Research Repository UCD

Title	Neo-Keynesian macroeconomics in an open economy
Authors(s)	Neary, J. Peter
Publication date	1989-04
Publication information	Neary, J. Peter. “Neo-Keynesian Macroeconomics in an Open Economy” (April, 1989).
Series	UCD Centre for Economic Research Working Paper Series, WP89/8
Publisher	University College Dublin. School of Economics
Item record/more information	http://hdl.handle.net/10197/1465
Notes	A hard copy is available in UCD Library at GEN 330.08 IR/UNI

Downloaded 2024-04-17 05:52:33

The UCD community has made this article openly available. Please share how this access benefits you. Your story matters! (@ucd_oa)

© Some rights reserved. For more information

12013162 E5

Neo-Keynesian Macroeconomics in an Open Economy

by

Peter Neary

Working Paper No. WP89/8

April 1989

Earlier versions of this paper were presented at the annual IAUTE Annual Conference, Renvyle, April 1986, at the CEPR - University of Manchester Conference on Developments in Disequilibrium Macroeconomics, April 1986, at the Conference on International Economics at the Norwegian School of Economics and Business Studies, Bergen, May 1986 and to seminars at the University of Maryland and at Trent University, Peterborough, Ontario. Research assistance from Gabrielle Doyle and comments from Patrick Honohan, Jack Mintz and Sweder van Wijnbergen are gratefully acknowledged.

An earlier version of Sections I to III of this paper was previously circulated as Centre for Economic Research Working Paper No. 42, May 1986.

Working Papers represent preliminary reports on research in progress and should not be cited without permission from the authors. A complete list of Working Papers published by the Centre for Economic Research is available on request.

TABLE OF CONTENTS

NEO-KEYNESIAN MACROECONOMICS IN AN OPEN ECONOMY

I. INTRODUCTION

This paper attempts to provide an overview of those writings which have applied the approach known variously as "disequilibrium," "fix-price," or "neo-Keynesian" macroeconomics to an open economy.[1] While some advanced issues are touched on, my aim is essentially pedagogic. In particular, I attempt throughout to present the simplest possible model in which a given result can be illustrated. This provides a convenient way of drawing together an extensive literature where the differences between individual contributions are often clearer than the similarities. It also serves to clarify the essential nature of disequilibrium phenomena and the circumstances in which we might expect them to emerge.

A convenient way to introduce the field is to discuss the different labels which have been applied to it. The first of these is "disequilibrium", which has come to be widely used as a description of the approach to macroeconomics stemming from Barro and Grossman (1971), Benassy (1977) and Malinvaud (1977), who drew in turn on the insights of Clower (1965) and Patinkin (1965). Yet despite its widespread use, the term is entirely inappropriate, since in all the models in this tradition there is a well-defined concept of equilibrium. It is, however, a different concept from the usual one of Walrasian competitive equilibrium, and presumably the popularity of the term "disequilibrium" derives from the fact that it draws attention to this contrast. In Walrasian equilibrium, no trading takes place until a set of prices has been established which equates the aggregate supply

---

[1] Other surveys of this literature may be found in Cuddington, Johansson and Löfgren (1984), Hénin and Marois (1985) and Itoh and Negishi (1987). See also Benassy (1986), especially Part III.

and demand for each good in each market. In disequilibrium analysis, on the other hand, there are assumed to be restrictions on the ability of prices to adjust to these levels. As a consequence, the decisions of suppliers and demanders must be reconciled by some mechanism other than price adjustment. The standard assumption made is that agents cannot be coerced into trading more than they wish, and so the "short side" of each market dominates: actual transactions equal the *minimum* of supply and demand, and agents on the long side of any market face quantity constraints which lead them to recalculate their decisions and so "spill over" to influence behaviour on other markets.

In the light of this, the term "fix-price" is more appropriate as a descriptive label for this approach to macroeconomics, which examines the nature of the equilibria that are established subject to some or all prices being at levels other than those which would prevail in a Walrasian equilibrium. On the other hand, this term implies an unnecessarily restrictive view of the types of equilibria which can be considered and it draws attention to one of the least satisfactory aspects of the whole approach, namely, the fact that it does not provide a theory of price determination in the first place. However, although the *equilibrium concept* used by this approach postulates fixed prices, this does not make it applicable only to environments in which this assumption literally applies. (That the approach is of great potential usefulness in studying situations where prices are actually fixed, for example by effective government controls, is not in dispute.) The assumption of tâtonnement trading made in conventional equilibrium theory is a convenient analytic fiction and is probably an acceptable first approximation to the evolution of most markets in the long run. However, in the short run, its empirical relevance to many markets, especially those for labour, credit and intermediate goods, is questionable at best. Even in the absence of a satisfactory theory of short-run price determination, it is of considerable interest to examine how

an equilibrium will be determined conditional on pre-existing non-Walrasian prices, and in the remainder of this survey I confine attention to recent writings which have attempted to do this in the context of open economies.

With both disequilibrium and fix-price unsatisfactory as labels, I have chosen to use instead that of "neo-Keynesian."[2] By this I mean that it attempts to avoid the most serious criticism of traditional Keynesian macroeconomics, namely its lack of microeconomic foundations. At the same time, it is concerned with the same issues, such as spillovers between markets, the possible failure of wage cuts to stimulate output and employment, and the possible efficacy of fiscal policy in doing so, even to a magnified extent. As we shall see, the approach does indeed provide a firmer basis for these traditional Keynesian results. However, in an open economy context, some care is needed in establishing which assumptions are crucial in generating these phenomena.

In the remainder of this paper, I consider a sequence of models of increasing sophistication. Section II examines an elementary Classical model with no price or wage rigidities whatsoever. Despite its Walrasian properties, this model serves as a convenient vehicle for introducing some of the analytic questions to be considered later in the paper. Section III then examines the implications of appending to this model a rigid wage. The consequences of assuming that labour supply is variable and that some goods are non-traded are also considered. Finally, Section IV considers a number of approaches which have been adopted to investigating Keynesian phenomena in models of small open economies.

---

[2]Benassy (1975) appears to have been the first to apply this term to the disequilibrium approach. Whether this term is indeed accurate in suggesting that the approach is faithful to Keynes's views is a matter for historians of economic thought. Strong cases could be made for either the textbook IS-LM approach or the "post-Keynesian" school as more closely approximating Keynes's thinking, contrary to the claims of Leijonhufvud (1968).

II. AN ELEMENTARY CLASSICAL MODEL

This section introduces the simplest model in which the issues discussed in the introduction can be explored. This postulates a single country, assumed to be "small" in the conventional sense that it can trade an unlimited amount with the rest of the world at fixed prices. Moreover, it produces and consumes a single good, which can of course be interpreted as a Hicksian composite commodity, the assumption of fixed world prices allowing all goods to be aggregated in this way. This good in turn is produced by means of a single variable factor of production, labour, and in both production and consumption explicit consideration is given to a single period only (although, as we shall see, household behaviour takes account of the future in a rudimentary way). Finally, the economy is assumed to have a single financial asset, money, which is not traded internationally.[3] In later sections the consequences of relaxing these assumptions will be examined in turn. In the present section, I first examine the behaviour of the individual agents in the model and then consider its properties in a fully Walrasian environment. This serves as a prelude to the next section where I look at the implications of sticky wages. Although we shall see that this model cannot exhibit many of the features which are usually described as "Keynesian", it serves to introduce many of the principal issues which have been considered in the literature on fix-price macroeconomic models of open economies.

A. THE BEHAVIOUR OF FIRMS AND HOUSEHOLDS

The simplest approach to modelling the firm and household sectors is to

---

[3]We can think of this as a "one-by-five" model (one country, one good, one factor, one period and one asset), by analogy with the Heckscher-Ohlin "two-by-two-by-two" model which forms the standard introduction to many courses in international trade theory.

ignore distribution effects and assume that each is characterised by a single price-taking agent. In the case of firms, I simplify further and assume that no investment is carried out. With labour the only variable factor and production subject to diminishing returns, the firm's behaviour can therefore be characterised in terms of its profit function:

$$\Pi(p,w) = \max\ [py - we:\ y = f(e)] \tag{2.1}$$

Here e and y are the levels of employment and output respectively, related by the production function $f(\cdot)$, and w and p are the market wage and output price respectively. Differentiation of the profit function gives the firm's labour demand and output supply functions, which are increasing in p, decreasing in w and homogeneous of degree zero in p and w together:

$$y = y(p,w) \quad \text{and} \quad e = e(p,w). \tag{2.2}$$

In addition to specifying the firm's behaviour, it is also necessary to make some assumptions about the disbursement of its profits. Here again, I make the simplest possible assumption, that all profits are distributed instantaneously to the aggregate household, and so form part of its lump-sum income in the current period. Some writers have adopted the alternative assumption that profits are not redistributed until the following period.[4] However, by imposing in effect a zero marginal propensity to consume out of profits in the current period, this assumption biases the model's properties in a more Keynesian direction. As a starting point, therefore, it seems more natural to begin by assuming that both profit and wage income are spent in the same manner.

The household therefore receives a lump-sum income equal to the total value of current production, py, plus an endowment of money balances, $\bar{m}$ which consists of money carried over from the last period as well as any new money

---

[4]See in particular, Malinvaud (1977), Dixit (1978) and Neary (1980).

created in the current period. I assume that its objective is to allocate this income optimally between current consumption, c, and money balances carried over to the next period, m. For the present, I assume that the household does not derive utility from leisure as such. Instead, its desired or notional labour supply is fixed at a level equal to L. Thus the aggregate household's utility function is given by:

$$u = u(c,m) \tag{2.3}$$

which is maximised subject to the budget constraint:

$$pc + m = I = py + \bar{m}. \tag{2.4}$$

Under these assumptions the behaviour of the household is easily seen to be summarised by demand functions for current output and money balances to be carried over to the future period:

$$c = \underset{- \;\; +}{c(p,I)} \qquad \text{and} \qquad m = \underset{? \;\; +}{m(p,I)}. \tag{2.5}$$

With both current consumption and money balances assumed to be normal, the signs of the partial derivatives of these functions are as indicated.

It should be noted in passing that the inclusion of money balances as an argument in the utility function raises more difficulties than it resolves. Some writers, such as Patinkin (1965), have justified this procedure on the grounds that money holdings are desired for their own sake. However, most have preferred to view the demand for money as a derived demand, stemming either from a transactions motive, as in the cash-in-advance framework of Clower (1967), or from an asset motive. The difficulty which the latter view raises is that the utility derived from money held over to the next period depends on the prices which are expected to prevail in that period. Hence, any comparative statics changes must be assumed to be contingent on unchanged expectations of future prices. I will return to the issue of expectations in Section IV.C.3.

B. NOTIONAL OR WALRASIAN EQUILIBRIUM

The determination of equilibrium in this model when wages are flexible is easily illustrated. The assumption that the household's notional labour supply is fixed, when combined with the labour demand schedule from (2.2), gives the labour-market equilibrium condition:

$$L = e(p,w) \tag{2.6}$$

FIGURE 1 ABOUT HERE

The absence of intertemporal considerations from the firm's decisions, implying that labour demand is homogeneous of degree zero in p and w, means that this equilibrium condition can be represented by a straight line from the origin in (w,p) space, as illustrated in Figure 1. Points above the line labelled L represent points of incipient unemployment (denoted by U), while those below correspond to points of incipient excess demand for labour (denoted by E). Of course, provided I assume that wage adjustment is instantaneous, neither of these states will actually emerge.

