A STUDY ON HYSTERESIS IN NEW KEYNESIAN ECONOMICS

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Ⅰ. Introduction

In dynamic models with hysteresis, the equilibrium to which the economy converges is not invariant to the path followed to reach it. Indeed, the actual behavior of the system affects the equilibrium position, which accordingly is no more an immutable attractor. This property proved popular with many economists, for its possible application to the analysis of unemployment behavior in the eighties. The data for most industrialized countries show that the unemployment rate has significantly increased in the last two decades and, moreover, the recovery of the second half of the eighties did not result in markedly decreasing unemployment rates. Yet, it was not the presence of high unemployment that was puzzling — indeed, there have been plenty of adverse shocks in the last two decades or so, namely the two oil price shocks and the widespread adoption of disinflationary policies.

Hysteresis is a precise concept if we take its formal definition However, the term has become very fashionable since the second half of the last decade, and has been used very loosely — quite

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often to mean a situation of strong dynamic persistence. For this reason, this paper start with some discussion of what we mean by hysteresis: the concept is examined more closely, and the implication of hysteresis in unemployment for standard Keynesian analysis are outlined.

Ⅱ. The Concept of Hysteresis

1. What does hysteresis mean?

In non-linear dynamic models, hysteresis can be generated in a wide ranges of models with different features, for example, when there are discontinuities with bands of inaction, as in the case above, or when there are asymmetries in behavior, with different reaction to positive and negative shocks. For hysteresis to take place, very precise conditions can be formulated in this case : hysteresis can be obtained only with point restrictions on the values of the parameters of the model. Consider a dynamic linear model in discrete time, and take a simple one-dimensional case :

$$Y_t = dY_{t-1} + X_t$$

where Y_t is the endogenous and X_t the exogenous variable. If $d \neq 1$ we have the standard a hysterical case. Here the steady-state equilibrium-defined by $Y_t = Y_{t-1} = Y^*$ – is

$$Y^* = \frac{X^*}{(1-d)}$$

where X^* denoted the steady-state value of the variable X. In this case, Y^* is unique and independent of the path followed by the exogenous variable X, for the determination of the equilibrium position only the steady-state level X^* matters. If the stability condition $|d| < 1$ is satisfied, the system converges over time to this unique stationary equilibrium.

Hysteresis occurs only when a dynamic system of difference equations possesses one or more unit roots. In our one-dimensional case, we have hysteresis when $d = 1$ Then, provided that the existence requirement $X_t \rightarrow 0$ as $t \rightarrow \infty$ is satisfied, the solution to the equation is

$$Y^* = Y_0 + \sum_{t=0}^{\infty} X_t$$

Indeed, the steady-state value of Y is not unique and Y^* will actually upon the path of X. Moreover, this formula makes it clear how any temporary disturbance to X will have a permanent effect on Y.[1]

We focus here on hysteresis in (un)employment. Hysteresis, however, is relevant in other areas as well. For example, Georgescu-Roegen(1967) introduced hysteresis in the theory of consumer behavior : the preferences of an individual change in response to his consumption experience, that is, to his continuous adjustment to changing price and income conditions. The permanent change in market structure shift the relationship between the exchange rate and trade flows. this suggests the possibility that if the currency behavior triggers hysteresis effects, the country might not be able to return to its trade balance simply by reverting to the original exchange rate; Large temporary shocks may bring about a change in the equilibrium exchange rate.[2]

2. Implications of hysteresis for Keynesian analysis

The implications of hysteresis for the traditional Keynesian analysis are now outlined, and the crucial question is addressed of what kind of microeconomic foundations can be found for hysteresis in unemployment.

Let us start with hysteresis in the framework of the textbook phillips curve model.[3] Take a standard formulation thereof :

$$\dot{P}_t = \dot{P}^e_t - a(u_t - u^*_t) \quad \cdots\cdots (1)$$

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1) Similarly, in system of Linear differential equations with constant coefficients($\dot{x} = Ax - z$) hysteresis is present when $|A| = 0$, that is, when A has one or more zero eigenvalues. Giavazzi and Wyplosz(1985) state the conditions under which for any set of initial conditions, a unique stationary equilibrium may be directy computed

2) See Baldwin(1988), Baldwin and Krugman(1989), Dixit(1989) and Krugman(1989). More general remarks on investment decisions can be found in the survey by Dixit(1992).

