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MONETARY AND FISCAL POLICIES IN SHORT RUN EQUILIBRIA WITH RATIONING*

BY BRYCE HOOL[1]

1. INTRODUCTION

The recognition of quantity-constrained choice as a basic element in the description of short-run equilibrium situations has led to considerable research into the structure and analysis of non-Walrasian models. Much of the inspiration can be traced to the reconsideration of Keynes' economics by Clower [1965] and Leijonhufvud [1968], and to the general equilibrium model of Barro and Grossman [1971]. The logic of short-run equilibria with rationing has been developed in subsequent contributions by Benassy [1975, 1978], Boehm and Levine [1976], Drèze [1975], Grandmont [1977], Grandmont and Laroque [1976], Hahn [1978], Varian [1975, 1977] and Younès [1970, 1975], among others. As a basic framework for policy analysis, equilibrium with rationing has been exploited by Barro and Grossman [1976], Dixit [1976, 1978] and Malinvaud [1977].

Although, in its present state of development, it does not provide a theory of macroeconomic fluctuations, the non-market-clearing paradigm yields useful insights into the characteristics of short-run situations and the potential for policy intervention. Once it is realized that, for whatever reason, prices cannot be relied on to equilibrate demand and supply continuously, and that at least part of the economy's adjustment to an exogenous shock will be revealed in quantities, it becomes important to know how market imbalances are likely to condition the response to policy. As Malinvaud has shown, careful distinction between alternative economic environments permits a better evaluation of the appropriateness of a given policy in a particular economic context.

In Malinvaud [1977] the focus is on the "multiplier" theory based on the interaction between the markets for goods and labor, with policy alternatives of government spending and controls on prices and wages. The analysis there is carried out in the context of a particular example, using specific functional forms for utility and production, similar to the specifications considered previously by Benassy [1978] and Younès [1970], and more recently by Dixit [1978]. The present paper extends and generalizes this work, by allowing for monetary as well as fiscal policy and by conducting the analysis in terms of general functional forms. The introduction of a market for government-issued bonds permits the government to pursue independent monetary and fiscal targets by engaging in

[1] I thank J. M. Grandmont, D. Hester, E. Malinvaud and a referee for useful comments.

open market operations. A significant aspect of the analysis is the impact of bond market adjustment that is induced by the financing of government policies.

The basic model is described in Section 2. In Section 3 we present the conditions determining the endogenous variables in each of the possible types of short-run equilibrium.[2] From these are obtained the comparative static effects of changes in monetary and fiscal policies and of price and wage adjustments. In Section 4 we determine the qualitative characteristics of the regions of (wage, price) combinations associated with equilibria of a particular type and their dependence on monetary and fiscal policy parameters. Using this regional configuration some conclusions are drawn for possibilities and limitations of these policies. Summary remarks are presented in Section 5.

2. THE MODEL

2.1. *The Economy.* We consider an economy with three sectors: production, consumption and government; and three markets, where an aggregate consumption good (hereafter referred to simply as "goods"), labor and government bonds are each traded against money. In the short run the price of goods (p) and the money wage (w) are taken as fixed, with the respective markets clearing by quantity rationing. A government-issued bond is a promise to pay interest of one unit of money in perpetuity. Its price (q, the reciprocal of the interest rate) is flexible and adjusts to clear the market in which bonds are traded by the government and the household sector.

The production sector will be treated as an aggregate firm (sometimes referred to as "firms") which employs a quantity e of labor to produce a quantity y of goods according to a production function

$$y = f(e) \qquad f' > 0, \quad f'' < 0. \tag{1}$$

The firm's objective is to maximize the current period's profit, $py - we$. Capital is fixed in quantity, there is no investment (including inventories), and profits are not distributed until the beginning of the subsequent period.

The consumption sector comprises N households, each of which seeks to maximize a derived utility function of the form $v(x, b, m)$, where x is the quantity of goods consumed, b is the final quantity of bonds held, and m is the final nominal money balance. Throughout the analysis it will be assumed that goods, bonds and money are all normal. Each household is assumed to supply inelastically a quantity l of labor and to have positive initial holdings of bonds (b_0) and money (m_0); m_0 includes the redistributed profits of firms in the preceding period. Its choices will be constrained by the current value of these initial assets and of its wage income.

The government's role is to choose various policy parameters. Pure fiscal

[2] More detailed derivation of these conditions is given in a previous version of this paper, available from the author on request.

policy will be the purchase of goods (g) financed by the issue of bonds. (Taxes are not treated in this model although they could be introduced without much difficulty.) Pure monetary policy will set the money supply (M) through open market operations, i.e., the purchase or sale of bonds. A combination of monetary and fiscal policies can determine M and g independently but together these imply an action in the bond market, which must also take into account the interest payment on outstanding debt equal to the initial supply of bonds (b_0^G). The stocks of money (M) and of bonds (b^G) in existence as a result of government actions are related to initial stocks and to government purchases of goods by the identity

$$M - M_0 \equiv q(b_0^G - b^G) + b_0^G + pg$$

where $M_0 = Nm_0$ and $b_0^G = Nb_0$. In addition to the monetary and fiscal policy parameters the government may also be able to exercise some control over wages and prices.

