Seminar Paper No. 259

DISEQUILIBRIUM ANALYSIS IN OPEN ECONOMIES:
A ONE-SECTOR FRAMEWORK

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This paper will be Chapter 3 of J.T. Cuddington, P.O. Johansson, and K.G. Lofgren, Disequilibrium Macroeconomics in Open Economies (forthcoming, Basil Blackwell, 1984).

Seminar Papers are preliminary material circulated to stimulate discussion and critical comment.

August, 1983

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3.1: Introduction.

Chapter 2 surveyed the extensive literature on closed-economy macro models with quantity rationing. Much of this literature assumes a single production sector. The present chapter lays the groundwork for the two-sector open-economy models used in the rest of the book by considering a single-sector model of the open economy. Using this framework, a number of key aspects of fix-price models can be discussed. Furthermore, the uninitiated reader should find the model more easily digestible than the two-sector models to follow. Several simple policy analyses will be used to illustrate the usefulness of even the simple one-sector model.

The model is similar to that in Dixit [1978] but emphasizes the intertemporal aspects of the household's choice problem, as Muellbauer and Portes (1978) did in the closed-economy context. It is the intertemporal view of the household's decision problem that we want to emphasize here as providing the underlying justification for the analysis in the remainder of the text. Hence it is elaborated upon in Section 3.5 by turning to an explicit two-period set-up. In so doing, we hope to convince the reader that a utility function containing only current consumption, labor supply, and end-of-first-period wealth (or money balances if money is the only asset) can be used if interpreted appropriately. Doing so has the advantage of enabling us to make use of most
previous works on fix-price trade models which, although they use such a utility function, are uniformly sketchy regarding intertemporal considerations.

3.2: The Dixit Model

The simplest open-economy, temporary-equilibrium model with quantity rationing is that of Dixit [1978]. In his set-up, there is a single good which the "small country" under consideration can buy or sell without limit at the fixed foreign-currency price $p^*$. Given a fixed exchange rate $e$ and assuring the law of one price holds, the domestic-currency price is also fixed: $p = ep^*$. The good is assured to be perishable (implying no inventory holding) and there is no capital investment.

It is important to determine why prices are fixed before presuming that the fix-price framework with quantity rationing is appropriate. By the "small country" assumption we mean that the foreign net supply curve is perfectly elastic at price $p^*$. Hence quantity rationing never occurs in the goods market even though it is in some sense a "fix-price" market from the small country's point of view. This specification of the goods market serves to make the one-sector open-economy model described in Dixit considerably simpler than its closed-economy counterparts. In particular, Keynesian unemployment—caused by a deficiency of demand for domestic output—can never arise.

In addition to the goods market, Dixit's model contains a labor market and a money market. Only in the former is rationing a possibility. The central bank buys or sells domestic money so as to continually
equate money supply and money demand at the official or target exchange rate (without exchange controls or other quantitative restrictions). Money is the only private store of wealth; the private sector of the domestic economy holds no foreign money balances.

Within this environment firms maximize profits given the fixed wage \( w \) and the price of the tradeable good, which equals the exchange rate \( e \) after normalizing so that \( p^e = 1 \). The first-order conditions for profit maximization give rise to the usual unconstrained or notional labor demand function:

\[
(3.1) \quad L = L(w,e), \quad \frac{\partial L}{\partial w} < 0, \quad \frac{\partial L}{\partial e} > 0.
\]

Inserting (3.1) into the production function, where labor is the sole variable factor, yields notional output supply:

\[
(3.2) \quad Y = Y(w,e), \quad \frac{\partial Y}{\partial w} < 0, \quad \frac{\partial Y}{\partial e} > 0.
\]

If labor supply \( L^s \) falls short of the firms' demand for labor at \( (w,e) \), however, firms will face a quantity constraint \( \bar{L} = L^s < L^d(w,e) \) on the labor market. Output then falls short of the profit maximizing level. The firm's effective output supply \( \hat{Y} \), which recognizes the constraint on labor availability, equals:

\[
(3.3) \quad \hat{Y} = \hat{Y}(\bar{L}) < Y(w,e), \quad \frac{\partial \hat{Y}}{\partial \bar{L}} > 0.
\]

Equation (3.3) is found by inverting the production function. Throughout the chapter, bars over variables indicate quantity constraints. A
hat (\(^\wedge\) ) over a variable indicates a constrained or effective supply/demand in one market given the constraint the agent faces on a second market.

Households are assumed to maximize utility:

\[
U(D, L, M') = \pi_o + M - T
\]

s.t. \( eD + M' = wL \)

where \( D, L, M \) are consumption of goods, labor supply \((\partial U / \partial L < 0)\), and desired money holdings. \( M \) is initial money balances; \( \pi_o \) is distribution of last period's profits and hence is predetermined in the current decision period. \( T \) equals the lump-sum tax levied on households.

Several aspects of Dixit's specification are worth pointing out because they are typical in the literature. First, there is the (admittedly rather arbitrary) assumption that all labor income is received by households in the current period but profit income is not distributed until the beginning of the subsequent period.\(^1\) This, of course, implies that the marginal propensity to save out of current-period profits is unity. Consequently any policy change that affects income distribution alters national saving. In the open-economy context this assumption may have (unintended) implications for the current account of the balance of payments, which according to the well-known accounting

\(^1\) Below we consider the alternative assumption that current-period profits are distributed in the current period rather than in the subsequent period. The careful reader will notice that it is not the point in time when profits are distributed that is important. Rather the issue is whether expected profit income has any effect on current expenditure decisions, even though the income may be received at the beginning or the end of the period.
identity is just equal to the difference between national saving and domestic investment. As we shall emphasize below, explicit treatment of the intertemporal nature of household's saving-consumption decision is important for a clear understanding of the current account.