3) The implications of hysteresis within the traditional phillips curve framework have been discussed by various authors, such as Hargreaves Heap(1980), Buiter and Gersovitz(1981), Buiter and Miller(1985), Sachs(1986), Cross(1987) and Gordon(1989).

where $\dot{P}_t$ and $\dot{P}^e_t$ are the actual and expected rates of inflation respectively, u_t is the actual rate of unemployment and u^*_t is the natural rate of unemployment or the more empirically oriented concept of NAIRU. Clearly, $u^*_t = cx_t$, where x_t is a vector of relevant variables.[4] In the steady-state equilibrium $\dot{P}_t = \dot{P}^e_t$ and $u_t = u^*_t$. In the short-run, fluctuations in aggregate demand may affect u_t because of nominal rigidity, sluggish expectations or misperception, but then the system returns to a unique real equilibrium.

Hysteresis can arise when u^*_t depends on the lagged unemployment rate u_{t-1} in addition to its traditional determinants represented by x_t. The natural rate automatically follows the path of the actual unemployment rate

$$u^*_t = u_t + cx_t \quad \cdots\cdots (2)$$

Substituting (2) in (1) results in

$$\dot{P}_t = \dot{P}^e_t - a(u_t - u_{t-1}) + a\ cx_t$$

In this framework, inflation depends only on the change in unemployment, not on its level as in the previous case. When the steady-state conditions $\dot{P}_t = \dot{P}^e_t$ and $u_t = u_{t-1}$ are imposed, the existence requirement $x_t \rightarrow 0$ as $t \rightarrow \infty$ is obtained with no further restrictions on u. There is no longer a unique steady-state equilibrium. The first author to apply the notion of hysteresis in a natural rate model was Phelps, who suggested that equilibrium unemployment may depend on fluctuations in actual unemployment.

In this sense, hysteresis leads to strong conclusions for Keynesian Economics, as the economy can shift from one equilibrium to another. If fluctuations in aggregate demand affect the actual employment level, they permanent effects : without further policy actions, both high and low unemployment situations represent equilibrium positions of the economy.

Now, returning to (2) note that a unit coefficient is used for u_{t-1}. In fact, if a different

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4) Friedman's definition of the natural rate of unemployment in his presidential address(Friedman, 1968, p.8) has been quoted in chapter 1. As stressed by Friedman, the natural rate is not a constant, but rather a function of structural characteristics of the labor and commodity markets. As far as the NAIRU is concerned, it is generally assumed to depend on social and economic variables(Layard, Nickell and Jackman (1991)).

specification is adopted, like

$$u_t^* = du_{t-1} + cx_t$$

no hysteresis arises anymore. The steady-state equilibrium is unique and the economy moves slowly towards it. This is another case of persistence in unemployment, which is different from that associated with deviations of inflation from its expected values, and is not necessarily linked to the existence of price or expectational sluggishness. In the description of models of this kind, the word hysteresis is sometimes used, while, strictly speaking, it seems maybe better of talk of persistence: the steady-state equilibrium configuration $\dot{P}_t = \dot{P}_t^e$ and $u_t = u_{t-1} = ut^*$ is still unique.

Drazen(1985) analyses the working of a mechanism like that in an intertemporal optimization model. In the case where a training period is required to obtain skilled labor. Drazen explicitly shows that a temporary period of low economic activity, even if perceived as temporary, will lover potential output well often the downturn is over.

Ⅲ. Hysteresis in Insider-Outsider Models

We considered the insider-outsider theory and focused in particular on the derivation of the involuntary unemployment equilibrium result — at the prevailing wages, the unemployed would be better off being employed than remaining unemployed, but they are unable to find jobs. We now want to examine these implications : if insiders have some market power in negotiation over wages, then temporary shifts in the aggregate labor demand relation may give rise to permanent changes in the level of (un)employment. A major contribution of the insider-outsider theory lies in its account of the sources of insider power : insider power derives from labor turnover costs of various kind-hiring, training and firing costs, but also costs arising from non-cooperation and harassment activities, and from effort reaction to labor turnover.

The structure of the model is very simple. A singly firm and its insider workforce are considered. There are three key element of the model : the membership rule, the labor demand relation, and the wage-employment setting rule.

We assume that in each period there are L^m insiders. In the static models, L^m was taken as given; here, instead, we focus on the determinants of the size of the insiders' group. For simplicity, we impose here the strongest link between membership and employment behavior:

$$L^m = L_{-1} \quad \cdots\cdots (3)$$

where L_{-1} is employment level in the previous period. Membership of the insiders' group is acquired (lost) immediately by employed (unemployed) workers.

