MONETARY POLICY UNDER RATIONAL EXPECTATIONS: A selective overvew

By DIMITRIOS VASILIOU, M.A. (Econ)

I. Introduction

In the 1960s, economists knew or thought they knew the kind of policy which would yeild improvements in economic performance beneficial to everyone. The neo-Keynesian view together with the Phillips curve was the dominant theory which has given the quidelines to the policymakers. The key element was the existence of a «tradeoff» between inflation and real output. So a high rate of inflation has been associated with a low unemployment rate and high output. But although these neo-Keynesian models have worked quite well in the 1960s, they could not repeat their good performance in the next decade.

During the 1970s the inflation rate has seldom been running at a single figure and at the same time the unemployment rate has been extremely high (especially at the end of this decade in the United Kingdom). Thus, T«stagflation» has proved that policy recommendations based on the above theory were not very successful. Stabilization policy as it has been described by the macromodels could not fulfill its role.

The need for a different kind of policy has resulted in a remarkable development of the theories of the business cycle. However the most significant development in macroeconomics during the last decade has been the Rational Expectations theory. This «revolution» is associated with the re-emergence of Classical economics and is based on R. Lucas's original application of an earlier assumption made by Muth (1961) about how economic agents form their forecasts. Rational Expectations theory still assumes the two Classical postulates (i) that markets clear and (ii) that agents act in their own self interest, and also concludes with the same monetary ineffectiveness proposition. Moreover, the «New Classical Macroeconomists» as its followers are commonly referred to, are capable of expalining the positive correlations between money stock and aggregate output or employment which have been observed and the Classical models failure to explain. We now turn to this theory which is based, as already mentioned, on Muth's (1961) assumption that individuals form their forecasts rationally.

II. The theory of non-Activist policy under Rational Expectations. Definition and assumptions.

All economic agents have expectations for future events bassed on their information set. The Rational Expectations theorists argue that these expectations are exactly the same as the predictions of the relevant economic theory. Rephrasing the above assumption as Muth (1961) has done, we can cite that the subjective probability distribution of outcomes tend to be distributed, for the same information set, about the «objective» probability distributions of outcomes. In order to use this assumption in their models, the New Classical Macroeconomists have defined agents' rational expectations of future economic variables as true mathematical expectations conditioned on all information known to them (i.e. to economic agents).
Albgebrically this definition can be written in general as:

$$x_t = E_{t \cdot k} [Xt/lt\text{-}k]$$

where TX^*_t denotes the expectation at time t of a variable x, and $E_{t\text{-}k}$ [Xt/It-k] is the mathematical expectation of χ at time t conditional to the information set I which is known at time t-k. (i.e. t-k is the current period at which the agents form their expectations for the period t).

However it is worth pointing out that the main implication of the rational expectations hypothesis for macroeconomic modelling, is its ability to solve simultaneously for the expectations of the endogenous variables and their actual values calculated from the model.[1]

The models in which the New Classical Macroeconomists use the above definition of Rational Expectations are mainly Walrasian equilibrium models. Consumers, firms, and, in general, all the economic agents are assumed price takers. The prices are flexible and there exists a set of prices (i.e. a competitive equilibrium) that could logically reconcile the potentially conflicting choices of all the agents of the economy.

The Rational Expectations theorists incorporate this new way of forming optimal forecasts into their models, by making some critical assumptions about the structure of the economy. One of these critical assumptions is that the individuals' information set includes both knowledge of the specification of the structure of the economy itself and knowledge of the appropriate past and current data for taking economic decisions. A second assumption is the acceptance of the «natural rate of unemployment» hypothesis.

Milton Friedman first used this term in his 1967 presidential address to the American Economic Association. According to his view there are some unique «natural» levels of aggregate output, employment and unemployment, which are exogenous and not numerically constant «but depend(s) on «real» as opposed to monetary factors — the effectiveness of the labour market, the extend of competition or monopoly, the barriers or encouragements to working in various occupations, and so on» Friedman (1977). In this way if the actual aggregate output and emplyment

are higher than their natural magnitudes then the actual inflation rates are higher than the expected. Higher actual inflation rates than the expected tend to increase the inflationary expectations and so there will be steady increases in both the expected and the actual inflation rates. Exactly the opposite results (i.e. decreases in the actual and the expected inflation rates) will occur in the case where actual output and employment are below their natural levels. Thus, according to the natural rate hypothesis, there is no economic policy which can permanently keep output above and unemployment below their natural levels.

The only service that economic policy can offer is to minimize the difference between actual and expected inflation rates which will have as consequence the minimization of the difference between actual levels of output and unemployment and their natural levels.

There are also other assumptions which are worth noting. Private economic agents are supposed to collect and use information until the marginal alternative cost of collecting and using this information equals the marginal benefit from it. So the individuals' information set is not unbounded. Furthermore, the New Classical Macroeconomists assume that the different expectations of the agents, conditional on the above specified information set, will average out. Thus, they assume that in general all the economic agents form the same expectations; an assumption which according to their view, «fits the facts».