Second, money is the only asset in virtually all fix-price quantity rationing models. There are two possible justifications for including money balances in the utility function. The first is that money yields utility directly by providing some monetary services that eliminate the inefficiencies of barter. Presumably it is real money balances that are important here, where "real" is defined in terms of current prices of consumption goods. The utility function need involve no intertemporal considerations.

A preferable interpretation for our purposes is that the utility function including money balances is a mixed direct-indirect utility function. Underlying it is a multi-period optimization problem, but future consumption and leisure choice variables have been eliminated by the recursive substitution technique familiar from dynamic programming. In this case money balances are a store of wealth that reflects a desire for future consumption. Whether the store of wealth is "money" or some nonmonetary asset is immaterial.

Future consumption, of course, depends on future prices, which are buried in the dynamic programming procedure. To emphasize the dependence of utility on expectations about future prices (as well as future quantity constraints) Muellbauer and Portes (1978) include the parameter $\theta$ in the utility function. Other authors deflate money
balances by the current price of goods in the utility function, as was done in Chapter 2. This amount to implicitly assuring that future prices are always equal to current prices. All price changes would then have to be interpreted as permanent rather than temporary changes. The intertemporal framework will be explored more systematically in Section 3.5 and 3.6 below.

The usual first-order conditions for the utility maximization problem in (3.4) — where there are no quantity constraints — yield the notional commodity demand, labor supply, and "money" demand functions:

\[
\begin{align*}
(3.5) \quad D &= D(\bar{e}, \bar{w}, \bar{M} + \pi_o - T) \\
(3.6) \quad L^S &= L^S(\bar{e}, \bar{w}, \bar{M} + \pi_o - T) \\
(3.7) \quad M &= M(e, w, M + \pi_o - T).
\end{align*}
\]

The standard assumptions regarding the partial derivatives in (3.5) and (3.6) have been noted. The signs of the partials in the end-of-period money demand function are often left unspecified, and with good reason. From the budget constraint, we see that nominal money demand must equal:

\[
(3.8) \quad M'(e, w, M + \pi_o - T) = wL^S(e, w, M + \pi_o - T) + M + \pi_o - T - eD(e, w, M + \pi_o - T).
\]

Given the assured signs of the partial derivatives in (3.5) and (3.6), it can be seen from (3.8) that the partials in (3.7) are uncertain a priori.
It should be emphasized that the commodity demand and labor supply functions (3.5) and (3.6) need not be homogeneous of degree zero in the nominal variables. This depends on the interpretation of money in the utility function. If the utility function contains real money balances in terms of current output and if current and future prices are always equal, then (3.5) and (3.6) are indeed homogeneous of degree zero and can be rewritten:

\[(3.9) \quad D = D\left(\frac{w}{e}, \frac{m + \pi_o - T}{\pi_o - T}\right)\]

\[(3.10) \quad L^S = L^S\left(\frac{w}{e}, \frac{m + \pi_o - T}{\pi_o - T}\right).\]

Comparing (3.6) and (3.10) it is clear that the negative real wage effect of a change in the price of goods on labor supply must overpower the positive effect of the fall in real balances in order to be compatible with the gross substitution assumption that \(\partial L^S/\partial e < 0\) in (3.6).

If the utility function is parameterized, at least implicitly, on unchanged future prices, however, the behavioral functions in (3.5) and (3.6) are homogeneous of degree in \((e, w, M + \pi_o)\) and future prices. In this case the specification in (3.9) and (3.10) is potentially misleading because it ignores the relative price of future consumption in terms of current consumption.

By writing the behavioral functions in extensive form as in (3.5)-(3.7) we leave open either of the above interpretations about price and wage changes. In the absence of an explicit intertemporal framework, it
is often unclear whether existing fix-price analyses have in mind permanent or temporary effects in their comparative static exercises. We return to this problem in Section 3.6 after laying out a two-period consumer choice framework in Section 3.5.

When there is unemployment so that households face a quantity constraint on the labor market, they maximize utility in (3.4) subject to the budget constraint plus the employment constraint: \( \bar{L} < L^g \). The resulting effective demand for goods and money take the form:

\[
(3.11) \quad \hat{D} = D(e, w, M + \pi_o - T, \bar{L})
\]

\[
(3.12) \quad \hat{M} = M(e, w, M + \pi_o - T, \bar{L})
\]

The sign of the partial derivative \( \partial \hat{D} / \partial \bar{L} \) depends on two factors. The first is the positive income effect of the rise in employment (at the prevailing wage). The second factor depends on the complementarity or substitutability between labor/leisure and consumption. If leisure and consumption are substitutes, for example, an increase in the employment constraint \( \bar{L} \), which reduces leisure, raises the utility of goods. This shifts the demand for goods upwards at prevailing prices and wages. Hence both influences contribute to \( \partial \hat{D} / \partial \bar{L} \) being positive when leisure and consumption are substitutes. In the event that they are complements, the sign of \( \partial \hat{D} / \partial \bar{L} \) would be ambiguous. However, it is generally assured in the literature that \( \partial \hat{D} / \partial \bar{L} \) is positive, implying that the income effect must dominate in the complements case.\(^2\)
The partial derivatives of the effective money demand function in (3.12), like those for the notional demand function in (3.7), are uncertain a priori.

