MICROECONOMIC FOUNDATIONS AND PROPERTIES OF A MACROECONOMIC MODEL WITH IMPERFECT COMPETITION

Jean-Pascal BENASSY

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A B S T R A C T

This article constructs a macroeconomic model with imperfect competition on the basis of rigorous microeconomic foundations (notably objective demand curves and rational expectations) and deducts various features : Inefficiency and Keynesian properties of the equilibrium, neutrality of monetary policy, characterization of optimal government spending policies. Finally this model is compared to the corresponding Keynesian and Walrasian macroeconomic models.

Keywords : Imperfect Competition, Macroeconomics, Microeconomic Foundations of Macroeconomics.

Journal of Economic Literature Classification Numbers : 021, 022, 023.

FONDEMENTS MICROECONOMIQUES ET PROPRIETES D'UN MODELE MACROECONOMIQUE AVEC CONCURRENCE IMPARFAITE

R E S U M E

Cet article construit un modèle macroéconomique avec concurrence imparfaite sur la base de fondements microéconomiques rigoureux (notamment courbes de demandes objectives et anticipations rationnelles) et en déduit diverses propriétés (inefficacité et caractère "keynésien" de l'équilibre, effets des politiques monétaires, politiques de dépenses gouvernementales optimales). Finalement on compare ce modèle aux modèles macroéconomiques keynésien et walrasien correspondants.

Mots clefs : Concurrence imparfaite, macroéconomie, Fondements microéconomiques de la macroéconomie.

Codes J.E.L. : 021, 022, 023.

1. INTRODUCTION

Recent years have witnessed a growing development of macroeconomic models with imperfect competition [(1)]. A strong point of these models is that both price and quantity decisions are made rationally by maximizing agents, which differentiates them from Keynesian models, where the price formation process is a priori given, and from Walrasian models, where the job of price making is left to the implicit auctioneer. The purpose of this paper is to review a number of properties of such micro-macro models. We shall do so by actually building a general equilibrium based macroeconomic model, and see that its properties are different in a number of respects from both Keynesian or Walrasian models. In order for the results not to depend on arbitrary conjectures or expectations, we shall assume both rational expectations and objective demand curves. This will be done in the framework of a stationary overlapping generations model, which we shall describe now.

2. THE MODEL

We shall consider here an overlapping generations model with fiat money. The agents in the economy are households, indexed by $i = 1,\dots,m$, living two periods each, firms indexed by $j = 1,\dots,n$, and the government.

There are three types of goods : Money, which is the numeraire, medium of exchange and store of value, different types of labor indexed by $i = 1,..m$, and consumption goods indexed by $j = 1,\dots,n$. Household i is the only one to be endowed with labor of type i , and sets the corresponding money wage w_i . Firm j is the only one to produce good j and sets its price p_j . We call p and w the price and wage vectors :

$$p = \langle p_j \mid j = 1,\ldots,n\rangle \qquad w = \langle w_i \mid i = 1,\ldots,m\rangle$$

Firm j produces a quantity of output y_j using quantities of the various labor types ℓ_{ij} , $i = 1,\ldots,m$. We shall assume a production function :

$$y_j = F_j(\ell_j) \tag{1}$$

where F_j is strictly concave and ℓ_j (a scalar) is a composite index of the ℓ_{ij}'s :

$$\ell_j = \Lambda(\ell_{1j},\ldots,\ell_{mj}) \tag{2}$$

We assume that the function Λ is homogeneous of degree one in its arguments. The firm's objective is to maximize profits

$$\pi_j = p_j\, y_j - \sum_{i=1}^{m} w_i\, \ell_{ij} \tag{3}$$

Let us turn now to households. Household i consumes quantities c_{ij} , $j = 1,\ldots,n$ in the first period of his life, c'_{ij} , $j = 1,\ldots,n$, in the second. He receives from the government amounts g_{ij} , $j = 1,\ldots,n$ in the first period. Also in the first period he sets the wage w_i and works a quantity ℓ_i :