2.2. *Notional and Constrained Demands.* Since p and w are fixed it will in general be the case that one or both of the goods and labor markets will not clear without quantity rationing. Assuming that the short side of a market determines the quantity transacted, either firms or households will then be rationed and this will influence their supplies and demands on other markets.

If a household is not rationed in any market, i.e., is constrained only by the usual budget equation,

$$px + qb + m = wl + (q + 1)b_0 + m_0 \equiv W_0,$$

its demands will be the notional or Walrasian demands,

$$x = x(p, w, q), \quad b = b(p, w, q) \quad \text{and} \quad m = m(p, w, q),$$

where here and henceforth the dependence on initial assets is suppressed.

In the event of an excess supply of labor, a given household is assumed to be fully employed (selling l units of labor) or unemployed (with zero wage income). An unemployed household's demands are then constrained by the current value of its wealth,

$$W_0' \equiv (q + 1)b_0 + m_0;$$

they are denoted by

$$\tilde{x} = \tilde{x}(p, q), \quad \tilde{b} = \tilde{b}(p, q) \quad \text{and} \quad \tilde{m} = \tilde{m}(p, q). \tag{2}$$

If there is excess demand in the goods market it will be assumed that the government realizes its demand (provided this is less than total output) and that households are treated equally in the rationing of the remaining supply. If the income-constrained demand of an unemployed household is less than $(y-g)/N$ then it will not be rationed, and its demands will still be given by (2). We shall assume this to be the case. The quantity of goods ($\bar{x}$) received by an employed household

is then determined by

$$N^e\bar{x} = y - g - N^u\tilde{x}(p, q)$$

where N^e and N^u are the numbers of households employed and unemployed, respectively. Taking this quantity constraint into account, the revised demands for bonds and money by an employed household will be

$$\bar{b} = \bar{b}(p, w, q) \quad \text{and} \quad \bar{m} = \bar{m}(p, w, q),$$

with

$$q\bar{b} + \bar{m} = W_0 - p\bar{x}. \tag{3}$$

The firm's choices, when unconstrained other than by the production function, are the notional profit-maximizing supply of goods (y) and demand for labor (e), given by

$$y = f(e) \quad \text{with} \quad f'(e) = \frac{w}{p}.$$

When there is excess demand in the labor market output is constrained by the supply of labor, so that

$$y = f(Nl) \quad \text{with} \quad f'(Nl) > \frac{w}{p}.$$

If there is excess supply in the goods market, output will be equal to aggregate demand (on the assumption that the firm can adjust its output immediately to what it can sell) so that

$$y = c + g$$

where $c = N^e x(p, w, q) + N^u\tilde{x}(p, q)$. Employment e is then determined from (1).

3. SHORT RUN EQUILIBRIA. LOCAL EFFECTS OF GOVERNMENT POLICIES.

If the wage-price combination happens to be one which clears all markets with notional supplies and demands, the economy will be in Walrasian equilibrium. Otherwise the equilibrium will exhibit some combination of excess demands or supplies on the goods and labor markets. Following Malinvaud we shall refer to equilibria with excess supply in both markets as Keynesian unemployment equilibria, those with excess demand for goods and excess supply of labor as classical unemployment equilibria, and those with excess demand in both markets as repressed inflation equilibria. The fourth logical possibility, equilibria with excess supply of goods and excess demand for labor, is ruled out by the assumption of no inventories and an instantaneous adjustment of output to sales.

3.1. *Keynesian unemployment equilibrium* is characterized by unemployment ($S_L > 0$) and an excess supply of goods ($S > 0$). The proximate cause of

unemployment is deficiency of the aggregate effective demand for goods. In this situation of general depression, as will be confirmed below, the traditional Keynesian remedy of expansionary fiscal or monetary policy is an appropriate one.

Firms are constrained by aggregate demand in the goods market and therefore wish to employ only the amount of labor required to produce that amount of goods. Some households are consequently unemployed and have an effective demand for goods that is income-constrained. Output and employment are then determined by

$$y = N^e x(p, w, q) + N^u \tilde{x}(p, q) + g,$$

where $N^e = F(y)/l$, $N^u = N - F(y)/l$, $F(\cdot) \equiv f^{-1}(\cdot)$, and with q determined by bond market equilibrium:

$$\frac{F(y)}{l} qb(p, w, q) + \left(N - \frac{F(y)}{l}\right) q\tilde{b}(p, q) = qb^G = (q + 1)b_0^G + M_0 + pg - M. \tag{4}$$

From these it follows that

$$dy\left[1 - \frac{F'(y)}{l}(x - \tilde{x}) - \frac{a}{p}\frac{F'(y)}{l} q(b - \tilde{b})\right] = dp\left[N^e x_p + N^u \tilde{x}_p + \frac{a}{p}(N^e q b_p + N^u q \tilde{b}_p - g)\right] + dw\left[N^e x_w + \frac{a}{p} N^e q b_w\right] + dg[1 - a] + dM\left[\frac{a}{p}\right], \tag{5}$$

where $a \equiv A/\sigma$, $A \equiv N^e p x_q + N^u p \tilde{x}_q$, $\sigma \equiv b_0^G - N^e(b + q b_q) - N^u(\tilde{b} + q\tilde{b}_q)$.