3.3: Short-Run Fix-Price Equilibria

A small open economy by definition faces a perfectly elastic world demand for its output and neither domestic firms nor households face rationing in the goods market. Short-run wage rigidity can nevertheless lead to labor market disequilibrium. Two disequilibrium regimes are possible: Classical unemployment and repressed inflation.

A. Classical Unemployment

In the first disequilibrium regime, the wage rate is sticky at a level which given the fixed exchange rate and the level of the domestic money supply results in an excess supply of labor:

\[ \bar{L} = L^d(w, e) < L^s(e, w, M + \pi_o - T). \]

This situation, in which households face an employment constraint \( \bar{L} \), is known as classical unemployment. It is caused by excessive real wages rather than the deficiency of aggregate demand for output that characterizes Keynesian unemployment. Of course, the latter type of unemployment can not arise in the Dixit model due to its "small open economy" assumption.

\[2/ \] The effects of quantity constraints on consumer and firm behavior are discussed in detail in Appendix A.
Given labor demand in (3.13), national output is given by (3.2). Domestic demand for goods, of course, is affected by the presence of unemployment. Households' consumption demand, given their labor market constraint $\hat{L}$, is the effective demand shown in (3.11).

The difference between domestic output and domestic demand (by both the private and public sectors) is the country's balance of trade:

\begin{equation}
BT = Y(w, e) - \hat{D}(e, w, M + \pi_o - T, \hat{L}) - G
\end{equation}

where $\hat{L}$ is defined by (3.13).

B. Repressed Inflation

The second disequilibrium regime that can arise in the simple Dixit model is similar to Malinvaud's repressed inflation case. There is an excess demand for labor, as the real wage is fixed below the Walrasian equilibrium level. Firms, therefore, face a constraint $\tilde{L}$ on their labor demand:

\begin{equation}
\tilde{L} = L^s(e, w, M + \pi_o - T) < L^d(e, w).
\end{equation}

Unlike Malinvaud's closed-economy version where there is also excess demand for goods, the goods market clears in the small open-economy context. It might, therefore, be more accurate to call this case repressed wage inflation, but we retain Malinvaud's label to emphasize the similarity of policy analyses in the closed and open-economy versions of the repressed inflation regime.
Given the employment level in (3.15), national output equals the labor-supply-constrained level in (3.3). Household demand for goods equals the notional demand in (3.5), because they are unconstrained in the labor market. Consequently, the balance of trade equals:

\[
(3.16) \quad BT = \hat{Y}(\bar{L}) - D(e, \pi, M + \pi_t - T) - g
\]

where $\bar{L}$ is defined by (3.15).

3.3.1: Aggregate Demand Management in Small Open Economies

It should be clear with a little reflection that "expansionary" government spending financed by money creation has no stimulative short-run effect on the level of employment or output in the present small open-economy context. When world demand for domestic output is perfectly elastic at the prevailing world price, domestic output is determined by the short-run level of employment rather than the level of aggregate demand. Employment, in turn, depends on the prevailing level of wages relative to world prices and also, in the repressed inflation case, on the level of money balances and taxes through their effect on labor supply. Policies aimed at affecting domestic output, therefore, must focus on the domestic labor market.

A. Classical Unemployment

In the classical unemployment case, the level of employment (3.13) is determined by the profit-maximizing decisions of firms. Hence employment can only be increased by policies that, one way or another, reduce the real product wage. Reducing wages or raising the domestic-
currency price of output (by devaluing the domestic currency, for example) are two possible methods. These policies are considered in the following Section. Other "supply-side" policies designed to shift the short-run production function through increased capital investment or technological innovation might also be effective in combating classical unemployment in the intermediate, if not the short, run.

B. Repressed Inflation

Under repressed inflation, employment (3.15) is limited by labor supply rather than demand. Changes in income taxation might be designed to increase labor supply, thereby increasing national output. Again the efficacy of these policies depends on their labor market or "supply-side" effects, not their aggregate demand management aspects.

The foregoing discussion brings out an important point. In small open economies, policy makers should not underestimate the potential of supply-side policies aimed directly at increasing employment as an alternative to textbook prescriptions, which focus on monetary and fiscal policies designed to stimulate aggregate demand.\(^3\) As we will see in Chapter 4, the latter policies do become more potent in open economies with significant sheltered or nontraded-goods sectors.\(^4\) But in that context, the policies' sectoral resource allocation effects must

\(^3\)Casual empiricism suggests that policy makers in the small open economies of Western Europe are not unaware of the efficacy of the types of employment policies alluded to here.

\(^4\)Similar conclusions are also obtained in the exportables-importables model in Chapter 6 where there is a less than perfectly elastic export demand curve.
also be taken into consideration. We defer further discussion of aggregate demand management policies until the tradeables-nontradeables model is introduced in Chapter 4.