$$\ell_i = \sum_{j=1}^{n} \ell_{ij} \leq \ell_o \tag{4}$$

where ℓ_o is each household's initial endowment of labor. The household maximizes a utility function of the form :

$$U_i = U_i(c_i, c'_i, \ell_o - \ell_i, g_i) \tag{5}$$

where c_i , c'_i and g_i are scalar indexes :

$$c_i = V(c_{i1},\ldots,c_{in}) \tag{6}$$

$$c'_i = V(c'_{i1},\ldots,c'_{in}) \tag{7}$$

$$g_i = V(g_{i1},\dots,g_{in}) \tag{8}$$

We assume that V is homogeneous of degree one in its arguments. Note that we use the same function for private and government spending so that our results will not depend at all on potentially differing elasticities between the two.

The function U_i is assumed to be strictly quasi-concave and separable in its arguments. We moreover assume that the iso-utility loci in the (c_i, c'_i) plane are the same for all i and homothetic and that the disutility of work becomes so high near ℓ_o that constraint (4) is never binding.

Household i has two budget constraints for the two periods of his life :

$$\sum_{j=1}^{n} p_j c_{ij} + m_i = w_i \ell_i + \pi_i - T_i \tag{9}$$

$$\sum_{j=1}^{n} p'_j c'_{ij} = m_i \tag{10}$$

where m_i is the quantity of money transferred in the second period, p'_j , $j = 1,\dots,n$ are the prices next period, T_i is the nominal amount of taxes paid to the government, and π_i is the level of profit income of household i , which is equal to :

$$\pi_i = \sum_{j=1}^{n} \theta_{ij} \pi_j \tag{11}$$

where θ_{ij} is household i's share in firm j .

Finally the government taxes T_i from household i and gives him goods g_{ij} , $j = 1,\dots,n$. We may also note that we use here non distortionary lump-sum taxation, in order not to add any distorsion to those due to imperfect competition. The government also fixes the quantity of money $\bar{m}_i$ that each old household $i = 1,\ldots,m$ owns at the beginning of the period studied.

3. THE IMPERFECTLY COMPETITIVE EQUILIBRIUM

As we indicated above, firm j sets the price p_j, the young household i sets the wage w_i. We shall assume that each does so taking all other prices and wages as given, and using objective demand curves as described below. The equilibrium is thus a Nash equilibrium in prices and wages conditional on these objective demand curves, which we shall now study.

3.1. Objective demand curves

When choosing the price (or wage) he will set, a price maker has to forecast the demand forthcoming to him for any value of (i) the price (or wage) he sets (ii) the prices (and wages) set by others. Following the methodology developed in Benassy (1988), we see that a natural definition of the objective demand for a price-wage vector (p,w) is simply the demand forthcoming at a fixprice equilibrium corresponding to (p,w). We shall now compute these demands.

Consider first firm j. At given wages and prices, its optimization program is :

$$\text{Maximize } p_j y_j - \sum_{i=1}^{m} w_i \ell_{ij} \quad \text{s.t.}$$

$$F_j[\Lambda(\ell_{1j},\ldots,\ell_{mj})] = y_j$$

where y_j is demand determined. The solution in ℓ_{ij} of this program is :

$$\ell_{ij} = \phi_i(w)\, F^{-1}(y_j) \qquad (12)$$

where $\phi_i(w)$ is homogeneous of degree zero in wages. $\phi_i(w)$ is a function associated to Λ by duality theory. As an example (cf. the Appendix), $\phi_i(w)$ will be approximately isoelastic if Λ is a C.E.S.

Consider now the old household, who arrives with a quantity of money $\overline{m}_i$. He wants to maximize his consumption index c'_i, as given by equation (9), subject to his budget constraint :

$$\sum_{j=1}^{n} p_j c'_{ij} = \overline{m}_i \tag{13}$$

The solution of this program is :

$$c'_{ij} = \phi_j(p).\frac{\overline{m}_i}{P} \tag{14}$$

where $\phi_j(p)$ is homogeneous of degree zero in prices, and equal to one if all prices are equal, and P is the price index associated to V. Again as an example (cf. the appendix) if V is C.E.S $\phi_j(p)$ is approximately isoelastic.

