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Rational Institutions Yield Hysteresis

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Abstract

We argue that labor market institutions are endogenous. Our analysis focuses on the government's decision to set unemployment benefits in response to an unemployment shock in a simple, reduced-form model of the labor market. It is found that the largest increases in benefits should occur in economies where the adverse incentive effects of benefits are largest. Adjustment costs of changing benefits can introduce hysteresis in benefit setting and unemployment. Both (very) bad and good temporary shocks (including monetary) can permanently reduce unemployment benefits and the unemployment rate. A desirable feature of the model is that the mechanism yielding hysteresis (which requires a concave utility function) ceases to operate when unemployment tends to one.

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I. Introduction

One of the biggest challenges in economics is to build a model that can explain European unemployment. The ideal model would explain two kinds of asymmetries. The first is an asymmetry over time: it should explain how unemployment could increase after a shock and then remain up for a very long period of time. The second is an asymmetry across countries: the theory should ideally also be able to explain why unemployment dropped in some countries once the shocks disappeared. The experience of the Europe and the US fit these descriptions. In this paper we aim to provide one such theory. It is based on the idea that labor market institutions (in particular unemployment benefits) are determined optimally.

The contrasting labor market performances of Europe and the US have been the subject of much research. The standard explanation is based on institutions. Generous unemployment benefits and strict employment protection rules drive up European unemployment.[1] Of course, this does not *explain* either of the two asymmetries. One of the first papers to focus on this problem was Blanchard and Summers (1986). They argued that when wages are set unilaterally by "insiders", wage (rather than employment) gains will follow the withdrawal of a temporary shock. The "insider-outsider" model of wage determination (Lindbeck and Snower (1988)) used in these models has been criticized however as involving a set of very special features (e.g. Fehr (1990), Hall (1986), Lindbeck and Snower (1990) and Rotemberg (1999)). A large literature has focused on morale and skill decay following joblessness, particularly when it is not so severe as to induce withdrawal from the labor force (see Layard and Nickell (1987)). These *duration effects* are a potential source of unemployment persistence, although rational choice models built on these assumptions do not yield strict hysteresis. Blanchard (1999), for example, has recently emphasized the way shocks and institutions interact to yield unemployment persistence (see also Bertola (1990)).

In some sense, our explanation for (strict) hysteresis is a stronger form of Phelps' (1994) explanation for unemployment persistence where "*unemployment may remain elevated because some (or all) of the driving forces are persisting […], not mainly*

[1] See Bentolila and Bertola (1990), Lazear (1990), Alvarez and Veracierto (1999), *inter alia*. See Gregg and Manning (1996) for a review.

because the volume of unemployment has some inherent persistence" (p.783 Phelps and Zoega (1998)). A key feature of our model is its ability to evaluate the effect of a (very simple) increase in the level of risk in the economy on the optimal level of unemployment benefits. Since unemployment benefits are supposed to provide insurance, the level of risk is a key parameter in the formulation of the problem. A large 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.[2]

To our knowledge the first paper that could, in principle, be used to study the effect of risk on the determination of unemployment benefits is Wright (1986).[3] 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, and discusses other institutions (such as job security provisions).

[2] 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, 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.

[3] Although Wright (1986) is a positive model of unemployment benefit determination.

Recently, Blanchard and Katz (1997) have argued that if unemployment increases unemployment benefits, then we have a way to explain the high persistence of unemployment shocks. 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.[4] This paper shows that the logic of rational 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 positive marginal effects in the presence of an unemployment shock. If there exists an adjustment cost of changing the benefit level, an asymmetry may exist: in a large number of cases, benefits should be increased due to an adverse shock but after it disappears their level should remain unchanged. In contrast to previous models in the literature, the mechanism that yields hysteresis here is no longer relevant when unemployment becomes very large.

A natural implication of this (and other hysteresis) models is that good shocks (including monetary shocks) have permanent effects on unemployment. In other words, it is no longer possible to 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.[5] The approach suggested here implies that this distinction is problematic. If

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

[5] 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).

unemployment shocks generate changes in the institutions, then it would not be feasible to define the natural rate independently of the current unemployment rate.

Figure 1 shows the variation of mean unemployment benefits in Spain as well as real commodity prices between 1969 and 1993. Benefits are measured using the parameters of the unemployment benefit system recently produced by the OECD.[6] Benefits increased rapidly over the period 1973-75 during and after the first oil shock in 1973-74. After a subsequent period of no change, benefits experienced another, larger, increase over the period 1979-83 during and after the second oil shock in 1979-80. After commodity prices returned to their pre-shock values in the mid-1980s there was no corresponding decline in the generosity of benefits. Figure 2 shows the variation of unemployment benefits in the United States during 1969 to 1993. It reveals a different pattern. The largest increase in benefits in the US occurred over the periods 1975-77 and 1979-81, during and after the two oil shocks. However benefits later returned to their pre-shock levels (after the mid-1980s). Our model can help explain these different time series of benefits as optimal responses of governments that are maximizing social welfare functions.

Section II presents a simple model of optimal benefit setting in the economy and section III includes the effect of a adjustment cost of changing the benefit level. Section IV studies the consequences of good and (very) bad shocks and the implications for the definition of the natural rate of unemployment. Section VI 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 or insure themselves in private insurance

[6] 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 the OECD Jobs Study (1994) for details).

markets.[7] The unemployment benefit program pays b to the unemployed and funds it with a tax equal to T levied on employed individuals.

At any point in time we denote the unemployment rate, $u=f(b)+e$. In other words, we assume that the economy is affected by a random aggregate shock, $e \hat{I} [e^l,e^h]$, which has mean zero. Unemployment is also affected by the generosity of the unemployment benefit program, b, with $f_b>0$.[8] This is the equilibrium, for example, in the following simple model of an economy. Assume that firms pay workers the gross real wage, W^g, and competition ensures zero profits: $p(W^g,e)=0$ (where $\pi_{W^g}<0$, $p_e<0$). Assume workers can shirk on their job (in which case their work effort equals 0) but if caught, they are fired. The expected income from being fired equals the probability of staying unemployed ($=a(U)$ where U is the unemployment rate and $a¢(U)>0$) multiplied by the level of benefits, plus the probability of finding a new job ($=1-a(U)$) multiplied by the wage net of taxes and effort costs.[9] The "No-Shirking-Condition" equates the value from exerting effort on the job to the value of shirking: $s(W^g,b,U)=0$ (where $s_{W^g}>0$, $s_b<0$, $s_U>0$). Equilibrium unemployment, u, can be expressed as a function of both the level of benefits and the shock ($u=u(b,e)$ where $u_b>0$, $u_e>0$) and the equilibrium gross wage can be expressed solely as a function of the shock ($w^g=w^g(e)$ where $w_e^g<0$). A linear approximation yields the equilibrium unemployment condition: $u=f(b)+e$.

Each period the government observes the aggregate shock and then sets benefits to maximize the expected utility of a random individual, subject to the budget constraint and the possibility that higher benefits may cause higher unemployment.[10] In other words, the shock is random but known when benefits are set. The problem is to:

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

[8] This can be derived from a variety of standard models of equilibrium unemployment, including an efficiency wage model, a union bargaining model or a search model. The fact that individuals are risk-averse makes it difficult to solve for explicit solutions, so a linear approximation must sometimes be used. For details, see Di Tella and MacCulloch (1995).

[9] Implicit in this definition is the assumption that newly hired workers who have already been caught shirking once are not able to shirk again.

