for example, there is no allowance for the fact that, in some countries, governments support the unemployed through subsidies linked to their previous employers rather than through benefits), we believe it represents a significant improvement over previously available benefit data. The OECD produced the data in 1994. Table A in Appendix II provides summary statistics for the regression variables.

Empirical results

Regression (1) in Table B presents our basic regression. It shows that unemployment benefits after the oil shock increased more in countries where benefits in 1973 where lowest. The effect is significant at the 10% level only. It also shows that benefits increased the most in countries where the initial increase in unemployment was largest, though the effect is not well defined. Regression (2) controls for the effect of income and shows similar results. Regression (3) excludes Norway, which was the only country that was a net exporter of oil over the period 1975 to 1981 and so experienced a positive income effect from the oil shock. Although unemployment barely rose from 1.5 to 2.3 per cent over the period 1973 to 1975 (and then fell to 2 per cent in 1981), benefits increased from 7.6 per cent to 29 per cent of wages between 1975 and 1981. In regression (3), the effect of the initial increase in unemployment on the subsequent rise in benefits is significant at the 5 per cent level.

IV. Conclusions

The view that labor market institutions are endogenous has important implications for our understanding of the workings of the labor market. We study the response of unemployment benefits to unemployment shocks in a simple, reduced-form model of unemployment. We find that the largest increases in benefits should occur in economies where the adverse incentive effects of benefits are largest. We also predict that the initial level of benefits should be negatively correlated with the benefit response to an unemployment shock. Using OECD data for the period following the oil-shock we find evidence consistent with this prediction.

Traditionally, Keynesian economics has argued that government spending should be counter-cyclical in order to reduce unemployment. The theory of endogenous institutions argues that spending on policy variables like unemployment benefits should increase to keep the balance between insurance and taxes, even if it means that unemployment rates will rise further.

Appendix I

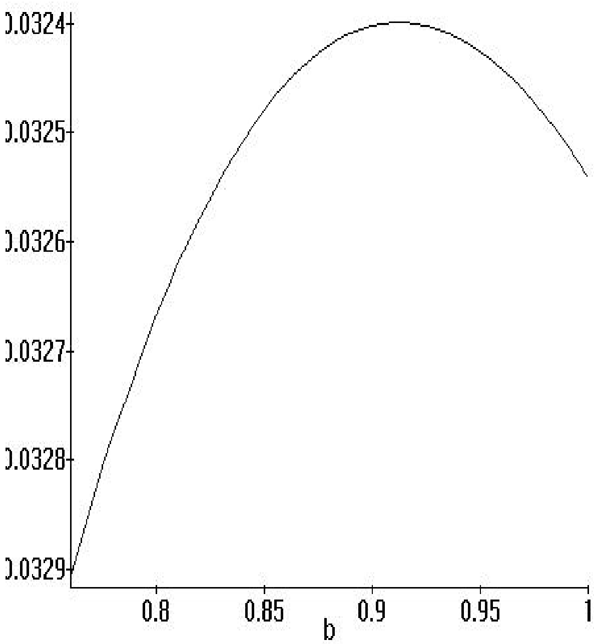

Figure 1: Social Welfare, *S*, as a function of Unemployment Benefits, *b*, when *u=0.03+0.002b*.

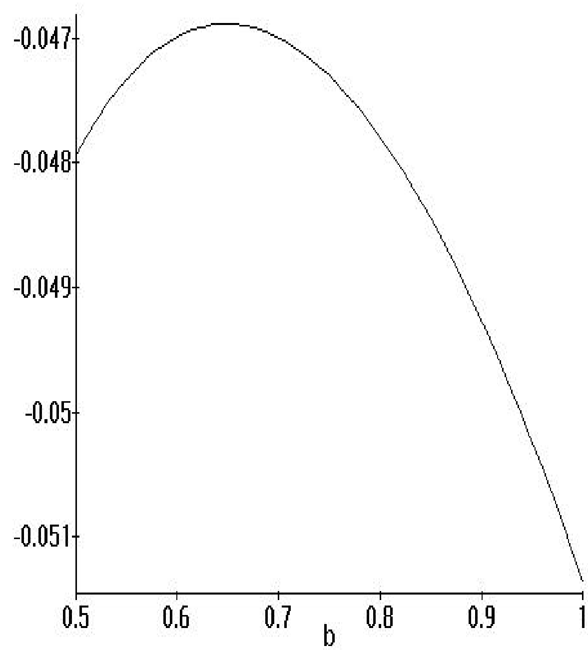

Figure 3: Social Welfare, *S*, as a function of Unemployment Benefits, *b*, when *u=0.03+0.02b*.

