Oxford Economic Papers 46 (1994), 171–199

IMPERFECT COMPETITION AND MACROECONOMICS: A SURVEY

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1. Introduction

THE IMPORTANCE of imperfect competition has long been recognised in many areas of economics, perhaps most obviously in industrial economics and in the labour economics of trade unions. Despite the clear divergence of output and labour markets from the competitive paradigm in most countries, macroeconomics where it has used microfoundations has tended to stick to the Walrasian market-clearing approach. However, over the last decade a shift has begun away from a concentration on the Walrasian price-taker towards a world where firms, unions and governments may be strategic agents. This paper takes stock of this burgeoning literature, focusing on the macroeconomic policy and welfare implications of imperfect competition, and contrasting them with those of Walrasian models.

We seek to answer three fundamental questions. First, what is the nature of macroeconomic equilibrium with imperfect competition in output and labour markets? With monopoly power in the output market causing price to exceed marginal cost, and union power leading to the real wage exceeding the disutility of labour, we would expect imperfectly competitive macroeconomies to have lower levels of output and employment than Walrasian economies, a Pareto-inefficient allocation of resources, and the possibility of involuntary unemployment. Few would disagree that deviations from perfect competition will probably have undesirable consequences. Second, to what extent can macroeconomic policy be used to raise output and employment in an imperfectly competitive macroeconomy? Third, if policy can raise output and employment, what will be the effect on the welfare of agents?

Whilst there may be fairly general agreement over the answer to question one, we believe that there are no truly general answers to questions two and three. In Walrasian models there is only one basic equilibrium concept employed: prices adjust to equate demand and supply in each market. There are, however, many different types of imperfect competition, which can differ in fundamental respects, as has been seen in industrial organisation and the 'new' international trade theory. Thus we would expect the theory of imperfectly competitive macroeconomies to embrace 'classical' models, with monetary neutrality and a vertical aggregate supply curve, as well as 'Keynesian' models. Imperfect competition, however, not only opens new channels of influence for monetary and fiscal policy, but also opens the possibility that an increase in output may be welfare-improving. The First Fundamental Theorem of welfare economics tells us that the Walrasian equilibrium is Pareto-optimal. But with imperfect competition, the market prices of goods and labour generally exceed their shadow prices, so policies that succeed in expanding output are very likely to increase welfare. The survey considers several cases of such policy effects, which are in stark contrast to those in Walrasian economies.

In Section 2 we present a general framework which nests much of the theoretical literature on imperfectly competitive macroeconomies, and enables us to explore the effects of imperfect competition on output and labour markets. In Sections 3 and 4 we explore monetary and fiscal policy respectively, concentrating on the mechanisms through which policy effects occur in an imperfectly competitive economy. We inevitably have been forced to omit several closely-related areas of potential interest, amongst which are the 'mesoeconomic' approach developed by Ng (1980, 1982a, 1986); open-economy applications (these are surveyed in Dixon 1992b); macroeconomic models of bargaining (MacDonald and Solow 1981; Jacobsen and Schultz 1990); and the 'insider–outsider' literature (Lindbeck and Snower 1989). We have also omitted the 'coordination failure' literature (see Silvestre 1993 and an earlier version of this paper, Dixon and Rankin 1991).

2. A general framework

The models constructed in much of the recent literature on imperfect competition have shared some common features. In this section we outline a generic model of an imperfectly competitive economy that provides a baseline, and we will use variants of it in subsequent sections to derive particular results. The three main points we make in this section are: (i) that imperfect competition in either output or labour markets will tend to reduce equilibrium output and employment; (ii) that the introduction of union wage-setting will tend to generate 'involuntary' unemployment; and (iii) that the model will possess a (unique in this case) Natural Rate, with money being neutral. This section thus highlights the 'classical' properties of imperfect competition, as a prelude to subsequent sections which will extend the framework to models with less classical effects for monetary and fiscal policy.

There are n produced outputs X_i, $i = 1, \ldots, n$. Households' utility function takes the form

$$[u(X)]^c[M/P]^{1-c} - \theta N^e \qquad 0 < c < 1,\ e \geq 1 \tag{1}$$

where u is a degree-one homogeneous subutility function, P is the cost-of-living index for u, M is nominal money holdings, and θN^e is the disutility of supplying N units of labour, $N \leq H$. Since preferences are homothetic over consumption and real balances we can aggregate and deal with one 'representative' household. Most papers further simplify (1). First, a specific functional form is assumed for $u(X)$—notably Cobb–Douglas or CES. Second, the labour supply decision may be made a [0, 1] decision—to work or not to work for each individual household. We can represent this for our aggregated household by setting $e = 1$, so that θ is the disutility of work. Most models of imperfect competition incorporate money using the standard temporary equilibrium framework (see Grandmont 1983, for an exposition) by including end-of-period balances in the household's utility function. Whether it should be deflated by the current price level as in (1) depends on the elasticity of price expectations, as we discuss in Section 3.2 below. As regards firms, we assume there are F firms in sector i, each with a log-linear technology

$$X_{if} = B^{-1}N_{if}^{a} \qquad a \leq 1 \tag{2}$$

The special case of constant returns where $a = 1$ is widely used.[1]

We have now to add the macroeconomic framework. Turning first to aggregate income–expenditure identities, income in each sector must equal expenditure Y_i on that sector, and national income must equal total expenditure Y. We will introduce fiscal policy in Section 4. In this section, the government merely chooses the total money supply M_0. In aggregate, the household's total budget consists of the flow component Y and the stock of money M_0. Given (1), households will choose to spend a proportion c of this on producer output, and to save a proportion $1 - c$ to accumulate money balances M.[2] Hence the income–expenditure indentities coupled with (1) imply that in aggregate:

$$Y = c[M_0 + Y] \qquad \text{or} \qquad Y = \frac{c}{1-c}M_0 \tag{3}$$

Given total expenditure, households allocate expenditure across the produced goods. Since preferences are homothetic, the budget share of output i, α_i, depends only on relative prices. Hence total expenditure on sector i, Y_i, is given by

$$P_i X_i \equiv Y_i = \alpha_i(\boldsymbol{P})Y \tag{4}$$

where α_i is homogeneous of degree zero in the vector of prices $\boldsymbol{P}$. We will assume symmetric preferences, so that if all prices of outputs are the same then $\alpha_i = 1/n$.

How are wages and prices determined? As a benchmark let us consider the Walrasian economy with price-taking households and firms. Furthermore, let us assume perfect mobility of labour across sectors, so that there is a single economy-wide market and wage W. The labour supply from (1) is then

$$N^s(W/P) = [\theta e]^{1/[1-e]}[W/P]^{1/[e-1]} \tag{5}$$

The additive separability combined with degree-one homogeneity of (1) rules out any wealth effect on labour supply, so that only real wages matter. Assume

[1] A quite common simplification of the above separate treatment of households and firms is to assume a single type of agent (the 'farmer') who produces output using only his own labour as an input. This is used for example in Blanchard and Fischer (1989, Ch. 8) and Ball and Romer (1989, 1990, 1991), and has the advantage that the model reduces to one in a single type of market—namely for goods, with the labour market being suppressed.

[2] Replacing the Cobb–Douglas form for sub-utility over aggregate consumption and money by a more general homothetic form makes no difference to the constancy of c, unless a different deflator for M is used. This becomes important in models with non-unit-elastic expectations: see Section 3.2.