A positive multiplier effect on output of a change in bond-financed government spending (pure fiscal policy) is revealed in

$$\frac{1}{p}\frac{dy}{dg} = \frac{1 - a}{B - aC},$$

where $B \equiv p - (F'(y)/l)p(x - \tilde{x})$ and $C \equiv (F'(y)/l)q(b - \tilde{b})$. That the multiplier is positive follows from the facts that

(i) $$0 < a = \frac{\frac{\partial}{\partial q}[N^e px + N^u p\tilde{x}]}{\frac{\partial}{\partial q}[N^e(W_0 - qb) + N^u(W_0' - q\tilde{b})]} = \frac{\frac{\partial}{\partial q}[N^e px + N^u p\tilde{x}]}{\frac{\partial}{\partial q}[N^e(px + m) + N^u(p\tilde{x} + \tilde{m})]} < 1;$$

and (ii), since output is constrained, $1/F'(y) > w/p$ and therefore $B - C > (p/wl)[wl$

$-(p(x-\tilde{x})+q(b-\tilde{b}))]>0$, given that m is normal.

Similarly, expansion of the money supply through open market operations (pure monetary policy) has a multiplier effect on output given by

$$\frac{dy}{dM} = \frac{a}{B - aC}.$$

Thus pure fiscal policy will be more or less of a stimulus to output and employment than will pure monetary policy as the aggregate demand for money is more or less responsive to changes in the bond price (or interest rate) than is aggregate consumption spending.

An intermediate policy of some interest is that of a change in government spending on goods with the money supply adjusted to maintain a constant interest rate. In this case, it can be shown that $dy/dg = 1/(B/p)$; $B/p = 1-(F'(y)/l)(x-\tilde{x})$ $>1-p(x-\tilde{x})/(wl)$, $p(x-\tilde{x})/(wl)$ being the "marginal" propensity to consume when shifted from unemployed to employed.

In the event that the government is able to institute an "incomes policy" by manipulating money wage and price separately, the prescription for stimulation of output and employment is an increase in the money wage or, in general, a reduction in product price. This confirms Malinvaud's observation that the need is to increase the real wage. It stems from the need to stimulate the aggregate effective demand for goods, and is quite the reverse of the adjustment appropriate in a situation of classical unemployment, discussed below, wherein employment is determined by the customary first-order conditions for the firm's optimum. The effect of increasing the money wage is given by

$$\frac{dy}{dw} = \frac{1}{B - aC}(N^e p x_w + aN^e q b_w) > 0.$$

The effect on output of a change in p is given by

$$\frac{dy}{dp} = \frac{1}{B - aC}[N^e p x_p + N^u p \tilde{x}_p + a(N^e q b_p + N^u q \tilde{b}_p - g)].$$

This derivative can be positive only in the unlikely event that a price increase induces an increased demand for bonds by households which exceeds the increased supply by government. This would raise the bond price and thence consumption demand, countering to some degree the direct contractionary effect of the price increase. However, it can be shown that even then the net impact is negative provided there is a real balance effect, i.e., if $\partial(N^e m + N^u \tilde{m})/\partial p > 0$.

3.2. *Classical unemployment equilibrium* differs crucially from Keynesian unemployment equilibrium in that the excess supply of labor ($S_L > 0$) coexists with an excess demand for goods ($D > 0$). Unemployment here is not a problem of deficient aggregate demand. Rather, the real wage is too high and firms which face no quantity constraints have no incentive to increase employment. In this situation, as will become apparent, monetary or fiscal policy can influence

only the excess demand for goods.

Here, as in the traditional theory of the firm, employment is chosen so that marginal product is equal to the real wage, $e=(f')^{-1}(w/p)$. Correspondingly, the numbers of households employed and unemployed are $N^e=(1/l)(f')^{-1}(w/p)$ and $N^u=N-(1/l)(f')^{-1}(w/p)$. The excess supply of labor is $S_L=N^u l$ and is independent of all policies except changes in the real wage; reduction of unemployment requires an increase in p relative to w.