3.3.2: Wage Policy

In situations of labor market disequilibrium due to wage stickiness, it is sometimes possible to institute policies (e.g. employment taxes or subsidies on firms or households' labor income, depending on the disequilibrium regime) that can alter wages — particularly in an upwards direction — more quickly than they would adjust without policy inducement. Analyzing the effect of policy-induced wage increases on domestic output and employment is straightforward using the analytical framework developed above. In the presence of classical unemployment (CU), wage increases reduce firms' profit-maximizing level of output, thereby worsening unemployment. Under repressed inflation (RI), in contrast, allowing wages to rise will increase labor supply (given our gross substitutability assumption). This reduces the labor shortage being experienced by producers thereby leading to an increase in domestic output. Thus it is critical for policy makers to know the state of the labor market if wage policy is to have the desired effects on output and employment.

The differing output effects of wage increases in the CU and RI cases suggest that trade balance effects may also depend critically on the type of disequilibrium being experienced in the labor market. Under classical unemployment, the trade balance effect of a wage increase is found by differentiating (3.14):
\[
\frac{dBT}{dw} = \frac{\partial Y}{\partial w} - \frac{\partial D}{\partial w} - \frac{\partial D}{\partial L} \frac{dL}{dw} < 0
\]

where \( \frac{dL}{dw} < 0 \) from (3.13). The wage increase reduces output and has several effects on consumption demand. The first effect of the wage increase is to cause households to substitute away from leisure towards consumption. This, of course, is not possible if households' demand for less leisure (implying greater labor supply) can not be effected.

Consequently, \( \frac{\partial D}{\partial w} \) in (3.17) involves no substitution component, only a positive income effect, in the case where households are rationed in the labor market. The second effect of a wage increase on consumption demand is the labor income effect due to the increased severity of labor market rationing on households as employment falls, reflecting an upwards movement along the firm's labor demand curve. Whether total labor income rises or falls, therefore, depends on the wage elasticity of producers' labor demand. The net effect of an increase in \( w \) on consumption demand, therefore, depends on whether total labor income goes up or down. Hence the short-run effect on the trade balance is indeterminate under classical unemployment.\(^5\)

Under repressed inflation, the trade balance effect of a rise in domestic wages is found using (3.16):

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\(^5\)This result depends critically on the usual assumption in the literature that profit income is not distributed to households in the current period. If both wage and profit income were distributed to households in the current period, the wage increase would cause domestic demand to fall, but by a smaller proportion than the reduction in national income. Hence the trade balance would unambiguously deteriorate.
\[ (3.18) \quad \frac{dB_T}{dw} = \frac{\partial Y}{\partial L} \frac{dL}{dw} - \frac{\partial D}{\partial w} \geq 0 \]

where \( \frac{\partial L}{\partial w} > 0 \) from (3.15). Again the trade balance effect is indeterminate. Although domestic demand unambiguously rises in this case (in contrast to classical unemployment), output also rises as the labor shortage facing firms is reduced. Whether the supply or demand change dominates is unclear \textit{a priori}.

3.3.3: Exchange Rate Policy

Countries often elect to devalue their currencies in order to alter domestic employment or the balance of trade. Unfortunately, the payments equilibriums or "external balance") are not always simultaneously attainable using exchange rate policy alone. Furthermore, the policy’s effects depend on the initial state of the economy.

A. Classical Unemployment

If the economy is suffering from classical unemployment, exchange rate depreciation reduces the real wage (assuming no change or at least a less-than-proportional change in nominal wages due to indexation, say). Hence total employment and national output rise. (See (3.1) and (3.2)). Domestic demand for output, on the other hand, may rise or fall with the rise in \( e \) due to the opposing influences of the negative substitution effect and the positive employment effect. Therefore the real trade balance may improve or deteriorate following a devaluation:

\[ (3.19) \quad \frac{dB_T}{de} = \frac{\partial Y}{\partial e} \frac{\hat{e}}{\partial e} - \frac{\partial D}{\partial e} - \frac{\partial D}{\partial L} \frac{dL}{de} > 0. \]

\[ (+) \quad (-) \quad + \quad + \]
B. Repressed Inflation

Under repressed inflation, devaluation reduces employment in (3.15). Consequently, domestic output falls, in contrast to the classical unemployment case:

\[
\frac{dY}{de} = \frac{d\hat{Y}}{de} \frac{dL}{de} < 0.
\]

This fall in output and the negative effect of the devaluation on demand work in opposite directions. Therefore, the effect of devaluation under repressed inflation is uncertain, although not because of an uncertain effect on domestic demand (as was the case under classical unemployment):

\[
\frac{dBT}{de} = \frac{d\hat{Y}}{de} - \frac{3D}{3e} \geq 0.
\]

It is clear from the foregoing analysis that policymakers must determine the nature of labor market disequilibrium (i.e., classical unemployment or repressed wage inflation) before the direction of output changes following devaluation can be predicted. Under either disequilibrium regime, the balance of trade effect is uncertain. Hence policymakers require detailed estimates of various supply and demand elasticities before the impact of devaluation on the trade balance can be ascertained.

This completes our policy analysis based on the single-sector disequilibrium model described up to this point. Although the model has limitations (e.g., it precludes the possibility of Keynesian unemployment), it nevertheless provides some useful insights about the
efficacy of fiscal, wage, and exchange rate policies in open economies. These insights carry over to the more complex, two-sector disequilibrium analysis in Part II of this book. The present model, however, has the advantage of being more manageable while bringing out important analytical issues in open-economy disequilibrium theory. The remainder of this chapter is devoted to some of these issues, most notably the fundamentally intertemporal nature of household behavior and current account imbalances. First, however, the international adjustment process is briefly discussed.