While the Walrasian equilibrium must lie along the L locus in Figure 1, its exact location depends on the exchange-rate regime being pursued. Under fixed exchange rates, the equilibrium point is determined by the exogenous world price level (p*) and the exchange rate itself (e) through the "Law of One Price" relationship:[5]

$$p = ep^*. \tag{2.7}$$

Because the only good in this model can be freely traded at a given world price, this Law (implying international equalisation by arbitrage of the

---

[5]Note that I follow the so-called U.S. convention in measuring the exchange rate: e measures the price in home currency of a unit of foreign exchange. Hence, a rise in e corresponds to a *depreciation* of the home currency, and a fall in e corresponds to an *appreciation*.

prices of individual goods) is equivalent to the hypothesis of Purchasing Power Parity (implying international equalisation of the price *levels* of different countries). As we shall see, this equivalence does not hold in more general models. At the equilibrium so determined, the balance of trade surplus is given by the excess of home production over home consumption:[6]

$$s = y(p,w) - c(p,I). \tag{2.8}$$

The case of flexible exchange rates is even more straightforward. With only a single financial asset, the exchange rate must adjust at each instant to ensure that the balance of trade is zero. The combinations of w and p consistent with this condition may be found by setting s equal to zero in (2.8). The slope of the resulting zero trade balance locus may be found by differentiation:

$$ds = \left(y_p - c_p - yc_I\right)dp + y_w dw, \tag{2.9}$$

where y_p denotes the partial derivative of y(p,w) with respect to p, and so on. Setting ds equal to zero, equation (2.9) may be simplified by invoking the Slutsky equation[7] and by rewriting in terms of logarithmic derivatives (e.g., $\hat{w} = d\ln w$):[8]

$$py_p\hat{w} = p\left(y_p - c_p^c\right)\hat{p}. \tag{2.10}$$

Both coefficients are positive and the coefficient of $\hat{p}$ exceeds that of $\hat{w}$, implying that the zero trade balance locus is upward-sloping and more steeply

---

[6] Note that, in locating this notional locus in the diagram, I allow changes in w and p to affect output, but assume that such changes are not taken into account by consumers in calculating their income, I, which is fixed at $py^* + \bar{m}$, where y^* is the full-employment level of output, equal to f(L). This slightly unsatisfactory convention is avoided when we come to the effective iso-trade- balance loci in Section III below.

[7] The standard Slutsky decomposition of the own-price derivative of consumption into income and substitution terms gives $c_p = c_p^c - c_I c$, which equals $c_p^c - c_I y$, since s is zero by assumption. The term c_p^c is the Hicksian or compensated own-price derivative, and is necessarily negative.

[8] Note that I also make use of the zero-degree homogeneity of y in p and w, implying that $wy_w = -py_p$.

sloped than the L schedule in Figure 1. The economic rationale is straightforward: a higher wage rate discourages domestic output and so brings about a deficit; a higher price stimulates domestic production and discourages domestic consumption, so tending to induce a surplus; while an equiproportionate increase in both w and p leaves output unchanged but reduces demand, once again giving rise to a surplus. The resulting locus is labelled S in Figure 1, with points to the left of it representing a deficit (denoted by D) and points to the right representing a surplus (denoted by S). The two loci therefore divide the diagram into four distinct regions, or "zones of economic unhappiness," in the phrase of Swan (1963). Of course, as already noted, because the wage rate is flexible, the economy is constrained to lie along the L locus at all times.

C. DYNAMICS AND COMPARATIVE STATICS OF WALRASIAN EQUILIBRIUM

Before considering the comparative statics properties of the equilibria just introduced, we must note an important difference between the two exchange rate regimes. While the floating exchange rate equilibrium is a full equilibrium in the sense that it will remain undisturbed unless some change occurs in the exogenous variables or parameters of the model, the same is only true of the fixed exchange rate equilibrium if the balance of trade surplus is zero.[9] If there is an initial trade imbalance, then the short-run equilibrium will adjust over time in a manner familiar from writings on the monetary approach to the balance of payments.[10] A surplus of home output over home expenditure leads to an inflow of foreign currency through the foreign exchanges. Provided this is not sterilized by the domestic monetary

---

[9] Helpman and Razin (1979) have pointed out that this comparison is misleading from the point of view of a welfare comparison of the two exchange rate regimes. The reason is that it assumes that foreign borrowing is allowed under fixed exchange rates but not under floating rates.

[10] See Frenkel and Johnson (1976). The mechanism assumed to operate here is simply the price-specie flow mechanism of Hume, extended to a fractional reserve currency.

authorities, as I assume, the money supply is therefore augmented and so domestic expenditure in subsequent periods is affected.

FIGURE 2 ABOUT HERE

This process is illustrated in the two panels of Figure 2. The left-hand panel shows the relationship between the trade surplus in domestic currency, ps, which equals the rate of increase of the domestic money supply, Dm, and the domestic price level, p. This relationship is derived from equations (2.8) and (2.4), using y* to denote the full-employment level of output, y* = f(L):

$$Dm = ps = py^* - pc\left[p, py^* + m\right]. \tag{2.11}$$

Viewed as a simple first-order differential equation, this is clearly stable, since d(Dm)/dm equals $-\mu$ (where μ is the marginal propensity to consume, equal to pc_I), which is negative. The curve Dm_0 in the left-hand panel of Figure 2 illustrates equation (2.11) for a given level of initial money balances.[11] It is easily shown to be upward-sloping, provided the initial deficit is not too large.[12] If the domestic price level equals OB, then the initial equilibrium is given by point A, with a positive trade surplus. Over time, this leads to an inflow of currency, raising m and so shifting the Dm curve leftwards, as indicated by the arrows. The final long-run equilibrium therefore occurs at point B, when both commodity and asset markets are in full equilibrium. Precisely the same story is told by the right-hand panel of Figure 2, which illustrates the relationship which must hold between p and m in long-run stock equilibrium. The equation for the locus labelled S in this panel is given by equation (2.11), with Dm set equal to zero. The

---

[11]This diagram is used by Dornbusch (1973). Note that Dornbusch uses hoarding (H) instead of m to represent the domestic money supply, and assumes a constant velocity of circulation.

[12]Differentiating (2.11): $d(Dm) = \left[(1-\mu)s - pc_p^c\right]dp.$

movement from point A to point B in the left-hand panel is matched by that from a (where the initial money supply equals m_0) to b (where the money supply is at its long-run equilibrium value, m*).

This discussion of the dynamics of the model under fixed exchange rates alerts us to the fact that the exchange rate regime does not affect the long-run comparative statics properties of the model as far as real variables are concerned. However, the mechanism by which the same real long-run equilibrium is attained is different in the two cases: under floating exchange rates, the domestic money supply is given and both wages and prices adjust; whereas under fixed exchange rates, the price level is given and wages and the money supply adjust. Finally, the impact, or short-run, effect of any exogenous shock under fixed exchange rates, is determined by the fact that both the price level and the money supply are given at their initial values.

Keeping these considerations in mind, I now proceed to examine the effects of different exogenous shocks in this simple model, assuming for the present that the initial position is one of full equilibrium (i.e., with a zero balance of trade).

1. Effects of an Increase in the Money Supply

FIGURE 3 ABOUT HERE

The effects of this shock are illustrated in Figure 3. The L schedule is unaffected, since its location depends only on relative prices (recall equation (2.6)). The initial increase in m raises home demand and so shifts the zero trade balance locus rightwards from S to S' as shown. The impact on the economy hinges on the exchange rate regime. Under floating rates, there is an instantaneous depreciation which raises home prices and wages by the same proportionate amount: the equilibrium jumps from A to B and no change

occurs in real variables. Under fixed rates, by contrast, the domestic price level is fixed at p^0. Since the requirement of continual labour market clearing keeps the economy along the L locus, the equilibrium therefore remains at point A. This now lies to the left of the new zero trade balance locus S', and so the monetary expansion gives rise to a trade deficit. Over time this leads to an outflow of foreign exchange reserves and so to a reduction in the domestic money supply. Hence the S' locus gradually shifts leftwards until the initial equilibrium at A is restored. This of course illustrates one of the dictums of the monetary approach to the balance of payments: in the long run the monetary expansion is completely offset and not merely the initial real equilibrium but the initial level of nominal variables is restored.

2. Effects of an Increase in Government Spending

So far, the model does not allow explicitly for direct purchases of goods by the government. However, it is trivial to extend it in this direction, so that equation (2.8) becomes:

$$s = y^* - c\left(p, py^* + \bar{m}\right) - g. \tag{2.12}$$

Of course, with only one financial asset, fiscal expansion in this model can only be financed by printing additional money. Thus, there is no analogue to pure or bond-financed fiscal policy. Indeed, it is illuminating to combine (2.12) with the household's budget constraint (2.4), to derive the purely accounting identity:

$$m = \bar{m} + ps + pg. \tag{2.13}$$

This shows that direct purchases of output by the government is one of three ways of augmenting the (end-of-period) money supply in the model, m, the other two being increases in the initial money supply, $\bar{m}$, and running a trade surplus.

Although increases in g must be financed by printing money, it does not necessarily follow that they have exactly the same effects as increases in $\bar{m}$. In fact, because of the assumption of fixed labour supply, the effects of increases in g and increases in $\bar{m}$ are qualitatively identical. They are not quantitatively identical, however, and two aspects of their magnitude deserve comment, since they will arise in later discussions. First, it is clear from (2.12) that, under fixed exchange rates, a fiscal expansion leads to an *exactly equal* deterioration of the trade balance. In policy discussions this result is often associated with the New Cambridge (U.K.) school,[13] and it is of interest to note that it arises in a fully Walrasian equilibrium model. The second point which deserves comment is the effect of a balanced budget fiscal expansion, defined by: $dg = -pd\bar{m}$. Differentiating (2.12), it may be checked that, under fixed exchange rates, this worsens the trade balance by the extent of the fiscal expansion times the marginal propensity to save:

$$ds = -(1-\mu)dg. \tag{2.14}$$

By contrast, in the long run (and, indeed, in the short run if the exchange rate is floating), a one-shot fiscal expansion cannot affect real variables.

3. Effects of a Technological Improvement

The next exogenous shock to consider is a supply-side rather than a demand-side one. Suppose that the production function includes an exogenous parameter, k, which may be identified with the state of technological knowledge. In general, this parameter should enter into the supply function and labour demand function given by (2.2) and it is plausible to assume that it has a positive effect on both:[14]

---

[13] See, for example, Cripps and Godley (1976).

[14] Note, however, that highly labour-saving technological progress could *reduce* the demand for labour at a given real wage. Conditions for this to occur, and their implications in a fix-price model, are derived in Neary (1981).

$$y = y(p,w,k) \quad \text{and} \quad e = e(p,w,k) \tag{2.15}$$

FIGURE 4 ABOUT HERE

The effects of an increase in k are now illustrated in Figure 4. First, the increase in the demand for labour at the initial real wage causes the L schedule to pivot counter-clockwise to L' as shown. It follows immediately that, under fixed exchange rates, the new short-run equilibrium must be at point B, directly above the initial equilibrium A: technological progress raises both real and nominal wages. The second impact of the shock is to shift the zero trade balance locus leftwards: at the initial levels of wages and prices, the increase in output is only partially offset by a rise in expenditure.[15] This information alone does not establish the effects of the shock on the trade balance, since the new locus S' could apparently lie either to the left or the right of point B. However, a direct argument serves to demonstrate that it must lie to the left, as shown in Figure 4. With labour as the only variable factor and w adjusting to ensure that desired employment remains equal to the available supply, the full-employment level of output may be written as an increasing function of the technology parameter alone, $y^*(k)$. The balance of trade equation, (2.8), therefore becomes in this case:

$$s = y^*(k) - c\left[p,\ py^*(k) + \bar{m}\right]. \tag{2.16}$$

Differentiating with respect to k thus gives:

$$ds = (1-\mu)y_k^* dk, \tag{2.17}$$

and so we may conclude that under fixed exchange rates technological progress improves the trade balance. Over time, of course, the surplus augments the

---

[15] Differentiating (2.8) with the augmented supply function from (2.15) gives at constant w and p: $ds = (1-\mu)y_k dk$, where y_k is the partial derivative of y with respect to the technology parameter k.

domestic money supply in the usual manner, and the new zero trade balance locus drifts rightwards from S' until a new long-run equilibrium is established at point B.

The only remaining issue to be considered is the effect of the technological progress under floating exchange rates. Perhaps surprisingly, however, it is not possible to sign its effects unambiguously, even in the present simple model, a fact which will prove of considerable importance when we later turn to consider more complicated models. The ambiguity derives from the fact that, while the new S' locus must lie to the left of point B, as I have just demonstrated, it is not possible to determine whether it must lie to the left or right of point D (which is level horizontally with the initial equilibrium A). In other words, it cannot be determined whether the nominal wage rate will rise or fall following the technological progress. To derive an explicit expression for the change in the wage rate, first differentiate the balance of trade condition, (2.16), with s set equal to zero. This gives an explicit expression for the change in the price level, which shows that it must fall:

$$c_p^c dp = (1-\mu)y_k^* dk. \tag{2.18}$$

Next, totally differentiate the full employment condition (2.6), amended to include the technology parameter, k, and substitute for dp from (2.18) to obtain:

$$(-e_w)dw = \left[e_p\left(c_p^c\right)^{-1}(1-\mu)y_k^* + e_k\right]dk. \tag{2.19}$$

This shows that there is a direct effect of the technological progress on the wage rate, represented by the term e_k, which tends to raise it; but this may be offset by the fall in the price level, which is greater the smaller the price responsiveness of demand (as measured by c_p^c). Even for simple specifications of the relevant functional forms, this expression cannot be signed unambiguously.

