Uncertainty, Adjustment Costs and Expected Keynesian Unemployment*

Christopher J. Ellis

No. 189

WARWICK ECONOMIC RESEARCH PAPERS

DEPARTMENT OF ECONOMICS

UNIVERSITY OF WARWICK
COVENTRY

Uncertainty, Adjustment Costs and Expected Keynesian Unemployment*

Christopher J. Ellis

No. 189

April 1981

* I thank Norman Ireland and Paul Stoneman for their generous help and comments. Naturally any errors that remain are entirely my own.

1. INTRODUCTION

Most macroeconomic models with quantity rationing regard agents as very naive, for despite successive periods of rationing they continue to behave as if they have had no such experience.[1/] This behaviour is logical since quantity adjustment is assumed costless and frictionless. However if we are to challenge the validity of the price tatonnement it is perhaps strange to allow free frictionless quantity adjustment.

In this model quantity adjustment costs are introduced in the form of resources consumed in the adjustment process. Agents are aware of adjustment costs, but have to state initial transaction demands before the state of the world is known, consequently they base initial trades upon the maximisation of Von Neumann-Morgenstern objective functions. On learning the true state of the world agents then adjust optimally away from their initial trade vector.

This model will be shown to behave significantly differently from the standard Malinvaud (1977) type treatments in three major respects. Firstly it will be shown that agents initial transaction demands will responnd discontinuously to changes in the models parameters, a marginal rise in the probability of unconstrained trade may, for example, lead to a large upward jump in consumer demand. Secondly transaction levels will be shown to be less variable than in standard treatments, and thirdly we shall show that the comparative static properties of the short-

---

1/ Pioneering contributions such as Malinvaud (1977) leave expectations implicit, but it may be argued that money balances carried forward contain the awareness of past and possible rationing. Notice however that such a treatment considers agents response pre-price announcement our treatment is part-price announcement.

run equilibria will be considerably modified by our treatment.

We shall analyse only the "Keynesian" cases, however a very similar treatment may be used to examine the "repressed inflation" possibilities of our model.

2. THE CONSUMER PROBLEM

We consider a representative consumer who holds a subjective probability distribution over the amount of labour he will be able to sell to a representative firm at the end of the quantity tatonnement. These levels of labour sales characterise states of the world for the consumer. If $f(L)$ is the consumers probability density function over states, then Figure 1 describes the states he may encounter.[1/]

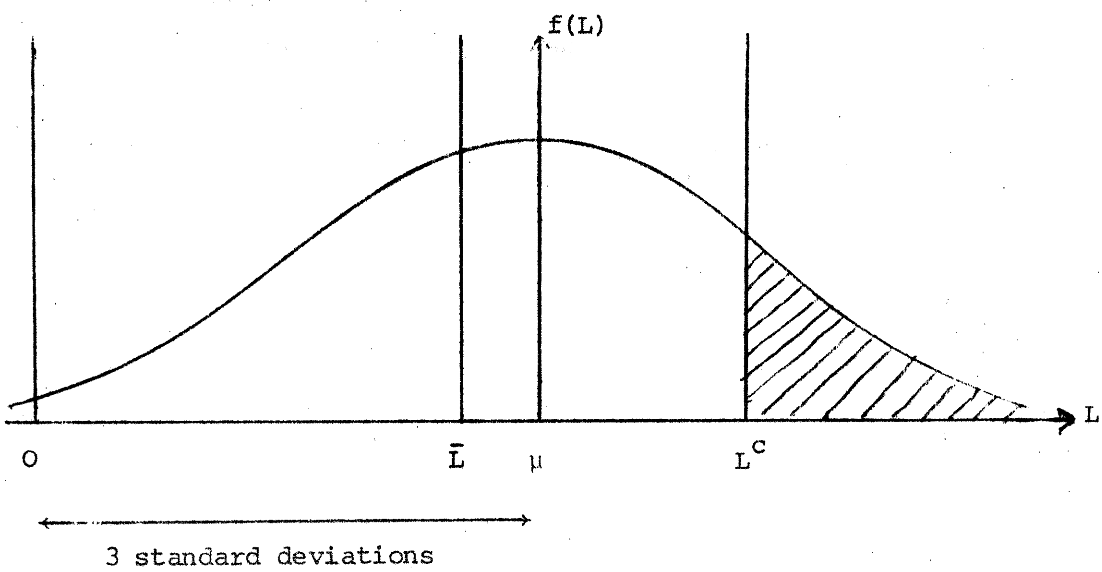


FIGURE 1

1/ The form of the distribution is not important.

The employment level L^c is the level of labour sales that the consumer/ worker would choose at given prices in the absence of uncertainty and adjustment costs. We may thus define

$$\varepsilon = \int_{L^c}^{\infty} f(L)\,dL \qquad \text{the probability of being unrationed}$$

$$1-\varepsilon = \int_{-\infty}^{L^c} f(L)\,dL \qquad \text{the probability of being rationed}$$

and

$$E(L) = \bar{L} = \mu - \frac{f(L-\mu)}{F(L-\mu)} \qquad \text{the expected ration level}$$

$F(L-\mu)$ is the normalised cumulative density function.

We now argue that the consumer behaves as if there are two possible states of the world, a good state hereafter laveled i characterised by $L \geq L^c$ to which is attached the probability ε, and a bad state labelled j characterised by $L = \bar{L}$ with an attached probability $1-\varepsilon$.

Our consumer faces a two-stage maximisation problem. First maximise expected utility, and state initial transaction demands. Second having learned the true state of the world, maximise utility subject to the costs of adjusting away from the initial trade vector.