Consider now the government and assume he has chosen a level g_i for consumer i's index of government consumption. The government chooses the specific g_{ij}'s to minimize the cost, i.e.

$$\text{Minimize } \sum_{j=1}^{n} p_j g_{ij} \qquad \text{s.t.}$$

$$V(g_{i1},\ldots,g_{in}) = g_i$$

whose solution is :

$$g_{ij} = \phi_j(p)\, g_i \tag{15}$$

where $\phi_j(p)$ is the same as in equation (14). The cost to the government is Pg_i.

Let us finally turn to the young household. Merging his two budget constraints (9) and (10) into a single one, we find that his maximisation program is :

$$\text{Maximize } U(c_i, c'_i, \ell_o - \ell_i, g_i) \qquad \text{s.t.}$$

$$\sum_{j=1}^{n} p_j c_{ij} + \sum_{j=1}^{n} p'_j c'_{ij} = w_i \ell_i + \pi_i - T_i$$

where the right hand side is exogenous to household i. We are interested in the current consumptions c_{ij}. Given the assumptions made on U_i (separability, homotheticity) the solution will be such that the value of current consumptions are given by :

$$\sum_{j=1}^{n} p_j c_{ij} = \gamma(P'/P)(w_i \ell_i + \pi_i - T_i) \tag{16}$$

where γ , the propensity to consume, is function of the ratio of P′ (tomorrow's price index) to P . Maximization of c_i under the budget constraint (16) yields the individual current consumption demands :

$$c_{ij} = \phi_j(p)\ \gamma(P'/P)[w_i \ell_i + \pi_i - T_i] \tag{17}$$

Now output y_j will be determined as the sum of demands

$$y_j = \sum_{i=1}^{m} c_{ij} + \sum_{i=1}^{m} c'_{ij} + \sum_{i=1}^{m} g_{ij} \tag{18}$$

which, using (14), (15), and (17) yields :

$$y_j = \phi_j(p) \left[\frac{\bar{M}}{P} + G + \gamma(P'/P) \sum_{i=1}^{m} (w_i \ell_i + \pi_i) - \gamma(P'/P)T \right] \tag{19}$$

$$G = \sum_{i=1}^{m} g_i \qquad \bar{M} = \sum_{i=1}^{m} \bar{m}_i \qquad T = \sum_{i=1} T_i \tag{20}$$

Straightforward manipulations of (19) using in particular the identity

$$\sum_{i=1}^{m} (w_i \ell_i + \pi_i) = \sum_{j=1}^{n} p_j y_j$$

give us the final expression for the objective demand for firm j , Y_j :

$$Y_j = \phi_j(p) \frac{1}{1-\gamma} \left[\frac{\bar{M}}{P} + G - \gamma\tau \right] \qquad (21)$$

where $\tau = T/P$ is the real value of taxes. If n is large, P , P′ (and thus γ) can be taken as constant by firm j , and the elasticity of Y_j is that of the function ϕ_j .

We can now easily compute the objective demand for type i labor, L_i , by summing the ℓ_{ij}'s , j = 1,...,n as given by equations (12), replacing y_j by the "objective" value we just found :

$$L_i = \phi_i(w) \sum_{j=1}^{n} F^{-1}(Y_j) \qquad (22)$$

where the Y_j's are those given by equation (21). In what follows, we shall denote the objective demands as :

$$Y_j(p,w,\bar{M},G,\tau) \qquad (23)$$

$$L_i(p,w,\bar{M},G,\tau) \qquad (24)$$

Note that these two functions are homogeneous of degree zero in $p,w,\bar{M}$.

