EUROPEAN UNIVERSITY INSTITUTE, FLORENCE

DEPARTMENT OF ECONOMICS

EUI WORKING PAPER No. 88/341

OPTIMAL MONETARY POLICY IN AN ECONOMY WITHOUT A FORWARD MARKET FOR LABOUR

by

David CANNING *

* Pembroke College, Cambridge

This paper was written while the author was a Jean Monnet Fellow at the European University Institute.

BADIA FIESOLANA, SAN DOMENICO (FI)

Printed in Italy in March 1988
European University Institute
Badia Fiesolana
- 50016 San Domenico (Fi) -
Italy

Optimal Monetary Policy in an Economy without a
Forward Market for Labour

David Canning

ABSTRACT

If markets are incomplete competitive equilibria may be inefficient. A market clearing, rational expectations, model with spot, but no forward, labour markets is constructed. An accommodating monetary policy stabilizes employment, Pareto dominating the fluctuating employment associated with a constant money stock. The optimal average rate of monetary growth and inflation is shown to be positive and increasing in the variance of the shocks. If policy is set sequentially by agents in each period the result is Pareto improving steady employment, but at a rate below the optimum, due to the inability to commit to future policies.

1. Introduction

In a market clearing economy, with a spot market for labour, rational agents may respond to shocks by changing their labour supply; unemployment during a recession may be rational. However, if futures markets existed for labour, risk adverse workers might well wish to sell their labour forward for a fixed income, risk neutral agents buying such contracts, accepting the risk of spot market fluctuations for the expected profits. The absence of such forward markets means that there may be a role for monetary policy; it can try to stabilize employment in the face of shocks.

Polemarchakis and Weiss (1977) show that if agents are unable to insure themselves before birth it may be possible to devise a monetary policy to provide this insurance ex post. The mechanism used by Polemarchakis and Weiss is a random monetary policy which prevents agents extracting information from price movements. Such a policy seems somewhat unnatural; the shock is the allocation of agents between markets and it is asking a lot for a macroeconomic tool, such as monetary policy, to overcome what is essentially a microeconomic problem.

Non-neutrality of monetary policy in market clearing, rational expectations, economies is easy to demonstrate, for example, Beenstock (1980), Pesaran (1984) and Marini (1985); the problem is to find a plausible role for such policies if the government has no informational advantages. Here the rationale for policy intervention is missing markets. Explicit futures markets for labour are not commonly observed. There are moral hazard problems in specifying such contracts, and it is unclear if they would be enforceable given the anti-slavery laws in many countries. The inefficiency associated with these missing markets may justify policy intervention.

An overlapping generations economy with aggregate supply shocks is investigated. The young observe an economy wide supply shock, the number of agents in the cohort, through its effect on the price level. Without monetary policy labour supply varies with the aggregate shock, since the shock affects the expected intertemporal terms of trade. Berger (1985) provides empirical evidence of the effect of cohort size on earnings.

The nonneutrality of monetary policy in the model is of the simplist possible type; money injections are lump sum and the expected inflation tax on money is distortionary. Since money is the only asset for transferring wealth between periods the expected inflation tax affects the labour supply decision. With a richer asset structure, as in Canning (1988) which allows money holding or investment in risky capital, the portfolio choice effect may be more important. Minford (1986) analyses a model in which demand for bonds, and the real rate of interest, varies with the inflation rate.

The model exhibits a short run Phillips' curve of the same type as that found in Lucas (1973); agents confuse price changes due to money shocks with price changes due to real shocks, though it is the expected intertemporal terms of trade rather than intermarket terms which affects supply decisions. The long run Phillips' curve in the model is upward sloping; expected inflation reduces the expected returns from working to earn money. Such upward sloping long run Phillips' curves are discussed by Friedman (1977), though he holds they will eventually become vertical as agents change the institutional arrangements of the economy.

A simple accommodating monetary policy is devised, money supply increasing in the previous period's price level, which stabalizes labour supply. Price shocks lead to expected money injections, which leave the expected intertemporal terms of trade unchanged. The average rate of money growth and inflation is set as an increasing function of the variance of the inflation rate (which depends on the variance of the shocks), so as to have a labour supply effect which cancels out the effect of the price variance. Since agents are assumed to be more risk adverse to employment fluctuations than to fluctuations in consumption they prefer to live in an economy with stable employment.

While the monetary policy in the model is efficient and Pareto dominates the non-policy equilibrium in the ex ante sense, the employment fluctuations of the constant money stock model are Pareto efficient in the ex post sense. The monetary policy is what Muench (1977) calls equal treatment Pareto optimal (ET-PO), it maximizes the expected utility of each agent given that agents born in the same state get the same utility. Its ex ante viewpoint amounts to saying to an agent, "which economy would you rather be born in?", before the agent knows the shock. As Lucas (1977) points out, this may not be the appropriate question. Given that an agent has been born, and knows the shock which has occurred, imposing an insurance contract ex post may well make him worse off. Peled (1982) shows that a fixed money stock is constrained Pareto efficient where the constraint is that agents cannot trade before they know the realization of the state in which they are born.

A second situation is considered to avoid this problem. Agents are assumed to live for three periods, having no endowment or consumption in the first period. In the first period they do not know the size of their cohort and would like to sell their labour forward to avoid the risk of spot market price fluctuations. If such forward labour markets do not exist then the equilibrium with a fixed money stock is constrained Pareto inefficient. A monetary policy for period t+1 can be devised which is Pareto improving for all three generations alive at period t-1, and has no effect on any other generation. All three generations would vote for such a policy. The optimal policy in such a setting again stabalizes the employment rate.