[10] The assumption about the timing ensures that the level of unemployment at any point in time is the relevant measure of "risk" in the economy. Other timings would require us to look at the distribution of e. In essence we are comparing across steady states. Kimball (1994) looks at labor market dynamics assuming benefits are exogenous.

$$\text{Max}_b \qquad S(b,e) = (1-u)U(w^g(e)-T) + uU(b) \tag{1}$$

$$\text{subject to} \quad u = f(b) + e \qquad \text{Incentive Constraint} \tag{2}$$

$$\text{and} \qquad T = \frac{ub}{1-u} \qquad \text{Budget Constraint} \tag{3}$$

This formulation implies the simplest assumption regarding transitional dynamics, namely that each period the probability of being employed is *(1-u)* regardless of previous employment history. The same is true for the unemployed.[11] Let the net wage be $w=w^g(e)-T$.

The First Order Condition (FOC) is:

$$(1-u)U_w[-\frac{u}{1-u} - \frac{bu_b}{(1-u)^2}] + uU_b(b) - u_b[U(w)-U(b)] = 0 \tag{4}$$

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, $b=b(u_b)$. 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.

For simplicity, assume logarithmic utility and that the incentive effects are linear (we also discuss how the results are affected by assuming more general functional forms). At each point in time, unemployment is given by $u=u^f+ab+e$ $(=u^n+e)$. This equals the sum of frictional unemployment, u^f (which we assume to be small, less than 0.1) as well as unemployment arising from the incentive effects of the benefit system, ab, and from temporary shocks, e (which we assume to be less than 0.2).[12]

[11] Alternatively, the same social welfare function (divided by the discount rate) is obtained if we consider the lifetime expected utility of employed and unemployed workers.

[12] A sufficient condition for the Second Order Condition to hold is $a \pounds u^f$.

Proposition 1: The government should set benefits low when there are large adverse incentive effects.

Proof: Compute $db/da<0$, using the implicit function rule on the FOC (4). #

The intuition for this result is simple. At the optimum, the government balances insurance against tax costs to fund the program and the adverse incentive effects that UI introduces, which increase unemployment. When incentive effects are large, the government will try to restrict benefits because, for a given level of insurance, benefits now increase unemployment and the tax burden more. We can also study what happens to the optimal level of benefits when there is an exogenous shock to the unemployment rate.

Proposition 2:

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

Proof: Let the function *F(.)* be equal to the left-hand side of (4). 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:

$$\text{sgn}[u_e\ U_b + U_w(-u_e - \frac{a\,b\,u_e}{(1-u)^2}) + U_{ww}(w_e^g - \frac{bu_e}{(1-u)^2})(-u - \frac{a\,b}{1-u}) - a\,U_w(w_e^g - \frac{bu_e}{(1-u)^2})] \qquad (5)$$

Noting that $u_e=1$, $U_b/U_w=1/r$ where $r=b/w$ (the replacement rate) and $s=-wU_{ww}/U_w=1$ (the Coefficient of Relative Risk Aversion) this expression can be simplified to:

$$\text{sgn}[\frac{1}{r} - 1 - (\frac{r}{(1-u)^2} - \frac{w_e^g}{w})(u + \frac{arw}{1-u}) - aw_e^g] \qquad (6)$$

Part a. As $a \to 0$, the FOC implies $U_w \to U_b$ and hence $r \to 1$. Furthermore, $u \to u^f$ and (6), which equals *sgn(db/de)*, becomes:

$$\text{sgn}\left[-u^f\left(\frac{1}{(1-u^f)^2}-\frac{w_e^g}{w}\right)\right] \tag{7}$$

which is negative (since $w_e^g<0$) . Hence $db/de<0$. #

Part b. As $a \to \infty$, benefits must initially be set low. As $r \to 0$, *sgn(db/de)* becomes:

$$\text{sgn}\left[\frac{1}{r}-1+w_e^g\left(\frac{u}{w}-a\right)\right] \tag{8}$$

which is positive. Hence $db/de>0$. #

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.

Perhaps the more interesting case is when incentive effects are large. Initially, unemployment insurance is set at relatively low levels and the optimal response to an adverse unemployment shock may be to *increase*, rather than reduce, the generosity of unemployment benefits. The easiest way to see this result is by looking at the social welfare function. For simplicity, let $w_e^g=0$ (or be small). Before the shock has occurred, $S(b,0)=u^n\log b+(1-u^n)\log(w-u^n b/(1-u^n))=\log w+u^n\log(b/w)+(1-u^n)\log(1-u^n(b/w)/(1-u^n))$.

When benefits are set low so that $b \ll w$, taxes are low and consequently $S(b,0)\approx \log w+u^n(\log(b/w)-b/w)$ (since $\log(1+x)\approx x$ for small x). In the presence of a shock, $S(b,e)\approx S(b,0)+e(\log(b/w)-b/w)$. The second term has a positive derivative with respect to b, equal to $e(1/b-1/w)$. Consequently if benefits were being set optimally before the shock occurred, well below the wage due to the large incentive effects, there now exists a

positive marginal welfare gain from more insurance. A fundamental aspect of this problem is the concavity of the effect of the shock on the objective function. The smaller is the initial level of benefits, the larger is the gain from adjusting.[13]

Not only does the first derivative of the social welfare function increase when benefits are initially set low, but as the next Proposition states, the concavity of the welfare function also increases.

Proposition 3: Assume that incentive effects are large. The concavity of the social welfare function increases in the presence of the adverse shock: $S_{bb}(b,e)<S_{bb}(b,0)<0$ in the neighborhood of b^0, where $b^0=argmax_b\ S(b,0)$.

Proof: The first derivative of S with respect to b is:

$$S_b = \frac{u}{b} - a\log\frac{w}{b} - \frac{u(1-u)+ab}{w^g - u(b+w^g)} \tag{9}$$

The second derivative is:

$$S_{bb} = -\frac{u}{b^2} + \frac{2a}{b} + \frac{a(u+\frac{ab}{1-u})}{w^g - u(b+w^g)} - \frac{2a(w^g - u(b+w^g)) + (u+\frac{ab}{1-u})(u+a(b+w^g))}{(1-u)(w^g - \frac{ub}{1-u})^2} \tag{10}$$

To see how S_{bb} changes in the presence of a shock, take the derivative of (10) with respect to e to give S_{bbe}. If incentive effects become large so benefits are set low ($=b^0$) then S_{bbe} tends to $-(1/b)^2$ in the neighborhood of b^0. In other words, the concavity of the social welfare function increases in the presence of an adverse shock. #

[13] Although in the present setup the reason why the initial level of benefits may be set low arises from the adverse effects of benefits on unemployment, there could be other reasons. For example, if the value of firms is included in the welfare function, higher benefits may lead to lower profits. Benefits may also be used by the government to change the distribution of income (see Boadway and Oswald (1983)).

An Example

Figure 3 shows how social welfare varies with benefits along the curve SS in the absence of a shock. The optimal level of benefits is set relatively low at b^0. Social welfare is $S(b^0,0)$ at point A. This figure also shows the impact of a shock to unemployment, e. Social welfare now varies with benefits along the curve S′S′. The optimal level of benefits rises to b^e and social welfare equals $S(b^e,e)$ at point C. The concavity of the post-shock welfare function, S′S′, is greater than the concavity of the pre-shock function, SS.