3.2. Optimal plans

Consider first firm j . It will solve the following maximization program in p_j :

$$\text{Maximize } p_j y_j - \sum_{j=1}^{n} w_i \ell_{ij} \quad \text{s.t.}$$

$$\begin{cases} y_j = F_j(\ell_j) \\ y_j \leq Y_j(p,w,\bar{M},G,\tau) \end{cases} \tag{A_j}$$

We assume this program has a unique solution, which yields the optimal price as :

$$p_j = \psi_j(p_{-j},w,\bar{M},G,\tau) \tag{25}$$

where $p_{-j} = \langle p_k \mid k \neq j \rangle$.

Consider now household i . He chooses the wage w_i so as to maximize utility according to the program A_i :

$$\text{Maximize } U_i(c_i,c'_i, \ell_o - \ell_i ,g_i) \quad \text{s.t.}$$

$$\begin{cases} \sum_{j=1}^{n} p_j c_{ij} + \sum_{j=1}^{n} p'_j c'_{ij} = w_i \ell_i + \pi_i - T_i \\ \ell_i \leq L_i(p,w,\bar{M},G,\tau) \end{cases} \tag{A_i}$$

which yields the optimal wage functions :

$$w_i = \psi_i(w_{-i},p,\bar{M},G,\tau) \tag{26}$$

where $w_{-i} = \langle w_k \mid k \neq i \rangle$

3.3. Equilibrium

We can now define our equilibrium with monopolistic competition as a Nash equilibrium in prices and wages as follows :

<u>Definition</u> : An equilibrium is characterized by w_i^* , p_j^* such that :

$$w_i^* = \psi_i(w_{-i}^*, p^*, \bar{M}, G, \tau) \qquad i = 1,\dots,m$$

$$p_j^* = \psi_j(p_{-j}^*, w^*, \bar{M}, G, \tau) \qquad j = 1,\dots,n$$

All the quantities are those corresponding to the fixprice equilibrium associated with (p^*, w^*) . Alternatively they are also those given by the solutions to programs (A_i) and (A_j) in the subsection above, replacing p and w by their equilibrium values p^* and w^*.

3.4. A characterization

For what follows, it will be useful to characterize the equilibrium prices and quantities through the Kuhn-Tucker conditions associated to programs A_i and A_j above. Consider first firm j and recall program A_j :

$$\text{Maximize } p_j y_j - \sum_{i=1}^{m} w_i \ell_{ij} \qquad \text{s.t.}$$

$$\begin{cases} y_j = F_j(\ell_j) \\ y_j \leq Y_j(p, w, \bar{M}, G, \tau) \end{cases} \qquad (A_j)$$

Assuming an interior solution, the Kuhn-Tucker conditions for this program yield :

$$\frac{w_i}{p_j} = \left(1 - \frac{1}{\eta_j}\right) \frac{\partial F_j}{\partial \ell_{ij}} \qquad (27)$$

where $\eta_j = -(p_j/Y_j)\,\partial Y_j/\partial p_j$ is the absolute value of the own price elasticity of objective demand. At equilibrium η_j must be higher than one.

Let us turn now to the program of household i :

$$\text{Maximize } U_i(c_i, c'_i, \ell_o - \ell_i, g_i) \quad \text{s.t.}$$

$$\begin{cases} \sum_{j=1}^{n} p_j c_{ij} + \sum_{j=1}^{n} p'_j c'_{ij} = w_i \ell_i + \pi_i - T_i \\ \ell_i \leqslant L_i(p, w, \bar{M}, G, \tau) \end{cases} \tag{A_i}$$

Assuming again an interior solution, and calling λ_i the "marginal utility" of wealth, i.e. the Kuhn-Tucker multiplier of the budget constraint, we obtain the following conditions :

$$\frac{\partial U_i}{\partial c_{ij}} = \lambda_i p_j \qquad \frac{\partial U_i}{\partial c'_{ij}} = \lambda_i p'_j \tag{28}$$

$$\frac{\partial U_i}{\partial(\ell_o - \ell_i)} = \lambda_i w_i \left(1 - \frac{1}{\varepsilon_i}\right) \tag{29}$$

where $\varepsilon_i = -(w_i/L_i)\,\partial L_i/\partial w_i$ is the absolute value of the own wage elasticity of the objective demand for labor i .