While such a policy is Pareto improving employment is stabilized at a rate below the ET-PO allocation. The reason for this is that with sequential policy setting the young risk share with the middle aged. If they agree to work harder still this benefits the middle aged but any benefits to the young depend on the monetary policy agreed on in the next period. Without commitment working harder today gives the young no extra consumption tomorrow. In the ET-PO allocation the equal treatment property implies that if an agent agrees to work harder so will the next generation in a similar state, compensating the agent with higher consumption; the ET-PO criterion, if applied between periods, implicitly allows commitment.

2 The Micro Model

Consider an overlapping generations model in which agents live two periods. In the first period they are endowed with L units of labour, in the second they have no endowment. Labour can be consumed directly as leisure, or transformed, on a one for one basis, into a non storable consumption good. Agents transfer purchasing power from one period to the next by holding money. The utility function for an agent born in period t is

$$U(L_t, C_{t+1}) = -L_t^{1+\alpha} + C_{t+1}$$

where L_t is the agent's supply of labour in the first period of life and C_{t+1} is consumption in the second. I shall assume $\alpha > 0$ so utility is increasing, and strictly concave, in leisure, $(L - L_t)$. Since agents can turn a unit of leisure into a unit of the consumption good they face the budget constraints

$$0 \leqslant L_t \leqslant L$$

$$C_{t+1}P_{t+1} \leqslant L_tP_t + A_{t+1}$$

where P_t is the price of the consumption good in period t, measured in money units and A_{t+1} is a lump sum money transfer from the government to the agent when old. The lump sum payment to the old seems to be the simplist, non-neutral, way of injecting money to the system. If transfers were proportional to cash balances the policy might have no real effects.

The government decides G_t, its total nominal expenditure in period t, before the price level P_t is determined. The old simply spend all their cash, both their savings and any transfer payments; it follows that the total demand for consumption goods in period t, Y_t is given by

$$Y_t = (M_{t-1} + G_t)/P_t$$

where M_{t-1} is the money carried forward by the old. Since the government transfer is in money we can set $M_t = M_{t-1} + G_t$ so that

$$Y_t = M_t / P_t$$

At time t the young choose between leisure and working to earn money to spend in t+1. They choose their labour supply L_t to maximize their expected utility, since P_{t+1} is uncertain. Performing this maximization yields

$$L_t^{\alpha} = (1+\alpha)^{-1} P_t E(P_{t+1}^{-1} | I_t)$$

where E is the expectation operator and I_t is the information available at time t. Note that, since utility is linear in consumption when old, the expected size of the transfer payment, A_{t+1}, has no effect on labour supply.

In order to generate real shocks it is assumed that the number of agents in each period, N_t, is a random variable with log-normal distribution, these shocks being independent. Total output in period t is given by

$$Y_t = N_t L_t$$

The shock N_t is not observed by individual agents or by government.

3 The Macro Model.

Taking the log of each variable in section two we can derive

$$e_t = y_n + b(p_t - E(p_{t+1} | I_t)) \quad (1)$$

$$y_t = e_t + n_t \quad (2)$$

$$y_t = m_t - p_t \quad (3)$$

where y_n is a constant, $b = 1/\alpha$, and the lower case letters are the natural logarithms of the upper case letters, except for $e_t = \log L_t$. The only difficulty occurs in taking the logarithm over the expectation operator, E. However, assuming that the conditional probability distribution over P_{t+1} given I_t is lognormal we have

$$\log E(P_{t+1}^{-1} | I_t) = -E(\log P_{t+1} | I_t) + 1/2\, \delta^2$$

where δ^2 is the variance of the marginal distribution of $p_{t+1} = \log P_{t+1}$, given I_t, which has a normal distribution (e.g. see Johnson and Kotz (1970)). The zero inflation level of output per head is given by

$$y_n = (1/\alpha)(1/2\,\delta^2 - \log(1+\alpha))$$

Since money is the only form of wealth holding, expected inflation worsens the terms of trade between leisure and consumption and leads households to reduce their labour supply.

We normalize the size of the population so that the n_t's are independently distributed random variables with mean zero and variance τ^2. In addition suppose the government chooses its expenditure pattern so that

$$m_t = m_{t-1} + g + s_t$$

where g is a constant rate of monetary growth and the s_t's are independently distributed normal random variables with mean zero and variance σ^2. To do this we require that government spending in period t is given by

$$G_t = M_{t-1}(\exp(g + s_t) - 1)$$

Sometimes the transfer payments will be positive, sometimes negative, but agents are never called on to pay a lump sum exceeding their cash holdings.

Agents born in period t are given the history of the economy to date, H_t, consisting of the prices $p_0, p_1, \ldots\ldots, p_{t-1}$ and the previous money supply figures, $m_0, m_1, \ldots\ldots, m_{t-1}$, and they also observe the current price level p_t. The information set is therefore $I_t = (H_t, p_t)$. Let q_t be the expected value of p_t given H_t. The difference between p_t and q_t will be due to period t shocks. The problem which agents face is that they do not know which part of any price shock comes from monetary factors, and is permanent, and which part comes from real factors, and is temporary.