The General Case

In problem (1), rather than assuming logarithmic utility and linear incentive effects, general functional forms were chosen for utility, $U(x)$, and incentive effects, $f(b)$. Proposition 2 applies just provided that one starts from a pre-shock equilibrium in which large incentive effects are associated with low benefit levels and taxes so that the marginal effect of increasing benefits after an adverse shock has first order effect of size, $eU_b(b)>0$. Similarly, Proposition 3 also applies just provided that one starts from a pre-shock equilibrium in which large incentive effects are associated with low benefit levels so that the change in concavity of the social welfare function after an adverse shock has first order effect of size, $eU_{bb}(b)<0$. The fundamental effect that drives the results in both Propositions 2 and 3 comes from the shock to unemployment adding the increasing, concave term, $eU(b)$, to the social welfare function.[14]

III. Optimal Benefits with Adjustment Costs

Assume that there is now an adjustment cost, m, of changing the level of the policy variable, unemployment benefits. This could be due to several factors, including not only

[14] The effect of a shock on a social welfare function should be contrasted with the effect of a shock on a firm's profit function. Blanchard and Fischer (1989) reviews the literature on how shocks lead to state-dependent rules for changing prices in the presence of menu costs (see pp 402-14). For example, let a firm maximize profits, $p(P,e)=PQ$ (where P is price and Q is quantity) subject to a demand function, $Q=f(P)+e$ (where e represents a demand shock). The effect on profits of a positive shock to demand is given by $p(P,e)= p(P,0)+eP$. In other words an increasing and linear term is added to the firm's profit function (which is also the case if the profit function includes a quadratic cost term). By contrast, the results in Propositions 2 and 3 come from the addition of an increasing, but *concave*, term to the social welfare function. As the next section of the paper shows, this introduces the possibility of an asymmetry in the optimal benefit response to shocks in the presence of an adjustment cost of changing the benefit level.

administrative costs but perhaps more importantly the costs of legislative changes and the political or institution process that must be followed to initiate a change. Consequently, the government must pay this cost not only if benefits are increased in the presence of an adverse unemployment shock, but also if it wishes to cut benefits once the shock disappears. To study the optimal path of benefits assume that the government maximizes the discounted value of social welfare where its rate of time preference equals *d*. The problem is:

$$V_t(b_{t-1}) = \max_{b_t,\, b_{t+1},\, \ldots} \mathrm{E}_t \{ \sum_{t=0}^{\infty} \frac{S(b_t, e_t) - m_t}{(1+d)^t} \} \tag{11}$$

subject to

$$u_t = f(b_t) + e_t \qquad \text{Incentive Constraint} \tag{12}$$

$$T_t = \frac{u_t b_t}{1-u_t} \qquad \text{Budget Constraint} \tag{13}$$

$$m_t = \begin{cases} m \geq 0 & \text{if } |b_t - b_{t-1}| \neq 0 \\ 0 & \text{if } |b_t - b_{t-1}| = 0 \end{cases} \qquad \text{Adjustment Costs} \tag{14}$$

where $S(b_t,e_t)=(1-u_t)U(w_t-T_t)+u_tU(b_t)$ and $V_t(b_{t-1})$ is the value function which is the present discounted value of expected welfare at the end of period *t-1* evaluated along the optimal path. As in the previous section of the paper, the shock (e_t) is random but known as of time *t*. Benefits are set at the beginning of each period. The solution to this problem satisfies the Bellman equation:

$$V_t(b_{t-1}) = \max_{b_t} \{S(b_t, e_t) - m_t + (1+d)^{-1} E_t(V_{t+1}(b_t)\} \tag{15}$$

If adjustment costs are zero, the problem reduces to the one-period optimization problem that was studied in the previous section of the paper. In other words, benefits are set each period so as to maximize $S(b_t,e_t)$. If adjustment costs are very large so benefits must be set initially at a single level that cannot be changed in future periods, then the optimal level of benefits solves the problem: $max_b\ E_t\ \{S\ S(b,e_t)/(1+d)^t\}$. For intermediate levels of adjustment costs, hysteresis in benefit setting can arise.

Start from a position where $e=0$ and benefits are being set to maximize social welfare in the current period, which equals $S(b^0,0)$. Consider the effect of a shock to unemployment of size, e. Continue to assume logarithmic utility and linear incentive effects.

Proposition 4 (Hysteresis): Assume that the incentive effects of benefits are large.

a. If adjustment costs are sufficiently small then benefits should be increased in the presence of an adverse shock and reduced to their initial value once the shock disappears.
b. If adjustment costs satisfy $S(b^0,0)-S(b^e,0)<m<S(b^e,e)-S(b^0,e)$ and the rate of time preference is sufficiently high then benefits should be increased in the presence of the adverse shock but not reduced once the shock disappears.

Proof:

Part a. Start from the equilibrium in which adjustment costs are zero and benefits are set so that $b^0=arg\ max_b\ S(b,0)$. Social welfare equals $S(b^0,0)$. In the presence of an adverse shock benefits should be increased to $b^e=arg\ max_b\ S(b,e)$ (see Proposition 2). After the shock has gone the optimal level of benefits returns to b^0. #

Part b. It is simple, but not necessary, to let d®¥`so that only welfare in the current period is valued by the government. In the presence of an adverse shock benefits should be increased from b^0 to b^e, provided that the corresponding increase in social welfare, $DS^e=S(b^e,e)-S(b^0,e)$, exceeds the adjustment cost, m. After the shock has disappeared the gain from reducing benefits to their initial value is $DS^0=S(b^0,0)-S(b^e,0)$. Proposition 3 tells us that the concavity of the social welfare function increases in the presence of an adverse shock. As a result, $DS^e>DS^0$, which can be shown by using second order Taylor approximations (see Appendix 1). Hence if the size of the adjustment cost satisfies $DS^0<m<DS^e$, benefits should be increased in the presence of an adverse shock but not reduced once the shock disappears. #

Consequently, in the presence of an adjustment cost of changing the policy variable, there now exists the possibility of hysteresis in benefit setting. The asymmetry (we adjust upwards but not downwards), arises because the size (and source) of the welfare gain arising from an increase in benefits in the presence of an adverse shock is different from the size (and source) of the gain arising from a reduction in benefits once it has gone. Whereas a shock gives rise to a need for greater insurance because of greater risk in the economy (captured by the term, *eU(b)*, in the social welfare function) once the shock has disappeared reductions in benefits increase welfare only to the extent that they reduce incentive problems and taxes.

Note that our results do not depend on $d \to \infty$. To see this, consider a shock that hits the economy whereby benefits are adjusted accordingly. Assume further that the shock disappears and we know that it will never return (i.e. $e=0$ for all t). Then the government may still want to keep benefits at b^e. By not changing the government saves on adjustment costs today, but loses the social welfare gain of having the "correct" level of benefits in the future. Hence, there will be hysteresis if $m > DS^0[1+(d(1+d))^{-1}]$.[15]

When there exists hysteresis in benefit setting, there must also exist a corresponding hysteresis in unemployment. The reason is that if unemployment benefits are increased in the presence of a temporary shock but not subsequently reduced, then the unemployment rate will also increase but not subsequently return to its pre-shock level. The extent of the rise in unemployment will depend on the size of the incentive effects of benefits. The following example illustrates Proposition 4.

An Example

In Figure 3 benefits are set at the pre-shock level, b^0, where social welfare equals $S(b^0,0)$ at point A. In the presence of an adverse shock to unemployment, e, social welfare now varies with benefits along the curve S′S′. If benefits are kept at their pre-shock level then welfare drops to $S(b^0,e)$ at point B. However if benefits are increased to b^e, which maximizes $S(b,e)$, then social welfare can be increased to $S(b^e,e)$ at point C. In other

[15] Even when the government knows ex-ante that the shock will disappear after one period, it should increase unemployment insurance provided $DS^e - m > DS^0(d(1+d))^{-1}$.

words, social welfare increases by DS^e. After the shock disappears, welfare equals $S(b^e,0)$ at point D. The gain from reducing benefits from b^e to their initial value, b^0, equals DS^0. The welfare gain from increasing benefits in the presence of the shock, DS^e, is significantly larger than the size of the welfare gain from reducing benefits after it has gone, DS^0. If adjustment costs are zero (or small) then along the optimal path benefits should be increased from b^0 to b^e and then subsequently reduced back to b^0.