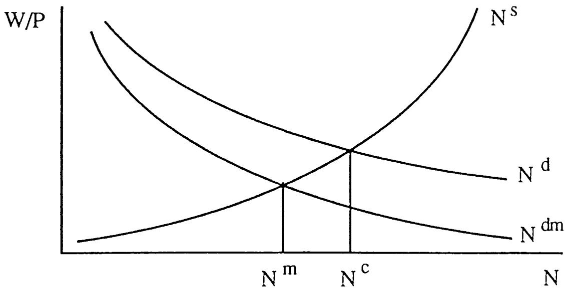

FIG. 1.

a single, representative, price-taking firm per sector.[3] Then sector i's labour demand takes the form

$$N^d(W/P_i) = [a/B]^{1/[1-a]}[W/P_i]^{-1/[1-a]} \tag{6}$$

In a symmetric equilibrium where $P_i = P$, (5)–(6) determine equilibrium real wages, employment and output in the representative sector. Equilibrium sector output X^* is given by $B^{-1}[N^*]^a$, under and symmetry $\alpha_i = 1/n$ in (4) so that the nominal price level is

$$P^* = \frac{c}{1-c}\frac{M_0}{nX^*} \tag{7}$$

Nominal wages and prices adjust to equate aggregate demand with equilibrium output. This is an entirely 'classical' model with full employment and neutral money.

What difference does the introduction of imperfect competition make? Let us assume that each output is monopolised by a sole producer ($F = 1$) and that there are many sectors. The large 'n' means that the monopolist treats the general price index P as exogenous when it makes its decisions. Before we proceed, it should be noted that the elasticity of demand $\varepsilon_i(\boldsymbol{P}) \equiv -[\partial \ln X_i/\partial \ln P_i]_{P \text{ const.}}$ from (4) is homogeneous of degree zero in prices, due to homotheticity. In a symmetric equilibrium $\varepsilon_i(\boldsymbol{P})$ will thus take the same value irrespective of the price level: $\varepsilon^* \equiv \varepsilon(\mathbf{1})$. We will assume gross-substitutability in general, so that $\varepsilon^* > 1$. If the individual firm maximises its profits treating the general price level as given, then its labour demand is easily obtained as

$$N^{dm}(W/P_i) = [1 - 1/\varepsilon^*]^{1/[1-a]}N^d(W/P_i) \tag{8}$$

Since $\varepsilon^* > 1$ and $a < 1$, labour demand is smaller for any given real wage, as we would expect. Equilibrium under symmetry is depicted in Fig. 1. For a given supply curve, in a symmetric equilibrium the effect of monopolistic competition is simply to reduce sectoral employment (and hence output) from N^c to N^m.

[3] So formally $F = 1$ but perfect competition is imposed by the assumption of price-taking: this enables a comparison with the monopoly case below which is not distorted by different numbers of production units.

Note that money will still be neutral, since (5) and (8) are both homogeneous of degree zero in (W, P). The degree of monopoly μ is $1/\varepsilon^*$. So the less elastic is demand when prices are all equal, the higher the marking-up of price over marginal cost and the lower equilibrium output. Imperfect competition in the output market has thus reduced total output and employment, although (since the labour market is competitive) households are on their labour supply curve N^s.

How will the introduction of unions alter matters? To take the simplest case, consider an economy-wide monopoly union that has the unilateral power to set the nominal wage. The union predicts, given the wage it has set, what prices will be set by firms and the resultant level of employment.[4] At the aggregate level, the trade-off between real wages and employment faced by unions in symmetric equilibrium is given by (8) multiplied by the number of sectors n. Several assumptions may be made about union preferences (see Oswald 1985). Here we will simply assume that the union's objective function is to maximise the total surplus, or wage revenue less disutility, earned by employed workers.[5] If we let $e = 1$, then there is a constant marginal disutility of labour θ. Each employed worker earns $W/P - \theta$ as surplus. The union's problem is thus

$$\underset{W/P}{\text{maximise}}\ [W/P - \theta]N^{dm}(W/P) \tag{9}$$

Since the elasticity of labour demand with respect to W/P is constant in (8), the solution to (9) has the property that the union chooses the real wage as a constant mark-up over θ

$$W/P = \theta/a \tag{10}$$

This is depicted in Fig. 2, where we show the union's maximum utility indifference curve U^*. The less elastic is the demand for labour (the lower a), the higher is the wage set by the union. Since the monopolistic and competitive firms have the same real-wage elasticity of labour demand, the real wage chosen by the union is the same, though employment is lower with monopolistic firms. Again, since (10) is homogeneous of degree zero in (W, P), money is neutral. This model illustrates the point that the introduction of wage-setting unions leads to involuntary unemployment. Since the union marks up the wage over the disutility of labour (from (10)), the unemployed households are worse off than the employed, and furthermore the employed would be willing to work more for less.

Turning to the case of sectoral unions, wages in each sector may now differ. The union is assumed to control entry into employment in that industry so that

[4] When there is a centralised union, we assume that firms' profits are received by a separate rentier class of household which entirely consumes them. If the union received them, it would effectively control the whole economy and so would obviously choose the first-best, competitive outcome.

[5] This is consistent with the maximisation of household's utility (1) if there is equal rationing of workers. With, instead, all-or-nothing rationing and random selection of workers, it is consistent with expected utility maximisation if $e = 1$, since (1) then exhibits risk-neutrality.

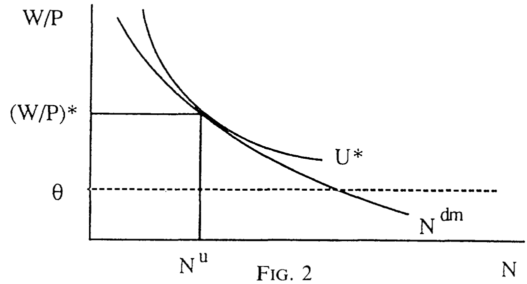

FIG. 2

employed 'insiders' are isolated from the potential competition of 'outsiders' (see Lindbeck and Snower 1989, for a discussion). In a large economy with many sectors, each individual union will take the general price level of goods consumed by its members as given (in contrast to the centralised union) and in a non-cooperative Nash framework it will also treat other sectoral unions' wages as given. However, each union will take into account the effects of its wages on its own sector's price P_i and hence on output and demand for labour in its sector. The sectoral labour demand curve is thus essentially a relation between nominal wages W_i and employment, because the firm bases its employment on the own-product wage W_i/P_i, in contrast to the union's objective function which depends on the real consumption wage W_i/P.[6]

Consider the elasticity of the sectoral unions' demand for labour with respect to W_i. The labour-demand equation stems from the price-cost equation which equates the own-product wage to the marginal revenue product of labour

$$\frac{W_i}{P_i} = \frac{\varepsilon - 1}{\varepsilon} aB^{-1} N_i^{-[1-a]} \tag{11a}$$

If we take logs and differentiate N_i with respect to W_i, taking into account that P_i depends upon X_i which depends upon N_i, we obtain the money–wage elasticity of labour demand as

$$-\frac{\mathrm{d}\ln N_i}{\mathrm{d}\ln W_i} = \frac{1}{1 - a + a[1 - \eta]/\varepsilon} \tag{11b}$$

where η is the elasticity of $[\varepsilon - 1]/\varepsilon$ with respect to P_i, which captures the effect of a rise in W_i (and hence P_i) on the mark-up of price over marginal cost, $\varepsilon/[\varepsilon - 1]$. This can take either sign, although it is perhaps more reasonable to assume that $\partial\varepsilon/\partial P_i > 0$ (demand becomes more elastic as you raise price), so that $\eta > 0$ (the mark-up falls as W_i rises). If the sectoral union maximises its surplus with respect to W_i, subject to the labour demand implicitly defined by

[6] However, one of the best-known models with sectoral unions does not fit this pattern. In Hart (1982) consumers are able to buy output only in one sector, so one sector's output is neither a gross complement nor gross substitute for another's and the money-wage elasticity of labour demand is not affected by having sectoral rather than centralised unions.

(11), the equilibrium real wage given symmetry across sectors is

$$\frac{W}{P} = \frac{\theta}{a} \frac{\varepsilon^*}{\varepsilon^* - 1 + \eta} \tag{12}$$

This is a higher real wage than with the centralised union (cf. (10)) so long as $\eta < 1$. If utility is CES then $\varepsilon(\boldsymbol{P})$ is equal to the constant elasticity of substitution, so $\eta = 0$ and the comparison of (12) with (10) is unambiguous.