Rewriting (1), (2) and (3) gives

$$p_t(1+b) = m_{t-1} + g - y_n + b\, E(p_{t+1} \mid I_t) + (s_t - n_t)$$

Suppose agents set $E(p_{t+1} \mid H_t) = E(p_t \mid H_t) + g$; then it is easy to derive

$$q_t = m_{t-1} + g - (y_n - bg)$$

Expected monetary injections raise the expected price level directly, through their effect on nominal demand, and indirectly, through the depressing effect of anticipated inflation on aggregate supply. We also have

$$\begin{aligned} E(p_{t+1} \mid I_t) &= E(m_{t+1} \mid I_t) - E(y_{t+1} \mid I_t) \\ &= E(m_t \mid I_t) + g - E(y_{t+1} \mid I_t) \\ &= (m_{t-1} + g + E(s_t \mid I_t)) + g - (y_n - bg) \\ &= q_t + g + E(s_t \mid I_t) \end{aligned}$$

In order to forecast future prices agents must estimate the size of the current monetary shock, s_t. From the above equations we have

$$p_t (1+b) = q_t - bg + b(q_t + g + E(s_t | I_t)) + (s_t - n_t)$$

and so

$$p_t - q_t = b(1+b)^{-1} E(s_t | I_t) + (1+b)^{-1} (s_t - n_t)$$

If $(s_t - n_t)$ is observable at time t, but s_t and n_t are not, agents will set

$$E(s_t | I_t) = (1 - \theta)(s_t - n_t)$$

$$E(n_t | I_t) = -\theta (s_t - n_t)$$

where $\theta = \tau^2 / (\sigma^2 + \tau^2)$ is a measure of the relative proportion of the shock which comes from real sources. Substituting for $E(s_t | I_t)$ we have

$$(s_t - n_t) = (p_t - q_t)(1 + b)(1 + b - b\theta)^{-1}$$

so if agents know the parameters of the model, b and θ, $(s_t - n_t)$ is indeed observable as a function of $(p_t - q_t)$. One rational expectations solution of the system is given by

$$e_t = y_n - bg + \pi (s_t - n_t) \quad (4)$$

$$p_t - p_{t-1} = g + (1 - \pi)(s_t - n_t) + \pi s_{t-1} + (1 - \pi) n_{t-1} \quad (5)$$

where $\pi = \theta b (1+b)^{-1}$. Both real and nominal shocks affect that period's output and price level. However, in the long run, nominal shocks, being permanent, have a coefficient of one in the inflation equation, while real shocks have a coefficient of zero. For internal consistency we need to confirm that the two assumptions we made in the course of the analysis are correct; we require that the conditional distribution of P_{t+1} given I_t be lognormal, and that $E(p_{t+1} | H_t) = E(p_t | H_t) + g$. These conditions clearly hold.

The model set out in equations (1), (2) and (3) is almost identical to that of Lucas (1973), except that it is the intertemporal terms of trade, rather than the expected intermarket terms, which affects supply decisions, and the shocks are economy wide, rather than summing to zero across markets. Comparing the results in (4) and (5) with those found by Lucas it is clear that variations in real output per head and unanticipated inflation are still correlated; however there are two differences. Firstly, variations in output and the price level come from the real aggregate shock as well as the nominal money supply shock, secondly, there is no natural rate of output per head, the higher the average rate of inflation, g, the lower is average output. There is a long run trade off between inflation and output, though in the opposite direction to the short run trade off. As suggested by Friedman (1977) the long run Phillips' curve is positively sloped.

The equilibrium we have derived is of the usual type for a log-linear macro model. However, since our model is equivalent to an overlapping generations framework, in which there are typically a multiplicity of equilibria, we should expect non-uniqueness. Another equilibrium is given by

$$e_t = y_n - bg - b(1+\alpha)^t + \pi(s_t - n_t)$$

$$p_t - p_{t-1} = g + (1+\alpha)^t + (1-\pi)(s_t - n_t) + \pi s_{t-1} + (1-\pi)n_{t-1}$$

Prices go up at an ever increasing rate, even if the money supply is constant. The falling real demand for goods is matched by a falling level of output, brought about by the effect of inflation on supply. The difficulty of ruling out this type of equilibrium in models where money is the only store of value is discussed by Obstfeld and Rogoff (1983). In what follows I shall concentrate on the equilibrium given by (4) and (5), in which prices are proportional to the money supply.

4. Ex Ante Efficiency and Monetary Policy.

We begin by considering an agent who is going to be born in the world but does not know in which state. I adopt Muench's (1977) notion of an equal treatment Pareto optimum. This implies that agents which experience the same state get the same payoff. Since the state of the system at time t is given by the number of old and the number of young agents in the economy at that time the allocation at time t depends only on (N_{t-1}, N_t). An agent born at time t who experiences the state (N_{t-1}, N_t) when young, and the state (N_t, N_{t+1}) when old, gets the utility

$$-L_t^{1+\alpha}(N_{t-1}, N_t) + L_{t+1}(N_t, N_{t+1})\, N_{t+1}/N_t$$

since the labour supply of the N_{t+1} young in the period t+1 is divided equally between the N_t old. In addition to agents in the same period being treated equally, the ET-PO criterion requires that the labour supply functions L_t and L_{t+1} are the same; the outcome depends only on state not on the time index.

The agent's expected utility, is given by

$$\int_{N_{t-1}}\int_{N_t}\int_{N_{t+1}} [-L^{1+\alpha}(N_{t-1}, N_t) + L(N_t, N_{t+1})N_{t+1}/N_t]$$

$$h(N_{t-1}, N_t, N_{t+1}) \quad dN_{t-1}dN_t dN_{t+1}$$

where h is the probability density function of experiencing the state (N_{t-1}, N_t, N_{t+1}). Let f be the probability density function of the lognormal distribution which determines population size in each period. I shall assume that the ratio of probabilities of being born at time t in populations of size N and N' is given by

$$\frac{P(\text{born in state } N)}{P(\text{born in state } N')} = \frac{P(\text{born} \mid N_t = N)\, P(N)}{P(\text{born} \mid N_t = N')\, P(N')} = \frac{N\, f(N)}{N'\, f(N')}$$