Stage 1 : Expected Uility Maximisation Initial Transactions Demands

We assume the consumer maximises a Von Neumann-Morgenstern utility function of the following form:[1/]

$$\max E(u) = \varepsilon\left[\log(X_i - c|X^* - X_i|) + \log(T-L) + \log M_i\right]$$

$$+ (1-\varepsilon)\left[\log(X_j - c|X^* - X_j|) + \log(T-\bar{L}) + \log M_j\right] \qquad (2.1)$$

S.T.

$$\text{(i)} \quad M_O + wL = pX_i + M_i \qquad (2.2)$$

$$\text{(j)} \quad M_O + w\bar{L} = pX_j + M_j \qquad (2.3)$$

where M_O, T, p, w, are parameters representing initial money balances total work time, good and labour prices respectively. X and M are variables representing goods and final money balances. c is the adjustment cost parameter $(1 \geq c \geq 0)$ and superscript $*$ indicates initial transactions demand.

To make the programme (2.1)-(2.3) differentiable we note that $X_i \geq X^* \geq X_j$ must hold,[2/] and rewrite the consumer maximand as

$$\max_{X_i, X_j, X^*, L} E(u) = \varepsilon\left[\log(X_i - c(X_i - X^*)) + \log(T-L) + \log(M_O + wL - pX_i)\right]$$

$$+ (1-\varepsilon)\left[\log(X_j - c(X^* - X_j)) + \log(T-\bar{L}) + \log(M_O + w\bar{L} - pX_j)\right] \quad (2.4)$$

S.T.

$$X_i - X^* \geq 0 \qquad (2.5)$$

$$X^* - X_j \geq 0 \qquad (2.6)$$

1/ The functional form is chosen for expositional ease.

2/ A simple proof is given in Appendix A.

We form the Lagrangian expression from (2.4)-(2.6) differentiate and from the Kuhn-Tucker condition it can be shown that there are three cases of interest.[1/] These are

(i) $X_i > X^* > X_j$

(ii) $X_i = X^* > X_j$

(iii) $X_i > X^* = X_j$

We now consider the parameter ranges over which each of these cases is relevant.

<u>(i) $X_i > X^* > X_j$</u>

From the Kuhn-Tucker first order condition we obtain

$$X^* = \frac{1}{pc(2+\varepsilon)}\left[M_O(5\varepsilon-2) + w\bar{L}(3c(1+c)) - wT(w(1-\varepsilon)(1-c))\right] + M_O/p \quad (2.7)$$

$$X_i = \frac{1}{3}\left[\frac{M_O + wT}{p} - \left(\frac{c}{1-c}\right)^{2X^*}\right] \quad (2.8)$$

$$X_j = \frac{1}{2}\left[\frac{M_O + w\bar{L}}{p} - \left(\frac{c}{1+c}\right)^{X^*}\right] \quad (2.9)$$

$$L = \frac{1}{6w}\left[4wT - 2M_O\right] - \frac{p}{w}\left(\frac{c}{1-c}\right)^{X^*} \quad (2.10)$$

Using (2.7)-(2.9) we may define the range of parameter values over which $X_i > X^* > X_j$ holds, these are given by (2.11).

1/ The case $X_i = X^* = X_j$ is the other possibility but is clearly uninteresting.

$$\left(\frac{M_O + wT}{3-c}\right)(1-c) > M_O \left[\frac{5\varepsilon-2}{c(2-\varepsilon)} + 1\right] + w\bar{L}\left[\frac{3\varepsilon(1+c)}{c(2+\varepsilon)}\right] - wT\left[\frac{2(1-\varepsilon)(1-c)}{c(2+\varepsilon)}\right] >$$

$$\left(\frac{M_O + w\bar{L}}{2+c}\right)^c \tag{2.11}$$

We may now interpret (2.7)-(2.10) as follows. If (2.11) holds then X^* is initial goods demand, L initial labour supply, and X_i and X_j are the anticipated optimal goods adjustment points once the state of the world has been revealed.

(ii) $X_i = X^* > X_j$

Again from the Kuhn-Tucker first order condition we obtain

$$X_i^2\left[p^3(1+c)(2\varepsilon+2(1-c)+1) - 2(1+\varepsilon)p\right] + X_i\Big[(1+c)p^2((M_O+w\bar{L})(2\varepsilon-2(1-c)+1)$$

$$+ (\varepsilon+1-c)(2M_O + 4wT)) - (1-\varepsilon)(2M_O + 4wT)\Big] + \left[\varepsilon-1+c\right](1+c)p(M_O+w\bar{L})$$

$$(2M_O + 4wT) = 0 \tag{2.12}$$

Expression (2.12) will be assumed to have only one positive real root, denoted R_i, which we assume to be increasing in w, M_O, T, $\bar{L}$ and ε, and decreasing in p and c.

The range of parameter values over which this case obtains are given when the left-hand inequality in (2.11) is violated.

(iii) $X_i > X^* = X_j$

From the Kuhn-Tucker first order condition we obtain

$$X_j^2\left[c\left[((1+c) + (1-\varepsilon)c)3p^2 - 3p^3 + \varepsilon p\right]\right] + X_j\left[(1+c) + (1-\varepsilon)c\right]p^2$$

$$\left[3c\left[M_O + w\bar{L}\right] - 6(1-c)\left[M_O + wT\right]\right] - p^2 6(1-c)(M_O + wT) - \varepsilon c(M_O + w\bar{L})] +$$

$$\left[(1+c) + (1-\varepsilon)c\right]\left[M_O + w\bar{L}\right]\left[6(1-c)\left[M_O + wT\right]p\right] = 0 \qquad (2.13)$$

(2.13) will be assumed to have one positive real root, denoted R_j, which we will assume increasing in w, M_O, T, $\bar{L}$, ε and c and decreasing in p.

The range of parameter values over which this case obtains are given when the right-hand inequality in (2.11) is violated.

We have thus established the first of our results, since a small change in one of the parameter values may cause one of the inequalities in (2.11) to be reversed, this will cause our consumer to make a discontinuous response in his level of initial goods demand, switching from (2.7) to (2.12) or (2.13) in determining X^*. We illustrate this result with a brief example.