Now assume that adjustment costs are larger, satisfying $DS^0<m<DS^e$, and the government's rate of time preference is high so that it only values current period welfare. In such a case, it is worthwhile for the government to raise benefits in the period that the shock occurs to b^e but not to reduce them once $e=0$. In the absence of further shocks, welfare remains at point D. The unemployment rate also does not return to its initial value, due to the higher level of benefits ($b^e>b^0$).

Discussion

An empirical prediction of the model is that, other things equal, differences in the government's rate of time preference should explain changes in the unemployment insurance system. A possible way of capturing differences in impatience is to focus on political color, as it is sometimes argued that left-wing parties discount the future more than right-wing parties. It is also possible that the length of the electoral cycle influences the government's discount rate. Then we may expect to see less evidence of benefit hysteresis in those countries that have longer periods between elections.

More importantly, the model suggests that countries may want to develop ways to reduce or avoid the legislative and political adjustment costs of changing the level of unemployment insurance. One way to do this would be to specify explicitly in advance a rule or formula of how benefits are going to be adjusted in the presence of a shock. Several countries actually do this: Canada, Japan and the U.S. have laws *stating* that benefits depend on aggregate unemployment conditions. In the U.S., the Federal/State Extended Compensation Act of 1970 established a second layer of benefits for claimants who exhaust their regular entitlement during periods of relatively high unemployment in a State. This program provides for up to 13 extra weeks of benefits at the claimant's usual weekly benefit amount. The benefits are triggered on "*if the State's insured*

unemployment rate for the past 13-week period is 20 percent higher than the rate for the corresponding period in the past two years and the rate is at least 5 percent." Hence in the U.S. adverse shocks that increase the unemployment rate also increase benefit generosity, by law. If this type of legislation lowers the adjustment costs of changing benefits we may expect the result in Proposition 4(a) to be more likely to apply. In other words, benefits should be increased in the presence of an adverse shock but returned to their initial value once the shock has gone. In fact, the U.S. Federal/State Extended Compensation Act does specify that "*extended benefits cease to become available when the insured unemployment rate does not meet either the 20 percent requirement or the 5 percent requirement*". Figures 1 and 2 illustrate the different paths of unemployment insurance after the oil shocks for both Spain and the US.

IV. Good Shocks, (Very) Bad Shocks and the Natural Rate

In this section, we contrast the predictions of our model with those from previous hysteresis models. A standard prediction in previous models is that if good shocks can permanently reduce unemployment, then the discretionary use of monetary policy can be justified. The same is true in our model, although for somewhat different reasons. In the present model, the key positive effect of a good shock is to reduce the optimal level of unemployment benefits by lowering the level of risk in the economy. In the period that this occurs, there is less demand for insurance and a relatively large welfare gain to be captured by cutting benefits (which further reduces the level of unemployment).[16] Appendix 2 shows more formally how this effect works and is illustrated by the following example:

An Example

In Figure 4 benefits are initially set equal to b^0 at point A. Assume that the government's rate of time preference is high and that adjustment costs, $m=DS^0+c<DS^e$ (where c is a small cost). After the economy has been hit by an adverse shock to unemployment,

[16] The Labour government of Great Britain has recently announced plans for reducing unemployment benefits. The unemployment rate is at record low.

benefits are increased to b^e and social welfare equals $S(b^e,e)$ at point C. In the absence of further shocks benefits remain at b^e and social welfare equals $S(b^e,0)$ at point D. Now consider the effect of a good shock that lowers the rate of unemployment by p. The direct effect of the shock is to increase social welfare to $S(b^e,-p)$ at point E on the curve, S″S″. If benefits remained at b^e and the cost of inflation is sufficiently high so that $S(b^e,-p)-C(p>0)-[S(b^e,0)-C(p=0)]<0$, then the government should not inflate.

However when benefits are cut to b^{-p} at point F social welfare can be increased further by DS^{-p} by paying the adjustment cost, m. Since $DS^{-p}>m$ it is now worthwhile to reduce benefits in the presence of the good shock. After it has disappeared (and in the absence of further shocks) social welfare falls to $S(b^{-p},0)$ on the curve SS. The level of benefits remains low and consequently the unemployment rate is also lower in future periods in the aftermath of the shock.

A different implication of the model from the previous literature concerns the effect of a succession of bad (or adverse) shocks. In a standard hysteresis model, unemployment should increase monotonically with the occurrence of negative shocks. This does not occur in the present model. Two cases are worth analyzing. In the first case, insurance effects of the shocks continue to dominate benefit setting, whereas in the second case tax effects begin to dominate. The first case is illustrated with an example:

An Example

In Figure 5 benefits are initially set equal to b^0 at point A. Let the rate of time preference be high and adjustment costs, $m=DS^0+c<min(DS^{e1},DS^{e2})$ (where c is a small cost and $min(x,y)$ is the mimimum value of the two arguments, x and y). After the economy has been hit by an adverse shock, benefits are increased to b^{e1} and social welfare equals $S(b^{e1},e1)$ at point C. In the absence of further shocks benefits remain at b^{e1} and social welfare equals $S(b^{e1},0)$ at point D. Now consider the effect in a future period of another, but larger, bad shock, $e2>e1$. Social welfare drops to $S(b^{e1},e2)$ at point E. If benefits are increased to b^{e2} then social welfare can be increased by $DS^{e2}-m$ by moving to point F. Once the shock disappears, if benefits remain at b^{e2} then social welfare increases to

$S(b^{e2},0)$ at point G on curve SS. However since $S(b^0,0)-S(b^{e2},0)>m$ it now becomes worthwhile to cut benefits back to b^0 where welfare is maximized at point A.

A second case concerns bad shocks of such large magnitude that tax effects, rather than insurance effects, begin to dominate the government's benefit setting problem (e.g $e>0.2$). First, assume that a bad shock has driven up optimal benefits and, because of institutional adjustment costs, it is optimal not to reduce them once the shock disappears. Now assume that a further bad shock hits the economy that leaves unemployed a large proportion of the labor force. If the size of the shock is sufficiently large then benefits must be directly reduced by the government due to tax considerations. This effect is not related to concavity per se, but rather to the budget constraint that mandates that benefits must be paid out of taxes on wages.

The Natural Rate of Unemployment

Work on the natural rate of unemployment drew a distinction between the short run, when variations in unemployment could affect inflation, and the long run, when unemployment could not vary. In particular, Friedman separated the demand management choices of policy makers from the constraints on those choices. Those constraints included the set of labor market institutions.