4. Effects of a Devaluation

The final comparative static shock I consider, a change in the exchange rate, is only relevant under fixed exchange rates. Under floating rates, the analogous disturbance is a rise in the foreign price level, p^*. However, this is immediately and exactly offset by a currency depreciation, reflecting the fact that (in the absence of capital mobility) floating exchange rates completely insulate the domestic economy from the effects of foreign disturbances. In the short run, a devaluation does not affect either of the loci in the diagram. However, it leads to an immediate increase in the domestic price level. Returning to Figure 3, the rise in the price level from p^0 to p^1 shifts the equilibrium to B, which now lies to the right of the original zero trade balance locus, S. Over time, therefore, the familiar monetary mechanism comes into play and the locus drifts rightwards until the new long-run equilibrium is established at B. The same process is illustrated in Figure 2: If the initial equilibrium is represented by points C and c, the impact effect is to move the economy to points A and a. While output is held constant by the full employment assumption, domestic demand is reduced by the price increase. The outcome is a trade surplus which over time leads to a monetary inflow which brings the economy eventually to the new long-run equilibrium represented by points B and b.

FIGURE 5 ABOUT HERE

In presenting this analysis, I have assumed that the initial situation is one of a zero trade balance. However, it is necessary to investigate whether the results hinge on this assumption (especially since in practice the interest in devaluation as a policy instrument derives from its potential usefulness in offsetting an existing trade imbalance). Figure 5 throws some light on this issue. As before, the curve labelled S is the zero trade

balance locus. The dashed curves to the right of it, labelled S_1 and S_2, are illustrative *iso-trade-balance loci*, showing combinations of w and e which yield the same value of s. This is equivalent to a constant trade balance *in foreign currency*, since p* is fixed. (Indeed, it is convenient in this diagram to fix its value at unity, so that the exchange rate e is measured along the horizontal axis.) As drawn, the second of these loci, S_2, is tangential to the L locus at point B. This implies that for starting points which lie to the right of point B (i.e., for initial exchange rates greater than e_2), a devaluation has the perverse effect of *raising* the already positive value of s. Analytically, this may be demonstrated by totally differentiating (2.8):

$$ds = \left[p\left(y_p - c_p^c\right) - \mu s\right]\hat{p} - py_p\hat{w}. \tag{2.20}$$

Recall that along the straight-line labour-market equilibrium locus L, $\hat{p} = \hat{w}$. Hence, for a devaluation to reduce the trade balance requires that the sum of the second and third terms in the coefficient of $\hat{p}$ in (2.20) be negative: in general, this is clearly possible for a sufficiently large and positive initial value of s. Of course, it is well known that if trade is not balanced initially the Marshall-Lerner condition can be violated. However, it is of interest to pin down the conditions for such a violation in this simplest version of the model, since it explains why some writers have found perverse effects of devaluations in more complicated models.[16]

It is clear from (2.20) that the Marshall-Lerner condition cannot be violated if there is an initial trade deficit. However, this is not true of the balance of trade measured in *domestic* currency, ps. The dotted loci to the left of the curve S in Figure 5 show combinations of w and e which hold constant the home-currency value of the deficit, and by the same reasoning as

[16] See, for example, Hanoch and Fraenkel (1979), and some of the papers on two-sector fix-price models mentioned in Section IV below.

before it is clear that for a sufficiently large initial deficit, such that the initial exchange rate is below e_{-2}, a devaluation will lower the value of ps. We may refer to this outcome as a violation of the Hirschman condition since the possibility was considered at length by Hirschman (1949), and once again an analytical condition for it may be found by totally differentiating (2.8):

$$d(ps) = \left[p^2(y_p - c_p^c) + (1-\mu)ps\right]\hat{p} - p^2 y_p w. \tag{2.21}$$

Thus, a reversal of the Hirschman condition, implying that a devaluation increases an existing deficit measured in home currency, is possible for a sufficiently negative initial value of ps. Note that a relationship between the Marshall-Lerner and Hirschman conditions similar to that between (2.20) and (2.21) holds in all the models considered below, since the change in the trade balance in domestic currency is in general related to the corresponding change in foreign currency as follows:

$$d(ps) = pds + ps\hat{p}. \tag{2.22}$$

III. AN ELEMENTARY STICKY WAGE MODEL

In the previous section, I devoted rather more attention than might be expected in a survey of fix-price open-economy models, to considering the properties of a simple Walrasian full-employment model. The advantage of this approach is that it highlights the differences which may be attributed to the presence of wage and price rigidities. In the present section, I take the first step towards considering disequilibrium models proper by adding to the model of the last section the assumption that the wage rate is predetermined in the current period. The resulting model is a special case of that presented in Dixit (1978), one of the first applications of fix-price

macroeconomics to an open economy.[17]

A. EFFECTIVE EQUILIBRIA WITH STICKY WAGES

The principal difference which a failure of the labour market to clear introduces into the Classical model of the previous section is that now every point in Figure 1 represents a potential short-run equilibrium, and not just points along the full-employment locus L. Moreover, at points which do not lie on this locus, the failure of the labour market to clear by the normal wage-adjustment mechanism has implications for the determination of the trade balance. This is of course the dual decision hypothesis of Clower (1965), whereby disequilibrium in one market (in this case, the labour market) spills over into the other market and influences the manner in which short-run equilibrium is determined there. Even though the process is relatively simple in this model (because there is no feedback from the goods market to the labour market), it is of interest to investigate it in some detail.

Notice first of all that equation (2.6), which gives the expression for the L locus, continues to represent the full employment condition in this model. In particular, it is unaffected by the disequilibrium nature of the model, because there is no rationing in the goods market at any time. This means that, despite its Keynesian flavour, this model must always have very Classical properties, since employment is always cost-determined.

Consider next the zero trade balance condition. The notional condition, equation (2.8) in the last section, must now be amended to take account of the conditions which actually prevail in the labour market. Suppose first that unemployment prevails. This must reduce the actual income received by households and so the condition must be rewritten as follows:

---

[17]The principal differences between my model and that of Dixit are that I assume that households' notional labour supply is fixed and I ignore distribution effects in demand. The consequences of these differences will be noted where appropriate.

$$s = y(p,w) - c\left[p,\ py(p,w) + \bar{m}\right]. \tag{3.1}$$

Since actual income, $y(p,w)$, cannot exceed the full-employment level which entered into (2.8), y^*, any (w,p) combination which corresponded to a notional trade balance must correspond to an effective trade surplus, when the expenditure-reducing effects of unemployment are taken into account. In geometric terms, this means that, in Figure 6, the region corresponding to a trade surplus when unemployment prevails must be larger than that which corresponded to a notional surplus in Figure 1. This region is labelled US, and the dashed line passing through it is the notional zero trade balance locus, given by (2.8) in the last section. To the right of this lies the corresponding unemployment-constrained locus, given by (3.1). Differentiating this shows that it must be upward-sloping, though more steeply sloped than (2.8), whose slope was given by (2.10):

FIGURE 6 ABOUT HERE

$$(1-\mu)py_p\hat{w} = p\left[(1-\mu)py_p - c_p^c\right]\hat{p}. \tag{3.2}$$

The difference of course derives from the presence of the marginal propensity to consume, μ, in the coefficients of both $\hat{w}$ and $\hat{p}$.

The other difference between Figures 1 and 6 relates to the zero trade balance locus in the region corresponding to excess demand for labour (i.e., below the L locus). With income now fixed at its full-employment level, the expression for this locus is:

$$s = y^* - c\left[p,\ py^* + \bar{m}\right]. \tag{3.3}$$

It is clear that this is independent of w, and so it is represented by a vertical straight line in Figure 6. In this case, the ED region, representing equilibria with excess demand for labour and a deficit, is enlarged in moving from notional to effective decisions. The reason is that points along the dashed notional locus implicitly assume that output can be

increased beyond the full-employment level. Since this cannot occur, such points must correspond to an effective deficit.

B. COMPARATIVE STATICS OF EFFECTIVE EQUILIBRIA

Examining the response of the economy to exogenous shocks is not difficult. However, it introduces a new conceptual difficulty which makes it slightly less straightforward than in the case of the Walrasian equilibria considered in the last section. The new feature is that any exogenous shock now has two kinds of effects: both a standard effect, which may differ depending on the regime (of unemployment or excess demand for labour) in which the economy is assumed to lie initially; and an additional effect in altering the relative sizes of the regions corresponding to each regime.

1. Effects of Changes in the Wage Rate

The easiest change to consider is in the wage rate itself, both because it may be illustrated by a movement from one point in Figure 6 to another and also because, as already noted, employment is always cost-determined in this model. Thus, for a given level of p, a steady reduction in w leads first to higher and higher levels of employment; and then, when the full-employment barrier is reached, to no further changes in output or employment. Under floating exchange rates, the same pattern is followed, the only difference being that the equilibrium now lies at all times along the S locus. Thus a steady fall in w leads initially to an exchange rate appreciation (a fall in p) as unemployment falls and then to no further changes in the exchange rate once full employment is attained.

2. Effects of Changes in Monetary and Fiscal Policy

FIGURE 7 ABOUT HERE

The effects of monetary and fiscal policy can be considered together, since the only differences between them are identical to those outlined in

12013/02

the Walrasian case examined in the previous section. Consider first what happens if the money supply is increased when the economy is initially at the full-employment equilibrium point A in Figure 7. It must be stressed that, under fixed exchange rates, point A continues to represent the economy's equilibrium, since the initial values of w and p are unaffected by the monetary expansion. The full-employment locus itself is also unaffected, since it depends only on the labour demand decisions of firms. However, the zero trade balance locus is affected. From both (3.1) and (3.3) it is clear that, irrespective of the state of the labour market, at the initial values of w and p, home spending is increased but home output unchanged. The trade balance therefore worsens, and the S locus shifts rightwards to S' as illustrated in Figure 7.

Comparing Figures 2 and 7, it is clear that the location of the new Walrasian equilibrium point, B, is unaffected by the assumption that the wage rate is fixed in the short run. However, the short-run effects of monetary expansion are very different from the Walrasian case. Under fixed exchange rates, the equilibrium remains at A and the labour market remains in equilibrium but a trade deficit emerges. This may be seen from the fact that A lies to the *left* of the new zero trade balance locus S'. Under floating rates, by contrast, the equilibrium jumps on impact to point C: the exchange rate depreciates to eliminate an incipient trade deficit and, since the wage rate cannot rise in the short run, excess demand for labour emerges.

3. Effects of a Technological Improvement

We saw in the last section that a technological improvement has an ambiguous effect on the Walrasian equilibrium. However, this ambiguity does not carry over to its impact effect when wages are given. By analogy with Figure 4, if the economy starts in long-run equilibrium at point A in Figure 6, then a technological improvement will lead to a new long-run equilibrium

at a point such as E or F. In either case, in the short run under fixed exchange rates the economy remains at point A in the new ES region. The stickiness of the nominal wage implies a failure of the real wage to adjust to its new level. As a result, both labour demand and output overshoot their new long-run equilibrium levels, leading to excess demand for labour and a trade surplus. By contrast, if the exchange rate is flexible, it appreciates on impact and the economy jumps to a new short-run equilibrium at D. This will be characterised by unemployment if the new long-run equilibrium is at a point such as F (requiring a fall in the nominal wage) and otherwise by over-full employment.

4. Effects of a Devaluation

Finally, the effects of a change in e (and so in p) can be read off Figure 6. The effects on the trade balance are predictable, a devaluation tending in all cases to improve it, subject only to the same qualifications about the implications of an initial deficit which were already noted in the Walrasian case in the previous section. In addition, with the nominal wage rate fixed, a devaluation amounts to a cut in real wages, and so in all cases raises employment, until the full-employment ceiling is reached. This rise in employment, and so in income, dampens the impact of the devaluation on the trade balance, but it may be checked that it cannot offset it.[18]

C. VARIABLE LABOUR SUPPLY

So far, I have assumed that households are always willing to supply a fixed amount of labour services, L, and that restrictions on their ability to do so affect their behaviour only to the extent that they directly reduce their income. By contrast, many writers on fix-price economics have assumed

---

[18] Thus, for example, equation (2.21) is replaced in the unemployment case by: $ds = [(1-\mu)py_p - pc^c_p - \mu s]\hat{p}$, and in the overfull employment case by: $ds = -[pc^c_p + \mu s]\hat{p}$.

that labour supply is determined on a choice-theoretic basis.[19] Indeed, one of the first and best known papers in the field, that of Clower (1965), emphasised the inclusion of current income among the arguments of demand functions as the key innovation of Keynesian economics. It is of interest to examine therefore, how crucial this change in assumptions really is.

