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Aggregate demand and firm behavior: a new perspective on Keynesian microfoundations

The defining feature of Keynesian economics is that fluctuations in aggregate demand directly affect aggregate employment and output. This definition is more general than the mainstream neoclassical synthesis view that Keynesian results arise from nominal rigidity.[1] Our thesis is that the best way to understand the macroeconomic implications of aggregate demand is to study how changes in aggregate spending directly alter the environment faced by agents who make production and employment decisions. Simply put, we argue that a reduction in aggregate demand reduces output because firms' ability to sell output declines after aggregate demand falls, and they therefore cut production to serve their own interests. This direct mechanism does not necessarily require nominal rigidity, although a central question that we address is whether the macroeconomic impact of falling prices on aggregate demand can mitigate the impact of negative demand shocks on employment and production decisions.

Our main contribution is to link two ideas that have been analyzed separately in recent research on Keynesian macroeconomics: imperfect competition and the ineffectiveness of nominal deflation in stimulating aggregate demand. First, in a framework of monopolistic competition,

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[1] For recent surveys that address research on nominal rigidity, see Blanchard (1990), Gordon (1990), Zarnowitz (1989), and the essays edited by Mankiw and Romer (1991).

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changes in aggregate spending directly affect the demand conditions of individual firms. This feature is common to most of the literature that ties macroeconomics to imperfect competition (see, for example, Blanchard and Kiyotaki, 1987). Firms set prices optimally at every point in time, given marginal cost, but unemployment exists if aggregate demand is too low. Unemployment may result in wage deflation, inducing firms to reduce prices. This point leads to the second main idea: Lower prices restore full employment only if they stimulate aggregate demand. It is not at all clear that nominal deflation, no matter how fast and deep, is capable of curing the problem of insufficient aggregate demand. In this respect our approach is consistent with Keynes' conclusions in chapter 19 of the *General Theory*, which is almost universally ignored in the neoclassical synthesis interpretation of Keynes.[2] This point distinguishes our approach most sharply from so-called new-Keynesian research on imperfect competition and macroeconomics.

In addition to its substantive contribution, our framework permits comparison among several major approaches to modeling Keynesian microfoundations, including equilibrium models with imperfect competition, new-Keynesian menu cost and sticky output–price models, and traditional neoclassical synthesis models with sticky nominal wages. The framework extracts the macroeconomic essence of these approaches by cutting through technical details. Since our explanation for Keynesian aggregate demand effects does not rely on subtle structural or behavioral assumptions, we believe that it offers a more general foundation for Keynesian results than can be found in the modern mainstream microfoundations literature. Our approach is complementary to other ideas in the literature, however, and does not deny their empirical relevance in certain environments.

We review the microeconomic foundations of production under monopolistic competition in the next section and then use these ideas to characterize macroeconomic general equilibrium. We interpret recent attempts to provide microfoundations for Keynesian macroeconomics in a diagrammatic framework, devoting particular attention to the predicted cyclical variability of real wages and how the predictions fare empirically. When we present our main results, we present a macro model "in the spirit of Keynes." We show how aggregate demand shocks

[2] Also see Davidson (1991, p. 45), who writes: "The Post Keynesians, like Keynes, reject the view that the system is self-righting in the long run." The two main features of our work are closely related to the two "critical propositions" for the existence of effective demand equilibrium discussed by Palley (1996, p. 26).

directly affect firms' output and employment decisions in a way consistent with profit maximization. The results require neither nominal rigidity nor expectation errors. We discuss theoretical and empirical evidence showing that nominal deflation (or disinflation) need not restore aggregate demand to full employment levels. Later we summarize and interpret the paper, identifying several analytical benefits of building Keynesian macroeconomics on imperfectly competitive microfoundations. Limitations of the framework developed here and future research directions are also considered.

Production under monopolistic competition

We study the direct link between aggregate demand and the demand conditions facing individual firms in monopolistically competitive industries, an approach that has been widely used in macroeconomic work on imperfect competition. Layard, Nickell, and Jackman (1991, p. 363) succinctly summarize the advantages of this approach: "The key feature of the economy that is captured by the model we propose is that demand presents itself directly to firms rather than being mediated by an exogenously given price, as under perfect competition."

Is the assumption that firms operate in a monopolistically competitive environment a sufficiently general description of modern economies to provide the foundation for the production side of a macroeconomic model? The widespread existence of imperfect competition is clear empirically, and we believe there is little danger for the purposes of this paper in ignoring the possible existence of a perfectly competitive fringe.[3] A possibly more problematic concern is the neglect of strategic oligopoly issues through the assumption that all firms operate in a simple monopolistically competitive environment. Our approach can be easily generalized by including static (subjective) conjectural variations in the firm's perceived elasticity of its own demand, but this approach may not adequately capture dynamic aspects of strategic oligopoly interactions.[4]

[3] Papers that find imperfect competition and emphasize the macroeconomic implications of this result include Hall (1986), Domowitz, Hubbard, and Petersen (1986), and Chirinko and Fazzari (1994). Hahn and Solow (1995, p. 106) write that "a world with imperfect competition . . . is the natural habitat for the macroeconomics of everyday life." From a Post Keynesian perspective, Davidson (1991, p. 105) writes that modern developed economies have "permanent powerful economic groups" and that "perfect competition is incapable of ever being realized."

[4] See the discussion in Geroski (1988). On the nature of perceived demand, see Negishi (1961, 1987).

Some of the literature discussed below introduces more complex aspects of oligopoly behavior, but these do not change our central macroeconomic conclusions. It is difficult to specify a macroeconomic model that accommodates a general theory of oligopoly behavior because, as Schmalensee (1988, p. 660) makes clear, no such unified oligopoly theory exists.

Specifically, we assume that the firm's demand curve can be represented as

$$(1) \qquad D_j = D_j(P_j / P, AD),\ j = 1, \ldots, M,$$

where D_j is the demand function of firm j; P_j is the price set by firm j; P is the aggregate price level; M is the number of firms in the economy; and AD is real aggregate demand, which is assumed exogenous to the individual firm's price and quantity decisions.[5] Real aggregate demand is the sum of nominal firm demands deflated by the aggregate price level (defined below); it acts as a shift parameter for firm demand curves. The link between AD and firm demand is the key mechanism that transmits fluctuations in aggregate spending to the production and employment decisions of individual firms.[6] Prices of other firms affect the demand of firm j through the aggregate price level $P = g(P_1, P_2, \ldots, P_M)$. The function g is homogeneous of degree one in individual firm prices, has nonnegative partial derivatives, and has the averaging property $g(x, x, \ldots, x) = x$ for any common value of firm prices x. Blanchard and Kiyotaki (1987) present a specific function that satisfies these conditions.

Assume that each firm produces output Y_j with labor input N_j at unit cost w, where w is the same for all firms. The production function f_j implies $Y_j = f_j(N_j)$. Firms choose P_j^*, N_j^*, and Y_j^* to maximize profits. The first-order condition for maximization implies:

$$(2) \qquad w / P_j^* = f'_j(N_j^*)(1 - e_j),$$

where e_j is the firm's conjectural inverse elasticity of demand (e_j equals zero under perfect competition). Optimal price and output also satisfy

[5] Blanchard and Kiyotaki (1987), following Dixit and Stiglitz (1977), demonstrate how such a demand system may arise from individual preferences and utility maximization. Also see the models in Hahn and Solow (1995).

[6] We assume that firm demand is based on actual rather then expected values of aggregate demand and the aggregate price level. In practice, the dynamics of expectations formation are no doubt important, but it is important to note that our results do not depend on expectation errors. Layard, Nickell, and Jackman (1991, ch. 8) analyze a model with such errors.

the demand constraint,

$$Y_j^* = D_j(P_j^* / P^*, AD),$$

where P^* is the aggregate price level evaluated at optimal firm prices.