Work on hysteresis models mentioned in the introduction (e.g. Blanchard and Summers (1986)) has pointed out that this distinction may be overstated. Even if one rejects the behavioral assumptions in which those models stand, the difficulty in defining the natural rate remains once the generosity of the unemployment benefit system is endogenized. It is only possible for the special case in which benefits are set exogenously to define a natural rate of unemployment, u^n, independently of the temporary, random shocks affecting the economy:

$$u_t = f(b_t) + e_t \quad \Rightarrow \quad u^n = \mathrm{E}(u_t) = f(b_t) \tag{16}$$

assuming E(e_t)=0. On the other hand, if benefits are set to maximize a social welfare function, then the "natural rate" depends on the history of shocks to the actual unemployment rate, via the effect of these shocks on the level of benefits:

$$u^n = \mathrm{E}(u_t) = f(b(e_t, e_{t-1}, e_{t-2}, ...)) \quad (17)$$

In other words, and recalling Friedman's definition of the natural rate of unemployment, the previous results suggest that this definition may no longer yield a unique value once the structural characteristics of the labor market over which the social planner has control, are themselves set optimally.[17]

V. Conclusions

The hypothesis of exogenous labor market institutions is untenable. The case of unemployment benefits is, perhaps, the most telling. The time path of unemployment benefits in the US and Spain shows them increasing sharply in the years immediately after 1973 and 1979 (see Figures 1 and 2). A similar pattern is present in the data for other OECD countries. Those who believe in exogenous institutions must also believe that these countries were incredibly unlucky. The alternative is to develop a theory where institutions are rational. In such a theory, for example, the level of unemployment benefits should be set to balance insurance considerations with tax costs and adverse incentive effects (that may increase unemployment). This is the objective of this paper.

We present a model of rational institutions that can explain hysteresis in the labor market. The government is assumed to set unemployment benefits to maximize social welfare in response to a shock to unemployment. The set up is extremely simple: there is equilibrium unemployment, unemployment benefits introduce incentive effects (increase unemployment), there is a balanced budget rule and the government can observe the shock before setting benefits. Unlike previous models of hysteresis, our model does not require any special assumptions regarding "insiders", nor that the unemployment

[17] He states that it is "*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, …*".

experience affects workers in any particular way. The key assumption is that the individual utility function is concave and that there are "adjustment" costs to changing institutions.

The following results can be established.

1. In the absence of incentive effects, whereby higher unemployment benefits increase the unemployment rate, there should be full insurance. Unemployment benefits, on the other hand, should be set lowest (high) when the adverse incentive effects of benefits are largest (smallest).
2. In response to a shock that increases unemployment, benefits should be increased the most where the adverse incentive effects are more severe. The intuition for this result stems from the fact that benefits are set optimally at all times, including the moment just before the shock occurs. Thus, large incentive effects imply a low initial level of benefits. This means that there are large welfare gains derived from better insurance provision in the presence of an unemployment shock.
3. In the presence of an adjustment cost of changing the level of benefits there may now exist hysteresis in benefit setting and unemployment. In other words, the levels of these variables may rise in the presence of an adverse shock but after the shock disappears they may remain higher than their initial values. The reason for the asymmetry is that a shock adds a *concave* term to the objective function (social welfare). In other words, the value of adjusting changes with the level of benefits. This suggests that the key assumption behind hysteresis is the concavity of the utility function.
4. Temporary good shocks (including monetary) may now have permanent effects on unemployment. The reason is that lower unemployment may make lower benefits optimal. Unlike previous models in the literature, a succession of negative shocks does not reinforce the mechanism yielding hysteresis. In other words, unemployment is bounded above.

As in previous models of hysteresis, the natural rate of unemployment may no longer be able to be defined independently of the current unemployment rate. The approach

suggested here implies that unemployment shocks can generate permanent changes in the optimal design of institutions.

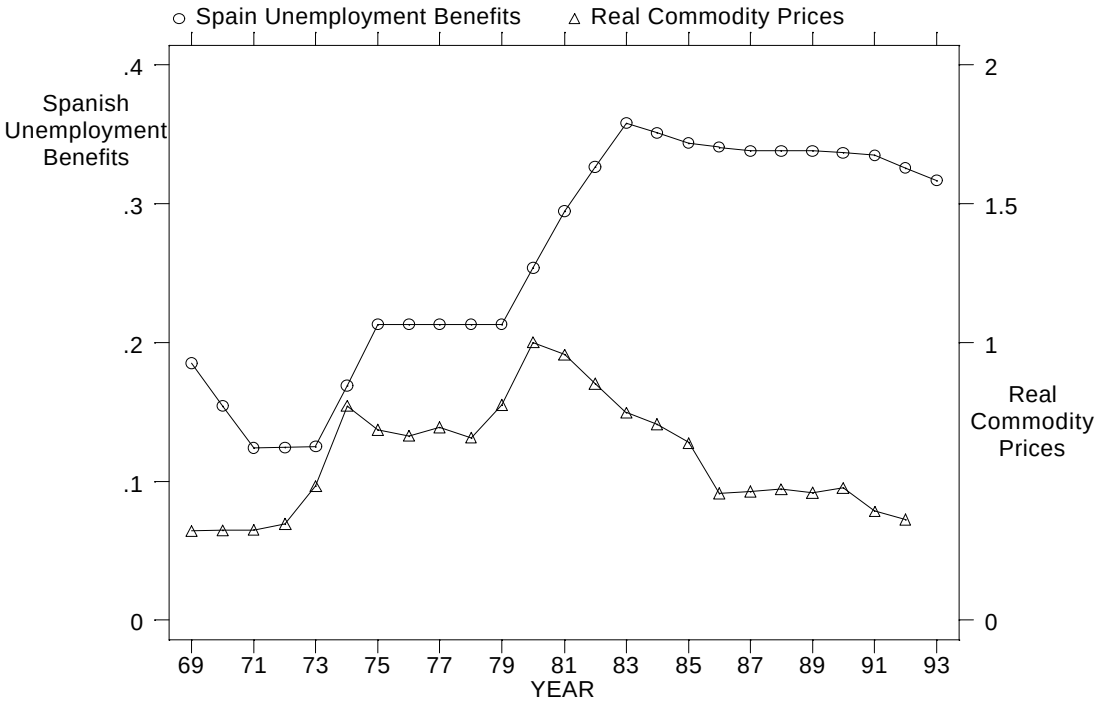

Figure 1: Spain's Unemployment Benefits and Real Commodity Prices from 1969 to 1993.