The neutrality hypothesis

The Rational Expectations theorists have used many models both complicated and simple, which conclude in more or less the same result: the neutrality hypothesis or the policy ineffectiveness proposition. In order to show this hypothesis we shall use the following model:[2]

$$Yt = a_0 + a, [it - E_{t-1} Pt_{+1} - Pt)] + v_{1t}, \quad a_1<0 \tag{1}$$

$$M_t - P_t = C_0 + C,Y_t + C_2 i_t + v_{2t}, \qquad C_2<0<C, \tag{2}$$

$$Y_t = a_0 + a, (P_t - E_t.iPt) + a_2 Y_t - i + u_t, \qquad a,>0,\ 1>a_2>0 \tag{3}$$

$$M_t = \mu_0 + \mu_1 M_{t-1} + \mu_2 Y_{t-1} + e_t \tag{4}$$

where Y_t,Pt and M_t are logarithms of aggregate output, price level and money stock respectively; i, is the one-period nominal rate of interest; $E_t iPt+j$ is the mathematical expectation of $P_{t+}j$ (for j=0,l,...) computed using the equations of the model and conditioned to the information set which is known at the period t-1. We also assume that the disturbances vi_t, V_{2t}, u_t and e_t follow a normal distribution (i.e. they have zero means and constant variances), and they are stochastically independent of past values of all variables and disturbances. In this model the first equation denotes that the output demanded for cosnumption and investment depends on the real interest rate. The second equation represents the demand for real money balances depend on

the real income and the nominal rate of interest. The third equation denotes that the aggregate supply function depends on its most recent value and the difference between the price level and the expected price level. So the natural rate hypothesis is empbodied in this equation as only the unexpected component of inflation matters. The fourth equation is a policy linear feedback rule in which the money stock depends upon its own most recent value and upon the most recent value of output.

Solving the model for output, we shall receive:

$$Y_t = \alpha_0 + \alpha_2 Y_{t-1} + \frac{\alpha_1 v_t + \beta_1 u_t + \alpha_1 \beta_1 e_t}{\alpha_1 + \beta_1} \qquad (5)$$

where

$$\beta_1 = \frac{a_1}{a_1 C_1 + C_2}$$

This fifth equation denotes that whatever the changes in the values of μ_0, μ_1 and μ_2 are, there will be no effect on output. This conclusion implies the rather «vulgar» version of Rational Expectations theory, as it shows that economic policy[3] cannot affect output at all.

The neutrality hypothesis is very weak when referred to output as a whole, because if we include a real-balance term in the IS function, the hypothesis does not hold any more. Sargent and Wallace in their 1975 model by assuming that there was no real-balance term in the IS function, concluded that changes in monetary policy parameters cannot affect movements in the real interest rate. So if the rate of growth of the capital stock depends only upon the real interest rate, the changes in the capital stock will be policy-independent. But if we add a real-balance term to the IS function, then the policy ineffectiveness proposition is invalid for the actual output. A result which even McCallum admitted in his 1980a paper. However, and this is very important, the neutrality hypothesis is still valid for the difference between actual and «natural» level of output.

McCallum (1980) has claimed that the neutrality hypothesis refers to output relative to capacity[4] and not to output itself. He has defined capacity (Y|) for the above simple model as the value of output that would be if there were no expectational errors (i.e. $P_t = E_t$-iPt) and if the output in the previous period equalled capacity in the same period (i.e. Y_t-i = Y⁻M). Taking the difference between actual and capacity output, the validity of the policy ineffectiveness proposition is provable. The same statement can also be concluded for Barro's (1976) «full information» output. But his definition is different from McCallum's in that only expectational errors are absent from his «output»; that is, ectual output did not equal full information output in the previous period.

We can now define the neutrality hypothesis as the economic policy that involve systematic responses to business cycle evelopments is ineffective in influencing the time pattern of difference between actual and natural levels of aggregate output and employment. The policy ineffectiveness proposition is based on the natural rate hypothesis together with some crucial assumptions about information. These assumptions seem to be:

(a) Government policy behaviour can be explained in terms of a policy rule so that government economic policy can itself be forecasted by the private agents, even if the government does not announce its behavioural pattern .
(b) The effects of the forecasted economic policy can be foresseen, on average, correctly. That is, the private agents by knowing the economic policy and the structure of the economy can predict accurately the effects of this policy.
(c) Individuals behave according to their perceptions or their expectations. In other words, aggregate output and employment satisfy market-clearing conditions.

The non-neutrality hypothesis.

The policy ineffectiveness proposition is a characteristic of stochastic steady state economics and it can predict nothing for the next period if we change the current policy. This happens because there will be a transitory or learning period until agents' expectations conform to a new steady state. At this point the New Classical Macroeconomists make the essential assumption that after the transitory period, the economy will converge in a new steady state. Thus, for a short period after a new policy rule (but different from the old) has been adopted or in general, when the economic policy is unsystematic or unperceivable for some reasons, it is very difficult for the private agents to make accurate forecasts of future economic variables. Thus, the behaviour of individuals is different that it would otherwise be. This incomplete information assumption generates the nonneutrality hypothesis in which unanticipated economic policy can influence in a significant way the pattern of business cycles. This is the explanation for the empirical relation between them.

A more formal analysis can be given in explaining the positive correlations between measures of aggregate demand, like the money stock, and aggregate output or employment. It can also explain the positive correlation in the time series between prices and/or wages, and measures of aggregate output or employment. The key point for showing all the aforementioned (i.e. the non-neutrality hypothesis), is the relaxation of the classical perfect information assumption. Let us suppose that economic agents have limited information and they do not know all the relative prices of the various goods they are interested in. Then, although individuals are making the best possible forecasts of all the relative prices they care about, errors are unavoidable. Thus, a general increase in all absolute prices is taken by the agents as an increase in the relative price of the good they are selling, leading them to increase their output more than they had planned. This increase of output will occur whenever

the actual price level exceeds agents' expectations and vice versa. However individuals, by assumption, do not make systematic mistakes. The more frequent the economicpolicy is unpredictable and unperceivable, the more often private agents' forecasts are accurate. Thus, we can denote a proposition which can be called the variance hypothesis, that the larger the variance of economic policy, the smaller the effects on aggregate output and employment.