At the aggregate level, the equilibrium between aggregate supply and demand follows from the equality of demand and supply for each firm. Define real aggregate demand and real aggregate output (Y) as

$$AD = \left(\sum P_j^* D_j\right)/P^*;$$

$$Y = \left(\sum P_j^* Y_j^*\right)/P^*.$$

Summing the micro equilibrium conditions across firms yields:

$$\sum P_j^* Y_j^* = \sum P_j^* D_j(P_j^*/P^*, AD), \tag{3}$$

which implies $AD = AS$. To interpret these equations, think of aggregate output as measured in market baskets of goods corresponding to the weights P_j^*/P^* implicit in the price aggregator function g. The units of the aggregate price level P^* are dollars per unit of aggregate output.

The contribution of the jth firm to aggregate output is

$$(P_j^* Y_j^*)/P^* = (P_j^*/P^*) f_j(N_j^*).$$

Although we do not believe it is essential to our main results, we assume that the technology is common to all firms in the sense that each firm makes the same contribution to Y for a given labor input. Define this common technology as $f(\cdot)$. We impose similar symmetry restrictions on the structure of final demand. All firms face the same conjectural elasticity of demand (independent of the level of output or AD) and, at a relative price of one, demand is equally divided among the M goods produced by the economy. In general macroeconomic equilibrium, therefore, all firms charge the same price, relative prices are unity, and all firms purchase the same amount of labor.[7] Under these assump-

[7] Again, see Blanchard and Kiyotaki (1987) for a model that satisfies these restrictions. We take seriously the criticism of representative agent models (see Kirman, 1992, for example). The key issue, however, for a theoretical treatment is whether the central results depend in an important way on symmetry. The intuition behind our model does not require symmetry, and we believe that the analysis presented below generalizes to a more realistic environment that recognizes firm heterogeneity.

tions, aggregate output can be expressed as a function of aggregate employment N^*:

$$Y = F(N^*). \tag{4}$$

Symmetry allows us to discuss the real wage for the economy as a whole meaningfully and therefore to compare our results with various strands of macroeconomics literature, where this symmetry assumption is almost universally invoked. From equation (2) and symmetry, we have:

$$\begin{aligned} w &= P_j^* f_j'(N_j^*)(1 - e_j); \\ w/P^* &= (P_j^*/P^*) f_j'(N_j^*)(1 - e_j); \\ &= f'(N^*/M)(1 - e). \end{aligned} \tag{5}$$

At the firm level, equation (5) is identical to the treatment of monopoly in Weintraub (1956, p. 66). Our aggregation procedure, however, differs from Weintraub. Since Weintraub is primarily interested in the "wage share" in total income, he aggregates nominal labor income, which does not require strong symmetry assumptions across monopolistically competitive firms. To compare our framework with mainstream literature, however, we require a unique real wage rather than a wage share, and we therefore need to invoke symmetry.

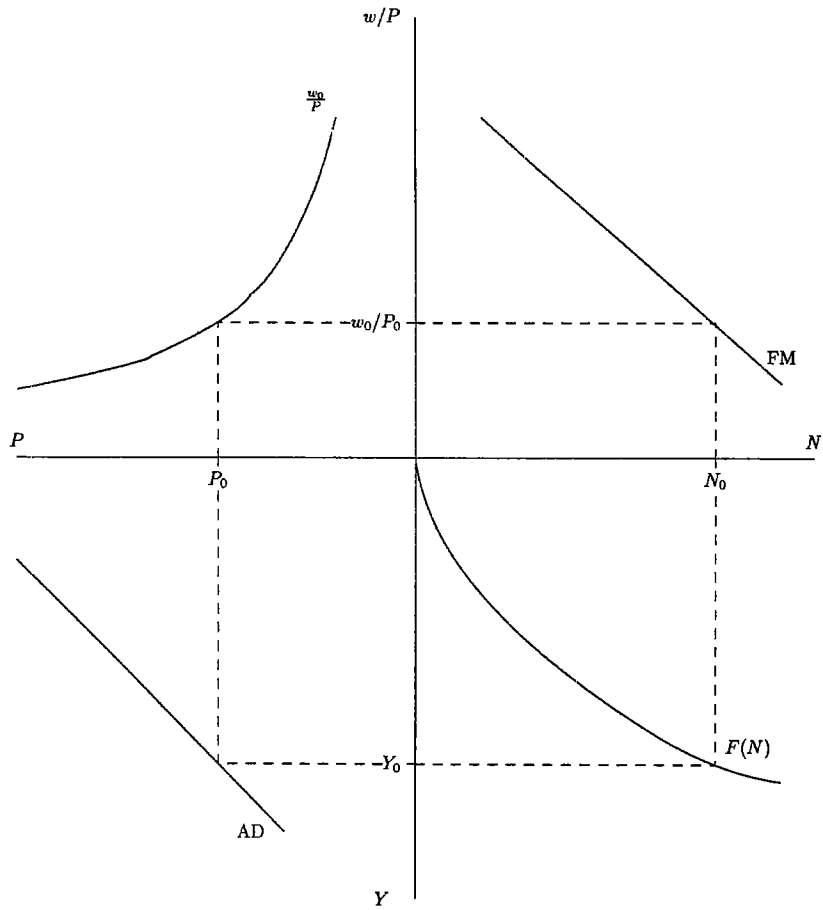
Macroeconomic equilibrium

We now examine the macroeconomic equilibrium links between output, employment, aggregate demand, and the real wage in a simple graphical framework.[8] In the upper right quadrant of figure 1, we graph equation (5) (added horizontally across firms) as the FM curve in real wage-aggregate employment space (FM stands for firm markup, which is inversely related to the real wage). It is the locus of employment and real wage combinations that satisfy the optimal pricing condition. The negative slope of FM follows from $f'' < 0$, on the assumption that the production technology exhibits decreasing returns; we discuss the impact of constant or increasing returns later.

It is important to recognize that FM does not by itself determine the employment choice of firms. Under perfect competition ($e = 0$), FM is

[8] Palley (1996, p. 28) presents similar diagrams.

Figure 1 Macroeconomic equilibrium



the marginal product of labor, which is the standard competitive labor demand curve that reflects all aspects of firm behavior that affect employment. But under perfect competition, firms perceive no limit on demand for their products; their production depends only on technology and the real wage taken as exogenous by each firm.[9] Under imperfect

[9] In Patinkin (1965) and in Barro and Grossman (1971), aggregate demand is assumed to impose a limit on labor demand while still assuming perfect competition. The limit on labor demand has no microfoundation in this literature, however, and requires an arbitrary rationing scheme on firms that otherwise act as if they can sell all they want at the prevailing price level.

competition, the firm's markup (and therefore its real wage) is endogenous, and the FM curve does not embody all the information necessary for the firm to determine employment. To identify the point on the curve at which firms choose to operate, we must also analyze the markets for their output.[10] In other words, what we might call "effective" labor demand in this framework is not a schedule in real wage-employment space but a point on the FM locus. This point is the result of the choice of the level of employment *and price* (given money wages) to maximize profits, subject to the constraint that a firm's supply equals its demand.

With our symmetry assumptions and equilibrium relative prices of unity, the equality of aggregate demand and aggregate supply is sufficient to assure that demand equals supply in each market. Aggregate demand is graphed as a function of price in the third quadrant of figure 1. We begin with the conventional "neoclassical synthesis" assumption that *AD* is a negative function of price. This assumption is critical to the analysis, and an alternative view, consistent with Keynes' *General Theory*, is considered in detail below. The aggregate production function (equation [4]) is graphed in the fourth quadrant of figure 1.[11] For any price level (such as P_0), aggregate demand determines aggregate output and employment. The price level is endogenous, however, and must be consistent with optimal firm behavior as summarized by the FM curve. To show this relationship graphically, we link the real wage in quadrant 1 to the price level in quadrant 3 at a money wage w_0, with the w_0/P curve graphed in the quadrant 2. This curve should be interpreted as determining the price set by firms to maintain their optimal markup, given the money wage. As such, the only parameter of the curve in quadrant 2 is the money wage, and the curve is unaffected by changes in technology or the microeconomic elasticity of demand. The four quadrants of the graph show the general equilibrium values of the

[10] This perspective is similar to Davidson's conclusion, for a competitive model, that the marginal product of labor is "a market equilibrium curve which specifies the real wage outcome associated with any given equilibrium level of employment" (1983, p. 106). Davidson's paper also presents a well-developed critique of the Patinkin-Barro-Grossman attempt to provide microfoundations for Keynesian aggregate demand effects.