4. PROPERTIES OF THE IMPERFECTLY COMPETITIVE EQUILIBRIUM

We shall now examine a number of properties of our equilibrium, which will differentiate it from both Walrasian and Keynesian equilibria. The first and obvious property is that, unlike a Walrasian equilibrium, the one considered here will never be a Pareto optimum. Indeed it is easy to see that a necessary property for a stationary Pareto optimum is that :

$$\frac{\partial U_i}{\partial(\ell_o - \ell_i)} = \frac{\partial U_i}{\partial c_{ij}} \cdot \frac{\partial F_j}{\partial \ell_{ij}} \tag{30}$$

But this equality is clearly inconsistent with our equilibrium, since by combination of equations (27), (28) and (29) we obtain :

$$\frac{\partial U_i}{\partial(\ell_o - \ell_i)} = \left(1 - \frac{1}{\varepsilon_i}\right)\left(1 - \frac{1}{\eta_j}\right) \frac{\partial U_i}{\partial c_{ij}} \cdot \frac{\partial F_j}{\partial \ell_{ij}} \tag{31}$$

which shows that as soon a one of the agents possesses some market power the equilibrium cannot be a Pareto optimum.

We shall in the next subsections characterize more fully these inefficiencies, see whether monetary policies can be effective against them and how prescriptions for the government's fiscal policy can be affected.

4.1. Keynesian features and inefficiencies

Lack of Pareto efficiency can occur in a great variety of situations. We want to make a step further, and show in this subsection that the equilibrium described above has actually a number of features and inefficiency properties which very much look like those of a Keynesian excess supply allocation.

We first see that at equilibrium there is both underemployment and underproduction : Equations (27) show that the firm would be happy to produce and sell more if the demand for its product was forthcoming. Similarly equations (29) show that the household would like to sell more of its labor if the demand was present. We should point out however that this underemployment of resources is not really "involuntary" as each agent chooses himself a price or wage high enough for him to be rationed.

Secondly equations (21) and (22) showing the determination of the various output and employment levels for a given set of prices and wages are extremely reminiscent of those found for a traditional Keynesian fixprice-fixwage equilibrium. In fact, equations (21) and (22) are a clear generalization of the traditional "one sector" Keynesian equations, which would read :

$$Y = \frac{1}{1-\gamma}\left[\frac{M_o}{P} + G - \gamma\tau\right] \tag{32}$$

$$L = F^{-1}(Y) \tag{33}$$

which are classic "Keynesian multiplier" formulas.

Thirdly it is known (see for example Benassy 1975, 1977) that in Keynesian multiplier equilibria it is possible to find increases in transactions which could increase everybody's utility (or profits for firms) at the going prices and wages, an inefficiency stronger than Pareto inefficiency. The reader can check that this property is indeed found here (See for example Benassy 1987a,b for exact computations).

All the above "Keynesian-type" features and inefficiency properties show us that it would be quite desirable to have policies which increase the level of activity. The traditional Keynesian prescription would be to use expansionary demand policies, such as monetary or fiscal expansion. Formulas (21) and (22) show us that, were prices and wages to remain fixed, such policies would indeed be effective in increasing output and employment. But, and this is where the resemblance with Keynesian theory stops, government policies will bring price and wage changes which may completely change their impact. This we shall now see studying first monetary expansions.

4.2. Neutrality of monetary policy

We shall now investigate a first type of expansionary policy, namely a proportional expansion of the money stock which goes from $\bar{M}$ to $\mu\bar{M}$. This policy has been chosen because it is known to be "neutral" in Walrasian equilibrium. We shall now see that such a monetary expansion is ineffective, or "neutral" just as in Walrasian models, as prices and wages will be multiplied, by μ , whereas production, employment and utilities will not move.