From all we have cited so far, it is obvious that the content of the information set is very crucial to the results of the Rational Expectations theory. By assuming for instance, that private agents have current period aggregate information when forming their expectations, the first equation of the simple aforementioned model can be written:

$$Y_t = a_0 + a, [i_t - E_t(P_{t+I} - P,)] + v_{lt}, a,<0 \qquad (\Gamma)$$

In this case if we solve the model (McCallum 1980a) we shall find out that the neutrality hypothesis does not hold any more.

The econometric policy evaluation proposition.

Lucas (1976) has launched a critique on the theoritical framework of the econometric tradition of forecasting models or on, as he prefers to call· it (following Tinbergen), the «theory of economic policy» based on this tradition. The Lucas' criticism is that the basic assumption for economic analysis (i.e. that the parameters of econometric models are invariant to changes in economic policy) is invalid. The syllogism behind this proposition as it was pointed out by Lucas in his 1976 paper is that «given that the structure of an econometric model consists of optimal decision rules of economic agents, and that optimal decision rules vary systematically with changes in the structure of series relevant to the decision maker, it follows that any change in policy will systematically alter the structure of econometric models».

The essence of the econometric policy evaluation proposition is that simulations of the major econometric models under alternative economic policy cannot provide quidance for policy decisions. This happens because while these simulations are based on fixed parameters estimated from the sample period, the true parameters may vary with each alternative policy. Thus, Lucas has concluded that such simulations cannot provide any useful information for the consequences of alternative economic policy. On the other hand Gordon (1976) has proposed that econometric macromodels can provide useful information on the effects of *some* policy changes if they allow for parameter shifts. These shifts can be estimated from the response of parameters to alternative policies within the sample period or can be deduced from a priori theoritical consideration. However, as he has admitted, his conclusions do not contradict Lucas' proposition that econometric simulations cannot predict the effects of *all* alternative economic policies but, as he added, only some.

One of the reasons for the inaccurary of the invariant of econometric model parameters is, as Taylor (1980) has claimed, that the parameters of these models in-

corporate people's expectations which change according to the changes of the economic policy. (Of course this is not the only reason why parameters shift in macroeconometric models). However a technique that deals with this particular aspect of the Lucas criticism and which appropriately modifies policy evaluation procedures is the Rational Expectations mechanism. Thus, assuming that Rational Expectations are accurate, we can deduce a new expectations mechanism whenever we change the economic policy which is incorporated in the model.

III. The theory of Activist policy under Rational Expectations
The policy effectiveness proposition.

There are some economists who have created models where agents' expectations are the predictions implied by the model itself, contingent on the information set available to economic agents, (i.e. incorporating the Rational Expectations hypothesis) and conclude in exactly opposite results of the aforementioned.
Their conclusion, that activist monetary policy can affect the behaviour of real output, is based on the Keynesian assumption that prices are rigid, at least in the short run, for one reason or another. In this paper we shall pay attention to some of these models such as Fischer' s (1977), Phelps and Taylor's (1977) etc.

Both Fischer' s and Phelps-Taylor's models are demand and not supply-oriented. Fischer (1977) has assumed that demand determines the level of employment, while Phelps-Taylor (1977) have supposed that the aggreagate demand determines the expected value of output in the current period. Another important characteristic of these models is that the effectiveness of the monetary policy is based on the assumption that the economy is subjected to random distrubances that affect output and the price level in each period. So by creating a monetary policy rule based on such «noise» in the monetary policy rule decreases the information value of individual price observations and so affects output. However his monetary policy rule does not include any such disturbance as a variable.

S. Fischer in his 1977 paper used a short-run «wage stickiness» in his model by assuming that all labour contracts have been made for two periods. In everything else the model was similar to the simple rational expectations model of Sargent and Wallace (1975). Moreover, if the model includes only one-period labour contracts, then the Sargent-Wallace results are confirmed. The explanation which Fischer has given for the irrelevance of the monetary rule for the behaviour of output, is that money is neutral and individuals know each period the money supply which will exist in the next period; so they set their nominal wage as to maintain constancy in their real wage. On the other hand the results are entirely different when tow-period nonindexed labour contracts have entered into the same model. By assuming that the contracts which have drawn up at the end of period t specifies nominal wages for period (t+1) and (t+2), he has concluded that monetary policy can affect the real output. The explanation which Fischer has offered for this conclusion is that by having two period labour contracts, the monetary authorities can react, during the second period of the contract, to new information about recent economic disturbances. Furthermore, as in the second period the nominal wage has already been negotiated, the

monetary authorities can affect the real wage of that period and thus output. However, as the same economist has pointed out, we should not expect the monetary policy to attain arbitrary levels of output because «the use of too active a policy would lead to a change in the structure of contracts». (Fishcer 1977). Needless to say the only case in which neutrality hypothesis could occur in this model is when the contracts are indexed in a way which duplicates the effects of a single-period contracts or the use of spot markets.

Edmund Phelps and John Taylor's 1977 paper had the same principal theme as Fischer's and more or less the same result i.e. that monetary policy is effective. However it is price, rather than wage, rigidity that leads to the above conclusion, although in an appendix of their paper they have presented a model where the money wage was also predetermined. Their essential assumption is that firms choose to set their prices and wage rates one period before the current period in which the monetary authorities decide their policy. So the government's information set is different and larger than the firm's information set, and prices and wages are sticky as they have predetermined from the previous period rather than the current period. Their conclusion is that the price rigidity generates a lagged noise on the stochastic evolution of inventories, prices and output; and the variance of this noise depends on the monetary policy parameters. So even correctly anticipated monetary policy can be useful for stabilization of output in a rational expectations model with sticky prices and wages. Moreover, another important result which has emerged from this paper is that a passive (1959) Friedman monetary rule will generally be inefficient with regard to the variances of output and the price level. However, they have also pointed out (as Fischer has) that hyperactivist monetary policy will not determine the expected price level and so the current aggregate demand.