[11] The graph in the fourth quadrant of figure 1 may also be interpreted in a way similar to Keynes's or Weintraub's (1956, ch. 2) aggregate supply curve: The graph relates employment offered (N) to expected aggregate demand. The concepts, however, are not identical. Keynes and Weintraub express aggregate supply as a relation between nominal "proceeds" and employment, while we relate demand in physical units (as defined earlier) to the employment offered by firms.

endogenous variables: the price level, the real wage, output, and employment.[12]

Varieties of mainstream macroeconomics

In this section we review mainstream research concerned with the problem of relating fluctuations in aggregate output and employment to fluctuations in aggregate demand, where the latter is taken to be exogenous. We include this material for two reasons. First, it demonstrates the usefulness of the framework summarized in figure 1 by showing that it can depict these other models. Second, we present theoretical and empirical weaknesses of these alternative approaches to justify the new model "in the spirit of Keynes" that we present in the next section. We first discuss equilibrium models and then consider disequilibrium models based on both nominal price and nominal wage rigidity.

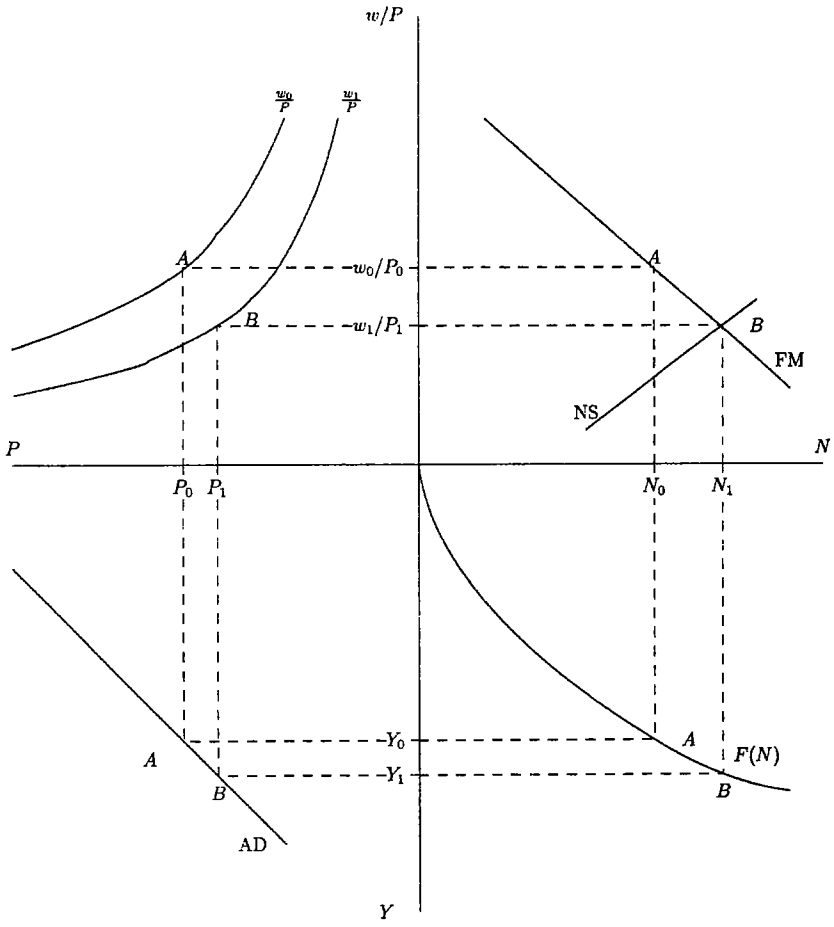
Equilibrium approaches

To study equilibrium models of aggregate fluctuations in the model we must specify the supply of labor, which is denoted by NS and graphed along with the FM curve in figure 2. The NS relation can be interpreted as a conventional competitive supply of labor curve. It could also be the outcome of a more complex model of real-wage setting behavior in a noncompetitive labor market (as in Blanchard and Kiyotaki, 1987, or Lindbeck, 1992), in which case competitive labor supply would lie to the right of NS. The precise definition of NS is not central to our discussion.

On the assumption of flexible wages and prices, consider the conventional solution to the Keynesian problem of insufficient aggregate demand (at points labeled *A* in figure 2). The excess supply of labor, evident in quadrant 1, puts downward pressure on nominal wages, shifting the *w/P* curve in quadrant 2 inward. This shift reflects the fact that lower nominal wages, given technology and microeconomic demand elasticities, induce profit-maximizing firms to reduce prices to maintain the optimal markup. Lower prices increase aggregate demand

[12] We assume that aggregate demand is independent of the real wage. That is, aggregate demand does not depend on the distribution of income. A link between aggregate demand and distribution is central to many macroeconomic theories, particularly that of Kalecki (see Mott, 1992, for discussion and references). We believe that our model could be generalized to allow an endogenous connection between real wages and aggregate demand without changing our main conclusions.

Figure 2 Adjustment to classical full employment



through real balance effects, causing movement along the aggregate demand curve in quadrant 3. Higher aggregate demand raises demand for individual monopolistically competitive firms, which then adjust price, output, and employment to maximize profits. This adjustment continues until the economy reaches a full employment general equilibrium (points *B* in figure 2).[13]

[13] If the NS curve arises from non-neoclassical behavior in the labor market, as in the insider–outsider model surveyed by Lindbeck (1992), an equilibrium such as point *B* may involve involuntary unemployment, but this occurs for the classical reason that

Note that convergence to points *B* requires the aggregate demand "externality" that arises from the effect of lower prices on aggregate demand. Lower wages and prices alone, without any expansion of aggregate demand through real balance effects, would leave the real wage unchanged, and employment would remain at point *A* in the first quadrant of figure 2.

If the nominal adjustment process that restores full employment takes place quickly, the most interesting macroeconomic questions are answered by looking only at the right-hand side of figure 2. Employment and output are completely determined by the technology and preference relationships summarized by the curves in quadrants 1 and 4. Aggregate demand is irrelevant for all but nominal variables. Say's Law holds because price adjustment automatically and quickly offsets any potential aggregate demand constraints. The model does not exhibit Keynesian features.[14]

How can such conclusions be reconciled with the belief that aggregate demand fluctuations affect output? Models of the "real business cycle" variety, of course, reach the conclusion that the problem lies with the Keynesian perspective on aggregate demand and that macroeconomic fluctuations should be explained from the "supply side." Another response is the mainstream Keynesian assumption of nominal rigidity, which we explore below. But other approaches explain effects of aggregate demand on output and employment while maintaining full equilibrium assumptions.

One of these approaches assumes that shocks to aggregate demand affect the FM curve. Under perfect competition, such effects are excluded because the FM curve is completely determined by technology. But with imperfect competition, aggregate demand could matter for the level of employment by causing movements in the conjectural inverse

special bargaining conditions or rigid real wages in the labor market keep the real wage above the classical market-clearing level. In addition, as pointed out by a referee, the assumption of a constant elasticity of microeconomic demand curves, independent of the level of *AD*, implies that the FM curve does not shift when *AD* changes from point *A* to point *B*. Keynes (1936, p. 245) also assumes that the "degree of competition" is constant as aggregate demand shifts. Kalecki and Harrod assumed that competitiveness varied with the business cycle. We consider the case of nonconstant demand elasticities below.

[14] Results of this kind lead Blanchard and Kiyotaki (1987) to conclude that monopolistic competition on its own cannot be responsible for Keynesian macroeconomic results. Similar conclusions are drawn by Weitzman (1985). Somewhat different results on this point are presented by Ng (1995).

elasticity of demand. Suppose, for example, that a reduction of aggregate demand causes an increase in the inverse elasticity e; that is, falling demand causes firms to behave less competitively. In that case, negative demand shocks push the FM locus down, the equilibrium given by point B in figure 2 moves down and to the left, and output and employment fall. This aggregate demand effect is indirect: The change in output is not directly the result of lower demand. Rather, lower aggregate demand changes micro-level demand elasticities, lowers real wages, and reduces employment and output by pushing the system down the NS curve.