Perhaps surprisingly, it turns out that the assumption of variable labour supply makes little difference to the essential features of the model presented above. The most obvious aspect of this is that in situations of unemployment, when firms are cost-constrained, the desired or notional supply of labour on the part of households plays no role whatsoever in the determination of the equilibrium. In particular, allowing labour supply to be determined on a choice-theoretic basis cannot alter the essentially Classical or, at least, unKeynesian, nature of the model. At the same time, this extension enriches the analysis of the excess demand for labour regime and also affects some of the comparative statics properties of the model. Finally, endogenising labour supply raises a technical difficulty in the modelling of the household's decision problem, and I begin by considering this issue.

To see how the technical problem arises, suppose I extend the model of the last section in what might seem the most obvious way to introduce variable labour supply. The utility function (2.3) now becomes:

$$u = u(c, H-\ell, m), \tag{3.4}$$

where H is the available endowment of time and ℓ is the aggregate household's labour supply. Retaining the same budget constraint as before, (2.4), a difficulty which immediately arises is that the household's income, y, is not independent of its decisions about how much labour to supply. This is shown

---

[19] See for example, Barro and Grossman (1971) and (1974), Malinvaud (1977) and Dixit (1978).

more clearly if we manipulate (2.4), noting that national income y is the sum of wage income, $w\ell$, and profits, Π:

$$pc + w(H-\ell) + m = I = wH + \Pi + \bar{m}. \tag{3.5}$$

The right-hand side of this equation gives total spending on the three "goods" consumed, output, leisure and end-of-period money balances. But the left-hand side, which gives the household's "full income," is only independent of the household's decisions about labour supply in cases where there is unemployment. In cases of excess demand for labour, the level of profits depends on *both* producer and household behaviour:

$$\Pi = \left[pf(e)-we: e = \ell(p,w,I)\right], \tag{3.6}$$

since income, I, itself depends on Π from (3.5). To take account of this in examining the properties of the model requires tedious recalculations at each stage, since household and firm behaviour are determined simultaneously. In order to avoid this additional technical complexity, it is easier to adopt the assumption that profits are redistributed to the household sector with a one-period lag. As has already been noted, this amounts to introducing a Keynesian bias: for example, a wage cut, by redistributing income from wage-earners to profit recipients, tends to lower aggregate spending and so have a deflationary impact. Provided we keep this bias in mind, however, the greater simplicity of assuming that profits are redistributed with a lag seems a useful advantage and much of the work which has allowed for variable labour supply has adopted this assumption (including Malinvaud, Dixit and Neary). The budget constraint therefore becomes:

$$pc + w(H-\ell) + m = I = wH + \bar{m}, \tag{3.7}$$

with income I independent of producer behaviour in the current period.

What differences to the model result from the introduction of variable labour supply? One difference is that the relative sizes of the different

regions are affected. Consider, for example, the zero balance of trade locus when excess demand for labour prevails: instead of equation (3.3) we must now substitute:

$$s = f\left[\ell(p,w,I)\right] - c(p,w,I). \tag{3.8}$$

This clearly depends on w, and so cannot be represented by a vertical straight line as in Figure 6. The other equilibrium loci must also be adjusted, and given the ambiguity of the responsiveness of labour supply to both w and p, the slopes of all these loci now become ambiguous. Nevertheless, the character of the model is not significantly affected by these changes and it seems unnecessary to delay with them. Another difference which variable labour supply introduces is that it now becomes necessary to distinguish more carefully between the effects of fiscal and monetary expansion. The reason for this is that monetary expansion changes the houshold's lump-sum income directly, and therefore affects its notional supply of labour, an effect which does not apply to fiscal policy changes.[20] Once again, this necessitates some additional care in examining the properties of the model but does not alter its character in any fundamental way.

D. NON-TRADED GOODS

I now return to the case where the labour supply is assumed fixed and consider instead an alternative way of extending the simple model in the direction of greater realism. This involves going beyond the one-good framework adopted so far and introducing a second good, which is not traded by the economy under consideration. The assumption of a non-traded good is a convenient way of allowing for some degree of domestic price determination

[20] A resulting complication when the budget constraint in equation (3.5) is adopted is that monetary changes in the presence of excess demand for labour have a "supply multiplier" of the kind discussed by Barro and Grossman (1974). This issue is discussed further in Section IV.C.1 below.

even in a small open economy. As such, it moves the model in the direction of greater realism and allows a much richer range of questions to be examined. However, rather like the case of variable labour supply, we shall see that, if the market for the non-traded good clears by price adjustment, then its introduction does not make the model in any way more Keynesian.[21]

1. Notional Equilibria

This model may be analysed in a number of alternative ways. To begin with, it is convenient to illustrate the different regimes in the space of the wage rate and the price of the non-traded good, denoted by q. I assume throughout that this diagram is contingent on a given price of the traded good, p, so confining attention to the case of fixed exchange rates. As before, it is convenient first to locate the notional equilibrium loci in the diagram. The notional equilibrium locus for the labour market may be written as:

$$L = e_t(p,w) + e_n(q,w), \tag{3.9}$$

where e_i represents the labour demand function for sector i (t denoting the traded good sector and n that producing the non-traded good).[22] This equation is represented in Figure 8 by the locus LL: it must be upward-sloping, since either an increase in w or a decrease in q reduces the aggregate demand for labour below the full-employment level. Moreover, it must be less steeply sloped than a ray from the origin: an equiproportionate increase in w and q leaves the non-traded sector's demand for labour unchanged but depresses that from the traded good sector, so giving rise to unemployment.

---

[21] The model of this sub-section, with a sticky wage rate and a flex-price non-traded good, has been considered under slightly different assumptions by Helpman (1977), Noman and Jones (1979), Liviatan (1979, Section 4) and Kennally (1983).

[22] It may be mentioned in passing that the assumption of a single non-traded good is far from innocuous and can be justified only on the basis of convenience.

FIGURE 8 ABOUT HERE

Next we must specify the notional equilibrium condition for the non-traded good market. To do this, we must digress to reconsider the household's decision problem. Naturally, we assume that its utility depends on its consumption of both goods, c_n and c_t, as well as on its holding of money balances at the end of the period (subject to the same qualifications made in discussing (2.3) in Section II). In addition, the analysis is greatly simplified if we assume that aggregate consumption is separable from money balances in the household's utility function. It may therefore be written as:

$$u = U\left[v\left(c_n, c_t\right), m\right]. \tag{3.10}$$

This is to be maximised subject to the current period budget constraint:

$$qc_n + pc_t + m = I = Y + \bar{m}, \tag{3.11}$$

where Y is the value of national output.[23] Finally, how is income determined? The answer depends of course on the regime in which the economy is operating. Confining attention to the notional case, the value of national income may be written as a function of the two commodity prices:

$$Y(p,q) = \max\left[qf^n\left(e_n\right) + pf^t\left(e_t\right): \ e_n + e_t = L\right], \tag{3.12}$$

where $f^i\left(e_i\right)$ is the production function for sector i.

I first make use of these underpinnings of household behaviour to locate

---

[23] This constraint may be rewritten in a form which points to the compatibility between our approach and many presentations of the monetary approach to the balance of payments. Writing total expenditure, qc_n+pc_t, as C and net acquisition of money balances, $m-\bar{m}$, as hoarding, H, equation (3.11) becomes: $C = Y - H$. Now, suppose that hoarding is proportional to the shortfall of actual from desired money balances, $H = h(m^* - \bar{m})$, and that m^* in turn is proportional to nominal national income, $m^* = bY$. These equations may now be manipulated to give: $C = \mu Y + h\bar{m}$, where μ equals $(1-bh)$. This is essentially an orthodox Keynesian consumption function augmented by a stock-adjustment mechanism which ensures that in the long run expenditure equals income.

n Figure 8 the notional equilibrium locus for the non-traded good sector, the equation for which is:

$$y_n(q,w) = c_n(q,p,I). \tag{3.13}$$

Totally differentiating yields, after some manipulation:

$$qy_{nq}\hat{w} = q\left(y_{nq} - c^c_{nq}\right)\hat{q}. \tag{3.14}$$

This is the analogue of equation (2.10) in the one-good model and it shows that the locus representing equation (3.13) must be upward-sloping in Figure 8, since either an increase in q or a decrease in w leads to excess supply of the non-traded good. Moreover, it must be more steeply sloped than a ray from the origin, since an equiproportionate increase in q and w leaves supply unchanged but discourages consumption, so leading to excess demand. With the two notional loci now located in the diagram, it is clear that the Walrasian equilibrium point is at A, and that the four regions correspond to states of incipient disequilibrium in the labour and non-traded good markets as indicated by the labels (e.g., EDN denotes excess demand for the non-traded good, etc.).[24]

2. Effective Equilibria with a Sticky Wage

How is Figure 8 affected if the wage rate is predetermined? In this section I continue to assume that the price of the non-traded good adjusts flexibly to clear that market at all times. Consequently, the equilibrium must always lie along the equilibrium locus for that market. However, the locus drawn in Figure 8 is only the notional one and must be adjusted to take account of the state of the labour market. Consider first the case where there is unemployment (i.e., at points above the LL locus). Under the assumptions made, equation (3.13) continues to apply. However, the level of

[24] It may be checked that, if w and q are assumed to adjust according to Râtonnement mechanisms, then the equilibrium at A is globally stable.

national income is no longer that determined by (3.12). Instead, it is given by:

$$\tilde{Y}(q, p, w) = qy_n(q, w) + py_t(p, w). \tag{3.15}$$

This is necessarily less than the full-employment level given by (3.12), and so the effective locus must lie to the left of the notional locus NN in the unemployment region. However, it turns out that the slope of the effective locus is ambiguous, since an increase in the wage rate has two opposing effects on the excess supply of the non-traded good: by discouraging production it tends to induce excess demand but by lowering income and therefore demand it tends to induce excess supply. These opposing effects may be seen by totally differentiating (3.13) and substituting from (3.15):[25]

$$(\phi_n - \mu_n)\hat{w} = \phi_n\left[1 - \mu_n - \varepsilon_{nq}/\epsilon_{nq}\right]\hat{q}. \tag{3.16}$$

Here, the coefficient of $\hat{q}$ on the right-hand side is necessarily positive: ϕ_n is a measure of the relative importance of the non-traded good in supply,[26] ϵ_{nq} is its price elasticity of supply and ε_{nq} is its compensated own-price elasticity of demand. However, the coefficient of $\hat{w}$ on the left-hand side reflects the two opposing influences already mentioned: ϕ_n measures the supply effect and μ_n is the marginal propensity to consume the non-traded good.[27] If the supply effect dominates, then the locus is upward-sloping just as in the notional case; but if the demand effect dominates, then it is downward-sloping as illustrated by the locus labelled NN in Figure 9.

---

[25] For simplicity, I assume that the trade balance is initially zero so that the share of the non-traded good in aggregate consumption equals its share in GNP. This equation has been independently derived by a number of authors, including Helpman (1977), Liviatan (1979), Noman and Jones (1979) and Bruno (1982).

[26] It equals $\theta_n\varepsilon_{nq}/\varepsilon$, where ε equals $\theta_n\varepsilon_{nq} + \theta_t\varepsilon_{tp}$, and θ_i is the share of good i in national income.

[27] Note that μ_n, which equals qc_{nI}, is the marginal propensity to consume out of total income, and not out of expenditure.

FIGURE 9 ABOUT HERE

The case where there is excess demand for labour also presents some new technical difficulties, since with two sectors competing for the fixed supply of labour in a situation of labour shortage, it is necessary to make some assumption about how the labour force is allocated between them. In principle, this issue also arises in the one-sector context, since some assumption must be made there about how the labour supply is allocated among competing *firms* when there is excess demand for labour. In practice it is usually assumed that the allocation is done in an efficient manner, and so it is natural to apply the same principle in the present context.[28] This means that the maximisation process implied by equation (3.12) applies, which means in practice that production and employment decisions are now independent of the wage rate (provided it remains at a level which implies over-full employment, of course). Thus (3.13) must be replaced by:

$$y_n(p,q) = c_n[p,q,Y(p,q) + \bar{m}]. \tag{3.17}$$

This is represented by the vertical straight line labelled NN' in Figure 9.