Another study in the same area but which is much different from the aforementioned is that of Howit (1981). Instead of a Walrasian auctioneer in a «market-clearing» model, he has used a sequence of six stages in which economic activities proceed in each time period. According to his view this scheme «bears some resemblance to the way prices actually get determined in many real-world markets» (Howit 1981). This paper is very important because it takes into account that there are positive costs of gathering and processing information and there is uncertainty concerning the structure of the economic system. However the whole structure of the model is different from that of Phelps-Taylor and Fischer. In this model economic agents formulate their demands so as to maximize their utility function subject to their budget constraint. Then a monitoring cost has been entered into the model. This cost indicates the expenses that economic agents should spend in monitoring a monetary policy indicator. It can also be separated into a collecting information cost and a processing information cost (i.e. computing and posting the optimal price of good-there is only one good in the model-given the value of the monetary policy indicator). In this case an economic agent is monitoring only if his additional expected utility of monitoring at least equals the minitoring cost. Assuming that the model applies to perfect competition economies, Howit has considered three alternative monetary policies: (i) a neutral monetary policy (ii) an activist policy and (iii) a disseminating policy, suggested by Barro, which proposes to nullify the policy reaction

coefficient (there is only one in the model) and publicize the monetary policy indicator. Accoring to Howit (1981) the activist monetary policy will dominate the other two policies if «(i) the [monetary policy] indicator is reliabe enough, effective demand is unstable enough, or marginal cost rises fast enough that V^{s}|i.e. the social gain to monitoring] exceeds the cost of administering an activist policy; and (ii) the cost of processing the information contained in the indicator [of monetary policy] is large enough or the predictability of the effect of changes in the level of aggregate demand is small enough that» the quotient of these two aforementioned magnitudes at least equals the social gain to monitoring[5].

Under these conditions, Howit has concluded, it is not necessary for the monetary authorities to have any cost advantage relative to the private agents, as the latter will not monitor even if the cost of collecting information is amost zero (because of the positive processing information cost). Thus, in the above special circumstances, an activist monetary policy is optimal.

The econometric policy evaluation proposition.

There are only a few models that can be used for valid policy simulations; that is simulations that are not open to Lucas's (1976) critique. Such models are Sargent (1976a), Barro (1978), Blanchard (1978), Blanchard and Wyplosz (1978), Taylor (1979), Blanchard (1980), Chow (1980) and perhaps a few others. Taylor's, Blanchard's and Chow's models favour more the activist stabilization policy, while in Sargent's and Barro's the choice among systematic policy feedback rules has no effect on output or unemployment processes. However, in this paper we shall take a closer look at Gregory C. Chow's study.

Chow (1980) has started his analysis by considering a linear reduced form model:

$$Y_t = BE_{t\_}!(Y_t) + B,E_t\text{-}i(Yt_{+}i) + AYt\text{-}i + CX_t + b_t + U_t \qquad (6)$$

where Y_t denotes a vector of endogenous variables X_t a cector of policy instruments or control variables, b_t a vector of exogenous variables not subject to control, and U_t is a vector of serially uncorrelated, identically distributed disturbances. At this point Chow has made some very important assumptions about the following procedure. He has assumed that monetary authorities announce their policy at the beginning of the planning period, irrespective of the nature of this policy. So the vector of policy instruments is known to the economic agents (i.e. $E_{t\_}i$ (X() = Xt). Moreover he has supposed that monetary authorities and individuals have identical expectations for the comined effects of the exogenous variables. Furthermore a rather «heroic» assumption follows. He has assumed that selected elements of $E_{t\_}i(Y_{t+}i)$ are equal or proportional to the corresponding elements of E_t-i(Yt)· Thus, the model will not embody expectations of future variables any more.

Therefore Chow has been able to entirely eliminate expectations of endogenous variables without any difficulty. One well-known method of achieving this is to take conditional mathematical expectations of both sides of equation (6) given $I_{t\_}i$, and

solve for $E_{t-1}(Y)$. Substituting the result back into equation (6) someone will receive:

$$Y_t = \bar{A}_t Y_{t-1} + \bar{C}_t E_{t-1} + (X_t) + (I-B)^{-1} E_{t-1}(b_t) + n_t \quad (7)$$

where $\bar{A} = (I-B)^{-1}A$, $\bar{C} = (I-B)^{-1}C$. Once the terminal codition for $E_{t-1}(Y_{t+i})$ has specified in equation (7), the set of difference equations (6) can be solved backwards in time by lagging one period equation (6) and repeating the same with the above procedure. In general equation (7) can be written:

$$Y_t = \bar{A}_t Y_{t-1} + \sum_{i=t}^{T} \bar{C}_{t,i} E_{t-1} + (X_i) + \sum_{i=t}^{T} D_{t,i} E_{t-1}(\bar{b}_i) + n_t \quad (8)$$

where $D_{tt} = I$. And as he has pointed out, this eight equation can be used to generate predictions for Y_t t=1, ...T) for the purpose of policy evaluation. Thus, Chow has shown that econometric policy evaluation is possible when rational expectations are used in macroeconometric models. However Chow has gone a step further and tried to formulate econometric policy optimazation. By considering a loss function in addition to his model, he has tried to find an optimal policy which will minimize total expected loss for T periods. He has used two types of monetary policy: (i) an open-loop policy where a vector (Xi ···. X_T) is announced for T periods and (ii) a linear feedback policy of the form