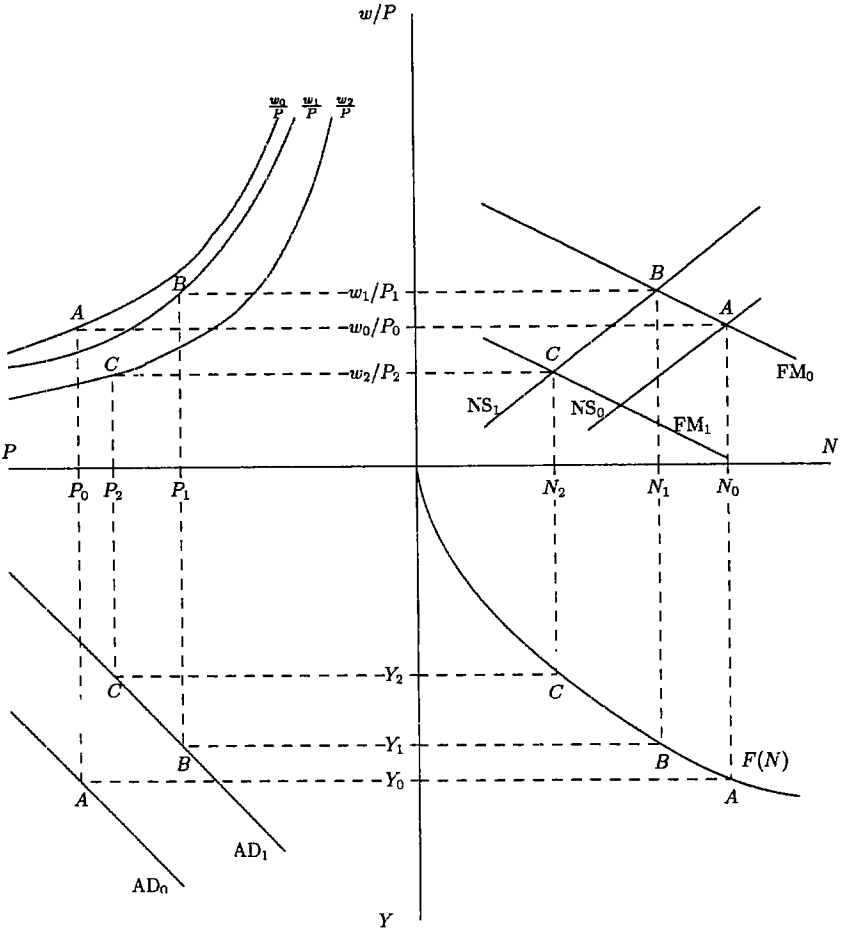
The difficulty with this approach is justifying the assumed countercyclical movement of the conjectural inverse demand elasticity both theoretically and empirically. Rotemberg and Woodford (1991, p. 74) point out that the demand elasticity *might* change over the business cycle (or with movements in aggregate demand) if preferences are nonhomothetic, but they write that "[t]here is little *a priori* reason to expect either direction of deviation from homotheticity," so that the FM curve is as likely to shift upward as to shift downward when aggregate demand declines.[15]

To shore up the microfoundations for this kind of theory, Rotemberg and Woodford (1993) construct a model in which changing expectations of future profits generate countercyclical movements in markups. Their approach illustrates how real business cycle ideas and imperfect competition work together to provide an explanation for demand-induced economic fluctuations. Suppose that a reduction of real aggregate demand causes real interest rates to decline and labor supply to fall through an intertemporal substitution channel.[16] This effect alone will cause output and employment to change in an equilibrium model (from A to B in figure 3). There are, however, at least two problems with this explanation for the correlation of output and real aggregate demand. First, if the intertemporal elasticity of labor supply is very small, the movement from A to B cannot explain substantial cyclical fluctuations

[15] A referee points out that the impact of non-constant demand elasticities is relevant not only to exogenous aggregate demand shocks, but also to endogenous movements along the aggregate demand curve due to changes in the price level (see quadrant 3 of figure 2). If micro demand curves are not iso-elastic, the FM curve cannot be determined independently of the level of aggregate demand. But, again, a departure from the assumption of iso-elastic micro demand curves is *a priori* as likely to induce a countercyclical link between aggregate demand and employment as it is to create a procyclical link.

[16] See Davidson (1983, p. 115) for a critique of the relevance of intertemporal substitution in explaining Keynesian unemployment.

Figure 3 Implicit collusion



in employment. Second, between A and B the real wage moves countercyclically, contrary to the results of most empirical studies.

To address these problems, Rotemberg and Woodford (1993) propose endogenous countercyclical movement of the markup. This movement arises from competitors' strategic interest in maintaining implicit collusion. In a slump, current profits are low relative to expected future profits. The incentive for individual firms to cheat on the implicit collusion therefore falls: The gain from cheating is higher current profits, which are low in a downturn, while the penalty from cheating is

the loss of future monopoly profits, which are high relative to current profits in a recession. Equilibrium markups, therefore, can rise in a slump without inducing individual firms to cheat on an implicit collusion agreement. This change shifts the FM curve inward when output and employment fall, leading to an equilibrium like the one indicated by points C in figure 3. The markup shift magnifies the output and employment changes beyond what can be explained by intertemporal substitution. If the FM curve shifts enough, the model also predicts procyclical movements of real wages (A to C in the first quadrant of figure 3). A symmetrical analysis explains a boom in output and employment induced by positive aggregate demand shifts.

In contrast to the implicit collusion model, however, one can imagine circumstances in which markups move procyclically. Suppose that competitive pressures intensify in a downturn when markets are tight and customers' search efforts increase, making conjectural demand curves flatter.[17] In this case, movements of the FM curve dampen fluctuations generated by intertemporal substitution effects, and the equilibrium model would have an even more difficult time explaining interesting macroeconomic fluctuations. Whether the strength and direction of markup movements are important influences on macro fluctuations is an empirical question. Bils (1987) and Rotemberg and Woodford (1991) find evidence of countercyclical markups. Others (see Domowitz, Hubbard, and Petersen, 1986, and Chirinko and Fazzari, 1994, for example) find acyclical or pro-cyclical markups. Countercyclical markups may be important for some industries, but Lindbeck (1992, p. 224) concludes that "the generality, quantitative importance, and permanence of [markup variations] may be somewhat doubtful" as general explanations for macroeconomic output and employment movements.

Menu costs and nominal price rigidity

At least since the work of Modigliani (1944), the Keynesian theory of the effects of aggregate demand on output has been widely viewed in mainstream macroeconomics as equivalent to the theory of nominal rigidity. Most "new-Keynesian" models of imperfect competition have

[17] Steindl (1950) identifies another barrier to countercyclical markups in mature economies. Mott (1992, pp. 119–120) summarizes the argument: "price competition . . . is only useful where it is possible to drive out marginal producers. . . . Mark-ups become downwardly inflexible because firms with large amounts of fixed capital will be able to fight too strongly in a price war to make it worth anyone's while to engage in such a strategy."