Example

Let $c = \frac{1}{2}$ and consider small changes in ε. We rewrite

(2.11) to obtain

$$a = \frac{24wT-6M_O}{33M_O+90w\bar{L}+17wT} \geq \varepsilon \geq \frac{4w\bar{L}-6M_O+20wT}{33M_O+88w\bar{L}+20wT} = b$$

Thus

$$X^* = \begin{cases} (2.7) & \text{if} \quad a \geq \varepsilon \geq b \\ (2.12) & \text{if} \quad a < \varepsilon \\ (2.13) & \text{if} \quad b > \varepsilon \end{cases}$$

We represent this case diagramatically in Figure 2.[1/]

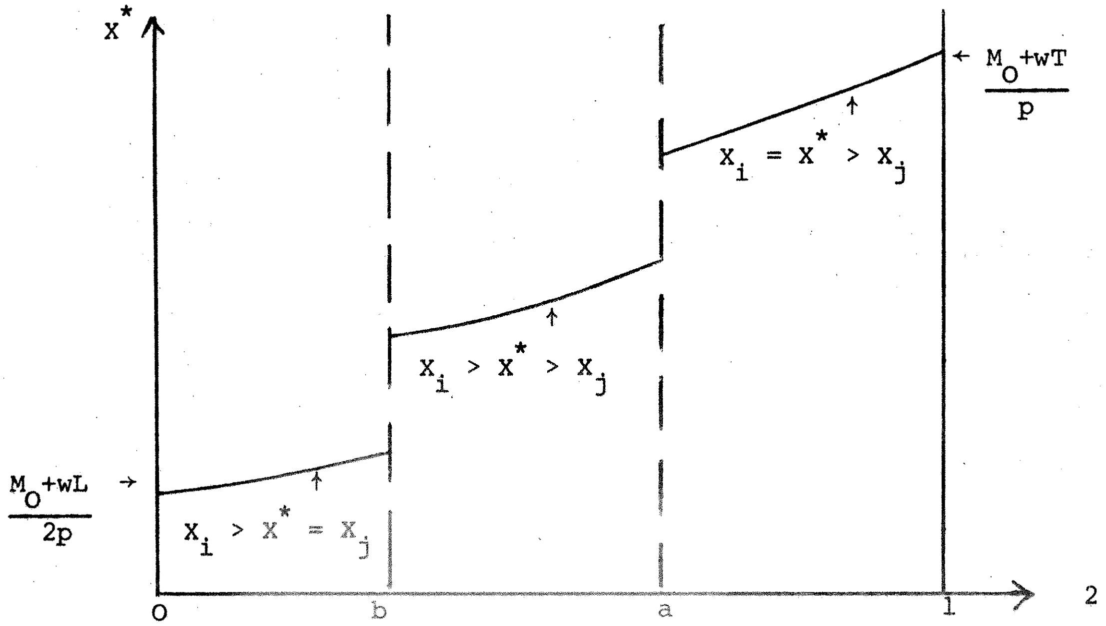


FIGURE 2

1/ In general we cannot ensure Ob, Oa-Ob or 1-Oa to be non-zero ranges.

As Figure 2 demonstrates if ε is in the neighbourhood of b or a then a small change in the probability attached to the good state of the world will induce a large jump in consumers initial goods demand X^*.

In general we observe that variations in the parameters of the problem will induce discontinuous responses from the variable.

<u>Stage 2 : Final Transactions</u>

Having determined the consumers initial transaction demands we now have to examine how these will be revised once he has learned the true state of the world. We recall that $\bar{L}$ was the consumers <u>subjective</u> mathematical expectation of the rationing level, which need not be correct.[1/] We denote the actual level of rationing $\hat{L}$.

To discover how the consumer revises his trades in response to $\hat{L}$ define his maximand as below

$$\max_{X_1 X_2 \geq 0} U = \log(X^* + X_1 - X_2 - cX_1 - cX_2) + \log(T - \hat{L}) + \log M_1 \qquad (2.14)$$

$$\text{S.T.} \quad M_0 + w\hat{L} = p(X^* + X_1 - X_2) + M_1 \qquad (2.15)$$

The two new variables X_1 and X_2 represent upward and downward adjustments from X^* respectively. We require these variables to identify the range of $\hat{L}$ over which the consumer will choose to revise trades upwards, downwards or not at all.

Substituting (2.15) into (2.14) differentiating and evaluating the Kuhn-Tucker conditions at $X_1 = X_2 = 0$ we obtain

$$\left(\frac{1-c}{X^*}\right) - \frac{p}{M_O+w\hat{L}-pX^*} \leq 0 \qquad (2.16)$$

$$-\left(\frac{1+c}{X^*}\right) + \frac{p}{M_O+w\hat{L}-pX^*} \leq 0 \qquad (2.17)$$

Rearranging (2.16) and (2.17) we obtain

$$\frac{1}{w}\left[p(X^* - \left(\frac{X^*}{1+c}\right)) - M_O\right] \leq \hat{L} \leq \frac{1}{w}\left[p\left(\frac{X^*}{1+c} + X^*\right) - M_O\right] \qquad (2.18)$$

Expression (2.18) defines the range of ration levels $\hat{L}$ over which the consumer chooses his different possible responses.

If we define $\hat{L}_L$ and $\hat{L}_u$ as the levels of $\hat{L}$ at which equalities hold with the left and right-hand terms in (2.18) we may make the following statements:

(i) <u>If $\hat{L} > \hat{L}_u$</u> The consumer will revise his goods purchased upwards.

The consumers maximand becomes

$$\underset{X}{\text{Max}}\ U = \log(X-c(X-X^*)) + \log(T-\hat{L}) + \log(M_O+w\hat{L}-pX) \qquad (2.19)$$

1/ In fact the probability of exactly $\bar{L}$ is zero.

which yields

$$X = \frac{1}{2}\left[\frac{M_O + w\hat{L}}{p} - \left(\frac{c}{1-c}\right)X^*\right] \qquad (2.20)$$

(ii) <u>If $\hat{L}_u \geq \hat{L} \geq \hat{L}_L$</u> Then the consumer will leave his goods purchased unaltered.

hence $X = X^*$. (2.21)

(iii) <u>If $\hat{L} < \hat{L}_L$</u> The consumer will revise his goods purchased downwards.