$X_t = G_t Yt\text{-}i + gt$, G_t and g_t being constants. But in equation (6) the first three terms on the right-hand side are all functions of Y_tt-> so he has concluded that a feedback policy may be better than an open-loop policy (as it takes into account the value of the endogenous variables in the previous time period). To find an optimal feedback monetary policy, Chow has suggested that the application of the method of dynamic programing is valid. But Kydland and Prescott (1977) have written that «current decisions of economic agents depend in part upon their expectations of future policy actions [and] ... only if these expectations were invariant to the future policy plan selected would optimal control theory be appropriate». However Chow has argued that optimal control theory is applicable in a model incorporating rational expectations, if the effects of future expectations are properly taken into account. And in order to prove this argument he has described a method of receiving optimal feedback rules by using the application of dynamic programing as stated in a previous paper (Chow 1975).

IV. Some Criticisms

Non-Tactivist models.

There are many characteristics of the neutrality proposition favoured in rational expectations models which have been criticized The most important of them, according to Fair (1978), is that the economic agents are assumed to be rational with respect to the formation of their expectations, but they are assumed to be irrational

with respect to their overall behaviour. That, is, most of these models do not assume that private agents' decisions are bassed upon the maximization of a utility function.

Fair (1978) has also pointed out the omission of some important variables from the supply equation of most rational expectations models. These models assume that the aggregate supply depends positively on the difference between the actual and the expected price level. This assumption «can be viewed as an effect of speculation over time associated with the intertemporal substitutability of leisure» (Barro 1976). That is, the aggregate supply function is closely related to the labour supply function. So rational expectation models are anologous to the Lucas and Rapping model where by assuming, among the other things that future leisure is a substitute for current leisure, labour supply is seen to be a positive function of the current wage rate and a negative function of the current and discounted future price and discounted future wage rate. The discount rate is the nominal interest rate. Thus, the interest rate, by affecting the current labour supply in Lucas and Rapping's model, should have an effect on the aggregate supply function of the rational expectations models (which are analogous to Lucas and Rapping's model as stated above). Except of the interest rate, the initial value of assets also has an effect on the current labour supply in the Lucas and Rapping model. So it should be included in the aggregate supply equation of rational expectations models; but most of them do not include any asset variables. However, Barro's 1976 model does include such a variable. Another variable which R. Fair (1978) feels that is excluded from the New Classical Macroeconomists' models' supply function is the personal tax rates. These have an effect on labour supply and so they should be embodied into the supply equation if the last has any microeconomic justification.

The above omissions would not be so important if they did not have any effect on the policy ineffectiveness proposition. But as Fair (1978) has shown by including rational expectations in a model having maximizing agents (Fair 1974), the monetary authorities can affect real output. Even if government actions are anticipated, they can affect the variables that influence labour supply (i.e. they can affect the labour-leisure of economic agents), and so they can affect output. «The key variable that government actions do affect, which in turn affects the labour-leisure choice of households and thus real output, is the interest rate». (Fair 1978).

Another important point about the crucial aggregate supply functions has been raised by B. Friedman (1978). The non-neutrality hypothesis is based, as we have already mentioned, on the assumption that agents under certain conditions make temporary mistakes by taking «... a general increase in all absolute prices as an increase in the relative price of the good that they are selling, leading them to increase their supply of that good over what they had previously planned...» (Lucas-Sargent 1978). But if the economic agents learn the prices of imputs which they buy, before they learn the prices of outputs at which they can sell their products, the rational expectations aggregate supply function will imply results exactly opposite to those of the New Classical Macroeconomists. In this case an increase in the relative price of the

good that economic agents are buying (which would be followed by an increase in the price of the good they are selling or in all absolute prices), will lead them to decrease their production. Thus, B. Friedman has concluded that the above assmption is rather an ad hoc, arbitrary restriction as he could not see any justification behind it.

In addition Haberler has expressed doubts about the Rational Expectation theorists' assumption that the different expectations of the agents will average out. Furthermore, he has an argument which we could also countersign, that «it is quite difficult to distinguish sharply between fully systematic and Preductable policies, on the one hand, and entirely unsystematic and unpredictable policies on the other». (Haberler 1980).

Activist models.

The New Classical Macroeconomists have criticized Activists' models by pointing out that there is a missing theoretical link in explaining the reason of existing wage and price rigidity. S. Fischer, although, does admit that there is not a microeconomic basis for the existence of long-term labour contracts, he has attributed them to the transaction costs of frequent price setting and wage negotiations. Some other economists have suggested that these contracts derive from an insurance element. By this explanation, firms guarantee the workers a fixed wage rate (which incorporates the main portion of the risk), because the firms are assumed to be less risk averse or to have better access to capital markets. However, Lucas has argued that «none of these models offers an explanation as to why people should choose to bind themselves to contracts which seem to be in no one's selfinterest... » and because of this he has conjectured «... that when reasons for this are found they will reduce to ... informational difficulties ...» (Lucas 1981). Moreover Lucas-Sargent (1978) have pointed out that these institutional arrangements should not be considered as exogenous, but endogenous to a model which will show how these contracts are likely to respond to alternative monetary policy regimes. However B. Friedman (1978) has argued that these are long-run models and soare not applicable in this discussion.

The same argument (i.e. that there is no explanation for the price rigidity) can be said for Phelps-Taylor (1977) model, where firms choose to decide the prices and wages at which they would sell and hire a time period in advance. However the authors «do not pretend to have a rigorous understanding of those considerations at this time» TPhelps-Taylor (1977).