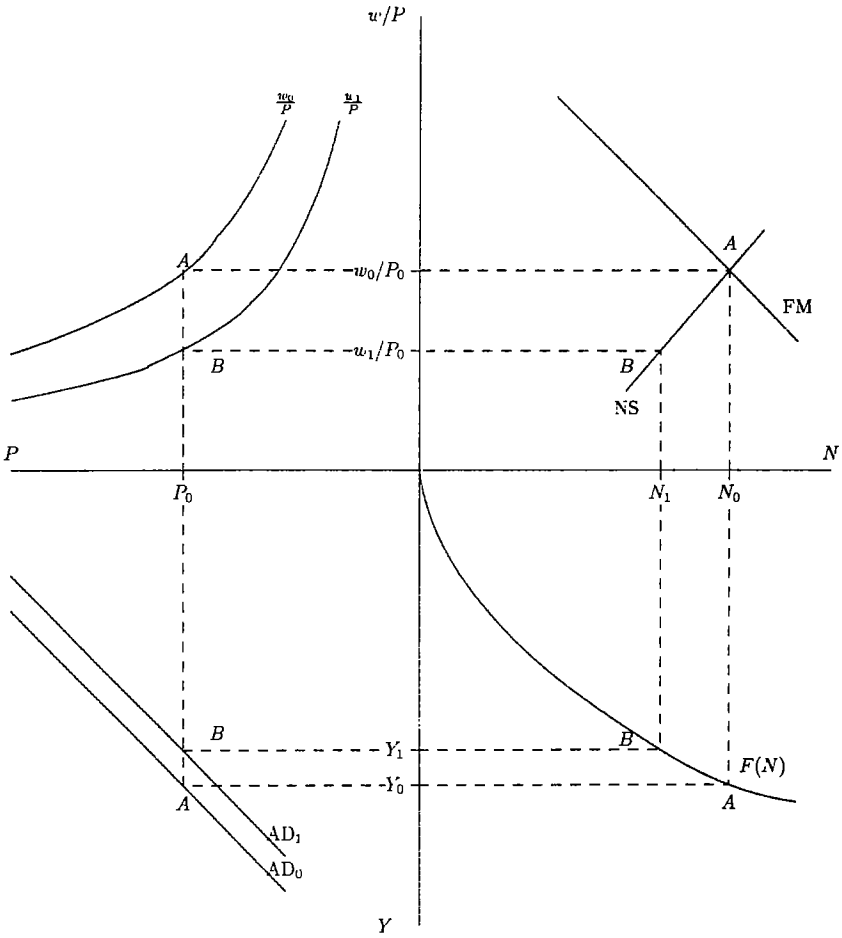
focused on the microfoundations and macro implications of sticky output prices. Sticky prices may arise for two reasons: Firms may fail to maximize profits (probably temporarily) and set a price that is inconsistent with equation (5), or the price-setting problem may be more complex than our simple model recognizes, causing firms to deviate optimally from equation (5). In either case, sticky prices in our framework are depicted by operation of the economy off the FM curve; that is, firms do not continuously set prices consistent with the markup behavior summarized by equation (5). The effect of a negative demand shock in a model with rigid prices is shown in figure 4. Lower AD reduces output, employment, and the real wage.[18]

The challenge for sticky price models is to explain why it is optimal for firms to keep prices constant when their demand falls. Mankiw (1985) and Blanchard and Kiyotaki (1987) justify such behavior by assuming that firms face fixed "menu costs" of adjusting nominal prices. If aggregate demand falls, the cost of adjusting prices may exceed the gain from adjustment. For a range of demand shocks it is therefore optimal for firms to allow the markup to deviate from the FM curve. The standard nominal deflation process that restores aggregate demand to the classical benchmark (point A in figure 4) does not operate unless the shock is of sufficient size to induce firms to incur the costs of price adjustment. The key question for the relevance of such models is the range of demand shocks that can occur without inducing price adjustment. Because of imperfect competition, Mankiw (1985) and Blanchard and Kiyotaki (1987) argue that even small menu costs of price adjustment could lead to large output fluctuations. Ball, Mankiw, and Romer (1988) offer empirical support for the implications of the menu-cost model.

Woodford (1991) pursues a different approach, but one that is logically linked to the menu-cost literature. He assumes that the optimal markup is not unique as a function of employment (as we have assumed in constructing the FM locus). Rather, optimal markups lie in an interval for any given level of output because firms face "kinked" demand curves and marginal revenue is discontinuous. Woodford assumes that prices remain rigid as long as demand shocks do not push markups outside the optimal range. Demand changes can result in real output and employ-

[18] The money wage need not fall all the way to point B in the first and second quadrants of figure 4. If it does not, some involuntary unemployment will exist. We address nominal wage rigidity below.

Figure 4 Sticky prices



ment fluctuations of the kind depicted in figure 4. The question again arises, however, whether kinked demand curves are sufficiently widespread to provide a general explanation of Keynesian macro effects. Indeed, as Woodford (1991, p. 79) states, the key test is to cross-check the assumptions of the model against micro studies of firm behavior.[19]

In summary, price stickiness can logically explain effects of aggregate demand shocks on output and employment. Recent work has shored up microeconomic explanations for why prices might be sticky. Empirical

[19] Two recent studies of this kind are Blinder (1991) and Kashyap (1995).

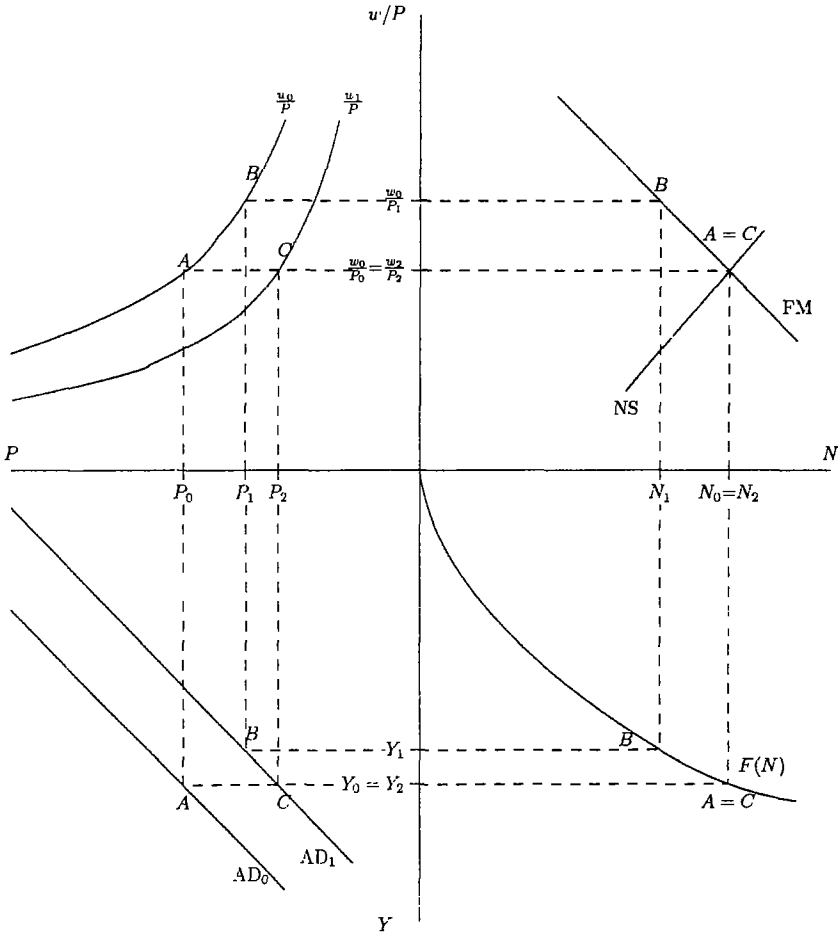
evidence on price adjustment, however, has been criticized as inconsistent with menu-cost models, and a number of theoretical objections have been raised to this approach, even by economists who view Keynesian macroeconomics favorably. Gordon (1990, pp. 1146–1147) surveys problems with menu-cost models and gives references to other literature. We find compelling Gordon's point that firms' costs of output adjustment are likely to be at least as large as the costs of price adjustment.

Wage contracts and nominal rigidity

In contrast to the new-Keynesian emphasis on price stickiness, much of the earlier mainstream Keynesian literature was based on the rigidity of nominal wages. This approach can be analyzed in our framework as follows: Suppose aggregate demand falls and nominal wages are sticky. If firms continue to set prices optimally, the economy will move to an equilibrium like the one depicted by B in figure 5. Optimal markup behavior keeps the economy on the FM locus, but rigid nominal wages force the system off the labor supply curve. The result is involuntary unemployment, which is almost always presented as a short-run state. Unemployment will eventually put downward pressure on money wages, and optimal markup behavior will then induce firms to cut nominal prices. In the standard mainstream framework, lower nominal prices stimulate aggregate demand (a strong assumption to which we return in the next section), and the economy returns, in the long run, to points C in figure 5. Demand shocks have real effects in short-run disequilibrium states when nominal wages are sticky, but not in a long-run flexible wage equilibrium.