The proof is actually straightforward in view of the homogeneity properties of the model. We already noted in subsection 3.1 that the objective demand curves $Y_j(p,w,\bar{M},G,\tau)$ and $L_i(p,w,\bar{M},G,\tau)$ are homogeneous of degree zero in $p,w,\bar{M}$. Looking now at the programs (A_i) and (A_j) yielding the optimal price and wage strategies (subsection 3.2), we see that the functions ψ_j and ψ_i are homogeneous of degree one in the "nominal" variables, i.e. :

$$\psi_j(\mu p_{-j},\mu w,\mu\bar{M},G,\tau) = \mu\ \psi_j(p_{-j},w,\bar{M},G,\tau)$$

$$\psi_i(\mu w_{-i},\mu p,\mu\bar{M},G,\tau) = \mu\ \psi_i(w_{-i},p,\bar{M},G,\tau)$$

Let us recall the equilibrium equations :

$$w_i^* = \psi_i(w_{-i}^*,p^*,\bar{M},G,\tau) \qquad i = 1,\dots,m$$

$$p_j^* = \psi_j(p_{-j}^*,w^*,\bar{M},G,\tau) \qquad i = 1,\dots,n$$

It appears immediately that to a quantity of money $\mu\bar{M}$ will correspond new equilibrium values μw_i^* and μp_j^* . Plugging now these values into programs (A_i) and (A_j), we then see that the equilibrium quantities will remain unchanged.

Q.E.D.

Of course monetary policy of the kind described here, is extremely special (which may be the cause for its popularity). We want now to describe what happens with other policies, such as government spending policies. This we shall now do, but before we shall construct a symmetrical version of our model, which will be easier to work with.

4.3. A symmetrical equilibrium

We shall now study quickly a simplified symmetrical version of our model. In order to have a "representative agents" version, we shall further assume that m = n , i.e. there are as many households as firms. We shall also assume that :

$$F_j = F \quad \forall j \qquad U_i = U \quad \forall i \qquad \bar{m}_i = \bar{m} \quad \forall i$$

and that the functions Λ and V are symmetrical in they arguments. Let us further assume there is a unique equilibrium, which is then symmetrical, i.e. such that

$$\ell_j = \ell \qquad y_j = y \qquad \eta_j = \eta \qquad \forall j$$

$$\ell_i = \ell \qquad c_i = c \qquad c'_i = c' \qquad g_i = g \qquad \varepsilon_i = \varepsilon \qquad \forall i$$

$$\ell_{ij} = \frac{\ell}{n} \qquad c_{ij} = \frac{c}{n} \qquad c'_{ij} = \frac{c'}{n} \qquad g_{ij} = \frac{g}{n} \qquad \forall i,j$$

Now the Kuhn-Tucker conditions (equations 27,28,29) are rewritten as :

$$\frac{w}{p} = \left(1 - \frac{1}{\eta}\right) F'(\ell) \tag{34}$$

$$\frac{\partial U}{\partial c} = \lambda p \qquad \frac{\partial U}{\partial c'} = \lambda p' \tag{35}$$

$$\frac{\partial U}{\partial(\ell_0 - \ell)} = \lambda w \left(1 - \frac{1}{\varepsilon}\right) \tag{36}$$

The rest of the equations being simply the production function :

$$y = F(\ell) \tag{37}$$

the representative household's budget equations :

$$pc + p'c' = w\ell + \pi - p\tau \tag{38}$$

$$pc' = \bar{m} \tag{39}$$

and the physical feasibility constraint on the goods market :

$$c + c' + g = y \tag{40}$$

Equations (34) to (40) fully describe the symmetrical equilibrium. With their help we shall now investigate some normative properties for government spending.

4.4. Normative rules for government policy

Quite obviously the case of a monetary expansion considered in the subsection 4.2. is extremely particular in that it has no real effect in Walrasian setting, while other policies will usually have some real effects, in both competitive and noncompetitive frameworks. What we want to show in this subsection is that eventhough a particular policy is effective in both contexts (i.e. that it affects the level of output and employment in both cases), the normative rules for the use of this policy by the government will be different. To demonstrate this we shall consider the policy problem of choosing an appropriate level of government spending g , assuming it is entirely financed by taxes (i.e. $\tau = G$). Let us first compute the "stationary first best" solution of this problem. It is obtained as the solution of the following program :

$$\text{Maximize } U(c, c', \ell_0 - \ell, g) \quad \text{s.t.}$$

$$c + c' + g = F(\ell)$$

which yields the conditions :

$$\frac{\partial U}{\partial c} = \frac{\partial U}{\partial c'} = \frac{\partial U}{\partial g} = \frac{1}{F'(\ell)} \cdot \frac{\partial U}{\partial(\ell_0 - \ell)} \tag{41}$$