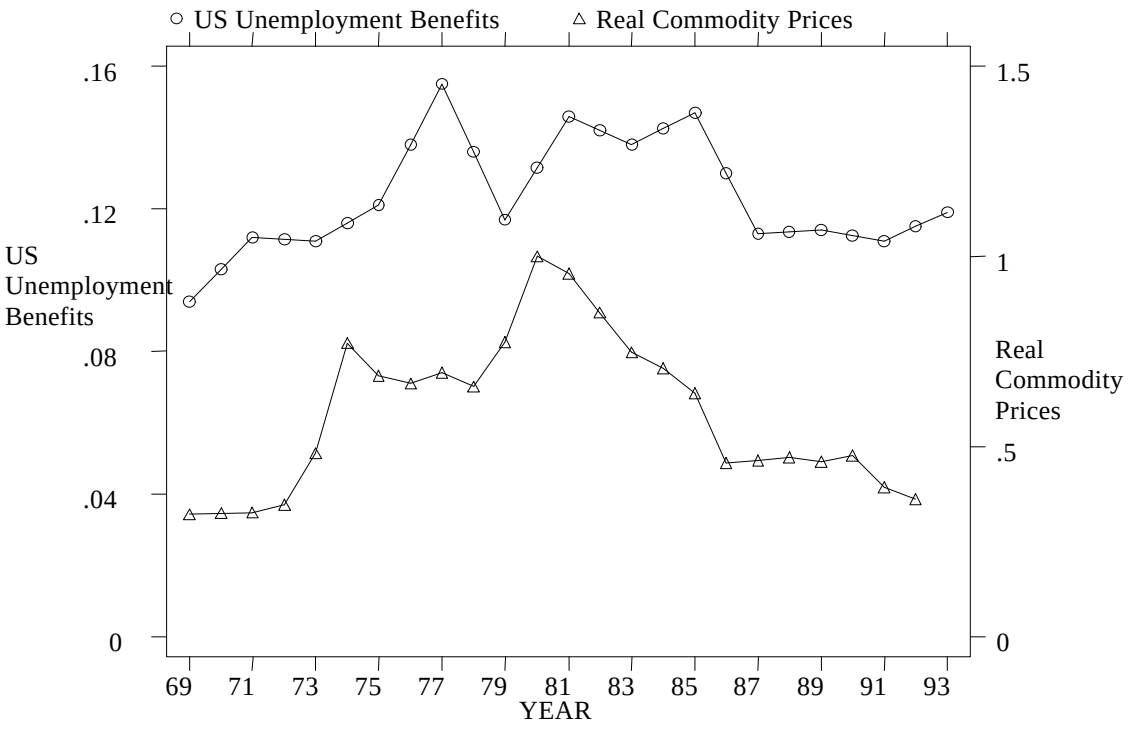

Figure 2: The United State's Unemployment Benefits and Real Commodity Prices from 1969 to 1993.

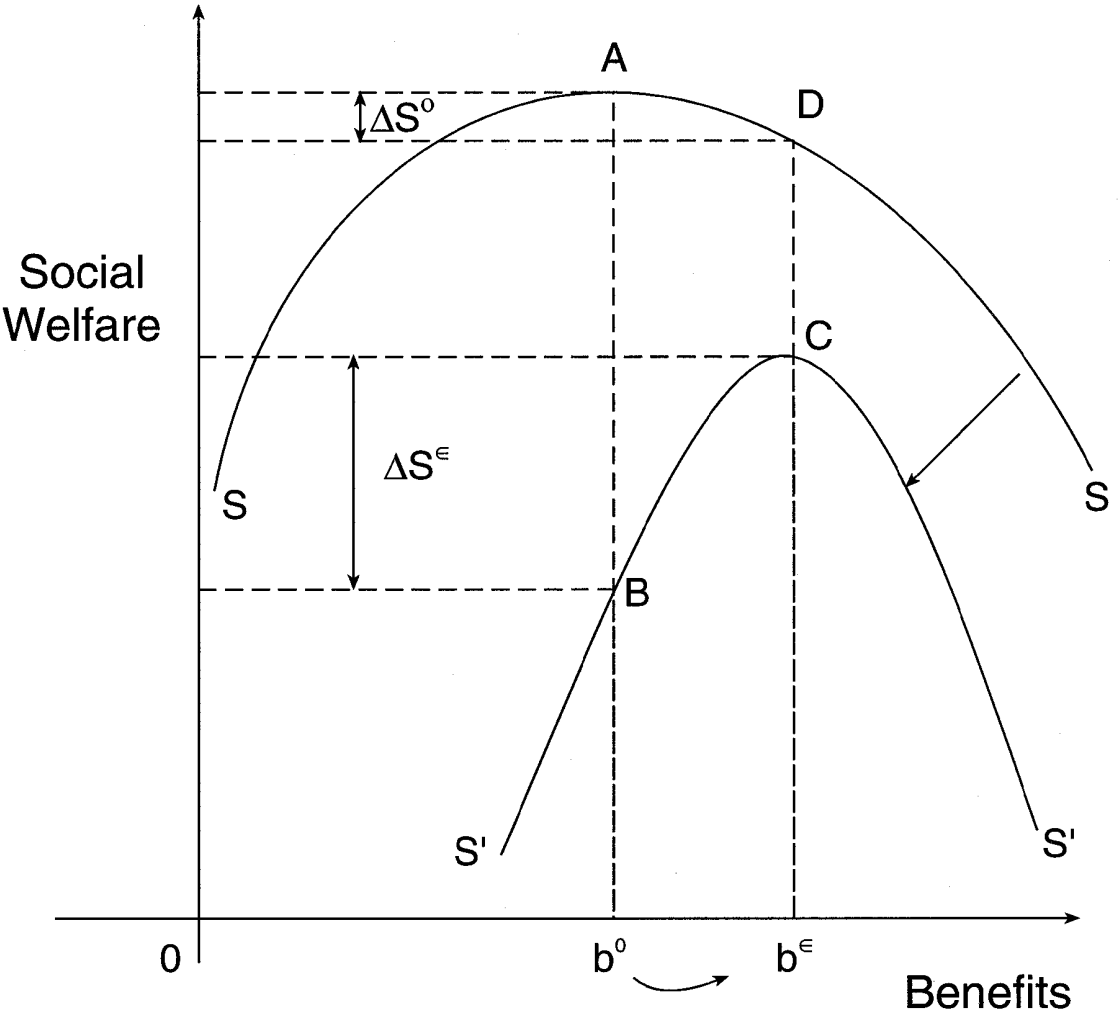

Figure 3: Social Welfare versus the Generosity of Unemployment Benefits Before a Shock (SS) and After an Adverse Shock to Unemployment (S′S′).