Such models are not much discussed in recent research for at least two reasons. First, there is a widespread view that sticky nominal wages lack adequate microfoundations. Most attempts to explain wage rigidity (implicit risk-sharing contracts and efficiency wage theory without nominal adjustment costs, for example) lead to real, not nominal, rigidity. Rigid real wages may cause unemployment, but the existence of rigid real wages alone does not explain why aggregate demand shocks have real effects on output and employment. There are less formal microfoundations for sticky nominal wages, such as the relative wage model of Taylor (1980), which has been recently emphasized by Tobin (1993). Sticky nominal wages can also arise from such misperception models as that of Friedman (1968) and those developed in the new-classical

Figure 5 Sticky nominal wages



macroeconomics. Although the literature has not reached a consensus on the reasons for sticky nominal wages, sticky wage microfoundations appear at least as strong as those for sticky prices emphasized by the new-Keynesian research.[20]

The second reason why these models were largely abandoned is that

[20] Gordon (1990) reaches similar conclusions. Explicit wage contracts without "COLAs" exist (consider academic salaries), but these contracts themselves require explanation. Akerlof and Yellen (1985) use new-Keynesian efficiency wage ideas to motivate nominal wage stickiness.

sticky wage models based on perfectly competitive microfoundations imply countercyclical real wages (as Keynes assumed in the *General Theory*). The empirical failure of this prediction led to the rejection of wage contract models of the neoclassical synthesis variety and contributed to the downfall of the new-classical "nominal misperception" approach. Real business-cycle models claimed empirical support from studies that found procyclical real wages. In a competitive framework, this requires that employment fluctuations arise from shifts of the demand for labor curve (technology shocks) rather than from movements along the labor demand curve due to sticky nominal wages. New Keynesians took up this challenge by searching for models that allowed aggregate demand effects on real output without requiring countercyclical real wages, leading them to emphasize price rather than wage stickiness (see figure 4).

If one accepts imperfectly competitive microfoundations for production and employment decisions, however, countercyclical real wage movement need not arise from sticky wage models of aggregate demand fluctuations. If the marginal product of labor and the markup are constants, then the FM locus in figure 5 would be horizontal. A negative aggregate demand shift would cause output and employment to fall, even though firms' optimal pricing policies would imply no change in the real wage. Note that the assumption of theoretical price flexibility need not conflict with findings of substantial empirical price rigidity as in Carlton (1986). If the markup and the marginal productivity of labor are constant, nominal prices remain rigid when there are demand shocks because of nominal wage rigidity. In these circumstances, firms are free to adjust prices, but they optimally choose not to do so. The imperfectly competitive model can accommodate some degree of declining marginal costs (as long as they fall more slowly than marginal revenue), suggesting that the FM locus could be upward-sloping and demand shocks would cause procyclical real wages.[21] Similar real wage patterns could result from a systematic fluctuation in the conjectural elasticity of demand or the implicit collusion model. One of the strongest empirical criticisms of mainstream Keynesian business cycle theory in the neoclassical synthesis—the absence of countercyclical real wages—is thus

[21] Weitzman (1982) argues that some degree of increasing returns is essential to explaining involuntary unemployment. Chirinko and Fazzari (1994) find that returns to scale vary from approximately constant to strongly increasing across eleven manufacturing industries. Ramey (1991) finds evidence of decreasing *marginal* costs.

vitiated in a macro model with microfoundations in monopolistic competition (see Ball, Mankiw, and Romer, 1988, pp. 13–16).

A model in the spirit of Keynes

We are not convinced that the mechanisms linking aggregate demand to production and employment discussed in the preceding section are sufficiently widespread or of an adequate empirical magnitude to provide a general account of the macroeconomic impact of aggregate demand fluctuations. In this section we present an explanation for Keynesian aggregate demand effects that we believe is simpler, more general, and more direct than those offered in the research surveyed above.

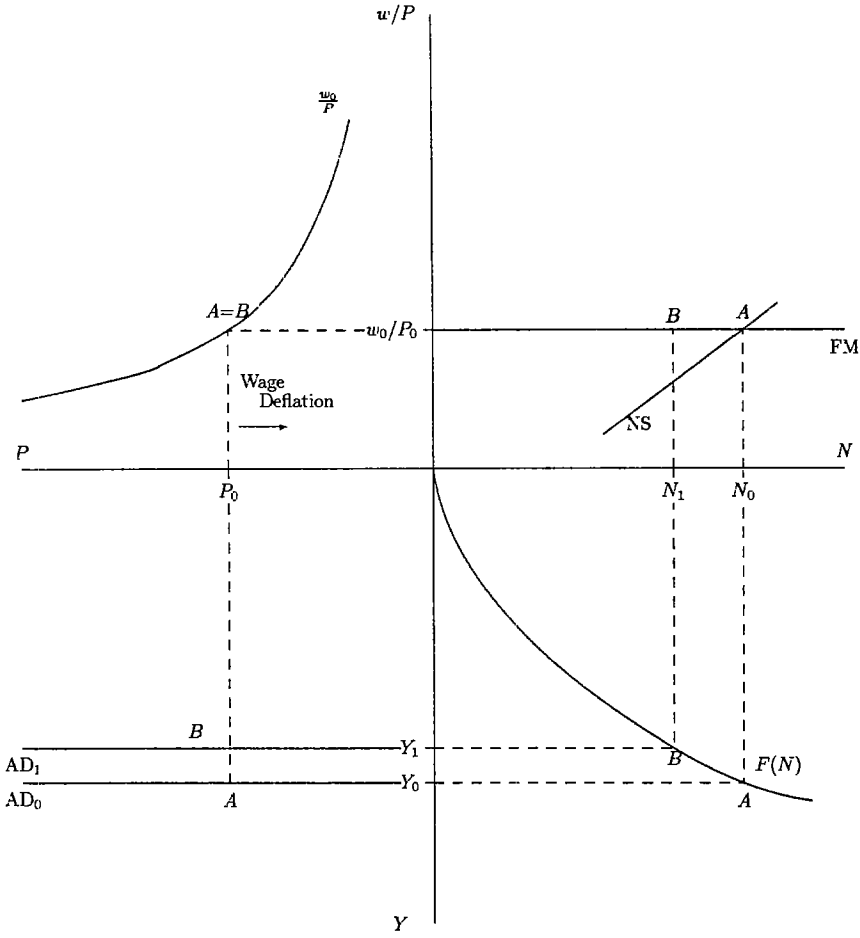
Production, demand, and wages

We return to the model presented earlier in which firms set prices, choose production levels, and decide how many workers to hire in a monopolistically competitive environment. The constraints on firms' choices arise from their technology, demand curves, and input costs (nominal wages in our model). Profit maximization under these conditions implies that the price-cost markup is set according to equation (5) and that firms operate on the FM locus (in contrast to models with sticky prices). If aggregate demand falls, demand curves shift inward, and firms choose to hire fewer workers and produce less output. The process is well described by Davidson (1991, p. 67): "drying up of sales revenue signals managers that they are in danger of incurring further large pecuniary losses if they continue to produce at current levels. Hence self-interest dictates that managers respond to any aggregate fall-off in demand by firing workers" (or allowing employment to decline through attrition without replacement).

To make the results consistent with evidence suggesting acyclical behavior of the real wage, we also assume that firm markups and marginal costs are independent of the level of employment, leading to a horizontal FM locus as depicted in the first quadrant of figure 6.[22] Reduced aggregate demand causes the economy to move from A to B. Because firms continue to operate on the FM curve, their pricing and

[22] That is, we assume a constant elasticity of demand and constant returns to labor in the technology. These assumptions are not essential for our results. Also see Davidson (1983, note 2).

Figure 6 Demand shocks in a Keynesian model



employment decisions are optimal. (We discuss the horizontal AD curve below.)