The probability of being born in a given state is proportional to the population size in that state. Setting N' = 1 we have

$$P(\text{born in state } N) = N\, f(N)\, (P(\text{born in state } 1) / f(1))$$

$$\text{and } P(\text{born in state } x \leqslant N) = \int_0^N x\, f(x)(P(\text{born in state } 1) / f(1))$$

Since the agent must be born in some state the limit as N tends to infinity of this integral must be one. Hence

$$P(\text{born in state } 1) / f(1) = 1 / E(N)$$

and the probability density function on being born in a state with population size N is given by g(N) where

$$g(N) = N\, f(N) / E(N)$$

Since the probability of being born in a state is independent of the population sizes of the preceeding and succeeding generations we have

$$h(N_{t-1}, N_t, N_{t+1}) = f(N_{t-1})\, f(N_{t+1})\, N_t\, f(N_t) / E(N_t)$$

Substituting this distribution into the expected utility we can derive expected utility maximizing labour supply at time t

$$L^*(N_{t-1}, N_t) = L^* = (1 + \alpha)^{-1/\alpha}$$

given that $E(N_{t+1}) = E(N_t)$. Agents would like their labour supply to be state independent. This makes their consumption when old volatile; it is given by $L^* N_{t+1}/ N_t$. Since they are risk adverse in labour supply when young, and risk neutral in consumption when old, they prefer to undergo all the risk in their consumption.

Now consider the monetary economy set out above. Setting the money stock to be constant, $M_t = M$, so that all shocks are real we can derive

$$L_t = L^* (\exp(1/2\, \delta^2))^{1/\alpha}\, N_t^{-1/(1+\alpha)}$$

When a population shock occurs the price level changes; high cohort size is associated with a low price for labour. Since the expected value of the next period's price level is independent of the current shock price changes affect the expected intertemporal terms of trade, and the labour supply decision. The variance of prices δ^2 in this case is given by $(\alpha/(1+\alpha))^2 \gamma^2$. Price variance depends on the variance of the real shocks, and the variance of future prices affects the current labour supply decision.

Clearly the equilibrium with the constant money stock is very different from the ex ante optimal allocation. However, consider the following monetary policy

$$m_{t+1} = e^* + p_t + g \qquad (6)$$

We can consider this to be a sequence of nominal income targets, made up of a real target e* and a price target of an increase in prices by the proportion g. With such a policy prices become a random walk with drift. Incorporating (6) with (1), (2) and (3) we can solve the model directly. If the model does stabilize the employment rate at e* agents will have the expectation $E(y_{t+1} | I_t) = e^* + E(n_t | I_t) = e^*$ and so

$$E(p_{t+1} | I_t) = E(m_{t+1} | I_t) - E(y_{t+1} | I_t)$$

$$= p_t + g$$

Substituting this into equation (1) gives

$$e_t = e^* = y_n - bg = (1/\alpha)\ (1/2\delta^2 - \log(1+\alpha) - g)$$

$$\text{or } L_t = (\exp(1/2\,\delta^2 - g))^{1/\alpha}\ (1+\alpha)^{-1/\alpha}$$

The target level of output per head and target inflation rate must be set jointly for consistency. Setting

$$g = 1/2\ \delta^2 = 1/2\ (\alpha/(1+\alpha))^2 \tau^2$$

gives

$$L_t = L^* = (1+\alpha)^{-1/\alpha}$$

the ex ante ET-PO allocation. The real shocks now affect the price level but not the employment rate.

The monetary policy does two things. Firstly, when agents see the price shock in period t they expect a monetary injection in period t+1 to keep the expected intertemporal terms of trade unchanged. Price shocks are accommodated by monetary policy. The point is that it is not the price shock itself which disturbs the supply decision, but the expectation that it is temporary and will be reversed, the policy removes this expectation.

Secondly the average rate of monetary growth and inflation is set as an increasing function of price variability (and so indirectly of the variance of the shocks). Agents care both about the expected intertemporal terms of trade and the variance of these terms, when making supply decisions. The supply effect of a higher inflation rate can offset the effect of increased price variability. It has been argued that the variability of inflation may be an increasing function of the inflation rate (e.g. see Logue and Thomas (1976)); here it is argued that the optimal rule for Government may be to increase the inflation rate in response to a rise in the variance of the price level. Note that the optimal average rate of growth of the money supply is always positive.

The simply active monetary policy set out in equation (6) can achieve the ET-PO allocation. It remains to be shown that this allocation Pareto dominates, ex ante, the allocation achieved by the fixed money stock rule. The expected utility of an agent in the economy with monetary policy is

$$E(- L^{*1+\alpha} + L^* (N_{t+1}/N_t))$$

$$= -L^{*1+\alpha} + L^*$$

where the expectation is taken relative to the probability density function $h(N_{t-1}, N_t, N_{t+1})$ derived above. In the fixed money stock economy ex ante expected utility (again using the probability density function h) is

$$E(-L_t(N_t)^{1+\alpha} + L_{t+1}(N_{t+1}) (N_{t+1}/N_t))$$

$$= -L^{*1+\alpha}(\exp(1/2\,\delta^2))^{(1+\alpha)/\alpha} \exp(1/2\,\gamma^2)^{-1}$$

$$+ L^* (\exp(1/2\,\delta^2))^{1/\alpha} E(N_{t+1}^{\alpha/(1+\alpha)}) \exp(1/2\,\gamma^2)^{-1}$$

since $E(N_t) = \exp(1/2\,\gamma^2)$. Replacing the variance of prices δ^2 with $(\alpha/(1+\alpha))^2\gamma^2$, and using the fact that for a lognormal distribution $E(N^k) = E(N)^{k^2}$, in the constant money stock world expected utility is given by

$$(-L^{*1+\alpha} + L^*) (\exp(1/2\,\gamma^2))^{-1/(1+\alpha)}$$

Providing $\gamma^2 > 0$, so the population shocks have non-zero variance, and $\alpha > 0$, so the agents' utility functions are strictly concave in leisure, the expected utility of being born in the fixed money stock economy is strictly less than from being born in the active policy economy.