3.4: Short-Run Walrasian Equilibrium and the International Adjustment Process

Short-run Walrasian equilibrium in the open economy occurs when the nominal wage rate \( w \) is allowed to adjust (relative to the fixed domestic-currency price of output \( e \) and predetermined \( M + \pi_o - T \)) so as to achieve full employment. That is, \( w \) must equate notional labor demand in (3.1) to notional labor supply (3.6):

\[
L(\bar{w}, \bar{e}) = L^g(\bar{e}, \bar{w}, \bar{M} + \pi_o - T).
\]

The locus of wage rate-money supply combinations consistent with full employment at the fixed exchange rate is shown as the FE locus in Figure 3.1. Full-employment output then follows immediately from (3.22) by plugging equilibrium labor demand into the production function in (3.2).

The balance of trade is determined by taking the difference between domestic output and total domestic demand for goods at the equilibrium wage (determined by (3.22)):

\[
BT = Y(\bar{w}, \bar{e}) - D(\bar{e}, \bar{w}, \bar{M} + \pi_o - T) - G
\]
where $G$ equals government demand for goods. Here BT has been defined in units of real output or, what amounts to the same thing as long as the foreign-currency price $p^*$ and the exchange rate $e$ are fixed, units of foreign exchange.

Equation (3.23) shows that the excess domestic supply of output, which can be sold at the prevailing world (given the small country assumption), is mirrored in the trade balance.

In the short run, nothing insures that the trade balance is zero even if the wage adjusts immediately to the Walrasian equilibrium level. In other words, while wage flexibility achieves "internal balance", to use James Meade's terminology, "external balance" need not be attained in the short run.

Over time, however, external balance is ultimately restored. Trade surpluses imply an inflow of foreign exchange over time, which the private sector converts into domestic money at the fixed exchange rate offered by the central bank. (Conversely, trade deficits imply foreign reserve outflows and concomitant contractions in the domestic money supply.) Thus a gradual adjustment of the domestic money supply occurs whenever there is a trade imbalance. As the money supply expands (contracts), domestic expenditure rises (falls) until it eventually equals domestic income so that external balance is achieved. The decrease in the labor supply (as $M$ rises) reduces output, which also contributes to the adjustment. This international adjustment process whereby a steady state with external equilibrium is ultimately attained

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6/ This government expenditure can be assured to be tax-financed, in which case $eG = T$. Money finance would, of course, affect the adjustment path of the economy over time.
is well-known from Hume's discussions of the so-called price-specie-flow mechanism. More recently the international adjustment process has been emphasized in writings on the monetary approach to the balance of payments.

In order to properly describe adjustment towards the steady state, it is necessary to recognize that although profits (or expected profits) might be considered predetermined at a given moment in time, they adjust endogenously over time. Current-period profits equal:

\[(3.24) \quad \pi(w,e) = eY(w,e) - wL(w,e).\]

For the study of adjustment dynamics it simplifies matters somewhat to assume that profits are distributed to households in the current period. Thus the short-run labor market equilibrium in (3.22) should be reinterpreted with \(\pi\) endogenously determined via (3.24). Similarly, the profit function is substituted into the expression for the trade balance in (3.23).

In the present model, the steady state achieved by endogenous adjustment in the domestic money supply \(M\) is defined by a trade balance equal to zero:

\[(3.25) \quad BT = Y(w, e) - D(e, w, M + \pi - T) - G = 0\]

\[\text{As mentioned above, in subsequent chapters we adopt the specification current-period profits are distributed immediately, not next period. Of course this distinction disappears if the dynamic analysis is conducted in continuous rather than discrete time.}\]
where profits are defined by (3.24). Equation (3.25) indicates the locus of \((w, M)\) combinations consistent with long-run equilibrium in the economy. It is easy to see that wage increases must be accompanied by decreases in money holdings if the trade balance is to be kept in equilibrium. In other words the \(BT = 0\) locus in downward sloping in Figure 3.1. To confirm this, totally differentiate (3.25) to find the slope:

\[
\frac{dw}{dM} = -\frac{3D}{\partial X} \left[ \frac{3D}{\partial W} - \frac{\partial Y}{\partial W} - \frac{3D}{\partial X} \frac{\partial X}{\partial W} \right]^{-1} < 0
\]
Figure 3.1
The International Adjustment Process
and note that $\frac{\partial Y}{\partial w}$ is larger in absolute value than $\frac{\partial \pi}{\partial w}$ (from (3.24)).

Given an arbitrary initial money stock $M$, the economy's short-run equilibrium wage rate is determined from the full employment (FE) locus in Figure 3.1. If this point $(w, M)$ on the FE locus is to the left of the long-run equilibrium locus where $BT = 0$, the country has a trade surplus. Consequently its money supply will grow gradually as the international adjustment process moves the economy along the FE locus towards its steady state. Wages necessarily rise to maintain labor market equilibrium as the money supply increases due to the trade surplus. Similarly, if the short-run equilibrium involves a trade deficit, the economy is at a point on the FE locus to the right of $BT = 0$. Hence wages must fall over time, thereby improving international competitiveness, as the money supply gradually shrinks to bring about external balance.