Labor demand is given by

$$L^d = L(w)\varepsilon \qquad L' < 0 \quad \cdots\cdots (4)$$

where w is the real wage and ε is a random shock — which for simplicity is a multiplicative shock, taken as a generic shift in the labor demand curve. The analysis focuses on the effects of a temporary change in ε. In this formulation, ε can be interpreted directly as supply-side shock. To examine the effects of demand shocks, more general formulation of the labor demand relation in imperfectly competitive markets are required. Insiders are offered jobs before the unemployed, but all insiders are treated symmetrically; thus, seniority rules are excluded. Insiders are assumed to set the wage rate in order to maximize the expected utility of the representative member. Employment and wage decisions are taken within a one-period model and the optimization problem can be specified as

$$\max \ \mu = sU(w) + (1-s)U(\overline{w}) \quad \cdots\cdots (5)$$

subject to

$$L^d = -L(w)\varepsilon \qquad \text{and} \qquad \overline{w} \le w \le \overline{w} + k$$

Here, we denote by s the probability of being employed; $U(w)$ is the utility derived from real wage when employed in the firm, and $U(\overline{w})$ when not employed. The reservation wage $\overline{w}$, the income obtained outside the firm, is given — an assumption which is typical of the pure insider model : outside factor could enter through this term, but they are assumed exogenously given. The parameter k measures the firm's turnover cost, the cost of replacing an insider an entrant.5)

5) In this basic formulation, turnover costs are assumed not to affect labor demand. A possible justification

The maximization of expected utility is subject to a labor demand constraint which represents an 'absolute profitability constraint' — with perfect competition, it means that the wage cannot exceed the marginal productivity of labor. Instead, $w \leq \overline{w} + k$, is the 'relative profitability constraint' : it requires that an insider should remain at least as profitable as on outsider, otherwise all the workforce will be replaced. Accordingly, $\overline{w} + k$ is the highest wage rate that insiders can obtain without being replace by outsider : the insiders' power is bounded from above. In conclusion, $\overline{w}$ and $\overline{w} + k$ determine the range of wage that can be set.

1. Insider behavior with non-predetermined wage

When the is set after realization of the shock, the probability of being employed is given by L/L^m, if the standard assumption is made that, when L/L^m, the workers to be laid off are chosen by random drawing — with the same risk of job loss imposed on each worker. Expected utility is then specified as

$$\mu = \frac{L}{L^m} U(w) + \left(1 - \frac{L}{L^m}\right) U(\overline{w})$$

However, once all insiders have a job, the utility for the representative member of the insiders' group becones simply

$$\mu = U(w)$$

As stressed by Carruth and Oswald(1987), this means that the indifference curves for this preference structure are kinked at an employment level equal to current membership. To the left of that point, the indifference curves have a negative slope in the wage-employment space reflecting the willingness to trade off wages for employment.

Given this specification of the insiders' utility function, the optimization problem can deliver an interior optimal solution(Fig. 1(a)) characterized by the following first-order condition.

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of this hypothesis is interpreting turnover costs as the costs of replacing the insider workforce with outsider, but not as the costs of changing the size of the workforce. See Lindbeck and Snower(1988, 1990) for a static analysis of the effects of turnover costs on both demand and insider's market power.

$$\frac{L(w)\varepsilon}{L^m}U(w)+\frac{L'(w)\varepsilon}{L^m}(U(w)-U(\overline{w}))=0 \quad \cdots\cdots (6)$$

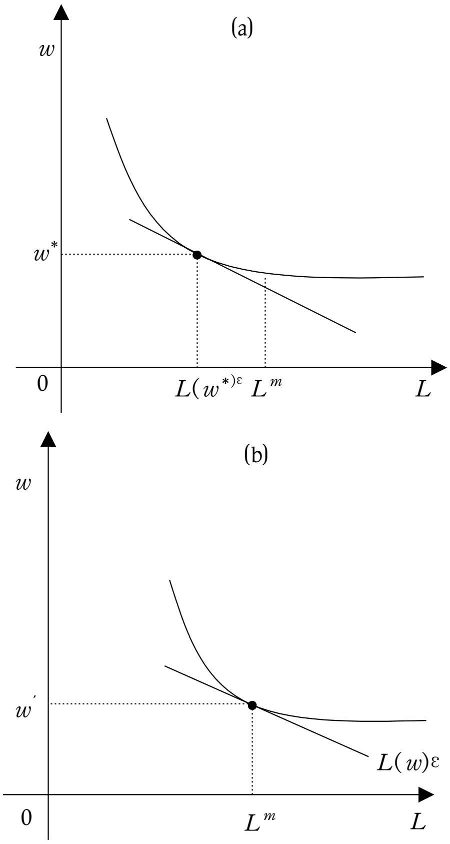

Figure 1 Kinked indifference curve and the optimal wage : (a) interior solution : and (b) corner solution.