Thus, the sectoral union tends to set a higher nominal wage, with a consequent lower level of employment, despite the fact that the money wage elasticity of its labour demand is likely to be higher than for a centralised union.[7] The reason is that it sees no effect of its own behaviour on the general price level P at which its members consume. A centralised union takes the general rise in P which it causes into account, and so restrains its wage pressure. This can also be seen as an example of externalities: the price rise caused by a sectoral union is mostly borne by members of other unions. For a detailed discussion of the effect of different union structures on wage determination, see Calmfors and Driffill (1988).

An alternative to sectoral unions—which are organised by industry—are craft unions, which are organised by labour skills. Blanchard and Kiyotaki (1987) use these. Each union sells a different type of labour, some of which is required by every firm. The number of labour types is assumed large, so each W_h has a negligible effect on the general index of wages W and no union sees itself as affecting any firm's output. Firm i's demand for type-h labour, which is obtained by minimising the cost of producing a given output X_i, is

$$N_{ih} = k_n [W_h / W]^{-\sigma} X_i^{1/a} \qquad k_n = \text{constant} \tag{13}$$

where σ (> 1) is the constant elasticity of technical substitution between labour types. Blanchard and Kiyotaki further assume increasing marginal disutility of work, i.e. $e > 1$ in (1), so that the union's surplus is[8]

$$[W_h/P]N_h - \theta N_h^e \tag{14}$$

Maximising (14) subject to (13) (aggregated over all i) taking W and $X_1, \ldots, X_n$ as given, union h chooses the level of labour sales

$$N^{sm} = [1 - 1/\sigma]^{1/[e-1]} N^s(W_h/P) \tag{15}$$

Since $\sigma > 1$, labour sales are smaller for any given real wage than in the competitive case (5), as we would expect. Combining (15) with (8) determines equilibrium under symmetry amongst firms and unions, as in Fig. 3. Whether the employment level is higher or lower than with sectoral unions depends on technological substitutability between labour types. With $\eta = 0$ and $e = 1$, employment is lower if $\sigma < 1/[1 - a[1 - 1/\varepsilon]]$. Money is clearly still neutral.

[7] If goods are gross substitutes a rise in W_i and thus P_i will cause consumers to switch to other goods j, something which would not happen if all goods' prices rose together.

[8] This objective function still derives directly from the household's utility function (1): we should think of each household as now constituting a separate union.

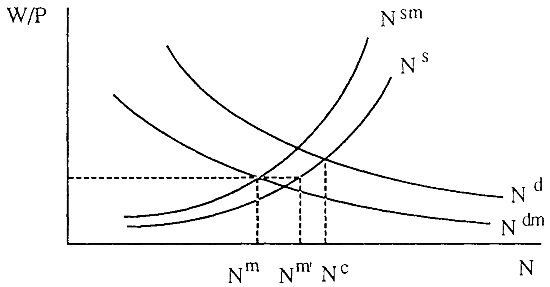

FIG. .3

In this section we have presented a simple general framework that captures some common features of much of the recent work on imperfect competition and macroeconomics. We will now proceed to see how extensions of this general framework yield less orthodox results.

3. Monetary policy

Imperfect competition by itself does not create monetary non-neutrality, as we have seen.[9] It is the combination of imperfect competition with some other distortion[10] which generates the potential for real effects. The nature of this other distortion provides us with a natural method for classifying models of monetary policy effectiveness. First, the largest part of the literature combines imperfect competition with small lump-sum costs of adjusting prices ('menu' costs), which are intended to represent the administrative costs of printing new price lists, etc. Examples of this approach are Mankiw (1985), Akerlof and Yellen (1985a), Blanchard and Kiyotaki (1987), Benassy (1987), Caplin and Spulber (1987), Ball and Romer (1989, 1990, 1991). A second group of papers may be interpreted as taking the same general framework of imperfect competition in a monetary temporary equilibrium, but as relaxing an implicit assumption often unconsciously made there: namely, that of unit-elastic expectations of future with respect to current prices. These include the seminal paper of Hart (1982) and applications and extensions by Dehez (1985), D'Aspremont *et al.* (1989, 1990), Silvestre (1990), and Rankin (1992, 1993). Thirdly, papers by Dixon (1990b, 1992a), Fender and Yip (1990), and Moutos (1991) look at the imperfect competition combined with a small nominal rigidity

[9] This point was not recognised in some early literature, which tended to regard any situation in which agents face downward-sloping demand curves as generating *ipso facto* demand management effectiveness. A simple fallacy is to argue that a money supply increase shifts outwards agents' demand curves causing them to raise output, forgetting that in a general equilibrium context cost curves will shift up by an exactly offsetting amount. In several papers, Ng (1980, 1982a, 1982b, 1986) claims that imperfect competition breaks the classical dichotomy despite this, but his argument also rests on proving the existence of a local continuum of equilibria: see the interchange with Hillier *et al.* (1982). The clearest statement of the need for distortions in addition to imperfect competition is in Blanchard and Kiyotaki (1987).

[10] 'Distortion' is not an ideal term because not all the extra factors we consider are necessarily sources of failure to achieve Pareto optimality in a competitive economy, although they could be.

in some sector of the economy. Common to all three approaches is that the same distortions in the presence of perfect competition would not cause monetary policy to affect output significantly. It is the interaction between minor, and perhaps intrinsically uninteresting, distortions and imperfect competition which generates major departures from neutrality. This can be viewed as an instance of the theory of the second best at work: monetary policy is not capable of causing Pareto improvements given either imperfect competition or the other distortion on its own, but given both together, it is.

3.1. *Menu costs*

We take Blanchard and Kiyotaki's (1987) model for our illustration, though the central ideas appear first in Mankiw (1985) and Akerlof and Yellen (1985a). Very similar points were simultaneously made by Benassy (1987), and Parkin's (1986) paper also has strong parallels. That this approach has also been influential outside the realm of pure theory is shown by Layard and Nickell's adoption of the Blanchard–Kiyotaki framework for their widely-known empirical studies of UK unemployment (Layard and Nickell 1985, 1986, 1991). The model in the absence of menu costs has already been described in Section 2. Suppose now that the price- and wage-setting agents face administrative costs of changing prices and wages (e.g. for a restaurant, the cost of reprinting its menus). Such costs are lump-sum in nature: they do not depend on the size of the price or wage change. If they are large enough to outweigh the foregone profits or utility of not adjusting a price or a wage when an increase in the money supply occurs, the firm or union still has to decide whether to meet the increase in demand, or whether to ration it. This is where monopoly is important: since price exceeds marginal cost and wage exceeds marginal disutility in the initial equilibrium, firms and unions will prefer to satisfy the extra demand (up to a point), since a profit or suplus is made on every extra unit sold. This is illustrated in Fig. 4, where the trapezium ABCF indicates the increase in the firm's profits or the union's utility. By contrast, under perfect competition, the price (wage) equals marginal cost (disutility) initially, and the firm (union) would lose profits (utility) if it is satisfied an increase in demand, and so would choose to ration its customers.[11]

Once general equilibrium spillover effects have been taken into account, the size of the horizontal shift in the goods demand curves, and hence the size of the increase in output, will be in percentage terms equal to the increase in the money supply. This may be seen from the macroeconomic aggregate demand function (3), whence, together with the goods demand function (4) and the

[11] Jones and Stock (1987) claim that imperfect competition is not necessary for the result. They assume 'near rationality', as introduced by Akerlof and Yellen (1985a, b). Behaviour is 'near-rational' if the foregone utility or profits is less than some small fixed amount. If the failure of rationality is a failure to adjust prices optimally, then this is formally equivalent to menu costs. However, Jones and Stock assume it takes the form of a 'rule of thumb' in which competitive firms increase output whenever demand increases, which is clearly different from the notion of menu costs.