Using the full-employment model just described, it would be possible to examine the effects of various government policies aimed at either raising the full-employment level of output or altering the speed with which external payments imbalances are eliminated. For the most part, however, real-world policy decisions must recognize the existence (or potential, at least) for short-run wage stickiness as in Section 3.3, rather than assuming that wages adjust freely and continuously to clear the labor market. It would be desirable, therefore, to carry out an analysis of the international adjustment process in the presence of wage stickiness. Although there are a number of published papers on fix-price disequilibrium dynamics in the closed-economy context (see Appendix B), the important task of extending this work to open economies
has not yet (to our knowledge) been undertaken. Yet it is obviously important for a thorough understanding of the international adjustment process.

The existing closed-economy literature on adjustment dynamics in fix-price (dis)equilibrium models as well as the Walrasian model of the adjustment process in the present section are all based on an extremely myopic behavioral specification. It treats successive temporary equilibria as completely unrelated. In particular, the behavioral functions—(3.5) to (3.7)—in the present model—depend only on current prices and wages even though these variables may be adjusting over time towards their steady-state levels as shown in Figure 3.1. Even if agents lack perfect foresight, they presumably have some idea of the direction of change for wages (say, in the present context) or, more generally, wages and prices. The demand for goods as well as the supply of labor should depend not only on current wages and prices but also on their expected future values. It would seem most satisfactory to do this in an explicitly intertemporal framework that recognizes the interdependence between successive temporary equilibria and the importance of expectations generating processes. Although we do not attempt such a dynamic analysis here, the intertemporal model developed below should bring out the temporal interdependence that is inherent, although greatly underemphasized, in existing treatments of macroeconomic disequilibrium theory. Microeconomic discussions of disequilibrium theory, however, place greater emphasis on the sequential nature of temporary equilibria (see, e.g., Grandmont, 1977).
3.5: An Intertemporal View of Household Behavior

It is becoming clear as a result of recent research in macroeconomics that much can be learned by explicitly formulating the intertemporal aspects of households' consumption decisions, as well as the capital investment decisions of firms. Such a framework is necessary for an understanding of the permanent income hypothesis and for the comparison of temporary as opposed to permanent economic shocks or policy changes, just to give two examples. Much of the recent microtheoretic work on the current account of the balance of payments is also exploiting the intertemporal decisions that underlie the current account. (See, e.g. Svensson and Razin (1983)). Recall that, according to a well-known accounting identity, the current account just equals the difference between domestic saving and investment. Both saving and investment decisions are inherently intertemporal in nature.

A thorough understanding of open-economy models with quantity-rationing and macroeconomic disequilibrium is greatly facilitated by an intertemporal interpretation of the household choice problem. Although we have not undertaken the ambitious task of using an explicit intertemporal framework throughout the book, much of it can be re-interpreted using such a framework. To help the reader to appreciate the usefulness of the intertemporal approach, we will briefly explore its implications for household decision making.

Consider a household that consumes a single good and supplies labor in each of two periods. It can save income earned in period 1 for future consumption by purchasing bonds that yield a market-determined interest rate $r$ and have a single-period maturity date. We assume this asset provides no monetary services per se and hence does not enter the
direct utility function. Hence it will not be referred to as "money," thereby avoiding the existing confusion between money and nonmonetary assets in the fix-price literature. In Chapter 5, the analysis will be extended by forcing households to hold money for transactions purposes, while bonds continue to function as a store of value for future consumption. This enables previous work on macroeconomic quantity-rationing models to be extended to include the asset choice problem.\(^8\)

In the absence of quantity constraints in the current period as well as expected constraints in the future,\(^2\) households maximize the utility function:

\[
U(D, L, D', L')
\]

subject to the intertemporal constraints:

\[
eD + \left(\frac{e'}{1+r}\right)D' = \omega L + \pi + W - T + \frac{1}{1+r} [\omega' L' + \pi' - T']
\]

where primes ('') on variables indicate second-period values. \(\pi\) and \(\pi'\) are first and second-period profits. \(W\) is beginning-of-first-period wealth. \(T\) and \(T'\) are lump-sum taxes. Both borrowing and lending are allowed at the prevailing interest rate \(r\).

Once the possibility of borrowing or lending at the prevailing interest rate is introduced, the issue of whether profits are distributed in the period in which they are generated or in the

\(^8\)Recent work by Persson (1982) pursues a similar approach.

\(^2\)For an analysis of the effects of expected future constraints, see Muellbauer-Portes (1978), Neary-Stiglitz (1983), and Persson-Svensson (1983).
subsequent period becomes less important. It only affects the prices that are appropriate in defining profits. In what follows it will be assured that all current income (labor and profit) is distributed within the current period. This specification avoids the unintended income distribution effects alluded to in Section 3.2 above.