While the derivation of the effective equilibrium loci is clearly more complicated as a result of the failure of the labour market to clear by wage adjustment, the properties of the model are not very different from those in the sticky-wage case with no non-traded good. For example, since the economy must always lie along the NN or NN' loci in Figure 9, a wage cut will always induce a tightening of the labour market. It may also be checked that increases in government purchases of traded goods lead, as before, to an

---

[28] The assumption that labour is allocated efficiently between firms in situations of excess labour demand is made by Malinvaud (1977, p.50). However, Moene (1987) has shown that the model's predictions are sensitive to this assumption. Neary (1980) explores the consequences of assuming instead that one or other of the two sectors is given priority in the allocation of the labour force.

exactly equal deterioration of the trade balance, without affecting the level of economic activity.

A new feature of this model is that fiscal policy may take the form of government purchases of the non-traded good, and these will have real effects on the domestic level of activity. Moreover, we find in this model, for the first time, that fiscal policy has a multiplier effect, though one that is dampened by the induced increase in the price of the non-traded good. Adding a term g_n to (3.13) to represent government purchases of the non-traded good, the output effect of fiscal expansion may be shown to be:

$$dy_n/dg_n = \left[1 - \mu_n - \varepsilon_{nq}/\epsilon_{nq}\right]^{-1} \tag{3.18}$$

It should be stressed that the mechanism by which fiscal policy affects output in this model is very Classical: expansionary policy only succeeds because it raises the price of the non-traded good which acts in effect to reduce real wages facing employers in that sector.

IV. KEYNESIAN PHENOMENA IN THE OPEN ECONOMY

In the last section, we saw that appending a sticky wage to a simple Classical model led to some plausible and interesting results. However, it did not lead to Keynesian phenomena such as policy multipliers or perverse effects of wage cuts. Moreover, adding either variable labour supply or a flex-price non-traded good to the model, while greatly complicating it, did not seriously alter the nature of the equilibria observed. The only case where a Keynesian multiplier effect was found (as shown in equation (3.18)) relied on an extremely Classical mechanism. In the present section we will see a number of alternative ways in which Keynesian phenomena can be introduced, without abandoning the assumption that the economy is relatively small in world markets. As we shall see, in all cases what is required is some failure of the goods market to clear fully by price adjustment (whether because of a sticky price of a non-traded good, an export sales constraint or a sticky price of a differentiated exportable). One of the main themes of this survey is that it is the *interaction* of such failures with the rigid wage in the labour market which gives rise to Keynesian phenomena.

A. EXPORT SALES CONSTRAINTS

The simplest way to introduce non-price rationing in the goods market is to append to the one-good model of earlier sections an exogenously given constraint on the level of net exports. When combined with the assumption that the goods price is set exogenously, this leads to an open-economy model whose properties are essentially identical to those of the one-good closed economy model of Barro and Grossman (1971), Benassy (1977) and Malinvaud (1977). In this sub-section, I present a new diagrammatic derivation of this model, which serves to relate its properties to those of the more familiar aggregate supply and demand macro model of undergraduate textbooks.

The first point to note is that the presence of an exogenous sales

constraint implies a fundamental difference in the nature of unemployment. This is most easily illustrated in Figure 10.[29] Here, the upper panel represents the labour market, with e(p,w) the aggregate labour demand schedule and L the fixed labour supply. The lower panel illustrates simply the direct relationship between labour input and goods output implied by the short-run aggregate production function: $y = f(e)$. Note that the vertical axis in the upper panel measures the *nominal* wage, so the labour demand curve is drawn for a given price level, p_0. Unemployment of the kind considered in the last section implies a chain of causation (illustrated by the arrows emanating in a *clockwise* direction from the wage w_0) running from the nominal wage to the levels of labour demand and output: $y_0 = y(p_0,w_0) = f[e(p_0,w_0)]$. This is clearly cost-constrained or (in the terminology of Malinvaud) *Classical* unemployment: it can only be reduced by supply-side measures which lower wages or raise prices,[30] and it is essentially caused by "too high" a real wage.

FIGURE 10 ABOUT HERE

By contrast, suppose that firms face a binding sales constraint denoted by $\bar{y}$ in the lower quadrant. Facing the real wage w_0/p_0, firms would find it profitable to produce y_0; but this desired or "notional" supply exceeds the constraint $\bar{y}$ and so firms are "rationed" in the goods market. The resulting equilibrium is determined by a very different chain of causation, as the arrows emanating from $\bar{y}$ in a *counter-clockwise* direction indicate. Employment is now determined directly through the production function: in the terminology of Clower (1965), firms are forced to "recalculate" their

---

[29] This diagram was introduced in Neary (1981).

[30] Of course, as in Section III.D.2, a demand expansion which raised p would raise employment; but even in this case, as I have already argued, the mechanism at work is a supply-side or Classical one.

decisions and employment is given not by the notional labour demand function $e(p,w)$ but by the *effective* demand schedule, the inverse of the production function: $\tilde{e}(\bar{y}) = f^{-1}(\bar{y})$. The actual wage-employment combination is represented by the point B which, from a Classical perspective, appears to float in space, apparently divorced from cost considerations.[31] Small changes in the real wage will now have no supply-side effect on employment; indeed, a cut in the nominal wage could even *lower* unemployment. This would occur if wage-earners had a higher marginal propensity to spend than profit recipients, since then a wage cut serves to redistribute income from "big" to "small" spenders and so to tighten still further the sales constraint $\bar{y}$.[32] Clearly, an exogenous demand expansion will raise employment and output so the adjective "Keynesian" is appropriate for this type of unemployment. However, it should be noticed that the distinction between Keynesian and Classical unemployment only applies to *small* changes in demand or real wages: at least in the case illustrated in Figure 10, an increase in demand could raise employment as far as OH but the remaining unemployment is Classical and can only be eliminated by supply-side measures.[33]

---

[31] In this context, we may recall Patinkin's remark: "our first task in studying involuntary unemployment is to free ourselves of the mental habit - long ingrained by the methods of static analysis - of seeing only the points *on* the [labour] demand or supply curve." (Patinkin, 1965, p. 323; emphasis in original.) Of course, point B lies on the *effective* labour demand curve, which is simply the vertical line EBF.

[32] As noted in Section III.C, this assumption is implicitly made by those writers who assume that profits are redistributed to households with a one-period lag. It thus explains, for example, the result of Malinvaud (1977) that a wage cut lowers unemployment.

[33] Put differently, using the terminology of rationing theory (see Neary and Roberts (1980)), unemployment is Keynesian whenever the actual wage is less than the "virtual wage". The latter, represented by $\tilde{w}$ in Figure 10, is the wage which would induce firms to produce "voluntarily" the output level $\bar{y}$; equivalently, it equals the marginal revenue product of labour at the sales-constrained level of employment. The difference between the actual and virtual wages, BF, (which I have called the "Patinkin gap" in Neary (1981)), is thus a measure of the severity of labour-market disequilibrium and (as Laroque (1982) has suggested) a likely determinant of the change in the wage rate over time. Hence, any reduction in this gap (whether caused by a rise

So far, Figure 10 has served to illustrate the different properties of the two types of unemployment. However, it does not tell us much about when either type will be observed nor about whether the same economy could exhibit both types in different circumstances. To illustrate this, we must introduce a different diagram: the "tripod" diagram of Benassy (1977) and Malinvaud (1977) which shows which type of unemployment will emerge in a given economy for different values of the wage rate and the price level. The easiest way to derive this diagram is using the two-panel device in Figure 11.[34]

FIGURE 11 ABOUT HERE OR ON THE NEXT PAGE

Consider first Figure 11a. In the left-hand panel the economy's notional aggregate demand and supply curves are drawn: "notional" in the sense that they represent the amounts demanded or supplied in the absence of quantity constraints. The aggregate demand schedule, $y^d(p,g,\bar{s})$, is defined by the solution to the goods-market clearing condition (or IS curve):

$$y = c(p,py+\bar{m}) + g + \bar{s}, \tag{4.1}$$

where c is private-sector consumption (as in previous sections) and $\bar{s}$ is the exogenously fixed constraint on net exports. (For convenience I will set this equal to zero in what follows.) The feature of Figure 11a which distinguishes it from Figures 11b and 11c is that the aggregate supply schedule, $y^s(p,w)$, is drawn on the assumption that the wage rate equals that value w* which would obtain in a Walrasian equilibrium. It follows that it

---

in the market wage or a demand-expansion-induced fall in the virtual wage) corresponds to a reduction in Keynesian unemployment but also (as long as the real wage exceeds the Walrasian level) moves the economy closer to a state of Classical unemployment.

[34] Of course, the simplicity of this derivation follows mainly from the assumption that notional labour supply is fixed. For example, this ensures that the notional and effective aggregate demand schedules coincide.

must intersect the aggregate demand schedule at the price level p^* which would also prevail in full Walrasian equilibrium. Holding w fixed at w^*, variations in p now imply different types of equilibrium. By the principle of "voluntary exchange" (implying that no agent can be forced to consume or sell more of any commodity than they wish), the "short-side rule" prevails: at each price the actual level of output equals the *minimum* of the amounts implied by the notional demand and supply schedules (provided also that that minimum does not exceed the full-employment level of output y^*, which equals f(L) or, equivalently, $y^s(p^*,w^*)$):

$$y(p,w,g,\bar{s}) = \text{Min}\ [y^d(p,g,\bar{s}),\ y^s(p,w),\ y^*]. \tag{4.2}$$

The actual level of output at each price is therefore shown in Figure 11a by the heavily scored locus: for prices higher than p^* (such as p_B), output is determined by the aggregate demand schedule and so the equilibrium is of the demand-constrained Keynesian unemployment type; whereas for prices below p^* (such as p_C), output is determined by the aggregate supply schedule and so Classical unemployment prevails. In all cases other than point A itself, the level of output is below the full employment level, y^*. The right-hand panel of Figure 11a simply translates this information into (p,w) space: point A' corresponds to point A in the left-hand panel and represents the Walrasian equilibrium pair, (p^*,w^*), while points such as C' below it correspond to Classical unemployment and points such as B' above it to Keynesian unemployment. (Note that, by construction, the *level* of unemployment at points B' and C' is the same.)

Figure 11b repeats this exercise for a case where the nominal wage rate equals some value w_1 *greater* than the Walrasian value. In the left-hand panel, the notional aggregate supply schedule now intersects the aggregate demand schedule at a point E where output is below its full-employment level. Once again the actual level of output at different prices is represented by

the heavily scored locus: the short-side rule implies that Keynesian unemployment must obtain for price levels above p_E and Classical unemployment for prices below. One additional observation allows us to deduce the implications of this for the typology of unemployment in the right-hand panel. Note that, at point F, the notional supply of output (which is not realised because it exceeds notional demand) equals the full-employment level. Hence, since notional supply depends only on the real wage, it follows that the real wage at point F, w_1/p_F, must equal the Walrasian real wage, w^*/p^*. Hence, the corresponding point in the right-hand panel, F', must lie on O'A', the same ray from the origin as point A', implying that p_E, the borderline price level between the regions of Keynesian and Classical unemployment, must lie between p^* and p_F. An important economic implication follows: the real wage may equal or even (as at points between E' and F') exceed its Walrasian level and yet the economy can exhibit Keynesian unemployment if the price level exceeds the Walrasian level so that deficient demand emerges. Finally, since the choice of w_1 was arbitrary, the same exercise may be repeated for all wages above w^*, thus tracing out the locus A'E' which separates the regions of Classical and Keynesian unemployment.[35]

Finally, Figure 11c considers the case where the wage rate w_2 is *below* the Walrasian level. The aggregate supply schedule now intersects the aggregate demand schedule at a point H which lies to the right of the full-employment ceiling y^*, so this point is unattainable. For prices above p^* or below p_G, the analysis is as before, the corresponding equilibria exhibiting Keynesian and Classical unemployment respectively. The only new feature is the range of prices between p_G and p^*, where *both* firms and households are rationed, since both notional demand and supply exceed the

---

[35] The equation for this locus, where the goods-market constraint just binds and unemployment prevails, is given implicitly by: $y^s(p,w) = y^d(p,g,s)$.

maximum productive potential of the economy. The economy is now at full employment but there is incipient upward pressure on both prices and wages since excess demand prevails in both goods and labour markets. Hence the term "Repressed Inflation" suggested by Malinvaud seems appropriate for this region. By noting once again that the real wage at G equals the Walrasian real wage (w_2/p_G), so that G' lies on O'A', we can pin down precisely the regions in the right-hand panel which correspond to each of the three types of equilibrium: for any wage such as w_2 below w*, prices above p* correspond to Keynesian unemployment, prices below the ray O'A' to Classical unemployment and intermediate prices (i.e., those on the line segment a'G') to Repressed Inflation.