The movement from A to B in the first quadrant of figure 6 and the resulting unemployment are similar to the effects of sticky wages shown in figure 5. What can workers do *directly* about the real wage and the problem of unemployment? The answer is nothing. The unemployed may offer to work for lower nominal wages, and the firms may accept these offers. But if nominal prices are flexible, optimizing firms will cut prices in proportion to any fall in nominal wages, preventing the real

wage from declining, as Keynes suggested in the early chapters of the *General Theory* (see also Kregel, 1988; Tobin, 1993; and Palley, 1996, ch. 4). It follows that analysis at the micro level cannot by itself explain how the economy might be dislodged from *B* in figure 5, nor can it offer a cure for the involuntary unemployment associated with this point.

Macroeconomic effects of deflation: the slope of aggregate demand

Although falling wages cannot directly increase employment, there may be an *indirect* benefit of nominal wage declines and the corresponding fall in prices if these changes lead to macroeconomic effects that stimulate aggregate demand. This is, of course, the standard assumption in mainstream macroeconomics. But Keynes rejected this assumption in chapter 19 of the *General Theory*, and we believe his reasoning was and is valid.

Generalized deflation solves the problem of unemployment if and only if deflation increases aggregate demand. In the imperfectly competitive model, we have demonstrated that inward shifts in demand curves due to reductions in aggregate demand drive employment below the classical level, possibly without any change in the real wage; real wages might even be lower in an unemployment state than at full employment (if FM slopes upward). A "distorted" real wage does not cause unemployment in this example. Unemployment occurs because aggregate demand is not high enough, and deflation can solve the problem only if it stimulates aggregate demand. This point is central to understanding Keynesian macroeconomics, but it has not received the attention it deserves, probably because of the nearly universal and mostly unquestioned assumption that aggregate demand curves slope downward in price-output space.[23]

Mainstream macroeconomic models assume that deflation increases aggregate demand because falling prices with a fixed nominal money stock raise real balances. While Keynes recognized the benefits for demand from higher real money balances, he thought they would be more than offset by static and dynamic effects of falling prices that would depress demand in the aggregate.[24] Perhaps the most important

[23] The results here can be generalized to apply to disinflation, as well as deflation. for an economy that begins with a positive rate of inflation. See Tobin (1975), Caskey and Fazzari (1987), and DeLong and Summers (1986).

[24] This is not the place to go into a detailed discussion of Keynes' arguments in chapter 19. Recent literature on this point contains further exposition of Keynes's original ideas. See, in particular, Kregel (1988), Greenwald and Stiglitz (1993), and Tobin (1993).

of these destabilizing effects of deflation in modern economies is the redistribution of wealth and income from debtors to creditors if debt contracts are set in nominal terms. Almost by definition, debtors have higher propensities to spend than creditors. The redistribution of real wealth caused by deflation therefore lowers aggregate demand, as emphasized by Tobin (1975, 1993) and Palley (1996), and deflation lowers the value of collateral relative to nominal debt commitments.[25] The impact of deflation on credit also has a flow dimension. Lower nominal incomes reduce real cash flows relative to real debt service commitments, increasing the possibility of insolvency. These "debt-deflation" effects are likely to lead to tighter credit conditions and lower aggregate demand.[26] By incorporating debt-deflation effects into a conventional IS-LM-Phillips curve model, Caskey and Fazzari (1987) show that greater price flexibility can reduce output following negative demand shocks. In addition, as argued by DeLong and Summers (1986) and Hahn and Solow (1995), actual deflation leads to anticipated deflation if expectations are "rational" or "adaptive." In the absence of perfect Fisher effects on nominal interest rates, faster deflation can raise expected real interest rates, dampen expenditure, and prevent the standard stabilizing impact of lower prices on aggregate demand.

Against these destabilizing effects stand the real balance (Pigou) effect and the fall in nominal interest rates caused by higher real money balances (ironically, in the light of chapter 19 of the *General Theory*, often called the "Keynes effect"). How strong are these channels empirically? In spite of the crucial importance of this question for macroeconomics, very little has been done to provide an answer. Caskey and Fazzari (1992) construct a small dynamic macroeconomic model, calibrated to parameters from various empirical studies of the U.S. economy, to explore the role of price flexibility on output. They find that output losses due to negative demand shocks are not much affected by the responsiveness of the inflation rate to the state of output and employment, even if the destabilizing effects of falling prices or disin-

[25] In recognizing the importance of the distinction between debtors and creditors, we are, of course, rejecting the representative-agent approach on the demand side of the economy.

[26] The term "debt-deflation" originated with Irving Fisher (1933). Minsky (1975, 1982) emphasizes the central role of finance in the determination of aggregate demand. Much of the growing theoretical and empirical literature on liquidity constraints and capital market imperfections implies that financial conditions can constrain aggregate demand. See Caskey and Fazzari (1987) for references.

flation are excluded from the simulation. In particular, Caskey and Fazzari simulate the effect of a negative demand shock in a model that contains a Phillips curve equation that estimates the empirical responsiveness of inflation to output gaps. They find that the cumulative output loss ten quarters after the shock in this empirically estimated model is only 0.65 percent less than the output loss from a simulation model in which the inflation rate is completely unresponsive to output and employment gaps. The small stabilizing effect of disinflation in this model results from the Keynes and Pigou effects alone, using parameter values that are favorable to the size of their stabilizing influences.[27] When Caskey and Fazzari (1992) allow only a subset of the destabilizing influences mentioned above to operate at their estimated strength, the destabilizing effects of lower inflation dominate the standard stabilizing channels, and faster inflation responses to output gaps *magnify* the output loss from demand shocks.[28]

This striking influence of disinflation on aggregate demand does not arise because the destabilizing effects are exceptionally strong empirically. Rather, it is better explained by the very weak empirical basis for the standard stabilizing channels. Of course, the Pigou real wealth effect was never taken very seriously as an important empirical feature of modern economies. The propensity to consume out of real wealth is small, and outside financial assets are a small fraction of aggregate wealth.[29] The empirically measured impact of the Keynes effect, however, is also weak. There is no clear evidence that lower real interest rates stimulate consumption at all, which questions the relevance of the Keynes effect for two-thirds of aggregate demand. Recent estimates

[27] These results come from a model in which the nominal stock of money is exogenous. Post Keynesians such as Moore (1988) and Wray (1990) argue, however, that the money supply is endogenous. If the money supply is procyclical because lending conditions deteriorate as production and employment decline, the impact of the Keynes effect will be even smaller.

[28] Keating and Nye (1998) report results that are relevant to this debate. In a structural vector autoregression study, they show that permanent shocks to output behave like aggregate demand shocks for a sample of several pre–World War II economies. For the postwar sample, however, permanent shocks behave like aggregate supply shocks.

[29] Greenwald and Stiglitz (1993, p. 36) write "[t]he enormous attention that the real balance effect has received over the years hardly speaks well for the profession. Quantitatively, it is surely an nth order effect, one calculation put it that, even at the fastest rate at which prices fell in the Great Depression, it would take more than two centuries to restore the economy to full employment, and in the short run even its sign is ambiguous."

reported in Fazzari (1994–95) imply that a 200-basis-point decline in real interest rates would raise business fixed investment by only about 0.2 percent of aggregate demand over a five-year horizon. Housing investment may be more interest-responsive, but it was only 4.1 percent of U.S. aggregate demand in 1996. We must also be concerned with slips in the term structure of interest rates that may prevent reductions in short-term rates, induced by liquidity effects, from translating into changes in the interest rates that matter for long-term investment and housing expenditure.

We conclude that, as a first approximation, the aggregate demand curve in the third quadrant of figure 6 should be horizontal.[30] That is, a change in the nominal price level by itself has no net impact on aggregate spending. This crucial issue requires more research, and results are likely to differ across time periods and countries. But we find no empirical basis for the nearly universal assumption that lower prices stimulate spending.[31] Recently, other authors have reached similar conclusions (see, for example, Howitt, 1986; DeLong and Summers, 1986; Greenwald and Stiglitz, 1993; Tobin, 1993). If lower prices or reduced inflation have any effect on aggregate demand, they seem to reduce it, as Keynes concluded nearly a half-century ago.