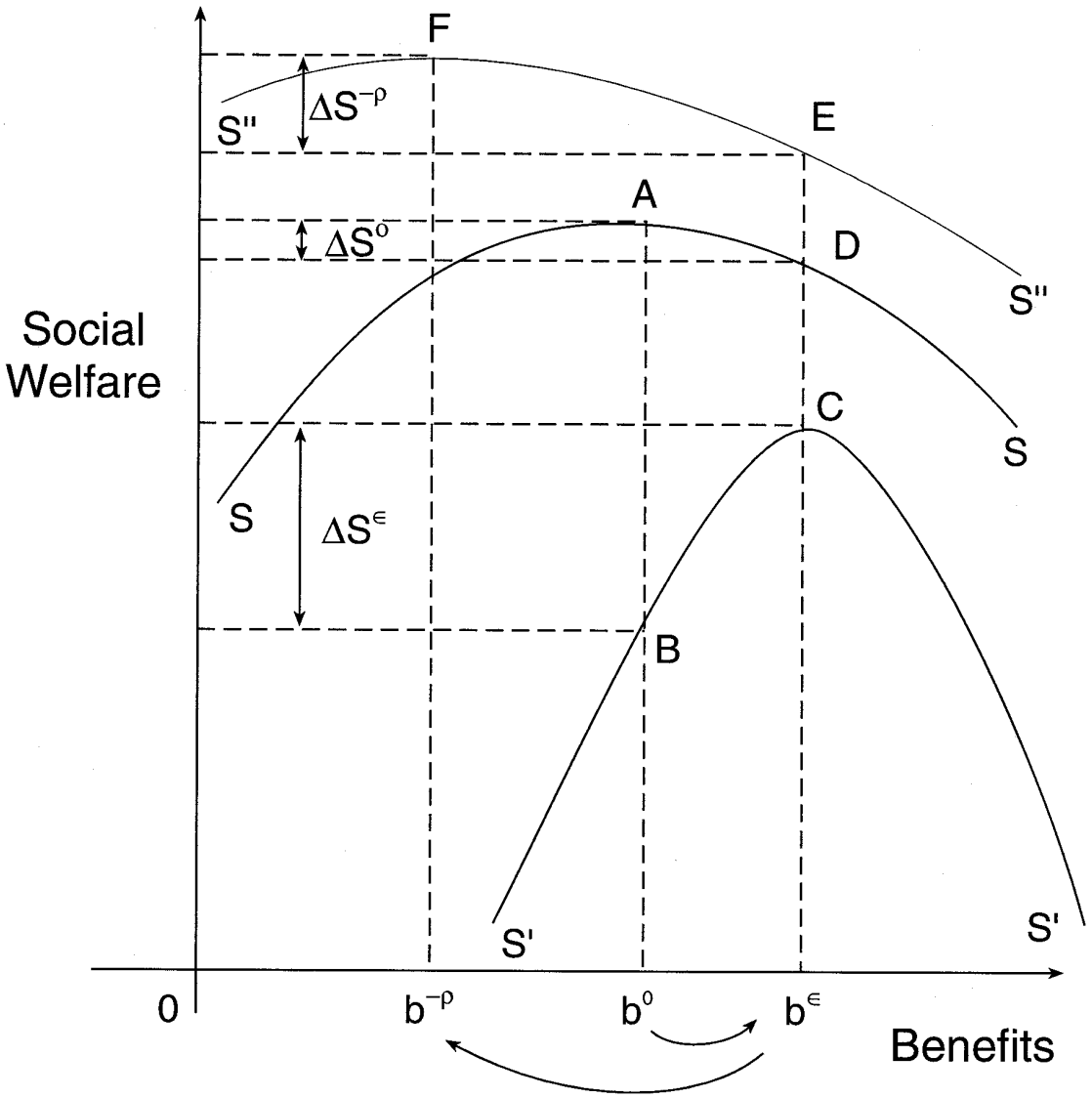

Figure 4: Social Welfare versus Unemployment Benefits Before a Shock (SS), After an Adverse Shock (S′S′) and After a Positive Shock that Reduces Unemployment (S′′S′′).

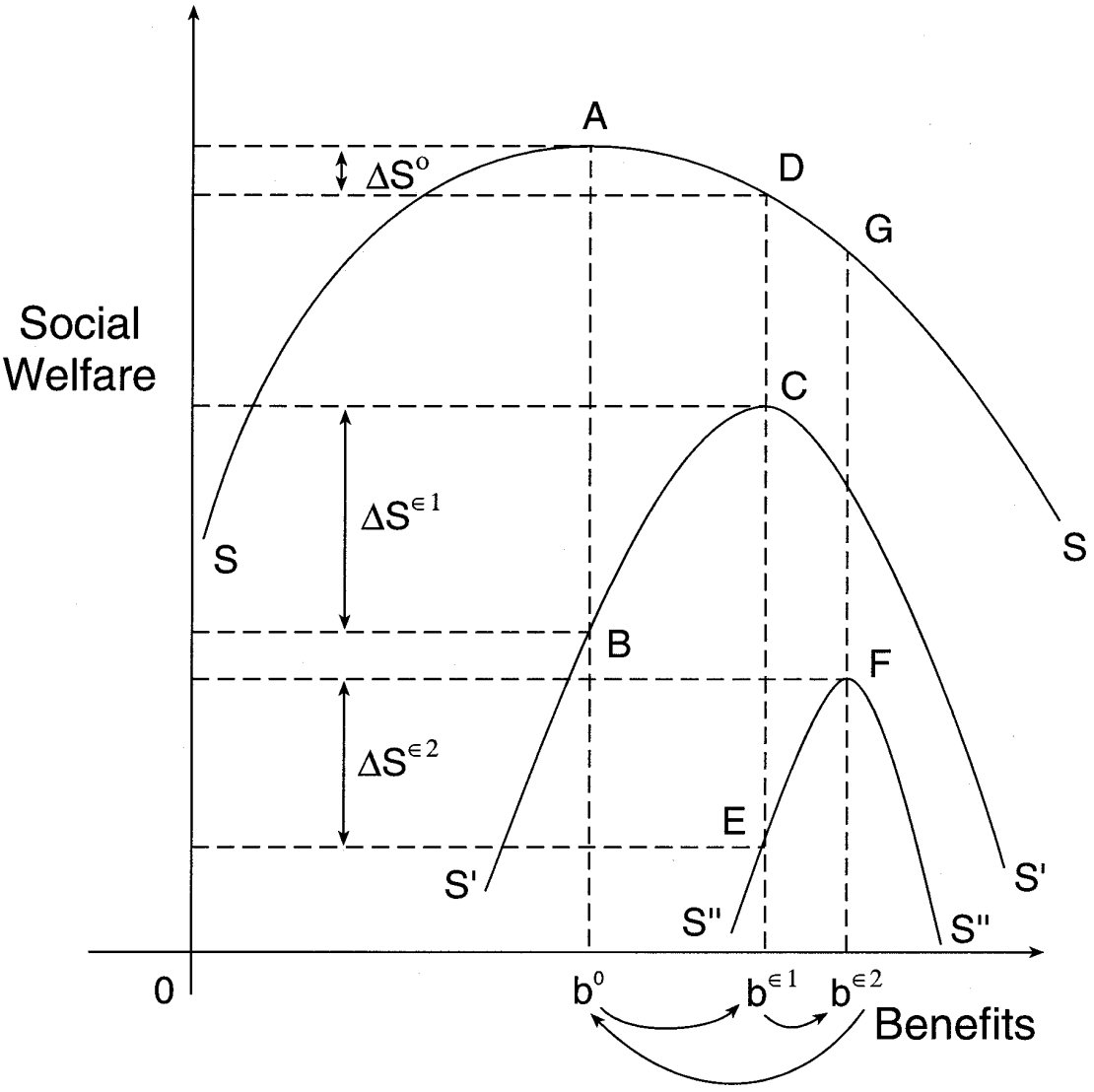

Figure 5: Social Welfare versus Unemployment Benefits Before a Shock (SS), After an Adverse Shock (S′S′) and After a Larger Adverse Shock that reduces Unemployment (S′′S′′).

Appendix 1

We wish to show that $DS^e > DS^0$ where $S_b(b^0,0)=S_b(b^e,e)=0$ and $S_{bb}(b,e)<S_{bb}(b,0)<0$. Using Second Order Taylor Approximations:

$$\Delta S^e \approx S_b(b^0,e)(b^e-b^0) + \frac{S_{bb}(b^0,e)(b^e-b^0)^2}{2!} \tag{A1}$$

and

$$\Delta S^0 \approx -[S_b(b^0,0)(b^e-b^0) + \frac{S_{bb}(b^0,0)(b^e-b^0)^2}{2!}] = -\frac{S_{bb}(b^0,0)(b^e-b^0)^2}{2} \tag{A2}$$

since $S_b(b^0,0)=0$. Furthermore:

$$b^e - b^0 \approx -\frac{S_b(b^0,e)}{S_{bb}(b^0,e)} \tag{A3}$$

and consequently:

$$\begin{aligned}\Delta S^e - \Delta S^0 &\approx -\frac{S_b(b^0,e)^2}{S_{bb}(b^0,e)} + \frac{S_b(b^0,e)^2}{2S_{bb}(b^0,e)} + \frac{S_{bb}(b^0,0)S_b(b^0,e)^2}{2S_{bb}(b^0,e)^2} \\ &= -\frac{S_b(b^0,e)^2}{2S_{bb}(b^0,e)} + \frac{S_{bb}(b^0,0)S_b(b^0,e)^2}{2S_{bb}(b^0,e)^2} \\ &= -\frac{S_b(b^0,e)^2}{2S_{bb}(b^0,e)}[1 - \frac{S_{bb}(b^0,0)}{S_{bb}(b^0,e)}] > 0 \end{aligned} \tag{A4}$$

since $S_{bb}(b^0,e)<S_{bb}(b^0,0)<0$.