The consumers maximand becomes

$$\max_X u = \log(X-c(X^*-X)) + \log(T-\hat{L}) + \log(M_O + w\hat{L} - pX) \qquad (2.22)$$

which yields

$$X = \frac{1}{2}\left[\frac{M_O + w\hat{L}}{p} + \left(\frac{c}{1+c}\right)X^*\right] \qquad (2.23)$$

Expressions (2.20), (2.21) and (2.23) describe the consumers response to the whole range of $\hat{L}$ which he regards as constraining his behaviour. It is possible that the consumer will be unconstrained, $\hat{L}$ does not bind, in which case we write his maximand

$$\max_{X,L} u = \log(c-c(X-X^*)) + \log(T-L) + \log(M_C+wL-pX) \qquad (2.24)$$

which yields

$$X = \frac{1}{3}\left[\frac{M_O + wT}{p} - \left(\frac{c}{1-c}\right)^{2X^*}\right] \qquad (2.25)$$

and $$L = \frac{1}{6w}\left[4wT - 2M_O\right] - \frac{p}{w}\left(\frac{c}{1-c}\right)^{X^*} \qquad (2.26)$$

We note that (2.25) and (2.26) are the same as (2.8) and (2.10). This allows us to state that the consumers anticipated optimal upward adjustment point is realised when $\hat{L}$ does not bind.

Using (2.20), (2.21) and (2.25) we may now represent the consumers labour constrained goods demand curve diagramatically, viz. Figure 3.

The effects of uncertainty and adjustment costs upon the representative consumers behaviour are clearly illustrated by our diagram. The broken diagonal line represents the labour constrained goods demand curve that the consumer would express in the absence of uncertainty and adjustment costs.[1/] The heavy line is the goods demand curve developed above. For the range $O\text{-}\hat{L}_L$ the consumer goods demand curve is given by expression (2.23). We notice immediately that the effects of uncertainty and adjustment costs are to increase goods purchases, for any $\hat{L}$ in the range, above the level that would be

---

1/ This demand curve is found by rearranging the first order conditions of the following programme.