Excess demand in the product market is

$$D = N^e x(p, w, q) + N^u \tilde{x}(p, q) + g - y \tag{6}$$

where $y=f((f')^{-1}(w/p))$ and q is the observed bond market equilibrium price, satisfying

$$N^e q\bar{b}(p, w, q) + N^u q\tilde{b}(p, q) = qb^G = (q+1)b_0^G + M_0 + pg - M. \tag{7}$$

In the absence of a monetary sector, excess demand for goods would be reduced by a price increase, a fall in the money wage, or a reduction in government spending (see Malinvaud [1977]). With the presence of a bond market, however, the response to any of these exogenous changes will be quantitatively, and conceivably also qualitatively, different. In fact, only the previously unavailable monetary policy will have unambiguously the expected effect on excess demand.

From (6) and (7) it follows that

$$\begin{aligned} dD = dp\Big[&\frac{e_p}{l}(x-\tilde{x}) + N^e x_p + N^u \tilde{x}_p + (N^e x_q + N^u \tilde{x}_q)\cdot \\ &\frac{1}{\bar{\sigma}}\Big(\frac{e_p}{l}q(\bar{b}-\tilde{b}) + N^e q\bar{b}_p + N^u q\tilde{b}_p - g\Big) - y_p\Big] \\ + dw\Big[&\frac{e_w}{l}(x-\tilde{x}) + N^e x_w + (N^e x_q + N^u \tilde{x}_q)\cdot \\ &\frac{1}{\bar{\sigma}}\Big(\frac{e_w}{l}q(\bar{b}-\tilde{b}) + N^e q\bar{b}_e\Big) - y_w\Big] \\ + dg\Big[&1 - (N^e x_q + N^u \tilde{x}_q)\frac{p}{\bar{\sigma}}\Big] + dM\Big[(N^e x_q + N^u \tilde{x}_q)\frac{1}{\bar{\sigma}}\Big] \end{aligned} \tag{8}$$

where $\bar{\sigma} \equiv b_0^G - N^e(\bar{b}+q\bar{b}_q) - N^u(\tilde{b}+q\tilde{b}_q) = \partial(N^e\bar{m} + N^u(p\tilde{x}+\tilde{m}))/\partial q > 0$.

We have $e_p>0$, $e_w<0$; $y_p>0$, $y_w<0$; $x_p>0$, $\tilde{x}_p<0$, $x_w>0$ (a pure income effect); $x-\tilde{x}>0$ and $\bar{b}-\tilde{b}>0$. We shall assume that $x_q>0$ and $\tilde{x}_q>0$.[3] From (3) it follows that $\bar{b}_p<0$ and $\bar{b}_w>0$. Finally, it will be assumed that $\tilde{b}_p>0$. (The possibility that $\tilde{b}_p<0$ or $b_p<0$ was responsible for the potential indeterminacy of the impact of a change in price on output in the Keynesian situation. An analo-

[3] Formally, this requires that the own-price elasticity of demand for bonds have magnitude greater than $1-b_0/b$ (respectively, $1-b_0/\tilde{b}$), for which it is sufficient that this elasticity exceed unity. Note also that the introduction of interest-elastic investment by firms would support the effect of $x_q>0$.

gous qualification will apply here.)

Consider, in (8), the effect on demand of a change in p alone. As long as the marginal propensity to consume does not exceed unity, it will be the case that

$$\frac{e_p}{l}(x - \tilde{x}) - y_p = \frac{e_p}{pl}[p(x - \tilde{x}) - wl] < 0.$$

Consequently, $\partial D/\partial p < 0$ provided that

$$\frac{e_p}{l} q(\bar{b} - \tilde{b}) + N^e q \bar{b}_p + N^u q \tilde{b}_p - g < 0.$$

It is likely that the possibility that direct price effects would be dominated by indirect price effects through the bond market would be ruled out by the requirement of stability of equilibrium with some reasonable dynamic on the quantity adjustment process, as it is for a Walrasian equilibrium with price adjustment (see Section 4.1). The stability question will not be considered any further here but it is noted that, except in the present case of classical unemployment, perverse reactions to a price change would be ruled out by real balance effects (see Sections 3.1 and 3.3).

In similar fashion it can be shown that a decrease in the money wage will reduce the excess demand for goods provided that

$$\frac{e_w}{l} q(\bar{b} - \tilde{b}) + N^e q \bar{b}_w > 0.$$

A decrease in bond-financed government spending will reduce excess demand provided that the (aggregate) demand for money is more responsive to interest rate changes than is the demand for goods. The decrease in government spending reduces demand directly on a one-to-one basis, but the reduced supply of bonds will cause an increase in the bond price and thence an expansion of households' demand for goods. The net effect is a reduction in excess demand if

$$\frac{dD}{dg} = 1 - \frac{p}{\bar{\sigma}}(N^e x_q + N^u \tilde{x}_q) > 0,$$

which will be the case if $\partial(N^e px)/\partial q < \partial(N^e \bar{m} + N^u \tilde{m})/\partial q$.