Maximizing (3.27) subject to the intertemporal budget constraint (3.28) yields notional commodity demand and labor supply functions for the first period of the following form:

\[
D = D(e, w, \frac{e'}{1+r}, \frac{w'}{1+r}, I)
\]

\[
L = L(e, w, \frac{e'}{1+r}, \frac{w'}{1+r}, I)
\]

where I is the present value of non-labor income less taxes, plus initial financial wealth. Equations (3.29) and (3.30) differ from those commonly used in the fix-price literature in that: (1) the intertemporal nature of the household choice problem is made explicit by including future prices \((e', w')\) and the interest rate \(r\) in addition to current prices \((e, w)\), and (2) the functions include the present-value of current and future-period profit income in addition to initial financial asset holdings.\(^ {10}\)

The following assumptions are made regarding the partial derivatives of the notional commodity demand and labor supply functions in (3.29) and (3.30):\(^ {10}\)

\(^ {10}\)Furthermore it should be noted that the behavioral relations in (3.29) and (3.30) are homogeneous of degree zero in prices and the initial level of nominal wealth. Recall our discussion regarding the (non)homogeneity of (3.5) and (3.6) above.
(3.31) \[ \frac{\partial D}{\partial e} < 0, \frac{\partial D}{\partial \omega} > 0, \frac{\partial D}{\partial e_t} > 0, \frac{\partial D}{\partial \omega_t} > 0, \frac{\partial D}{\partial \Omega} < 0, \]

(3.32) \[ \frac{\partial L}{\partial e} < 0, \frac{\partial L}{\partial \omega} > 0, \frac{\partial L}{\partial e_t} < 0, \frac{\partial L}{\partial \omega_t} < 0, \frac{\partial L}{\partial \Omega} < 0. \]

These assumptions are obtained by assuring that present and future consumption and leisure are all gross substitutes. \(^{11/}\)

Next consider the situation where the household faces a current-period employment constraint \((L < L^S)\) but expects to be unrationed in all subsequent periods. As the discussion in Section 3.2 above would suggest, the effective commodity demand function takes the form:

(3.33) \[ \hat{D} = D(e, \omega, \frac{e}{1+r}, \frac{\omega}{1+r}, I, \Omega) \]

where \(\frac{\partial D}{\partial L} > 0\). As in the unconstrained case, gross substitutability among current and future consumption and leisure is assured in order to sign the other partial derivatives. All of them have the same sign as they did in the notional commodity demand function (3.29).

For completeness let us finally consider situations where the representative household is rationed on the goods market. Even though this situation never arises in the simple model employed in this chapter (because of the small country assumption), it does arise in closed-economy models and multi-sector open-economy models.

\(^{11/}\) The gross substitutability assumption is widely employed in the literature. In some cases the weaker assumption of net substitutes has proved sufficient for obtaining definite results. See Johansson and Lofgren [1980].
If the household perceives a current-period quantity constraint \( D \) on its demand for current consumption, its labor supply and wealth accumulation decisions will certainly be affected. Maximizing (3.27) subject to (3.28) and the quantity constraint \( D > 0 \) yields the effective labor supply function:

\[
\hat{L} = \hat{L}(e, w, \frac{e'}{1+r}, \frac{w'}{1+r}, I, \hat{D})
\]

where presumably \( \frac{\partial \hat{L}}{\partial \hat{D}} > 0 \). That is, a reduction in the severity of rationing in the goods market should be expected to increase current-period labor supply. Note that the sign of \( \frac{\partial \hat{L}}{\partial e} \) is positive in this case: As long as the quantity constraint \( \hat{D} \) is binding and leisure is a normal good, an increase in the price of goods induces an increase in labor supply to (at least partially) offset the increased expenditure on rationed goods. The effect of an increase in the nominal wage \( \frac{\partial \hat{L}}{\partial w} \) is still assumed to be positive, although it is (according to Le Chatelier's principle) presumably smaller in magnitude than it would be if consumers were unrationed in the goods market (in which case they could spend their additional labor income on increased current consumption).

3.6: Transitory versus Permanent Price and Wage Changes

Once the intertemporal aspects of the household's decision problem are made explicit, the question arises as to whether comparative static analyses in the existing literature are, in fact, examining temporary or permanent changes in prices, wages, and various policy control
variables. In the case of temporary changes, prices revert to their initial level in the subsequent periods. With permanent changes, they remain at their new level. The demand and supply functions in the literature are typically specified as functions of current-period prices only; the role of future prices is not explicit. Yet for many policy-induced changes in wages or prices it might be presumed that the changes are permanent in the sense that current and future prices change by the same amount.

In any event, it seems necessary to consider what is expected to happen to future prices \((e' \text{ or } w')\) when current prices \((e \text{ or } w)\) change. It so happens that the assumption of gross substitutes among current and future consumption and leisure enables straightforward and useful results to be obtained. Rewriting (3.29) and (3.30) in elasticities form:

\[
\begin{align*}
\hat{D} &= \epsilon_1 \frac{\hat{e}}{\hat{e}} + \epsilon_2 \frac{\hat{\dot{w}}}{\hat{w}} + \epsilon_3 \left(\frac{\hat{\dot{e}}}{1+r}\right) + \epsilon_4 \left(\frac{\hat{\dot{w}}}{1+r}\right) + \epsilon_5 \frac{\hat{\dot{f}}}{\hat{f}} \\
\hat{L} &= \mu_1 \frac{\hat{e}}{\hat{e}} + \mu_2 \frac{\hat{\dot{w}}}{\hat{w}} + \mu_3 \left(\frac{\hat{\dot{e}}}{1+r}\right) + \mu_4 \left(\frac{\hat{\dot{w}}}{1+r}\right) + \mu_5 \frac{\hat{\dot{f}}}{\hat{f}}
\end{align*}
\]

where \(\epsilon_1\) and \(\mu_1\) are notional commodity demand and labor supply elasticities respectively and dots over variables denote \textit{percentage} changes, gross substitutability implies that the negative own-price elasticities (i.e. \(\epsilon_1\) and \(\mu_2\)) are larger in absolute value than any of the (positive) cross-price elasticities.\(^{12}\) Now consider a change in