$$\max_X \quad u = \log X + \log(T-\hat{L}) + \log M_O + w\hat{L} - pX.$$

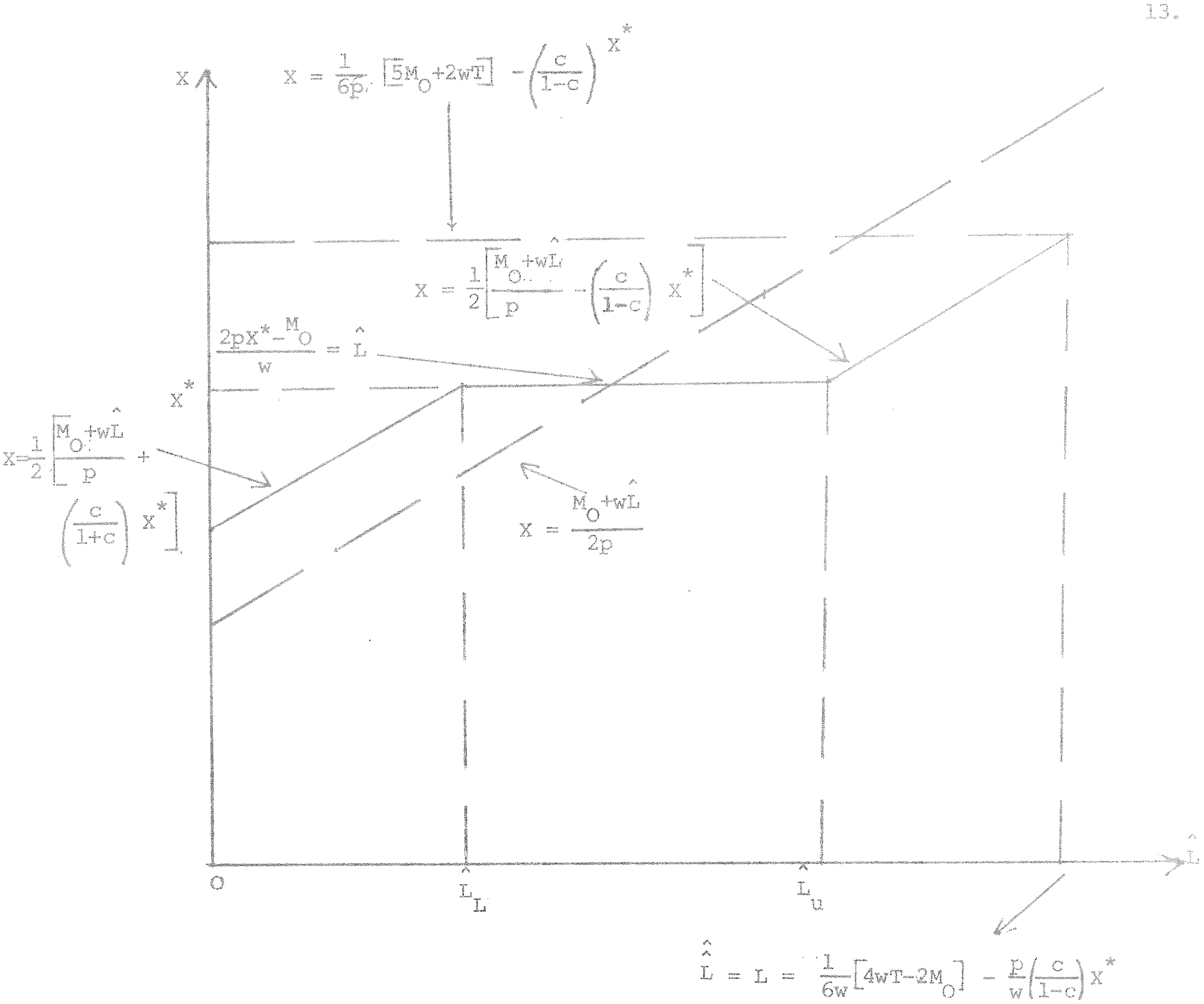


FIGURE 3

demanded in their absence. In the range $\hat{L}_u - \hat{\hat{L}}$ consumer goods demand, as given by (2.20), will be lower than in the absence of uncertainty and adjustment costs. Whilst for $\hat{L}_L - \hat{L}_u$ we observe that changes in the level of the ration has no effect upon goods demand, initial trades are left unaltered.

Recalling that earlier we established that initial goods demand responded discontinuously to changes in parameter values, we note that the effects of these discontinuities upon our final goods demand curve, as described in Figure 3, will be to make it jump as indicated in Figure 4.

FIGURE 4

We denote that as X^* jumps from X_1^* to X_2^* the consumer's labour constrained goods demand curve jumps as indicated in Figure 4.

We now turn our attention to [illegible] representative producer anticipating [illegible] effective demand.

3. THE PRODUCER'S PROBLEM

We treat the producer in a similar manner to the consumer, he too [illegible] distribution over possible states of the world, with states characterised by the level of effective demand. The producer behaves as though one of two possible states of the world may occur. A good state characterised by free trade and a [illegible] characterised by a 'known' [illegible] ration $\bar{X}$. Probabilities

Ψ and $1-\Psi$ are attached to the good and bad states respectively.

As with the consumer, the producer first expresses initial transaction demands based upon the maximisation of expected profit and second when the true state of the world is learned maximises actual profit subject to costs of adjustment.

Stage 1 : Expected Profit Maximisation, Initial Transactions Demands

We assume our producer to maximise the following expected profit function.[1/]

$$\max_{X_1, L_i, L_j, L^*} \quad E(\Pi) = \Psi\left[pX-wL_i-\phi(L^*-L_i)^2\right] + (1-\Psi)\left[p\bar{X}-wL_j-\phi(L^*-L_j)^2\right] \quad (3.1)$$

$$\text{S.T.} \qquad X \leq AL \qquad (3.2)$$

All notation as in the consumers problem, adjustment costs are quadratic and ϕ is a constant $0 \leq \phi \leq 1$.

The producer may choose any point within the production set, he may thus hoard labour rather than incur adjustment costs. We form the Lagrangian from (3.1) and (3.2) as

$$Z = \Psi\left[pX-wL_i-\phi(L^*-L_i)^2\right] + (1-\Psi)\left[p\bar{X}-wL_j-\phi(L^*-L_j)^2\right] + q_j(L_j-\bar{X}/A) + q_i(L_i-X/A) \qquad (3.3)$$

q_i and q_j are the shadow prices on the production constraints in the two states of the world.

1/ The constant returns production function is chosen for expositional ease.

Differentiating (3.3) and examining the Kuhn-Tucker first order conditions our producer considers the two following cases. 1/

(i) $\underline{q_i,\ q_j > 0}$ The production constraint binds in both expected states of the world.

From the first order conditions of (3.3) we obtain

$$q_j = w - \Psi A p \tag{3.4}$$

$$q_i = \Psi A p \tag{3.5}$$

$$L_j = \bar{X}/A \tag{3.6}$$

$$L_i = \frac{\bar{X}}{A} + \frac{1}{2\phi(1-\Psi)} \left[Ap - w\right] \tag{3.7}$$

$$X = \bar{X} + \frac{A}{2\phi(1-\Psi)} \left[Ap - w\right] \tag{3.8}$$

$$L^* = \frac{\bar{X}}{A} + \frac{\Psi}{2\phi(1-\psi)} \left[Ap - w\right] \tag{3.9}$$

(ii) $\underline{q_i > 0,\ q_i = 0}$ The production constraint binds only in the good state.

From the F.O.C. of (3.6) we obtain

$$L_i = \frac{1}{(2-\Psi)2\phi} \left(2pA - (1+3\Psi)w\right) \tag{3.10}$$

$$X = \frac{1}{(2-\Psi)2\phi} \left(2p - (1+3\Psi)\frac{w}{A}\right) \tag{3.11}$$

$$L^* = \frac{1}{(2-\Psi)2\phi} \left(\Psi pA - (2\Psi-1)w\right) \tag{3.12}$$

$$L_j = \frac{1}{(2-\Psi)2\phi} \left(\Psi pA - (1+3\Psi)w\right) \tag{3.13}$$

$$q_i = A\Psi p \tag{3.14}$$

1/ $q_i = 0$ would imply that the producer plans to hoard labour when he can sell all he can produce, clearly this will never be chosen.

We may represent the producer goods constrained labour demand curve as in Figure 5.