P. Howit' s model is important, but unfortunately his perfect competition assumption restricts it, by not being applicable to real markets. At the same time we should feel that the choice of economic policy is a much more complicated phenomenon than can be constructed from two inequalities. But even if we accept it, we ought to question how he can measure all of the magnitudes he is dealing with (Especially *λb).*

The criticism for Chow's model can be addressed to his assumption that selected

elements of Et-1Y + ι) are equal or proportional to the corresponding elements of Et-i(Yt)» which then eliminates expectations of future variables of the model. But, by making this assumption he seems to be assuming, what he should prove; because this is the main theoretical and computational problem in rational expectations models.

There is another point which is quite important and we should consider. The activists address their effectiveness proposition to actual output, while the non-activists to the difference between actual and natural levels of output. So the results are not so comparable.

Activist and non-activist models.

We have discussed so far, the criticisms that have been addressed by activists to non-activists and the other way round. However, there are some criticisms that apply to both categories.

All rational expectations models employ forecasts only for the price level which usually depends upon one time period ahead or, occasionally, upon two. Assuming that the current period is t, most of the models have: (i) currently anticipated value of the next period of the price level (E_tPt+i); 00 a time period past expectationsof the present value of the price level ($E_{t}\_iP,$); and (iii) two time periods pastexpectations of the next period value of the price level ($E_{+}]P_{t}\_i$). But economic agents do not formulate predictions only for the price level; they also have forecasts for other variables such as the money supply, the interest rates etc. At the same time, individuals' expectations go further in time than just one period and of course the economic agents must remember the past values of some macroeconomic variables (at least those variables which are not very old). Unfortunately all the aforementioned is excluded from the rational expectations models.

Another criticism of rational expectations hypothesis is that there is no learning procedure. In other words we do not know how economic agents acquire their knowledge of the true structure of the economy which they use in making their rational forecasts. B. Friedman (1979) has used a least-square mechanism for such learning procedure. Nevertheless, he has concluded that, in this case, rational expectations behave over time as if they were adaptive expectations, which do not yield classical properties in the short run when they are used in macroeconomic models .

Furthermore, except of the learning procedure, we do not have any indication of what individuals' information sets include. Thus, it is obious that there is still a great deal more to be learnt about models embodying rational expectations.

Stability

The study by Evans and Yarrow (1981) which, although applicable to hyperinflation periods, is quite useful since it explores the stability of the equilibrium of raional expectations models. In this paper, Evans and Yarrow have shown that a stable

equilibrium can exist in such models when the monetary authorities use a fixed financing requirement. (In their model the money supply growth varies inversely, proportional to the level of real balances). On the other hand when the money supply growth is constant, their study shows that the equilibrium is unstable under rational expectations. However, even in the case where a stable equilibrium exists, it possesses «perverse» comparative statics.

That is, an expansionary monetary policy which increases the money supply faster than the price level is associated with a falling inflation rate.

The above results cannot be generalized for every period without taking into account some important points. The money demand should not be considered as only a decreasing function of the expected rate of inflation (as it is in their hyperinflation period model), but it should depend on other variables as well. The use of the actual rate of inflation as a proxy of the rational expected rate, as Evans and Yarrow have employed it, should not seem appropriate to us. The rational expected rate of inflation should be the conditional expectation of it, generated by the econometric model itself given the available information set. However, should completely agree with these authors' conclusion that further research should be made for models allowing the coexistence of excess demand for goods and fully acticipated inflation.

V. Towards non-Walrasian Equilibrium

We have discussed so far the disagreement about the ability of the monetary policy to affect real output and employment in a market clearing world. New classical economists agree that, in a Walrasian economy with perfect foreseen government monetary policies a change in the money stock will leave real variables unchanged. This result follows, more or less, from the assumptions of zero degree homogeinity of excess demands, and the stability and uniqueness of the aforementioned equilibrium. On the other hand neo-Keynesian economists departing from a fixed-price equilibrium also agree that a higher money stock may easily yield another equilibrium in which output and employment are higher.

At this point we can introduce the notion of conjectural equilibrium (Hahn 1980) in our discussion. Let us consider an economy being in disequilibrium because of the quantity constraints that it includes. This means that transactions at current prices cannot be completed and quantity constraints may lead to a change in prices (in order to relax these constraints). However, this task will not be completed in the short-run, but rather, in the long-run (Hahn has assumed that there is no Walrasian auctioneer and the agents are price-makers and not price-takers as in the Walrasian oriented theories). So we shall have a sequence of short-run disequilibria (Hahn calls them Drèze equilibria from Dreze's 1975 paper) for some time periods, until the economy converges at the end in a long-run Walrasian equilibrium. Meanwhile, there might be some equilibria where prices stop changing before all quantity constraints have been removed. These are conjectural equilibria (as they have been called by

Hahn) where economic agents are quantity constraints because they are not interested in changing the prices as they think that the cost of removing or reducing a quantity constraint is too high. The same could happen even if economic agents form their expectations rationally. Then we might have long-run quantity constraint rational expectations equilibria, and at least, as Hahn has claimed, this should be the case in labour market. These conjectural equilibria arelong-run approaches in the sense that prices do not change over time if exogenous variables remain unchanged. In this case an activist monetary policy might be efficient. A correctly anticipated higher money stock will increase real cash balances (and action which could also be achieved by lowering money wages-as Walrasian economists argue), and so relax quantity constraints by leading the economy into a state where the price level will be unchanged. At the same time economic agents will not counteract to changes in the money stock, as we have assumed that they know precisely the structure of the economy (New Classical Macroeconomists' assumption). So, if the individual know that the economy will converge in a Walrasian equilibrium where all markets clear, there is no reason to «discount» monetary authorities actions by their actions.