FIGURE 12 ABOUT HERE

The net effect of the reasoning summarised in the three parts of Figure 11 is the full tripod diagram, Figure 12, in which the three regions are labelled C, K and R respectively, corresponding to the type of equilibrium which prevails in each. (Following standard convention and to facilitate comparison with earlier diagrams in the paper, I have reversed the axes relative to Figure 11, so that w is now on the vertical axis). Note that a real wage above the Walrasian level is necessary but not sufficient for Classical unemployment; that a price level above the Walrasian level is necessary but not sufficient for Keynesian unemployment; and that necessary and sufficient conditions for Repressed Inflation are that both the real wage and the nominal price level lie below their Walrasian levels.

B. COMPARATIVE STATICS

The next step is to consider the effects of exogenous shocks on the different equilibria. As far as the effects of changes in w and p are concerned, these correspond to movements of the equilibrium point around the

diagram without any shift in the tripod itself. Moreover, for movements within the C and K regions we can apply what we learnt from Figure 10. For example, unemployment is cost-determined in the C region, so iso-employment loci are rays from the origin there, the level of unemployment being higher the higher is the real wage. As for region K, unemployment here depends on demand and so is negatively related to p, but it is independent of w. Iso-employment loci are therefore vertical straight lines, corresponding to higher levels of unemployment the further they are from A. Finally, within the R region, the level of employment is fixed although the levels of incipient excess demand (as measured by the difference between notional demand and supply for goods and labour) are greater the lower are w and p. These results are illustrated in Figure 12, where the dashed lines represent iso-employment loci.

FIGURE 13 ABOUT HERE

The next type of shock to consider is an increase in exogenous demand. This introduces a new consideration: since the equilibrium is characterised by particular values of p and w the point representing it in (p,w) space is not affected by such a shock. Rather, the whole tripod itself is disturbed. To see how, note first that a shift in demand cannot affect the Walrasian real wage, since this corresponds to the requirement that the fixed supply of labour equals firms' notional demand. Moreover, it is clear by manipulating Figure 11 that the rise in demand must also increase the value of p^*. Hence, the whole tripod must shift outwards, as shown in Figure 13: the C and R regions expand at the expense of the K region. This confirms what we found earlier in discussing Figure 10: starting from a point such as H in Figure 13, a sufficiently large expansion of demand could move the economy from an initial state of Keynesian unemployment to one of Classical

unemployment.

FIGURE 14 ABOUT HERE

Notice that, in considering the effects of an increase in exogenous demand, all that was necessary was to determine its effects on the Walrasian equilibrium, since we already know the shape of the tripod. The same is true when we come to consider the effects of technological progress. However, this case is slightly more complex and so it is convenient to return to the two-panel setting of Figure 11. Note first that a supply-side shock such as this does not shift the aggregate demand schedule but that it raises the full employment level of output. Hence, in the left-hand panel of Figure 14, the y^* line shifts right to y_J and so the Walrasian price level must fall. It also follows, on the assumption that the technological progress raises the demand for labour at a given real wage, that the Walrasian real wage must rise;[36] hence the ray O'A' in the right-hand panel must pivot in a clockwise direction. However, the change in the Walrasian nominal wage rate (or, equivalently, the extent to which the initial aggregate supply schedule $y^S(p,w^*)$ shifts rightwards) is indeterminate, as we have already seen in Section 2: see equation (2.19). The new Walrasian equilibrium point may therefore lie at a point such as either J' or J" in the right-hand panel of Figure 14. In either case, we find that the technological progress serves to enlarge the K region at the expense of the C and R regions. Thus, if the economy were to start in Walrasian equilibrium at point A', technological progress would lead initially to Keynesian unemployment, as the downward stickiness of p fails to allow demand to keep

[36] Differentiating the full employment condition $e(p,w,k) = L$, where k is the technological parameter, and using the homogeneity restriction on the labour demand derivatives, $pe_p+we_w = 0$, yields: $pe_p(\hat{p}-\hat{w}) = -e_k dk$. Recall, however, from footnote 14 in Section II.C.3, that e_k could be negative.

pace with the economy's expanded productive potential. This argument can also be run in reverse, if we interpret "technological regress" as a reduction in profitability, caused for example by a rise in exogenous input prices.[37] Starting in initial Walrasian equilibrium at either J' or J", the apex of the tripod shifts to A', and the economy remains behind at the initial point, which now corresponds to a state of Classical unemployment. This analysis underlies the explanation suggested by Malinvaud (1977) for the effects of the 1973 oil crisis on the economies of Western Europe.

C. EXTENSIONS OF THE BASIC MODEL

In the open-economy context, it is desirable to go beyond the simple assumption that an export sales constraint is the only source of goods market constraint. In Section IV.D below, I will look at alternative ways of modelling the failure of goods markets to exhibit Walrasian price adjustment in an open economy. In this section, I consider a number of different extensions of the simple export sales constraint model. This has the advantage that the exposition throughout this section can be equally interpreted as applying to a closed economy.

1. Variable Labour Supply

We have already seen in Section III.C how the model may be amended to allow for variable labour supply. In that section, the amendment made little difference to the properties of the model, because there were no goods market constraints. Does the same hold when the economy faces a binding constraint on the level of net exports? In brief, the answer is that not much of importance is altered if unemployment prevails but that an interesting new feature is introduced in the case of excess demand for

---

[37] This requires a reinterpretation of the firm's profit and production functions.

labour.

Consider first the two different types of unemployment regime. I assume as in Section III.C that household behaviour arises from the maximisation of the utility function (3.4) subject to the budget constraint (3.7).[38] In the absence of additional constraints, this implies standard output demand and labour supply functions, which depend on both nominal prices and on exogenous income: $c(p,w,I)$ and $\ell(p,w,I)$. If households face only a labour supply constraint at a level $\bar{\ell}$, then their effective demand function becomes $\tilde{c}(\bar{\ell},p,w,I)$. In the Keynesian unemployment regime, employment and output are determined simultaneously by the labour and goods-market clearing conditions, where both firms and households are constrained:

$$\bar{\ell} = \tilde{e}(\bar{y}) \qquad \text{and} \qquad \bar{y} = \tilde{c}(\bar{\ell},p,w,I) + g + \bar{s}. \tag{4.3}$$

As a result, demand shocks will give rise to a Keynesian multiplier effect. By contrast, in the Classical unemployment regime, households are constrained by the actions of firms in both markets:

$$\bar{\ell} = e(p,w) \qquad \text{and} \qquad \bar{c} = y(p,w) - g - \bar{s}. \tag{4.4}$$

Clearly, the mechanisms at work, though not all the details, are identical to those already considered in the case of fixed notional labour supply. The only casualty is the simplicity of the diagrams. Since the notional aggregate demand schedule now depends on the nominal wage rate, the left-hand panels of Figure 11 are no longer applicable, so the properties of the tripod diagram must be derived analytically.[39]

---

[38] Recall the earlier discussion where I noted that this assumes that profits are redistributed to households with a one-period lag, an assumption which imparts a Keynesian bias to the model.

[39] For example, the boundary between the C and K regions, representing the locus of (w,p) combinations consistent with goods market clearing in the presence of excess supply of labour, is now: $y^e(p,w) = \tilde{c}[e(p,w),p,w,I] + g + \bar{s}$.

The principal difference which follows from the introduction of variable labour supply concerns the properties of the Repressed Inflation regime. Households now face a goods market constraint, $\bar{x}$, and this leads them to "recalculate" their notional labour supply decisions. The resulting effective labour supply schedule, $\hat{\ell}(\bar{x},p,w,I)$, combines with the goods-market clearing condition to determine simultaneously the levels of employment and private consumption:

$$\bar{e} = \hat{\ell}(\bar{c},p,w,I) \qquad \text{and} \qquad \bar{c} = \hat{y}(\bar{e}) - g - \bar{s}. \tag{4.5}$$

As a result, any expansionary demand-side shock (such as a rise in g) has both a direct effect of "crowding out" private consumption and indirect effects as it induces progressive reductions in labour supply. (This assumes, plausibly, that households reduce their labour supply in response to a tightening of the goods market constraint: $\hat{\ell}_c$ is positive; see Neary and Roberts (1980) for further discussion.) Barro and Grossman (1974) have labelled this phenomenon the "supply multiplier" and it is clearly symmetric to the standard Keynesian demand multiplier.[40]

One other difference which follows from the assumption that labour is supplied on a choice-theoretic basis is that monetary and fiscal policy have different effects: the former has an income effect on both goods demand and labour supply whereas the latter impinges directly only on the goods market. As a result, it is possible to recast the model in the space of the two policy instruments, $\bar{m}$ and g, and carry out an analysis of policy choice *along the lines of Meade (1951) and Mundell (1962). Such an analysis is* presented in Moore (1985).

---

[40] The symmetry between the two concepts is evident from the explicit expressions for them, derived from equations (4.3) and (4.5) respectively:

$$\frac{d\bar{y}}{dg} = (1-\tilde{c}_\ell\tilde{e}_y)^{-1} \qquad \text{and} \qquad \frac{d\bar{c}}{dg} = -(1-\hat{y}_e\hat{\ell}_c)^{-1}. \tag{4.6}$$

2. Investment by Firms

A feature of the model so far is that it predicts three possible disequilibrium regimes. This asymmetry in predictions is unusual in economic models and it is not difficult to trace its origin to an asymmetry in the model's assumptions: whereas households have been assumed to take account of the future in allocating their current income between consumption and savings, firms have hitherto had only a one-period horizon. As a result, it is possible for households to be doubly-constrained – simultaneously rationed in the goods and labour markets – but the direct link between sales and employment provided by the simple production function $y = f(e)$ rules out such a scenario for firms. However, once investment by firms is allowed, a current sales constraint may coexist with an employment constraint. This makes possible a new regime, in which households are unconstrained whereas firms are rationed on both markets, reflecting excess demand for labour and excess supply of goods. Malinvaud (1977) has suggested the term "Underconsumption" for such a regime and Muellbauer and Portes (1978) have suggested that it may be a good approximation to the normal state of the Japanese economy, which has exhibited a tight labour market and an export surplus for much of the post-war period. As Table 1 illustrates, the possibility of an Underconsumption regime restores a degree of symmetry to the model's predictions.

		Market for Goods	
		Excess Supply (firms rationed)	Excess Demand (households rationed)
Market for Labour	Excess Supply (households rationed)	K	C
	Excess Demand (firms rationed)	U	R

Table 1: Taxonomy of Disequilibrium Regimes

FIGURE 15 ABOUT HERE

Naturally, the introduction of investment by firms complicates the analysis of the model in all regimes, in addition to introducing the possibility of a fourth regime. However, the other complications are not fundamental in any way. Hence, I will not consider the specification of the investment model in detail but merely note that Figure 15 illustrates the modified tripod diagram with the Underconsumption region corresponding to real and nominal wages below the Walrasian level but to price levels above the Walrasian level. Finally, just as the K and R regimes are symmetric in that a multiplier may exist in each, so the C and U regimes are symmetric in precluding the possibility of multiplier phenomena. The reason is that one group of agents is completely unconstrained in each of these two regimes: firms in regime C and households in regime U. Hence the essential feature of a multiplier chain – the *simultaneous* relaxation of constraints on more than one set of agents – cannot occur.

3. Expectations

In the last sub-section, I showed that the model can easily be extended to take account of intertemporal decision-making by firms as well as by households. However, a notable omission from the discussion so far is the issue of agents' expectations of future periods. Since the role of expectations, and especially rational expectations, has been a major concern in recent macroeconomic research, it is desirable to examine what can be said about them in the framework of the simple neo-Keynesian models we have been considering.