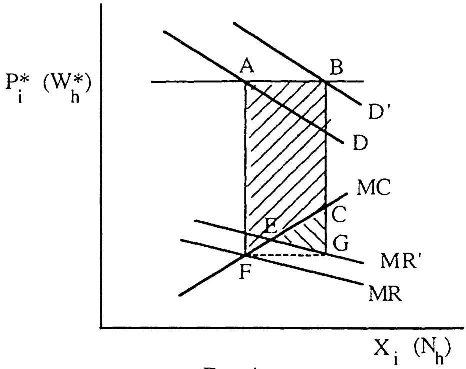

FIG. 4.

labour demand function (13), we may derive the multipliers

$$\frac{\mathrm{d}\ln X}{\mathrm{d}\ln M_0} = 1 \qquad \frac{\mathrm{d}\ln N}{\mathrm{d}\ln M_0} = 1/a \tag{16}$$

Although Fig. 4 is a partial equilibrium diagram in which the position of the marginal cost (disutility) curve depends on the general wage (price) index, these two indices may validly be assumed unchanged provided menu costs are binding for all agents. Hence no shift in the curve is needed to depict the new general equilibrium.

The limit of the possible increase in employment and output (always given large enough menu costs) is reached when demand equals the competitive supply in either market. Beyond this, even monopolistic agents will choose to ration any further increase. Whether the limit is first hit in the goods or labour market depends whether the real wage is above or below its Walrasian level (respectively). In Fig. 3, for example, the maximum employment level as M_0 is increased occurs at $N^{m\prime}$, where the supply constraint in the labour market becomes binding. This brings out the formal similarity between the menu cost models and the 'disequilibrium' models of the 1970's (Barro and Grossman 1971; Benassy 1975; Malinvaud 1977—see Benassy (1990) for a recent survey). Within the class of equilibria for which menu costs bind, the economy behaves exactly as if it were in a quantity-constrained equilibrium.[12] In particular, within the neighbourhood of the initial frictionless equilibrium, it behaves as if in a regime of generalised excess supply, or 'Keynesian unemployment'. Big increases in the money supply will shift it into a regime of 'repressed inflation' (as happens in Fig. 3) or 'classical unemployment', depending on whether labour or goods supply constraints are reached first. This similarity between excess supply and monopoly was first exploited by Benassy (1976, 1978) and Negishi (1979) as a means to 'endogenise' prices in disequilibrium models. Their models, however, use the concept of 'subjective'

[12] The formal similarities are explored in depth in Madden and Silvestre (1991, 1992).

demands, introduced by Negishi (1961), rather than the 'objective' demands used here.

Note that the increase in output also constitutes a Pareto improvement. This is for three reasons: first, the shift in demand for labour brings a utility gain to the household equal to the area ABCF in the diagram; second, households receive an increase in profits from firms; and third, real money balances increase, which increases households' utility directly. An interesting interpretation of the Pareto sub-optimality of the initial monopolistic equilibrium is to view it as resulting from a lack of cooperation amongst price-setting agents. Benassy (1987) and Blanchard and Kiyotaki (1987) both point out that an agreement by all firms and households simultaneously to lower their prices and wages by x% would produce the exact same real reallocation as a money supply increase of x% in the presence of binding menu costs. In either case real balances, and thus real demand and output, rise by x%, with no relative price changes. Monetary policy can thus be seen as a substitute for a cooperative agreement to lower prices. The failure to lower prices when acting independently is explained by Blanchard and Kiyotaki as due to an 'aggregate demand externality':[13] a lowering of one agent's price benefits all others to the extent that it slightly reduces the general price index and so raises real money balances and aggregate demand.[14] However the private gain to the price cutter is outweighed by the private loss due to the too-low relative price which would result. The monopolistically competitive equilibrium is therefore a form of economy-wide 'Prisoner's Dilemma'. In the absence of menu costs, when to expand the money supply would have no beneficial effect, a welfare-enhancing measure would be to impose an all-round wage and price cut by a prices and incomes policy.

Before the menu cost model can be taken seriously, it must tackle the obvious objection that in practice administrative costs of price and wage adjustment are very small. Because such costs are lump-sum, once they are dominated by the foregone profits or utility of not re-optimising in the face of a money supply increase, they will have no effect at all: an agent who has decided to adjust her price will adjust it to the same level as in the absence of menu costs, since the cost depends on the fact of the adjustment and not on its size. A large part of the research into menu costs has been concerned with overcoming this objection. The key observation is provided by Akerlof and Yellen (1985a) and Mankiw (1985), who point out that the opportunity cost of non-adjustment is second-order in the size of the money supply shock. That is, if we take a Taylor approximation to firm i's foregone profits of not increasing P_i, or to union h's foregone utility of not increasing W_h, it will contain no term in ΔM_0, only in $(\Delta M_0)^2$ and higher powers of ΔM_0. We explain why below. By comparison, the

[13] Clearly a 'pecuniary' rather than a 'technological' externality. The term 'externality' is misleading in so far as pecuniary externalities are not usually held to cause market failure: the underlying source of the market failure here is of course just the imperfect competition itself.

[14] The total effect of a fall in P_i on firm j's profits is negative to the extent that he is undercut by a rival, but these relative price effects cancel out when all prices and wages are reduced.

increase in output is first-order, i.e. proportional to ΔM_0, as is clear from (16). Thus, as ΔM_0 tends to zero, the ratio of the size of menu cost necessary for non-adjustment to the change in output which it sustains, also tends to zero. For non-infinitesimal but small changes in the money supply, it follows that only a very small menu cost will be required in order to sustain non-adjustment. For instance, Blanchard and Kiyotaki's calculations show that with a 5% money supply increase and $\theta = \sigma = 5$, $e = 1.6$ and $a = 0.8$, the minimum menu cost for households to prefer non-adjustment is equal to only 0.112% of GDP, and for firms to only 0.018% of GDP.

To see why the opportunity cost is second-order, consider again Fig. 4. (We have deliberately magnified the diagram in the neighbourhood of equilibrium, which permits us to approximate curves as straight lines.) If the price were to be adjusted following the shift in demand, the new output would be determined by the intersection E. Since output under no adjustment is greater than this, the foregone profits (utility) of not adjusting are measured by the cumulated surplus of MC over MR', given by triangle CGE. As the size of ΔM_0, and thus of the demand shift AB, is squeezed towards zero, the area of this triangle clearly falls with the square of AB, and thus with the square of ΔM_0 (note that distance BG always equals AF since demand elasticity is a constant). Intuitively, the reason why the cost is only second-order is that 'objective functions are flat on top': in the neighbourhood of a maximum the slope is close to zero, so that the loss from being only slightly away from the optimum is also very close to zero.

Several extensions of this basic analysis are made by Ball and Romer. In their 1989 paper, they show that if the money supply is stochastic then the welfare cost of price rigidity, as measured by the fall in expected utility, becomes second- rather than first-order, i.e. proportional to the variance of the money supply. Despite this, parameter values exist which will drive the ratio of second-order menu costs to second-order welfare losses to zero.[15] In their 1991 paper, they show that for a given money supply increase, there exists an intermediate range of values for the menu cost such that two equilibria co-exist: one with no and one with full price adjustment. For menu costs in this range it can thus be argued that if the outcome is no adjustment, price rigidity is due to a coordination failure: if each agent expected the others to adjust, she would want to adjust too. In yet a third paper, Ball and Romer (1990) address the problem for the basic menu cost model that, although theoretically acceptable parameter values exist which keep rigidity-sustaining menu costs small, these values are still unrealistic empirically. The lowest value of competitive labour supply elasticity ($1/[e-1]$) used in Blanchard and Kiyotaki's numerical illustrations is $1\frac{2}{3}$ (as in the cited example), which is much higher than most

[15] It would seem to be a limitation of Ball and Romer's analysis that risk aversion is only present in their model incidentally. They use the utility function from Blanchard and Kiyotaki's deterministic model without any modification: there is no separate risk aversion parameter; risk aversion simply happens to be present in the utility function due to the assumption of increasing marginal disutility of work ($e > 1$).