The reader can check that this first-best solution can actually be obtained as a Walrasian equilibrium (characterized by equations (34) to (40) with $1/\eta$ and $1/\varepsilon$ both equal to zero), provided the government adopts the following rules :

$$G = \tau \tag{42}$$

$$\frac{\partial U}{\partial g} = \frac{\partial U}{\partial c} \tag{43}$$

Equation (42) simply tells us that the government's budget is balanced. (43) tells that the government should push public spending exactly to the point where its marginal utility is equal to that of private consumption. In other words the government somehow acts as a "veil" : It picks exactly the level of g the consumer would have chosen himself if he was not taxed. We shall now see whether this last rule continues to hold under imperfect competition. To simplify the analysis, let us continue with a balanced budget ($g = \tau$). As a result prices are constant in time ($p' = p$) and equations (34) - (40) describing the imperfectly competitive equilibrium simplify as :

$$\frac{w}{p} = \left(1 - \frac{1}{\eta}\right) F'(\ell) \tag{44}$$

$$\frac{\partial U}{\partial c} = \lambda p \qquad \frac{\partial U}{\partial c'} = \lambda p \tag{45}$$

$$\frac{\partial U}{\partial(\ell_0 - \ell)} = \lambda w \left(1 - \frac{1}{\varepsilon}\right) \tag{46}$$

$$c + c' + g = y = F(\ell) \tag{47}$$

To find the optimal conditions, let us differentiate $U(c, c', \ell_0 - \ell, g)$ with respect to g :

$$\frac{\partial U}{\partial c}.\frac{\partial c}{\partial g} + \frac{\partial U}{\partial c'}.\frac{\partial c'}{\partial g} + \frac{\partial U}{\partial \ell}.\frac{\partial \ell}{\partial g} + \frac{\partial U}{\partial g} = 0$$

Using first the values of partial derivatives in (45) and (46), we obtain :

$$\frac{\partial U}{\partial g} = \lambda p \left[\frac{w}{p} \left(1 - \frac{1}{\varepsilon} \right) \frac{\partial \ell}{\partial g} - \frac{\partial c}{\partial g} - \frac{\partial c'}{\partial g} \right] \tag{48}$$

Differentiating (47) with respect to g yields :

$$\frac{\partial c}{\partial g} + \frac{\partial c'}{\partial g} + 1 = F'(\ell) \frac{\partial \ell}{\partial g} \tag{49}$$

And combining (44), (48) and (49) we finally obtain the formula :

$$\frac{\partial U}{\partial g} = \lambda p \left[1 - \left(\frac{\varepsilon + \eta + 1}{\varepsilon \eta} \right) F'(\ell) \frac{\partial \ell}{\partial g} \right] \tag{50}$$

Since $\partial U/\partial c = \lambda p$, this shows that there will be a systematic bias as compared to the first best rule : If $\partial \ell/\partial g > 0$, as soon as there is market power (i.e. either ε or η is short of infinity), the government will be led to push its spending beyond that which the consumer would freely choose, and the converse if $\partial \ell/\partial g < 0$.