5. Sequential Policy Setting.

In section four efficiency was considered from the point of view of an agent about to be born. If agents could vote before birth they would endorse an active monetary policy, but such voting is as implausible as pre-birth contingent claims markets.

Consider instead a model in which agents live three periods, the generation labelled t being born in period t-1. They have no endowment, and can not consume in t-1, they are merely waiting to work in period t and consume in t+1 as set out in section two. An economy with a fixed money stock and recursive spot markets for labour is not constrained Pareto efficient in this setup. To achieve Pareto effeciency we would require a set of contingent claims markets in period t-1, for labour in period t contingent on the shock, so that the young could insure themselves with the middle aged.

Such contingent claims markets may be difficult to organize, indeed in many countries labour futures contracts are not legally binding. Suppose instead we offer the three generations alive in period t-1 the choice between a constant money stock and monetary policy in period t+1 which stabilizes the employment rate in period t at

$$L_t = L^* (\exp 1/2 \cdot \tau^2)^{-1/(1+\alpha)}$$

In period t-1 the value of N_{t-1} is common knowledge since it is revealed in the spot market price P_t. The young in period t-1 do not know the value of N_t, their cohort size, but, given they have been born it is easy to construct their conditional probability distribution over N_t; if the probability of birth in period t-1 is proportional to the cohort size we have the conditional probability given cohort size of $g(N_t) = N_t f(N_t)/E(N_t)$.

The active monetary policy in t+1 does not affect generation t+1 or any generation after this. The only effect is on the generations alive in period t-1. The policy increases the expected utility of the young in period t-1 while the middle aged are indifferent, relative to the fixed money stock equilibrium. The middle aged experience the same expected intertemporal terms of trade as without the policy and so work equally hard in t-1, leaving the old in t-1 indifferent between the policy and a constant money stock. The active policy is Pareto improving.

There are many policies which are Pareto efficient and which Pareto dominate a constant money stock. Their common feature is that they stabilize the employment rate for the young when they work in period t. The policy above is the lowest level of employment which is Pareto efficient and Pareto improving. Any rate up to

$$L_t = L^* (\exp 1/2\, \tau^2)^{-1/(1+\alpha)^2}$$

satisfies these conditions.

If the employment rate is stabilized at a level between these two extremes all three generations in t-1 are better off in expected utility terms than under a fixed money stock; the young still gain from the stabilization of employment, the middle aged consume more when old, and their improved intertemporal terms of trade makes them work more in t-1, to the benefit of the old. If offered such a policy all three generations would vote for it and against a fixed money stock rule. If employment is stabilized at the lowest level all the gains go to the young, while at the highest level all the gains go to the old and middle aged.

With sequential voting for monetary policy employment is stabilized at a rate lower than in the ET-PO allocation. The problem is that if the young in t-1 vote for a higher rate of employment they simply lose in expected utility terms since this has no effect on the outcome of the vote when they are middle aged, which determines their consumption when old. In the ET-PO equilibrium if an agent works harder so do those in the next period, by the equal treatment criterion, so agreeing to work harder may improve the agent's expected welfare. With sequential voting the agents share risks but cannot achieve outcomes which require commitment to future policies.

6. Conclusion.

A model has been constructed in which the problem of missing futures markets for labour can be overcome by a systematic accommodating monetary policy. Large fluctuations in the employment rate due to shocks may be individually rational in a spot market but inefficient if forward markets are missing. It may be easier to stabilize employment and achieve an efficient allocation through a macroeconomic monetary policy than by attempting to introduce complete contingent forward labour markets.

In order to achieve an efficient allocation a planner must know that agents are more risk adverse with respect to employment than with respect to consumption; it is possible to construct the same macro-model as above with agents who are risk neutral in employment but risk adverse in consumption. Sequential voting over policies rules out commitment but reveals agents' preferences and may be necessary in the absence of a fully informed planner.

References

Beenstock, M. (1980), A neoclassical Analysis of Macroeconomic Policy, Cambridge University Press, Cambridge.

Berger M.C. (1985), "The Effect of Cohort Size on Earnings Growth: A Reexamination of the Evidence", Journal of Political Economy, Volume 93, pp 561-573.

Canning D. (1988), "Wage adjustment versus Monetary Policy as a response to Real Shocks", forthcoming in the Economic Journal Supplement.

Friedman M. (1977), "Nobel Lecture: Inflation and Unemployment", Journal of Political Economy, Volume 85, pp451-472.

Johnson N.L. and Kotz, S. (1970), Continuous Univariate Distributions, Volume I, J. Wiley and Sons, New York.

Logue D.E. and Willett T.D. (1976), "A Note on the Relation between the Rate and Variability of Inflation", Economica, Volume 43, pp 151-158.

Lucas R.E. (1973), "Some International Evidence on Output-Inflation Tradeoffs", American Economic Review, Volume 63, pp 326-334.

Lucas R.E. (1977), "Reply to Muench and Polemarchakis and Weiss", Journal of Economic Theory, Volume 15, pp 351-352.

Marini G. (1985), "Intertemporal Substitution and the role of Monetary Policy", Economic Journal, Volume 95, pp 87-100.

Minford P. (1986), "Rational Expectations and Monetary Policy", Scottish Journal of Political Economy, Volume 33, pp 317-333.