econometric estimates. Ball and Romer suggest a solution by showing that rigidities in nominal prices are made more likely if there are also rigidities in real—or relative—prices. Their general argument is as follows. Suppose agent i has the indirect utility function

$$U_i = W(M_0/P, P_i/P) \tag{17}$$

Agents in the model are 'farmers'.[16] i's optimum relative price is clearly determined from the first-order condition $W_2(M_0/P, P_i^*/P) = 0$ (the subscript denoting a partial derivative), whence

$$\partial(P_i^*/P)/\partial(M_0/P) = -\underset{(+)}{W_{12}}/\underset{(-)}{W_{22}} \qquad (\equiv \pi, \text{ say}) \tag{18}$$

If a change in aggregate demand causes only a small change in i's desired relative price, real rigidity is said to be 'high', so π is an inverse measure of it. The second-order approximation to i's private utility cost of not adjusting P_i after a change ΔM_0, given that others do not adjust, is

$$PC \approx [-(W_{12})^2/2W_{22}][\Delta M_0]^2 = \tfrac{1}{2}\pi W_{12}[\Delta M_0]^2 \tag{19}$$

Thus the smaller is π, i.e. the greater the real rigidity, the smaller is the menu cost needed to ensure i does not adjust his price. Ball and Romer flesh out this simple framework with two explicit models of real rigidities: a 'customer market' model in which firms face kinked demand curves due to ignorance by their customers of prices elsewhere; and a model with an 'efficiency wage' in the labour market.[17] Hence by combining three 'distortions'—imperfect competition, menu costs and real rigidities—an empirically plausible model of non-neutrality can be obtained.[18]

Are the results modified in a dynamic setting? Caplin and Spulber (1987) and Caplin and Leahy (1991) examine this question. Rules for optimal price- and wage-setting over time when subject to menu costs take an 'Ss' form: when the deviation of P_i from its no-menu-cost optimum, P_i^*, which follows a stochastic process determined by the process for the money supply, hits a ceiling S or a floor s, an adjustment is made to P_i, bringing $P_i^* - P_i$ back to some 'return point'. Caplin and Spulber show that when the money supply process involves only non-negative shocks to the money stock, money—rather surprisingly—turns out to be neutral in the aggregate. However when the process is symmetric, allowing negative as well as positive shocks, shocks do affect aggregate output, as shown in Caplin and Leahy.[19] Although these models are dynamic, the firm's optimisation problem is treated as static. Dixit

[16] See footnote 1.

[17] This is almost identical to Akerlof and Yellen (1985a), who however do not comment on the help which their efficiency wage assumption provides in keeping opportunity costs small.

[18] Again, 'distortion' may be a misleading label for certain kinds of 'real rigidities', since on Ball and Romer's definition they could consist of no more than, for example, highly elastic labour supply; yet it is clearly appropriate for those which derive from, for example, imperfect information.

[19] Blanchard and Fischer (1989, Ch. 8) provide intuitive explanations for these results.

(1991), in a partial equilibrium analysis, shows that with dynamic optimisation menu costs as small as fourth-order can sustain price rigidities. The considerable difficulties of aggregating across agents with different initial situations have, however, so far discouraged the rapid development of this branch of the literature.

3.2. *Non-unit-elastic price expectations*

Hart (1982) was the first to show that imperfect competition could generate policy effectiveness. The 'policy' he considers, however, is not strictly monetary policy at all: it is an increase in the stock of a 'non-produced' good. Although Hart is reluctant to interpret this as 'money', we can validly do so if we view Hart's framework as one of temporary monetary equilibrium in the manner of Patinkin (1965) and Grandmont (1983). In this case the key assumption necessary for monetary policy effectiveness is that—implicitly or explicitly— agents' expectations of future prices are 'non-unit-elastic' in current prices. We present here a simple version of Hart's model under this monetary reinterpretation. We also examine another question debated in the literature for which Hart's model has been the framework: whether imperfect competition in the goods market can cause unemployment even at a zero wage.

Relative to Section 2, we slightly modify the household's problem, to

$$\text{maximise } u(X, M/P^e) \qquad \text{subject to} \qquad M_0 + Y = PX + M \tag{20}$$

P^e is the subjective expectation of next period's price level, so M/P^e is expected future consumption (taking the simplest possible case, in which the household has no future income).[20] Our earlier utility function (1) is just the special case of this in which price expectations are unit-elastic in current prices: $P^e = k_1 P$. Hart's (1982) utility function is the special case of it in which expectations are zero-elastic: $P^e = k_2$. Here we posit an arbitrary expectations function, $P^e = \phi(P)$. If preferences are homothetic, the resulting consumption demand function then takes the form

$$X = \alpha(P/\phi(P))\frac{M_0 + Y}{P} \tag{21}$$

where $\alpha'(\cdot)$ could take either sign. From this we have the price elasticity

$$-\frac{\partial \ln X}{\partial \ln P} \equiv \varepsilon(P) = 1 - [1 - \varepsilon_\phi(P)]\varepsilon_\alpha(P/\phi(P)) \tag{22}$$

where ε_α, ε_ϕ are the elasticities of the functions $\alpha(\cdot)$, $\phi(\cdot)$.

Now assume a competitive goods market, and constant returns to labour such that $X = N$. Then $P = W$, and the demand for labour is just (21) with N

[20] As does Hart, we now assume that consumption is a scalar and that there is no disutility of work.

replacing X and W replacing P. This is the function faced by the r unions in a typical local labour market.[21] With no utility of leisure and equal rationing of its members, the appropriate maximand for the typical union is just its money wage revenue. Cournot competition amongst unions then requires that at an interior (unemployment) solution, where each union supplies $(1/r)$th of the market, we have

$$\varepsilon(W) = 1/r \tag{23}$$

This equation (if it has a solution) defines W, and thus P, independently of M_0. We thus have complete price rigidity, and consequently a standard Keynesian-type multiplier of money on output, as is easily shown by setting $Y = PX$ in (21) and solving for X.

What is the role of non-unit-elastic expectations? This may be seen from (22): with a unit elasticity ($\varepsilon_\phi = 1$), $\varepsilon(P)$ equals 1, a constant. Clearly, it is then the case that no value of W can satisfy equation (23). It would be easy to show that here the equilibrium must be a full employment one, if we were explicitly to take into account the upper bound on a union's labour sales imposed by its exogenous labour endowment. However at full employment, monetary policy cannot affect output. Full employment would also be the outcome, whatever the elasticity of expectations, under perfect competition in the labour market, which highlights how imperfect competition is essential for the policy effectiveness result.[22] Rankin (1993) shows that if we take a more general production technology, then given a sufficient degree of concavity, unemployment will result even with unit-elastic expectations. In this case any divergence of the expectations elasticity from unity, above or below, turns out to cause a positive effect of money on output. Thus, since the expectations elasticity is an arbitrary subjective parameter, money will almost always affect output positively. Such robustness substantially strengthens Hart's original findings.

However, are non-unit-elastic expectations 'irrational'? An overlapping-generations extension of the model in which this can be investigated is provided in Rankin (1992). The very concept of an expectations elasticity, of course, implies that an element of learning is involved in expectations formation: under the extremely strong assumption of fully 'forward-looking' expectations, money is—unsurprisingly—neutral. But if our criterion of rationality is the more moderate one that expectations should converge on the truth, then we can show that any expectations elasticity is consistent with this. Moreover, a unit elasticity

[21] To allow us to assume that unions take their firms' customers' incomes (Y) and their members' consumption prices as given, Hart postulates many (identical) locations, each with its own labour and goods market, such that workers at one location are dispersed, qua consumers, amongst other locations.

[22] It is true, as Patinkin (1965) showed, that non-unit-elastic expectations by themselves make money non-neutral. But here we are concerned with something stronger than mere non-neutrality: we are looking for a positive effect of money on output. Under perfect competition money is here non-neutral in that a change in M_0 affects real balances M_0/P—but this is an uninteresting non-neutrality.