Finally, as claimed above, a decrease in the money supply with government spending constant will unambiguously reduce the excess demand for goods, since

$$\frac{dD}{dM} = \frac{1}{\bar{\sigma}}(N^e x_q + N^u \tilde{x}_q) > 0.$$

3.3. *Repressed inflation equilibrium* is the counterpart of Keynesian unemployment equilibrium in being characterized by excess demand in both the labor market ($D_L > 0$) and the goods market ($D > 0$). Firms are constrained in their employment, which is at the maximum level (Nl); households are constrained in their consumption, which is limited to the full-employment output ($f(Nl)$) less government demand. Policy effects in this situation are symmetric with those in

the Keynesian unemployment equilibrium in the sense that impacts on the excess demand for goods correspond, with the appropriate adjustments for employment status, to the Keynesian impacts on output through aggregate demand.

The excess demand for goods is

$$D = Nx(p, w, q) + g - f(Nl)$$

with q determined by the bond market equilibrium condition,

$$Nqb(p, w, q) = qb^G = (q + 1)b_0^G + pg + M_0 - M. \tag{9}$$

In the manner of the Keynesian case analysis these relationships yield

$$\frac{dD}{dg} = 1 - \hat{a} > 0;$$

$$\frac{dD}{dM} = \frac{1}{p}\hat{a} > 0;$$

$$\frac{dD}{dw} = Nx_w + \frac{1}{p}\hat{a}Nqb_w > 0;$$

and

$$\frac{dD}{dp} = Nx_p + \frac{1}{p}\hat{a}(Nqb_p - g);$$

where

$$0 < \hat{a} \equiv \frac{Npx_q}{b_0^G - N(b+qb_q)} = \frac{px_q}{px_q + m_q} < 1.$$

As in the Keynesian case, the potential indeterminacy of the price effect is due to bond market reactions and is ruled out by a real balance effect.

The excess demand for labor is

$$D_L = (f')^{-1}\left(\frac{w}{p}\right) - Nl,$$

which, given the assumed inelasticity of the labor supply, depends only on the real wage. It is unaffected by fiscal or monetary policy or by equiproportionate changes in w and p.

A change in the money wage alone, or in the product price alone, will alleviate the excess demand in one market but aggravate that in the other.

4. EQUILIBRIUM REGIONS. GLOBAL EFFECTS OF GOVERNMENT POLICIES.

In this section we obtain a qualitative determination of the regions of fixed wages and prices which correspond to each type of quantity-constrained equilibrium. Following the approach of Dixit [1978], we first locate these regions relative to the Walrasian configuration obtained with reference to notional

equilibrium in each of the markets. We then focus on the market-clearing conditions for each of the fix-price markets when the other such market is in a state of excess supply or demand. Finally, the qualitative characteristics of these regional boundaries, and their behavior under changes in the monetary and fiscal policy parameters, are summarized. Throughout it will be assumed for ease of exposition that there are none of the perverse bond effects discussed in Section 3.

4.1. *Notional Market-Clearing.* With labor supply inelastic, the condition of notional equilibrium in the labor market is simply that the full-employment marginal product of labor be equal to the real wage, i.e., $w = pf'(Nl)$. This equilibrium locus is a straight line through the origin and is independent of government spending, the money supply, and the bond price.

The locus of notional equilibrium in the goods market is

$$Nx(p, w, q) + g = f\left((f')^{-1}\left(\frac{w}{p}\right)\right),$$

where q is the corresponding equilibrium bond price, given by (9). This locus has a positive slope, since

$$\frac{dw}{dp} = -\frac{Nx_p - y_p + \frac{1}{p}\hat{a}(Nqb_p - g)}{Nx_w - y_w + \frac{1}{p}\hat{a}Nqb_w} > 0.$$

The configuration of regions of notional excess supply and excess demand combinations then appears as in Figure 1. The relative steepness of the curves can be justified by a stability argument (see Dixit [1978]). Their intersection is the Walrasian equilibrium, W. (Note that, had the goods market equilibrium

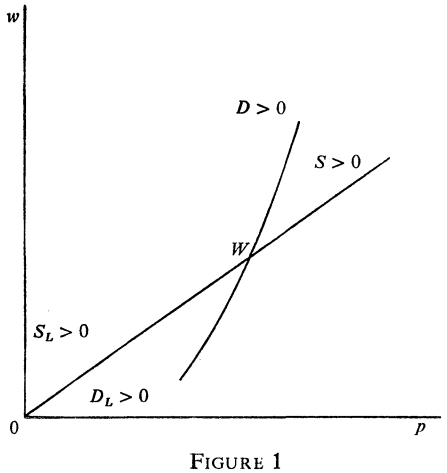

FIGURE 1

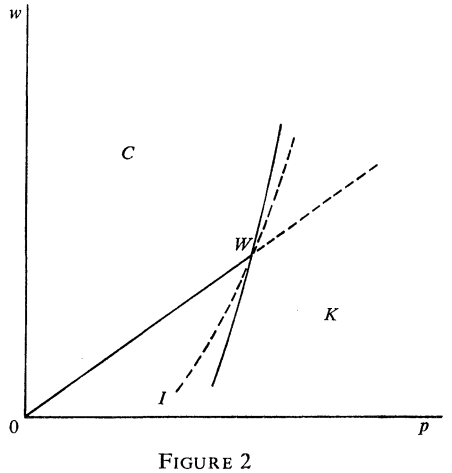

FIGURE 2

locus been negatively sloped because of perverse bond market effects, the Walrasian equilibrium would be unstable unless price changes as a positive function of excess demand. But such an adjustment is unreasonable if excess demand is observed to increase with price.)