The wage is increased until the first term, which measures the benefit from a higher wage, is balanced at the margin by the second term, the cost due to the increased risk of unemployment. Another solution is however possible : a corner solution at the risk $(L=L^m)$of the indifference curve(Figure 1(b)). In any case, there is no incentive to set a wage rate such that $L>L^m$.

The union chooses the optimal wage, and the corresponding level of employment is determined by the firm on the labor demand. The position of the latter depends on the value of ε. Accordingly, we can specify the solution of the model as a function of ε. The first-order condition for an interior solution(6) is independent of ε; and so the optimal real wage w^* is invariant to ε

(McDonald and Solow, 1981). The interior solution — $w = w^*$ and $L^d = L(w^*)\varepsilon$ — holds for $\varepsilon < \varepsilon^*$, where ε^* is the value at which all insiders are employed : $L(w^*)\varepsilon^* = L^m$. For $\varepsilon \geq \varepsilon^*$ this is not true anymore, since insiders have no incentive to expand employment beyond L^m : in this case they choose w', such that $L(w')\varepsilon = L^m$. In figure 2(line WE), for a given L^m, the optimal wage and the corresponding level of employment have been represented for all possible positions of the labor demand(for each value of ε). The curve obtained is called the wage employment preference path and has a reverse L- shape up to $w = \overline{w} + k$. The horizontal part of the curve is relevant for $\varepsilon \leq \varepsilon^*$, as the optimal solution in this case is a constant real wage; while the vertical part holds for $\varepsilon \leq \varepsilon^*$, with full employment of insiders and a wage level set to guarantee this result.

Changes in the size of the insiders' group L^m shift the kink in the indifference curves in figure 1. indeed, for $L^m < L^m$ the locus of the kinks shift leftwards and a new wage employment preference path can be drawn(line WE′ in figure 2). The horizontal part of the curve is unaffected, whereas the vertical segment starts from a lower level of employment $L = L^m$.

We are interested in the analysis of the effects of a temporary adverse shock. In the initial equilibrium, the labor demand is $L^d = L(w)\varepsilon^*$ and $L = L^m$(point A in figure 2). At time t, a negative shock shift the labor demand to $L^d = L(w)\varepsilon^*$ and the insiders optimally choose a reduction in employment to L(point B). According to (3) the unemployed soon become outsiders and have no role in wage setting in the nest period — when, accordingly, $L^m = L$. As we have seen, any change in the size of the insiders' group shift the position of the kink in the group's indifference curve and generates a new wage employment preference path(Figure 2 line WE′). This suggests the possibility of asymmetric behavior : if 'preference' change irrevocably at some point, the recovery may not merely be an mirror image of the recession(Carruth and Oswald, 1987).[6] Once the shock disappears, the labor demand cure shifts outwards to its original position $(L^d = (w)\varepsilon)^*$. Then the remaining insiders will be able to raise wage without facing the threat of dismissal : they choose point C on the vertical segment : a wage increase takes place with no effects on employment.

6) The change in the preference structure of the insiders' group, however, is due not to a change in the representative agent's tastes, but in the number of individuals whose interests are relevant.

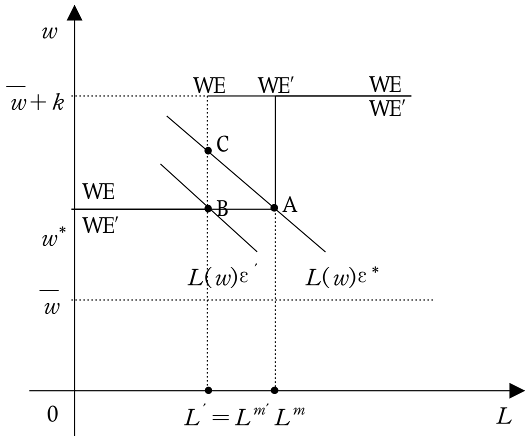

Figure 2 Hysteresis in the pure insider model with non-predetermined wage.