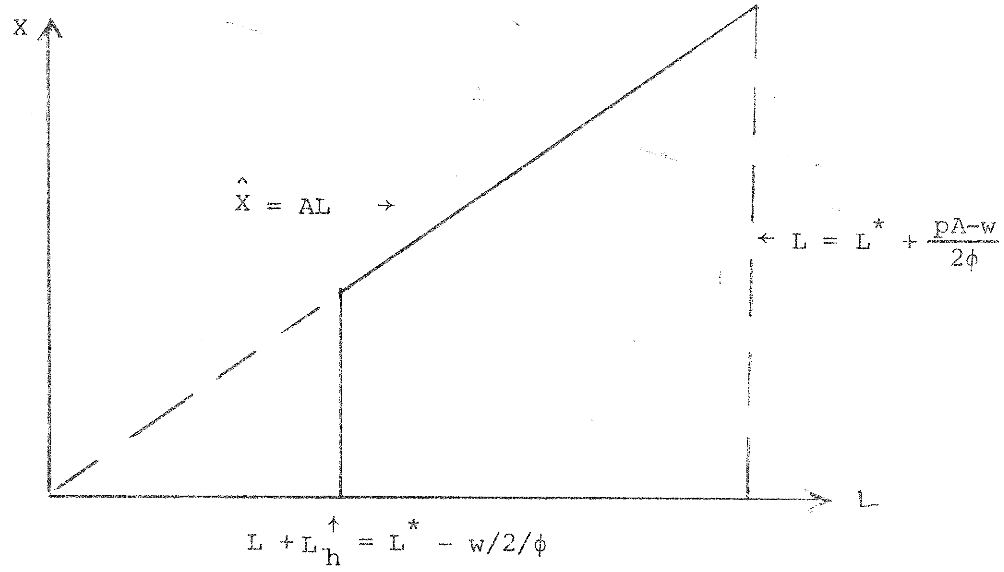
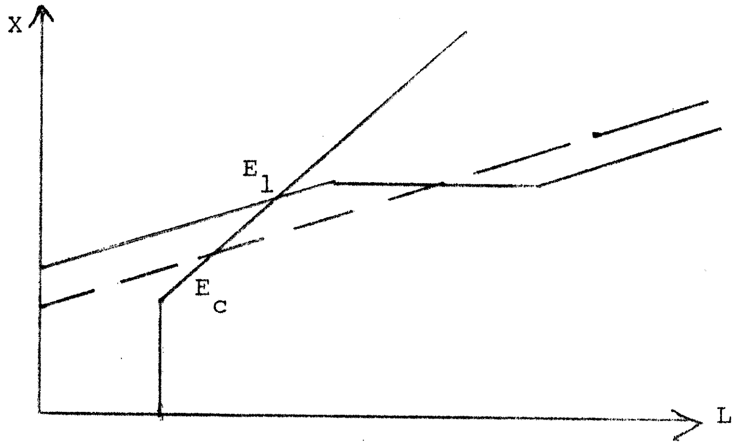


FIGURE 5

Having now established consumer and producer behaviour given that each anticipated a Keynesian Unemployment regime in the forthcoming market period, we may now turn our attention to the equilibria this behaviour generates.

4. MARKET PERIOD EQUILIBRIA

We define a market period equilibria as the state where both agents achieve mutually consistent trades upon both markets. Where the labour constrained goods demand curve cuts the effective demand constrained labour demand curve. Combining Figures 2 and 4 we may now define and illustrate six different Keynesian outcomes.



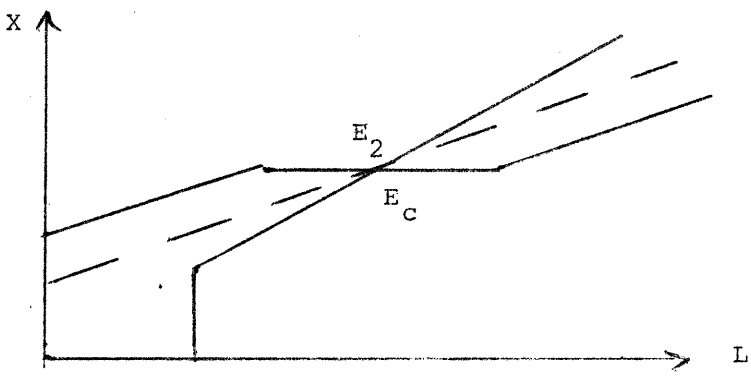
TYPE 1

This equilibria E_1 is defined by

$$X = \frac{1}{2}\left[\frac{M_O + w\hat{L}}{p} + \left(\frac{c}{1+c}\right)X^*\right] = \hat{X}$$

$$L = \frac{\hat{X}}{A} = \hat{L}$$

The other equilibria depicted E_c represents the outcome that would have been achieved in the absence of adjustment costs and uncertainty.[1/] We clearly observe that uncertainty and adjustments costs give rise to both higher employment and output levels than would occur otherwise.



TYPE 2

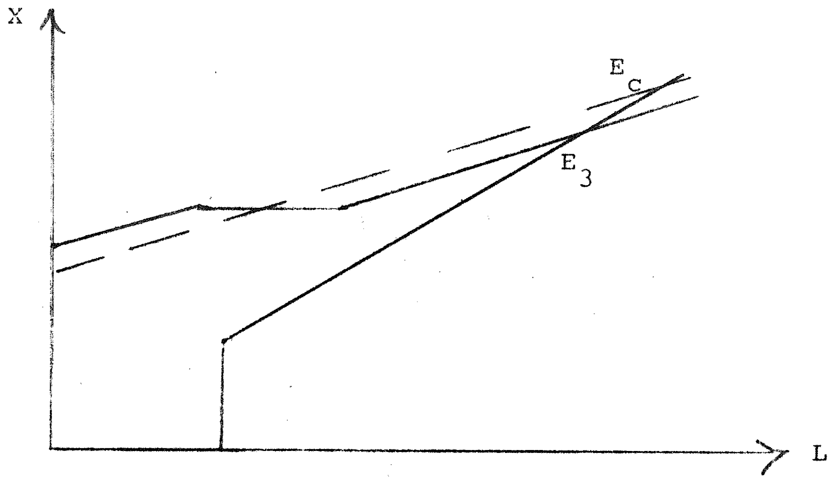
1/ This equilibria E_c is that that would have been achieved in the Muellbauer and Portes (1978) or Malinvaud (1977) structures.

This equilibria E_2 is defined by

$$X = \hat{X} = X^*$$

$$L = \hat{X}/A$$

In this type of equilibria we cannot state unequivocally that trades are above or below their level that would be achieved in the absence of uncertainty and adjustment costs.