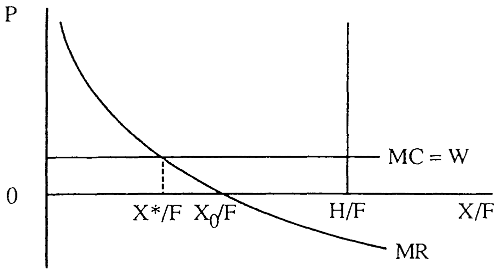

FIG. 5.

does not guarantee a correct short-run forecast: this will only be the case for 'step' increases in the money supply.[23]

Dehez (1985), D'Aspremont *et al.* (1989, 1990), Silvestre (1990) and Schultz (1992) all consider models similar to Hart's but in which imperfect competition is in the goods market, and a competitive labour market is assumed. This is in order to consider whether goods-market imperfect competition can cause a situation in which labour demand is bounded above, such that even at a zero wage, demand falls short of the economy's labour endowment. Assuming no utility of leisure, the market-clearing wage is then zero. Although such unemployment is formally 'voluntary', the situation is clearly one in which an extreme degree of wage flexibility is required, and only the smallest degree of inflexibility would in practice cause true involuntary unemployment.

The necessary condition for this type of unemployment is that a firm's marginal revenue should turn negative at some finite output level. This may be illustrated as follows. Assuming Cournot competition amongst F identical firms, in equilibrium we must have '$MR = MC$', i.e.

$$P[1 - 1/F\varepsilon(P)] = W \tag{24}$$

By relating P back to X/F (the output of a typical firm) through the demand function, we may plot MR in the usual way as in Fig. 5 above. Here we have drawn MR as cutting the horizontal axis at some output level X_0/F, which is assumed to be less than the full employment one H/F. Silvestre (1990) shows that this can happen if, for example, the expectations elasticity is zero and utility is CES with an elasticity of substitution less than $1/F$. In this case as W, and thus MC, is lowered towards zero, output and employment can go no higher than X_0/F: unemployment exists even at zero wage. A non-unit expectations elasticity is clearly necessary for this to occur: if $\varepsilon_0 = 1$ then from (22) $\varepsilon(P) = 1$, so by (24) MR is positive for all P (and thus for all X).[24]

[23] The main result stressed in Rankin (1992) is that with imperfect competition the assumption that expectations are validated does not tie down a unique long-run equilibrium. This still depends on the expectations elasticity, unlike in Walrasian models, and consequently so does the response to monetary growth.

[24] Schultz (1992) however challenges the robustness of the zero-wage unemployment result. Extending the model to include overlapping generations of consumers, he shows that MR is always positive in such a world.

3.3. *Small nominal rigidities*

There are in an economy many possible sources of nominal rigidity, which may occur in only a small part of the economy, but which may be the presence of imperfect competition cause significant non-neutrality of money. As is implied in the work of Ball and Romer (1990) and Haltiwanger and Waldman (1989), the relationship of strategic complementarity between the nominal choices of agents in general means that small nominal rigidities anywhere can induce some aggregate price rigidity (see also Dixon, 1994). The origin of the nominal rigidity may be outside the domestic private sector—for example, for a small country with a fixed exchange rate, in the nominal price of tradeables: Dixon (1990a) and Rivera-Campos (1991) study this case. Prices, subsidies, welfare payments and taxes set by the government are also often 'rigid' in the sense of being set in nominal terms for a given period. One of the most significant of such nominal rigidities is unemployment benefit. Dixon (1990b), Fender and Yip (1993), and Moutos (1991) focus on this. The presence of such nominal rigidities can have very different implications in a unionised economy from in a Walrasian economy. We will briefly look at the example of unemployment benefits.

Unemployment benefits are set in nominal terms by governments, and revised at regular intervals (at the annual budget, in the UK). In between revisions they are fixed. The level of unemployment benefits is important in a unionised economy because it alters the marginal trade-off between employment and unemployment for union members. If we take the baseline model and assume Cobb–Douglas preferences, no utility of leisure ($e = 0$), constant returns to scale ($a = B = 1$) and a perfectly competitive output market, then the market-clearing wage is (as depicted in Fig. 6 below)

$$W^c = \sum_{i=1}^{n} Y_i/nH = \frac{c}{1-c}\frac{M_0}{nH} \tag{25}$$

The presence of unemployment benefits whose nominal level is fixed at b will not influence the level of wages so long as $b < W^c$, which means that it is worthwhile working (the replacement ratio is below unity). Except for the fact that benefits provide a floor for wages, money is neutral in the Walrasian case.

With unions, however, things may be different. Suppose that households are grouped into r unions in each sector who behave as Cournot quantity-setters. If union k seeks to maximise the 'surplus' $[W_i - b]N_{ik}$ earned by its members, treating the general price level P as fixed, then as is shown in Dixon (1990b), the equilibrium nominal wage becomes a mark-up over the benefit level

$$[W_i - b]/W_i = 1/r \tag{26}$$

so long as $W_i > W^c$. This is depicted in Fig. 6. The important point to note here is that in a unionised economy the nominal wage becomes tied to the benefit level. Furthermore even levels of benefit below the competitive wage can lead to involuntary unemployment, depending on the level of the money supply. So $W_i > W^c \geq b$, and employed households earn more than the

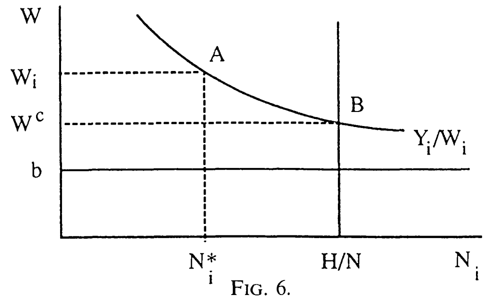

FIG. 6.

unemployed, as at point A. Otherwise employment is always at B. This contrasts with the Walrasian economy, in which benefits can only cause unemployment if they are above the market-clearing wage. As a result of the nominal rigidity introduced by unemployment benefits, with a unionised labour market there will be standard Keynesian multiplier effects. Again, this contrasts with the Walrasian economy in which there will be full employment and a zero multiplier so long as $b \leq W^c$.

4. Fiscal policy

The same set of factors which make monetary policy effective on output will generally also make fiscal policy effective. This should not surprise us, since as just seen these factors work by endogenously producing some form of price stickiness, and we have long been familiar with the idea that price stickiness makes any policy that influences aggregate demand effective. However unlike in the case of monetary policy, imperfect competition by itself is in general enough to cause significant effects of fiscal policy on output. This is for several reasons. First, it is of the essence of price and wage determination in imperfectly competitive markets that elasticity of demand matters. Government policies which influence the elasticity of demand therefore have the potential to alter the relative prices in a way that is absent in a price-taking economy. Second, imperfect competition influences the distribution of income between wages and profits. Where income distribution affects equilibrium, such as where there are income effects on labour supply, the degree of competition can alter the impact of government spending. A third reason is that in practice fiscal policy is not generally symmetric: governments tend to concentrate spending on particular areas. The exact microeconomic mix of expenditures turns out to have a significant macroeconomic influence which is much greater than in a Walrasian environment. Finally fiscal policy affects activity by inducing entry and exit of firms to and from the economy. Imperfect competition is here generally combined with increasing returns in production. In order to see the operation of these mechanisms clearly, in this section we abstract from the factors of the previous section which gave rise to monetary non-neutrality.[25]

[25] For an analysis where monetary non-neutrality and fiscal policy are combined, see for example Rankin (1993).

4.1. *Elasticity effects of the spending mix*

When the demand for output has two components, private and public, its price elasticity is simply the weighted average of the individual elasticities. An increase in government spending, by increasing the share of public expenditure in the total, shifts the elasticity of demand towards that of public spending. If the latter is higher (lower) than the elasticity of private spending, overall demand elasticity rises (falls), and consequently the degree of monopoly tends to decrease (increase). Given the general finding that raising monopoly power lowers output, output could be expected to rise (fall).