We have obtained a pure hysteresis result : after the temporary shock, the labor demand is back at the original level, but employment has not returned at the intial value $L = L^m$.

The aggregate employment level can be simply obtained by aggregation over firms, each acting independently. The equilibrium employment rate here is not uniquely determined by preference, technology and endowment of agent : it depends also on the size of the incumbent workforce. There is historically determined — it depends on the past history of actual employment. Therefore, this economy does not contain a natural rate of unemployment, and there is no convergence to an equilibrium configuration defined only by fundamentals.

The asymmetries in behavior described above will disappear once the relative profitability constraint is binding $(w = \overline{w} +)k$. At this wage rate the shock causes changes in employment with no changes in wages, In this sense hysteresis is a local result, holding for a finite range equilibrium employment values.[7)]

2. Insider behavior with predetermined wages

We now consider the case when insiders take their wage decisions before the realization of the

7) Moreover, the relative profitability constraint limits the tendency of employment to shrink — this tendency being due to employment reducing negative shocks, couples with positive shocks which trigger no expansions in employment beyond membership size(McDonald and Solow, 1984).

shock ε. We assume that ε is an independently distributed random variable, with a density function g(•), assumed to be symmetric and unimodal on the positive axis. With predetermined wages, insiders face another source to uncertainty, beyond the random lay-offs in case of reduced employment : here, uncertainty about the realization of ε arises as well. Accordingly, the maximization of the expected utility of the insiders' representative member can be specified as

$$\max {}^{\sigma}\mu = \sigma\ U(w) + (1-\sigma)U(\overline{w}) \quad \cdots\cdots (7)$$

subject to $L^d = L(w)\ \varepsilon$ and $\overline{w} \leq w \leq \overline{w} + k$
where σ, the probability of being employed, is

$$\int_o^{\varepsilon^*} \frac{L}{L^m} g(\varepsilon)d\varepsilon + \int_{\varepsilon^*}^{\infty} g(\varepsilon)d\varepsilon$$

with ε^* such that $L(w)\varepsilon^* = L^m$. For any realization of ε such that $L \langle L^m$, the probability of employment is $L \langle L^m$, whereas, if ε is such that $L \langle L^m$, the firm will maintain the whole workforce and the probability of employment is unity. Note that $\sigma = \sigma(L^m, w)$ with

$$\sigma_w = \frac{\partial\sigma}{\partial\omega} = \frac{L}{L^m}\int_0^{\varepsilon^*} \varepsilon g(\varepsilon)d\varepsilon \langle o \qquad \sigma_m = \frac{\partial\sigma}{\partial m} = -\frac{L(w)}{L^{m^2}}\int_0^{\varepsilon^*} \varepsilon g(\varepsilon)d\varepsilon \langle 0$$

It is worth remarking that, in this framework, with *ex ante* wage decisions there exist states in which demand is high enough so that, at the given wage, all previously employed workers retain their jobs, and some new workers are hired as well. By contrast, this was nat the case in the previous section. This difference is due precisely to wages being set before the demand shock is observed, which dispenses with the asymmetric wage response that characterized our previous model.

The optimal w^* is obtained from the first-order condition :

$$\mu_w = \sigma U'(w) + \sigma_w U(w) - U(\overline{w}) = 0$$

Once again, the expected return from a marginal increase in the wage — the probability of employment times marginal utility of a higher wage for those who are given the job — should equal the expected cost of the wage increase in terms of increased risk of unemployment.

Let us now examine whether a change in size of the insiders' group L^m modifies w^*. In contrast with the model of the previous section, a change in L^m now affects the wage demanded by the insiders, and hence the employment level. Indeed, differentiating the first-order condition with respect to L^m gives

$$\frac{dw^*}{dL^m} = \frac{\mu_{wm}}{\mu_{ww}} = -\frac{1}{\mu_{ww}}[\sigma_{mU(w)}(U(w) - U(\overline{w})] \cdots\cdots (8)$$

where

$$\sigma_{um} = \frac{\partial^2 \sigma}{\partial \omega \partial L^m} = -\frac{L'}{L^{m^2}} \int_0^{\varepsilon^*} \varepsilon g(\varepsilon) d\varepsilon + \frac{L'}{L(w)^2} g(\varepsilon^*)$$