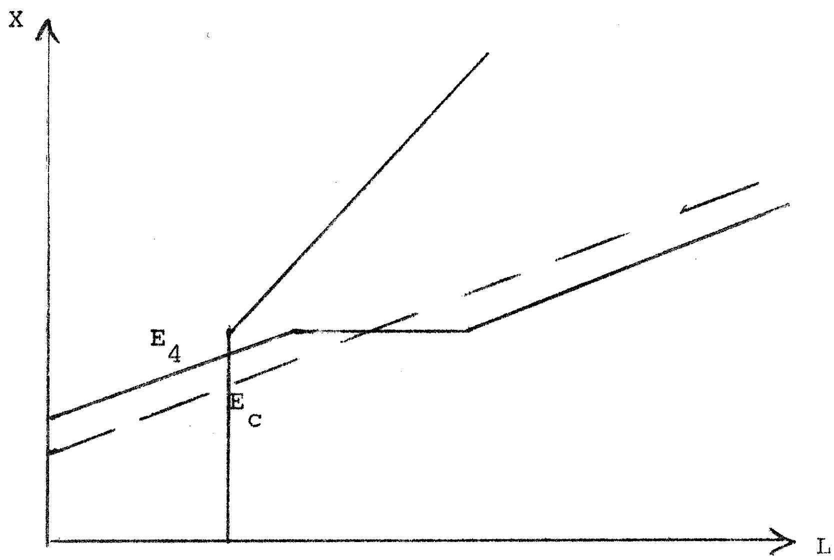
TYPE 3

This equilibria E_3 is defined by

$$X = \frac{1}{2}\left[\frac{M_O + w\hat{L}}{p} - \left(\frac{c}{1-c}\right)X^*\right] = \hat{X}$$

$$L = \hat{X}/A = \hat{L}$$

Here out introduction of adjustment costs and uncertainty causes lower transactions levels on both markets than would have been achieved in their absence (E_c)



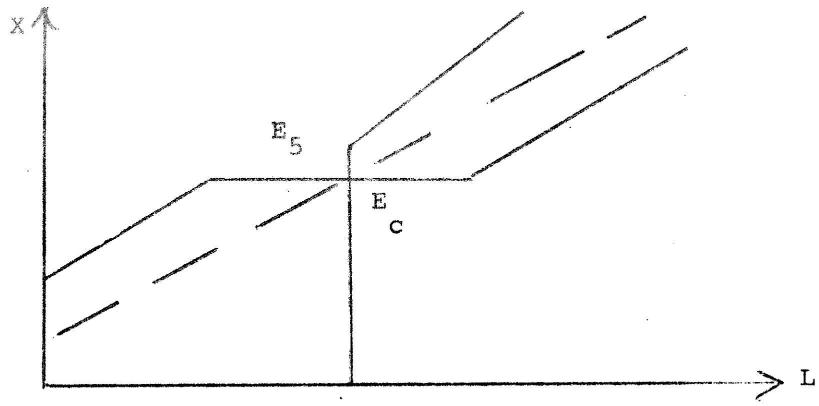
TYPE 4

This equilibria E_4 is defined by

$$X = \frac{1}{2}\left[\frac{M_o + w\hat{L}}{p} + \left(\frac{c}{1+c}\right)X^*\right]$$

$$L = L^* - \frac{w}{2\phi} = \hat{L}$$

Here our equilibria E_4 displays a higher level of goods demand than the costless certainty equilibria E_c, but due to labour hoarding, i.e. extra output being obtained by switching hoarded labour into productive labour, no extra employment is obtained.



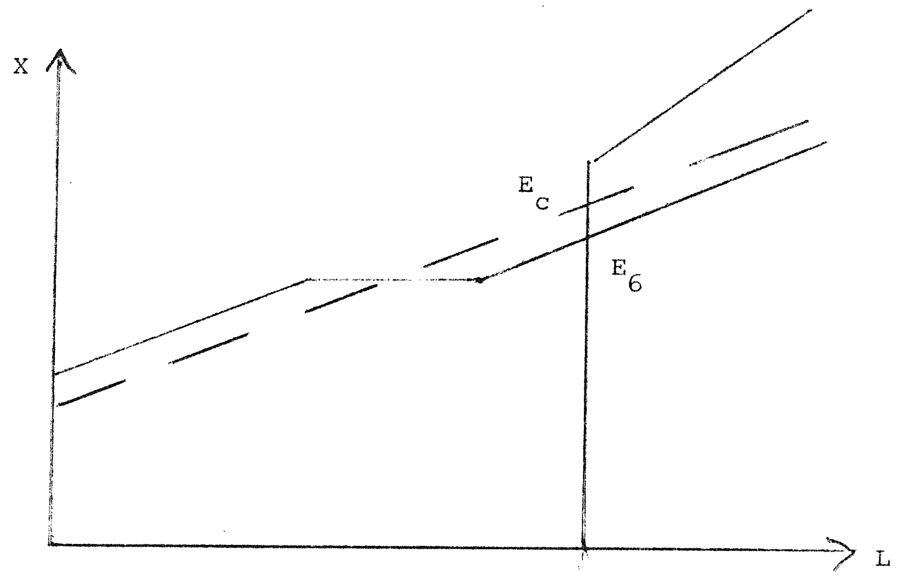
TYPE 5

This equilibria E_5 is defined by

$$X = X^*$$

$$L = L^* - w/2\phi$$

Whether E_5 yields higher or lower transaction levels than E_c will depend upon E_5's exact location in X,L space.



TYPE 6

The equilibria E_6 is defined by

$$X = \frac{1}{2}\left[\frac{M_O + w\hat{L}}{p} - \left(\frac{c}{1-c}\right) X^*\right]$$

$$L = L^* - w/2\phi = \hat{L}$$

Here goods purchases are lower in the uncertainty, adjustment cost equilibria E_6, however employment is the same in both E_c and E_6 since the producer does not lay off workers but simply hoards them.