Hence:

$$\Delta S^e > \Delta S^0 \tag{A5}$$

#

Appendix 2: The Effect of a Good Shock

Our model suggests that benefits may be cut following a good shock, so there may be a role for monetary policy: to make benefit cuts optimal. Again, it is simple, but not necessary, to let d® `, so that only welfare in the current period is valued by the government.

Assume that monetary policy (equated here to inflation) can achieve temporary reductions in unemployment. Hence when the government attempts to set benefits to maximize social welfare (see problem (11)) it now faces an unemployment rate given by:

$$u_t = f(b_t) + e_t - f(p_t - \mathrm{E}_{t-1}(p_t)) \qquad \text{(A6)}$$

where $\mathrm{E}_{t-1}(p_t)$ is the rational expectation in period *t-1* of inflation in period *t*. Social welfare in the current period can now be expressed as a function of benefits, the sum of the two shock terms and the cost of inflation: $S(b_t,e_t-f(p_t-\mathrm{E}_{t-1}(p_t)))-C(p)$, where $C_p > 0$. If benefits are assumed to be exogenous, then the government can only achieve temporary reductions in the unemployment rate, according to equation (A6), at the price of higher inflation. Consider the effect of a shock that causes unemployment to decrease in the current period by $-p=-f(p_t-\mathrm{E}_{t-1}(p_t))$. If unemployment benefits are exogenous and the cost of inflation is sufficiently high so that $S(b^e,-p)-C(p>0)-[S(b^e,0)-C(p=0)]=m$, where m is a small negative number, the government will not want to inflate. However this result may no longer hold once labor market institutions are set to maximize social welfare.

Proposition 5 (Non-Neutral Money): When benefits are set to maximize social welfare, temporary monetary shocks can have permanent effects on the level of benefits (and the unemployment rate).

Proof: Assume Proposition 4(b) applies so that benefits are increased from b^0 to b^e in the presence of an adverse shock, e, but not reduced to their initial value once the shock has disappeared. In the absence of further shocks, social welfare would equal $S(b^e,0)-C(p=0)$ in all future periods. Now consider the effect of a temporary monetary shock that causes unemployment to decrease in the current period by $-p$ and let $b^{-p} = argmax_b\ S(b,-p)$.

The direct effect of this shock is to reduce social welfare by $m\ (=S(b^e,-p)-C(p>0)-[S(b^e,0)-C(p=0)])$ because the cost of inflation exceeds the benefits from reducing unemployment. However b^e is not the level of benefits that maximizes $S(b,-p)$. When benefits are cut to b^{-p}, social welfare can be increased further by $DS^{-p}=S(b^{-p},-p)-C(p>0)-[S(b^e,-p)-C(p>0)]$ by paying the adjustment cost, m. If $DS^{-p}>m$ then it becomes worthwhile to reduce benefits in the presence of the shock. After it has disappeared (and in the absence of more shocks to unemployment) the level of benefits remains at the lower level, b^{-p}, provided $m>S(b^0,0)-S(b^{-p},0)$. Since benefits are lower, the unemployment rate is also lower in future periods in the aftermath of the shock. As d falls, the level of benefits chosen by the government after the monetary shock will tend to b^0. #

The intuition for this result is that a positive monetary shock temporarily lowers unemployment risk in the economy. In the period that this occurs, there is less demand

for insurance and a relatively large welfare gain to be captured by cutting benefits. Provided this gain now exceeds the adjustment cost of changing benefits, the government can increase social welfare by reducing benefits and keeping them low in future periods (in the absence of further shocks).

Appendix 3: A Numerical Simulation

Let w^g=1, u^f=0.04, a=0.2 and the government's rate of time preference be high so that it only values current period welfare. The optimal level of benefits, b^0, equals 0.13, and the unemployment rate equals 0.07. Social welfare, $S(b^0,0)$, equals –0.14. Consider the effect of an adverse unemployment shock, e, of size 0.04. For simplicity, assume that the gross wage is not affected by the shock. If benefits are kept at their pre-shock level then welfare drops to $S(b^0,e)$=-0.23. However in the absence of an adjustment cost if benefits are increased to b^e=0.32, which maximizes $S(b,e)$, then social welfare rises to $S(b^e,e)$=-0.21.[18] In other words, social welfare can be increased by $DS^e=S(b^e,e)-S(b^0,e)$=0.02. After the shock has disappeared, the gain from reducing benefits from b^e to their initial value, b^0, equals $DS^0=S(b^0,0)-S(b^e,0)$=0.01. Consequently, the welfare gain from increasing benefits in the presence of the shock is twice the size of the welfare gain from reducing benefits after it has gone. When adjustment costs are zero (or small) then along the optimal path benefits should be increased from 0.13 to 0.32 and then subsequently reduced back to 0.13.

Optimal Benefits with Adjustment Costs

Now assume that adjustment costs satisfy $0.01<m<0.02$. In such a case, it is worthwhile for the government to raise benefits in the period that the temporary shock occurs but not to reduce them once e=0. If the adjustment cost equals 0.015 then in the period of the shock, social welfare can be increased by 0.005 (DS^e-m=0.02-0.015) by increasing benefits from b^0=0.13 to b^e=0.32. In the period that the shock disappears, benefits should not be cut since this policy would result in a welfare loss equal to –0.005 (DS^0-m=0.01-0.015). The unemployment rate also does not return to its initial value, due to the higher level of benefits. After the shock has disappeared, the unemployment rate equals 0.10, which is 0.03 higher than its initial (pre-shock) value.

Good Shocks

Start from the position in which benefits have been optimally increased to b^e=0.32 following the adverse shock of size, e=0.04, and not subsequently reduced once the shock has disappeared due to the adjustment cost, m=0.015. Social welfare, $S(b^e,0)$=-0.15. Now consider the effect of a good (monetary) shock that temporarily reduces unemployment by $-p$=-0.02. Social welfare rises by 0.02 as a direct consequence ($=S(b^e,-p)-S(b^e,0)$= -0.13-(-0.15)) not taking account the costs of the associated higher inflation. By cutting benefits to b^{-p}=0.07 in the period of the shock, social welfare can be further increased by 0.01 ($=DS^{-p}-m=S(b^{-p},-p)-S(b^e,-p)-m$=-0.105-(-0.13)-0.015). In the absence of further shocks to unemployment, benefits will permanently remain at this lower level. Unemployment will also remain low, equal to 0.05, compared to its pre-shock value of 0.10.

[18] The optimal replacement rate rises from 0.13 (pre-shock) to 0.33 (post-shock).

A Succession of Bad Shocks

Start from the position in which benefits have been optimally increased from b^0=0.13 to b^{e1}=0.32 following the first adverse shock of size, *e1*=0.04, and not subsequently reduced once the shock has disappeared due to the adjustment cost, *m*=0.015. Social welfare, $S(b^{e1},0)$=-0.15. Now consider the effect of another bad, but larger, shock to unemployment of size, *e2*=0.16. If benefits are not changed then social welfare drops to $S(b^{e1},e2)$=–0.45. However if benefits are increased further to b^{e2}=0.46, which maximizes *S(b,e2)*, then social welfare can be increased by 0.005 ($=DS^{e2}-m=S(b^{e2},e2)-S(b^{e1},e2)-m$ =-0.43-(-0.45)-0.015). In the period that the second shock disappears, it becomes worthwhile to cut benefits back to their initial level, b^0=0.13, since the gain from doing so, even after paying the adjustment cost, is positive. It equals 0.015 ($=S(b^0,0)-S(b^{e2},0)-m$=-0.14-(-0.17)-0.015=0.015). Unemployment also returns to its initial level, equal to 0.07.

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