Muench T.J. (1977), "Optimality, the Interaction of Spot and Futures Markets, and the Nonneutrality of Money in the Lucas Model", Journal of Economic Theory, Volume 15, pp 325-344.

Obstfeld M. and Rogoff K. (1983), "Speculative Hyperinflations in maximizing models: Can we Rule Them Out?", Journal of Political Economy, Volume 91, pp 675-689.

Peled D. (1982), "Informational Diversity over Time and the Optimality of Monetary Equilibria", Journal of Economic Theory, Vol. 20, pp 255-274.

Pesaran M.H. (1984), "The New Classical Economics: a Critical Exposition" in Mathematical Methods in Economics, F. van der Ploeg (editor), J. Wiley and Sons Ltd, London.

Polemarchakis H.M. and Weiss L. (1977), "On the Desirability of a 'Totally Random' Monetary Policy", Journal of Economic Theory, Volume 15, pp 345-350.

WORKING PAPERS ECONOMICS DEPARTMENT

85/155:	François DUCHENE	Beyond the First C.A.P.
85/156:	Domenico Mario NUTI	Political and Economic Fluctuations in the Socialist System
85/157:	Christophe DEISSENBERG	On the Determination of Macroeconomic Policies with Robust Outcome
85/161:	Domenico Mario NUTI	A Critique of Orwell's Oligarchic Collectivism as an Economic System
85/162:	Will BARTLETT	Optimal Employment and Investment Policies in Self-Financed Producer Cooperatives
85/169:	Jean JASKOLD GABSZEWICZ Paolo GARELLA	Asymmetric International Trade
85/170:	Jean JASKOLD GABSZEWICZ Paolo GARELLA	Subjective Price Search and Price Competition
85/173:	Berc RUSTEM Kumaraswamy VELUPILLAI	On Rationalizing Expectations
85/178:	Dwight M. JAFFEE	Term Structure Intermediation by Depository Institutions
85/179:	Gerd WEINRICH	Price and Wage Dynamics in a Simple Macroeconomic Model with Stochastic Rationing
85/180:	Domenico Mario NUTI	Economic Planning in Market Economies: Scope, Instruments, Institutions
85/181:	Will BARTLETT	Enterprise Investment and Public Consumption in a Self-Managed Economy
85/186:	Will BARTLETT Gerd WEINRICH	Instability and Indexation in a Labour-Managed Economy - A General Equilibrium Quantity Rationing Approach
85/187:	Jesper JESPERSEN	Some Reflexions on the Longer Term Consequences of a Mounting Public Debt
85/188:	Jean JASKOLD GABSZEWICZ Paolo GARELLA	Scattered Sellers and Ill-Informed Buyers: A Model of Price Dispersion
85/194:	Domenico Mario NUTI	The Share Economy: Plausibility and Viability of Weitzman's Model
85/195:	Pierre DEHEZ Jean-Paul FITOUSSI	Wage Indexation and Macroeconomic Fluctuations

85/196:	Werner HILDENBRAND	A Problem in Demand Aggregation: Per Capita Demand as a Function of Per Capita Expenditure
85/198:	Will BARTLETT Milica UVALIC	Bibliography on Labour-Managed Firms and Employee Participation
85/200:	Domenico Mario NUTI	Hidden and Repressed Inflation in Soviet-Type Economies: Definitions, Measurements and Stabilisation
85/201:	Ernesto SCREPANTI	A Model of the Political-Economic Cycle in Centrally Planned Economies
86/206:	Volker DEVILLE	Bibliography on The European Monetary System and the European Currency Unit.
86/212:	Emil CLAASSEN Melvyn KRAUSS	Budget Deficits and the Exchange Rate
86/214:	Alberto CHILOSI	The Right to Employment Principle and Self-Managed Market Socialism: A Historical Account and an Analytical Appraisal of some Old Ideas
86/218:	Emil CLAASSEN	The Optimum Monetary Constitution: Monetary Integration and Monetary Stability
86/222:	Edmund S. PHELPS	Economic Equilibrium and Other Economic Concepts: A "New Palgrave" Quartet
86/223:	Giuliano FERRARI BRAVO	Economic Diplomacy. The Keynes-Cuno Affair
86/224:	Jean-Michel GRANDMONT	Stabilizing Competitive Business Cycles
86/225:	Donald A.R. GEORGE	Wage-earners' Investment Funds: theory, simulation and policy
86/227:	Domenico Mario NUTI	Michal Kalecki's Contributions to the Theory and Practice of Socialist Planning
86/228:	Domenico Mario NUTI	Codetermination, Profit-Sharing and Full Employment
86/229:	Marcello DE CECCO	Currency, Coinage and the Gold Standard
86/230:	Rosemarie FEITHEN	Determinants of Labour Migration in an Enlarged European Community
86/232:	Saul ESTRIN Derek C. JONES	Are There Life Cycles in Labor-Managed Firms? Evidence for France