The discussion so far has been concerned with the long-run, although this is not entirely applicable in this paper. However, even if we are not in conjectural equilibria, as Hahn has argued, monetary policy is still useful. Let us recall the aforementioned Drèze equlibria. If the economy is in one of these equilibria, it might reach the Walrasian rational expectation equilibrium after a long time. In this particular case an activist monetary policy, by increasing the stock of cash, will speed the economy to the destination it might reach after a longer period or not at all. Thus, as Hahn has pointed out, this procedure is much faster than the Walrasian price adjustment mechanism, although it converges to the same result. That is, in this particular case, «while the sequence [of Drèze equilibria! may be affected by monetary policy, the final resting place will not». (Hahn 1980).

It is obvious from the above analysis that quantity constraint play a very important role in building macromodels. Economic agents are constrained by more than their budget and the same can be said for firms, unless their profits are always zero. Thus, the demand for goods should depend on quantity constraints and «supply decisions [should alsol depend on forecasts of quantity constraints and on conjectures of the latter's responsiveness to prices» (Hahn 1980b). These constraints can be introduced in a rational expectations model, according to our view, by entering the variable $y - y^a$ into the model, (i.e. the difference between the potential Walrasian full employment output and the actual output). This variable should seem to us more appropriate than the actual output (y^a) which McCallum (1980) considers as an indicator for the quantity constraints. The advantage of taking the difference ($y'-y^3$) is that if the actual output equals the full employment, the variable will vanish.

An important question that has not been answered yet, is whether rational expectations can be incorporated in a disequilibrium model, that is in a non market-clearing model. Although this question will not be discussed here, we should feel that

it is quite important to regard some points about disequilibrium models. In these models the price level fails to equate the aggregate supply with the aggregate demand, as there is no Walrasian price-adjustment mechanism. So the observed actual output is not given by the equation of the aggregate supply with the existing disequilibrium models have employed the assumption that the actual output is the minimum of quantity supplied and quantity demanded at the current price level:

$y^a_t = \min (y^d_t)$[6]. (8)

Unfortunately this specification does not take into account the imperfection of the markets (e.g. the existence of monopolies). However, these «unfortunate» phenomena can be captured by adding an error term on the right hand side of the above equation.

• The essence of the eighth equation is that whenever $y_t < y^s t$ output is assumed to be less than the full employment level and there will be involuntary unemployment proportional to $y^f_t - y^a$ and vice versa

At this point we need a price-adjustment mechanism in order to see how the price level changes over time. Many price-adjustment mechanisms have been constructed by various authors which, for the most part are more or less the same. That is, the inflation rate (P_t-Pt-i) depends upon the past rate of unemployment (yryt-i) and/or the expected or not expected, difference of the past price level from the current full employment (P_t-P_t_i)[7]. Unfortunately these mechanisms are rather arbitrary and it is difficult to think of any theoretical basis for them.

In order to construct a different prce-adjustment mechanism, let us assume that we are in an one-commodity Walrasian market. However, we may suppose that the market does not clear because there is artficial excess demand in it, as the price of the good is higher than it should be (in order to clear the market). This could happen because the producers might earn more by selling lower quantities at a higher price, than by selling larger quantities at a lower price. At least this is the case of coffee in South America and of many fruits in Mediterranean countries. Thus, in the aforementioned particular case the value of the observed (actual) output of the good is higher or at least equal to the value of the potential Walrasian output of the same good.

Generalizing the above reltionship for the whole economy we can write:

$$P_t Y^a_t - P^f_t Y^f_t \geqslant O \qquad (9)$$

where P_t denotes the observed price level at time t, Y^a_t the observed output, p^f_t the potential Walrasian price level and Y^f_t the potential Walrasian output. By assuming that we are in the margin, we can convert the nineth inequality to equility and solving for P_t we can receive an equation for the actual price level.

$$P_t = \frac{P^f_t Y^f_t}{Y^a_t} \qquad (10)$$

However, it is worth pointing out that the above disequilibrium price-adjustment mechanism, under special circumstances, gives exactly the same results as the Walrasian mechanism. The actual price level equals the Walrasian equilibrium price level, when the actual output equals the Walrasian one and vice versa (i.e. $P_t = P^a_t$

The above points sketch a skeleton of a disequilibrium model where it seems quite possible, to incorporate rational expectations. The results of such study might be very interesting.

VI. Instead of Conclusions

The kind of monetary policy that the New Classical Macroeconomists favour, as might be expected, is the constant growth rate rule. This policy was originally proposed by Milton Friedman in his studies «A Monetary and Fiscal Framework for Economic Stability» (1948) and «A Program for Monetary Stability» (1959). Although this rule has had a limited impact so far, Rational Expectations therorists feel that its infuence will be greater in the near future. Lucas (1980) has described this kind of policy, after M. Fredman, as follows:

1. «A 4% annual rate of growth of Ml, maintained as closely as possible on a quarter-to-quarter basis.
2. A pattern of real government expenditures and transfer payments, varying secularly but not in response to cyclical changes in economic activity.
3. A pattern of tax rates, also varying secularly but not in response to cyclical changes in economic activity, set to balance the federal budget *on average*».

The New Classical Macroeconomists do not say that the constant growth rate monetary rule is superior to any activist policy. The only say, that as we do not know so far the sources of busines cycles and the nature of busines cycle dynamics, it is difficult to employ the optimal activist monetary policy. So by employing a sub-optimal activist policy, outcomes might well be inferior to those achievable with a robust constant rate rule.