Assuming that the second-order condition $u_{ww} \langle 0$ is satisfied, the sign of $\partial w^* \partial L^m$ is the same as that of u_{wm}. Let us examine more closely the expression in squared brackets in (8). On the one hand, in the first term we have $\sigma_m \langle 0$, that is a higher L^m has a negative effect on the probability of being employed, which clearly tends to reduce the benefit from a wage increase. On the other hand, an increase in L^m affects the cost of a wage increase, $\sigma_m(U(w) - U(\overline{w}))$, through its effects on σ_w. Now σ_{wm} is the sum of two terms. First, a higher number of insiders tends to reduce the cost of a wage increase, since a higher wage reduces employment, but the chance that this will affect some particular worker decreases as the number of insiders increases. Second, a higher L^m implies that there is a larger number of states in which a wage increase will reduce employnmet of insiders, sine ε^m is higer. In the latter case, a higher L^m tends to increase the costs of a wage rise, since the insiders face smaller job security. On the whole, the sign of the effect of L^m on w^m is ambiguous, since two elements are negative and one is positive. Gottfries and Horn(1987) show that a sufficient condition for a negative relation between L^m and w to hold is the one we imposed on the density function of ε.[8)]

The negative relation between the wage rate and the size of the insider workfored can be formalized via the following wage-setting rule :

8) This proposition is confirmed also by the results of Blanchard and Summers(1986) and Lindbeck and Snower(1988a). However, the link between L^m and w may be different if different assumptions are made about the density function of ε. Then it is correct of say that the sign is ambiguous in general, as is stressed by Blanchflower, Oswald and Garrett(1990).

$$w = f(L^{m)} \qquad f' < 0 \qquad (9)$$

with $\overline{w} \le w \le \overline{w}$ k According to (3), The size of the insiders' group is determined by the previous employment experience. Sine $L^m = L_{-1}$ a channel has been identified through which labor market conditions in one period affect future wage decisions. More precisely, the smaller the number of workers employed in the previous period, the higher the optimal wage and the lover the expected employment in the current period. Clearly, persistence of unemployment arises.

By combining the wage-setting function(9) with the labor demand(4) and the membership rule(3), we obtain a very simple dynamic microeconomic model. In order to move from this to a simple macroeconomic characterization of the labor market contains a fixed number of identical firms and insiders' groups. A graphical representation of the model may be useful : the wage-settig function is pictured in figure 3(c). In figure 3(d), a 45° line maps the equilibrium employment level in ond perid to the next. The steady-state equilibrium is given by point E with (w^*, L^{m*}, L^*) such that $L^{m*} = L^{m*}_{-1}$ and $L^* = L_{-1}$.

We consider now the effects of a temporary adverse shock. When such a shock occurs in period t=1, the labor demand curve LD shift leftwards — line LD′ in figure 3(b). Being predetermined, wages do not react to this change, and the adjustment falls entirely on employnent : there is a reduction in employment form L^* to L_1 and some insiders are dismissed. The change in employment modifies the size of the insiders' group in the next period according to the membership rule in figure 3(c) : $L^m_2 = L_1$. If the remaining insiders expect the underlying distribution of shocks to remain unchanged — so that the wage-setting rule is not modified — a higher wage ($w_2 > w^*$) is demanded in wage negotiations, according to the sage-setting rule in figure 3(a). In period t=2, the wage rise will discourage employment, that turns out to be lover than it would otherwise have been. More precisely, since the shock is temporary — just for one period — the labor demand function shift back outwards to the original position. But with the wage rate at w_2, employment is only L_2 rather than L^*. However, the dynamic adjustment is not yet complete : through L^m_3, L_3 and so on, the labor market converges to the original steady-state equilibrium (w^*, L^{m*}, L^*). Thus we have a persistent effect of temporary shocks : unemployment, cused by a temporary contractionary shock, persists well after wage contracts have been negotiated again.[9)]