86/236: Will BARTLETT Milica UVALIC	Labour Managed Firms, Employee Participation and Profit Sharing - Theoretical Perspectives and European Experience.
86/240: Domenico Mario NUTI	Information, Expectations and Economic Planning
86/241: Donald D. HESTER	Time, Jurisdiction and Sovereign Risk
86/242: Marcello DE CECCO	Financial Innovations and Monetary Theory
86/243: Pierre DEHEZ Jacques DREZE	Competitive Equilibria with Increasing Returns
86/244: Jacques PECK Karl SHELL	Market Uncertainty: Correlated Equilibrium and Sunspot Equilibrium in Market Games
86/245: Domenico Mario NUTI	Profit-Sharing and Employment: Claims and Overclaims
86/246: Karol Attila SOOS	Informal Pressures, Mobilization, and Campaigns in the Management of Centrally Planned Economies
86/247: Tamas BAUER	Reforming or Perfecting the Economic Mechanism in Eastern Europe
86/257: Luigi MONTRUCCHIO	Lipschitz Continuous Policy Functions for Strongly Concave Optimization Problems
87/264: Pietro REICHLIN	Endogenous Fluctuations in a Two-Sector Overlapping Generations Economy
87/265: Bernard CORNET	The Second Welfare Theorem in Nonconvex Economies
87/267: Edmund PHELPS	Recent Studies of Speculative Markets in the Controversy over Rational Expectations
87/268: Pierre DEHEZ Jacques DREZE	Distributive Production Sets and Equilibria with Increasing Returns
87/269: Marcello CLARICH	The German Banking System: Legal Foundations and Recent Trends
87/270: Egbert DIERKER Wilhelm NEUEFEIND	Quantity Guided Price Setting
87/276: Paul MARER	Can Joint Ventures in Hungary Serve as a "Bridge" to the CMEA Market?

87/319:	Peter RAPPOPORT Lucrezia REICHLIN	Segmented Trends and Nonstationary Time Series
87/320:	Douglas GALE	A Strategic Model of Labor Markets with Incomplete Information
87/321:	Gianna GIANNELLI	A Monopoly Union Model of the Italian Labour Market: 1970-1984
87/322:	Keith PILBEAM	Sterilization and the Profitability of UK Intervention 1973-86
87/323:	Alan KIRMAN	The Intrinsic Limits of Modern Economic Theory
87/324:	Andreu MAS-COLELL	An Equivalence Theorem for a Bargaining Set
88/329:	Dalia MARIN	Assessing Structural Change: the Case of Austria
88/330:	Milica UVALIC	"Shareholding" in Yugoslav Theory and Practice
88/331:	David CANNING	Convergence to Equilibrium in a Sequence of Games with Learning
88/332:	Dalia MARIN	Trade and Scale Economies. A causality test for the US, Japan, Germany and the UK.
88/333:	Keith PILBEAM	Fixed versus Floating Exchange Rates Revisited.
88/335:	Felix FITZROY Kornelius KRAFT	Piece Rates with Endogenous Monitoring: Some theory and evidence
88/337:	Domenico Mario NUTI	On Traditional Cooperatives and James Meade's Labour-Capital Discriminating Partnerships
88/338:	Pietro REICHLIN Paolo SICONOLFI	Government Debt and Equity Capital in an Economy with Credit Rationing
88/339:	Alfred STEINHERR	The EMS with the ECU at Centerstage: a proposal for reform of the European rate system

88/340:	Frederick VAN DER PLOEG	Monetary and Fiscal Policy in Interdependent Economies with Capital Accumulation, Death and Population Growth
88/341:	David CANNING	Optimal Monetary Policy in an Economy without a Forward Market for Labour

Spare copies of these working papers and/or a complete list of all working papers that have appeared in the Economics Department series can be obtained from the Secretariat of the Economics Department.

EUI WORKING PAPERS

EUI Working Papers are published and distributed by the European University Institute, Florence.

A complete list and copies of Working Papers can be obtained free of charge - depending on the availability of stocks - from:

The Publications Officer
European University Institute
Badia Fiesolana
I - 50016 San Domenico di Fiesole (FI)
Italy

Please use order form overleaf

PUBLICATIONS OF THE EUROPEAN UNIVERSITY INSTITUTE

To The Publications Officer
European University Institute
Badia Fiesolana
I - 50016 San Domenico di Fiesole (FI)
Italy

From Name ....
Address ....
....
....
....

Please send me:

☐ a complete list of EUI Working Papers

☐ the following EUI Working Paper(s):

No.: ....

Author, title: ....
....
....
....
....

Date: ....

Signature: ....

PUBLICATIONS OF THE EUROPEAN UNIVERSITY INSTITUTE DECEMBER 1987

87/284:	Saul ESTRIN and Derek JONES	The Determinants of Workers' Participation and Productivity in Producer Cooperatives
87/285:	Domenico Mario NUTI	Financial Innovation under Market Socialism
87/286:	Felix FITZROY	Unemployment and the Share Economy: A Sceptical Note
87/287:	Paul HARE	Supply Multipliers in a Centrally Planned Economy with a Private Sector
87/288:	Roberto TAMBORINI	The Stock Approach to the Exchange Rate: an Exposition and a Critical Appraisal
87/289:	Corrado BENASSI	Asymmetric Information and Financial Markets: from Financial Intermediation to Credit Rationing *
87/290:	Johan BARNARD	The European Parliament and Article 173 of the EEC Treaty
87/291:	Gisela BOCK	History, Women's History, Gender History
87/292:	Frank PROCHASKA	A Mother's Country: Mothers' Meetings and Family Welfare in Britain, 1850 - 1950
87/293:	Karen OFFEN	Women and the Politics of Motherhood in France, 1920 - 1940
87/294:	Gunther TEUBNER	Enterprise Corporatism
87/295:	Luciano BARDI	Preference Voting and Intra-Party Competition in Euro-Elections
87/296:	Gianna GIANNELLI	On Labour Market Theories
87/297:	Domenica TROPEANO	The Riddle of Foreign Exchanges: A Swedish-German Debate
87/298:	B. THOM, M.BLOM T. VAN DEN BERG, C. STERK, C. KAPLAN	Pathways to Drug Abuse Amongst Girls in Britain and Holland
87/299:	V. MAQUIEIRA, J.C. LAGREE, P. LEW FAI, M. De WAAL	Teenage Lifestyles and Criminality in Spain, France and Holland