4.2. *Constrained Market-Clearing and Effects of Policy Changes.* Relative to the notional configuration (shown as the broken curves in Figure 2) the constrained equilibrium loci are located as the solid curves in Figure 2. Equilibrium in the goods market requires a decrease in w (for any given p) when firms' output is less than the notional and households are unconstrained. Similarly, when households are constrained in their demand, equilibrium in the goods market requires a higher w for any given p. The region of classical unemployment (C) is consequently smaller than the corresponding notional one, while the regions of Keynesian unemployment (K) and repressed inflation (I) are expanded beyond their notional counterparts.

Because of the labor supply inelasticity, the locus of labor market equilibrium with excess demand in the goods market coincides with the notional equilibrium locus and is independent of monetary and fiscal policies.

When there is excess demand in the labor market, goods market equilibrium requires

$$Nx(p, w, q) + g = f(Nl),$$

with q determined in the bond market from (9). Thus

$$(10) \qquad dp\left[Nx_p + \frac{1}{p}\hat{a}(Nqb_p - g)\right] + dw\left[Nx_w + \frac{1}{p}\hat{a}Nqb_w\right] + dg[1 - \hat{a}] + dM\left[\frac{1}{p}\hat{a}\right] = 0;$$

so, for given g and M, the locus has a positive slope,

$$\frac{dw}{dp} = -\frac{Npx_p + \hat{a}(Nqb_p - g)}{Npx_w + \hat{a}Nqb_w}.$$

Since the multipliers of dg and dM in (10) are each positive, an increase in g or M will require a decrease in w for any given p. The locus shifts down to the right in each case. The magnitude of the shift with a change in g will be greater than that for an equivalent change in M ($dM = pdg$) if $\hat{a} < 1/2$, which is equivalent to $\partial px/\partial q < \partial m/\partial q$; i.e., if the demand for money is more responsive to interest rate changes than is consumption spending.

The locus of goods market equilibrium with unemployment is given by

$$N^e x(p, w, q) + N^u \tilde{x}(p, q) + g = f\left((f')^{-1}\left(\frac{w}{p}\right)\right)$$

with q determined from (4). Thus

$$dp\left[\frac{e_p}{l}(x-\tilde{x}-lf'(e))+N^e x_p+N^u\tilde{x}_p\right.$$
$$\left.+\frac{1}{p}a\left(\frac{e_p}{l}q(b-\tilde{b})+N^e qb_p+N^u q\tilde{b}_p-g\right)\right]$$
$$+dw\left[\frac{e_w}{l}(x-\tilde{x}-lf'(e))+N^e x_w+\frac{1}{p}a\left(\frac{e_w}{l}q(b-\tilde{b})+N^e qb_w\right)\right]$$
$$+dg[1-a]+dM\left[\frac{1}{p}a\right]=0,$$

with a as previously defined. So for given g and M,

$$\frac{dw}{dp}=$$
$$-\frac{\frac{e_p}{l}(x-\tilde{x}-lf'(e))+N^e x_p+N^u\tilde{x}_p+\frac{1}{p}a\left(\frac{e_p}{l}q(b-\tilde{b})+N^e qb_p+N^u q\tilde{b}_p-g\right)}{\frac{e_w}{l}(x-\tilde{x}-lf'(e))+N^e x_w+\frac{1}{p}a\left(\frac{e_w}{l}q(b-\tilde{b})+N^e qb_w\right)}$$

Since $a<1$ and $f'(e)=w/p$, we have

$$\frac{e_p}{l}(x-\tilde{x}-lf'(e))+a\frac{e_p}{lp}q(b-\tilde{b})$$
$$<\frac{e_p}{lp}(p(x-\tilde{x})+q(b-\tilde{b})-wl)$$
$$<0,$$

since m is normal. Similarly, $(e_w/l)(x-\tilde{x}-lf'(e))+a(e_w/lp)q(b-\tilde{b})>0$. So the denominator of dw/dp is unambiguously positive, while the numerator (taking