\(^{12}\)The elasticities always satisfy the adding-up condition; i.e., they sum (over \(i\)) to zero.
the current price of goods, \( \hat{\varepsilon} \) which (potentially) causes a change in the household's point expectation regarding the future price denoted \( \hat{\varepsilon}' \). From (3.35) the change in goods demand equals:

\[
D = (\varepsilon_1 + \varepsilon_3(\hat{\varepsilon}'/\hat{\varepsilon}))\hat{\varepsilon}.
\]

Gross substitution implies \( |\varepsilon_1| > \varepsilon_3 \). Thus as long as households have regressive expectations so that \( \hat{\varepsilon}'/\hat{\varepsilon} < 1 \), current-period demand for goods will decline as \( e \) rises. More specifically, equation (3.37) is unambiguously negative for either temporary \( (\hat{\varepsilon}'/\hat{\varepsilon} = 0) \) or permanent \( (\hat{\varepsilon}'/\hat{\varepsilon} = 1) \) price changes. The absolute value of the total derivative in (3.37) is, of course, smaller for permanent price changes than for temporary changes because there is no intertemporal substitution effect in the former.

Analogously, it follows from gross substitution and the assumption that the elasticity of future price expectations with respect to current prices does not exceed unity (i.e., regressive expectations) that:

\[
\dot{\Omega} = [\mu_2 + \mu_4(\hat{\varepsilon}'/\hat{\varepsilon})]\hat{\Omega}
\]

from the notional labor supply function in (3.36).

Equations (3.35)-(3.36) and (3.37)-(3.38) pertain to the household's unconstrained or notional commodity demand and labor supply functions. In the case where the household faces a current-period constraint on the labor market \((\bar{L} < L^S)\), the assumptions of gross substitutes and less than unitary expectations of future prices with respect to current prices are again sufficient to insure that:
\[ (3.39) \quad \dot{D} = [\epsilon_1 + \epsilon_3(\dot{\epsilon}'/\dot{\epsilon})] \dot{\epsilon} < 0 \]

\[ (3.40) \quad \dot{G} = [\epsilon_2 + \epsilon_4(\dot{\omega}'/\dot{\omega})] \dot{\omega} > 0. \]

The hats (\(^\wedge\)) which should be included over both \(D\) and the elasticities have been omitted to avoid notational clutter, but these variables now pertain to the effective demand function (3.33).

Finally in the case where the household is rationed in the goods market, the effective labor supply function (3.34) has total price and wage effects of the following form:

\[ (3.41) \quad \dot{L} = [\mu_1 + \mu_3(\dot{\epsilon}'/\dot{\epsilon})] \dot{\epsilon} > 0 \]

\[ (3.42) \quad \dot{L} = [\mu_2 + \mu_4(\dot{\omega}'/\dot{\omega})] \dot{\omega} > 0. \]

Again hats (\(^\wedge\)) on \(L\) and the elasticities have been omitted for notational simplicity, but we are referring to (3.34) not (3.30). Gross substitution implies that \(\mu_2 > |\mu_4|\) so that (3.42) is unambiguously positive. The sign of (3.41), however, is indeterminate due to uncertainty about the sign and magnitude of \(\mu_3\) in situations where the household is rationed on the goods market in the current period.

3.6.1: An Important Observation

The observations in (3.37)-(3.42) are important. They suggest that the comparative static effects of changes in \(e\) and \(\omega\) derived in the fix-price literature -- and those derived in the remainder of this
book — can often be interpreted as either temporary changes or permanent changes. As long as we assume gross substitutability and regressive expectations, many qualitative results will remain valid. 13/ This is true provided we rule out switching between different non-market-clearing regimes as expectations adjust, just as we typically assure that policy changes are small enough that they don't move the economy from one disequilibrium regime to another.

It should be emphasized, however, that the foregoing discussion concerns only price changes and ignores any general equilibrium dependence that they have on current or future profits (incorporated in I). This is consistent with much of the existing fixed-price literature that considers profits to be predetermined and hence exogenous, although it differs from recent work on intertemporal models which typically assumes current-period distribution of profits and, in effect, perfect foresight regarding future profit income. (See, e.g. Neary-Stiglitz (1983), Persson (1982), Persson-Svensson (1983), and Svensson-Razin (1983)). In that context permanent and temporary price changes have effects of different magnitudes on the present value of household income and hence commodity demands and labor supply in the current period. This may cause the current account effects of various policies to differ.

13/ The case in (3.49) is an exception. The effective labor supply function in the presence of goods market rationing on which (3.49) is based, however, never arises in the small open-economy context discussed in this chapter.
The intertemporal models of open economies are of very recent vintage (as the references in the above paragraph attest) and are likely to play an important role in future research. At this point, however, the literature is insufficiently developed to permit a thoroughgoing treatment of open-economy fix-price models. Nevertheless, in the following chapters it is often instructive for the reader to re-examine various issues with the intertemporal framework in mind, thereby gaining further insights.
REFERENCES