* :Working Paper out of print

PUBLICATIONS OF THE EUROPEAN UNIVERSITY INSTITUTE DECEMBER 1987

87/300:	A. ELZINGA, P. NABER, R. CIPPOLLINI, F. FACCIOLI, T. PITCH	Decision-Making About Girls by the Criminal Justice System in Holland and Italy
87/301:	S. LEES, J. SHAW, K. REISBY	Aspects of School Culture and the Social Control of Girls
87/302:	Eleanor MILLER, Rosa ANDRIEU-SANZ and Carmen VAZQUEZ ANTON	Becoming a Teenage Prostitute in Spain and the U.S.A.
87/303:	Mary EATON and Lode WALGRAVE	A comparison of crime and its treatment amongst girls in Britain and Belgium
87/304:	Annie HUDSON Edna OPPENHEIMER	Towards an effective policy for delinquent girls
87/305:	G. VAN DER LAAN and A.J.J. TALMAN	Computing, Economic Equilibria by Variable Dimension Algorithms: State of the Art
87/306:	Paolo C. GARELLA	Adverse Selection and Intermediation
87/307:	Jean-Michel GRANDMONT	Local Bifurcations and Stationary Sunspots
87/308:	Birgit GRODAL/Werner HILDENBRAND	Income Distributions and the Axiom of Revealed Preference
87/309:	Eric PEREE/Alfred STEINHERR	Exchange Rate Uncertainty and Foreign Trade
87/310:	Giampaolo VALDEVIT	American Policy in the Mediterranean: The Operational Codes, 1945-1952
87/311:	Federico ROMERO	United States Policy for Postwar European Reconstruction: The Role of American Trade Unions
87/312:	Pietro REICHLIN	Output-Inflation Cycles in an Economy with staggered wage setting
87/313:	Neil KAY, Jean-Philippe ROBE and Patrizia ZAGNOLI	An Approach to the Analysis of Joint Ventures
87/314:	Jane LEWIS	Models of Equality for Women: The Case of State Support for Children in 20th Century Britain

* :Working Paper out of print

87/315:	Serge NOIRET	Nuovi motivi per studiare i meccanismi delle leggi elettorali. Una riflessione metodologica a proposito della legge del 1919 in Italia
87/316:	Alain GOUSSOT	Les sources internationales de la culture socialiste italienne à la fin du 19e siècle et au début du 20e siècle. Problèmes de la composition de l'idéologie du PSI et ses rapports avec la circulation des idées en Europe
87/317:	Eamonn NOONAN	Württtemberg's exporters and German protection, 1931-36
87/318:	Jean-Pierre CAVAILLE	Theatrum Mundi. Notes sur la théatralité du Monde Baroque.
87/319:	Peter RAPPOPORT and Lucrezia REICHLIN	Segmented Trends and Nonstationary Time Series
87/320:	Douglas GALE	A Strategic Model of Labor Markets with Incomplete Information
87/321:	Gianna GIANNELLI	A Monopoly Union Model of the Italian Labour Market
87/322:	Keith PILBEAM	Sterilization and the Profitability of UK Intervention 1973-86
87/323:	Alan KIRMAN	The Intrinsic Limits of Modern Economic Theory
87/324:	Andreu MAS-COLELL	An Equivalence Theorem for a Bargaining Set
88/325:	A. GROPPI	"La classe la plus nombreuse, la plus utile et la plus précieuse". Organizzazione del lavoro e conflitti nella Parigi rivoluzionaria.
88/326:	Bernd MARIN	Qu'est-ce que c'est "Le Patronat"? Quelques enjeux théoriques et observations empiriques
88/327:	Jean BLONDEL	Decision-Making Processes, Conflicts, and Cabinet Government
88/328:	Ida KOPPEN	The European Community's Environment Policy. From the Summit in Paris, 1972, to the Single European Act, 1987
88/329:	Dalia MARIN	Assessing Structural Change: The Case

* :Working Paper out of print

		of Austria
88/330:	Milica UVALIC	"Shareholding" in Yugoslav Theory and Practice
88/331:	David CANNING	Convergence to Equilibrium in a Sequence of Games with Learning
88/332:	Dalia MARIN	Trade and Scale Economies. A causality test for the U.S., Japan, Germany and the UK
88/333:	Keith PILBEAM	Fixed versus Floating Exchange Rates Revisited
88/334:	Hans Ulrich Jessurun d'OLIVEIRA	Die EWG und die Versalzung des Rheins
88/335:	Felix Fitzroy and Kornelius Kraft	Piece Rates with Endogenous Monitoring Some Theory and Evidence
88/336:	Norbert LORENZ	Die Übertragung von Hoheitsrechten auf die Europäischen Gemeinschaften - verfassungsrechtliche Chancen und Grenzen einer europäischen Integration erläutert am Beispiel der Bundesrepublik Deutschland, Frankreichs und Italiens -
88/337:	Domenico Mario NUTI	On Traditional Cooperatives and James Meade's Labour-Capital Discriminating Partnerships
88/338:	Pietro REICHLIN and Paolo SICONOLFI	Government Debt and Equity Capital in an Economy with Credit Rationing
88/339:	Alfred STEINHERR	The EMS with the ECU at Centerstage: A proposal for reform of the European Exchange rate system
88/340:	Frederick VAN DER PLOEG	Monetary and Fiscal Policy in Interdependent Economies with Capital Accumulation, Death and Population Growth
88/341:	David CANNING	Optimal Monetary Policy in an Economy without a Forward Market for Labour
88/342:	Gunther TEUBNER	"And God Laughed..." Indeterminacy, Self-Reference and Paradox in Law

* :Working Paper out of print