Keynesian unemployment

Upon joining the assumptions of imperfectly competitive markets and a flat *AD* curve, we may find the economy in a situation like the one depicted by point *B* in figure 6. Firms rationally perceive that their individual demand conditions do not justify fully employing all the workers who want to work at the real wage that firms set optimally. Firms have no desire to change prices or output at *B*; this point is an

[30] Note that the axes in the third quadrant of figure 6 (as well as in the other figures) are reversed compared with the standard textbook aggregate demand diagram: The price level is on the horizontal axis and output is on the vertical axis. The horizontal aggregate demand curve in this space therefore corresponds to a vertical aggregate demand curve in the conventional textbook diagram.

[31] An important factor ignored in our discussion and in most of the cited literature is the impact of lower prices on international trade. This effect may, in the absence of offsetting exchange-rate movements, induce a negative relation between the aggregate price level and aggregate demand. Of course, no such effect can operate in the world economy as a whole, where demand gained by one country through real exchange rate changes is demand lost by another. This issue also deserves more research attention. Also see Fazzari (1994–95).

equilibrium from the firms' point of view despite the presence of unemployment. Optimal behavior by monopolistically competitive firms causes output to conform to expected and actual aggregate demand. Unemployment can induce nominal wage deflation, and firms respond to such deflation by cutting prices to maintain the optimal real wage. But no important macroeconomic consequences arise from the deflation. Nominal deflation induced by unemployment cannot raise aggregate demand and will not affect output or employment.

The unemployment at B need not therefore be viewed as the result of sticky wages. The problem facing the economy is the insufficient aggregate demand that directly causes low demands for individual firms, which reduces their incentives to produce. This problem cannot be overcome by falling wages and prices when AD is insensitive to price. Thus, unemployment is persistent, even when nominal variables are fully flexible. Moreover, because of imperfect competition, there is no need for real wages to move countercyclically as employment fluctuates in response to demand shocks. Real wages may move acyclically or even procyclically.

It might seem that the pressure to reduce nominal wages due to unemployment (and, therefore, prices in our model) would result in an implosion of nominal values, which is not observed. The possibility of unemployment equilibrium without persistently declining nominal wages may be justified by a model of wage setting in which changes in wage rates depend on changes in the level of unemployment rather than the level of unemployment. We offer a sketch of such a model in the context of Lindbeck and Snower's (1988) "insider–outsider" model. Assume that insiders resist attempts to cut nominal wages relative to expected prices in the absence of any credible threat to their own employment. Unless employed workers see a threat to their own jobs, they will use their insider position to punish the firm if it violates what Lindbeck (1992) calls the "twelfth commandment" to firms: They must not accept offers of unemployed workers to underbid the wages of existing employees. It is also assumed that workers bargain for nominal wages without perceiving a direct link between the nominal wage they accept and the expected price level of goods they buy. In this environment, nominal wages can fall relative to expected prices only when firms can credibly signal that workers have something to gain from accepting lower wages. Since the most credible signal is an actual decline in employment, nominal wages may fall relative to expected prices only

when actual employment decreases.[32] It is the change in unemployment, not its level, that makes it possible for firms to negotiate lower nominal wages. If this is the case, our model need not result in a wage-price "implosion" when employment is below the classical level. We believe this topic deserves more attention in future research.

Concluding remarks

By linking an imperfectly competitive model of production and employment to aggregate demand that is insensitive to price changes, we have shown how weakness in aggregate demand can cause persistent weakness in macroeconomic activity. Lower aggregate spending feeds directly into lower expected and actual demand for monopolistically competitive firms. These shifts in demand induce firms to reduce production and employment and, in general, to change prices. Unemployment increases, but reductions in nominal wage rates do not restore full employment, directly or indirectly. Firms' optimal pricing behavior transforms lower nominal wages into lower prices, keeping real wages constant for a given level of aggregate demand and thereby eliminating any direct effect of nominal wages on employment. The standard assumption that lower nominal prices stimulate aggregate demand—and therefore that wage declines indirectly raise employment through macroeconomic channels—neither has strong theoretical justification nor appears to have any empirical basis in recent research. In this environment Keynesian aggregate demand effects arise and persist even in the absence of nominal rigidity. These effects do not rely on subtle cyclical changes in demand elasticities or competitive structures, nor do they require expectation errors. Such changes and errors may exist and they may influence macroeconomic outcomes, but, on the basis of theory and empirical evidence, we do not believe that they are the primary reasons why the economy responds to changes in aggregate demand.

In most respects, this approach to understanding the macroeconomic impact of aggregate demand changes follows the analysis in the *General Theory*. There are, however, at least three advantages of the imperfect competition framework compared with the perfect-competition assumption of Keynes (and most of the Keynesian literature up to 1980). First, real wages need not move countercyclically when output movements

[32] A symmetrical argument need not apply for nominal wage increases, because there is no factor corresponding to the penalty imposed by insiders when wages increase.

arise from demand shocks. Indeed, as the special case of a horizontal FM locus in figure 6 illustrates, real effects from a negative aggregate demand shock need not result in any change of the real wage relative to its full employment level.

Second, the link between costs and prices is the explicit result of optimizing behavior by firms. In contrast, perfectly competitive models leave unresolved Arrow's (1959) question of "whose job it is to set prices." This approach also validates Keynes' claims about the inability of workers to lower real wages by accepting reduced nominal wages in the face of unemployment.

Third, and in our view most important, imperfect competition makes clear how changes in aggregate expenditure affect the demand conditions, and therefore the production decisions, of individual firms. Under perfect competition, firms act as if they can sell all they want at the prevailing price. Changes in macro aggregate demand, by assumption, can have no direct impact on the quantity demanded as perceived by competitive firms at the microeconomic level. That is why, after Keynes, attempts to provide microfoundations for changes in aggregate supply as the result of demand fluctuations relied on the indirect link between aggregate demand and distortions of the real wage due to nominal rigidity.[33] In contrast, imperfectly competitive firms recognize that they cannot sell all they want without changing their price, and it is natural to link changes in demand curves at the micro level to changes in the aggregate level of demand. In a monopolistically competitive environment, reduced output can be explained as the *direct* result of firm responses to an aggregate demand shock without requiring a change in the real wage.[34]

While these points indicate progress, we recognize that our analysis is incomplete. In particular, a complete model must also deal with the issue of excess demand. Generalizing the model to handle excess demand might be accomplished by introducing asymmetries into the response of aggregate demand to price changes. Inflationary pressures may choke

[33] Alternatively, some papers have motivated cyclical unemployment by changes in competitive firms' demand uncertainty. See Balvers and Miller (1992) for discussion and further references.

[34] From a Post Keynesian perspective, it is also interesting to note that imperfect competition may play a stabilizing role in the economy because, as argued by Shapiro (1997), imperfect competition provides market stability that helps support investment. The volatility of prices in perfect competition may create uncertainty that reduces investment and aggregate demand.

off excess demand at full employment, at least when inflation rises substantially, although disinflation does little to stimulate demand. In addition, more work is needed to understand the dynamics of nominal wages in an environment in which deflation or disinflation fails to eliminate unemployment. We leave development of these ideas to future research.

Finally, the model only begins to capture the wide-ranging insights associated with Keynesian and Post Keynesian macroeconomics. The model illustrates something that Keynes understood more than half a century ago but that has been largely forgotten in much recent mainstream macroeconomic research—the dominant role played by aggregate demand in the direct determination of output and employment. With this point established, research must explore the short-run and long-run dynamic determinants of aggregate demand. Keynes' own writing and much of the research of the Post Keynesian paradigm address these questions. While recognizing the limited scope of the model presented here, we believe our approach can contribute to resolving the state of affairs identified by Davidson (1991, p. 43): "To a neoclassicist, the Post Keynesians have no theoretical structure to replace neoclassical analysis. To a Post Keynesian, the theoretical structure of the neoclassical scholars is based on inapplicable axioms and cannot solve real-world problems."

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