Since this is a huge topic, I will concentrate on only one aspect, namely, the implications of different assumptions about expectations formation for the efficacy of fiscal policy when Keynesian unemployment bot prevails today *and* is expected to prevail in the future. Returning to the basic model of Section IV.A, in which notional labour supply is fixed and no investment is carried out, suppose that the horizon of the model is extended to two periods, labelled 1 and 2. In Keynesian unemployment, output in period 1 is determined by the equation:

$$\bar{y}_1 = c_1(p_1, p_2, Y) + g_1 + \bar{s}_1, \tag{4.7}$$

where p_1 is the current price and p_2 the expected second-period price. (Both prices are exogenous since Keynesian unemployment prevails in the current period and is expected to prevail in period 2.) Income Y in turn, equals any initial money endowment plus the value of output in the two periods:

$$Y = \bar{m} + p_1\bar{y}_1 + p_2\bar{y}_2. \tag{4.8}$$

If agents have static expectations of future output, so that y_2 is assumed fixed, then differentiation yields the standard Keynesian multiplier:

$$\frac{dy_1}{dg_1} = (1-\mu_1)^{-1}, \tag{4.9}$$

where μ_1 is the marginal propensity to consume current output. Suppose

instead that agents rationally anticipate that period 2 will also be characterised by Keynesian unemployment. Output in that period will therefore be determined by a similar equation:

$$\bar{y}_2 = c_2(p_1, p_2, Y) + \bar{s}_2, \tag{4.10}$$

and rational agents, anticipating this, effectively solve the two equations (4.7) and (4.10) simultaneously. Differentiating and solving yields after some manipulations:

$$\left.\frac{dy_1}{dg_1}\right|_{RCE} = [1-\mu_1-\mu_1\mu_2(1-\mu_2)^{-1}]^{-1}, \tag{4.11}$$

where "RCE" denotes "rational constraint expectations". This is unambiguously greater than the multiplier with static expectations (4.9) (provided the marginal propensities to consume current and future output, μ_1 and μ_2, are both positive and less than unity). The reason is simply that rational agents who have full information concerning the working of the economy anticipate the effect of a relaxation of the *current* output constraint in raising lifetime income and so relaxing the *future* output constraint. Hence rational expectations of future constraints *raise* the Keynesian multiplier.

FIGURE 16 ABOUT HERE

This result is illustrated in Figure 16, where the axes are the current and future levels of output. The curve labelled y_1 depicts equation (4.7); it is upward-sloping, reflecting an aspect of what Neary and Stiglitz (1983) called the "bootstraps effect": a tightening of the expected future constraint serves to reduce current output. A rise in g_1 now shifts this locus rightwards to y_1' as shown, and so with static expectations of future output equal to y_2^0 the multiplier (4.9) leads to a rise in current output of AB. However, if agents anticipate the actual dependence of future on

current output, then equation (4.10) depicted by the curve labelled y_2 is relevant. This is also upward-sloping but less steeply so than the y_1 curve. With rational constraint expectations, the equilibrium therefore moves from A to C, the additional horizontal move from B to C reflecting the excess of the RCE multiplier (4.11) over (4.9). This conclusion holds in more general models too. For example, if investment is carried out by firms, then it will be positively related to the level of expected future sales. As was first noted by Grossman (1972), expected goods market constraints thus rationalise the traditional Keynesian investment accelerator and, as shown by Neary and Stiglitz (1983), this serves to raise further the Keynesian demand multiplier if constraint expectations are rational.

D. STICKY NON-TRADED GOODS PRICES

Until this point, I have considered the properties of a one-good open economy which faces an exogenous constraint on the level of its net exports. This is a useful first step in the examination of Keynesian phenomena in an open economy and, of course, it has the great convenience that the model is identical to that of a closed economy. However, it is rather implausible to assume that an economy faces a single constraint on the level of its net exports. Most authors therefore have preferred to disaggregate domestic production when considering Keynesian phenomena in open economies. Two distinct routes have been followed. One approach has been to disaggregate the traded sector, distinguishing between import-competing and exporting sectors. Goods-market disequilibrium can then be modelled by assuming that the economy faces a sales constraint in its export market whereas imports can be freely imported at a fixed world price.[41] The other approach has been to retain the assumption of a single composite traded good market in which

[41] Examples of this approach include Bruno (1982), Cuddington (1980, 1981) and Sampson (1984).

trading is unconstrained but to append to it a domestic sector producing a non-traded good. If the price in this market is assumed to adjust sluggishly in the short run, then once again Keynesian phenomena can emerge.[42]

In fact, although the interpretation of the two models (the exportable-importable model and the traded-non-traded model) are rather different, their short-run properties are essentially identical. Their key feature is that goods market rationing can emerge in one sector (either the exportable or the non-traded sector depending on the model) but not in the other (either the importable or the traded good sector). The models thus behave as a hybrid of the Classical sticky-wage model of Section III and the Keynesian model of Section IV.A. Rather than presenting their properties in exhaustive detail, I will concentrate here on the traded-non-traded model and merely note how its properties differ from those of the one-good neo-Keynesian model. A further convenience of exploring this route is that most of the work has already been done in Section III.D, where a model with a traded good and a *flex-price* non-traded good sector was examined in detail. The shift from notional to effective equilibrium loci for the non-traded good market as a result of a sticky wage is exactly as discussed in that section and the resulting NN and NN' loci from Figure 9 are reproduced in Figure 17. The major difference, however, is that now all points in (w,q) space are potential equilibria. Thus, for example, the location of the labour market equilibrium locus must be reconsidered. Under excess demand for the non-traded good, households are on the short side of the goods market and so are rationed. However, the assumption that labour is supplied inelastically means that this does not influence their behaviour in the labour market. Hence, the notional locus is unaffected in this region, as shown by the

---

[42] Neary (1980) illustrates this approach. See also Steigum (1980) who considers a model with three goods – an exportable, an importable and a non-traded good – and allows for both kinds of goods-market constraints.

segment labelled LL in Figure 17 (identical to the corresponding segment in Figure 9). However, under excess supply of the non-traded good, the locus is affected. Producers are now constrained to sell less than they wish to produce given the real wage they face. Hence they scale down their demand for labour accordingly, and the effective labour market equilibrium locus becomes:

FIGURE 17 ABOUT HERE

$$L = e_t(p,w) + \tilde{e}_n\left[c_n(p,q,I)\right]. \tag{4.12}$$

where $\tilde{e}_n(\bar{y}_n)$, equal to the inverse of the production function $f^n(e_n)$, is the effective labour demand function for the non-traded sector when it faces a sales constraint of $\bar{y}_n$. A key property of this locus is that, because employment in the non-traded good sector is now *demand*-determined, it depends *negatively* rather than positively on the price of the non-traded good, q. The locus is therefore downward rather than upward sloping as indicated by the line labelled LL' in Figure 17. (Compare this with the LL locus in Figure 9.)

The outcome of the interaction between the disequilibrium in the two markets, therefore, is that (w,q) space is partitioned into the same four regions, each with its own distinctive comparative statics properties, as were found in the one-good model with an export sales constraint.[43] The behaviour exhibited in each of these regimes is similar to that which was found in Section IV.B and the details may be left to the reader. One new feature which deserves comment is that the presence of the traded good sector

[43] An Underconsumption regime arises in this case not (as in Section IV.C.2) because firms carry out investment and can therefore face constraints in both goods and labour markets but because there are two types of firms. Regime U emerges when traded sector firms are constrained in the labour market and non-traded sector firms are constrained in the goods market.

UNIVERSITY COLLEGE DUBLIN LIBRARY

which never faces a goods market constraint imparts an element of Classical behaviour to the model even in the Keynesian regime. This may be illustrated in Figure 18, which extends Figure 10 to a two-sector framework.

FIGURE 18 ABOUT HERE

The upper panel illustrates the labour market, with the horizontal axis measuring the given labour supply and the notional demand for labour by each sector plotted as a decreasing function of the wage rate, for given values of the two output prices. Since the non-traded sector faces a binding sales constraint equal to $\bar{y}_n$ in the lower panel, its effective demand for labour equals AB, whereas in the face of the wage rate w_C its notional demand equals AC. This means that the unemployment of BC may properly be described as Keynesian, in the sense that an exogenous relaxation of the sales constraint would eliminate it. At the same time, unlike the one-good model of Section IV.A, cost measures alone will also work, to the extent that they improve the profitability of the traded good sector. The unemployment of CD is thus Classical unemployment since it is cost-determined and impervious to demand-side policies. Thus, in interpreting the results, we should be careful not to place too much emphasis on the label "Keynesian": although the equilibrium illustrated in Figure 18 lies in the K region of Figure 17, the unemployment which prevails there is in fact a mixture of both Classical and Keynesian types.

V. CONCLUSION

In this paper, I have attempted to provide a self-contained introduction to the literature on neo-Keynesian macroeconomics in open economies. Where possible, I have used diagrammatic rather than algebraic tools throughout, in the process developing new geometric expositions of the distinction between Classical and Keynesian unemployment (Section IV.A), the derivation of the

Benassy-Malinvaud "tripod" diagram (Section IV.A) and the effects of rational constraint expectations on the value of the Keynesian multiplier (Section IV.C.3). In addition, I have deliberately tried to use the simplest possible model in which each issue may be considered and have also tried to explain throughout which assumptions are crucial for particular results. This explains, for example, my unusually long discussion of the Walrasian or Classical model in Section II, which hopefully throws into relief the essential differences which follow from the assumption in Sections III and IV that wages or prices do not move instantly to clear markets.

Aside from the properties of individual models, a number of general conclusions seem justified:

(a) *Two constraints are needed to generate Keynesian phenomena*: While the sticky wage model of Section III could generate unemployment, it was always of the "Classical" variety, in the sense that firms were on their "notional" labour demand schedules and so supply-side measures such as a wage cut were needed to reduce unemployment. By contrast, Keynesian multipliers and ineffective wage cuts became possible when any of the forms of goods-market disequilibrium considered in Section IV were added to the sticky wage. Note that this point can be seen as an application of the standard theory of the "second best": if only one nominal variable differs from its Walrasian value, a movement towards that value will always bring the economy closer to the Walrasian equilibrium; whereas if two variables differ from their Walrasian values, a movement of one of them in the "right" direction may have perverse results.

(b) *Two sets of agents must be constrained for Keynesian phenomena to emerge*: While two constraints are necessary, they are not sufficient. As I argued in Section IV (especially in Section IV.C.2), the key requirement for a "multiplier" (whether the conventional demand multiplier or the

Barro-Grossman supply multiplier) is the simultaneous relaxation of constraints on two sets of agents. Hence, regimes (such as Classical unemployment or Underconsumption) in which one group of agents face two constraints but the other group faces none do not exhibit Keynesian properties.

(c) *The more open is the economy, the less "Keynesian" are its properties*: Here, "openness" refers to the number of markets on which goods can be traded without being subject to quantity constraints. As the model of Section IV.A showed, even if all goods are traded, the fact that they are subject to binding quantity constraints makes the behaviour of the economy identical to that of a closed economy. Conversely, if some goods are freely traded, then although Keynesian features may still emerge because of price rigidities and/or sales constraints in other goods markets, the economy nevertheless exhibits some Classical features. (See, for example, the two-sector model in Section IV.D).

Of course, this paper has not exhausted the applications of the neo-Keynesian approach to open-economy issues. Models similar to those of Section IV have been applied to a variety of policy questions, such as the desirability of adjustment assistance to declining industries (Bruno, 1982), the external trade problems of centrally planned economies (Portes, 1979), the "Dutch Disease" phenomenon whereby natural resource booms may pose problems for the rest of the economy (van Wijnbergen, 1984 and Neary and van Wijnbergen, 1986), the consequences of export price instability (Zee, 1984) and the effects of foreign aid in developing economies (Gunning, 1983, Standaert, 1985 and van Wijnbergen, 1986). In addition, the scope of the model has been extended in a variety of directions. Thus two-country neo-Keynesian models have been explored by Dixit and Norman (1980, Chapter 8), Lorie and Sheen (1982), Owen (1985) and Hool and Richardson (1983).

Two-period models, extending that of Neary and Stiglitz (1983) which was considered in Section IV.C.3, have been developed by Persson and Svensson (1983), Moore and Neary (1985), van Wijnbergen (1985) and Cuddington and Vinals (1986a, 1986b), and a multi-period model has been constructed by Blanchard and Sachs (1982). Finally, normative issues in open economy neo-Keynesian models have been examined by Benassy (1984), Cuddington, Johansson and Lofgren (1984, Chapter 8), Fourgeaud, Lenclud and Picard (1986), Marchand, Mintz and Pestieau (1984, 1985) and Stournaras (1984).

In all these developments, the insights of neo-Keynesian macroeconomics have proved fruitful in elucidating the consequences of less-than-instantaneous wage and price adjustment and in deepening our understanding of Keynesian phenomena such as the multiplier. Despite these achievements, the approach has increasingly come into disfavour, the main target for criticism being its failure to provide a *theory* of wage and price determination.[44] This is especially true of North America, where the approach has never been popular and where it has been virtually abandoned, even by those interested in Keynesian phenomena, in favour of a variety of alternative approaches based on imperfect competition, informational externalities or efficiency wages.[45] But the very diversity of these approaches (not to mention the variants of New Classical Macroeconomics, which essentially assume Walrasian price determination) testifies to the lack of consensus on an agreed theory of price determination among contemporary macroeconomists. Pending the emergence of such a consensus, it is surely worthwhile to have as complete as possible an understanding of the *consequences* of wage and price stickiness.