This mechanism has been formalised and emphasised by numerous authors.[26] In practice it seems reasonable to argue that public spending is less price-elastic than private spending for most economies. This is obvious if the government fixes its spending, and its allocation between sectors, in real terms (zero elasticity), but it is also true if it fixes spending in nominal terms (unit elasticity). Such an argument implies a negative impact of an increase in spending on output. In general terms, governments often conceive of policies as affecting the trade-off faced by market participants. For example, in 1957 the British Chancellor of the Exchequer Mr Thorneycroft argued that 'if . . . money national income was pegged . . . wages could push up prices only at the expense of employment: the onus of choice was, as it were, placed on the unions' (Dow 1964, p. 101). It is also possible to view one reason for the shift from volume planning to cash planning of UK public spending in the 1970s, and for the general attempt to reduce the scale of public spending in the 1980s, as being the desire to weaken monopoly (particularly labour monopoly) power, with the aim of countering the trend rise in unemployment.

4.2. *Income effects on labour supply*

Even in a Walrasian economy, one way in which fiscal policy may affect output is through the labour supply. A balanced-budget increase in government spending will have a positive effect on output if leisure is a 'normal' good in households' preferences, by virtue of the higher tax burden which causes a lower demand for leisure and thus stimulates labour supply. Up to now we have deliberately excluded income effects on labour supply by the use of the utility function (1). Now we relax this assumption and show how imperfect competition strengthens such an effect, since it leads to a higher proportion of income entering the household's budget constraint in the form of profits.

The following simple example is taken from Mankiw (1988); other models exhibiting the same transmission mechanism are constructed by Dixon (1987) and Startz (1989). The representative household in a barter economy has

[26] Amongst others, Solow (1986), Svensson (1986), Dixon (1990), Thomas (1990), Rankin (1993), Jacobsen and Schultz (1993).

Cobb–Douglas utility over goods and leisure

$$U = \left[\prod_{i=1}^{n} C_i^{1/n} \right]^c [H - N]^{1-c} \tag{27}$$

This implies that the price elasticity of private-sector demand for each good is unity. To abstract from the 'elasticity' effects discussed above, government spending in each sector is taken to be fixed at G_i in nominal terms, so that real government spending, $g_i = G_i/P_i$, is also unit-elastic. On the production side we assume there are constant returns to scale ($X_i = N_i$), and thus marginal cost equals the wage, W. Given F firms per sector, the unit elasticity of demand implies that under Cournot–Nash equilibrium there will be a fixed mark-up of the price over the wage, with

$$\frac{P_i - W}{P_i} \equiv \mu = 1/F \Rightarrow \frac{W}{P_i} = 1 - \mu \tag{28}$$

Firms' nominal and real profits in sector i are

$$\Pi_i = [P_i - W_i]N_i \qquad \Pi_i/P_i = \mu N_i \tag{29}$$

Profits are immediately distributed and government spending is financed by lump-sum taxation, so the household has the budget constraint

$$\sum_{i=1}^{n} P_i C_i + W[H - N] = WH + \sum_{i=1}^{n} \Pi_i - \sum_{i=1}^{n} G_i \tag{30}$$

Since Cobb–Douglas utility implies constant expenditure shares, we can immediately write down the households' spending on leisure as

$$W[H - N] = [1 - c]\left[WH + \sum_{i=1}^{n} \Pi_i - \sum_{i=1}^{n} G_i \right] \tag{31}$$

The macroeconomic system is completed by assuming a symmetric goods market equilibrium with a competitive, clearing labour market. Using (28) and (29) in (31) yields an equation for N

$$N = cH - \frac{1 - c}{1 - \mu}[\mu N - g] \tag{32}$$

We now have, differentiating (32), the following balanced-budget spending multiplier

$$\frac{\mathrm{d}N}{\mathrm{d}g} = \frac{1 - c}{1 - c\mu} \tag{33}$$

As the degree of monopoly, μ, increases from zero to one, we see that the multiplier rises from $1 - c$ to unity. Thus it approaches the macro textbook multiplier for a high degree of monopoly. This may be understood in either of two ways. First, a higher mark-up increases the profit feedback from firms to households per unit increase in output. This boosts consumption spending and so the multiplier. Alternatively viewed, a higher μ lowers the real wage, $1-\mu$. The income effect on labour supply of the increased taxation is thereby strengthened, as may be seen from the term $1-\mu$ *in* (32). This is because the 'propensity to spend on leisure' is a constant, $1-c$: a lower real wage means more leisure is consumed per unit increase in exogenous income. The mechanism demonstrated here is not specific to a barter economy: Dixon (1987) obtains essentially the same outcome in a monetary economy with money-financed expenditure (see also Molana and Moutos 1992, for a discussion of taxation in this model).

4.3. *Effects of sectoral spending asymmetries*

One of the most important ways that fiscal policy differs from monetary policy is in its inherently microeconomic content. This is obvious in the case of taxation: most taxes levied by governments alter supply-side incentives. It is, however, also true in the case of government expenditure: the government decides not just how much to spend, but also on what to spend it. The issue of how to allocate government expenditure is given much consideration by politicians, and quite rightly is seen by many as having important economic consequences. Some of these stem from the intrinsic value of government expenditure—on health, education and so on. However, in this section we will rather consider the case where government expenditure is 'waste'. We will also assume that apart from possibly different levels of government expenditure the 'fundamentals' of each market are the same—technology, the number of firms, union and consumer preferences. This rules out fairly obvious reasons for expenditure decisions based on differential employment effects due to capital intensity, import content and so on. By what mechanism can the allocation of government expenditure influence aggregate employment?

In an economy with perfect labour mobility and a competitive labour market, there can only be a single market-clearing wage in the economy. Whilst fiscal (or monetary) policy might influence this, it cannot influence relative wages. However, if there are sectoral unions, then these can in principle determine wages in their own sectors, and relative wages can then vary. In effect the union can be seen as an institution which limits labour mobility: the employed union 'insiders' are protected from the competition of 'outsiders', who may either be unemployed or employed in other industries. Since relative wages can then differ across sectors, the allocation of government expenditure amongst sectors has a foothold from which to influence aggregate output and employment.

In order to illustrate this, we outline the approach in Dixon (1988, 1991). In each of n sectors, there is a monopoly union which sets the nominal wage W_i in that sector, according to a Stone–Geary utility function (as is commonly used in empirical work—see Pencavel 1984; Dertouzos and Pencavel 1984). Each union sets its wage treating the general price level as given. Households have Cobb–Douglas preferences, there is no disutility of labour ($\theta = 0$), and constant returns to labour. Dixon derives a 'reaction function' for the sectoral union which states the nominal wage it wishes to set given the level of demand in its sector and the cost of living. The demand in that sector is determined by the sector-specific level of government expenditure (fixed in nominal terms) and the level of nominal national income. Given that prices are a mark-up on costs (determined by Cournot oligopoly), we can solve for the equilibrium nominal wage and employment in each sector for a given government policy.

The equilibrium employment equation is given by

$$N_i = N_B y_i^{1/n} \tag{34}$$

where N_B is a constant (determined by union preferences and the degree of monopoly in the product market), and y_i is the ratio of nominal expenditure in sector i (Y^i) to the geometric average of sectoral expenditures ($[\prod_{i=1}^{n} Y_i]^{1/n}$). This yields the fundamental Natural Range property

$$\prod_{i=1}^{n} N_i = (N_B)^n \prod_{i=1}^{n} y_i^{1/n} = (N_B)^n \tag{35}$$

That is, the product of sectoral employment levels is constant, defining a rectangular hyperbola in employment space. We can thus graph the combinations of possible equilibrium employment levels when $n = 2$ as in Fig. 7. Total iso-employment isoquants are represented by negatively-sloped 45° lines, $N_1 + N_2 = N$. The total employment constraint is set by the aggregate labour supply, H. There is then a range of feasible aggregate employment levels: with a symmetric fiscal policy, aggregage employment is minimised at A with $N = 2N_B$; as we move away from the positively-sloped 45° line total employment increases up to full employment at H. For any given government policy, there is a unique equilibrium on the rectangular hyperbola $N_1 N_2 = (N_B)^2$. By altering the mix of government expenditure across sectors, the economy is made to move along the hyperbola, with the resultant change in aggregate employment.