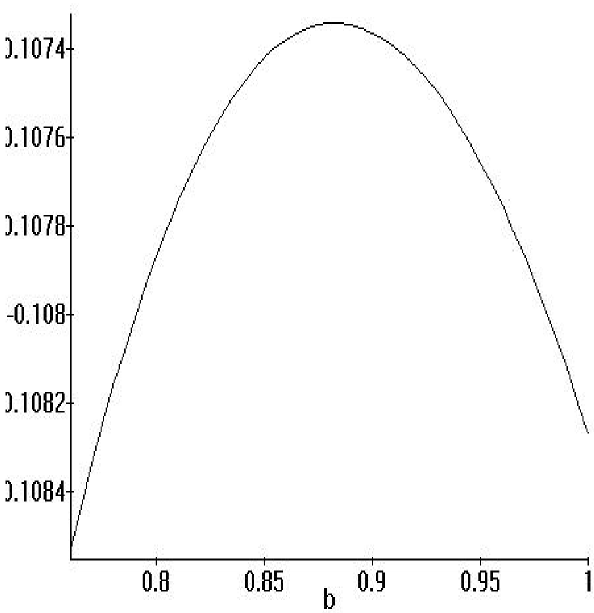

Figure 2: Social Welfare, *S*, as function of Unemployment Benefits, *b*, after a shock when *u=0.03+0.002b+e* and the of the shock to unemployment, *e=0.07*.

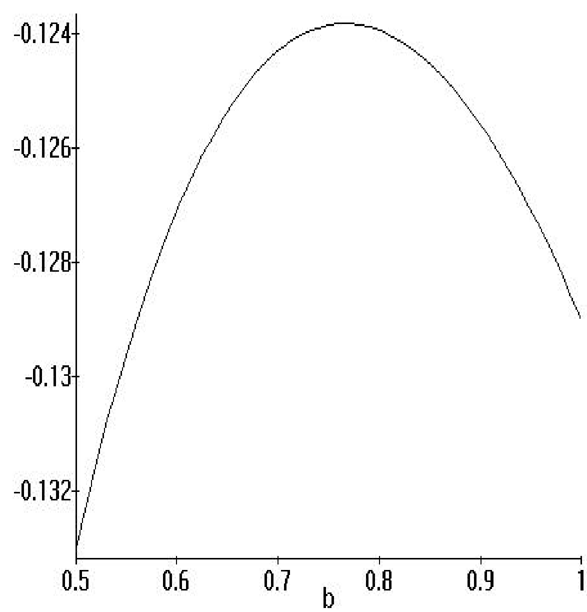

Figure 4: Social Welfare, *S*, as a function of Unemployment Benefits, *b*, after a shock when *u=0.03+0.02b+e* and the size size of the shock to unemployment, *e=0.07*.

Appendix II

Table A: Summary Statistics

Variable	Obs.	Mean	Std.Dev.	Min.	Max.
Δ Benefits 75-81	19	0.035	0.067	-0.046	0.214
Benefits 73	19	0.209	0.134	0.006	0.480
Δ Unemployment 73-75	19	0.014	0.013	-0.007	0.043
GDP per Capita 73	19	8110.3	2678.0	3806	14425

Table B:
The Change in Unemployment Benefits in the OECD after the Oil Shock of 1973

Dependent Variable: Δ Benefits 75-81	(1)	(2)	(3)
Benefits 73	-0.222*	-0.241*	-0.174
	(0.125)	(0.138)	(0.107)
Δ Unemployment 73-75	1.956	2.171	2.229**
	(1.273)	(1.425)	(1.085)
GDP per Capita 73		-2.4e-6	-3.1e-6
		(6.4e-6)	(4.9e-6)
No of Observations	19	19	18
Adjusted R^2	0.09	0.04	0.09

Notes: [1] * denotes significance at the 10% level. ** denotes significance at the 5% level.
[2] Standard errors in parentheses.

Appendix III

Sample of 19 countries:
Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Norway, New Zealand, Sweden, Spain, Switzerland, The United Kingdom and The United States

Definition of the Variables:
Benefits: The OECD index of (pre-tax) unemployment insurance benefit entitlements divided by the corresponding wage (calculated for odd-numbered years). This summary measure estimates the situation of a representative individual. It calculates the unweighted mean of 18 numbers based on all combinations of the following scenarios: *(i)* three unemployment durations (for persons with a long record of previous employment); the first year, the second and third years, and the fourth and fifth years of unemployment. *(ii)* three family and income situations: a single person, a married person with a dependent spouse, and a married person with a spouse in work. *(iii)* two different levels of previous earnings: average earnings and two-thirds of average earnings. See the OECD Jobs Study [1994].

Unemployment: The unemployment rate from the OECD Historical Statistics.

GDP per Capita: Real GDP per capita at the price levels and exchange rates of 1985 (U.S. dollars), from OECD World Statistics [1993].

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