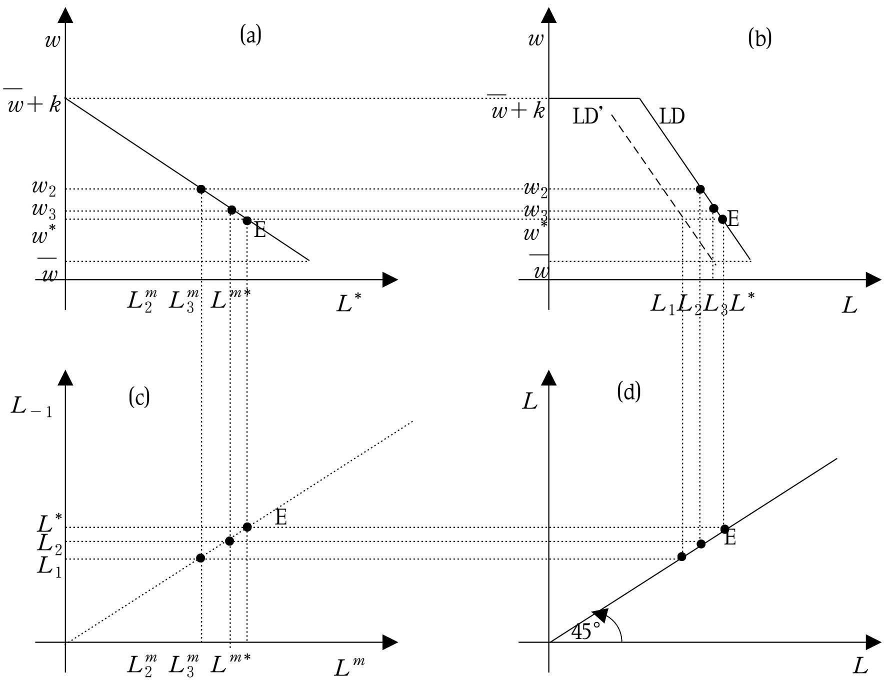

Figure 3 Persistence of a temporary shock with predetermined wages : (a) the wage-setting function; (b) the labor demand function; (c) the membcrship rule; and (d) the 45° line

Hysteresis in unemployment is derived only as a special case in this model. Graphically, hysteresis can be obtained in the case described in figure 4, in which a specific wage-setting rule is used : the wage is set in such a way that expected employment equals the size of the membership : E $(L(w)\varepsilon) = L_m$. In other terms, insiders set the wage at a level such that all of them are expected to be employed. This is the case considered in Blanchared and Summers(1986).[10]

Consider the effects of a temporary shock in this framework. The initial steady-state equilibrium is described by points E_1 with (w^*, L^{m*}, L^*). A negative shock causes employment to decrease from L^* to L'. Given the membership rule in figure 4(c), the new unemployment

9) Lindbeck and Snower(1988a) derive very similar results by assuming that wages are determined by Nash bargaining between insiders and firm.

10) In Blanchard and Summers(1986) the optimization problem is formulated in such a way as to give rise to the stochastic equivalent of an inelastic labor supply : in logs, wages are set so that expected employment equals membership plus a constant term, which can be negative or positive.

workers lose their insider status($L^{m'} = L'$), and the remaining insiders demand a higher wage w'. Since the shock is temporary, the labor demand shifts back in the original position, but w' ensures that only the L' workers who did not lose their jobs still remain employed. The current employment level becomes a new equilibrium employment level, and the economy reaches the new steady-state at points E_2. Thus any level of unemployment may be self-perpetuating, because insiders set the wage so as to protect only their own jobs. The notion of natural rate loses its relevance.

In more formal terms, a simple equation for employment dynamics can be derived by using a loglinear specification of (3) and (4)

$$l^m = l_{-1} \quad \cdots\cdots (10)$$

$$l^d = l(w) = aw + e, \qquad Ee = 0 \qquad a < 0 \quad \cdots\cdots (11)$$

while formulating the wage-setting rule as

$$E(l(w)) = l^m$$

which can be written as

$$w = \frac{1}{a} l^m \quad \cdots\cdots (12)$$

Equations (10) (11) and (12) give the following employment dynamics

$$l = l_{-1} + e$$

that has a unit root. This is exactly the condition for hysteresis in linear models. Actually, this equation has been originally obtained by Blanchard and summers(1986) in a model with nominal wage rigidity, where monetary shocks are effective even under rational expectations. However, only slight modifications are required in the analysis developed in this section to obtain monetary non-neutrality.