Moreover, the Rational Expectations theorists do not seem to have a standard transition period policy leading to a fixed-rule regime. This happens because they claim that the monetary authorities are not in a position to influence the economy in any significant way towards fixed non-reactive policy rules. However, the New Classical macroeconomists have suggested some 'mediumterm financial strategies' as (i) the explicit announcement of «monetary growth targets in advance and account for deviations afterward.... [or (ii) 1 movements for constitutional limits on the federal budget deficit». (Lucas 1980). nevertheless, a question ramains. Should the monetary authorities reach their planned growth of the money supply through moderate reductions in successive years ('gradualism'), or through a rapid transition period ('immediacy')? The latter seems to be preferred, although the reasons for this are not very clear.

The non-neutrality hypothesis is based, as we have seen, on the unanticipated

monetary authorities' actions. But as Barro (1976) has written, unanticipated stabilization policy (that is the pure variance of money) clouds the real picture for individuals and is therefore likely to reduce welfare. So the monetary authorities should not introduce any unanticipated changes in their own behaviour, which means that government policy should be as predictable as possible. This is the reason why the Rational expectations theorists ask for a very simple, fixed monetary rule such as 4% annual growth rate of Ml. However, they have shown (Barro 1976), that a constant growth rate rule will be dominated if the monetary authorities have superior economic information - as well as the appropriate objectives - and providing information to the public is costly[9]. But the New Classical Macroeconomists do believe that this is simply not the case and that the monetary authorities should employ M. Friedman's proposal which is based upon the presumption of ignorance of the nature of the business cycle.

On the other hand, neo-Keynesian economists who have used the rational expectations hypothesis in their models, have concluded with exactly the opposite kind of policy. By accepting, for one reason or another, that prices are sticky — at least in a short period — they suggest that changes in the money stock affect the aggregate demand, which affects output and employment. This is the familiar Keynesian mechanism which calls for an activist stabilization monetary policy. This kind of policy — according to their view — dominates a fixed monetary grouth rule. However, some studies (Taylor 1979) have shown that the latter would be superior to the actual (U.S.A. in this case) postwar policies. But let us pay more attention to the differences between these two kinds of policy. The constant rule depends on information which is available at the beginning of the planning period; while the activist policy depends in addition upon the new information which will be available in the future, but was not available when the policy was chosen. So a discretionary monetary policy can differ whenever new coming information calls for it, although this policy has been operating for some period. In other words, it takes new information into account, while a constant monetary rule does not permit any response to it. Thus, an activist policy is much more flexible than a constant monetary rule. This advantage has two aspects. «The first relates to the classic lender of last resort function of the central bank, in which flexibility enables the central bank to intervene in potential financial crises ... The second type of flexibility is that permits the [monetary authorities] ... to react to business cycle developments». (Fisher 1980).

An activist policy also has disadvantages that count, more or less, as advantages for the constant rate rule. For instance the decision lag and the cases where monetary actions are too much and or too late will be eliminated. Another disadvantage which kydland and Prescott (1977) have proposed, is that monetary authorities often change their policy, despite that economic agents have already made their plans based on expectations of given policy. This disadvatage will also be eliminated by the adoption of a constant rule from the monetary authorities.

There might be only one point where there is no disagreement among the advocates of different policies. This is, whatever kind of policy is pursued by the monetary authorities, it should be announced as clearly as mossible and as soon as it is adopted. Moreover, the most appropriate policy which the monetary authorities

could employ with the present knowledge of the business cycle, seems to be a modified activist policy as has been described by S. Fischer. This policy should be such that it «responds very little or not at all to minor actual and prospective disturbances, but with proportionately more vigour to actual and potential major disturbances».
(Fischer 1980). In other words, the policy should be passive by following a constant growth rate rule in ordinary cases, but it should become activist whenever «circumstances warranted».

FOOTNOTES

1. See Buiter (1980)

2. This model has been taken from B. McCallum (1980) and it is a variant of the one used by Sargent and Wallace in their paper of 1975.

3. In this model the effects of fiscal policy variables will be similar to those of monetary policy.

4. McCallum (1980) has used capacity instead of the natural level of output, and Barro (1976) has used full information output. However, the idea is more or less the same and only the definitions differ from author to author.

5. The conditions under which an activist monetary policy will be uniquely optimal, have been written by Howit (1981) as: $Z_a < V < Z_p/\lambda b$ where z_a denotes the administrative cost of using an activist monetary policy; V the social gain to minitoring; Z_p the cost of processing the information; λb a measure of the predictability of the effect of changes in the level of aggregate demand; and V^e λb is the private gain to monitoring.

6. Disequilibrium models which have employed the assumption that is presented by the eighth equation are: Barro-Grossman (1971), Rosen-Quandt (1978) etc.

7. McCallum (1980b) has used the following price-adjustment mechanism:

Pt - Pt-i = a(Y$_t$-i - Y^t) + ET-1(P , - P,.,); In McCallum (1978) this mechanism has taken the form:

$$Pt - Pt\,\iota = Y(P^f_t - Pt\,\iota) \qquad 0<\gamma<1$$

In Blanchard (1980) a similar mechanism has been used:

$$Pt - (1-\gamma)\text{-}Pt\text{-}i = yP^* \qquad 0<\gamma<1$$

where P^*_t is the «desired» level which maintains portfolio balance.

8. The conversion of the nineth relation to equality is not only due to unmanageable calculations; there is another reason as well. If $P_t > P_t$ we might have (from the relation (9)
$^a t > Y_t$. But this result contradicts the economic theory which claims that ceteris paribus we cannot sell larger quantities than we used to at higher prices. So it is not unreasonable to consider only the equality.

9. If there is no cost in providing information to the public, the monetary authorities can achieve the same result merely by giving them to the public.

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