Thus, in the unionised multi-sector economy the government's allocation of expenditure across sectors determines aggregate employment. This stands in total contrast to the Walrasian economy. In this case, perfect mobility of labour

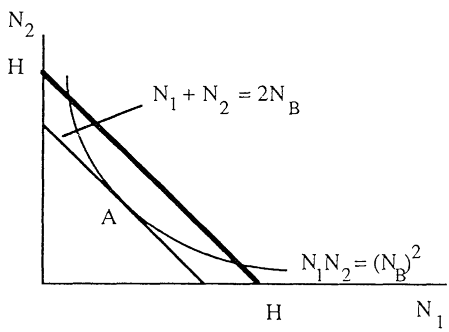

FIG. 7.

ensures that there is a single wage W for all workers, and furthermore that so long as $W > 0$ there will be full employment at H (since $\theta = 0$). Switching expenditure from one sector to another merely serves to cause exactly offsetting changes in employment to maintain full employment. The reason for the difference with imperfect competition is that the presence of unions means that wages may differ across sectors, and that as demand shifts across sectors relative wages alter, and thus changes in sectoral employment need not cancel out. The particular functional forms give rise to the specific 'natural range' result found in these papers, but the existence of a natural range in general does not depend upon them (see Dixon 1988, Theorems 1 and 2).

Given that the government can increase total employment within the natural range, will it want to? Recall that we are treating government expenditure as waste. It can be shown that the real government expenditure multiplier in this model is less than unity (higher prices crowd out private expenditure—see Dixon 1991, Proposition 6). However, despite this, government policy that increases total employment will increase the total utility of households (Dixon 1991, Theorem 2). This is an interesting and possibly counterintuitive result. In unionised (as opposed to Walrasian) labour markers the real wage will usually exceed the marginal disutility of labour. Each employed worker thus earns a 'surplus': as total employment goes up, there is an increase in the total surplus as unemployed people become employed.

4.4. *Fiscal effects on entry and exit*

All the imperfectly competitive economies considered so far have treated the number of firms as fixed. In this sense they are 'short-run' analyses. One strand of the literature, beginning with Weitzman (1982) and developed further by Snower (1983), Solow (1986), Pagano (1990), Green and Weale (1990), focuses on entry and exit of firms as the explanation of unemployment and the effects of fiscal policy. In simple terms, policy which induces entry will tend to increase competition in the market.[27] Hence fluctuations in the number of firms can influence output, with more firms leading to higher output.

Increasing returns in production are an essential feature of these models, and the ultimate source of the imperfect competition. Weitzman (1982) claimed to have explained involuntary unemployment on the basis of increasing returns and goods–market imperfect competition alone, but his model, and the very similar one by Solow (1986), lack any treatment of the supply side of the labour market. Pagano (1990) builds an overlapping-generations version of the Weitzman model, completing it with a Walrasian labour market. This eliminates involuntary unemployment, but permits employment to fluctuate by allowing

[27] It is worth noting that this does not hold with the Dixit–Stiglitz (1977) CES version of monopolistic competition universally used in the menu cost literature (see Hart 1985, for a discussion of this fundamental microeconomic issue). Consequently most of the models with entry use Salop's (1979) 'competition on a circle' model.

a variable labour supply. Fiscal policy in the form of a tax cut financed by bond issues is shown to reduce output and employment in his framework: the tax cut raises the interest rate and causes capital decumulation, reducing long-run output. The basic mechanism is the same as in Diamond's (1965) growth model, where the continuous birth of new households implies that 'Ricardian equivalence' fails to hold. However imperfect competition here reinforces the negative impact, because as firms are driven out of business the degree of monopoly increases, tightening the monopolistic restriction of output.

A further role for fiscal policy arises owing to the possible existence of multiple equilibria, which are a common feature of models with increasing returns. Pagano shows that there may be situations in which by changing taxation the government can eliminate a low-output, Pareto-dominated equilibrium, forcing an economy which has settled there to move to a superior one. (For other examples of multiple equilibria, see Cooper and John 1988; Kiyotaki 1988; Frank 1990, and the rest of the 'coordination failure' literature described in the longer version of this survey).

5. Conclusions

What has imperfect competition added to the macroeconomic interest of the Walrasian model? First, it generates a sub-optimally low level of output and employment, which is an apparently pervasive feature of real economies. This is suggested by any partial equilibrium model of imperfect competition, but the macromodels in addition enable us to see how inefficiently low output results from coordination failure amongst imperfectly competitive agents. Second, closely associated with low output, imperfectly competitive economies typically generate unemployment. When there is imperfect competition in the labour market, such unemployment is involuntary in the sense that there are individuals who would prefer to work more at the prevailing wage. Even where it is voluntary, as when the labour market is competitive, it is above the Pareto-efficient level of unemployment.

Our focus has been on policy effectiveness. As regards fiscal policy, imperfect competition adds several important new mechanisms whereby policy can affect output, and modifies others. It is notable that, so long as money remains neutral, there is no general presumption in favour of a positive rather than a negative effect of a fiscal expansion on output. The transmission mechanisms are different from those of the Keynesian multiplier, and the sign of the effect depends on features of little importance in a Walrasian economy, such as relative price elasticities of private- and public-sector demands, or the sectoral allocation of spending. We may be tempted to think of these as 'supply side' mechanisms, but this would be incorrect, since they work mainly via demand. Imperfect competition tends to undermine the textbook demand-side/supply-side dichotomy. However, the most critical difference between fiscal policy in Walrasian and imperfectly competitive economies is on the welfare side. Since output and employment are inefficiently low, it is much more likely that a fiscal policy change which increases output will bring about an increase in welfare (even if not necessarily a Pareto improvement). This is never true in Walrasian models, where if government expenditure is pure 'waste', an increase will always reduce welfare, irrespective of the change in employment.

As regards monetary policy, we emphasised from the start that we need some second distortion in addition to imperfect competition to generate real effects. The importance of imperfect competition is that without it the distortion would cause no, or only negligible, non-neutralities. Monetary policy, unlike fiscal policy, almost never has a negative effect on output, and where money is non-neutral the general behaviour of the economy is much closer to that of traditional macroeconomic theory. The reason is that there is then some form of endogenous nominal rigidity, i.e. a tendency of prices and wages to respond only weakly to aggregate demand. The study of imperfectly competitive macroeconomies thus tends to reinforce the view—which is still not especially widespread—that to generate some type of nominal rigidity is an essential part of any explanation of traditional macroeconomic policy effects.

What are the promising directions for future research? Two relatively unexplored areas are extensions to the open economy and to dynamic models. Work on the former exists primarily in the shape of studies of exchange rate pass-through, by Dornbusch (1987), Giovannini (1988), Froot and Klemperer (1989) and others (see the survey by Dixon 1992b). This could profitably be merged with studies of policy effectiveness in the open economy such as Dixon (1990a): an example of this is Rivera-Campos (1991). Work on dynamic models exists in the papers by, amongst others, Caplin and Spulber (1987), Caplin and Leahy (1991), Pagano (1990), and Rankin (1992) and Jacobsen and Schultz (1993). This is still a disparate set of contributions: in particular, the complex strategic issues which potentially arise in the intertemporal setting have yet to be incorporated into macroeconomics. Other macroeconomic areas in which imperfect competition has been and will continue to be widely applied, but which we have not attempted to cover here, are the recent theory of endogenous growth (see for example Grossman and Helpman 1991), and the theory of economic development (Murphy *et al.* 1989). In view of the importance of nominal rigidities to traditional short-run macroeconomic questions, much future work is likely to focus on models which generate these. Serious questions remain for the dominant menu cost approach, such as whether it is reasonable that for a sufficiently large monetary shock neutrality will prevail. A difficult but potentially rewarding sequel would be to model not the direct administrative costs of price adjustment, but the indirect costs resulting from uncertainty and asymmetric information: some macroeconomic implications of these have begun to be explored by, for example, Andersen and Hviid (1990).

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ACKNOWLEDGEMENTS

We acknowledge the very helpful comments of three referees, and of many seminar and conference participants.

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