Our six equilibria types establish our second major result that transactions levels are less variable when adjustment costs and uncertainty are present. We saw that when transactions levels are low, types one and four, then output is higher in the presence of adjustment costs and uncertainty, whilstemployment is higher if there is no labour hoarding. When transaction levels are high, then, as we observe from types 3 and 6, adjustment costs and uncertainty reduce goods purchases, and depress employment if there is no labour hoarding.

We now examine the comparative static effects of changes in agents expectations. Our earlier analysis ensures.

$$\frac{\partial L^*}{\partial \Psi} \text{ and } \frac{\partial X^*}{\partial \varepsilon} > 0 \qquad (4.1)$$

Thus $\frac{\partial X}{\partial \Psi}, \frac{\partial L}{\partial \Psi}, \frac{\partial X}{\partial \varepsilon}, \frac{\partial L}{\partial \varepsilon}$

take the sign of $\frac{\partial X}{\partial X^*}, \frac{\partial L}{\partial X^*}, \frac{\partial X}{\partial L^*}, \frac{\partial L}{\partial L^*}$

From our definitions of equilibria we obtain:

	$\partial X/\partial X^*$	$\partial L/\partial X^*$	$\partial X/\partial L^*$	$\partial L/\partial L^*$
1	$\frac{1}{2}\left(\frac{c}{1+c}\right)$	$\frac{1}{2A}\left(\frac{c}{1+c}\right)$	0	0
2	1	$\frac{1}{A}$	0	0
3	$-\frac{1}{2}\left(\frac{c}{1-c}\right)$	$-\frac{1}{2A}\left(\frac{c}{1-c}\right)$	0	0
4	$\frac{1}{2}\left(\frac{c}{1+c}\right)$	0	$\frac{1}{2}\frac{w}{p}$	1
5	1	0	0	1
6	$-\frac{1}{2}\left(\frac{c}{1-c}\right)$	0	$\frac{1}{2}\frac{w}{p}$	1

We concentrate our interest on equilibria types 2 and 4, since these illustrate our model's novel comparative static properties.

In Type 2 equilibria an optimistic revision of expectations by our producer induces no change in either output or employment, whilst an increase in consumer optimum (a rise in c) will push the equilibria out along the boundary of the production set increasing both employment and output. Thus in Type 2 equilibria only consumers expectations matter.

In Type 4 equilibria an increase in producer optimum (a rise in Ψ) increases both output and employment with employment rising by exactly the same amount as initial labour demand rises. Increases in consumer optimum only increase output, since this extra output is achieved by putting hoarded workers to use.

The comparative static properties of our equilibria are both realistic and Keynesian in spirit. Our model's behaviour is heavily modified by the existence of rigidities within the system, but these rigidities are not ad hoc impositions, but rather the result of agents behaving optimally in the face of adjustment costs and uncertainty.

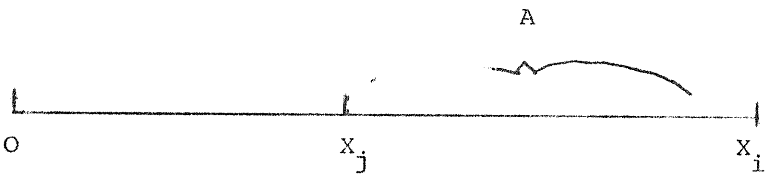
5. CONCLUSION

In this model we examined the behaviour of agents who are aware of uncertainty and adjustment costs. We demonstrated that they will base initial transactions upon the maximisation of Von Neumann-Morgenstern objective functions. Then we examined how they will adjust their trade vectors when the true state of the world has been revealed. We found that to allow our agents to behave in this sophisticated manner gives the model several new features. We noticed that initial transactions responded discontinuously to changes in parameters, for example we saw how small changes in the probability attached to the good state of the world (unconstrained trade), by the consumer lead to large changes in initial and final goods demands. Also we saw how adjustment costs and uncertainty altered the shape of the constrained demand curves for both goods and labour. We derived six different Keynesian short-run equilibria which were shown to be characterised by different transaction levels and/or different comparative static properties than those to be found in the literature. Further we observed that these comparative static properties were caused by rigidities which were not imposed ad hoc. It is thus argued that our results are very much in the spirit of both reality and Keynes.

APPENDIX A

We wish to establish $X_i \geq X^* \geq X_j$.

We know $X_i \geq X_j \;\forall\; p,w$ since X_i represents unconstrained trade and we do not allow forced consumption. Hence to establish our proposition we need only demonstrate X^* falls within the range $OX_i - OX_j$.



Define $OX_i - OX_j$ as A.

Let us choose a point outside the range labelled a and a point inside the range labelled b, such that

$$\varepsilon u[-c(a)] = \varepsilon u[-c(b)]$$

The expected utility loss of adjusting back to X_i from each of the two points is equal.

If we now consider the expected utility loss of adjusting back to X_j from a and b we may write

$$(1-\varepsilon)u[-c(A+a)] + \varepsilon u[-c(a)] < (1-\varepsilon)u[-c(A-b)] + \varepsilon u[-c(b)]$$

Hence any point above X_i is clearly dominated by a point inside the range $OX_i - OX_j$.

Hence $X_i \geq X^* \geq X_j$ clearly follows if we use the same argument applied to points below X_j.

REFERENCES

R.W.Clower, "The Keynesian Counter-Revolution : A Theoretical Appraisal" in Monetary Theory, ed. R.W.Clower, 1965.

C.J.Ellis, "Temporary Equilibrium Expectations and Notional Spillover", Warwick Economic Research Paper No.165, February 1980.

E.Malinvaud, The Theory of Unemployment Reconsidered, Oxford, Basil Blackwell, 1977.

J.Muellbauer and R.Portes, "Macroeconomic Models with Quantity Rationing", Economic Journal, December 1978.

L.E.O.Svensson, "Effective Demand and Stochastic Rationing", Review of Economic Studies, 1980.