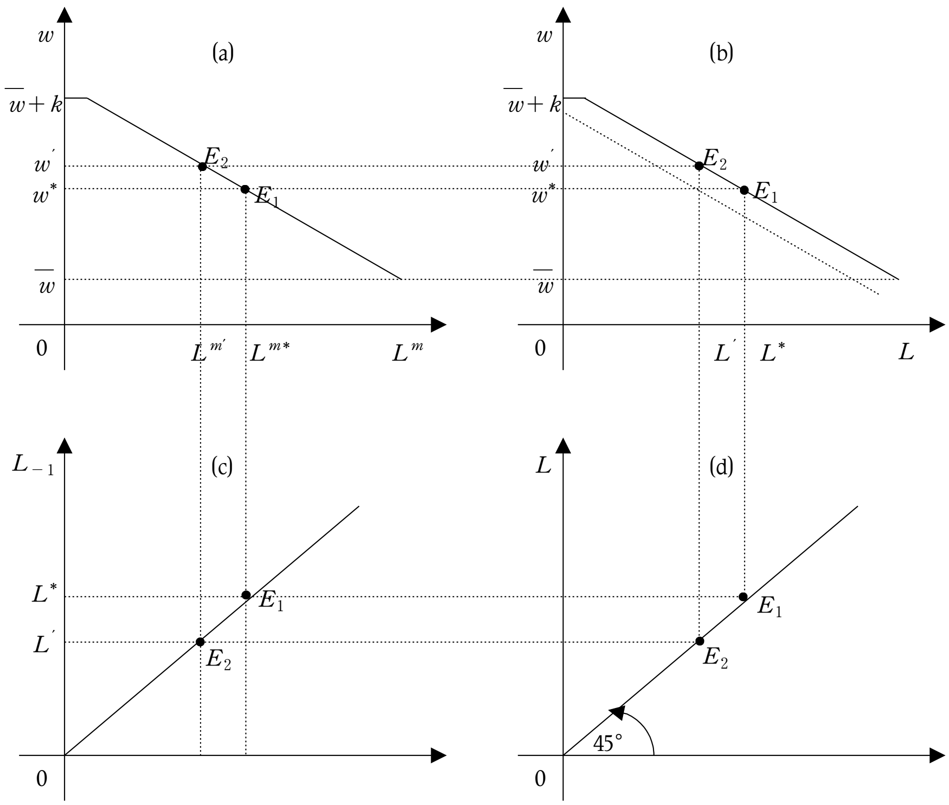

Figure 4 Hysteresis with predetermined wages : (a) the wage-setting function : (b) the labor demand function : (c) the membership rule : and (d) the 45° line.

Ⅳ. Concluding Remarks

In the analysis developed in this paper, various mechanisms have been identified, that can generate persistent dynamic effects of transitory shocks on the level of (un)employment. The result of hysteresis is much less robust. The property of hysteresis is peculiar, because it can be guaranteed only by stringent conditions; indeed. it holds under very specific (even punctual) restrictions on the specification of the model.

In this paper, the distinction between hysteresis and persistence has been emphasized, since formally there is a substantial difference between the two — with relevant theoretical and, possibly, policy implications. Hysteresis implies that the steady-state equilibrium position towards which the system converges is not unique, while persistence refers to the speed of convergence towards a fixed equilibrium configuration. As Summers(1988) stresses, there may be difficulties in distinguishing between situations with multiple equilibria, and situations with very weekly determined but unique equilibria, since they are unlikely to be observationally very different. Besides the unemployment problem, for example, in the empirical analysis of price and trade flows reaction to exchange rate movement, very few studies were able to detect the presence of hysteresis, to be contrasted with an extremely long J-curve effect. Moreover, in a non-market-clearing context the theoretical relevance of a unique equilibrium position which the economy is seeking may be questioned, in the sense that the characterization of 'best' solution associated to the 'natural rate' is lost.

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<ABSTRACT>

A STUDY ON HYSTERESIS IN NEW KEYNESIAN ECONOMICS

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In this paper, the distinction between hysteresis and persistence has been emphasized, since formally there is a substantial difference between the two — with relevant theoretical and, possibly, policy implications. Hysteresis implies that the steady-state equilibrium position towards which the system converges is not unique, while persistence refers to the speed of convergence towards a fixed equilibrium configuration. As Summers(1988) stresses, there may be difficulties in distinguishing between situations with multiple equilibria, and situations with very weekly determined but unique equilibria, since they are unlikely to be observationally very different. Besides the unemployment problem, for example, in the empirical analysis of price and trade flows reaction to exchange rate movement, very few studies were able to defect the presence of hysteresis, to be contrasted with an extremely long J-curve effect. Moreover, in a non-market-clearing contest the theoretical relevance of a unique equilibrium position which the economy is seeking may be questioned, in the sense that the characterization of 'best' solution associated to the 'natural rate' is lost.

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