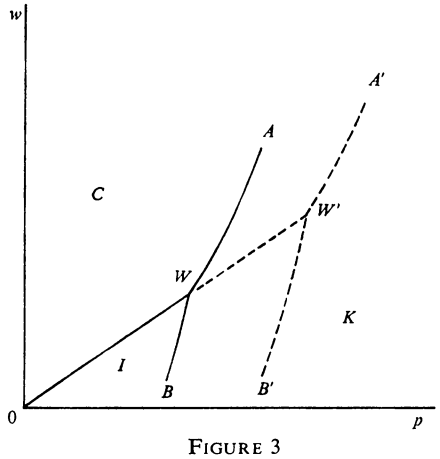

FIGURE 3

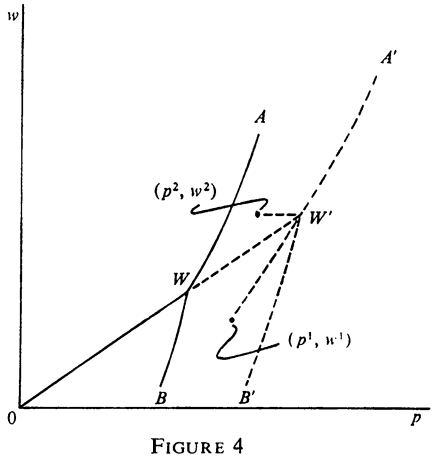

FIGURE 4

into account the multiplicative $-$) will be positive provided there is a real balance effect. Then $dw/dp>0$.

Since the multipliers of dg and dM are both positive, an increase in g or M shifts the locus down to the right. The determination of relative magnitudes of shifts in g and M (with $dM=pdg$) is also analogous to that for the previous locus.

The configuration of equilibrium regions is then as shown in Figure 3, with the broken lines indicating the position of the boundaries after an increase in g or M.

4.3. *Scope of Government Policy.* The independence of OW with respect to g and M is due to the fixed labor supply. One consequence is that the Walrasian equilibrium must always lie on the ray OW. If the given price-wage pair is off this ray, a Walrasian equilibrium cannot be reached by budgetary or monetary policy; with the parameters N and l constant, a price or wage policy is required. From any point off OW changes in M or g will ultimately cause that point to be on a boundary such as $W'A'$ or $W'B'$. Thus if (p, w) is in the K region above OW (i.e., the real wage exceeds the Walrasian equilibrium real wage) the effect of increasing M or g will be to reduce the excess supply of goods, ultimately to zero (at a boundary $W'A'$) without eliminating unemployment. Beyond this there is classical unemployment with different relations governing the effects of M and g. On the other hand, if (p, w) is in the K region below OW (i.e., the real wage is less than that of a Walrasian equilibrium) increasing M or g will reduce unemployment to zero (on $W'B'$) with the excess supply of goods still positive. Similar results follow for the C and I regions.

If the economy is initially in Walrasian equilibrium at W, an increase in g or M would leave the economy on the boundary between classical unemployment and repressed inflation; i.e., the labor market would remain in equilibrium but there would emerge an excess demand for goods. A reduction in g or M would turn an initial general market-clearing equilibrium into one of Keynesian unemployment.

Consider now the effects of price and wage policies with other parameters fixed. Suppose the initial (p, w) produces Keynesian unemployment. A proportional reduction in both p and w is a movement along the ray toward the origin. If the initial real wage is higher or lower than that of the Walrasian equilibrium the result will be to reach the boundary WA in the former case, with the excess supply of goods equal to zero but still unemployment, or to reach WB in the latter case, with zero unemployment but still an excess supply of goods. The removal of imbalance in both markets requires a change in both money wages and prices and the real wage (unless this is equal to that of W initially) in the direction of W.

The differential relation (5) indicated that increasing w and lowering p would be the appropriate policy combination for reducing the excess supplies of labor and goods. But the global view of Figure 3 shows that such a movement in the northwest direction will lead to WB or WA (and only fortuitously to W itself), leaving an imbalance in one of the markets. The attainment of W from a point

in K may require any one of the possible combinations of increases or decreases in w and p, the real wage having to rise or fall according as (p, w) is initially below or above OW.

Given the practical difficulty of reducing money wages or prices, which restricts changes in (p, w) to the northeast direction, general market clearing could be achieved by combining a relative change in w and p with an expansion of the money supply or government demand so that the Walrasian equilibrium is moved outward along OW. This is illustrated in Figure 4 where W' is the new Walrasian equilibrium after an increase in M (or g) and can be attained from an initial position such as (p^1, w^1) or (p^2, w^2) by an increase in one or both of p and w. In the first case the real wage is increased, in the second it is lowered.

Again, there are similar effects in the C and I regions. The general conclusion that emerges is that, while neither monetary nor fiscal policy can completely eliminate imbalance in all markets simultaneously, each can be used to improve the situation and to minimize the necessary changes in wages and prices.

5. CONCLUDING REMARKS

The economy analyzed in this paper is an extension and generalization of specifications considered previously by Benassy [1978], Younès [1970] and, in particular, Malinvaud [1977]. The introduction of a flex-price asset, traded by household and government sectors, provides an alternative form of saving for households and the essential mechanism by which the government can conduct independent monetary and fiscal policies: pure fiscal policy financed by borrowing, pure monetary policy through open market operations, or some mix of the two. Although none of the conclusions is surprising given Malinvaud's analysis, the general lessons of which are confirmed here, the analysis serves to expose more clearly the channels through which exogenous changes impact on the economy. It also brings out the factors which determine the relative efficacy of monetary and fiscal policies, involving primarily the relative responsiveness of category expenditures to interest rate changes. Interactions through bond market adjustments incorporate the effects of financing government spending and open market operations, sometimes dampening, sometimes reinforcing the direct effects of exogenous changes.