---

[44] I have argued in Neary (1982) that assuming exogenously determined prices and wages is at least as intellectually respectable as assuming that wages and prices are costlessly and instantaneously adjusted to their Walrasian levels by an anonymous auctioneer.

[45] See Howitt (1986) and Greenwald and Stiglitz (1987) for further references.

While the neo-Keynesian approach which I have surveyed in this paper cannot claim to provide a complete theory of macroeconomic phenomena, the insights it provides are likely to prove an important building block of such a theory.

REFERENCES

Barro, R.J. and H.I. Grossman (1971): "A General Disequilibrium Model of Income and Employment," *American Economic Review*, vol. 61, 82-93.

Barro, R.J. and H.I. Grossman (1974): "Suppressed Inflation and the Supply Multiplier," *Review of Economic Studies*, vol. 41, 87-104.

Benassy, J.P. (1975): "Neo-Keynesian Disequilibrium in a Monetary Economy," *Review of Economic Studies*, vol. 42, 503-523.

Benassy, J.P. (1977): "A Neo-Keynesian Model of Price and Quantity Determination in Disequilibrium," in G. Schwödiauer (ed.): *Equilibrium and Disequilibrium in Economic Theory*, Boston: Reidel.

Benassy, J.P. (1984): "Tariffs and Pareto Optimality in International Trade," *European Economic Review*, vol. 26, 261-276.

Benassy, J.P. (1986): *Macroeconomics: An Introduction to the Non-Walrasian Approach*, Orlando, Florida: Academic Press.

Blanchard, O. and J. Sachs (1982): "Anticipations, Recessions, and Policy; an Intertemporal Disequilibrium Model," *Annales de l'INSEE*, vol. 47-48, 117-144.

Bruno, M. (1982): "Import Competition and Macroeconomic Adjustment under Wage-Price Rigidity," in J.N. Bhagwati (ed.), *Import Competition and Response*, Chicago: Chicago University Press, 11-32.

Clower, R.W. (1965): "The Keynesian Counterrevolution: A Theoretical Appraisal," in F.H. Hahn and F.P.R. Brechling (eds.), *The Theory of Interest Rates*, London: Macmillan; reprinted in R.W. Clower (ed.): *Monetary Theory*, London: Penguin, 1969.

Clower, R.W. (1967): "A Reconsideration of the Microfoundations of Monetary Theory," *Western Economic Journal*, vol. 6, 1-9.

Cripps, F., and W. Godley (1976): "A Formal Analysis of the Cambridge Economic Policy Group Model," *Economica*, vol. 43, 335-348.

Cuddington, J.T. (1980): "Fiscal and Exchange Rate Policies in a Fix-Price Trade Model with Export Rationing," *Journal of International Economics*, vol. 10, 319-340.

Cuddington, J.T. (1981): "Import Substitution Policies: A Two-Sector, Fix-Price Model," *Review of Economic Studies*, vol. 48, 327-342.

Cuddington, J.T., P.O. Johansson and K.G. Löfgren (1984): *Disequilibrium Macroeconomics in Open Economies*, Oxford: Basil Blackwell.

Cuddington, J.T. and J.M. Vinals (1986a): "Budget Deficits and the Current Account in the Presence of Classical Unemployment," *Economic Journal*, vol. 96, 101-119.

Cuddington, J.T. and J.M. Vinals (1986b): "Budget Deficits and the Current Account: An Intertemporal Disequilibrium Approach," *Journal of International Economics*, vol. 21, 1-24.

Dixit, A.K. (1978): "The Balance of Trade in a Model of Temporary Equilibrium with Rationing," *Review of Economic Studies*, vol. 45, 393-404.

Dixit, A.K. and V. Norman (1980): *The Theory of International Trade: A Dual General Equilibrium Approach*, London; Cambridge University Press.

Dornbusch, R. (1973): "Devaluation, Money and Nontraded Goods," *American Economic Review*, vol. 63, 871-883.

Fourgeaud, C., B. Lenclud and P. Picard (1986): "Shadow Prices and Public Policies in a Disequilibrium Model of an Open Economy," *European Economic Review*, vol. 30, 991-1012.

Frenkel, J.A. and H.G. Johnson (eds.) (1976): *The Monetary Approach to the Balance of Payments*, London: George Allen and Unwin.

Greenwald, B. and J.E. Stiglitz (1987): "Keynesian, New Keynesian and New Classical Economics," *Oxford Economic Papers*, vol. 39, 119-133.

Grossman, H.I. (1972): "A Choice-Theoretic Model of an Income-Investment Accelerator," *American Economic Review*, vol. 62, 630-641.

Gunning, J.W. (1983): "Rationing in an Open Economy: Fix-Price Equilibrium and Two-Gap Models," *European Economic Review*, vol. 23, 71-98.

Hanoch, G. and M. Fraenkel (1979): "Income and Substitution Effects in the Two-Sector Open Economy," *American Economic Review*, vol. 69, 455-458.

Helpman, E. (1977): "Nontraded Goods and Macroeconomic Policy under a Fixed Exchange Rate," *Quarterly Journal of Economics*, vol. 92, 469-480.

Helpman, E. and A. Razin (1979): "Towards a Consistent Comparison of Alternative Exchange Rate Regimes," *Canadian Journal of Economics*, vol. 12, 394-409.

Hénin, P.-Y. and W. Marois (1985): "Sur les Désequilibres d'une Economie Ouverte: Une Révue des Recherches Recentes," in P.-Y. Hénin *et al.* (eds.) (q.v.), 11-64.

Hénin, P.-Y., W. Marois and P. Michel (eds.) (1985): *Désequilibres en Economie Ouverte*, Paris: Economica.

Hirschman, A.O. (1949): "Devaluation and the Trade balance - A Note," *Review of Economics and Statistics*, vol. 31, 50-53.

Hool, B. and J.D. Richardson (1983): "International Trade, Indebtedness and Welfare Repercussions among Supply-Constrained Economies under Floating Exchange Rates," in J.S. Bhandari and B.H. Putnam (eds.): *Economic Interdependence and Flexible Exchange Rates*, Cambridge, Mass.: M.I.T. Press, 402-424.

Howitt, P. (1986): "The Keynesian Recovery," *Canadian Journal of Economics*, vol. 19, 626-641.

Itoh, M. and T. Negishi (1987): *Disequilibrium Trade Theories*, Fundamentals of Pure and Applied Economics, Volume 23, Chur, Switzerland: Harwood Academic Publishers.

Kennally, G.F. (1983): "Some Consequences of Opening a Neo-Keynesian Model," *Economic Journal*, vol. 93, 390-410.

Laroque, G. (1981): "A Comment on 'Stable Spillovers among Substitutes'," *Review of Economic Studies*, vol. 48, 355-361.

Leijonhufvud, A. (1968): *On Keynesian Economics and the Economics of Keynes*, London: Oxford University Press.

Liviatan, N. (1979): "A Disequilibrium Analysis of the Monetary Trade Model," *Journal of International Economics*, vol. 9, 355-377.

Lorie, H.R. and J.R. Sheen (1982): "Supply Shocks in a Two Country World with Wage and Price Rigidities," *Economic Journal*, vol. 92, 849-867.

Malinvaud, E. (1977): *The Theory of Unemployment Reconsidered*, Oxford: Basil Blackwell.

Marchand, M., J. Mintz and P. Pestieau (1984): "Shadow Pricing of Labour and Capital in an Economy with Unemployed Labour," *European Economic Review*, vol. 25, 239-252.

Marchand, M., J. Mintz and P. Pestieau (1985): "Public Production and Shadow Pricing in a Model of Disequilibrium in Labor and Capital Markets," *Journal of Economic Theory*, vol. 36, 237-256.

Meade, J.E. (1951): *The Balance of Payments*, London: Oxford University Press.

Moene, K.O. (1987): "Keynesian Unemployment and Overmanning," *Economic Journal*, vol. 97, 740-745.

Moore, M.J. (1985): "Demand Management with Rationing," *Economic Journal*, vol. 95, 73-86.

Moore, M.J. and J.P. Neary (1985): "Désequilibre Intertemporel dans une Economie Ouverte," in P.-Y. Hénin *et al.* (eds) (q.v.), 137-167.

Muellbauer, J. and R. Portes (1978): "Macroeconomic Models with Quantity Rationing," *Economic Journal*, vol. 88, 393-404.

Mundell, R.A. (1962): "The Appropriate Use of Monetary and Fiscal Policy for Internal and External Balance," *IMF Staff Papers*, 9, 70-77.

Neary, J.P. (1980): "Non-Traded Goods and the Balance of Trade in a Neo-Keynesian Temporary Equilibrium," *Quarterly Journal of Economics*, vol. 95, 403-429.

Neary, J.P. (1981): "On the Short-Run Effects of Technological Progress," *Oxford Economic Papers*, vol. 33, 224-233.

Neary, J.P. (1982): "Comment," on Bruno (1982) (q.v.), in J.N. Bhagwati (ed.): *Import Competition and Response*, Chicago: Chicago University Press, 32-37.

Neary, J.P. and K.W.S. Roberts (1980): "The Theory of Household Behaviour under Rationing," *European Economic Review*, vol. 13, 25-42.

Neary, J.P. and J.E. Stiglitz (1983): "Towards a Reconstruction of Keynesian Economics: Expectations and Constrained Equilibria," *Quarterly Journal of Economics*, vol. 98 (Supplement), 199-228.

Neary, J.P. and S. van Wijnbergen (1986): "Natural Resources and the Macroeconomy: A Theoretical Framework," in J.P. Neary and S. van Wijnbergen (eds.): *Natural Resources and the Macroeconomy*, Oxford: Basil Blackwell and Cambridge, Mass.: M.I.T. Press, 13-45.

Noman, K. and R.W. Jones (1979): "A Model of Trade and Unemployment," in J.R. Green and J.A. Schienkman, (eds.): *General Equilibrium, Growth and Trade: Essays in Honor of Lionel McKenzie*, New York: Academic Press, 297-322.

Owen, R.F. (1985): "A Two-Country Disequilibrium Model," *Journal of International Economics*, vol. 18, 339-355.

Patinkin, D. (1965): *Money, Interest and Prices*, Second Edition, New York: Harper and Row.

Persson, T. and L.E.O. Svensson (1983): "Is Optimism Good in a Keynsian Economy?" *Economica*, vol. 50, 291-300.

Portes, R. (1979): "Internal and External Balance in a Centrally Planned Economy," *Journal of Comparative Economics*, vol. 3, 325-345.

Sampson, A.A. (1984): "Real Balances, Relative Prices and the Marshall-Lerner Conditions in an Open Economy Model of Temporary Equilibrium with Rationing," *Bulletin of Economic Research*, vol. 36, 33-49.

Standaert, S. (1985): "The Foreign Exchange Constraint, Suppression of the Trade Deficit and the Shadow Price of Foreign Exchange in a Fix-Price Economy," *Journal of Development Economics*, vol. 18, 37-50.

Steigum, E., Jr. (1980): "Keynesian and Classical Unemployment in an Open Economy," *Scandinavian Journal of Economics*, vol. 82, 147-166.

Stournaras, Y.A. (1984): "Optimal Taxes and Subsidies in Fix-price, Open Economies," *Oxford Economic Papers*, vol. 36, 459-477.

Swan, T.W. (1963): "Longer-Run Problems of the Balance of Payments," in H.W. Arndt and W.M. Corden (eds.): *The Australian Economy: A Volume of Readings*, Melbourne: Cheshire Press; reprinted in R.E. Caves and H.G. Johnson (eds.): *Readings in International Economics*, London: George Allen and Unwin, 1968.

van Wijnbergen, S. (1984): "Inflation, Employment and the Dutch Disease in Oil Exporting Countries: A Short-Run Disequilibrium Analysis," *Quarterly Journal of Economics*, vol. 99, 233-250.

van Wijnbergen, S. (1985): "Price Shocks, Unemployment, Investment and the Current Account: An Intertemporal Disequilibrium Analysis," *Review of Economic Studies*, vol. 52, 627-645.

van Wijnbergen, S. (1986): "Macroeconomic Aspects of the Effectiveness of Foreign Aid: On the Two-Gap Model, Home Goods Disequilibrium and Real Exchange Rate Misalignment," *Journal of International Economics*, vol. 21, 123-136.

Zee, H.H. (1984): "A General Equilibrium Model of Export Earnings Instability in Developing Countries," mimeo.