Another way to view this is to imagine that we start from the level of government spending that the consumer would freely choose, which can be characterized by adding the following equation to equations (44) - (47) :

$$\frac{\partial U}{\partial g} = \lambda p = \frac{\partial U}{\partial c} \tag{51}$$

Let us now compute the net increase in utility coming from a small increase dg :

$$dU = \left[\frac{\partial U}{\partial c} \cdot \frac{\partial c}{\partial g} + \frac{\partial U}{\partial c'} \cdot \frac{\partial c'}{\partial g} + \frac{\partial U}{\partial \ell} \cdot \frac{\partial \ell}{\partial g} + \frac{\partial U}{\partial g} \right] dg \tag{52}$$

which, using (57) - (60), (63) and (65) yields :

$$dU = \lambda p \left[\left(\frac{\varepsilon + \eta - 1}{\varepsilon \eta} \right) F'(\ell) \frac{\partial \ell}{\partial g} \right] dg \tag{53}$$

which shows that, as compared with the first best rule, the government should systematically bias its spending so as to increase activity. This bias will be higher, the higher the "market power index" $(\varepsilon + \eta - 1)/\varepsilon\eta$.

The intuition for this result is fairly straightforward : Because of imperfect competition on the goods and labor markets the level of activity is inefficiently low as we saw in subsection 4.1. When choosing its level of spending, the government not only takes into account the direct effect on the household's utility (which would yield the "first best" rule $\partial U/\partial g = \partial U/\partial c$), but also takes into account the indirect utility gains which derive from the positive effect of its macroeconomic policy on activity. The government should not act as a "veil" anymore, but should use a "second-best" policy different from what would have been chosen by small individual households.

5. CONCLUSION

We constructed in this paper a simple micro-macro model with imperfect competition, rational expectations and objective demand curves, and studied some of its properties. We saw that it displayed underemployment of resources and inefficiency properties quite similar to those found in a traditional Keynesian excess supply fixprice models, but that nevertheless a "helicopter" monetary policy was completely ineffective against these inefficiencies. We saw however that the normative rules for government policy were substantially altered as compared with the perfectly competitive case. This shows that results substantially different from those of a "new classical" market clearing model can be obtained with explicit microfoundations for both price and wage formation. This should encourage further study along this line of research.

APPENDIX

We shall now give briefly some explicit complutations concerning the case where the functions Λ and V are C.E.S. and symmetrical [(2)]. As we shall see, this leads to approximately isoelastic objective demand curves. Let us thus assume :

$$\Lambda(\ell_{1j},\dots,\ell_{mj}) = m\left(\frac{1}{m}\sum_{i=1}^{m}\ell_{ij}^{\frac{\varepsilon-1}{\varepsilon}}\right)^{\frac{\varepsilon}{\varepsilon-1}} \tag{54}$$

$$V(c_{i1},\dots,c_{in}) = n\left(\frac{1}{n}\sum_{j=1}^{n}c_{ij}^{\frac{\eta-1}{\eta}}\right)^{\frac{\eta}{\eta-1}} \tag{55}$$

Straightforward computations yield :

$$\phi_i(w) = \frac{1}{m}\left(\frac{w_i}{W}\right)^{-\varepsilon} \tag{56}$$

with

$$W = \left(\frac{1}{m}\sum_{i=1}^{m}w_i^{1-\varepsilon}\right)^{\frac{1}{1-\varepsilon}} \tag{57}$$

$$\phi_j(p) = \frac{1}{n}\left(\frac{p_j}{P}\right)^{-\eta} \tag{58}$$

$$P = \left(\frac{1}{n}\sum_{j=1}^{n}p_j^{1-\eta}\right)^{\frac{1}{1-\eta}} \tag{59}$$

Equations (56) and (58) show that the objective demand curves are isoelastic, if we neglect the influence of w_i on W, and p_j on P respectively. Equations (57) and (59) show that this condition will be approximately be satisfied if m and n are large.

F O O T N O T E S

(1) See notably Benassy (1976,1977,1982,1987a,b, 1989), Negishi (1977,1979), Hart (1982), Weitzman (1982, 1985), Snower (1983), D'Aspremont, Dos Santos, Gerard-Varet (1985), Dehez (1985), Dixon (1987), Svensson (1986), Blanchard-Kiyotaki (1987), Sneessens (1987), Silvestre (1988).. The classic paper introducing monopolistic competition in general equilibrium is of course Negishi (1961).

(2) These were introduced in the macrosetting with imperfect competition by Weitzman (1985).

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