The model itself is restrictive in several respects. First, the assumption of an inelastic labor supply, which simplifies the analysis considerably, would need to be relaxed if the focus were on the labor market and differential impacts of unemployment policies. Second, firms do not invest and play no part in the bond market. The effect of interest rate changes on aggregate demand is correspondingly reduced. More generally, intertemporal aspects are not considered explicitly at all. The influence of expectations on the economy's current state and on its dynamic behavior, ignored in this paper, is an important topic for further research in this area. For an indication of possible ramifications, see Hildenbrand and Hildenbrand [1976]. Third, the economy is closed. This precludes a number

of interesting effects and issues of international trade, capital movements and the balance of payments. For some results in this context, see Dixit [1978], Neary [1978] and Hool and Richardson [1979].

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REFERENCES

BARRO, R. J. AND H. I. GROSSMAN, "A General Disequilibrium Model of Income and Employment," *American Economic Review*, 61 (March, 1971).

———, *Money, Employment and Inflation* (N.Y.: Cambridge University Press, 1976).

BENASSY, J. P., "Neokeynesian Disequilibrium Theory in a Monetary Economy," *Review of Economic Studies*, 42 (October, 1975), 503–523.

———, "A Neokeynesian Model of Price and Quantity Determination in Disequilibrium," in, G. Schwödiauer, ed., *Equilibrium and Disequilibrium in Economic Theory* (Dordrecht, Boston: Reidel, 1978).

BOEHM, V. AND J. P. LEVINE, "Temporary Equilibria with Quantity Rationing," CORE Discussion Paper, No. 7614 (1976).

CLOWER, R. W., "The Keynesian Counterrevolution: A Theoretical Appraisal," in, F. H. Hahn and F. P. R. Brechling, eds., *The Theory of Interest Rates* (N.Y.: Macmillan, 1965).

DIXIT, A., "Public Finance in a Keynesian Temporary Equilibrium," *Journal of Economic Theory*, 12 (April, 1976).

———, "The Balance of Trade in a Model of Temporary Equilibrium with Rationing," *Review of Economic Studies*, 45 (October, 1978).

DRÈZE, J., "Existence of an Exchange Equilibrium under Price Rigidities," *International Economic Review*, 16 (June, 1975).

GRANDMONT, J. M., "The Logic of the Fix-Price Method," *Scandinavian Journal of Economics*, 79 (1977).

——— AND G. LAROQUE, "On Temporary Keynesian Equilibria," *Review of Economic Studies*, 43 (February, 1976).

HAHN, F. H., "On Non-Walrasian Equilibria," *Review of Economic Studies*, 45 (February, 1978).

HILDENBRAND, K. AND W. HILDENBRAND, "On Malinvaud's Reconsideration of the Theory of Unemployment," CRMS Discussion Paper, University of California, Berkeley (December, 1976).

HOOL, R. B., "Monetary and Fiscal Policies in Equilibria with Rationing," University of Wisconsin, Madison (February, 1978).

——— AND J. D. RICHARDSON, "International Policy Transmission and Domestic Policy Effectiveness in Equilibria with Price Rigidities," University of Wisconsin, Madison (August, 1979).

KEYNES, J. M., *The General Theory of Employment, Interest and Money* (New York: Macmillan, 1936).

LEIJONHUFVUD, A., *On Keynesian Economics and the Economics of Keynes* (New York: Oxford University Press, 1968).

MALINVAUD, E., *The Theory of Unemployment Reconsidered* (New York: Wiley, 1977).

NEARY, J. P., "Non-traded Goods and the Balance of Trade in a Neo-Keynesian Temporary Equilibrium," Nuffield College, Oxford (May, 1978).

PATINKIN, D., *Money, Interest and Prices*, 2nd edition (New York: Harper and Row, 1965).

SAMUELSON, P. A., "Maximum Principles in Analytical Economics," *American Economic Review*, 62 (June, 1972).

VARIAN, H. R., "On Persistent Disequilibrium," *Journal of Economic Theory*, 10 (April, 1975).

———, "Non-Walrasian Equilibria," *Econometrica*, 45 (April, 1977).

YOUNÈS, Y., "Sur les Notions d'Equilibre et de Déséquilibre Utilisées dans les Modèles Décrivant l'Evolution d'une Economie Capitaliste," CEPREMAP Discussion Paper, Paris (1970).

————, "On the Role of Money in the Process of Exchange and the Existence of a Non-Walrasian Equilibrium," *Review of Economic Studies*, 42 (October, 1975).